

ELECTRONICS

MARCH 2019

sourcing

NORTH AMERICA



AEROSPACE: A NO-FLY ZONE FOR COUNTERFEITS

ALSO INSIDE: NEWS • MARKET WATCH • PURCHASING • PRODUCTS

AN MMG PUBLISHING TITLE



Access to
8.5 Million+
Products Online

DIGIKEY.COM

1,600,000+ PRODUCTS IN STOCK | 8.5 MILLION+ PRODUCTS ONLINE

The World's Largest Selection of Electronic Components Available for Immediate Shipment®



1.800.344.4539
DIGIKEY.COM



750+ INDUSTRY-LEADING SUPPLIERS | 100% AUTHORIZED DISTRIBUTOR

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



On the cover – March 2019

Aerospace: a no-fly zone for counterfeits
page 16

Contents

04

News

Mil-spec cable assemblies ship same day



12

Aerospace

Safe supply paramount in volatile market



28

Power

The power to influence



36

Enclosures

Protection against the odds



45

Buyers' Guide

All the facts and figures to help you buy



Contact



EDITORIAL

Managing Editor: Jon Barrett
jonb@electronics-sourcing.com
Contributing Editor: Amy Barker
amyb@electronics-sourcing.com
Editorial & Production: Thomas Smart
thomas.smart@electronics-sourcing.com
Editorial & Production Assistant: Ben Kitching
ben.kitching@electronics-sourcing.com

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 78, Vol.10 No.03

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



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 – ©istockphoto.com/rzdeb

Editor's Word



Drip, drip, drip

As the complexity of the world increases and my cognitive capacity decreases, I often have fun thinking of simple ways to judge complicated things. For example, this week I've decided that I will measure the 'state of a nation' by how it cares for its gutters, downspouts and storm drains. At this point you may be wondering if I've lost the plot. Hear me out.

Water is the universal solvent. Given enough time it will destroy every manmade object in its path. Architects and city designers understand this and have engineering standards for collecting and diverting rain water.

However, gutters are high on roofs and drains are underground. They represent a classic case of 'out of sight, out of mind'. It takes a conscientious and hardworking society to even remember it has gutters and drains, let alone clean and maintain them.

So, why am I writing about gutters and drains in *Electronics Sourcing*. Well, I see this story as a metaphor for any process, including purchasing. When your company started purchasing electronic products I imagine it first decided what was important and then put processes in place to manage the task.

However, over time, the people who designed those processes move on and no one is quite sure who is responsible for maintaining them. Eventually they drift from view and remain frozen in time while the rest of the world moves on.

I invite you to place your purchasing processes in the front of your mind at all times. Monitor them, measure them, tidy them up and replace them with superior processes when you can.

Jon Barrett



Tested mil-spec cable assemblies ship same day

Fairview Microwave has launched a new series of MIL-DTL-17 RF cable assemblies ideal for military electronics, electronic countermeasures, avionics, unmanned systems and identification friend-or-foe systems. These military-grade assemblies are 100 per cent tested and come complete with test data, test report and material lot traceability.

Assemblies feature operating frequencies of up to 12.4GHz and voltage standing wave ratio as low as 1.3:1 per connector. Six different cable types are available in 124 basic configurations for a total of more than 1,200 part numbers, all of which can be supplied for same-day shipment with test reports.

Assemblies consist of MIL-C-17 qualified cable, MIL-PRF-39012 qualified connectors, J-STD soldering and AS23053 heat shrink, making them ideal where there is a high cost-of-failure.

Product manager, Dan Birch, said: "Being able to offer 1,200 commercial-off-the-shelf cable assemblies with same-day shipping and test reports is a game changer. In the past, customers would have to wait weeks or months for cables built to these specifications and with traceability, but this entire line is ready and available immediately."

www.fairviewmicrowave.com

New line adds breadth to IP&E focus

Master Electronics has announced a strategic partnership with Samtec, whose product line will add breadth and design flexibility to Master's existing interconnect, passive and electromechanical offering.

President of Master Electronics, Riad Nizam, explained: "Samtec is not just another connector company on our line card. It is committed to exceptional service, quality products, and convenient design tools. Samtec's products fit beautifully into our IP&E focus and its track record of accumulating service awards and new product development is impressive."

www.masterelectronics.com

Buying into precision MEMS gyros

Newark element14 has expanded its portfolio of inertial sensing solutions with high-performance MEMS gyros from Tronics Microsystems, a division of TDK. Ideal for applications that require high bias stability, typical usage will include precision navigation, motion tracking and control and optical stabilization.

Head of product management, semiconductors at Premier Farnell and Newark element14, Andrea Rivero, said: "Tronics' Gypro closed-loop MEMS gyros take MEMS inertial sensors to an unrivalled level of performance with excellent measuring accuracy and long-term stability. This collaboration addresses applications on the high-end side of the motion sensing sector."

The Gypro series is said to combine several benefits on a single chip with bias instability of only 0.8° per hour along with ultra-low noise. The built-in closed-loop electronics also boast superior linearity, increased signal to noise ratio and improved behavior in harsh vibration, shock and temperature environments.

www.newark.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 and developments within the global electronics supply chain. Register for free at www.electronics-sourcing.com/newsletter

IT ALL STARTED IN 1887 AS A SMALL BOSTON STOREFRONT SELLING SPEAKING TUBES.



Over 130 years later, Sager Electronics has grown into a leading North American distributor of interconnect, power and electromechanical electronic components. Acquired in 2012 by TTI, Inc., a Berkshire Hathaway, Inc. company, Sager continues to operate with the same dedication to its core values – integrity, service and adaptability.



OVER 130 YEARS OF DISTRIBUTING CONFIDENCE®

In Brief

Supporting legacy SDRAM

Alliance Memory is offering several end-of-life 8G DDR3L SDRAMs for which Micron Technology announced a last time buy date of 13 January 2019. Various part numbers are offered, and for three of the devices, Alliance is also offering versions with Alliance Memory part numbers using the same single-die Micron silicon as the Micron-numbered parts. www.alliancememory.com

Datamate range extended

Harwin has secured supply chain support from Digi-Key, Mouser and TTI for its narrow-pitch T-Contact products. Part of the Datamate series, products feature a six-finger mechanical design, machined out of a single piece of beryllium copper. Benefits include increased conductivity and spring performance plus heightened operational robustness. Applications include unmanned vehicles, avionics and satellites. www.harwin.com

Custom connector support

Lemo USA has signed an agreement with Luscombe Engineering for the Southern California and Southern Nevada Regions. Luscombe will support Lemo's interconnect solutions by providing a high level of quality including handling customers that need a quick-turn-around solution. Thanks to the agreement, Luscombe will be able to provide more customized solutions to customers. www.lemo.com

IHLP lead-times cut

Vishay Intertechnology has introduced alternative versions of its 10 most popular commercial style IHLP inductors with shorter lead times of eight to 10 weeks. Manufactured on separate, dedicated production lines, the line-up consists of over 100 part numbers in the 1616, 2020, 2525, and 4040 case sizes. These devices are equivalent in fit, form, and function but may show slight deviation in datasheet parameters. www.vishay.com

Partnership puts infrared sensors center stage

Pyreos has announced a new global distribution partnership with Mouser Electronics, which will extend availability of Pyreos' infrared sensor solutions for applications such as gas and fire detection, medical, food safety, fuel and oil analysis.

Products include linear array sensors, single, dual and quad channel analogue TO-39 packaged sensors, and the latest ezPyro family of mid-infrared surface mount pyroelectric sensors for gas and flame detection and food analysis. This product has recently been selected by two medical equipment suppliers for CO₂ gas detection because of its low power consumption, small size and short response time. Mouser will also offer Pyreos product evaluation systems to facilitate rapid adoption of the sensors.

Vice president of supplier marketing at Mouser Electronics, Kristin Schuetter, said: "The market for infrared sensors is growing steadily and Pyreos has proven expertise and technology leadership in this area, with products used in a wide range of applications."

Vice president of sales at Pyreos, Keith Pruden, added: "The combination of Mouser's exceptional logistics and customer service and our technology's unique performance, will allow more rapid prototyping and adoption worldwide."

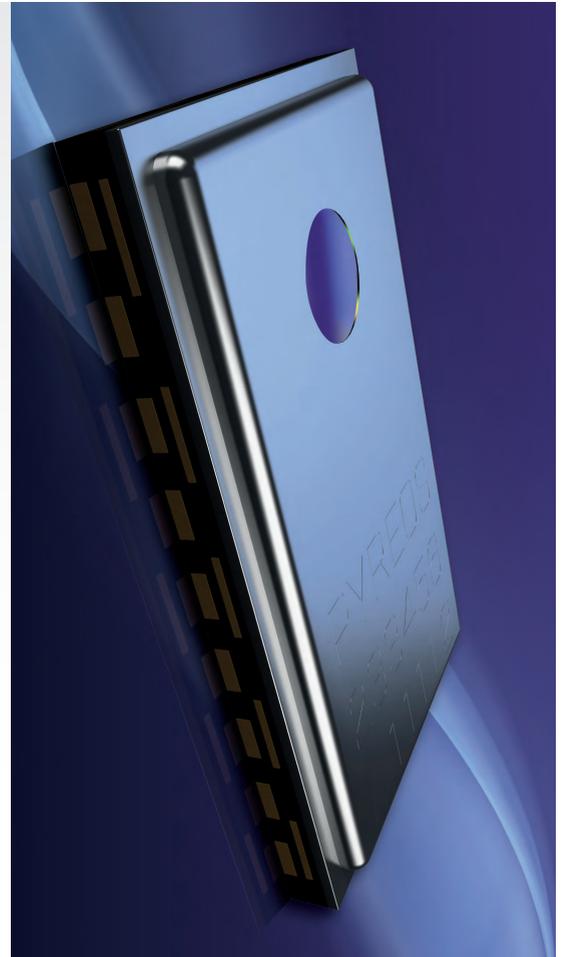
pyreos.com



Fixed temperature thermostats in stock

TTI is now stocking Sensata Technologies' 1NT series of single throw, snap action, fixed temperature thermostats suitable for a variety of industrial and commercial applications. Suitable for use as a regulating thermal switch, over-temperature control or pilot duty control switch, the thermostat has an ambient temperature rating from -40 to 240°C. Various termination and mounting configurations are offered, along with options for automatic reset, manual reset, trip-free manual reset and one shot.

www.ttiinc.com



Compact supplies offer quiet power

Sager Electronics is now stocking Traco Power's TPP 450 series 450W AC/DC power supplies. The supplies boast a high efficiency design using industrial grade components to provide superior performance in the standard three by five inch footprint. Operating over an extended -40 to 85°C temperature range, the TPP 450 has an integrated 12V fan output with variable speed control to minimize fan noise. This ensures the TPP 450 is ideal for space limited, thermally challenged industrial applications that require maximum power in a small space, including medical requirements where audible fan noise cannot be tolerated.

www.sager.com



element14

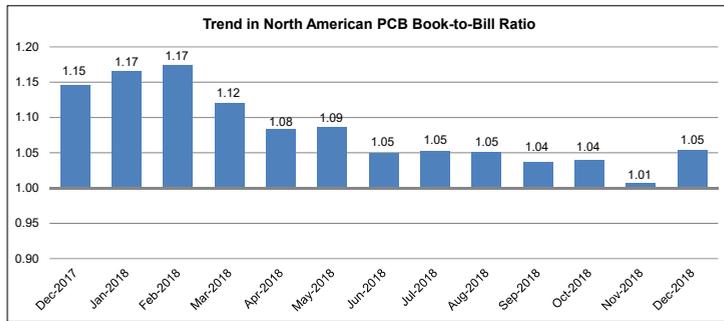
Call us at 1-800-463-9275
newark.com

Discover Over a Million Engineering Products from Suppliers You Know and Trust

- 900+ new products added each week
- Custom services such as kitting, panel meters, enclosures, and many more!
- Market-leading online community of over 500,000 engineers

Your
**DEVELOPMENT
DISTRIBUTOR**





Note: The January 2018-March 2018 ratios have been revised since their original publication due to updated data from statistical program participants.

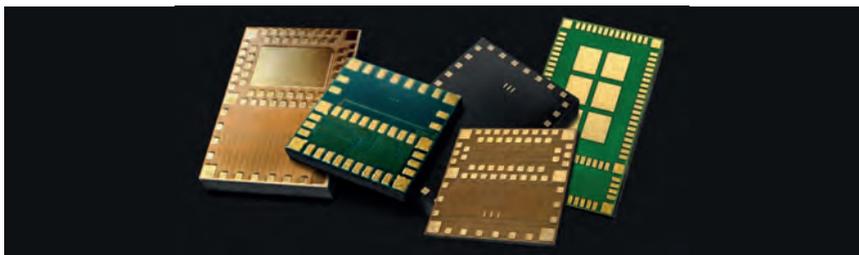
PCB growth remains solid

Findings from the IPC's North American printed circuit board statistical program reveal that overall sales growth remained solid last year. Despite slower progress towards the end of the year, it seems growth bounced back in December 2018, with the book-to-bill ratio also strengthening.

Total North American PCB shipments in December were up 7.7 per cent compared to the same month last year and up 17.1 per cent compared to the preceding month. PCB bookings were down 3.1 per cent year-over-year but ended 2018 at 5.7 per cent above the previous year. Bookings in December were also up 26.3 per cent from the previous month.

IPC's director of market research, Sharon Starr, concluded: "Despite slowing PCB sales growth in North America in recent months, the industry ended the year well ahead of 2017. Although year-on-year PCB order growth was negative in December, order growth remained positive for 2018. Despite declining orders and a related decline in the book-to-bill ratio, the ratio bounced back in December. It has now been in positive territory for almost two years, which indicates a positive outlook for continued sales growth in the first half of 2019."

www.ipc.org



SiP module provides complete Bluetooth solution

Rutronik has announced that Insight SiP's new ISP1507-AL system-in-package is now available at Rutronik24. Based on the nRF52810 multiprotocol system-on-chip from Nordic Semiconductor, this fully-integrated Bluetooth low energy module is ideal for mesh relay nodes and price-sensitive internet of things applications.

The module features an ARM Cortex M4 floating point processor, which enables the new SiP to do fast calculations and manage all 13 I/Os, as well as analog and digital peripherals. Devices also feature 192kB flash memory, 24kB RAM, and two integrated crystals, plus an antenna and various interfaces.

Due to its small dimensions, high performance and range of functions, the ISP1507-AL BLE is ideal for solutions that require fast processing and low power consumption. Target applications include IoT, industrial sensors, wearables, beacons and home automation.

