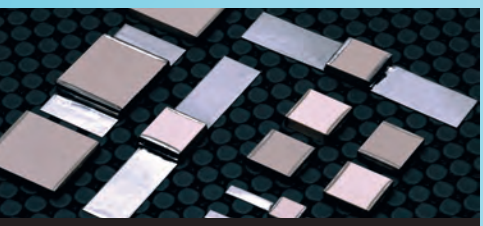
ELECTRONICS
sourcing
JUNE 2021
NORTH AMERICA
AN MMG PUBLISHING TITLE



2020	Company	Head-Quarters	EMS Sales (calendar 2020) (millions USD)	EMS Sales (calendar 2019) (millions USD)	EMS 2019 rank
	HonHai Precision (Foxconn)	New Taipei, Taiwan	181,592	172,878	1
	Pegatron	Taipei, Taiwan	47,504	44,209	2
	Wistron	Taoyuan, Taiwan	28,868	28,418	5
	Jabil Circuit	St. Petersburg, FL	27,594	26,282	3
	Flex	San Jose, CA	24,578	24,951	4
	BYD Electronics	Shenzhen, China	10,050	7,676	7
	USI	Shanghai, China	6,972	6,372	10
	Sanmina	San Jose, CA	6,876	7,886	6
	New Kinpo Group	New Taipei, Taiwan	6,863	6,500	8
	Celestica	Toronto, ON, Canada	5,748	5,888	9
		Neenah, WI	31	3CEMS Group	To
		Singapore	32	VIDEOTON	Sa

EXPLORE THE ELECTRIFICATION OF

MID-CLASS TRUCKS

FIND OUT ON PAGE 22

On the cover – June 2021

Explore the electrification of mid-class trucks
Find out on page 22

Contents

Contact

ELECTRONICS sourcing
mmg PUBLISHING US LTD

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

ADVERTISING
Advertisement Manager: Emma Poole
emma.poole@electronics-sourcing.com

DESIGN
Graphic Designer: Katie Williams
katie.williams@electronics-sourcing.com

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

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

Issue 105, Vol.12 No.06
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
@Electrosourcing

Printed in the United States

abc ELECTRONICS SOURCING IS INDEPENDENTLY ABC AUDITED 2005/2020

ecia
Connect. Influence. Optimize.

Editor's Word

All eyes on us

As an RV operator I have access to one of the world's most energy diverse systems. Let me explain. RVs use diesel for the vehicle engine: gasoline for AC generators; propane for heating and cooking; mains electricity for multiple high voltage systems; lead acid starter/ leisure batteries for multiple low voltage systems; solar panels for charging the leisure batteries; and even charcoal for the BBQ.

These systems have been optimised over many decades and are fit for purpose. However, apart from the solar panels, they are fossil-based. So begins the slow march to renewable electrification.

In my mind, reducing energy diversity must surely increase risk. Thus, voluntary adoption will rely on electrification being affordable, practical, reliable, safe and secure. I have no doubt, given sufficient time and money, our industry will be able to deliver admirably on all these fronts.

However, this comes at a cost. From now, all eyes are on the electronics and electrical industries. If we fail, everything fails. There will be no other energy system to demonise and blame. Without really knowing it, this industry has just accepted responsibility for everything, forever.

To ensure the general public is willingly walking in lockstep with the introduction of electrification technology, our industry needs to share its achievements and successes. However, at the time of writing, the broadcast media is actually focussing on the industry's inability to deliver due to chip shortages and the horrific cost of maintaining EV vehicles. Not a great start.

Jon Barrett

N
ES News

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

Connector innovations available for shipping

GCT has announced a global distribution agreement with Mouser Electronics covering products including the latest USB, SIM, memory and board-to-board connectors.

GCT's global distribution manager, Richard Clark, said: "GCT has a proven track record of developing new products in the connectivity space. Working with Mouser Electronics provides additional opportunities to digitalise our product offering and reach a wider global customer base. We are delighted to launch our relationship with Mouser, whose capabilities add to our distribution channel, and provides greater portfolio access for our current and future customers."

Mouser's vice president of supplier management, Krystal Jackson, added: "GCT brings a wealth of connector solutions with unique attributes. With a strong portfolio of products now available for shipping, we're excited to see more innovations from GCT as we grow our partnership."

www.gct.co

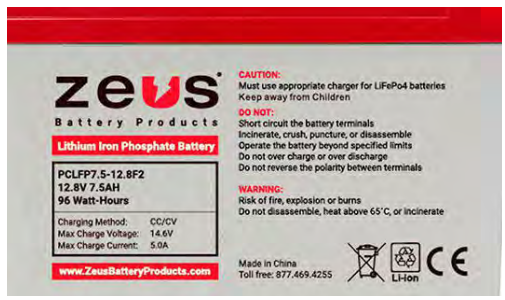
New cable and connector options

Bürklin Elektronik has added several new cabling and connector product lines. The company has expanded its range of assembled power cords and can offer many different types for a variety of countries from its Oberhaching warehouse.

The company offers the Deutsch DT family of environmentally sealed two-way 13A plugs with housing for female terminals. These are designed to withstand harsh environment, cable-to-cable and cable-to-board applications where connection degradation cannot be accepted.

The Binder 581 series of M16 IP40 female cable connectors suits cable outlets from 6.0 to 8.0mm and is compatible with other brands having the same contact arrangement.

www.buerklin.com



Power ahead with battery choice

Newark has increased its range of batteries and chargers with the introduction of Zeus Battery Products in North America.

Zeus offers a selection of replacement batteries, chargers and power accessories optimized for energy or power density. The company also offers rechargeable battery cells designed for electric vehicles or energy storage applications. Many products feature lithium iron phosphate chemistry for cycle and calendar life.

Newark's head of product management IP&E, Michael Ulch, said: "We're charged up to have Zeus Battery Products added to our battery portfolio. Zeus provides the value-added assembly and stringent quality control measures synonymous with all Newark products, ensuring a premium product every time. We know our customers will appreciate their reliability and superior value."

