ELECTRONICS
sourcing
AUGUST 2019
NORTH AMERICA



COMPONENT COMPARISON: EYES FRONT!

ALSO INSIDE: NEWS • MARKET WATCH • EMC • PRODUCTS • PURCHASING

165,000+ PRODUCTS FIND IT HERE!
Texas Instruments
AUTHORIZED DISTRIBUTOR Digi-Key ELECTRONICS
digikey.com/ti

AN MMG PUBLISHING TITLE

YOUR PREFERRED COMPONENT PART SEARCH?

SURVEY SAYS...



Source: ELECTRONICS sourcing
ESNA Reader Survey 2018
MMG Publishing LLP

1.800.344.4539

DIGIKEY.COM

Digi-Key® ELECTRONICS

Digi-Key is an authorized distributor for all supplier partners. New products added daily. Digi-Key and Digi-Key Electronics are registered trademarks of Digi-Key Electronics in the U.S. and other countries. © 2019 Digi-Key Electronics, 701 Brooks Ave. South, Thief River Falls, MN 56701, USA

ECIA MEMBER Supporting The Authorized Channel



On the cover – August 2019

Component comparison: eyes front!
page 15

Contents

04
News
Expansion adds capacity

12
Component Comparison
Strategic sourcing pays dividends

18
Electric Vehicles
Charging up for the EV revolution

24
Purchasing
Component supply conditions favor purchasers

28
Buyers' Guide
All the facts and figures to help you buy

Contact

ELECTRONICS sourcing mmg PUBLISHING US LTD

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

ADVERTISING
Director of Sales: Charlotte Morgan
charlotte.morgan@electronics-sourcing.com
Area Sales Executive: Emma Poole
emma.poole@electronics-sourcing.com

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

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

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

Issue 83, Vol.10 No.08

Published 12 times per year
by MMG Publishing US Ltd

MMG PUBLISHING US Ltd
Normandale Lake Center
8400 Normandale Lake Boulevard
Suite 920, Bloomington MN 55437
Tel: 866.364.0951
Fax: 952.378.2770

Printed in the United States

© 2019 MMG Publishing US Ltd

ELECTRONICS SOURCING IS INDEPENDENTLY ABC AUDITED 2005/2017

ecia
Connect. Influence. Optimize.

Articles appearing in this magazine do not necessarily express the views of the Editor or the publishers. Every effort is made to ensure the accuracy of information published. No legal responsibility will be accepted by the publishers for loss arising from articles / information contained and published. All rights reserved. No part of this publication may be reproduced or stored in a retrieval system or transmitted in any form without the written consent of the publishers. Cover image – ©shutterstock.com/dashtik



Component comparison dance

The ebb and flow of component availability often forces purchasing professionals into periods of sourcing 'comparable' parts. My advice: beware. More than once I've watched as a 'direct equivalent' has failed to perform as expected.

Don't rely on the device manufacturer, don't rely on the distributor, don't even rely on your own team. Instead, take advice from all three sources, make an informed choice, then test, test and test some more.

You could argue that this process only applies to critical, high value parts. Not so. In the past I've witnessed tests where humble surface mount resistors were swapped for equivalents. The data sheets' matched yet the two manufacturing processes led to a slight difference in dimensional tolerances. This was just enough to cause the surface tension of the molten solder to 'tombstone' the parts during reflow.

In another example, a purchasing manager bought an equivalent brand of rather expensive self-lubricating polymer. The datasheet specifications matched, apart from one unpublished attribute 'free machineability'. The upshot: it refused to cut on the lathe.

Take extra precautions when outsourcing production. Twenty, years ago, when outsourcing became a trend, a detailed bill-of-materials sent to an offshore facility would often return with an extra column labelled 'equivalent'. Maybe, with some luck, the equivalent was cheaper and better than the original selection. Then again maybe it wasn't.

At the end of the day you can outsource the task of finding equivalents but you can't outsource the responsibility of getting it right. Invite those with knowledge and experience to comment, make your choice and test.

Jon Barrett

ES News

View current editions online – www.electronics-sourcing.com





Expansion adds capacity

Mouser Electronics is greatly expanding its global headquarters and distribution center to meet the needs of its business in the next decade. Construction is under way to add more than 125,000ft² to the distribution center, as well as a new 50,000ft² office building, at Mouser's Fort Worth campus, in Texas.

Upon completion, the global headquarters and distribution center will consist of one million square feet accommodating Mouser's inventory of one million unique SKUs for products from over 750 electronic component manufacturers.

President and CEO, Glenn Smith, explained: "With the rapid increase in technological advances such as IoT, electric vehicles, artificial intelligence, robotics, and 5G, we definitely find ourselves in a very robust and fortunate position. We are planning for future growth as our customer needs increase."

www.mouser.com



An affordable option for industrial connectors

Newark continues to expand its connector offering with the addition of Micro-Bayonet connectors from Amphenol Industrial Operations. The Micro-B line is said to provide an affordable alternative to connectors in industrial markets requiring high signal counts and small packages.

The new circular connector series boasts light weight and high performance with a small footprint, utilizing a robust triple bayonet coupling for quick and positive locking. It is ideal for industrial applications such as telecommunications, factory automation, industrial instrumentation, and test equipment where electrical performance must be met with affordability.

According to its manufacturers, Micro-B delivers excellent shell-to-shell electrical bonding for electromagnetic interference protection. Products also feature high density insert patterns with size 22D contacts allowing for more circuits to be connected and a simplified termination process. It also offers tool-less, fast mating for ease of use in the field.

www.newark.com



Power products now IRIS certified

Bel Power Solutions has announced that its Slovakian manufacturing facility, based in Dubnica nad Vahom, is now certified to the International Railway Industry Standard. Based on the ISO 9001 structure, but with additional, railway specific requirements, IRIS certification affirms Bel's continued dedication to manufacturing railway, transportation and harsh environment solutions. The Slovakia facility remains Bel's Center of Excellence for its Melcher brand of rail products.

Under the Melcher brand, Bel provides high performance, rugged DC/DC and AC/DC converters designed to meet the highest international standards for harsh environments, safety and EMC/EMI. Products undergo rigorous EVT/DVT and HALT/HASS tests and adhere to strict engineering guidelines to ensure low component stress, thermal profiling and high phase margins for stability and dynamic response.

www.belfuse.com



Sager Power Systems offers over 30,000 world-class AC-DC and DC-DC standard solutions, the widest range of modular power supplies available in North America and custom design services.

As an authorized distributor with 21 world-class power supply manufacturers, a team of dedicated power sales engineers and a 20,500 SF value-add Power Solutions Center, we're here to help.

PERFECTING POWER

SAGER POWER SYSTEMS
A SPECIALIZED GROUP WITHIN SAGER ELECTRONICS

ABB · Artesyn Embedded Technologies · COSEL · MEAN WELL · PHOENIX CONTACT Inspiring Innovations · POWER-ONE · TDK·Lambda
Advanced Energy · CALEX · EOS · muRata Power Solutions · Power Partners · RRC · TRACO POWER
aimtec Your Power Partner · CINCON · excelsys · PHIHONG · PROTEK POWER NORTH AMERICA · SL Power Electronics · VOXPOWER

power.sager.com • 1.866.588.1750 • power@sager.com

ES News

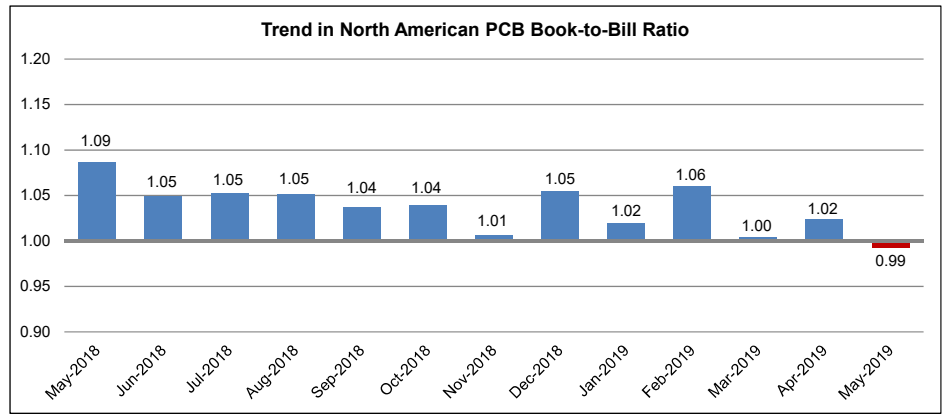
In Brief

Buy US-made batteries
Lithium-ion battery manufacturer, BMZ Group, has opened the new headquarters of its American subsidiary, BMZ USA. The new building in Virginia Beach, VA, offers around 26,000ft² to support its growing US-based battery pack production. BMZ USA plans to invest in additional automated assembly lines to relocate existing lines from overseas and assemble products developed in the US.
www.bmz-group.com

IP rated for IoT
GradConn's Nautilus range of waterproof coaxial cable assemblies and connectors is now available through DigiKey Electronics for those working in the rapidly growing internet of things market. The partnership will strengthen Digi-Key's coaxial offering with new configurations such as N type front mount, reverse polarity SMA rear mount, and vertical mount SMA bulkhead jack connectors.
www.digikey.com

Expanded optics support
Infinite Electronics has acquired Integra Optics, a provider of optical transceiver products. The merger, which adds to Infinite's existing capabilities, will see Integra continue to operate as an independent brand within the Infinite family. Not only will this broaden the technologies Integra Optics can offer to existing customers, it is also expected to expand its technical reach.
www.infiniteelectronics.com

MLCCs available fast
Vishay's multilayer ceramic capacitor division has undergone an expansion, increasing production and reducing lead times for its MLCC components. As a result, Vishay can now offer lead times in the mid 10-weeks range for military / hi-rel and RF / hi-frequency MLCCs, and in the lower 10-weeks range for commercial and automotive MLCCs, excluding transit.
www.vishay.com



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

Slow growth ▲

Recent findings from the IPC's North American printed circuit board statistical program reveal sales and order growth in May, however, the book-to-bill ratio dipped below parity for the first time since 2017.