Director, product marketing North America at Rutronik, Mary Ellen Bauchman, commented: "ISP1507-AL provides a complete solution for Bluetooth low energy and ANT connections."

www.rutronik.com

Wireless module ready to roll

Global distributor, Future Electronics, can now offer the latest PAN9026 series of dual-band wireless modules from Panasonic, which are said to be both compact and cost-effective. The PAN9026 is a dual band 2.4/5GHz 802.11 a/b/g/n Wi-Fi radio module with integrated Bluetooth basic rate/enhanced data rate/low energy. According to Future, it has been specifically designed for highly integrated and cost-effective applications.

www.futureelectronics.com



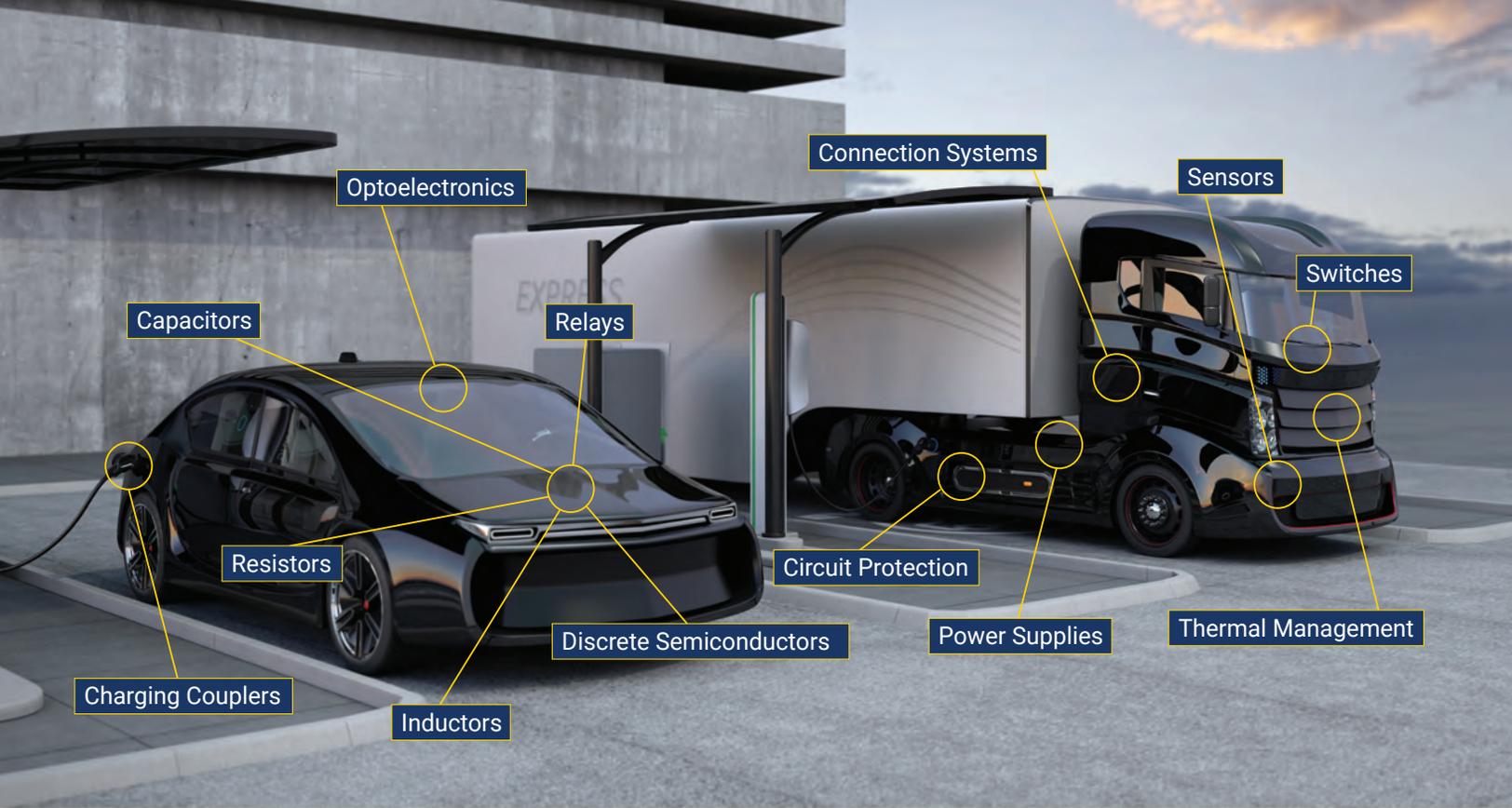
Green power portfolio extended

New Yorker Electronics has teamed with Lite-On Semiconductor in a new global franchise distribution agreement to supply Lite-On Semi's discrete power management devices worldwide. These green power related semiconductor components are mainly applied in communications, information and consumer products' switching power supply and system power supply. LSC can also build custom power management solutions to enhance power efficiency.

President of New Yorker Electronics, Barry Slivka, said: "Along with a vast inventory, Lite-On brings a lot to the table in terms of better leads times, cost effectiveness and flexibility."

As a franchise distributor, New Yorker Electronics will supply the entire line of Lite-On Semiconductor rectifiers, thyristor devices, mosfets, zener diodes, SiC Schottky diodes, contact image sensors, power management ICs, optoelectronics and small signal devices.

www.newyorkerelectronics.com



TTI has the High Voltage Components to Keep Your Production Rolling

North America's leading inventory of ready-to-ship electronic components

The Transportation Specialists at TTI have a broad and deep inventory of interconnect, passive, and electromechanical components for transportation systems ranging from 48-volt subsystems to fully electric vehicles. These parts are stocked where you need them:

- A 180,000 square-foot warehouse dedicated to transportation components in Fort Worth, Texas
- Our all-new 800,000 square-foot distribution center in Fort Worth, Texas
- One of our seven proximity warehouses in Mexico's major manufacturing centers



For conventional and plug-in hybrids, battery electric, or fuel cell vehicles, TTI Specialists have the components you need, when you need them at 1.800.CALL.TTI, or visit us online at ttiinc.com

ttiinc.com
1.800.CALL.TTI

A Berkshire Hathaway Company





Buyers look to niche distributors for products and technical expertise

In-depth product knowledge, ease of doing business and flexibility are some reasons why buyers choose to do business with niche connector distributors



James Carbone

It's no secret that many electronics purchasers at OEMs and electronics manufacturing services providers, often purchase from large broad line distributors because they provide a virtual one-stop shop for many semiconductors, passives, electromechanical devices and connectors.

Often, large, broadline distributors provide the value-added and supply chain services that can cut costs for an OEM or electronics contract manufacturer. However, with certain products, many buyers choose to use smaller niche distributors that may carry a limited number of products from a select group of component manufacturers.

Such niche distributors often have a deep knowledge of the products they carry and can offer buyers and engineers advice on which components are the best fit for an application.

One niche product area that some distributors focus on is connectors. About a dozen of the top 50 North American-based distributors derive more than 50 per cent of their revenue from connectors. Some specialist connector distributors serve specific industries such as defense, aerospace and industrial. Some focus on specific products such as circular connectors.

One connector specialist is SMD Inc., based in Irvine, Calif. "About 90 per cent of our business involves some type of interconnect product," said Rich

Unruh, president. "We used to be a passives distributor, but around 2005, we started to focus on the interconnect side of the business," he said.

SMD has posted strong revenue growth in recent years. "We moved into the top 25 distributors list last year. A lot of that is driven by growth in the interconnect market," said Unruh.

He said much of its business is with the automotive industry. It has an exclusive contract to carry Yazaki connectors in North America and many of the manufacturer's connectors are used in automotive applications. Automotive is about 30 per cent of SMD's total business. "We did \$45 million last year, so it's a significant part of our business," said Unruh. SMD also serves industrial, medical and instrumentation OEMs.

"We have all kinds of customers including companies that build elevators, air-conditioning units, sprinkler systems and other equipment," he said.

Focus on North America

About 93 per cent of SMD's business is in North America and the rest is international. "We focus on the customer base that is building in North America," said Unruh.

SMD's business is split about 50-50 between OEMs and EMS providers, he said. Many of SMD's customers are small to midsize contract manufacturers. "I don't call on Flextronics, Jabil or



Rich Unruh, president of connector distributor SMD Inc.

"About 90 per cent of our business involves some type of interconnect product"

Sanmina or those other big guys," said Unruh. "I do some business with them, but not a lot. However, there are sub-\$100 million EMS providers that we are engaged with," he said.

He said smaller EMS providers and OEMs "appreciate a smaller distributor who is flexible and pays more attention to them than the big four or the big five distributors." "A lot of smaller companies just don't get the support from the larger guys that they require, certainly from a flexibility standpoint," said Unruh.

He said SMD has developed a loyal customer base over the years. "Some of our top customers we've been doing business with for 10 to 15 years or even longer on an ongoing basis," Unruh said.

Value added expected

Being a specialized connector distributor often means it's necessary to provide value-added services to customers. "The value-added service that we provide to our customers is the fact that the connector is actually custom assembled to their specification," said Wayne Nelson, general manager at Benchmark Connector, based in Sunrise, Fla.

He said about 90 per cent of Benchmark's business is circular connectors. "The connectors are available in either male or female and have five or six different shell styles. There're also three or four different finishes so there's a lot of combination. That's the value-added part."



"We also have D-sub connectors that we carry and other rectangular shaped connectors," said Nelson.

He said most of the connectors that Benchmark sells are military grade. "They are light and have a specification calling out the parameters and electrical characteristics. In some cases, customers want to modify connectors in some way, said Nelson.

Benchmark is a value-added distributor for Aero Electric Connector, J-Tech, Spacecraft Components, Elecsys and a stocking distributor for ADI, Detoronic, SI-Connects, Cristek and Preci-DIP.

Most of Benchmark's business is with the defense and aerospace companies, said Nelson. It also supplies connectors to companies that build equipment used in harsh environments such as oil rigs and motor sports.

Benchmark has developed long-term relationships with its customers because it provides a high level of service and technical expertise, according to Nelson.

"We've been doing business with some of our customers for 10 to 15 years or even longer" he said.

Some niche connector distributors say the key to their success is providing value to

customers as well as suppliers. "We are driven by customers to provide the best offering in the unique space that we occupy," said John Hufnagle, vice president of North American sales and engineered solutions for PEI-Genesis, based in Philadelphia. Most of PEI-Genesis' sales are for connectors.

Bring value with connectors

"We don't strive to be all things to all people. We focus on where we can bring value," said Hufnagle. "We have a very focused offering of connectors." That focus differentiates PEI-Genesis from larger broadband distributors.

"A broad line distributor carries an array of products ranging from capacitors, resistors, to semiconductors to connectors, but the only thing we primarily carry is connectors," he said. "We view ourselves a very powerful extension of the manufacturers we represent because we are specialized distributor."

PEI-Genesis carries connectors used in mil-aero systems and in other harsh environment applications. It carries connectors made by Deutsch, ITT Cannon, Conesys and Amphenol among others.

PEI-Genesis assembles connectors for customers and offers value-added services such as kitting and cable assembly. "Value-added services can be



"We've been doing business with some of our customers for 10 to 15 years or even longer"

Wayne Nelson, general manager of Benchmark Connector.

anything from technical support to special packaging," said Hufnagle. "Internal application engineering would be a value-added service. Having resources specific to answer customers' technical questions is a value-added service," he said.

In fact, many OEM customers rely on distributors for technical expertise during design. Bernard Gizzi, president of Electronic Connector Company (ECCO), based in Chicago said ECCO often is involved in the design of customers' products.

Much of ECCO's business involves building circular connectors for OEM customers, said Gizzi. ECCO builds connectors for Aero Electric/Conesys, Amphenol, ITT Cannon and Cinch.

Over the years ECCO has developed a deep understanding of many of its customers' products. If a customer has a problem when designing a product, ECCO can offer solutions. For instance, if a customer has a problem terminating a wire because of space limitations, "we can suggest a different insert pattern, for better manufacturing/assembly," said Gizzi.

The specialist advantage

Gizzi said there are advantages for customers to do business with a smaller specialist connector distributor such as ECCO. "Big

distributors do a great job of being a supply chain partner," he said. But they can be weaker "because they are too stretched." They carry many types of products and have tens of thousands of customers.

ECCO and other niche distributors, have fewer product lines and have an in-depth knowledge of the products that they carry.

ECCO is certified by manufacturers and the government to assemble connectors and services OEMs in the military, aerospace, transportation and industrial segments. "Industrial is the number one segment," said Gizzi. It includes companies that are making some type of industrial machine, construction equipment, a robot, things that are industrial in nature," he said. The second largest segment for ECCO is defense and aerospace, followed by medical and energy, he said.

"I have about 800 unique customers that I do business with in a given year," said Gizzi. "It's not like I have a limited number of customers that generate all of the revenue. It's a pretty broad base."



Safe supply is paramount in a volatile marketplace

With extended lead times and rapid obsolescence cycles, the risk of encountering counterfeit components just keeps mounting. Safe supply has never been so important, says Astute Electronics

Counterfeit material exists in most industries but nowhere is this issue more threatening than in life critical systems in aerospace and defence equipment. The importance of a secure, warranted supply chain cannot be over stated — problems caused by counterfeit electronic components represent an unacceptable risk of catastrophic failure.

Effective counterfeit mitigation is paramount to identify any counterfeit activity such as re-marking or refurbishing components to disguise bad quality, old branding and part numbers. In extreme cases, components may be completely reprogrammed to deliberately compromise the integrity of an aerospace or defence application.

The ERAI recently announced that independent distributor,

Rogelio Vasquez, aka Roger Vasquez, aka James Harrison, pleaded guilty to knowingly supplying counterfeit parts to the US military, including parts that were historically used in military applications such as the B-1 Lancer Bomber aircraft.

This is just one of many examples. Counterfeiting is hugely profitable and although there have been some high profile cases resulting in substantial fines and criminal sentences, the threat is still very real. It is therefore an industry-wide responsibility to strategically eliminate risk from the supply chain.