Rechargeable lithium iron phosphate cells are designed to provide a low cost, high power, fast charging, safe and reliable solution. Stated specifications include excellent thermal stability, 2.8V, 7.5Ah with quick connect and over 2,000 cycles at 100 per cent DOD.

www.newark.com

N
ES News

In Brief

Understanding smart cities
Digi-Key has launched a new 'smart cities' video series sponsored by TE and Microchip. The three-part series focuses on some of the world's most advanced cities and how the latest technology and innovations in public safety combine to reshape the way people work, commute and live.
www.digikey.com

Beamforming agreement
Mobix Labs and Richardson RFPD have entered into a global distribution agreement, under which Richardson RFPD will represent Mobix Labs' beamformers, antenna solutions and analog/ RF semiconductors. The company's CMOS-based technology includes single SKU devices designed to offer advantages in performance, efficiency, cost, size and time-to-market.
www.mobixlabs.com

Reliable connections
Lectrix has announced a partnership with Bulgin, a specialist in environmentally sealed connectors and components. Bulgin's president, German Casillas, said: "Providing fast, reliable sealed solutions for the harshest of applications across multiple industries is what Bulgin does best. Working with Lectrix allows us to get in front of our customers with targeted information."
lectrixgroup.com

NA EMS down 3.6 per cent
Findings from IPC's North American Electronics Manufacturing Services (EMS) Statistical Program show book-to-bill at 1.43 and total North American EMS shipments in March 2021 down 3.6 per cent compared to the same month last year. Compared to the preceding month, March shipments rose 10.9 per cent. EMS bookings in March rose 8.9 per cent year-over-year and decreased 8.7 per cent from the previous month.
www.IPC.org

Global support for RF broadband solutions

RFMW has announced a global distribution agreement with RF-Lambda covering RF broadband solutions including high-end RF and mmWave components and modules such as solid state power amplifiers, low noise amplifiers, switches, phase shifters and attenuators.

RF-Lambda general manager, Richard Clary, said: "As a leader of RF Broadband solutions, RF-Lambda offers state of the art designs with a focus on repeatability and reliability, critical for those who depend on our products. Whatever your need, we can offer customized designs and support a variety of applications including wireless infrastructure, RF testing equipment, defense and aerospace."

RFMW's president, Joel Levine, added: "We are incredibly excited to formally partner with RF-Lambda. Having seen customer requirements for their products over the years, we are intimately familiar with their performance and value. A formal agreement expands RFMW's broadband product offering in markets and applications we support. RFMW's industry leading technical sales and global logistics teams allow us to provide engineers with the latest technology for their innovative designs."

www.rfmw.com

AC/DC modules keep a low profile

Sager Electronics is now stocking Recom Power's RAC02E-K/277 and RAC03E-K/277 series 2W and 3W AC/DC converters. These modules are capable of 277VAC with 4kVAC isolation. Providing versatile power in a compact space, these converters offer outputs ranging from 3.3V up to 24VDC and a footprint of 1.35 by .88in or 1.45 by .95in respectively and a 15.4mm profile.

The products are designed to offer a wide operating temperature range and provide a cost-effective solution for IoT, IIoT and household applications requiring low-power AC/DC converters.

www.sager.com

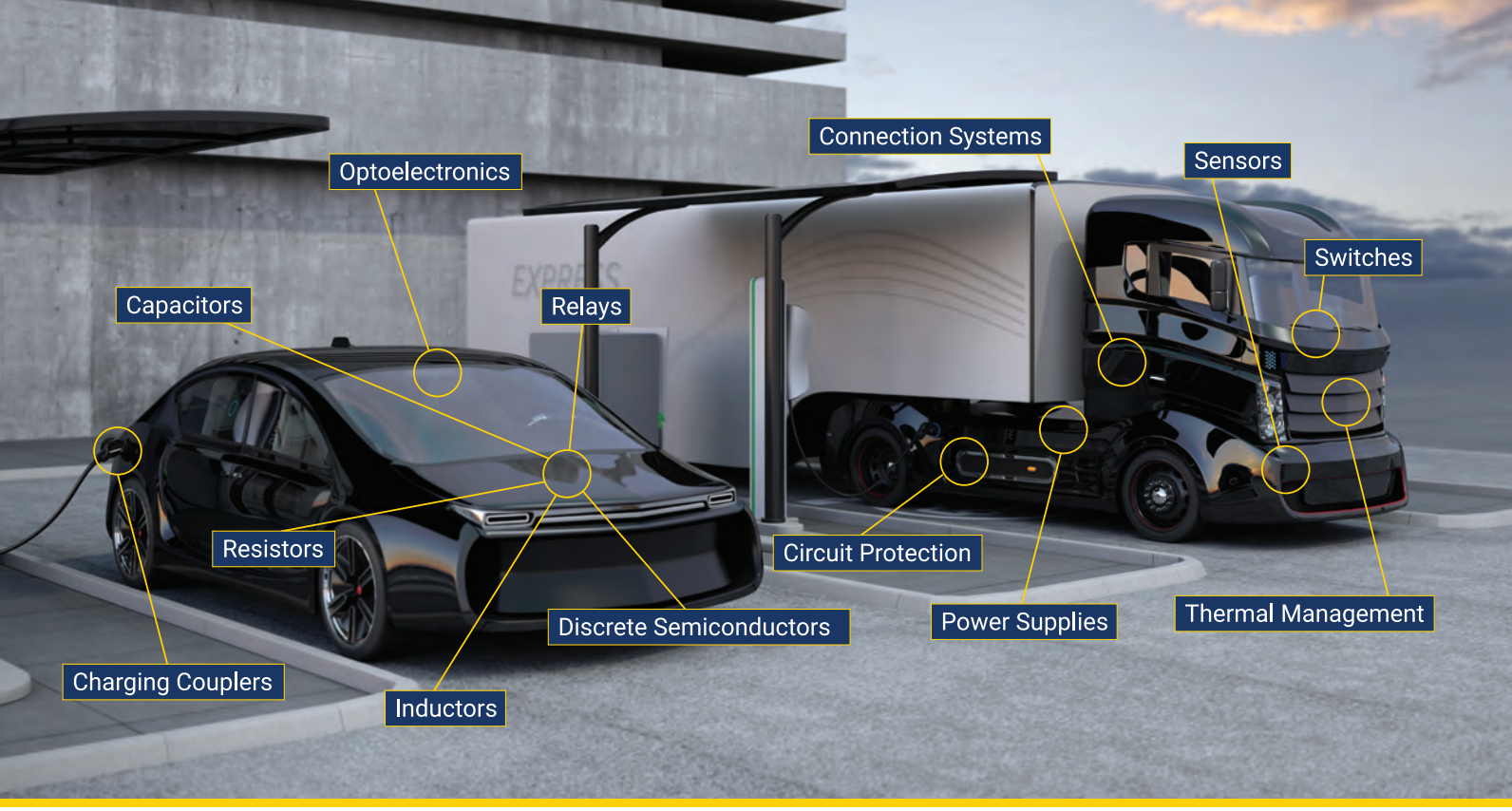
Accelerated time-to-market

The XRF8 RF SoC Gen 3 system-on-module is now available from Avnet. The technology suits RF applications demanding small footprint, high-speed serial connectivity and real-time processing.