Compared to the same month last year, total North American PCB shipments were up 5.6 per cent, and compared to the preceding month, shipments increased 2.5 per cent. PCB bookings in May also increased, growing 5.6 per cent year-over-year, however, bookings were up only 0.5 per cent from the previous month.

IPC director of market research, Sharon Starr, said: "Although sales and order growth continued in May for the North American PCB industry, slowing order growth rates pushed the book-to-bill ratio below parity. This was the first time since January 2017 that the industry registered a book-to-bill ratio below 1.00. Recent ratios hovering around parity indicate continued but slower growth in the coming months."

www.ipc.org

Off-the-shelf antennas in stock

Heilind Electronics has expanded its portfolio of wireless solutions with new ready-to-use antennas from Molex. The antennas are designed for a range of applications, including internet of things, automotive, industrial and medical.

Responding to demands to reduce space, cost and integration time, the Molex antenna portfolio comprises dual-band, multi-band, ultra-wide band, GPS and cellular antennas with combo capabilities that reduce engineering support at component level design. Custom antenna solutions can also be applied in multiple form factors including PCB, FPC, stamped metal and selective metallized plastic. Whatever the requirement, for off-the-shelf or custom solutions, Heilind works closely with Molex not only to provide antennas, but also to help apply essential RF antenna best practice to ensure performance is maximized.

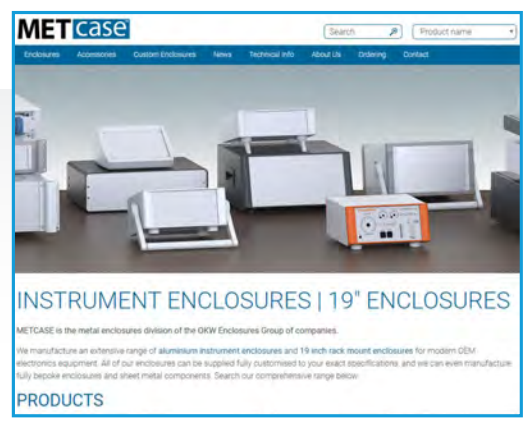
www.heilind.com

Website makes custom orders easy

Metcase has launched a new responsive website, designed to make it easier for purchasers to request samples or specify customization of its metal electronics enclosures.

The site enables desktop, mobile and tablet users to view and specify standard and customized 19in rack cases, desktop/portable instrument enclosures and wall mounted housings. To request samples, users simply tick a checkbox at the quotation stage. Customization can also be specified easily by clicking to add each modification as if it were a product.

First, users choose the model and size of the enclosure, after which they visit the modifications page to add the required service to their specification list. To help customers make their selection, Metcase has added more photos of



its CNC punching and folding, custom fixings and inserts, painting and finishing, so customers can see processes in more detail. Each of these pages features service codes so customers can click to specify their chosen metals, cutouts, studs, standoffs, nuts, cable tie mounts, paint color or finish.

www.metcaseusa.com



BEST SOURCE FOR LITHIUM COIN CELL RETAINERS AND BATTERY CAGES

WWW.BATTERYHOLDERS.COM



Rutronik vice president North America, **Sean Sisson**

Passives franchise extended to US

Rutronik is now distributing Vishay's extensive range of products including resistors, inductors and capacitors, in the Americas.

Predominantly serving the industrial, automotive, computing and telecommunications markets, Vishay's portfolio includes: mosfets, power resistors, voltage dividers, battery shunts, optical sensors, ESD and Zener diodes, transient voltage suppressors, Schottky diodes, power ICs, tantalum and multilayer ceramic chip capacitors, power inductors, infrared receivers, and microBuck regulators.

Vice president of global distribution sales at Vishay, Robert Kirch, commented: "We've enjoyed a strong partnership with Rutronik in Europe for 17 years. Now we're looking forward to building on that relationship in the Americas, where Rutronik's support will be instrumental as we look to increase our presence in a range of markets."

www.rutronik.com

Looking for more news?

Receive the weekly electronics e-newsletter for Electronics Purchasing Professionals

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

New kitting services support uptime

Procurement specialist, California Integration Coordinators, has entered into a strategic agreement to provide kitting services to Digi-Key customers around the world.

With a history of helping firms develop prototype printed circuit boards for consumer and industrial sectors CIC's capabilities have expanded to include contract procurement, kitting, strategic inventory management and custom fabrication.

Digi-Key vice president, applications engineering, Randall Restle, commented: "Through our Design Services Provider resources, Digi-Key has identified a key partner in CIC to help procure and manage components used to manufacture electronic systems. This includes kitting parts which alleviates what can be a very time-consuming effort to fulfill manufacturers' operations uptime requirements. CIC has a long history of providing excellent service to printed circuit board assembly customers, in multiple sectors, around the world."

www.cic-inc.com

Hybrid protection offers drop-in MOV replacement

TTI is now offering Bourns' GMOV hybrid protection device, which combines a patented gas discharge tube with FLAT technology and a metal oxide varistor. Ideal for AC and DC power applications where a high level of performance is required over time, GMOV devices are drop-in replacements for standard 14 and 20mm MOVs and are UL 1449 Type 5 rated.

According to the manufacturer, GMOV components help minimize degradation and catastrophic failure issues that can occur with discrete MOVs. The MOV is shielded from transients and temporary over-voltage spikes by 'on-call but not on-duty' isolation of the MOV from line voltage by the GDT. Furthermore, leakage of the device is eliminated by the series GDT, mitigating damage to the MOV due to watt-loss heating.

www.ttiinc.com



Acquisition expands custom power offering

Sager Electronics has entered into a purchase agreement to acquire Technical Power Systems, a specialist in the production of custom battery assemblies headquartered in Lisle, Illinois.

President of Sager, Frank Flynn, stated: "Through our specialized group, Sager Power Systems, we offer both off-the-shelf and customized value-add AC power and on-board DC power solutions. Batteries and custom battery packs are a natural extension of our power offering, supporting our customers' growing requirements for portable power. As a recognized specialist in custom battery assembly and battery pack design, Technical Power Systems bolsters our value as a technical specialist to our customers."

President and founder of Technical Power Systems, Joe Giovanatto, added: "It's an exciting opportunity to join forces with an industry leading distributor committed to selling power solutions with the goal of pursuing the top power distribution and value-add position in the market."

www.sager.com



With More than 6 Billion Components in Stock, There's a Good Chance TTI has Exactly What You Need

At TTI we just moved into our new custom-built 800,000 square foot distribution center. More than 6 billion parts, over 650,000 part numbers, zipping along miles of conveyors, pulled from acres of multi-story racks stocked with the parts you need. TTI has more specialized inventory than anyone in the business – from capacitors and resistors, to connectors and sensors, on the shelf and ready to ship. And now, we have even more of it.

Call your local TTI Specialist at 1.800.CALL.TTI or check us out online at ttiinc.com, chances are we have the components you can't find anywhere else.

ttiinc.com
1.800.CALL.TTI

A Berkshire Hathaway Company

Buyers want more from distributors

Distributors have invested more in supply chain and design services, enhanced and enlarged warehouses and other facilities and expanded into new regions to attract new customers and gain more business with existing ones

James Carbone

Electronics distribution in North America has always been a competitive business, but it has become increasingly fierce over the last 10 years as OEMs and electronics manufacturing services (EMS) expect more from their distributors than just supplying components.

They expect their distributors to help them reduce total cost of ownership and time-to-market by providing a wide range of services including design and technical expertise, risk mitigation, supply chain, inventory services, forecasting and market intelligence. Many OEMs expect distributors to keep them apprised of technology advances and identify new business opportunities.

To be competitive and gain more business from existing customers and win business from new ones, OEMs and EMS providers want their distributors to be partners, not just parts purveyors.

Most electronics distributors have answered the clarion call and have invested in warehouse space, vendor managed inventory programs, design, and procurement tools and have beefed up their websites to provide as much relevant information as possible to buyers and engineers. Some have made strategic acquisitions to boost capabilities in specific technologies and components such as solid-state lighting, sensors, or specialized semiconductors.

Many distributors have decided to remain competitive they can no longer just service the North American market. Many have expanded operations to Europe and Asia to serve OEMs and EMS providers that have shifted manufacturing overseas. Distributors are also looking to attract new OEM and EMS customers in Europe and Asia that may not have used U.S.-based distributors in the past.

Competing overseas

Many distributors have boosted their overall sales in Europe and Asia. One distributor that has proven to be a strong competitor in Europe and Asia is Mouser Electronics, which specializes in providing components for design and prototypes.

Kevin Hess, Mouser's senior vice president of marketing, said that design used to mainly occur in the U.S. "But now you also have Germany, Korea, Japan and China more involved in design rather than just manufacturing," he said. "The opportunity for a company like Mouser moving forward is outstanding."

In fact, overseas sales were outstanding in 2018 for Mouser. The distributor grew its European sales 45 per cent and its revenue in Asia Pacific 49 per cent.

"Europe has been our most consistent growing region," said Pete Shopp, senior vice president, business operations for Mouser. It's now 30 per cent of our total sales. Last year, Asia was our fastest growing region with 49 per cent growth, but that was really the first time Asia had been the fastest growing region."



"The opportunity for a company like Mouser moving forward is outstanding"

Kevin Hess, senior vice president of marketing for **Mouser Electronics**

While Mouser has posted strong sales growth in Europe and Asia, the Americas still account for 45 per cent of Mouser's overall business. While Europe represents 30 per cent and Asia, 25 per cent. However, those percentages are changing. Ten years ago, 95 per cent of Mouser's business was the US. In the future, each region will probably represent a third of Mouser's sales, said Shopp.

Mouser's customers cut across virtually every industry and its business grows every year because of its focus on design. While demand for electronics equipment will wax and wane, OEMs are always designing new products and supplying parts for new product introduction is at the core of Mouser's business.

Focus on automation

While many distributors are growing sales in Europe and Asia, some are finding success in North America by focusing on a limited number of products and customer segments. One example is Allied Electronics.

"Our main focus is on industrial automation," said Dan Stewart, vice president of marketing and e-commerce at Allied Electronics. Industrial automation spans various vertical markets including oil and gas, food, beverage, pharmaceuticals, water/wastewater and any type of machine builder.