Eliminating risk
Monitoring counterfeit activity via forums such as ERAI is an effective way of keeping informed. Since 2001, ERAI has been collating a non-

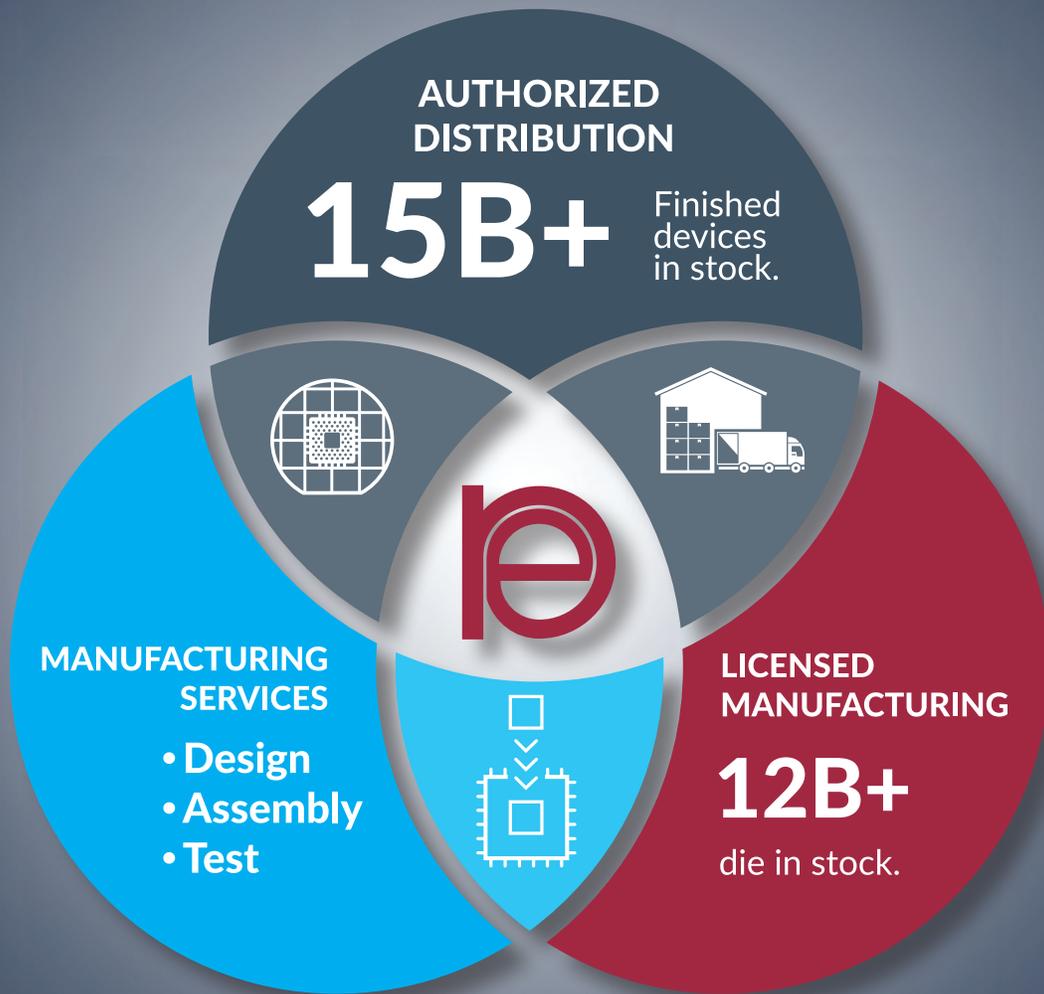
conformance image library, which enables users to understand and identify various types of counterfeit material for themselves. Participants can also report any counterfeit material, with information fed back to thousands of industry professionals that will benefit.

Distributors supplying components into the aerospace industry should have a clear understanding of suitable standards or be AS6081 accredited. Astute Electronics incorporates the AS standards into its anti-counterfeit avoidance programme, which also offers additional tests such as scanning electron microscopy and energy dispersive x-ray spectroscopy, Dataman, solderability testing and Diagnosys for part authentication.

Accredited test labs should issue reports for non-traceable products. A key rule of thumb is that components should be either traceable or come with an adequate test report. If a supplier cannot provide either of these, then it should be considered a risk to supply the parts into any aerospace application.

Astute sales and marketing director, Mark Shanley, concluded: “With current volatility in the component supply chain, extended lead times and rapid obsolescence cycles, it’s even more important to be aware of the threats.”

www.astute.global



THE SEMICONDUCTOR LIFECYCLE SOLUTION™

100% Authorized by over 70 leading semiconductor manufacturers.



**Rochester
Electronics®**
www.rocelec.com

Aerospace quality depends on strong foundations

Distributor Smith explains the extra steps it takes to defend component quality for its aerospace and defense customers

The technology that underpins the aerospace and defense industry depends on reliable electronics. These mission-critical products require components that meet the most strenuous quality-assurance standards to validate that they can perform effectively under any conditions. From the parts in GPS systems that guide aircraft to those in ground-

based telecommunications tools, components must be quality-tested based on rigorous industry standards.

As a distributor, Smith adheres to specific federal aerospace and defense sourcing compliances for electronic components. To better serve A&D customers' needs, the company has also attained AS6081 and AS9120

certification and membership in the Government-Industry Data Exchange Program (GIDEP), Customs-Trade Partnership Against Terrorism (C-TPAT), and Importer Self-Assessment (ISA).

Focus on dependability

Establishing a product's dependability begins with procuring components from trusted suppliers.



SMITH

www.smithweb.com

Smith Supports the Aerospace and Defense Industries

Intelligent Distribution™

Counterfeit Mitigation

Obsolescence Management

Die Banking and Nitrogen Storage

In-House Testing

Smith conforms to federal sourcing compliances like DFARS 252.246-7007 and DFARS 252.246-7008 when securing components for A&D customers' specific orders. Compliance means that suppliers are thoroughly screened and audited as needed. It also means that components must be sourced from either the original manufacturer or an authorized supplier or thoroughly tested to ensure authenticity. Smith's internal sales platform is equipped with a supplier rating system that continuously evaluates suppliers' performance based on company background, quality systems and procedures, and on-time delivery. It can certify, locate, and sort parts by origin in order to comply with federal standards.

Key certifications AS6081 and AS9120 define the stringent testing and quality standards for components used in aerospace and defense products. These SAE Aerospace Standards outline procedures for the avoidance, mitigation, and proper disposition of counterfeit electronic components within this supply chain.

Smith's chief operating officer, Kirk Wehby, said: "Comprehensive documentation of authenticity test reports must be kept, following AS6081 standards, and larger testing samples are also required. AS9120 compliments AS6081 and outlines the best quality practices for distributing components used in aerospace and defense products, providing customers with properly inspected product that they can trust."

Building trust

The supply-chain organizations GIDEP, C-TPAT, and ISA help safeguard components' authenticity through their far-reaching memberships. Their focus on protecting the global supply chain helps members like Smith to offer aerospace and defense customers carefully screened product.

GIDEP serves as an information repository, providing access to extensive research and records about suppliers and suppliers' quality issues. The GIDEP database is used globally to help keep the supply chain ethical.

C-TPAT and ISA support supply chain customs adherence. As an active C-TPAT member, Smith meets customs and border security requirements, which helps aerospace and defense customers avoid delays that slow product delivery. ISA membership also supports a secure global supply chain and allows Smith to audit and surveil its own deliveries and systems. All

customs requirements must be upheld, and membership can be utilized to more quickly receive acceptance of specialized products and machinery.

High-tech electronic equipment is vital to the aerospace and defense industry. Replacing outdated equipment is inevitable as technology and

the industry evolve. Thus, the need for more electronic components in aerospace and defense products will continue to grow. Smith is a dependable partner in this sphere, offering specific aerospace and defense warranty programs on a case-by-case basis. Certifications like AS6081 and AS9120 and supply-chain security memberships are essential for

procuring the highest-quality components. Establishing a relationship with a trusted, qualified supplier that prioritizes these measures helps ensure a secure supply of the authentic parts that tactical objectives demand.

www.smithweb.com

ASTUTE

Safe-Supply

ACAP in a volatile marketplace

ACAP has been developed over 30 years, working alongside government and industry bodies in Europe & the USA.

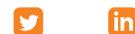


- De-risking the component supply chain
- Protection against counterfeit, fraudulent and suspect products from non traceable sources
- Extended AS6081 testing
- Products issued with 10-year warranty and detailed test report

Global Sourcing
Franchised Distribution
Third Party Logistics
Obsolescence Management

Visit our website for more information astute.global

United Kingdom Australia China Germany India Israel Mexico Turkey USA
astute.global / +1 757 483 4285



Aerospace: a no-fly zone for counterfeits

To reduce supply chain risk, authorized distributor, Mouser Electronics, has been certified to the aerospace industry's uber-vigilant AS6496 anti-counterfeiting standard

Understandably, the aerospace industry has high standards regarding anti-counterfeiting measures in authorized electronic component distribution, as set out in the AS6496 accreditation process. Now Mouser Electronics has achieved this certification, demonstrating its commitment to quality in this exacting industry sector.

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

Designed to mitigate the risk of introducing counterfeit parts into the supply chain, CAAP is a cooperative industry effort reducing the cost of compliance throughout the aviation, space and defense industries. The program

was established to enable organizations that purchase components and assemblies to demonstrate they have systems in place to identify counterfeit products, and to minimize the risks associated with them. CAAP accreditation reassures customers of a supplier's vigilance and ability to act appropriately. Efforts made all the more important by the Defense Federal Acquisition Regulation Supplement issued by the US Department of Defense.

Vice president of quality at Mouser Electronics, Chuck Amsden, explained: "By becoming accredited to AS6496, Mouser demonstrates commitment to providing customers with only authorized, genuine components. At Mouser, we can provide full traceability to the manufacturer on everything we sell. From sales to shipping, Mouser is committed to providing customers with the right product, on time, every time."

To achieve these goals, the AS6496 aerospace standard sets requirements for the avoidance, detection, mitigation and disposition of counterfeit products in the authorized distribution supply chain. It requires authorized distributors to have a counterfeit mitigation policy and a counterfeit electronics parts control plan, making it relevant to all industries and individuals looking to reduce the risk of counterfeit electronic parts entering the supply chain.

In addition to AS6496, Mouser Electronics is also registered to AS9100D/ISO 9001:2015 and ANSI/ESD S20.20-2014, the industry's gold standards for quality, control and electrostatic discharge. Mouser's quality management system also sets down additional aviation, space and defense industry requirements demonstrating its ability to provide traceability, risk management, process control, customer



AS6496 requires authorized distributors to have a counterfeit mitigation policy and parts control plan

support, product availability, document and record control.

Thus, despite growing concerns over counterfeit parts, purchasers can order with confidence, knowing that Mouser has rigorous processes in place to prevent counterfeit products from entering inventory.

www.mouser.com/quality



Electronic Connector Co.
"Connecting Solutions...Together"



**Fast - Flexible - Technical
Connector Assembly
Cables
Conductive Heat Shrink
Switches and More**



www.eccoconnectors.com



Amphenol
Industrial Products Group



ShrinkMate[®]
molex
one company > a world of innovation



ITT
AERO-ELECTRIC CONNECTOR, INC.
ENGINEERED FOR LIFE

1-800-742-3262
sales@eccoconnectors.com

Ensuring 100% Genuine Electronic Components for Our Customers



mouser.com/quality





Stacking connectors offer space and weight savings

Cinch Connectivity Solutions has announced commercial availability of its CIN::APSE stacking connector series, which boasts a flight proven history on military, aerospace and satellite applications worldwide.

CIN::APSE solderless, high density, stacking interconnects are used for board-to-board, flex-to-board and component-to-board applications. They feature a 1.0mm pitch to accommodate high density circuits between boards and are ideal in applications where a mezzanine style PCB layout is utilized to reduce space and weight. The durable mechanical contacts are suitable for applications that require several cycles of disconnections for modifications or testing and can help reduce the need for soldering and subsequent inspection.

belfuse.com/cinch



SMT D-subminiatures save space in aerospace engineering

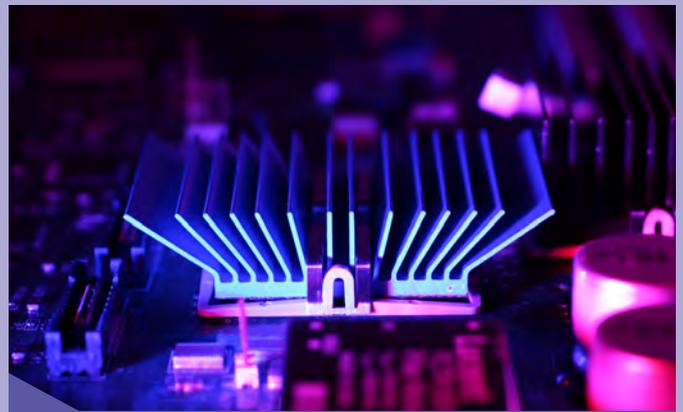
C&K has launched a new range of space-grade D-subminiature surface mount electrical connectors primarily intended for aerospace engineering applications such as developing communication and network ports for satellites, spacecraft and launchers.

Manufactured under CS-FR053 specification, the new SMT D-sub connectors claim to reduce weight and make PCB footprint savings in space and military avionics applications. By utilizing surface mount technology, C&K's D-sub connectors do not require plated holes drilled through the PCB. This frees up the other side for use, resulting in a simpler, lighter design and a miniaturized footprint overall.

Constructed from a single-part machined aluminium shell, the series boasts a smaller form factor than traditional six-part copper-alloy stamped shells. This can achieve up to 50 per cent less weight compared to standard through-hole connectors.

The D-Sub product lines conform to European Space Agency standards and are qualified to the ESA/European Space Components Coordination code 3401.

www.ckswitches.com



Source tough cooling solutions fast

Advanced Thermal Solutions has signed a new North American distribution partnership with Master Electronics, an authorized distributor supplying aerospace, military and industrial sectors.

Various ATS thermal management products, including the maxiFLOW heat sink with superGRIP attachment technology, will now be available from Master Electronics' nine stocking locations across North America. Other solutions include the Power Brick heat sink line, designed for cooling industry-standard DC to DC power converters and the ultra-low-profile blueICE heat sink, said to provide high-performance in dense systems where space and airflow are limited.

qats.com



Sealed photodiodes support high-speed communications

Marktech Optoelectronics' new MTPD1346D-xx series indium gallium arsenide/indium phosphide broadband PIN photodiodes are designed to convert broadband light into photocurrents within the VIS-SWIR range. Ideal for applications where high-speed, high data rates, low dark current, small capacitance and small active area sizes are required, typical applications include aerospace, automation, autonomous vehicles and high-speed communications.

In addition to low noise, high sensitivity and high-speed response, MTPD1346D-xx series InGaAs/InP PIN photodiodes boast wide standard spectral ranges of 0.6 to 1.7 μ m, low dark current, and high efficiency, typically 0.6A/W. Standard models are offered in active area sizes from 0.1 to 3.0mm. Each is packaged within a hermetically sealed, three-pin TO-46 metal can with flat lens cap, and with choice of either through-hole or surface mount configuration.

www.marktechopto.com

Can't find legacy devices?



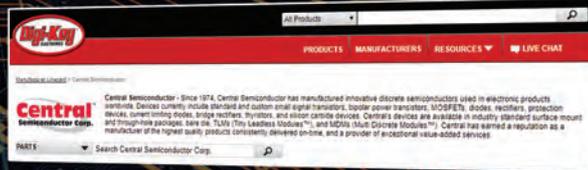
Central has what you need.

As other semiconductor manufacturers discontinue **legacy discret**es, Central continues to manufacture these devices for designers who need them.

Central's extensive inventory includes over 3,000 legacy device types.

Learn more:
www.centrasemi.com/legacy-devices

Available for immediate shipment
from



Search for Central at www.digikey.com

diodes &
rectifiers

bipolar
transistors

MOSFETs &
JFETs

protection
devices

thyristors

multi discrete
modules

Central Semiconductor Corp.