Avnet's vice president of engineering and technology, Jim Beneke, said: "Together with Xilinx, we created a production-ready module solution that frees developers to focus on the differentiating features of their products. This is our latest offering designed to accelerate time-to-market allowing developers to more quickly deliver real business value."

Samtec's director of precision RF, Mike Dunne, added: "Combining high-speed digital and precision RF signals in a small form factor poses unique routing and isolation challenges. The XRF8 module and companion carrier card leverage best-in-class RF and signal integrity design techniques to provide high-speed connectivity across the platform. System architects and designers can develop next-gen RF applications with confidence the XRF8 delivers the system performance needed."

avnet.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 tti.com

tti.com
1.800.CALL.TTI

A Berkshire Hathaway Company

Amphenol · APTIV · BOURNS · EATON · ITT cannon · KOSTAL · Littelfuse · molex
OMRON · PANDUIT · Panasonic · PHOENIX CONTACT · TDK · TE · VISHAY

Crossing the MLCC supply void

Johanson Technology's vice president, Scott Horton, explains how domestic MLCC manufacturers are ramping capacity to fulfill orders for large format, high Q ceramic capacitors

Industrial, medical and military demand for high quality, high-voltage, multi-layer ceramic capacitors (MLCCs) has been hit hard by the insatiable requirement for smaller, lower voltage—and in some way—lower performance MLCCs fueled by 5G networks, smart phones and mobile devices. OEMs are experiencing delays up to six months, jeopardizing product release schedules, industrial market share and potentially even military readiness.

Due to a slowdown in capacitor demand in 2019, many OEMs and distributors were left holding surplus inventory and were hesitant to order inventory in 2020. As the market ramps up, so does MLCC demand despite low capacitor inventory. This further exacerbates shortages of larger high voltage, high Q MLCCs, since some manufacturers have focused production on smaller/lower voltage devices.

Johanson Technology vice president, Scott Horton, said: "There is a ripple effect to the industrial and military market sector that is not really fully understood. Although a shortage of electronic products used to manufacture smartphones and automobiles would be national news, the lack of larger, higher voltage MLCCs for industrial and military applications are typically under-reported. However, it will continue to squeeze business customers and eventually end users." Industrial, medical and military consumers of MLCCs depend on high voltage and high-Q capacitors for power supplies, amplifiers, MRI coils, plasma generators, lasers and many other specialized applications. In higher current circuits, higher-Q MLCCs are preferred to reduce self-heating.

The Q factor represents the efficiency of a capacitor's rate of energy loss. High Q capacitors lose less energy reducing the need to dissipate or cool the heat which protects the board from damage and performance loss in sensitive applications.

Not all MLCCs are created equal, even among the high performance MLCCs, yet ensuring a consistent level of performance is critical for the high reliability applications required by industrial and military end users.

Horton explained: "If an MLCC manufacturer is not tightly controlling the layer count, they might be providing 10-layer batches in one batch and then later deliver 17-layer parts in a subsequent batch. These two parts will not perform the same at high frequencies." Domestic sources of MLCCs for industrial and military applications have been ramping up capacity. Increased domestic MLCC supply means industrial or military customers need not delay a product's build or shipment.

Drawing on its focus on high-Q and high voltage MLCCs, Johanson, for example, has expanded its capacity to fill some of the supply void caused by the market's shift to smaller capacitors.

Horton added: "We've been investing in expanding our capacity for several years now through a modernization of our production facility and the opening of a second production line that will essentially double our MLCC output. We can take that even higher with more production shifts."

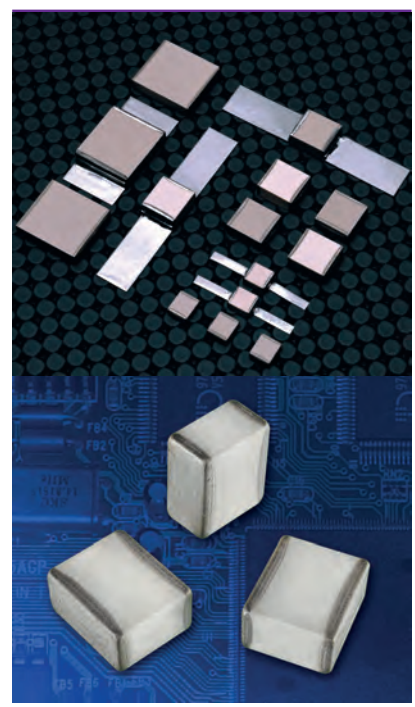
At the time of writing, Johanson is quoting large size high voltage MLCC order fulfillment times at 10-weeks.

Horton concluded: "There's just no reason to move away from ceramic for your high-voltage, high quality applications. There is now a growing domestic MLCC supply available to meet our domestic needs."

www.johansontechnology.com

Not all MLCCs are created equal, even among the high performance MLCCs

Examples of MLCCs



FUSIONWORLDWIDE

SOLVING SUPPLY CHAIN SHORTAGES

Have the final say when electronic component and finished product shortages disrupt your supply chain.

Industries we support:

- Personal computing
- Enterprise computing
- Telecom
- Industrial automation
- Automotive
- Transportation
- Healthcare
- Contract manufacturers
- ODMs
- Aerospace
- Defense
- Security
- Lighting
- Gaming computing
- IoT

Learn more at **fusionww.com**

It's not just about inventory and timely delivery anymore

Buyers need distributors to provide more technical advice, market intelligence and cost-reducing value-added and supply chain services

James Carbone

In the not-so- distant past the expectations that many electronics purchasers had of distributors were that distributors had the parts buyers needed in stock and would be able deliver them in a timely fashion.