MOUSER ELECTRONICS
The Newest Products for Your Newest Designs®
Widest Selection

Allied supplies a range of components for machines used in factories. "I'm talking about power supplies, relays, programmable logic devices (PLD) PLCs and then there are things connected to that so wires and cabling, connectors and sensors," said Stewart. He said Allied does not focus on board-level sensors, but larger closed sensors used on the factory floor.

He said the distributor is well positioned to service the industrial automation segment. "Our position right now is better than anyone else's," said Stewart. "We have the suppliers and a portfolio of products that no one else can match by a wide margin," said Stewart.

Allied supplies to the two main customer segments in factory automation, according to Stewart. "One is OEM machine manufacturers building industrial equipment of some sort or another," he said. A good example would be a packaging machine that is going into a food and beverage facility. "Or you could have some sort of machinery or equipment, that's going into oil or gas operation," Stewart said.

The other segment is on the MRO side for companies that use those machines and need to maintain them on a regular basis.
He says that Allied helps customers with new product introduction. "We have a centralized technical support team and we have application engineers in the field," said Stewart. We also have a number of outside salespeople that can help walk our customers through a technical issue."

A large menu

While smaller distributors can compete with a limited number of products in a focused customer segment, large global distributors need to provide customers with a complete menu of components as well as wide range of services. They are often are called on by OEM customers to be involved in the design stage of a new product offering both parts and technical ideas. Once the design is finished, large global distributors often support volume manufacturing of the product through its lifecycle and may provide parts for repair and refurbishment and be involved in asset recovery, recycling and disposal of the product.

Offering soup to nuts technology solutions to OEM and EMS customers is imperative for large global distributors to be successful in the global marketplace.
"It is a matter of survival," said Bill Amelio, CEO of Avnet. He noted that there has been a lot of consolidation among semiconductor and other manufacturers of these years.



"We ask customers where can we add more value?"

Bill Amelio, **Avnet** CEO

"When suppliers consolidate, they look at the contracts that they have with their distributors and all their partners and they pick the ones that are best for them," said Amelio.

Obviously, suppliers want distributors that can provide as many products and technology solutions to as many OEMs and EMS providers as possible.

One key to Avnet's competitiveness is "we have this great engine which is our core distribution business which allows us to be in 140 countries around all the world," said Amelio.

Avnet has hundreds of thousands of customers which give the distributor entrée into selling more which are more important to customers.

"We ask customers where can we add more value?" said Amelio. Value can be added with hardware, software and printed circuit board design services, simulation verification, vendor managed inventory, and component obsolescence programs amongst others.

Amelio said such services support every phase of a product lifecycle and gives Avnet a competitive advantage.

Entering North America

While some North American based distributors such as Arrow, Avnet, TTI, and Mouser have grown sales by expanding into Europe and Asia, some European and Asian distributors, including WPG and Rutronik, sought sales growth by expanding operations North America.

The latest overseas distributor to delve into the North America market is RS Components, a high service distributor based in the United Kingdom. It had a "soft launch" in the U.S. in April. Cameron Ward, senior vice president global electronics at RS, said the company has launched its americas.rsdelivers.com platform, which provides "tools, knowhow and an extensive selection of small design packs, enabling customers to learn, design and purchase from a single site," he said.

"The decision to come into the Americas was really driven by requests of suppliers," said Ward. "Suppliers said 'we really need you in the marketplace' so the decision was made."

He said RS's business model is similar to Mouser's and Digi-Key's. "We have similar line cards for electronics, but our range of product solutions is much different. We carry a very large industrial and MRO range of products in addition to our electronics offerings," said Ward.

RS has a design community called DesignSpark which has 800,000 members and about 105,000 in North America. Other high-service distributors have similar communities, such as Hackster and element14, Ward said. "But what's different is we have a lot of free design tools. We have printed circuit board tools and mechanical tools 3-D CAD software tools," he said.

Another distributor that entered the North American market about 11 years ago in an effort to boost sales and increase competitiveness is WPG Americas.

"We tend to consider ourselves more of a specialized distributor, not a broad line distributor in some key technology and vertical market areas" such as LED lighting and the embedded market, said Ian Basey, vice president of supplier marketing.

While WPG is a large broadline Asian distributor, WPG Americas is smaller, more focused.

"Being smaller we have quicker reaction time. I think that's what customers like about us," said Rich Davis, president of WPG Americas.

No Minimum Order Quantites

Worldwide leading authorized distributor of semiconductors and electronic components.

mouser.com

Strategic sourcing pays dividends

Careful supply chain analysis and thorough research are key to ongoing successful product selection, explains Rutronik. But do you know how to spot a winner?

There are various aspects to consider when strategically selecting products and suppliers. In the beginning, there are two main questions. Firstly, you need to consider how innovative the supplier is, and whether they have long-term viability. Second, do their products support your long-term strategy, enabling you to expand your market position over time.

You can answer these questions based on criteria in several distinct areas. These include product characteristics, positioning on the market, and innovation. Next comes availability in the regions where you are active, and market penetration. Then there are aspects such as price, quality, and the competitive situation.

It's also important to analyze the supplier's market potential and lastly, their value-added services in logistics, availability, sales and technical skills. All of these aspects need to fit.

Product characteristics

With regard to product characteristics, there are several questions to discuss with distributors. Is the component a single-source product with diversified technical characteristics, such as an SoC, or is it a substitution product from a qualitatively, commercially, and technically adequate second source? Is it so popular that it is always available from stock? Does the component manufacturer have long-term strategic plans that will affect availability or PCN/PTN management at the end of the life cycle?

The next step is to review availability and market coverage. Market penetration in individual countries and regions can vary greatly, impacting availability for customers that operate production facilities worldwide. Single-source products have advantages and disadvantages: on the one hand, they may offer specific benefits, but they could also be niche products with a limited number of customers.

An ideal distributed product should typically be used by several customers in order to avoid the risk of discontinuation. Long-term demand from other customer groups can therefore play an important role, especially for industrial customers. Pricing must also be in step with the market, technology, and application.

Finally, consider the competitive situation around the product. Second-source products, similar products, and competitor products are all indicators of your application's market penetration and relevance. With single-source, cutting-edge products however, availability may not be so good.

Supplier considerations

Product selection is not just a purchasing decision, but one that developers, product marketing managers, and buyers must make together. That's why it makes sense to thoroughly discuss product selection with your distributor. Together with customers, Rutronik analyzes which company is the technological market leader in a defined product segment and compares product penetration, and the manufacturer's market position. These indicators determine whether a product is really leading in terms of performance.

Distributor support is another important consideration, especially in the US, where the DTAM is extremely high compared to the direct account OEM channel. Rutronik aims to offer a balanced product range with high availability, suitable logistics services, and a professional sales and technical team.

Rutronik also keeps a close eye on the global economic environment regarding trade relations between the US and China. The issue is not just tariffs, but also where a product's value is created. Asian production already leads the field in this respect due to the added value of the chips, wafer production, assembly, and testing, most of which take place in Asia. Careful supply chain analysis is vital because we live in a globalized world and have to work without borders.

Thus, the decision regarding which distributor or manufacturer to choose is extremely important. Partners can only come up with new ideas and methods when they are a good fit culturally as well as professionally. To this end, Rutronik is also exploring new approaches in process management to improve quality, component supply, and time to market. Addressing these criteria underpins successful partnerships with customers and suppliers alike.

www.rutronik.com



An ideal distributed product should typically be used by several customers in order to avoid the risk of discontinuation

EOL is not the end of the world.



© 2019 Rochester Electronics, LLC. All Rights Reserved.

THE SEMICONDUCTOR LIFECYCLE SOLUTION™

100% Authorized by over 70 leading semiconductor manufacturers.
Authorized distribution and licensed manufacturing.

100% AUTHORIZED AND GUARANTEED

Rochester Electronics®
www.rocelec.com

Exclusively sponsored by Digi-Key Electronics

Second half 2019: mayhem ahead



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

John Denslinger alerts buyers to the volatility and uncertainty they can expect to encounter during the remaining months of 2019

Supply chain demand • By John Denslinger

Are you having trouble projecting supply and demand in the second half of 2019? Truth be known, you're not alone. Given the daily barrage of headline news expounding the latest tariff tiff, the latest trade negotiation stalemate, the latest Fed monetary hint, the latest Brexit talk, the latest currency manipulation, the latest labor shortage, or the latest whatever, it's difficult to read the business landscape with any certainty. So, how does one account for the unforeseen and still plan with accuracy?

Typical to most companies today, identifying sales potential is rather routine. Most use book-to-bill as the best indicator of near-term shipments. That coupled with customer forecasts, new sales opportunities in the pipeline, new product introductions, share growth targets, and viable pricing strategies readily ballpark sales for the next horizon. Although time consuming, it's not terribly difficult building a forecast. The real challenge remains: execution. I would say, supply and demand today are far from normal. It begs the question, have you adequately considered the severity of these headline issues on execution in real-time?

In my experience two departments generally wear the collar for missed plans: sales (when bookings fail to materialize as planned) and procurement (when sales are delayed or lost due to supply or quality problems). Sales can always point to changing competitive conditions, delayed or cancelled programs, slow customer adoption of new products and production line transfers, all of which are normal, reasonable and generally outside one's control. The procurement department, on the other hand, is less likely to get a free pass when it comes to production line interruptions. Sourcing is not a last minute, flip-of-the-coin decision. Supply lines are supposed to be set and suppliers fully vetted. Vendor selection processes are designed to be rigorous and competitive.

Contractual terms are naturally weighted in favor of the procurer. Purchasing is therefore accountable for supplying quantity and quality on demand, and still, things do go wrong. Procurement never escapes the top-down pressure to fix disruptions and fix them fast. With so much at stake, I would encourage frequent communications with your top ten suppliers. Compare their supply perspectives. Look for undesirable trends. Move swiftly when you see a problem. It won't get any better with a wait-and-see approach.

To be clear, there is a lot of volatility in the market. At the beginning of 2019, the semiconductor forecast for the Americas ranged from one to five per cent growth. Entering the year, book-to-bill showed signs of decline but backlogs steady with inventory levels reasonable. Unfortunately, the 2018 tailwind never materialized as Q1 2019 sales results decreased 29 per cent from Q4 2018. Further, according to a June survey by TPC, industry professionals are seeing weakening demand and further erosion of bookings while noting undesirable increases in inventories and cancellation trends. The latest semi forecast now indicates a year-over-year drop of around 23 per cent in 2019 for the Americas.