145 Adams Ave • Hauppauge, NY • 11788 • USA
1.631.435.1110 • www.centrasemi.com

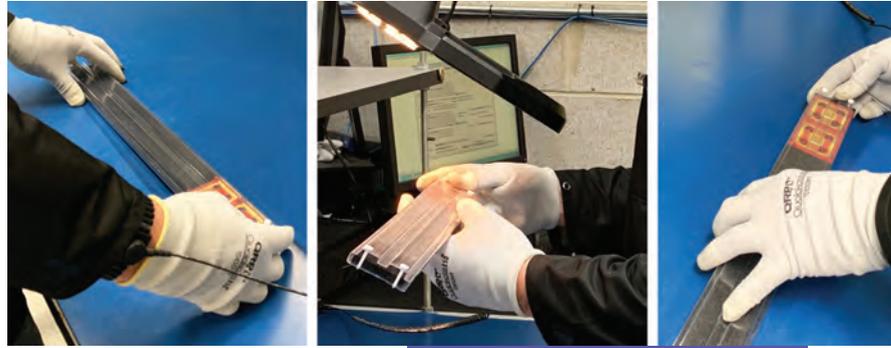
explore Central's solutions

- custom device development
- up-screening capabilities
- Super IndustrialTM & SpaceliteTM devices for extreme environments

Just
Ask

Going above and beyond

When servicing the aerospace, military and space market, suppliers must adhere to stringent quality requirements. Here Falcon Electronics explains how it strives to meet and exceed those expectations



ESD precautions include ionizers, gloves and wrist straps

Companies that service the aerospace, military and space sector must adhere to the stringent quality requirements and flow downs that AMS customers rightfully demand. The quality needs of this market are increasingly challenging and although third-party audits are performed, distributors such as Falcon are also frequently audited by customers to ensure compliance.

Quality processes

One of the main requirements for aerospace clients is AS9120, a certification specifically designed for electronic component distributors that service this industry. Certification covers quality processes, procedures, and training, with customers such as Boeing, BAE, Honeywell, and Lockheed conducting audits based on the standard. Non-conformance could involve training records not updated, procedures not followed, ESD testing not performed, or a scale not properly calibrated. Annual internal audits must therefore cover all areas of the quality management system to mitigate non-compliance.

ESD procedures at Falcon comply with ANSI S20.20 and JESD625 B, which dictate strict handling protocol. The company can also handle class zero product, which requires specialized work areas and extra precautions such as ionizers, gloves, wrist straps,

appropriate storage and ESD class 0 labels.

Another major concern is foreign object debris prevention. Auditors look for food, water, dust, or other debris on and around the work station, as well as scrutinizing the physical condition of storage boxes and of the warehouse itself. At Falcon, a clean-as-you-go policy supports the required housekeeping and all employees are trained annually about FOD so they understand the problems it can cause.

Eliminating risk

AS6496 establishes procedures for the avoidance, detection, and disposition of counterfeit products in authorized distributors and their supply chain. Auditors begin by verifying where product is from so an approved vendor list with only authorized OEMs and distributors is essential. Auditors will also review manufacturers' certificates of conformity to ensure full traceability.

Falcon records manufacturers' lot and date codes in its QMS for all product. A Falcon generated lot code can trace product back to the original manufacturer's purchase order and these records are kept for a minimum of 10 years.

Falcon's return merchandise authorization process is also

strict. All returns are inspected to verify the product was originally purchased from Falcon, ensuring product from brokers cannot enter Falcon's inventory. All employees receive counterfeit training, so they understand the risks and potential damages counterfeit parts can cause for customers.

Staff training

In addition to regular in-house training, the quality inspectors and quality manager at Falcon all hold AS13001 certification, which is the first step to becoming a delegated product release inspector. Delegated product release verification is the process whereby a supplier has the authority to act on behalf of another to release products or services directly to the customer's production floor.

Falcon's DPRV process is compliant with SAE AS9117, which combined with the extra AS13001 training and any customer specific training, gives Falcon's quality inspectors a higher-level qualification.

With these processes, policies and procedures in place, non-conformance can be eliminated and customer audits go smoothly, working effectively to provide protection across the supply chain.

www.falconelec.com



Auditors will review manufacturers' certificates of conformity to ensure full traceability



Falcon can handle class zero product, which requires specialized work areas and extra precautions

Electronics Sourcing 2019 Reader Survey

Complete the 2019 ESNA Reader Survey
to Win an **Apple Smart Watch!***

Your feedback is very important to this
publication and will assist us in providing
the very best editorial and articles for you

Enter the URL below, complete the survey
and you will automatically be entered into
the prize draw to win the **Apple Smart Watch***

www.electronics-sourcing.com/esna-survey-2019

** Deadline for prize draw / completed surveys is April 5, 2019*



Fast. Focused. Falcon.

AS9120 REV A/ISO 9001:2008 Certified • Small Disadvantaged Business



api
technologies corp.

D DATEL

DPACI
DEFENSE PROGRAMS AND CONTRACTS INTERNATIONAL

FMJ
REQUIREMENTS DRIVEN SSD SOLUTIONS

HOLT INC.
INTEGRATED CIRCUITS

mercury
systems.

Microsemi
a MICROCHIP company

pdi
PRECISION DEVICES INC.

SEMTECH

SMART
Modular Technologies

Tt Electronics
Make Possible

OPTEK
SEMELAB

1-800-444-4744
sales@falconelec.com
www.falconelec.com

falcon
electronics

Exclusively sponsored by



John Denslinger's 40-year electronics career ranges from time with passives specialist Murata Electronics, to managing manufacturing plants in Mexico. John is a trained industrial engineer

Technology exchanges help insure supply continuity

In this article, John Denslinger explores the practical steps customers, manufacturers and distributors can take to underpin supply continuity

Supply Continuity • By John Denslinger

In times of component shortages, I'm always amazed at the number of customers with substantial, metric-based supply chain engagements scrambling to secure sub-one cent passive components just to keep production lines running.

Pressure? After all, schedules are schedules and the next quarterly report is due tomorrow. Likewise, for factory and quality assurance management, it must be quite disheartening to see workers hand placing shortage components on boards already processed through highly automated lines. As if procurement anxiety wasn't enough, there is that unaccounted productivity loss across the entire company, as well as, that distasteful factory-floor negative variance all left in the wake of short supply.

It's nothing new. Supply and demand imbalances exist all the time: some severe, some aberrational. Yet it occurs to me to ask one simple question: 'does anyone take time to conduct a serious forensic analysis after a severe supply shortage?' Surely, there must be countermeasures to the problems encountered, but where does one start?

For those tasked with sourcing components, ask yourself: how robust is my supplier engagement and is it delivering to my expectations given the speed at which technology advances today? At an early age one learns evolution is the survival of the fittest. By experience, one also learns technology innovates the continual advancement of fit, form and function. All too often the evidence suggests customers rely too heavily on evolution while the manufacturer operates largely in the technology spectrum. Can the two objectives be more effectively linked for win-win?

Frequent communications between customer and supplier is good but not enough. Sharing performance metrics is vital but again not a solution by itself. Best to establish and maintain multi-level engagements that build trusted relationships, mutual respect for company cultures, commitment and long-term loyalty. These are some of the keys that position you, as the customer, for an uninterrupted supply stream. Keep in mind, these partnerships are often triangular: customer, manufacturer and distributor. Each plays a vital role and each has an expectation to be met. Without a doubt, it will take time, money and resources over a long run. Think of the investment as insurance, knowing that insurance is always beneficial hedging that downside you hope never happens.

As the buyer of components, what should you expect from your partners? Price and delivery are obvious replies but do approach it more strategically than that. Like a job interview, get to know your supplier in depth. First, ask for capacity plans and allocation policies on components that make up the greatest unit volume on the BOM. Ordinarily, 'the spend' is not that high but a disruption in supply quantity could be crippling. Second, inquire about technology and product roadmaps. Understand where the manufacturer is heading and determine whether your design and engineering direction is synced. If not, consider hosting technology exchanges well in advance of EOL or new board layouts. Next, review the manufacturer's cost reduction plan. It's understood, procurement groups are often measured on PPV. Manufacturers are very open to sharing planned cost savings. And lastly, understand both the manufacturer's and their distributor's inventory policy. Pipelining supply is not that difficult with reasonably accurate forecasts.

Avoid the next shortage. A little insurance goes a long way to insuring your supply continuity.



DIGIKEY.COM

**SAME-DAY SHIPPING
NEXT-DAY DELIVERY
ON ORDERS ENTERED
BY 8:00 PM CST**



Tips for confident counterfeit detection

Unfortunately, receiving counterfeit components is not a rare occurrence. Drawing on its extensive inspection experience, AERI offers an insider's guide to detecting counterfeits

From experience and discussion with AERI customers, it seems almost every manufacturer has experienced a counterfeit nightmare. Sometimes manufacturers are not even aware that their failures were due to a counterfeit, seeing only a higher than normal failure rate during production, without identifying a fake.

Thus, it has become necessary for distributors of electronic components and manufacturers of electronic equipment to inspect all incoming electronic components for authenticity. But are you sure you know how to inspect for counterfeits properly? The following guide draws on years of inspections at AERI's facility and extensive involvement in industry committees to enlighten readers and ensure they feel confident in their evaluations.

Basic equipment

Counterfeit electronic components are most prevalent in mainland China, however, it is not unlikely a broker down the street is selling them too. Often the counterfeits supplied to AERI are from long time, good standing suppliers that are just not trained or prepared to avoid the fakes.

To start with, there are some simple tools that are essential for counterfeit detection. In addition to all the standard safety equipment for handling electrostatic sensitive parts, you will need a microscope with at least 30x magnification. It is also important to have a camera built into the microscope since some processes may require photos to be sent for evaluation. You will also need a solvent to check for part marking permanence. Acetone is commonly used to determine if the part has been remarked, but a less harsh solvent is a combination of three parts mineral spirits and one part alcohol. This is the mixture that MIL-STD-883 method 2015.13 requires part markings to withstand.

Inspect packaging

To begin avoiding counterfeit electronic components, start with a visual inspection of the packaging. Verify that the date code on the label matches dates codes on the parts and ensure there are no impossible date codes, such as 1857, which denotes the 57th week of 2018, or dates in the future. Next, check for logos on the packaging material that do not look correct, bar codes that don't match

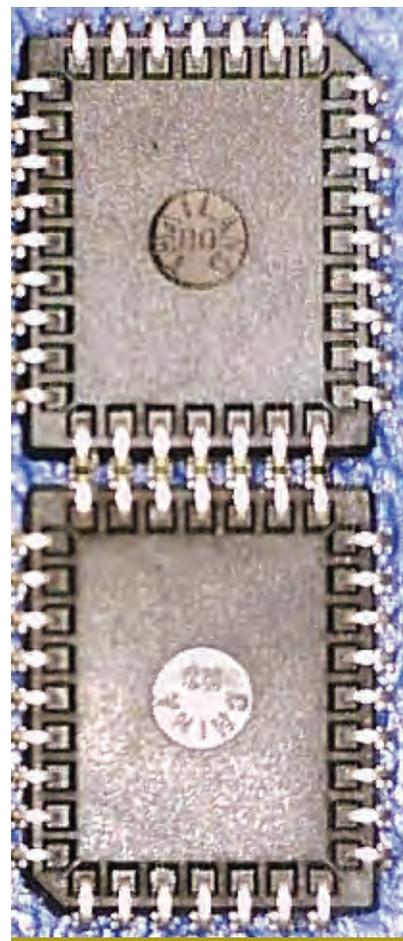
the type written part information or countries of origin that are incorrect per the manufacturers' information.

If parts are moisture sensitive, they require a dry pack and a humidity indicator card. Often counterfeiters forget some piece of the moisture sensitive packaging requirements, but part specific requirements can usually be found on the datasheet. Finally, misspellings on the manufacturers' labels are also a give-away.

Examine indents

With the packaging removed, it's time to start inspecting the actual parts. Most plastic integrated circuits have cavities purposefully made during the mold process. Some indicate pin one, or other designations for use during placement, but others are just part of the plastic molding process. Mold cavities should be clean from the manufacturer.

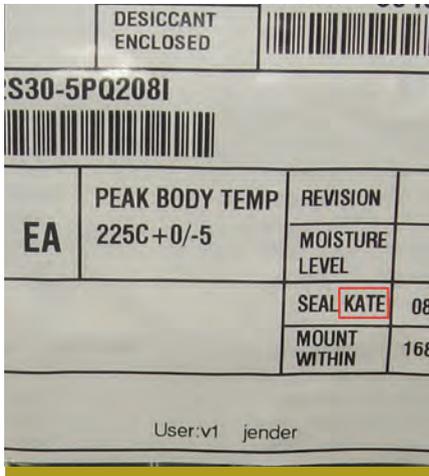
Examining these indents is a primary way of detecting counterfeit components since the counterfeiters have a difficult time keeping indents clean and consistent during their refinishing process. For example, look out for parts in the same lot with indents of a different size



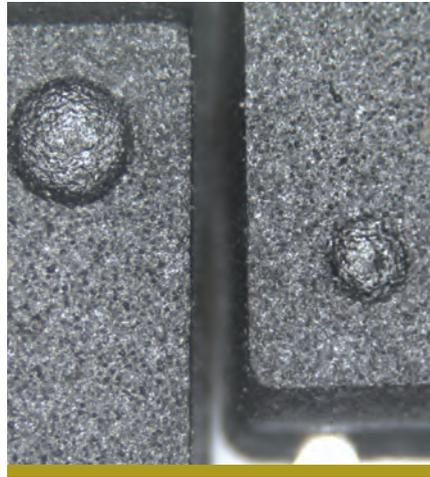
Parts with the same lot code cannot be manufactured in different countries



To begin avoiding counterfeit electronic components, start with a visual inspection of the packaging



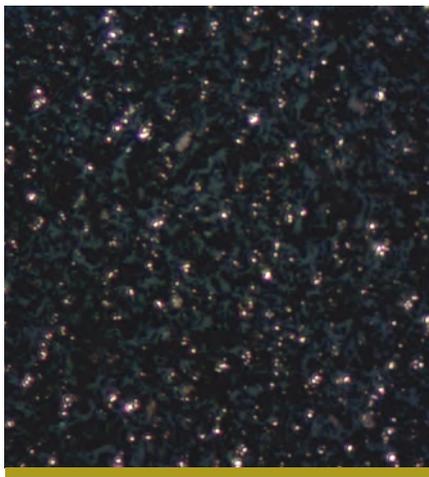
Misspellings on manufacturer labels are a give-away



The shape and size of indents may be different due to the amount of sanding to remove old part markings



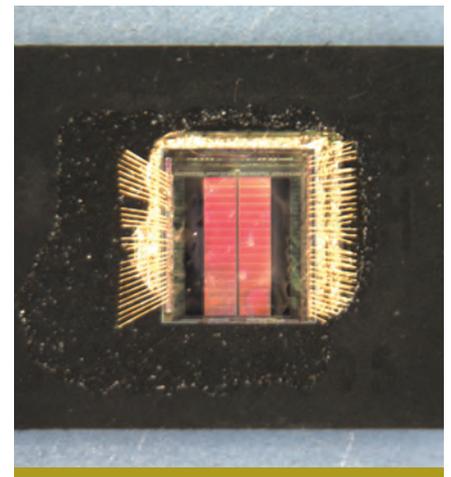
The surface of a true part has sharp peaks and valleys



When painted with blacktopping material, peaks and valleys are smoothed over and filled in



This sloppily labelled part features an out of proportion Siliconix logo



Decapsulation shows whether at least one of the die in the lot is correct

or shape. These differences are due to the amount of sanding required to remove old part markings and blacktopping paint fill.

Country of origin

Most parts will display where they were manufactured somewhere on the component; often this information is placed in the indents. Having questioned component manufacturers extensively, they all concur that a part with the same lot code as another

cannot be manufactured in different countries.