But times have changed and buyers now expect much more from distributors. Some buyers regard their distributors as strategic partners and rely on them not just for parts and timely delivery, but also for cost-cutting value-added and supply chain services and for need-to-know market intelligence about the supply chain. They also want distributors to provide insight on environmental and social responsibility regulations and provide documentation that parts purchased meet those regulations. Buyers also want distributors that have design tools that make it easier for their companies' engineers to find the best solution for new designs.

"Buyers' expectations have changed immensely over the years," said John Hufnagle, vice president, North American sales and engineered solutions for distributor PEI-Genesis. One reason is technology development. "The ability to access information, procure material, research technical information or evaluate buying patterns and vendor performance has advanced dramatically and continues to do so on a daily basis," said Hufnagle.

He said buyers look to PEI-Genesis for insight when there are changes in market conditions, demand and lead times. "We see that now in certain product groups as the economy starts to rebound as a result of the COVID recovery," said Hufnagle. "Our customers look to us for guidance and advice on navigating those waters."

He said PEI-Genesis puts a strong focus on "value added selling whether it is the on-hand component inventory, a bond program for an 18-week lead time product, a cable assembly design and manufacture or a kit for engineering in the early stages of a design."

Customers today are looking for a good user experience, said Hufnagle. "We take pride in helping our customers make the right choices," he said. PEI-Genesis has as expansive portfolio of connectors and "we are able to evaluate applications, buying situations, available inventory, market conditions and guide customers to sensible decision making."

Technical expertise required

Wayne Nelson, general manager at Benchmark Connector Corp., said more of Benchmark's customers "expect us to have technical/performance answers to their questions about the products we provide," he said. Buyers are also more concerned about environmental impacts of these products. "We spend a great deal of time filing out material/composition declarations then we ever had before," said Nelson.

Responsiveness is more important to buyers especially over the past year during the pandemic. They expect a prompt response to an enquiry to a technical question or product usability, he said. "Most of my staff have their company emails on their personal phones which gives the customer almost around the clock availability," said Nelson. Customers expect that a distributor will be "easy to work with, easy to communicate with and quick to respond," said Nelson.

He added customers are looking for more in-depth information on origin of materials used in manufacturing and in the end products.

Nelson said buyers expect distributors to cut down on lead times by stocking millions of dollars' worth of components "so we can custom assemble the connector they are looking for quickly." He added buyers are also always asking about when certain connectors may go obsolete. "Some companies ask every year about obsolescence of the same items. If an item becomes obsolete, they are looking for a suggestion for replacement," said Nelson.

Lowest cost wanted

Richard Diaz, vice president of operations & supply chain for Avnet, said many buyers are looking for the lowest possible total cost when they buy parts. "How that cost is defined and measured, however, varies dramatically across the array of customers and industries that we serve," said Diaz.

Richard Diaz, vice president of operations & supply chain for **Avent**

> "When we develop new services and solutions, it is because we see a gap between customer needs and their ability to fulfill those needs either through their internal resources or via other partners within the value chain"

He said a small number of customers focus only on piece-part price. However, supply chain resiliency and risk mitigation "are certainly more likely to be factored into the total cost calculation for most customers," especially during the pandemic, said Diaz.

Avnet has a growing number of OEM and EMS customers whose business models and end customer demands require them to take a more comprehensive, total cost of ownership approach to their bill of material (BOM) sourcing. "This factors in everything from assurance of supply and business continuity to brand reputation concerns around ESG (environment social and guidance) and quality," said Diaz. As a result, it is "critical for a distributor like Avnet to have an absolutely comprehensive understanding of the markets we serve and the customer profiles within these markets," he said.

Buyers expect a range of services from Avent including traditional services such as inventory management, in plant stores, IC programming, kitting and cable assembly. The distributor has added new services based on customers' need and are designed to reduce costs and guarantee continuity of supply.

"When we develop new services and solutions, it is because we see a gap between customer needs and their ability to fulfill those needs either through their internal resources or via other partners within the value chain," Diaz said. He said on the design side there's a growing need for more specialized design support in areas that many companies don't have the bandwidth or resources to support. "For example, there aren't as many engineers skilled in power management as there once were, so many OEM customers rely on Avnet's power experts for guidance and support," said Diaz.

IoT development, especially considering the complexity of integrating hardware and software connectivity into one solution, is a rapidly evolving field that requires a lot of time and attention to keep up with, he said.

Besides services, buyers rely on Avnet to aggregate not only demand, but market intelligence. He said there is a "real thirst for data and insights" from all customers across almost every segment, for market intelligence. "We may share this information informally through the normal course of our engagement with customers, or via an array of more structured reports and newsletters, like the Product & Technology News digital newsletter or the regular Product Lead Times & Supply Trends report our Americas' team puts together," said Diaz.

Be aware of services

In some cases, OEM and EMS customers are unaware of the services that a distributor can provide. For instance, Dave Doherty, president and chief operating officer of Digi-Key, said that customers may know that Digi-Key programs chips but may not know the extent of the distributor's programming capabilities.

"We have a number of manufacturers that have given us access physically to equipment to do programming, such as on silicon timing devices, etc." Manufacturer SiTime "refers everyone who wants some small quantity programmable timing devices to Digi-Key to have the devices programmed," said Doherty. "We have a capable labor force here and the ability to program chips in small quantities very efficiently is right in our wheelhouse."

Hayne Shumate, senior vice president internet business for **Mouser Electronics.**

"Customers expect us to have a fast website, to be able to navigate it easily and to be able to get everything that they want"

Another service that may be under the radar is quick-turn, niche cable assemblies. "In some areas we do a number of different configurations of cabling and connectors, ribbon cables etc., but in a very confined area," said Doherty. He said Digi-Key does not compete with customers that build cable assemblies. Those customers buy some of the components from Digi-Key " and they produce value-added assemblies," he said. "A number of them will sell their solutions on our website."

Hayne Shumate, senior vice president Internet Business for Mouser Electronics, says customer expectations of distributors' websites and purchasing and design tools have changed. Customers expect distributors to have a fast website, to be able to navigate it easily and to be able to get everything that they want, he said. "There is always pressure to make the tools better so people can show up and get what they need as quickly as possible," he said.

Mouser takes feedback from its customers to develop new tools or to enhance existing ones. "We get an enormous amount of feedback every day. "There's a constant stream of information coming from our customers about what they love about our website and what frustrates them," he said. Mouser will factor customers' feedback into decisions concerning its website tools.