Buckle up, mayhem ahead. Even without all the headline news, 2019 will be difficult.



100% AUTHORIZED DISTRIBUTOR DIGIKEY.COM
SAME-DAY SHIPPING NEXT-DAY DELIVERY ON ORDERS ENTERED BY 8:00 PM CST
Digi-Key ELECTRONICS

Not a fan of surprises?

Extending your approved vendor list can minimize risk when component lead times extend, but purchasers still need to be careful when sourcing device alternatives, explains Future Electronics' Karim Yasmine

The electronics component industry has recently gone through one of the most aggressive extended lead time cycles in 20 years. With that in mind, many procurement professionals are looking for ways to extend their AVL to reduce the risk of impacting their continuity of supply. Looking at alternative components on multi-source devices may seem simple, but there are always 'gotchas' to lookout for.

Sourcing safe alternatives

There are several things to keep in mind when looking at alternative components. First and foremost, don't get fooled by 'similar' equivalents. Too many manufacturers claim to have a 'pin for pin' equivalent, but there may be some minor differences in the actual device operation.

Always endeavor to discover if a device type is part of the core business of a manufacturer. Also assess how popular a device family may be through thorough product life cycle analysis. On certain technologies there are few physical developers of the product, and many others who re-brand or license someone else's product, so it's always good to understand this as well.

Due to heavy merger and acquisition activity in recent years, many devices may be on a manufacturer's line up today but not in their long term plans due to ongoing pruning. Many semiconductor manufacturers now offer longevity programs. It is important to work with a distributor like Future who can guide you on these critical items.

Quality is often of foremost importance when it comes to alternate sourcing. Based on your application requirements, a simple audit of the manufacturing facility may be a good proactive behavior.

Finally, a new challenge has arisen in the last year — the risk of choosing a device that is impacted by tariffs. A distributor that can help you navigate the intricacies of tariffs as well as understanding how to work around them where possible will be of great benefit.

Look for inventory solutions

Partnering with a distributor that is focused on inventory solutions and has deep product knowledge is always wise. The product marketing group at Future Electronics, for example, boasts extensive product knowledge, which is accessible to customers as an extension of their purchasing teams. Future Electronics also offers differentiated bonded inventory solutions, which can help shield purchasers from an extended lead time situation. Future's continued commitment to on time delivery and differentiated inventory solutions provide customers with the flexibility required in unpredictable circumstances.

Component comparisons and alternative sourcing should be a continuous discipline, however, irrelevant of market and lead time conditions. As the consolidation of the supply base continues, customers need to work with proactive distributors like Future Electronics to ensure they are positioned to thrive in all environments. Certain segments will continue to grow at a fast pace indicating lead time extension may arise again in the near future; preparing for such shifts on multi-source components may be the difference between thriving and surviving.

www.futureelectronics.com



Future Electronics corporate vice president, **Karim Yasmine**

> **A distributor that can help you navigate the intricacies of tariffs as well as understanding how to work around them where possible will be of great benefit**

Time-saving EMI solutions

With smaller enclosures and more components, today's devices often require both EMI protection and thermal management. Custom shielding may provide an answer but can add leadtime. Laird EMC offers a solution

Due to reduced form factors and the need to include more and more components in every device, many original equipment manufacturers are looking to combine electromagnetic interference and thermal management solutions in a single assembly. This complicates the thermal design process and creates a need for multiple thermal interface layers whose performance interacts with each other.

With the ability to design and manufacture products for wireless and other advanced electronics applications, Laird specializes in both electromagnetic interference shielding or absorption products and thermal transfer materials. The company's multi-compartment shields can cover multiple-board areas simultaneously, incorporating thermal interface materials with board-level protection.

Combined EMI and thermal solutions

In one such application, Laird Performance Materials recently worked with an OEM to design a combined EMI/thermal solution capable of reducing package temperature. A simulation showed that the package temperature of the heat source initially exceeded the maximum value of 90°C. Laird's subsequent optimization reduced this to an acceptable level, 13°C below the original design.

What's more, the design was optimized in only a few days compared to the many weeks that would have been required using the normal one-iteration-at-a-time method.

To achieve a heat reduction, Laird developed a custom solution consisting of a printed circuit board with a heat source and an EMI shield consisting of a metal plate that also serves as a heat spreader. The heat source is separated from the EMI shield by a layer of thermal interface material. A heat sink is mounted to the EMI shield and separated from it by another layer of thermal interface material.

As this is a complex design, there are numerous alternatives that could be changed to deliver an optimized solution. The traditional approach would be to use hand calculations to develop the initial design concept. Then a prototype would be built and tested to evaluate temperatures at key points. An iterative process of modifying and testing could take months to find an acceptable solution.

Simulation speeds development

Instead of building a physical prototype, however, Laird simulated the initial concept using thermal simulation software.

Rather than randomly evaluating alternative designs, Laird used the software to automate the process of design optimization. The software defined parameters that could be varied, such as the number of heat sink fins, fin thickness, heat sink base thickness and thermal resistance of the two thermal interface materials. Each of the design parameters could vary by ±50 per cent of the initial design concept.

Absolute limits were specified for several variables and Laird was able to specify that the goal of the optimization was to minimize the junction temperature. Automatic sequential optimization then created and ran the required simulations to explore the entire design space in the most cost-effective way.

The thermal simulation software generated a response surface showing the value of the design goals for all combinations of variables. Laird viewed the results in 3D to visualize the effectiveness of changes in each design parameter. To complete the project, Laird picked out the preferred optimum value, selecting a design that substantially reduced junction temperatures while meeting all other design constraints.

Laird technicians then built and tested a prototype of the optimized design. The thermal performance of the prototype matched simulation predictions closely and the thermal/EMI solution is now in production. Feedback from the customer is positive and the whole process was completed in just a few days.

www.laird.com

Instead of building a physical prototype, however, Laird simulated the initial concept using thermal simulation software

EMC Products



Low leakage filters add to the range

Schaffner introduces the new FN 3287 and FN 3288 series EMI filters designed for motor drives, power drive systems and other power converter applications or to meet the requirements of machine tool and machinery equipment.

EMC filter solutions for three-phase applications contribute significantly to compliance with the EMC directive and improve system reliability and stability. Now the FN 3287 and FN 3288 series has been extended with low leakage current versions, providing a choice of an EMI filter with leakage currents from 12 to 0.1mA.

The FN 3287 and FN 3288 series are available with 11 current ratings from 10 to 160A. All models are CE, UL and ENEC approved and RoHS compliant.

www.schaffner.com



Accelerate EMI qualification

Microchip has announced three new maXTouch touchscreen controllers to address electromagnetic interference and electromagnetic compatibility challenges related to automotive touchscreens. The family facilitates the use of very thick glass or plastic cover lenses and multi-finger, thick gloved touch support, up to the equivalent of 4.5mm polymethyl methacrylate.

MXT1067TD, MXT1189TD and MXT1665TD devices add several variants, cost-optimised for nine- to 13in automotive touchscreens. Devices address the increasing demand for functional safety features and are designed in accordance with the automotive SPICE level three capability and ISO 26262 automotive safety integrity level B requirements.

All devices in the TD family feature a waveform shaping capability to optimise the performance of the touch controller's radiated emissions. This helps the touchscreens to work together with other in-vehicle applications, such as remote keyless entry. This process can save many hours of expensive EMC test chamber time.

www.microchip.com



Charging up for the EV revolution

Sales engineer with TTI's transportation unit, Gabe Osorio, reviews the current state of electric vehicle technology and the challenges that must be overcome for EVs to achieve their full potential



Sales engineer, **TTI** transportation business unit, **Gabe Osorio**

For decades, we've imagined the possibilities that electric technology can bring to passenger travel, long-haul shipping and air travel. Today those possibilities are becoming reality with faster, more reliable charging and higher power capacities. However, there are still some hurdles to clear before these technologies become widespread.

Greater availability of charging technology is the biggest need. Despite the success of consumer EV companies like Tesla, which boasts over 13,000 rapid chargers around the US, the high-capacity charging solutions needed for supply chain and logistics applications are still emerging. Bringing the industrial equivalent of Tesla's 30-minute recharge times to larger-scale vehicles remains a challenge.

To meet the needs of large-scale rapid charging, companies like ITT Cannon, Phoenix Contact, Huber and Suhner and Tesla are designing systems and parts such as liquid-cooled charging inlets and couplers designed to dissipate waste heat from charging. Expanded EV charging will also drive increased demand for the likes of mosfets, current and voltage sensors, resistors, and capacitors. Lastly, high-capacity, fast-charging batteries will need to become not just available, but affordable enough to outfit a substantial number of both new and retrofitted industrial and shipping vehicles.

EV rollout

Many logistics providers and companies such as Amazon are working with truck manufacturers like Freightliner and Peterbilt to create electric fleet delivery systems.

The benefits of EVs for shipping, distribution and third-party logistics are obvious. Even without government directives to reduce emissions, companies know the environmental and cost benefits of going electric. They are working with EV retrofitters OrangeEV, Complete Coach Works, Motiv and Cummins Efficient DriveTrains, to convert their current fleets to electric drivetrains. Besides reduced CO^2 emissions, retrofitted vehicles benefit from weight savings, which boost the trucks' range.

We're also seeing the birth of commercially-viable electric aircraft. British carrier, EasyJet, and US-based startup, Wright Electric, made headlines at the 2019 Paris Air Show, announcing electric planes capable of short-haul routes under 300 miles.

As higher-capacity batteries and more efficient charging become the norm, practically every transportation application will be impacted. TTI already sees companies developing EV engines for trucks, recreational vehicles, motorcycles and personal scooters. Electric personal watercraft and off-road vehicles could come next and there are no shortage of manufacturers finding ways to bring dreams to reality.

Technical challenges

By 2030, annual demand for EV charging energy in the US is expected to reach 53 billion kilowatt hours. To achieve this will require substantial investment in new infrastructure to deliver power to the warehouses, distribution centers, dockyards and airports where next-generation vehicles will recharge.