Magnify texture

Plastic electronic components are typically made with a mix of fine glass and plastic. The surface of the molded package is textured when it is removed from the mold. Unfortunately, counterfeiters have come up with a mixture to create a very similar effect on top of the original surface. With the naked eye, it is almost impossible to determine

the difference between the original surface and a fake surface, however, with the help of a microscope, there are signs that can help determine component authenticity.

Under the microscope, the differences between a typical blacktopped fake and an authentic part are clear. The surface of a true part has a sharper and duller look, with the glass in the mixture making for sharp little peaks and valleys. When painted

with the blacktopping material, however, the peaks and valleys are smoothed over and filled in, like if you were to put a coat of paint on sand paper. Although this is not relevant to every part, the majority will have this type of finish.

Other textures to look for are directional sanding marks, parts that are sandblasted, exposing the silicon spheres, and blacktopping that has a visible line where it stops on

the sides of the part.

Identify imperfections

All genuine component manufacturers have high quality standards that preclude major imperfections. Part numbers must be in a certain location on the part and they cannot be crooked, misspelled, or out of alignment. Logos are also monitored very closely and should not vary from part to part. In addition, the markings are designed to withstand tough environments and still be legible.

Internal characteristics

With counterfeiters now so successful in their external efforts to deceive, it is essential to inspect the internal characteristics of any part destined for a high reliability application. The equipment and personnel required to perform these tests are much more advanced and therefore costlier.

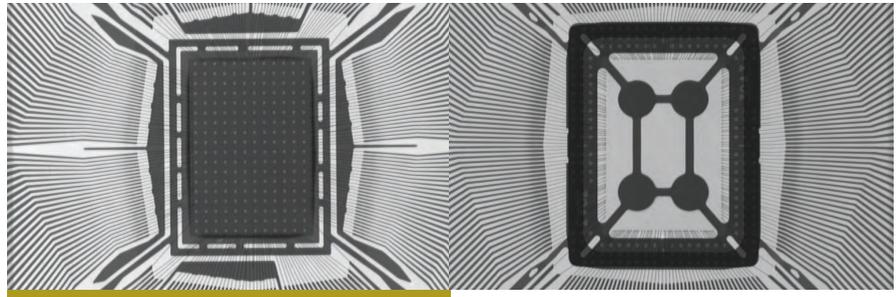
Decapsulation is the most important tool for internal evaluation to see that at least one of the die in the lot is correct. Following this, x-ray inspection of a large sample of the balance of the lot is required to confirm that the entire lot is the same.

Physical composition

Another helpful process to confirm a part's authenticity is by identifying if the leads are constructed with the correct material. Counterfeit parts can be either re-tinned to cover up previous use or constructed with a different material because they are not the actual part as marked. An x-ray fluorescence analyzer can help to identify this anomaly. A report regarding XRF analysis makes it possible to compare results with the original manufacturer's specifications.

Hopefully this overview will provide those involved with the purchase and receipt of electronic components with a better idea of how to detect counterfeit parts. Counterfeits threaten every facet of our industry and it is important that we work together to stop the problem.

www.aeri.com



X-ray suspect counterfeits to identify parts with the same part number and lot code but different internal characteristics

Delivering Good Vibrations to the World for over 35 Years!

Why Dove Electronic Components?

Dove invented Crystal & Oscillator Distribution 35 Years Ago!

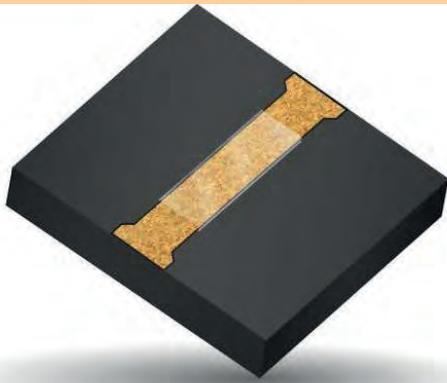
- ✓ 100% Authorized distributor for over 35 frequency control suppliers
- ✓ Unmatched Line Card in Frequency Control Products
- ✓ Quick-turn In-house oscillator programming for multiple suppliers
- ✓ Committed to Quality: AS9100:2016 and ISO9001 2015 Certified

Dove Electronic Components is the most well-known, experienced distributor of crystals and oscillators, serving customers worldwide since 1983. Dove supports its partners' success by connecting more than 35 of the world's leading frequency control suppliers with a broad base of customers, providing cost-effective, value-added services and solutions.

Large-Scale Oscillator Programming
As lead times in our industry are increasing, Dove's programming center can be a quick-turn solution. Our state of the art programming center allows us to ship product in 1-3 business days. We program oscillators for all major premier frequency control lines. Our experienced sales team can help you determine the right solution for your needs!

Dove
Electronic Components, Inc.
The Crystal & Oscillator Specialist

1-800-232-9825 • www.doveonline.com
sales@doveonline.com



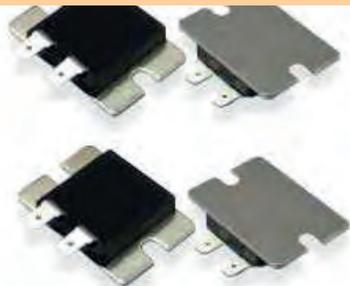
Improving RF performance

AVX has introduced a new line of ultra-miniature, thin-film transmission line capacitors ideal for high-performance microwave and RF applications including high-frequency links and DC blocking in the UHF range.

The capacitors feature a metal-insulator-metal structure with copper traces for optimal circuit conductivity, a transmission line wire-bond pad and a gold-metallized backside ground. They can be supplied on a variety of low-loss substrates, including quartz, alumina, glass, and silicon. Capacitance values range from 0.3 to 50pF with a ± 20 per cent tolerance and devices are made using a high-frequency structure simulator to provide the highest possible RF performance and reliability.

Purchasers can choose from three standard substrate thicknesses and two standard substrate widths, with length determined by transmission line dimensions. Parts are tested to MIL-STD-883-2011.8 for bond strength, MIL-STD-883-2018 for shear strength, and MIL-STD-202-108 for lifetime.

www.avx.com



Chassis mount resistor saves size, weight and cost

New Yorker Electronics has released a new series of miniature 300W non-inductive chassis mount heat sink resistors from RCD Components. Designed specifically to save space, height and weight, the RCD CM300 is rated up to 300W and claims to be significantly less in size, weight and cost than a conventional RE80 250W chassis mount resistor. The series is also said to be less than half the height of a SOT227 package, with insulation ratings up to 5kV.

RCD's CM300 series is non-inductive and features a range of resistance values from 0.1ohm to 1Mohm. The CM300 model features .187in male quick-connect terminals, while the CM300L features flexible insulated leads with a range of customized terminations. Burn-in, military-screening and numerous design modifications are available.

www.newyorkerelectronics.com



Miniature low-profile power inductors save space and energy

TT Electronics has introduced the HA74 series of surface-mount power inductors, which are said to combine a low profile, small footprint and 3MHz switching capability for efficient, space-saving DC/DC converters.

AEC-Q200 certified and specified for operation from -55 to 155°C, the HA74 series is ideal for automotive applications including high-density converters and pi filters for ADAS (Advanced Driver Assistance System) controllers. The shielded inductors boast low EMI and corrosion resistance.

The maximum height of 2.05mm lets designers create slimline modules. With a 5.5 by 5.5mm footprint, current ratings up to 2.9A and DC resistance down to 74m Ω , the HA74 series aids high power density and energy efficiency.

With 3MHz switching capability allowing use in high-frequency converter designs, these inductors are ideal companions to small high-frequency filter capacitors, minimizing module size and weight. TT's low-loss metal-alloy core composition is designed to offer high efficiency and low heating at elevated frequencies.

The complete HA74 family comprises 10 parts covering standard inductance values from 4.7 to 33 μ H and current ratings from 1.2 to 2.9A. Semi-custom inductors conforming to individual customer specifications are available to special order.

www.ttelectronics.com

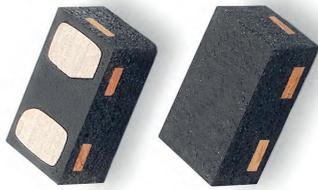


Filters deliver attenuation across a wide frequency band

TDK introduces its RSKN series of 6, 10, 20 and 30A, 250V AC/250V DC rated EMC filters. Suitable for use in a range of industrial and communications applications, the filters feature a two stage design said to deliver high attenuation across a wide 100kHz to 100MHz frequency range, as well as providing protection against high voltage input pulses.

Filters are packaged in metal cases with sizes ranging from 47 by 107 by 26mm for the 6A model, to 67 by 151 by 35mm for the 30A. RSKN filters operate in ambient temperatures of -25 to 85°C, derating above 50°C for the six and 10A and above 45°C for the 20 and 30A models. All models are certified to UL1283, CSA C22.2 No.8 and EN60939 safety standards.

www.tdk-lambda.com



Compact module prevents ESD damage in consumer devices

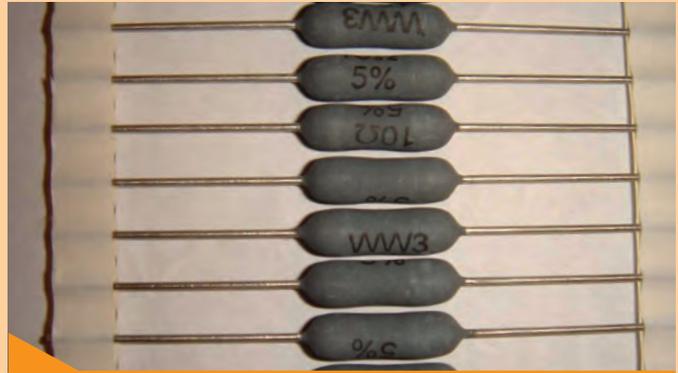
Littelfuse has introduced the first in a new series of bidirectional TVS diode arrays designed to protect high-end consumer and wearable electronics from damaging electrostatic discharge generating events.

Housed in an 0201 package, the SP1333-01UTG offers a breakdown voltage of 3.3V. It features back-to-back diodes fabricated using a proprietary silicon avalanche technology to provide symmetrical data line protection up to ± 30 kV, safely absorbing repetitive ESD strikes without performance degradation. Low clamping voltages also allow the SP1333 series to tolerate surges of over 5A, for extended operating life of the electronics they protect.

Typical applications include: smartphones, portable medical devices, portable navigation devices, tablets and point of sale terminals.

Business development manager, TVS diode arrays at Littelfuse, Tim Micun, said: "The SP1333 series completes our portfolio of TVS diode arrays in compact 0201 packages to cover the full breakdown voltage range from 3.3 to 36V. This addition eliminates the need to source devices for this breakdown voltage from another vendor."

Littelfuse.com



Wirewound resistors combine safety and versatility

Stackpole Electronics' WW series high temperature silicone coated wirewound resistors meet UL94V-0 flammability requirements. The all welded series is available in power ratings from 0.5 up to 11W and tolerances from five to 0.1 per cent. Typical temperature coefficient of resistance ranges from 90ppm or better for resistance values below one ohm, to 20ppm or better for values above 10 ohms.

Low inductance and non-inductive styles are available, as well as high pulse power handling and high voltage versions. This versatility makes the WW a popular choice for a range of applications including power management, motor controls and protection, and power supply input protection. Pricing depends on size, resistance value and tolerance.

www.seielect.com

Capacitor ups voltage headroom in power conversion products

Vishay Intertechnology has increased the voltage rating of its BCcomponents 500 PGP-ST series of aluminum screw-terminal capacitors to 500V while extending its useful life to 5,000 hours at 85°C.

These polarized aluminum electrolytic capacitors feature a non-solid electrolyte, making them ideal for DC-linking in power conversion electronics rated at 20kW and above including large motor drives, UPS systems and solar inverters. The 500V rating provides increased voltage headroom in these applications

while allowing three-phase, 380V designs to be re-used in 480V systems by upgrading the DC-link capacitors and enabling solar inverter systems to be upgraded for 1,000V maximum input.

Nine case sizes are offered ranging from 50 by 80mm to 90 by 220mm. Devices feature capacitance ratings from 680 to 22,000 μ F over a voltage range from 350 to 500V.

www.vishay.com



XEL50xx Low-loss Power Inductors for High Switching Frequencies



Compact footprint: 5.28 x 5.48 mm

- Extremely low DCR ... and ultra-low AC losses
- 25 inductance values ... from 0.1 to 22 μ H
- Optimized for high frequencies ... up to 5+ MHz
- Superior current handling ... up to 45.0 Amps

Free samples @ coilcraft.com/XEL50xx

The power to influence

Sager's director of supplier marketing and product management for power, Paul Kopp, explains how educated purchasers can influence power supply selection by evaluating quality requirements and risk factors



Director of supplier marketing and product management for power, **Paul Kopp**

The role of purchasing is continuously expanding such that today's purchasing professionals can heavily influence component selection. Their understanding of the parts they're sourcing is critical to ensuring they make the right purchase, at the right price, and the right time. An educated buyer evaluates components, recognizes product quality requirements, and understands risk. This information is then used to inform purchasing decisions.

In the area of power supplies, these decisions are made all the more challenging by the complexity of the product, with endless design options and potentially higher average selling prices. Power supplies can also have long lead times, limited liability warranties, and stringent efficiency and safety requirements. Power supplies are also subject to counterfeiters and can easily be sourced through unauthorized channels. With all these challenges, what can a purchasing professional do to source the best solution while protecting their company?

Pushing technology boundaries

Understanding the complexities, efficiency and safety requirements of power supplies has a far-reaching, positive impact. The easiest way to gain that understanding is to work with an authorized distributor that specializes in power conversion products. This is even more critical as future power supplies will push the boundaries of technology, packing the most power into the smallest package while staying ahead of the latest safety, EMI/EMC requirements.

An authorized distributor focused on power knows that by lowering the amount of wasted energy within the power supply, it will run cooler, simplifying the thermal design of the overall system. Less heat generated by the power supply allows component size to be reduced or more power to be generated within the same package size.

For instance, not so long ago a three by five inch power

supply was designed to handle 40W of power. Today, that same three by five inch power supply can handle 250W with no airflow, or up to 500W with air blowing across it. Standardization in footprints provides more options, but the sheer choice may be daunting. Having a resource to help guide purchasing through the buying process can save time, aggravation and money in the long-term.

Keeping up with standards

Adhering to changing standards is another challenge. The international safety standards for power supplies, as well as end systems, are constantly being updated. Electromagnetic interference and electromagnetic compatibility requirements are changing based on new technology and how devices interact with each other.

For example, the increase in electronic devices in our homes and businesses dictate more stringent requirements on electrostatic discharge protection. Susceptibility

levels resulting from the presence of multiple electronic devices have also been raised to account for the proliferation of mobile phones, Wi-Fi networks, and smart appliances that are all connected wirelessly. An increase in home healthcare devices has also prompted additional safety standards. Authorized distribution works closely with power supply manufacturers to stay on top of these changes.