In other cases, Mouser develops ideas for tools that customers didn't know what is possible. For example, Mouser's bill of materials tool has a feature that allows customers "to upload their spreadhseets and get their spreadsheets back with all the formatting they originally had with our data for price availability, import/export data, environmental information," he said.

"No one asked us for that. But we thought folks that were sending us similarly formatted spreadsheets over and over again that might find it useful. And there's a class of customer classifier that really appreciates that functionality," he said.

Semiconductor shortages: not the end of the line

Rochester Electronics introduces buyers to an array of services specifically designed to mitigate the semiconductor shortages the industry is currently experiencing

Current semiconductor shortages are widespread. Few manufacturers and product families have been spared extended lead-times and even allocation. Though the automotive market leads the charge to secure supplies in a lean supply chain, all other market sectors are affected, or may soon be affected.

Customers are under pressure to guarantee supply, with grey market or unauthorized sources often seen as the only solution. This could not be further from the truth. Rochester Electronics, an authorized after-market supplier, offers risk-free sourcing and alternative solutions to keep lines running.

Top semiconductor manufacturers have partnered with and authorized Rochester Electronics to manage their surplus active stocks during times of plenty. In some instances, Rochester has taken control of all material after last-time-ship. As the market moves from surplus to deficit, Rochester's authorized stock is an essential buffer to help customers avoid line-stops.

Rochester Electronics can provide instant stock of active parts which are typically older date-code but backed by the original manufacturers and stored to AS6496 standards. Product is supplied with full warranties and guarantees.

As a 100 per cent authorized source of supply, anti-counterfeiting standards that apply to independent suppliers such as AS6171 and AS6081, are not required.

Alternative solutions include discontinued stock from other historically approved suppliers, different temperature/speed grades, different packages and older die iterations or build versions (eg plating standards, gold instead of copper bond-wire, etc).

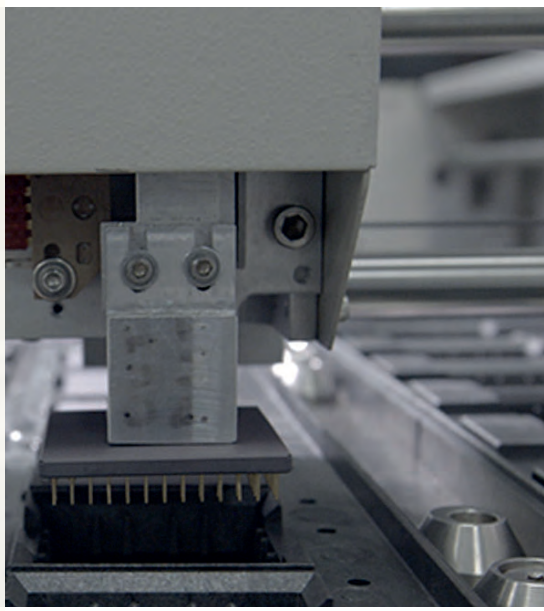
Reverting to a previous design or making minor design modifications (which do not trigger a full system re-qualification) can often be an alternative to a line-stop.

Rochester is also licensed to continue building many end-of-life semiconductor product families. Products are built using original known-good-die, tested using original test processes and marked with the original part number.

Where Customers struggle to build current products, some are re-starting the production of older designs or extending the service-lives of product in the field, to fulfil market demands.

www.rocelec.com

> **Few manufacturers and product families have been spared extended lead-times and even allocation**



New powerful tools and features for optimized TrustedPart.com searches.

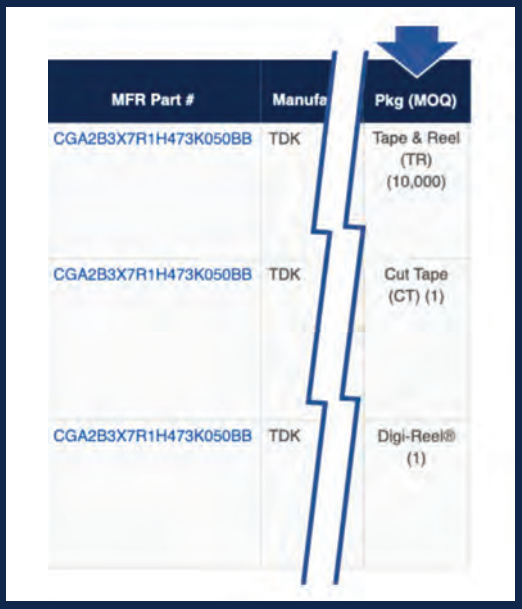
BOM Tool Enhancements for Reference Numbers, Pricing, and File Export

- Upload and export internal reference numbers
- Quickly view or hide expanded price breaks
- Edit and sort export file fields

PLUS

Packaging Types and Minimum Order Quantities Now Display in Search Results

- Search results for applicable parts include packaging and minimum order quantity (MOQ) details
- The Pkg (MOQ) column lets our authorized distributors list even more information about their products



MFR Part #	Manufa	Pkg (MOQ)
CGA2B3X7R1H473K050BB	TDK	Tape & Reel (TR) (10,000)
CGA2B3X7R1H473K050BB	TDK	Cut Tape (CT) (1)
CGA2B3X7R1H473K050BB	TDK	Digi-Reel® (1)

100% AUTHORIZED SOURCES

Search authorized distributors at TrustedParts.com

Identifying products not recommended for new designs

Mouser explains that one of the simplest ways to manage obsolescence is to avoid components classed as 'not recommended for new designs'

Serving purchasing professionals sometimes involves telling customers what not to buy

Mouser Electronics' vice president of Americas sales and service, **Coby Kleinjan**

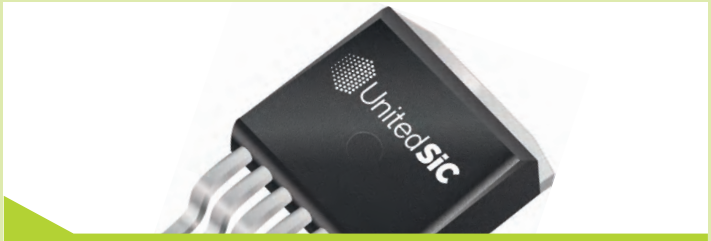
In the quickly evolving world of electronic components, Mouser Electronics works hard to identify products not recommended for new designs (NRND). The company identifies end-of-life, obsolete and NRND products to avoid older components making their way into new designs.