Making rapid, high-power charging viable for truck fleets and shipping vessels will require a hard line delivering 400V or more —up to a one kilovolt connection for fleets of electric trucks—as well as the cable, conduit and ancillary systems needed to tie directly into the power grid.

And there are other challenges facing the industry, including a lack of standardization or regulation around EV charging. Industry groups and evolving regulations will alleviate this but until then, it's difficult to know which technologies will become standard. The one sure fact is that new EV technologies are coming sooner than you might expect.

www.ttiinc.com

eBOM.com

How does it work?

Principal Manufacturer launches New Component

Distributor / Principal

DISCOVER

Component release published on eBOM.com

SOURCE **COMPARE**

Live component pricing + quantities available

powered by ecia

BUY!

Buy components from a Distributor of your choice

eBOM LIVE

eBOM Authorized powered by ecia

Smart ideas for EV charging

Standardizing the charging connection for plug-in hybrid and battery electric vehicles will increase adoption, but as Digi-Key Electronics' Rich Miron explains, EV charging still presents some challenges

Extensive use of electric vehicles could significantly reduce emissions without sacrificing the freedom of personal transport. Standardizing the physical charging connections will help consumer adoption and there are currently three charging specifications in the international standard IEC 62196-2. These include the Type 1 SAE J1772 plug, widely used in North America, and the IEC Type 2 plug, primarily used in Europe.

Make charging simple

The J1772 specification and IEC 61851-1, the global standard for EV charging electrical interfaces, specifies basic electrical signaling across a pilot connection between the charging point and the vehicle's on-board charger electronics. These interactions confirm connection and negotiate power delivery based on criteria such as available ventilation to guard against potential hazards like overheating.

To simplify the design process, TI has produced a reference design for J1772 compliant electric vehicle service equipment. It uses features in the MSP430F6736 microcontroller to facilitate control and monitoring of the pilot signal line. These include a timer module for generating a PWM signal and a successive approximation register analog-to-digital converter to read the response of the vehicle on the pilot wire.

To drive the pilot signal across several meters of cable and through the load resistance applied by the vehicle when connected, the reference design uses an OPA171 operational amplifier. The MSP430 microcontroller monitors the output of the OPA171 to detect the load resistance applied by the vehicle.

All the electrical functions of a J1772 charging interface are covered by the reference design, including: power management to generate ±12V DC and 3.3V logic supplies from the main AC line, and a TPL7407L low-side driver that manages a two-stage output relay. The design also leverages the MSP430F6736 to provide protection against potentially dangerous ground faults and to integrate power metering.

Plugging EVs into the smart grid

Standardizing the charging interface will go a long way towards encouraging greater use of electric vehicles, however, as the number of such vehicles increases, so too will the load on the power grid. On the other hand, if charging is managed intelligently, EVs could support active demand response programs that work to prevent excessive peak loads and could also be used as storage for surplus renewable energy. Negotiations between the vehicle and charging point utilize communication with grid management systems to determine energy capacity and tariffing.

After charging commences, communication allows the vehicle and its charge point to exchange information such as control and configuration data, access privileges, time-stamp, tariff information, customer ID and location, and meter readings.

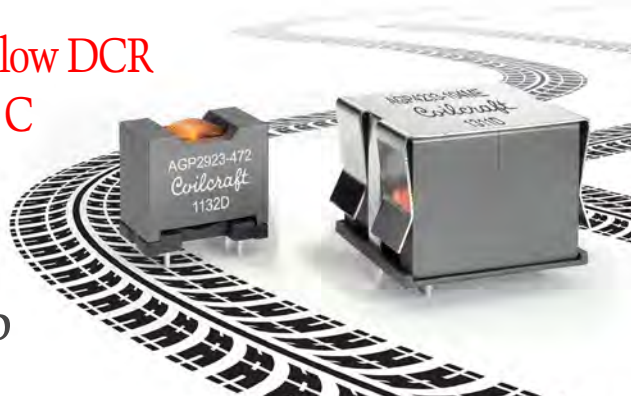
One approach for communication between the vehicle and grid management systems uses the IEC 61850 protocol. The Fraunhofer Institute has developed a reference system using ISO/IEC 15118 and IEC 61850 standards, as well as HPGP and IPv6, for V2G communication via a smart charging station. With these measures in place, intelligent EV charging is increasingly within reach.

www.digikey.com

Coilcraft

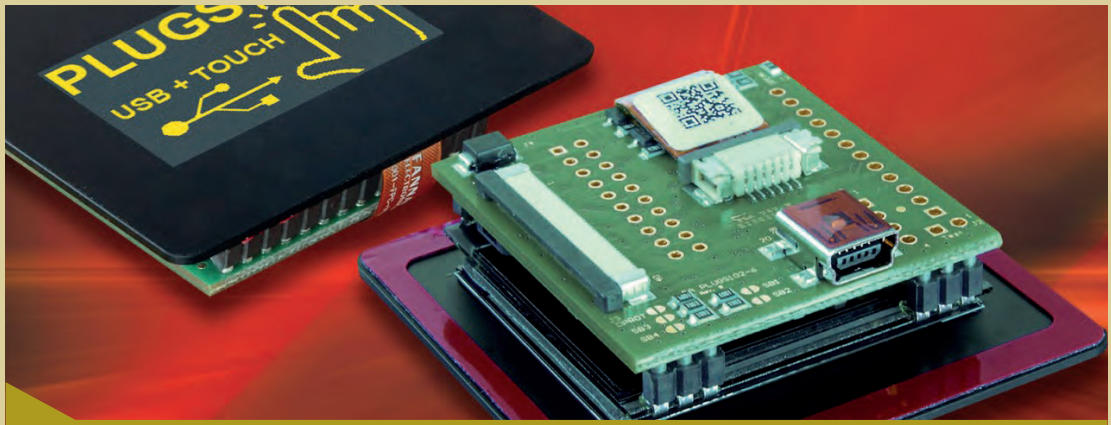
High-Performance Power Inductors
for Automotive Applications

- Current ratings up to 108 Amps ... and exceptionally low DCR
- AEC-Q200 Grade 1 ... temperature ratings up to 140° C
- Stable mounting ... for high vibration applications



AEC Q200 +140°C

Free Samples @ coilcraft.com/AGP



In touch with OLED demand

Display Visions has developed a graphic OLED display with a touch-sensitive front made of real glass, ideal for small monitoring and control tasks.

The new EA PLUGS102-6 features a 36 by 25mm display area and resolution of 102 by 64 pixels. Since every pixel represents a light source, the panel boasts brilliant color, low black levels and strong contrast compared to LCD displays. A separate backlight is not required and display brightness can be adjusted by software.

More than just a display, the module can also operate as a full control unit featuring a range of interfaces. An integrated USB interface means the display is automatically powered. Data transfer takes place serially, either via USB, SPI, RS232 or I2C connection.

For measurement and control tasks, the EA PLUGS102-6 is equipped with eight freely configurable digital I/O interfaces, two analog inputs and one PWM and one analog output. A small loudspeaker is also integrated.

For ease of set up, the EA PLUGS102-6 recognizes high-level language-like graphics commands. In addition to eight integrated fonts, the display also features several graphic functions. Text and graphic elements can be mixed at will, positioned precisely and provided with blink attributes. Up to 256 images and the same number of macros can be stored in the internal memory.

The complete OLED module measures 55 by 54 by 15mm and features an operating temperature range of -20 to 70°C.

www.display-visions.us



Displays with a difference

Data Modul has expanded its portfolio with a new 10.4in TFT display from Innolux featuring an extended operating temperature range. Ideal for demanding environments, the G104ACJ-L01 is perfect in high-end and automotive applications.

Benefits are listed as a precise color display and perfect readability thanks to brightness values of 900cd/m², UVGA resolution, a contrast ratio of 1:1000 and 85deg viewing angles from all directions. The display is distinguished by its extended temperature range of -40 to 85°C with a storage temperature range of -40 to 90°C. This makes it ideal for outdoor use, but also for challenging applications such as cold storage, in agricultural equipment and unheated warehouses. The lifetime of the display is said to be 50,000 hours.

Head of product management, display solutions, Data Modul, Claus Vogt, commented: "Due to the high demand from industrial customers for displays for the most varied applications, we have to constantly adapt our portfolio. With this display, we can now offer a suitable solution for particularly demanding environmental conditions, without losing readability and lifetime."

www.data-modul.com



Lead times for power transistors will continue to shrink in the second half

The days of 40+ week lead times for power transistors are over as suppliers have added capacity and demand growth is expected to slow

James Carbone

The worldwide power transistor market in 2019 will grow at a slower rate than last year as sales increase five per cent to $17.1 billion, according to researcher IC Insights.

The growth rate in 2019 will be sharply lower than 2018 when power transistor sales grew 14 per cent and unit demand increased eight per cent.

Strong demand and limited capacity in 2018 resulted in long lead times, shortages and a six per cent increase in the average price of a power transistor, the researcher said. However, power transistor manufacturers have added capacity and supply is catching up with demand. The power transistor average price in 2019 will decline about one per cent and lead times will further shrink. In fact, lead times have fallen from more than 40 weeks last year to 12-18 weeks and will continue to fall in the second half, IC Insights said.

Manufacturers say while lead times have shrunk, power transistor demand remained healthy if not stellar in the first half of this year. For instance, STMicroelectronics (ST) has seen five-6 per cent sales growth for power transistors in the first four months of the year, said Puccio Conti, marketing manager, analog & discretes group, Americas region. He said he expected similar growth to continue through 2019.

"The market will keep growing on the high side of single digits. We see growth at the same rate or slightly higher in the second half compared to the first," said Conti.

Vishay Intertechnology has also seen healthy growth for power transistors in the first half of the year. Demand for MOSFETs has remained strong, said Dave Valletta, executive vice president worldwide sales for Vishay. "The same drivers are there. Automotive has been strong and continues to be. Telecom has been strong. We've had a lot business coming in 5G programs. So, the outlook is good," he said.