Sourcing smaller, more efficient, warrantied, and safe products, from an authorized power specialist like the Sager Power Systems group, will ultimately result in cost savings and an enhanced return on investment.

www.sager.com





HELPING YOU PROTECT WHAT MATTERS



**MPD CAN BE FOUND IN SECURITY DEVICES
AROUND THE WORLD**

WWW.BATTERYHOLDERS.COM

PoE supplies support IP innovation

Sager Electronics is now stocking Phihong's POEA30U 30W single-port power over Ethernet injector power supplies. These IEEE802.3at mid-spans meet Department of Energy VI efficiency regulations for external power supplies. They provide 30W of power from a 1.79 by 5.52 by 1.18in footprint. Potential applications include: IP cameras, VoIP phones, building and access control equipment, Wi-Fi access devices, and IP print servers.

www.sager.com



Big data demands more power

Bel Power Solutions has announced a high efficiency power supply, designed to deliver more power in a standard form factor for big data and cloud computing applications. Housed in a 69 by 42 by 555mm form factor, the PFE3600 series can convert standard AC mains power or high voltage DC bus voltages into a main output of 12V DC.

This capability helps meet growing power requirements from servers and super computers running scalable and distributed computing of large data volumes. Sometimes referred to as hyperscale computing, applications include blockchain processing, artificial intelligence, data analysis, cyber security and real-time consumer analytics.

The PFE3600-12-069RA reverse airflow 3,600W is available as an AC/DC power-factor corrected or DC/DC power supply, for the growing number of DC-powered data centers and for powering high voltage DC equipment. Units are hot-pluggable and offer parallel operation with active current sharing or analog bus and full digital controls for improved performance.

belfuse.com/power-solutions



Converters offer flexibility in small spaces

Recom's REC15E-Z series of 15W isolated DC/DC converters boasts wide input ranges at low cost in a one by one inch case size. This can save significant PCB space, while increasing flexibility by accepting several standard bus voltages.

Ideal for cost-sensitive applications where board space is at a premium, these fully-specified 15W converters have no minimum load, 1,600V DC isolation, and boast efficiency up to 90 per cent with low ripple or noise. The 4:1 input ranges accept nine to 36V or 18 to 75V to cover multiple supply options such as lead-acid or lithium batteries or 12, 24, 36, and 48V industrial bus voltages. Inputs are protected against transients of up to 100V and feature UVLO to protect batteries from being over-discharged. The single or dual outputs are continuously protected against short circuit and overload conditions and can drive high-capacitive loads.

REC15E-Z converters are fully certified to industrial EMC and safety standards and come with a three-year warranty.

www.recom-power.com

Converter saves space in mobile equipment

Traco Power's THN 15N series of 15W DC/DC converters are packaged in a standard one by one inch footprint and utilize the latest power technology to meet EMI Level A standards without external components. They also boast reduced no-load power consumption of 96 to 336mW and efficiencies up to 91 per cent.

The converters are ideal for power conversion requirements in mobile equipment, instrumentation, distributed power architectures and industrial electronics applications, particularly when PCB space is limited.

Features of the THN 15N include a wide 2:1 input range of nine to 18, 18 to 36, or 36 to 75Vin with single and dual outputs ranging from 3.3 to 24V DC. These high density DC/DC converters provide input to output isolation of 1,600V DC and feature remote on/off control with a voltage trim function. They are housed in a six-sided shielded metal case with an insulated base plate and offer a full load operating temperature range of -40 to 70°C.

www.tracopower.us

Don't overlook the essentials

From nailing down application requirements to lead times and avoiding fakes, ESNA quizzed Memory Protection Devices president, Tom Blaha, on the basics of battery holder sourcing

Q What impact has the trend towards miniaturization had on battery holders?

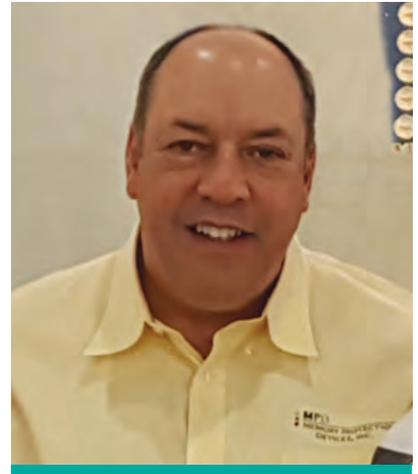
Thru-hole mounted components are giving way to surface mount devices that permit lower profiles and higher density, however, surface mount technology makes soldering more of a challenge, especially for battery holders that require highly reliable solder connections to handle the weight of a battery.

Q What is the current average lead time for MPD products?

Lead times vary from products that are in stock and ready for immediate shipment to two to four weeks for many standard products. For a more predictable supply chain, we often recommend a just-in-time delivery program that helps keep customer inventory levels lean while ensuring appropriate reserve inventory within our warehouses.

Q How quickly can MPD ship quick turn orders for battery holder products?

Our products are sold through leading distributors that keep a huge inventory of product on hand and can provide same day service in most cases. For example, Digi-Key is renowned for providing 20-minute turnaround for order entry, picking, packing, and preparation for shipment.



Tom Blaha, President of Memory Protection Devices, Inc.

Q What should buyers look for when comparing battery holders?

Often, two battery holders will look essentially alike, when in fact, significant differences

DANTONA[®]
INDUSTRIES, INC.
FOR ALL YOUR BATTERY NEEDS

INDUSTRIAL BATTERIES

CUSTOM BATTERY PACKS

CONSUMER BATTERIES

COMMERCIAL BATTERIES

SINGLE CELLS AND BATTERY PACKS FROM:

- Panasonic
- Eveready
- Saft
- Energys
- Sanyo
- Hawker
- FDK
- Ultrafire
- Tadiran
- Ultralast
- & More!

Single Cells - Lithium, Li-Ion, NiCd, NiMh, Alkaline, SLA, CR123
Custom Batteries, Chargers, Emergency Lighting, Security, 2-Way Radio, Bar Code Scanner Batteries, PLC batteries, Hotel Door Locks, Meter batteries, & More

YOUR ONE STOP SHOP FOR BATTERIES



OVER 40 BATTERY CATEGORIES IN STOCK
FAST ONLINE BATTERY CROSS REFERENCE
LARGEST RANGE OF BATTERIES IN THE INDUSTRY - OVER 7,000 BATTERY MODELS
PROFESSIONAL/KNOWLEDGABLE TECHNICAL HELP

WWW.DANTONA.COM
ESNA@dantona.com

Tel: 1(800) DANTONA Fax:1(516) 783-3428

exist in terms of the quality of the raw materials, the care of manufacturing, and the quality assurance or quality control processes used to maintain product consistency. The best way to ensure that a battery holder will perform as promised is to conduct thorough due diligence when reviewing potential vendors.

Q What certifications or standards are essential for battery holders?

Certification requirements vary depending upon on the application. For example, a ‘throwaway’ advertising specialty item can have fairly low quality standards, however, if the battery holder is being used in a life-saving medical device, such as a portable defibrillator, then

the battery holder must be manufactured to the highest quality standards, including ISO-9001 and UL94 certifications, to name a few.

Q How will battery holders develop in the future?

The ongoing trend is towards electronic devices becoming smaller, lighter, and more environmentally friendly, using less plastics and metals, while offering higher impact resistance.

Q How can purchasers identify counterfeit MPD battery holders?

Certain companies are using our part numbers to create a bait and switch scheme with unbranded battery holders being unknowingly substituted

as MPD products. To help prevent counterfeiting, our battery holders contain a unique mint-mark that is embedded in the plastic.

Q What advice would you give to someone who is new to sourcing battery holders?

Work closely with the design engineers to make sure that the correct battery holder is being specified in the first place. For example, if the application is intended for extreme environments, then it pays to spend a little more for higher quality plastics and gold-plated contacts that offer greater corrosion resistance. Once you’ve defined the product requirements, then you can focus on the supply chain. MPD products are sold through approved distributors listed on our website. Any distributor can claim to supply our products, but we only sell through franchised distributors. When negotiating with a distributor, be sure to communicate all your needs, including special packaging requirements, kitting of sub-assemblies, drop shipping, JIT delivery, or vendor managed inventory programs. Be sure to maintain open lines of communication and continually forecast future demand to keep product manufacturing and the supply chain on schedule for timely deliveries.



Work closely with the design team to ensure the correct battery holder is specified

www.memoryprotectiondevices.com



**100-1500VDC Input DC/DC Converter
Designed for PV Power System**




▶ PV Series

- Power: 5W, 10W, 15W, 40W, 45W, **200W**
- Isolation: 4000VAC
- Operating temperature: -40°C to +85°C
- Operating elevation up to 5000m
- Protection: UVP, RVP, SCP, OCP, OVP
- PCB, Chassis mounting, Din-Rail mounting, Metal cage

✦ For the detailed information, please refer to datasheet.

E-mail: sales@mornsunamerica.com
Website: www.mornsun-power.com



MODULES FOR DISTRIBUTED POWER ARCHITECTURE

TARIFF-EXEMPT

High quality, low-cost DC/DC converters



WE POWER YOUR PRODUCTS
www.recom-power.com

**RECOM**

Just a small selection of the newest component launches on eBOM.com

Go online to find out more about the headlines below

Semiconductors

Analog Devices' Self-Calibrating Energy Metering IC
Analog Devices

Microchip – PCIe 3.1 Ethernet bridges using low-power sub-states enable power savings
Microchip

Kontron presents Mini-ITX Board with latest 8th Gen Intel® Processors
Kontron

Nexperia launches 40 V low RDS(on) automotive MOSFETs in a 3×3 mm footprint
Nexperia

Maxim's MAX22195 High-Speed Octal Digital Input for PLC & Automation
Mouser

Wireless

u-blox expands Bluetooth and Wi-Fi connectivity software with high performance script
u-blox

The Launch of the NEW LoRa Transmitter Range
RF Solutions

Sensors

Low Power Sensor Technology for the Internet of Things (IoT)
ON Semiconductor

Fully Integrated Proximity Sensors from Vishay are Available from TTI
TTI

Introducing the USB multi-function Environmental Sensor for the IoT from Omron
Omron Electronic Components

Now at TTI ROHM Serial Output 16bit Color Sensor
TTI

Nano-sensor technology increases battery life of earbuds by up to 20%
Nanusens

Power

Vicor introduces four new tightly regulated DC-DC converter ChiP modules
Vicor

TRACO Power's TMPS10 Ultra Compact AC/DC Power Modules Now Shipping
Sager Electronics

1kW Configurable supply is ideal for Medical Applications
Luso

3 W and 5 W Encapsulated AC-DC Power Supplies Offer Multiple Mounting Options
CUI Power Group

Passives

AEC-Q200 qualified, High Voltage Thick Film Chip Resistor for Automotive Applications
KOA

Vishay Intertechnology WSBS Power Metal Strip® Battery Shunt Resistors in 5216 Size
Vishay Intertechnology

Rhpoint components is pleased to introduce the new BVF series from Isabellenhütte
Isabellenhütte

TTI Offers Broad and Deep Inventory of Vishay's Surface Mount Current Sense Resistors
Vishay Intertechnology

Enclosures

1551V sensor enclosures for the IoT
Hammond Electronics

Vented Hammond enclosures ideal for sensors available from Rapid
Rapid

Optoelectronics

IPS TFTs Now Being Offered at Newhaven Display
Newhaven Display

VCC is Bending the Rules of Lighting Design with New VentoFlex Tiles
Visual Communications Company

Memory & Storage

SMART Modular Technologies Announces New N200 Family of SATA Flash Products
SMART Modular Technologies

Connectors and Cabling

DG12: Compact connector with circuit breaker and filter
SCHURTER

Development Kits

LoRa Development Kits from Raltron
Dove Electronic Components

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
Electronic Component Industry Association

BUY!

Buy components from a
Distributor of your choice

Protection against the odds

Hazardous industrial environments simultaneously present multiple threats to electronics. Ropec helps you specify the right level of protection when compromise isn't an option

Industrial hazards seldom threaten electronics one by one. They attack in force, so electronic devices may have to survive multiple assaults simultaneously including heavy impact, extreme temperatures, water or dust ingress and chemicals. That can make specifying enclosures a real challenge because to guarantee strength in one area, you may have to compromise in another, and compromise may not be an option—especially where the great outdoors is concerned.

Strength and sealing

Diecast rather than folded aluminum is usually the best starting point, although it may not be your final choice. It is strong, light and easy to cast or machine and therefore cost-effective to customize.

Specify an enclosure with a high IP rating for superior ingress protection. IP66 offers protection against temporary flooding in environments such as heavy seas. IP67 is required if the enclosure will be dipped in water up to 3ft for a short period. IP69K protects against close-range high-pressure water jets and high-temperature spray downs.

Choose an enclosure that offers a range of IP protection so you can upgrade the seals if the working environment is more hazardous than initially predicted.

Consider installation

Another key feature is installation. There's no point specifying an IP69K seal if you open the lid to install the enclosure in bad weather. To prevent this, 'lid closed' installation provides separate screw channels for the lid and fixing screws. Ropec's aluCASE, for example, offers lid closed installation with protective plastic or aluminum clip-on covers for fixing screws.

If an environment is seriously tough, however, engineers should spend as little time there as possible. Specify an enclosure with maximum protection and minimum installation time, particularly if regular inspection or servicing is needed.

To meet this brief, the aluCLIC enclosure clicks into place on a pre-installed bracket. It can be removed easily by clicking a tab with a screwdriver, enabling the enclosure to be opened and inspected in a less hazardous location. Alternatively, for applications that require enhanced security to deter tampering, a compromise between the aluCASE and aluCLIC is aluSMART. It offers similar advantages to aluCLIC but is secured to the pre-installed bracket by four easily accessible horizontal screws. All three options are available with IP66, 67 or 69K sealing.

Impact resistance

Where diecast aluminum isn't strong enough and higher impact resistance is required, stainless steel is the way forward, in either grade A2 AISI 304 or A4 AISI 316L. Of the two, A4 has the lower carbon content, which offers superior weldability and greater protection against corrosion. Electropolishing further improves corrosion resistance in either variant, making these cases ideal for marine and offshore applications.

Ropec offers three models in both A2 and A4 stainless steel: the inoCASE, available in standard sizes, and the inoCASE Mini, available in small sizes, both of which can be sealed to IP66, 67 or 69K, plus the inoBOX, available in standard sizes, with IP66 protection. In-house laser processing means all three can be supplied with cut-outs for mounting components.



The aluCASE is designed for lid closed installation

IP69K protection ensures enclosures can withstand hot jet washing

Chemical resistance

Of course, metal enclosures are not always the answer. Glass-reinforced polyester is robust, versatile and highly resistant to chemicals, as well as being cost-effective. Rolec's GRP enclosures are therefore used in oil and petro-chemical facilities all over the world.

Options include the polyTOP, available with IP66 or 67 sealing, which features single-channel fastening to maximize interior space and a choice of polyamide lid screws. Available with IP65 sealing, the polyKOM is manufactured in industry-standard sizes, with options such as external hinges, supporting hinges and mounting brackets. Finally, the IP66-rated polyDOOR offers a hinged front lid, optional lid window and a choice of lid screws to deter tampering, or hand screws for easy access.