Serving purchasing professionals sometimes involves telling customers what not to buy. This way, customers can be confident they're designing with the most advanced, genuine electronics available, and can subscribe to receive product notifications online.

Mouser Electronics' vice president of Americas sales and service, Coby Kleinjan, said: "We work closely with all our manufacturer partners to provide the fastest and easiest access to the industry's newest components. Having the most advanced technology to develop cost-efficient prototypes limits costly redesigns, manufacturing delays or even the termination of a project. It also leads to a design edge in delivering more product features and capabilities, as well as longer lifecycles."

Identifying product lifecycle and NRND products are two examples of Mouser's commitment to value-added services beyond component supply. The company also suggests component alternatives, including their risk level.

mouser.com



Performance, reliability and size benefits

UnitedSiC has introduced six new 650V and 1200V SiC FET options housed in the D2PAK-7L surface mount package. Available in 30, 40, 80 and 150mΩ versions, these latest SiC FETs suit applications in server and telecom power supplies, industrial battery chargers and power supplies, EV on-board chargers and DC-DC converters.

UnitedSiC's VP engineering, Anup Bhalla, said: "Through the fast switching capabilities of these latest FETs, alongside the superior thermal performance resulting from Ag sintering, we continue to bring performance, reliability, size and layout benefits to the power designer."

The devices support significantly heightened switching speeds, with a Kelvin source connection improving gate drive return performance. Through the use of Ag Sintering, die attachments can be done on conventional PCBs as well as complex insulated metal substrate arrangements. Creepage and clearance figures are 6.7mm and 6.1mm respectively, meaning the highest degrees of operational safety can be assured even at elevated voltages.

unitedsic.com

Reduce drive cost and complexity

Power Integrations' Motor-Expert software is an embedded C code application, library and control GUI that enables designers using the company's BridgeSwitch brushless DC (BLDC) motor driver ICs to precisely control and tune single-phase motors. BLDC motors are used in appliances such as compressors, fans and water pumps in domestic appliances and for ceiling fans and room air conditioning systems.

Senior marketing manager, Cristian Ionescu-Catrina, said: "BLDC motors are experiencing exponential growth in home appliances and other markets due to new energy efficiency regulations. The BridgeSwitch Motor-Expert software reduces the cost and complexity of BLDC drives. The new software comes with ready-to-use application examples for constant-speed and constant-torque operation, all of which are IEC6730 Class A-ready. Power Integrations created Motor-Expert to radically streamline the design process and reduce time to market."

Motor-Expert software supports the cost-effective single-phase motor architecture, slashing the number of high-voltage devices, associated costs, system complexity and inventory burden.

motor-driver.power.com/bridgeswitch

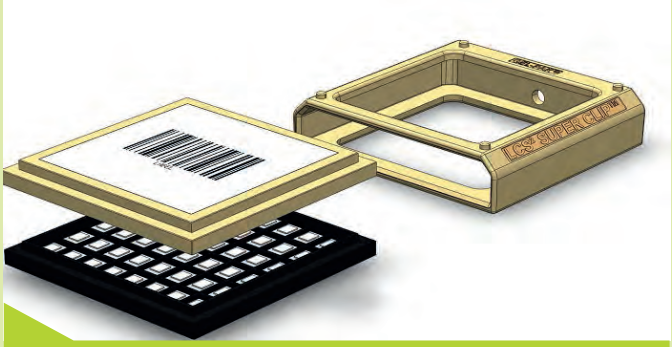
Improved MOSFET and SiC diode performance

ON Semiconductor is introducing new superjunction MOSFETs and SiC diodes. The 650V Superfet III fast MOSFETs are designed to deliver better switching performance than other superjunction MOSFETs, with improved efficiency and higher reliability. These features suit applications including 5G, electric vehicle charging stations, telecoms and server sectors.

The company is also introducing automotive AECQ101 and industrial grade qualified next generation 1200V SiC diodes, ideal for high power applications such as EV charging stations and solar inverters, UPS, EV on board chargers and EV DC-DC converters.

SiC diodes offer advantages over silicon solutions, including higher reliability, lower EMI and simpler cooling requirements. The new design improves on the first generation SiC diodes thanks to a smaller die size and lower capacitance.