Unit shipments to rise

In fact, underlying demand for power transistors is healthy and unit sales in 2019 should again increase six per cent, according to IC Insights. Sales in the first quarter of the year were up 10 per cent, the researcher said

"We think it (power transistor sales) will slow quite a bit in the second half of the year. That's why we have a growth rate of five per cent," said Rob Lineback, senior market analyst for IC Insights.

Power transistors, which include power metal oxide semiconductor field emitting transistors (MOSFETs), insulated gate bipolar transistors (IGBT) and bipolar junction transistors (BJTs) are used in a wide range of electronics equipment. Power MOSFETs below 200V account for about 42 per cent of the power transistor market while. Power MOSFET above 200 V, which are used in servers, telecommunications and switching equipment, account for 14 per cent, according to IC Insights.

IBGTS used in modules represent about 23 per cent of the power transistor market, while individual IGBT sales account for nine per cent of the market. BJTs, which are mature products, represent five per cent of the market and RF and microwave transistors account for about six percent of power transistor revenue, the researcher said.

Power MOSFETs have posted the strongest growth rates over the last several years. In 2018, power FETs for 40-100V applications increased 21 per cent and and insulated-gate bipolar transistors (IGBTs), rose 20.3 per cent, said IC Insights. Power FETs for up to 40V applications grew 17 per cent, while power FETs for 100-200V applications increased six per cent. IGBT power modules rose 15 per cent.

The only power transistor segment that suffered declining sales was RF/microwave power transistors. Revenue for the segment fell one per cent last year.

By the Numbers

62.8 billion
The number of power transistor units shipped in 2018

25.7 cents
The average price of a power transistor in 2019

5%
The expected growth rate for power transistors in 2019

3.3%
The compound annual growth rate for the power transistor market from 2018 through 2023

$19.2 billion
The forecasted size of the global power transistor market in 2023

MOUSER ELECTRONICS
The Newest Products for Your Newest Designs®
Same-day Shipping

"Power transistor demand has been pretty much across the board because power transistors are used in everything," said Lineback. "The automotive market was one of the strong segments driving power transistor growth over the past couple years," he said. "The automotive market was one of the strong segments driving power transistor growth over the past couple years," said Lineback.

Robust demand from automotive resulted in shortages which drove up prices and increased revenue growth for power transistor manufacturers, he said.

Capacity added

To meet rising demand, power transistor manufacturers have been steadily adding capacity over the last year. Some transitioned some power transistor manufacturing to 300mm wafers. By switching to larger size wafers, chipmakers can produce more chips per wafer to boost supply without having to add new production lines.

However, suppliers have been careful not to add too much capacity and in the first quarter of the year, most suppliers were still trying to catch up with demand, according to IC Insights.

The good news for buyers is that tight supplies of most power transistor product types are expected to end in the second half of the year because of the overall slowdown in the global economy and slower demand growth for power transistors, the researcher said. However, the continuing trade war between the US and China could adversely impact the power transistor market.

Because capacity has increased, power transistor lead times continue to shrink and could end up in the "normal" range of 8-12 weeks later in the year. "It may get to the point where there would not be a glut, but maybe a little bit of oversupply in the market," he said.

In the next several years more capacity may be needed. While power transistors are used in a wide range of equipment, there could be new drivers for the power transistor market. Lineback said the transition to 5G networks will be "good news for the RF power transistor side of the business which has not done well" but it will not happen overnight.

He said 5G smart phone will eventually drive power transistor sales, but it may take several years. "I don't think it will cause a tremendous surge in power transistor sales" in the short term, he said. It will take several years before 5G cell phones have an impact on power transistor demand.

However, he noted 5G is not just about smart phone handsets The next-generation wireless technology is going to involve "anything connected to the Internet or connected to things. Automotive will be a strong 5G market because cars" will be connected to a cellular network to have access to the Internet. Also, IoT will possibly run through 5G networks versus going throw wired connections, said Lineback.

More SiC power transistors

A key trend for buyers to watch is the transition of power transistors to silicon carbide and gallium nitride compounds.

"Every single supplier has transistors based on one or both of those technologies," said Lineback. Gallium nitride/silicon carbide transistors are forecast to grow at a compound annual growth rate of 45 per cent and sales of the devices will reach more than $900 million by 2023.

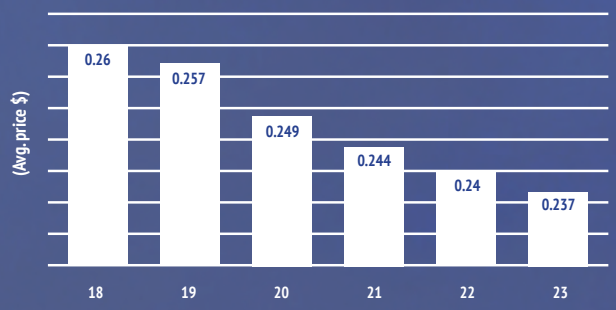
More silicon carbide and gallium nitride power transistors will be made because of the advantageous wide-bandgap properties of the materials. Conventional silicon semiconductors have a bandgap in the range of 1-1.5 electronvolt (eV). Wide-bandgap materials have bandgaps in the range of 2-4 eV. Having a wider bandgap means that chips using the compounds can operate at much higher voltages, frequencies and temperatures than silicon-based semiconductors.

Silicon carbide and gallium nitride are more widely used in RF and microwave power transistors. More power transistors will use silicon carbide and gallium nitride in the next five years.

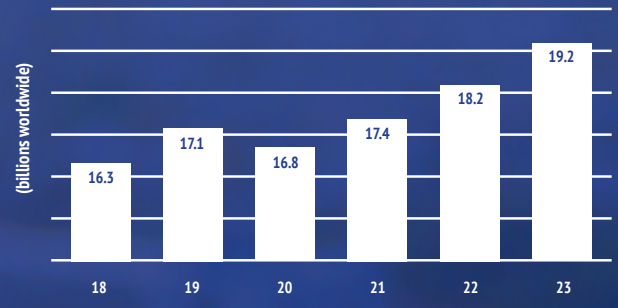
Only about one per cent of power transistors use one of the compounds today, the figure will increase to five or six per cent in five years, said Lineback.

Robust demand will prevent power transistor prices from falling too sharply
Source: IC Insights

Power transistor prices will drop



Power transistor market to grow 5 per cent in 2019



Power transistor revenue will grow 5 per cent to $17.1 billion in 2019
Source: IC Insights

Authorized Distributor
Worldwide leading authorized distributor of semiconductors and electronic components.
mouser.com

Sponsored by eBOM.com



Component supply conditions favor purchasers

Prices and lead times have fallen and most allocations are over as high inventory levels and weaker demand have improved supply conditions for electronics purchasers.

Electronic component buyers may not yet be singing "Happy days are here again," but many purchasers are pleased supply conditions for passives and connectors have turned. There is adequate, if not plentiful, supply for many parts compared to last year when some components were on allocation, most had long lead times and prices for many increased.

Depending on the part, prices are falling or stable and lead times are down although not quite to pre-2018 levels. Most allocations are over and while lead times for all components may not be "normal," many have retreated from 40 to 50 weeks to 20 weeks or less, while some are still more than 30 weeks, according to industry analysts and manufacturers buyers.

Lead times are likely to further shrink in the third quarter. And, while it may not be a buyer's market, supply conditions for multilayer ceramic capacitors (MLCC), and other capacitors, resistors, and connectors will be more favorable to buyers through the second half of the year and maybe into 2020.

The reason buying conditions for purchasers have improved is that many component and connector manufacturers added capacity last year because of robust orders from OEMs and EMS providers across most industries. Distributors also boosted orders to manufacturers.

With resistors and capacitors. "There was a tremendous amount of capacity added," said Dave Valletta, executive vice president, worldwide sales for Vishay Intertechnology. Distributors and OEM were trying to get their hands on as much product as they could. But all of a sudden everybody realized there was way too much inventory," he said.

At the same time, toward the end of 2018, demand declined across most industries. There was also slower economic growth in China which resulted in less component demand.

As a result, supply became plentiful and lead times and prices started to fall. "Automotive usage and handset demand along with handset accessories are way down which is freeing up a lot of inventory," said Stephanie Martin, senior vice president global supply for EMS provider Vexos. In China, business was expected to be sluggish in the first quarter because of the Chinese New Year, but business was worse than expected and Q2 wasn't much better, she said.

"Some distributors based in China told us business was down 10 per cent in the fourth quarter of 2018, down 8 percent in Q1 and it looked like it would drop 8-10 per cent in Q2," said Martin. Many distributors in China are "in an over inventory position because large EMS and OEM customers double and triple booked, then cancelled orders," she said.

High inventory levels and weakened demand from key market segments has resulted in falling prices for components. Prices have declined 60 per cent for some components and are reaching 2017 price levels. "But remember we had a lot of price increases in 2018," said Martin

Good news, bad news

The good news for buyers, but not so good news for component factors, is inventory levels have not yet worked off, and it may take two more quarters for that to happen. It could be a bonafide buyer's market in the second half of the year, at least temporarily.

"Right now, there's still a lot of stock on customer shelves," Valetta said in early July. "There is stock on distributors' shelves. There is enough capacity." Inventory is being worked off, but it could take several quarters, he said. "Most component manufacturers are in the doldrums right because of all of the inventory that is sitting there," said Valletta.

On the positive side for component manufacturers,

Meet New Suppliers & See New Technologies

DESIGN 2 PART SHOWS

at America's Premier Design & Contract Manufacturing Trade Shows!