For explosive atmospheres, only ATEX certified enclosures will suffice with approval based on the 94/9/EC directive. Rolec's polyKOM and its aluminum equivalent aluKOM can be specified as Ex-certified models, as can the polyTOP and the 'round' aluminum enclosure, aluDISC.

www.rolec-usa.com



Stainless steel enclosures are ideal for marine environments



Rolec's GRP enclosures are used in oil and petro-chemical facilities all over the world

19" ENCLOSURES FOR DESKTOP ELECTRONICS

NEW



TECHNOMET 19" CASES

Highly attractive and versatile table-top rack cases for 19" chassis and subracks. Standard heights: 3U, 4U and 6U, painted in light gray or anthracite. Supplied assembled with side handles, chassis supports, ventilation and non-slip feet. Can be customized to your exact requirements.

Ask about your own custom version!



METCASE ENCLOSURES

800 965 9872 | www.metcaseusa.com

METcase™



Expect ample supply and stable prices for TFT-LCDs

A spike in demand for a particular size LCD panel size could create a temporary period of tight supply in 2019



James Carbone

Electronics purchasers can expect it to remain a buyers' market for thin-film transistor liquid crystal displays (TFT-LCD) at least through this year as capacity remains high and supply ample for most size LCD panels.

However, there could be temporarily tightness of supply for some panel sizes if there is sudden high demand for a specific panel size. For instance, if there is a spike in demand for LCD panels used in smart phones, manufacturers could devote more capacity to that panel size resulting in reduced supply for other size LCD panels.

But overall the LCD market will remain adequately supplied. "For the broad LCD panel market I would say it is definitely a buyer's market," said Linn Huang, research director at International Data Corp (IDC).

Average selling prices will decline contributing to a drop in overall LCD revenue. In 2018 TFT-LCD revenue totaled \$88.9 billion,

but in 2019 sales revenue will drop to \$86.5 billion and by 2022 TFT-LCD revenue will be \$77.7 billion, according to researcher IHS Markit.

Unit demand will also decline. Overall TFT-LCD unit shipments will drop from 2.7 billion in 2018 to 2.6 billion in 2019, according to IHS Markit. Shipments will continue to drop through 2022 when 2.44 billion TFT-LCD units will ship. While unit shipments and revenue will decline, total TFT-LCD area shipments, as measured in millions of square meters, will rise steadily through 2022. In 2018, 210.9 million square meters of LCDs shipped, IHS Markit said. By 2022, 230.8 million square meters of LCDs will be purchased because of the general trend toward larger size LCD panels.

The good news for buyers is that there will be very little change in TFT-LCD average selling prices over the next several years. In 2018, the average price was \$32.99. The ASP will rise slightly

to \$33.15 in 2019, but then decline through 2022 when the average price will be \$31.85, IHS Markit said. However, there will likely be price declines for large 65- and 75-inch display panels.

The price forecast varies depending on the size of the panel and by customer segment. For instance, a large TFT-LCD panel for an LCD-TV will rise from \$107.81 in 2018 to \$113.77 in 2020, before declining to \$109.42 by 2022. However, a panel used for a computer monitor will decline from \$66.91 in 2018 to \$60.76 in 2022.

Demand for large-size, high-end panels will remain strong driven by rising demand for gaming-PC and professional-purpose monitors. Some LCD panel makers are devoting more capacity to monitor panels replacing existing TV panel production to make up for "poor performance of that business," said Robin Wu, principal analyst at IHS Markit.

There is also strong demand for

public, automotive and industrial displays. Demand from those applications grew 17.5 per cent by area and 28.6 per cent by units in 2018, said Wu.

He said TFT-LCD manufacturers view those applications as a "a new cash cow" that make up for the price erosion that has occurred in panels used in televisions, desktop monitors and notebook computers.

Panel shipments for monitors rise

However, IHS said that some LCD panel makers will continue to focus on the monitor and notebook PC panel businesses. Panel shipments for monitors will increase 5.3 per cent, while shipments for notebook PCs will rise 6.6 per cent. TV panel shipments will grow just 2.6 per cent, according to the researcher.

The good news for buyers who purchase panels for televisions is that more capacity will come on line this year which will boost competition and could lead

By the Numbers



\$88.9 billion

the size of the thin-film transistor liquid crystal display market in 2018.



\$33.15

The average selling price for a TFT-LCD panel in 2019.



\$47.33

the average price of a TFT-LCD panel used in a notebook computer in 2018.



\$77.7 billion

The forecast size of the global TFT-LCD market in 2022.



2.7 billion

the number of LCD panels shipments in 2018.



to even more aggressive price reductions.

In 2019, three new 10.5-generation fabs are expected to start mass production, according to Wu. ChinaStar, BOE and Foxconn/Sharp have built the fabs and all of them will manufacture TV panels, further boosting television panel supply, he said.

Because of stiff competition with TFT-LCD television displays, some manufacturers will focus on LCDs for computer monitors and notebook PCs.

Huang said there was "renewed vigor" by major monitor manufacturers because demand for monitors was stronger in 2017 and 2018. An increase in monitor demand means greater demand for LCD panels which is welcome news for LCD manufacturers producing panels for monitors because the monitor market had been steadily declining before 2017.

With demand rising, the monitor market has stabilized. "That may be a misleading word because the market is still generally down, but

it's down a lot less," said Huang. He noted that the monitor market is no longer closely tied to the PC market as it was 10 years ago. "The performance of the PC market has material impact on the monitor market, but I would argue that impact has been diminished greatly over time," said Huang.

No more bundling

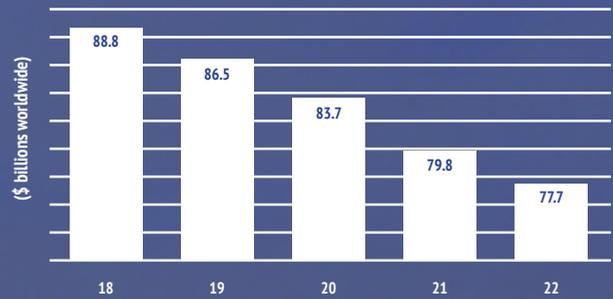
In the past, PC sales used to have a bigger impact on monitors because PC companies used to bundle monitors with PCs. If someone bought a PC, the monitor was included.

So when the PC market boomed, so did monitor sales. "When the PC market was doing terrible, so was the monitor market," said Huang. "Over time, the impact of the performance of the PC market on monitor has waned," he said.

Flat-panel LCDs replaced CRTs with desktops and other computers. Flat panels have a longer lifecycle than PCs, so PC manufacturers now sell desktops and other computers without monitors because PC buyers often do not need new displays. Computer buyers might decide to

Source: IHS Markit

TFT-LCD market to decline



buy new monitors several years after a PC purchase often opting to buy a bigger display.

Huang said no one panel size dominates computer monitors. In fact, there are six primary panel sizes that used: 18.5, 19.5, 21.5, 23, 24 and 27-inch. Those sizes account for about 80 per cent of LCD panel volume and no one panel size accounts for more than 21 per cent of shipments.

LCD panels measuring 18.5 inches are the least expensive, costing about \$60-\$70, but account for a small percentage of overall LCD panel shipments because of the trend towards larger size computer displays, he said.

"On the monitor side there has been this inevitable migration upwards to bigger screen sizes so there's something constantly pushing the mix upward," said Huang.

Overcapacity to continue

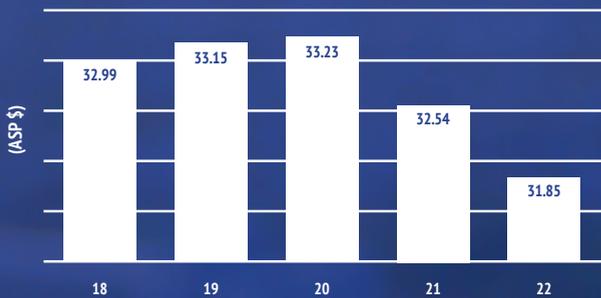
Regardless of panel size, there has been overcapacity of LCD panels for about a decade and

overcapacity will likely continue. In 2017 and 2018 when demand increased, overcapacity was less of an issue but, "overcapacity in general is still a long-haul issue." LCD panel overcapacity results in lower prices and less revenue for manufacturers.

Huang said overall industry overcapacity does not necessarily mean oversupply. "There have been moments of brief shortages even though the panel industry has been at overcapacity for a while," he said.

For instance, this can occur if Apple releases new product and some panel manufacturers transition production from larger size panels to smaller ones needed for iPhones. That could lead to a shortage of panels for monitors, he said.

Average LCD tags to fall



Source: IHS Markit

Taking a focused approach

President of TTI Semiconductor Group, Michael Knight, explains how the company is turning its laser focus onto the semiconductor market, having made a series of acquisitions to accelerate its expertise in this area

Since its inception, TTI's approach to distribution has focused on being a specialist rather than a broadline component supplier. As a specialist distributor of interconnect, passive and electromechanical components, this means having an intense focus on a core group of suppliers and product sets to facilitate best-in-class service and support.

Recently however, TTI expanded this specialist approach to include semiconductors, a product area in which it previously had little involvement. For this purpose, it formed the TTI Semiconductor Group as a specialty branch of the family tree and several acquisitions were made to accelerate the company's move into this space. Each of these initial acquisitions specializes in key elements of the semiconductor industry.

IoT expertise

The first acquisition, Symmetry Electronics is predominately focused on the internet of things, designing in wireless and cellular modules, video and audio chips, sensors and antennas. Its technical sales and application engineers help customers wirelessly connect their end products to the internet and other wireless devices. From design-in to supply chain management, Symmetry supports sensing and connectivity applications. Furthermore, this sector is growing exponentially with 40 to 50 billion connected devices already in existence

and one trillion sensors potentially growing to 100 trillion by 2030.

Automotive know-how

Headquartered in Korea, Changnam represents another acquisition. It supports Korean companies manufacturing in China and Vietnam, focusing primarily on automotive electronics and related infrastructure, and secondly on consumer electronics. The automotive industry and the broader transportation sector are electrifying at an ever-increasing rate. By 2020, it is estimated that 35 per cent of the cost of a new car will be in electronics. For battery electric vehicles, that figure will be even higher. Add in autonomous driving capability, such as radars, cameras, lidar, sonar, V2X and GPS, and it is higher still. Over the course of the next ten years, battery electric vehicles are forecast to swell to 220 million which in turn will drive the buildout of 40 million charging stations. This ensures the automotive industry will be a leading driver of the electronics industry overall.

Driving RF development

With its own set of competencies, RFMW specializes in radio frequency and microwave components such as amplifiers, switches, modulators and demodulators, attenuators, RF transistors, diodes and filters. The team boasts long tenure and extensive training in design-in of RF and microwave components, with its efforts being driven by global connectivity, especially

cellular infrastructure, antenna arrays and satellite communication systems. With more than half the world still to be connected to the internet, and the looming proliferation of 5G wireless networks, RFMW's area of specialization is well aligned with the future of the industry.

Though 2019 is predicted to be more up and down than the strong, consistent growth of the last couple of years, the industry areas addressed by TTI Semiconductor Group companies are expected to outperform the industry overall. In addition to strong organic growth, TSG will also continue to expand geographically with select acquisitions of semiconductor distributors that share TTI's specialized approach. This new branch of TTI aims to make the company ever more valuable to customers, providing clear sight lines on the many areas of exponential growth in the electronics industry.

www.ttiinc.com



President, **TTI Semiconductor Group**,
Michael Knight



With its own set of competencies, RFMW specializes in radio frequency and microwave components

Zero-drift amplifier ensures data accuracy

Microchip's new MCP6V51 zero-drift operational amplifier is designed to provide ultra-high precision measurement while minimising the influence of high-frequency interference. Launched in response to the growing number of sensors that must be monitored in industrial control and factory automation applications, the MCP6V51 can provide accurate, stable data from a variety of sensors.

The device features a self-correcting zero-drift architecture, enabling ultra-high direct current precision, with a maximum offset of $\pm 15\mu\text{V}$ and only $\pm 36\text{nV}/^\circ\text{C}$ of maximum offset drift.

Ideal for applications such as process control and building automation, the MCP6V51 also supports a wide operating voltage range, from 4.5 to 45V.

With the proliferation of wireless sensors, high frequency interference within sensitive analogue measurement is becoming a critical consideration. On-chip EMI filtering provides protection from these unwanted and unpredictable interference sources.

www.microchip.com



Bucking the trend on EMI

Diodes has announced a new range of 2A synchronous DC/DC buck converters said to deliver class-leading electromagnetic interference performance across a range of input and output voltages. The AP63200/AP63201/AP63203/AP63205 devices are ideal for applications such as home appliances and industrial electronics, as well as telecommunications, power tools and consumer products.

Unlike other switching DC/DC converters, which can typically introduce significant EMI, devices in the range employ a frequency spread spectrum technique and proprietary gate driver technology to improve EMI performance. This supports

single layer PCB designs and can remove the need for vias to further reduce EMI. Furthermore, the proprietary gate driver design can also reduce switching node ringing without sacrificing mosfet turn-on and turn-off times.

These fully integrated devices feature high-side and low-side mosfets with low on-resistance. By employing pulse frequency modulation, the devices also deliver efficiencies of up to 88 per cent under light-load conditions and a quiescent current as low as $22\mu\text{A}$.

www.diodes.com

Save Time in Your Purchasing Process

Work Directly With the Manufacturer



How We Can Help You:



Largest Inventory of Microchip Products



Special Pricing for High-Volumes



Schedule Orders up to 12 Months in Advance



Low Risk: 30-Day Reschedule and Cancellation



Buy Now, Pay Later (with a Microchip Credit Line)



Purchase and Program Your Devices Securely

...and many more features!

microchip.com/purchase

The Microchip name and logo and the Microchip logo are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.
© 2019 Microchip Technology Inc. All rights reserved. 02/19 DS00002362F



New product development is key to EMS revenue growth in Canada

Some OEM buyers involved in outsourcing decisions are looking to EMS providers in Canada to help bring new products to market

Electronics manufacturing services (EMS) providers in Canada say while many OEMs choose to manufacture in Canada to sell products into the Canadian market, many are also turning to them to develop new products that will be sold globally.

In addition to state-of-the-art manufacturing facilities, many EMS providers in Canada also have design centers or programs to support OEMs' new product introduction efforts. The idea is to offer OEM customers greater value by assisting in the design of new products, building prototypes and then helping the OEM transition a new product into volume manufacturing.

For instance, global EMS provider Flex, which is based in Singapore, has two design centers in Canada, one in Ottawa and another Markham, Ontario. Its "Sketch to Scale" program provides assistance to OEMs with design concept, advanced design engineering and new product introduction capabilities.

Smaller EMS providers also offer NPI and design help to OEMs developing products in Canada. For instance, Vexos is a global EMS provider with manufacturing in the U.S., Mexico, China and Canada where it builds equipment for Canadian-based OEMs.

"Our business in Canada certainly has been growing," said Wayne Hawkins, senior vice president and general manager for Vexos' Markham manufacturing facility.

"We had strong growth over the last few years," he said. "Last year revenue increased by about 10 per cent. It has been a very good environment over the last couple of years."

He said Vexos builds printed circuit board assemblies as well as entire systems and we "do full test for the end application to make sure quality requirements are met." Connectivity and RF products and industrial equipment "would be the majority of what we do in Markham," said Hawkins. It also builds medical and security products.

He added that Vexos is seeing "a lot of new business opportunities because of the growth of Internet of Things" as more industrial products are being connected to the Internet.