onsemi.com



Safer semi shipping

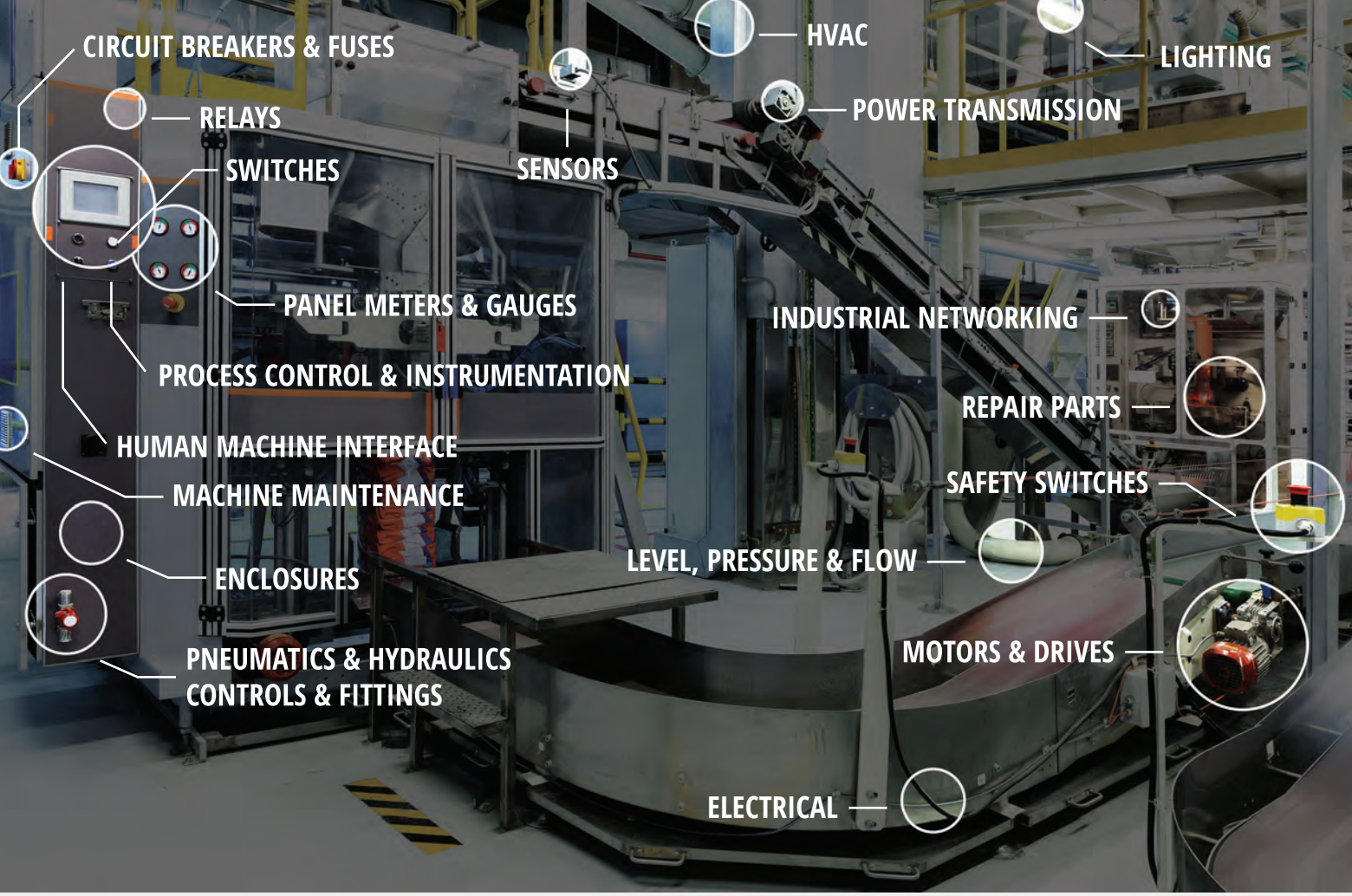
Gel-Pak, a division of Delphon, has announced collaboration with BAE Systems on an innovative new product called the Lid/Clip Super System (LCS2). The patent pending LCS2 is designed to prevent thin semiconductor components from migrating out of the pockets of waffle pack chip trays during shipping and handling.

Delphon's VP of sales and marketing, Darby Davis, said: "The new LCS2 product has the potential to save semiconductor manufacturers millions of dollars in costs associated with yield loss, rework labor and RMAs caused by die migration."

Shipping today's thin semiconductor die in industry standard waffle packs presents a challenge for many semiconductor manufacturers. Thin devices packaged in these chip trays can migrate, causing costly component-out-of-pocket (COOP) damage to occur.

Together Gel-Pak and BAE Systems studied the root causes of COOP and created this unique solution. The LCS2 product, designed to work with industry standard waffle pack trays, consists of pad and interleaf materials integrated into a static dissipative gold lid along with a highly engineered single piece clip that uniformly compresses the tray and lid together to seal each waffle pack pocket. This lid/lip system has been shown to eliminate thin die migration issues.

www.gelpak.com



MILLIONS OF PRODUCTS. THOUSANDS OF APPLICATIONS. ONE SOURCE.

Your Source for Industrial Electronics & Automation

Finding the right part for the job has never been easier. Galco carries more than 3 million electrical products, with free technical support to help you find the part you need and get it quickly.

GALCO Galco.com • 888-851-0301

America - Essential component battleground

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

John Denslinger investigates EV batteries and how their associated manufacturing and distribution supply chains represent new electronics industry frontiers

EV batteries • By John Denslinger

In April's editorial I discussed the 'small but big impact' semiconductors were having on the supply chain citing the auto industry's predicament in particular. Later that week, arguably the largest component, the EV battery, captured US headlines as LG Chem and SK Innovation settled a bitter lawsuit involving trade secrets. The resolution was significant. At risk was a $2.6B new plant investment under construction in Georgia. It represented a key piece of national security interest: that is, building critical technology in America.

Most resident automakers (domestic and foreign based brands) entering the EV market aren't vertically integrated with EV know-how or have the production capability to produce Li batteries in large volumes. Tesla might be the lone exception. The investment level is enormous with most automakers deciding to partner with EV battery specialists. Probably a wise move as far as shareholders are concerned.

Battery technology is one of the essential technologies of the future. Governments everywhere are trying to tilt the playing field in their direction. In the US, the Biden administration recently threatened to set aside rulings in the LG Chem vs SK Innovation case forcing both parties into a quick settlement. In Japan, more than 50 companies have drafted policy proposals for government action in the areas of raw material acquisition and recycling systems. In China, the government is only subsidizing vehicles equipped with Chinese made batteries. Each would like to dominate the market, but in the end, each will likely settle for sustainable domestic supply that fills every type of vehicle PO in local production.

At a macro level, the global EV battery market is dominated by six players. In share order they are: LG Chem, CATL, Panasonic, Samsung SDI, BYD, and SK Innovation per SNE Research through Q3 2020. One quickly notices all have Asian roots. Absent from the list is US and EU entrepreneurs.

Why does this matter? Producing an EV now requires a JV or long-term partnership with one or more large Li battery manufacturers. LG Chem touts a relationship with at least eight auto companies; CATL lists eight; Panasonic identifies four; Samsung SDI shows three; BYD supplies in-house only; and SK Innovation another six automakers. Bloomberg Green rightly points out the EV euphoria has made battery manufacturers the new power brokers in the deal.

Here's the gotcha! Will the consumer place more value on the auto or battery brand? Will sleek designs or battery range/fast-charging rates decide the vehicle sale? We may yet see another ironic 'Intel Inside' co-branding battle.

Momentum is building everywhere to replace internal combustion engines with EV. California already passed legislation banning sales of new gas-powered vehicles from 2035. The Biden administration has mentioned hefty investments in federal R&D, increased federal procurement of clean energy items, and subsidy consideration on EV purchases and charging stations.

It may take years for US automakers to build their own, scalable Li battery production. Meanwhile the gap will be filled stateside by LG Chem, Panasonic and SK Innovation having invested billions already in US GWh. It's a battleground moment. Branding recognition, national security, essential technology leadership and mountainous investment are but a few of the conflicts. Establishing a viable raw material supply chain isn't an easy undertaking either. Nevertheless, all are solvable, but there's no substitute for expedient action by the EV automakers and well-funded American start-ups.