2019 Fall Shows

Marlborough, MA	September 25 & 26
Pasadena, CA	October 9 & 10
Oaks, PA	October 23 & 24
Indianapolis, IN	November 6 & 7
Charlotte, NC	November 13 & 14

2020 Spring Shows

Grapevine, TX	February 26 & 27
Atlanta, GA	March 25 & 26
Uncasville, CT	April 15 & 16
Schaumburg, IL	May 6 & 7
Nashville, TN	May 20 & 21
Santa Clara, CA	June 10 & 11

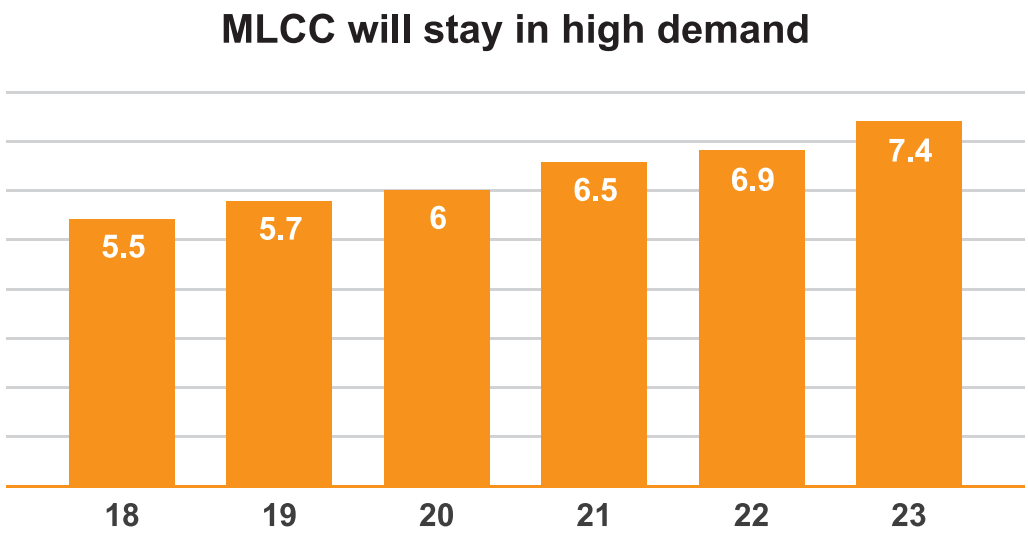
MADE IN USA for over 40 years

- Compare Vendors
- Improve Quality
- Reduce Your Costs

Metal, Plastic, Rubber, Electronics
From Design & Prototypes to Production & Finishing

@Design2Part

For More Information or for FREE Show Registration, D2P.com



Demand for multilayer ceramic capacitors will reman strong through 2023 driven by multiple end market customer segments ranging from computers to new 5G handsets.

distribution business is doing well and "that inventory will move," he said. "It would be a lot worse if distributors' outlook wasn't good. Distributors are more of an indicator of the health of the market."

Obviously, most purchasers want buying conditions to improve and would welcome a buyer's market. Lead times and prices for many components were falling at the beginning of the third quarter.

Supply continues to improve for many devices including MLCCs, which were a thorn in the side for most buyers in 2018. Last year, MLCCs from some manufacturers were on allocation. MLCC tags increased 40 to 50 per cent depending on the application, according to researcher Frost and Sullivan.

Today most devices that are 0402 or smaller case sizes are in the 12 to 16 week lead time range. However, MLCCs in large case sizes, including 0603, 0805 and 1206, have 30 to 40 week lead times, but those are down from 52 weeks last year.

Most manufacturers added about 10-15 per cent capacity last year for smaller size parts 0201 and 01005's, but manufacturers apparently are not adding capacity for parts in larger case sizes. In fact, some manufacturers earlier had stopped making such parts, while others don't plan to add additional capacity, which could result in longer lead times. However, there are exceptions. Samsung is focusing more production in larger case sizes including 0805 and above, according to Vexos. Vishay is also producing more parts in larger case sizes.

Murata has designated a number of MLCCs as Not Recommended for New Design (NRFND) which could be an indication that the manufacturer will soon discontinue the parts. Because overall business is sluggish, the company may hold off issuing end-of-life notices for the parts in larger case sizes until business picks up when they will need production lines for MLCCs in smaller case sizes, said Martin

MLCC demand will rise again

While supply conditions for capacitors are improving, the favorable conditions may be short lived because demand will likely pick up again. "The number of MLCCs is increasing significantly in every application/segment," said Aravind Seshagiri, global research manager, industrials for Frost & Sullivan. Besides traditional applications for capacitors, the buildout of 5G networks and the expansion of Internet of Things applications will add capacity.

MLCC demand across industries has increased and the challenges in capacity, supply chain, technology requirements have certainly impacted the MLCC supply, said Seshagiri. In addition, there has been consolidation in the electronics industry, which has impacted supply.

While suppliers have added capacity, the expansion and increase in production has been slow and this is likely to continue as manufacturers are "more focused on high volume, as well as margin segments such as automotive, aerospace and defense, and healthcare," said Seshagiri.

Resistor lead times fall

Supply conditions for resistors have also done an about-face. Generally, resistor lead times are in the 8 to 16 week range with parts from Yageo running at about 8 to 10 weeks, according to Martin.

The times for chip resistors were in the 12 to 24 week range. The CRCW series from Vishay is down from 78 weeks to 40 to 52 weeks, while the ERJ series from Panasonic is off of allocation and in the 17 to 21 week range, according to Vexos.

As with capacitors and resistors, there is weaker demand for connectors this year than in 2018. "Demand is slowing worldwide," said Ron Bishop, president and founder of connector research firm Bishop & Associates. He said for all regions, connector sales through May were down 3.5 percent.

Only North America is showing year-over-year growth. North American connector sales are up 3.6 per cent year to date over 2018. However, sales in North America declined 1.7 per cent in April and May after posting growth in each month of the first quarter.

Europe's year-to-date's sales were down 5.4 per cent. China's sale fell 8.5 per cent and Japan was down 6.7 per cent, while the Asian-Pacific year-to-date sales dropped 1.3 per cent.

Despite the slowdown in connector sales in recent months, industry revenue for the year will still grow, but it won't be as strong as last year. Earlier Bishop had forecast the connector market would rise 6.5 per cent to $71.1 billion in 2019. However, with demand weakening, the growth rate would be in the low single digits, said Bishop.

Bishop added that connector lead times and prices were stable at the beginning of the second half and "we expect that to remain so for the remainder of the year." He added connector companies are not increasing capacity right now. "Demand is a little soft and companies are watching for market direction. Raw material costs are up a little but nothing that is causing great concern," he said.

Decline in critical markets

Connector and passive component sales declined in the first quarter because several key market segments suffered downturns. For instance, revenue in the telecom/data market declined 11 per cent in the first quarter, compared to the first quarter of 2018, according to Bishop. Automotive had been a strong market for many component manufacturers, but sales in the segment declined 5.2 per cent in the first quarter.

The industrial, computer and peripheral segments also posted declining sales in the first three months of 2019. However, the mil/aero segment grew 10.4 per cent while transportation revenue rose 4.4 per cent according to Bishop.

One indication of slowing growth is the printed circuit board (PCB) book-to-bill ratio fell to 0.99 in May from 1.02 in April, according to the Association Connecting Electronics Industries (IPC). A book- to-bill ratio of 0.99 means that for every $100 of printed circuit boards that manufacturers shipped in May, PCB makers received only $99 in new orders, an indication of slowing business. May's board book-to-bill ratio was a drastic change from 2018 when the ratio was 1.09.

"Although sales and order growth continued in May for the North American PCB industry, slowing order growth rates pushed the book-to-bill ratio below parity," said Sharon Starr, IPC's director of market research." She noted that May 2019 was the first time since January 2017 that the industry registered a book-to-bill ratio below parity (1.00). "Recent ratios hovering around parity indicate continued but slower growth in the coming months." she said.

Industry analysts, component manufacturers and electronics buyers don't know how long the slowdown will last. Some component manufacturers and electronics distributors say component demand will pick up in second half of the year once high inventory levels in the supply chain are worked off. Others say business will remain sluggish through the year and higher than average inventory levels and lower prices will take their toll on component revenue for the year. For instance, Vishay's sales for the year will be flat to down, according to Valletta.

Buyers are hoping that lead times and prices continue to fall and get back to 2017 levels, but there is no certainty that will happen. Favorable business conditions for buyers will continue through at least the third quarter, according to Martin. "Q4 is an unknown at this time, but I'm not hearing any increased orders with our suppliers yet that indicate a spike. We are just happy to have stable and decent lead times again," she said.

However, some buyers are concerned about what the impact of 5G networks and handsets will have on electronic components supply. When the technology kicks in, the expectation is that the market for components in larger case sizes will become constrained again, since no additional capacity is being added for parts in larger cases. If demand from automotive system and handset manufacturers bounces back, component supply will become even more constrained.

The market is in a lull because of cancelled orders and double/triple bookings by the large EMS providers and OEMS, which has resulted in high inventory levels the supply chain. "When this excess inventory is consumed and demand spikes up again, we expect the roller coaster to start again. I believe it will be in late Q4 or early Q1 next year," said Martin.

So rather than singing 'Happy days are here again, many buyers may just be singing the blues in a few months.

Although sales and order growth continued in May for the North American PCB industry, slowing order growth rates pushed the book-to-bill ratio below parity

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No.of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No.of Technical Support Staff	Total No. of Staff	Pack and Hold
ACOUSTIC COMPONENTS											
BeStar Electronics Ind. Co. Ltd.	BeStar Technologies Inc.	520-439-9204	www.bestartech.com	Y	N/A	$250,000	N/A	100.00%	50	900	Y
CABLE & WIRING											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23235	N/A	$0	0.46	50	1,000+	Y
Alpha Wire	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,106	N/A	$0	93.00%	50	1,000+	Y
Belden Wire & Cable	Mouser Electronics	800-346-6874	www.mouser.com	Y	5,863	N/A	$0	97%	50	1,000+	Y
Molex	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Molex	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
CIRCUIT PROTECTION											
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,462	N/A	$0	68.00%	50	1,000+	Y
Eaton	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,487	N/A	$0	100%	50	1,000+	Y
Littelfuse	Mouser Electronics	800-346-6873	www.mouser.com	Y	28,790	N/A	$0	67%	50	1,000+	Y
Schurter	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	31,445	N/A	$0	68%	50	1,000+	Y
DISPLAYS & LEDs											
BIVAR	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,390	N/A	$0	99.00%	50	1,000+	Y
Dialight	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,179	N/A	$0	84.00%	50	1,000+	Y
Displaytech	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Electronic Assembly	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Kingbright Company, LLC	Mouser Electronics	800-346-6873	www.mouser.com	Y	301	N/A	$0	100.00%	50	1,000+	Y
Lumileds	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Newhaven Display	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,690	N/A	$0	100.00%	50	1,000+	Y
VCC	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ELECTROMECHANICAL											
ALPS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Apem, Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,326	N/A	$0	83.00%	50	1,000+	Y
C&K Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	27,230	N/A	$0	90.00%	50	1,000+	Y
E-Switch	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Grayhill	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y