OEM customers also want Vexos to help them develop new products.

"We are located close to design centers of our customers where quick turn NPI service" is needed to help customers launch new products, he said. There is a lot of new product development in the Toronto

area as well as Kitchener and Ottawa.

Building prototypes

He said Vexos works with OEMs building prototype products and then helps "them ramp up production to get their products to market." The EMS provider assists OEMs in transitioning their new products from small production to volume production at its "sister location in Shenzhen, China to reap the benefits of lower-cost manufacturing if a customer needs to kick something to higher volumes to get cost efficiencies," said Hawkins.

Another EMS provider that helps its customers develop new products in Canada is Sanmina, which is based in San Jose, Calif., but has facilities in Canada, including a design center in Ottawa. The center specializes in developing RF, optical and microelectronic products for customers. The engineering team at the center develops RF and optical products for telecommunications, industrial, medical, clean energy and defense and aerospace OEM.

Many of Sanmina's customers want to leverage the EMS provider's expertise in RF and optical technology and its new product development know-how when they design a new product.



Wayne Hawkins, senior vice president and general manager for **Vexos**.



Our business in Canada certainly has been growing. We've had strong growth over the last few years

Many of Sanmina's OEM customers in Canada are technology focused companies. "We help them with design and new product introduction and then potentially assist them transferring those newly developed products to other lower cost locations that Sanmina has," said Stewart.

"Canada is a significant region for Sanmina," said Jeremy Stewart, director business development for Sanmina's operations in Ottawa. "Across the globe we have many large multinational customers that control the supply-chain out of Canada or have operations here in Canada," he said. But some customers like to develop their products in Canada because of the high degree of high-tech expertise in the country, especially in Ottawa.

"People call Ottawa the Silicon Valley of the North because it is a significant technology hub," said Stewart. "There is a lot of research and development taking place in Ottawa as well as Toronto and in Montreal to some degree," said Stewart,

Leveraging expertise

Many, although not all, of Sanmina's customers want to take advantage of that expertise. Customers that Sanmina services in Canada fall into three categories, said Stewart. "The EMS provider has OEM customers that are headquartered in Canada and manufacture in Canada or globally," said Stewart. Other customers are multinational OEMs and want to develop high-technology new products and introduce them to the market quickly.

"We're very active with them on new product introduction to help them launch their products," he said. The third category is OEM customers that "want us to manufacture their products and leverage our RF/optical, microelectronics design and manufacturing capabilities that we have here which is

a real differentiator for us in Ottawa," said Stewart.

While telecommunications is the largest industry Sanmina services, "we also support industrial customers here which is broad customer vertical for us," said Stewart. Sanmina also supports medical and defense and aerospace OEMs with its RF, microwave and radar expertise and manufacturing capabilities.

Those OEMs leverage Sanmina's technical capabilities with RF and optical technologies in different ways. In some cases, customers "collaborate with our engineers" on new products, said Stewart. In other cases, Sanmina develops products for them in its labs and "and literally turn around prototypes in a couple days."

He said Sanmina is starting to see an opportunity in the automotive industry because of its optical and RF capabilities as automotive OEMs develop self-driving vehicles.

"We're involved in design and new product development for multiple lidar systems on the automotive side," said Stewart. Lidar is a technology that measures distance to another vehicle or pedestrian by illuminating the car or person with a pulsed laser light and measuring the reflected pulses with a sensor. Autonomous vehicles in the future will use lidar for obstacle detection and collision avoidance to navigate safely on the road through the use of rotating laser beams.

Seeking design support

Internet of Things and industrial customers are also seeking design support. "In our industrial segment, there is a connectivity evolution occurring with industrial products tying into IoT," said Hawkins.

In addition, there are new

customers with "niche products that are IoT applications," he said. "A lot of them are new ventures involving new emerging companies and a higher risk. It could be a great opportunity or a they could die quickly," but some of the new IoT products will be part of Vexo's future growth, said Hawkins.

There are also opportunities with traditional segments he said. "We are seeing more growth potential around security products," said Hawkins.

There are new products involving security access controls and cyber security for the defense industry and businesses. Such products will be opportunities for EMS providers that have high-level optical capabilities and manufacturing expertise with fine-pitch technology and flexible printed circuit board assemblies.

While helping OEM customers design and develop new products may be important to EMS revenue growth long-term, some EMS companies say recently imposed tariffs on Chinese goods imported to the U.S. may spur some short-term sales growth for some Canadian EMS providers.

Hawkins said Vexo's is getting more quotes from U.S. companies inquiring about manufacturing in Canada since tariffs of Chinese goods went into effect in the U.S.

"U.S. companies are looking at a 25 per cent tariff of products coming from China," he noted. "Some U.S. companies are asking 'what are the 'opportunities and options to avoid that?'" said Hawkins. "Certainly, leveraging a Canadian EMS site to build products and ship them into the U.S. and avoid some tariffs" is an option, he said.

He noted that Canadian

labor costs are lower than in the U.S. "There are some cost reduction opportunities utilizing Canadian EMS providers, maybe not to the extent of China or Mexico but you're getting the benefit of a highly skilled workforce, engineering, and serviceability," said Hawkins.



Canada is a significant region for Sanmina. Across the globe we have many large multinational customers that control the supply-chain out of Canada or have operations here in Canada

Jeremy Stewart, director business development for **Sanmina's operations** in Ottawa.

EMS industry in Canada is small but growing

The electronics manufacturing services industry in Canada is small compared to other regions such as China or the U.S., but many of the world's largest EMS providers build electronic systems in Canada for the domestic market.

For instance, Celestica, which is headquartered in Toronto, has almost 1 million square feet of manufacturing space in Canada, according to New Venture Research. Celestica has a new site in Newmarket that handles manufacturing and new product introduction. Flex has a facility in Toronto that has about 426,000 square feet and another factory in Ottawa with 220,000 square feet of manufacturing space, the researcher said. Sanmina also has a manufacturing facility with about 136,000 square feet of manufacturing space.

There are also many smaller EMS providers that are either based in Canada or have facilities there. For instance, Creation Technologies,

headquartered in Vancouver, British Columbia, has manufacturing facilities in Vancouver, Toronto and Mississauga.

Vexos, which is headquartered in New York, has manufacturing facilities in Markham, Ontario. SMTc, based in Toronto, has a design and engineering center in Toronto.

The EMS industry in Canada had about \$4.5 billion in revenue in 2017 which is about a tenth of the size of the U.S. EMS market, according to Randall Sherman, president and CEO of New Venture Research, based in Nevada City, Calif. The global EMS market totals about \$365 billion. The Canadian EMS market grows about 3 per cent per year. By 2022 EMS sales revenue will reach \$5.65 billion, he said. "Most of the production is for domestic purposes. There's not a lot of export," he said.

There's also not a lot of high-volume manufacturing

in Canada. "Cell phones, computers, networking equipment are not made in Canada," said Sherman. It's more low- to mid-volume manufacturing high-complexity" products including medical and industrial products, aerospace systems, robotics, test and measurement and process control equipment, he said.

EMS providers in Canada tend to service smaller OEMs. Although there are exceptions, such as aerospace manufacturer Bombardier.

Although growth in the EMS industry has been modest, there could be an uptick in growth as more OEMs in Canada embrace the outsourcing model.

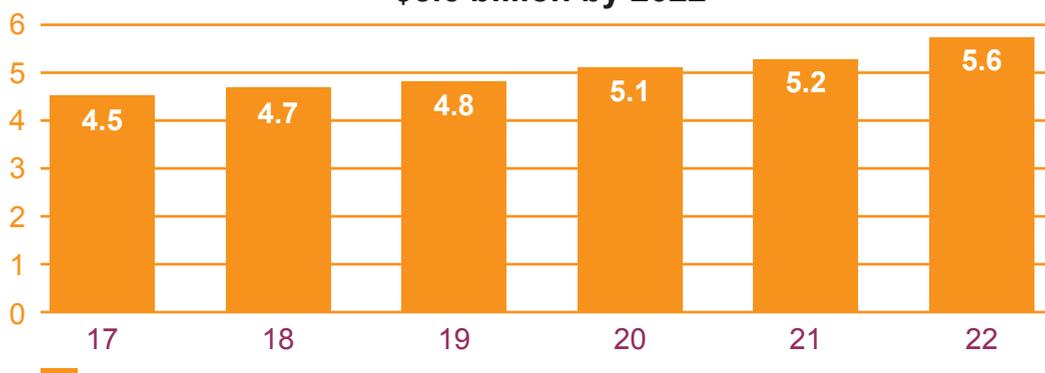
"They have good quality manufacturing capacity in Canada," said Sherman. In addition, the dollar value of the total available market (TAM) for electronics production in Canada including manufacturing by

OEMs and EMS providers totals \$63 billion. EMS providers in Canada could "capture a larger share of total available market over time," said Sherman.

Gelston Howell, senior vice president of marketing for Sanmina said the EMS provider has a long history of manufacturing for the telecommunications industry. He said the company's growth in Canada was "not due to printed circuit board and surface mount technology, but because of its involvement with high technology and telecommunications. "RF and optical really enable multiple generations of bandwidth improvement for the industry," he said.

He said Sanmina is now leveraging its expertise and optical and RF technologies for medical and automotive OEMs.

Canadian EMS market to reach \$5.6 billion by 2022



Source: New Venture Research

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
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

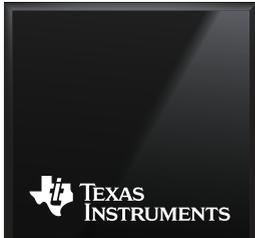
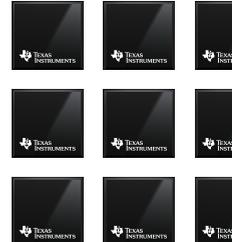
Continue on page 46

Advert Index

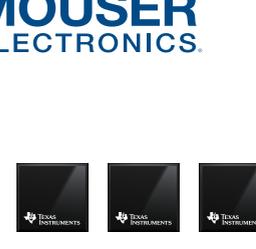
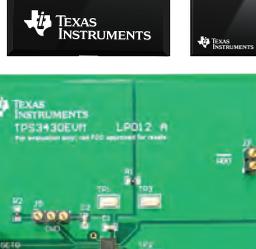
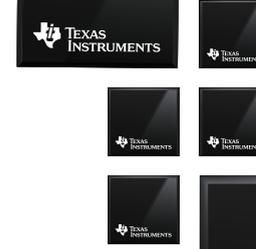
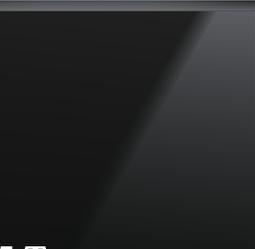
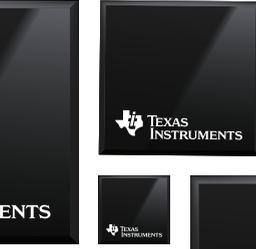
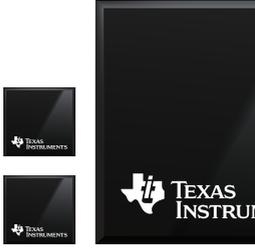
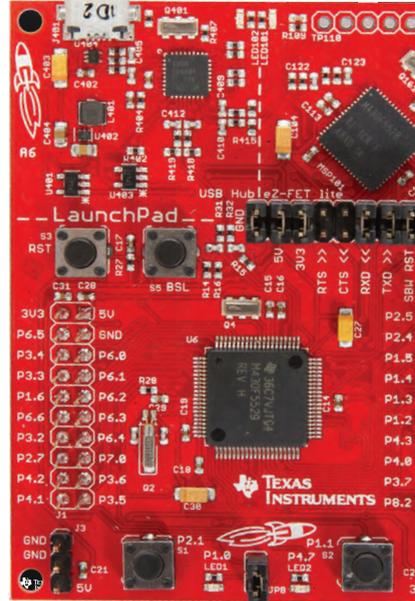
Advert	Page	Advert	Page
Astute	15	Mouser Electronics	10, 11, 17, 38, 39, 47, 50 & IBC
Central Semiconductor	19	MPD	29
Coilcraft	27	Newark	7
Dantona	31	OKW	37
Digi-Key Electronics	FC, IFC & 22	Recom	33
Dove	25	Rochester	13
eBOM.com	35	Rutronik	BC
ECCO	16	Sager	5
Falcon	21	SMITHS	14
Microchip	41	TTI	9
Mornsun	32		

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 48



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



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	Y
	Rochester Electronics	978-462-9332	www.rocelec.com	Y		N/A	\$250		10	400+	Y
OPTO ELECTRONICS											
Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	582	N/A	\$0	99.00%	50	1,000+	Y
Finisar	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,927	N/A	\$0	99%	50	1,000+	Y
ROHM Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
PASSIVES											
ABRACON	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
AVX	Mouser Electronics	800-346-6873	www.mouser.com	Y	42,454	N/A	\$0	72%	50	1,000+	Y
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	38	N/A	\$0	78%	50	1,000+	Y
Cornell Dubilier	Mouser Electronics	800-346-6873	www.mouser.com	Y	24,145	N/A	\$0	71%	50	1,000+	Y
Coilcraft	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	26,533	N/A	\$0	98.00%	50	1,000+	Y
Fair-Rite	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Kemet	Mouser Electronics	800-346-6873	www.mouser.com	Y	77,568	N/A	\$0	66%	50	1,000+	Y
KOA Speer	Mouser Electronics	800-346-6873	www.mouser.com	Y	34,078	N/A	\$0	58%	50	1,000+	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	33,780	N/A	\$0	99%	50	1,000+	Y
Nichicon	Mouser Electronics	800-346-6873	www.mouser.com	Y	20,389	N/A	\$0	84.00%	50	1,000+	Y
Ohmite	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,293	N/A	\$0	55.00%	50	1,000+	Y
Panasonic Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,948	N/A	\$0	100.00%	50	1,000+	Y

Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
PASSIVES (Continued)											
Taiyo Yuden	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,620	N/A	\$0	98.00%	50	1,000+	Y
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,663	N/A	\$0	100.00%	50	1,000+	Y
TT Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
United Chemi-Con (UCC)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	102,917	N/A	\$0	64.00%	50	1,000+	Y
Würth	Mouser Electronics	800-346-6873	www.mouser.com	Y	934	N/A	\$0	99.00%	50	1,000+	Y
Yageo Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,246	N/A	\$0	100.00%	50	1,000+	Y
POWER & BATTERIES											
Artesyn Embedded Technologies	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cincon	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cosel	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
CUI Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Delta Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
MEAN WELL	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Mornsun	+1-978-567-9610/+1-978-293-3923	www.mornsunamerica.com				N/A	\$0	100%	N/A	2000+	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
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

ANALOG DEVICES
AHEAD OF WHAT'S POSSIBLE™

EM

Electronic Components
KEMET
CHARGED™

molex

CREE
AUTHORIZED D

muRata
INNOVATOR IN ELECTRONICS

maxim
integrated.

inte

Amphenol

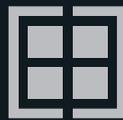
NXP

spark
ELEC

POWER BY LINEAR™

OSRAM
Opto Semiconductors

ST
life.augme



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