Continue on page 30

Advert Index

Advert	Page	Advert	Page
Coilcraft	20	Mouser Electronics	10, 11, 22, 23, 29, 31, 34, IBC
Design 2 Part	25	OKW	17
Digi-Key Electronics	FC, IFC & 14	Rochester	13
eBOM.com	19	Rutronik	BC
ELECTRONIC ASSEMBLY	21	Sager	5
Memory Protection Devices (MPD), Inc	9	TTI	7

Many distributors make claims

We simply win awards

MOUSER ELECTRONICS

ORDER WITH CONFIDENCE

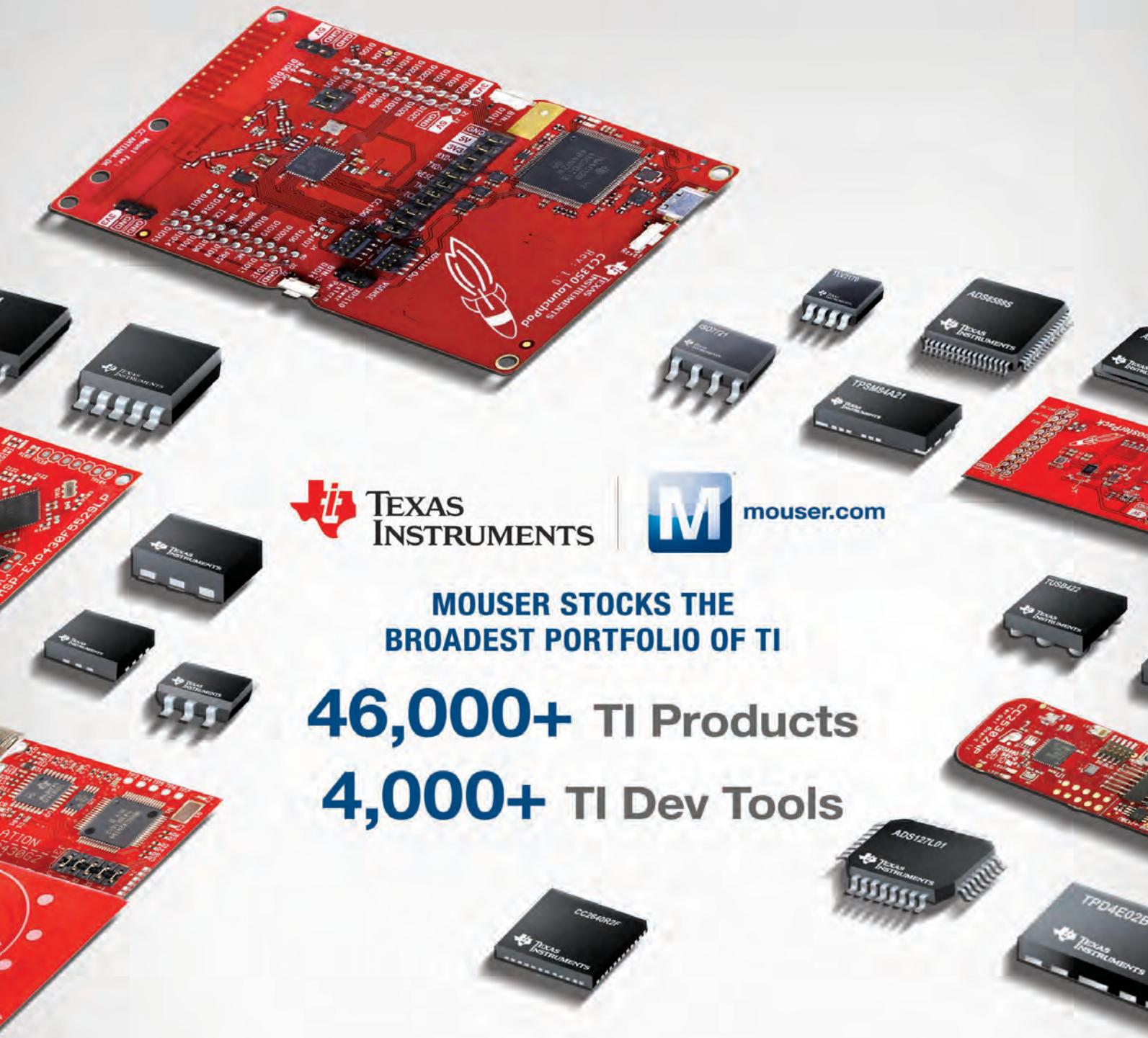




6th consecutive NorthFace Scoreboard Award for service excellence

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											
Abracon Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,780	N/A	$0	100%	50	1,000+	Y
CTS Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,889	N/A	$0	100%	50	1,000+	Y
ECS Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,070	N/A	$0	100%	50	1,000+	Y
Epson Toyocom	Mouser Electronics	800-346-6873	www.mouser.com	Y	178	N/A	$0	100%	50	1,000+	Y
IQD Frequency Products	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Kyocera	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Silicon Labs	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ICs & SEMICONDUCTORS											
Analog Devices, Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,749	N/A	$0	95%	50	1,000+	Y
Broadcom Limited	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Central Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Central Semiconductor Corp.	Future Electronics	(800) 675-1619	www.futureelectronics.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	Y
Cree, Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Cypress Semiconductor Corp	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,325	N/A	$0	81.00%	50	1,000+	Y
Digi International	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Diodes Incorporated	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
FTDI	Mouser Electronics	800-346-6873	www.mouser.com	Y	94	N/A	$0	100%	50	1,000+	Y
IDT (Integrated Device Technology)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Infineon	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,580	N/A	$0	63%	50	1,000+	Y
Intel	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ISSI	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
IXYS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Lattice	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
MACOM	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Maxim Integrated	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Microchip	Mouser Electronics	800-346-6873	www.mouser.com	Y	5,800	N/A	$0	100%	50	1,000+	Y
Microsemi	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Monolithic Power Systems (MPS)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Nexperia	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
NXP	Mouser Electronics	800-346-6873	www.mouser.com	Y	7,205	N/A	$0	100%	50	1,000+	Y
ON Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	7,486	N/A	$0	96%	50	1,000+	Y
Power Integrations	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Qorvo	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Renesas Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ROHM Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
SanDisk	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Silicon Laboratories Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,141	N/A	$0	100.00%	50	1,000+	Y
Skyworks	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ST Microelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,145	N/A	$0	96.00%	50	1,000+	Y
Swissbit	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	29,676	N/A	$0	94%	50	1,000+	Y

Continue on page 32



Mouser Electronics – your authorized TI distributor stocking more products for your next design.

mouser.com/ti

MOUSER ELECTRONICS

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
OBSOLESCENCE / HARD TO FIND											
	America II Electronics	800-767-2637	www.americaii.com	M	1,900	$1B	$0	75.00%	59	550+	Y
	Lantek Corp.	973-579-8100	www.lantekcorp.com	M	186,000	$22M	$0	75.00%	5	62	Y
	Chip 1 Exchange USA, Inc.	949-589-5400	www.chip1.com	Y	850,000	N/A	$0	85%	20	150	
	Rochester Electronics	978-462-9332	www.rocelec.com	Y		N/A	$250		10	400+	Y
OPTO ELECTRONICS											
Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	582	N/A	$0	99.00%	50	1,000+	Y
Finisar	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,927	N/A	$0	99%	50	1,000+	Y
ROHM Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
PASSIVES											
ABRACON	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
AVX	Mouser Electronics	800-346-6873	www.mouser.com	Y	42,454	N/A	$0	72%	50	1,000+	Y
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	38	N/A	$0	78%	50	1,000+	Y
Cornell Dubilier	Mouser Electronics	800-346-6873	www.mouser.com	Y	24,145	N/A	$0	71%	50	1,000+	Y
Coilcraft	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	26,533	N/A	$0	98.00%	50	1,000+	Y
Fair-Rite	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Kemet	Mouser Electronics	800-346-6873	www.mouser.com	Y	77,568	N/A	$0	66%	50	1,000+	Y
KOA Speer	Mouser Electronics	800-346-6873	www.mouser.com	Y	34,078	N/A	$0	58%	50	1,000+	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	33,780	N/A	$0	99%	50	1,000+	Y
Nichicon	Mouser Electronics	800-346-6873	www.mouser.com	Y	20,389	N/A	$0	84.00%	50	1,000+	Y
Ohmite	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,293	N/A	$0	55.00%	50	1,000+	Y
Panasonic Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,948	N/A	$0	100.00%	50	1,000+	Y

Buyers' Guide

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

Contract Manufacturers Buyers' Guide

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



Increase your buying confidence

- Access the Newest Products from More Top Manufacturers
- Widest Selection of Electronic Components in Stock
- See Our Ever-Expanding Linecard of Leading Manufacturers

MOUSER ELECTRONICS

mouser.com/ES-Linecard


TE connectivity
AUTHORIZED DISTRIBUTOR
Honeywell
cinch
CONNECTIVITY SOLUTIONS
a bel group
SILICON LABS
molex
ANALOG DEVICES
AHEAD OF WHAT'S POSSIBLE™
Electronic Components
KEMET
CHARGED.
maxim integrated
muRata
OVATOR IN ELECTRONICS
Amphenol
NXP
POWER BY LINEAR™
OSRAM
Opto Semiconductors

RUTRONIK
ELECTRONICS WORLDWIDE



RUTRONIK.

Where “in stock” doesn’t come with air quotes.

At Rutronik, “in stock” means in our warehouse. The one in Texas.

Rutronik brings the selection, buying power and technical support of the world’s 11th largest electronics components distributor to America.

We’re the sweet spot of distribution—a true stocking distributor big enough to deliver the volume and pricing you need, but not so big we can’t be bothered to talk to you if your order isn’t for a million parts.

Give us a call and experience a new world of distribution, right in your own backyard.

Contact us: +1 469-782-0917 or sales-na@rutronik.com

ecia MEMBER

www.rutronik.com

Committed to excellence