Navigating supply chain shortages

Digi-Key's director of regional supply chain solutions, Margaret Cunha, explains how the company is helping buyers weather the supply shortage storm

While the term borders on overuse 'unprecedented' certainly describes the current supply chain shortages of electronic components. Supply chains were beginning to tighten before Covid 19 and the effects of the global pandemic slowed or shuttered production of essential components for days, weeks or even months.

As we see light at the end of the tunnel, industries are beginning to ramp up production and electronic component demand is through the roof. While the 'perfect storm' of supply chain issues rains down, Digi-Key is helping purchasing professionals shore up electronic components and navigate shortages.

In nearly every industry demand for components has rapidly revved up, all at the same time. From automotive and smartphones, to medical and IoT markets, all need increasingly larger numbers of components for finished products.

The following examples highlight the issues. The smartphone market is expected to grow by a compound annual growth rate of 11 per cent from now through 2026. Smartphone manufacturers alone use approximately 1.5 trillion multilayer ceramic capacitors, accounting for 50 per cent of worldwide production.

In the automotive industry, global sales of electric vehicles are estimated to increase more than 30 per cent in 2021 and electric vehicle engines use up to 22,000 MLCCs each.

Gartner reports the IoT market will grow by more than six times from $212 billion in 2018, to $1,319 billion in 2026. IoT devices like smart home thermostats, doorbells, alarm systems, cameras, appliances, fitness equipment and more, need sensors and multiple components to run.

While demand has rapidly increased, supply has been under significant pressure due to the pandemic and a compounding range of challenges as described below.

Staffing capacity has been a common issue for many manufacturing facilities as they adhere to Covid prevention policies including social distancing.

For similar reasons, freight is taking longer to move, across all industries and countries. Fewer available commercial flights and port issues are causing delays in product transfers and receipt of materials, including the Suez Canal debacle in March.

Systemic issues include under-investment in eight-inch fabs, resulting in struggles to ramp up production. Without significant investment in a fab's early stages, the supply chain is impacted for many years. Unfortunately, under-investment in this standard size years ago is causing significant shortages today.

Extreme weather patterns are wreaking havoc on many areas including a drought in Taiwan which is forcing some manufacturers to truck water in, creating delays that could continue into June 2021.

Several major factory fires have impacted commodity production, from the Asahi Kasei Micro and Renesas Electronics plant fires in Japan, to the Panjit International factory fire in Taiwan. All these factories were critical in producing specific oscillators, semiconductors and chips, and could take several months to resume full operations.

Suppliers are doing their best to overcome these challenges and keep up with demand, working around the clock to get components where they're needed around the world. As with most storm clouds, there are silver linings. While increased demand puts pressure on suppliers, it is a positive sign of recovery. Many distributors, including Digi-Key, predicted this sharp spike in demand. They proactively invested in significant inventory, while working closely with suppliers to expedite orders to ensure enough product is on hand to help customers weather the storm now and into the future.

Working with global distributors like Digi-Key assures customers they will likely find what they need among 11.8 million available products, including 2.6 million in-stock parts from over 1,700 manufacturers.

digikey.com

Digi-Key Electronics' director of regional supply chain solutions, **Margaret Cunha**

Exploring global EMS activity

Manufacturing Market Insider's latest research highlights how the global EMS sector is responding to increasing demand across different regions and industry sectors.

Manufacturing Market Insider has released its annual MMI Top 50 list of the world's largest EMS providers. In 2020, Top 50 sales accounted for $384 billion in revenue, an increase of $17 billion from 2019. MMI mainly tabulates its ranking information through an annual survey of over 100 of the largest EMS companies worldwide.

Top 50 sales increased from the previous year by 4.6 per cent, largely because the top ten EMS firms dominated industry growth. This included Foxconn, Pegatron, Wistron, Jabil, Flex, BYD Electronics, USI, Sanmina, New Kinpo Group and Celestica with growth rates ranging from -22.1 per cent (Asteelflash) to 31.1 per cent (Katek SE).

Foxconn alone reportedly achieved revenue growth of 5.2 per cent from 2019 to 2020 and accounted for over half the Top Ten revenue. All MMI international currency conversions are based on average annual conversion rates established by the US Federal Reserve.

Overall, the APAC region accounted for around 81.9 per cent of the Top 50 EMS revenue, with the Americas representing 16.2 per cent and EMEA 1.9 per cent. The APAC region achieved the highest growth of 6.0 per cent, while the Americas saw a -0.2 per cent decline and EMEA experienced -3.4 per cent negative growth. This illustrates that the APAC region has been the main beneficiary of communications and computer replacement/upgrades that took place in 2020. The medical equipment market expanded strongly for all three regions, as did EV automotive.

In addition to ranking providers by 2020 sales, the MMI Top 50 listing includes sales growth, previous rank, number of employees, number of plants, facility space, space in low-cost regions, number of SMT lines and customer data. This special data was published in the March 2020 edition of MMI and in April included market segmentation data obtained from the MMI survey

www.mfgmkt.com

Rank 2020	Company	Head-quaters	EMS Sales calendar 2020 (millions USD)	EMS Sales calendar 2019 (millions USD)	EMS 2019 rank	EMS Growth '19-'20 in US$ (%)
1	HonHai Precision (Foxconn)	New Taipei, Taiwan	181,893	172,878	1	5.2%
2	Pegatron	Taipei, Tawian	47,504	44,209	2	7.5%
3	Wistron	Taoyuan, Taiwan	28,868	28,418	5	1.6%
4	Jabil Circuit	St. Petersburg, FL	27,594	26,282	3	5.0%
5	Flex	San Jose, CA	24,578	24,951	4	-1.5%
6	BYD Electronics	Shenzhen, China	10,050	7,676	7	30.9%
7	USI	Shanghai, China	6,972	5,372	10	29.8%
8	Sanmina	San Jose, CA	6,876	7,886	6	-12.8%
9	New Kinpo Group	New Taipei, Taiwan	6,663	6,500	8	2.5%
10	Celestica	Toronto, ON, Canada	5,748	5,888	9	-2.4%
11	Plexus	Neenah, WI				
12	Venture	Singapore				
13	Shenzhen Kaifa	Shenzhen, China				
14	Benchmark Electronics	Scottsdale, AZ				
15	Zollner	Zandt, Germany				
16	Fabrinet	Grand Cayman, Cayman Islands				
17	SIIX Corp.	Osaka, Japan				
18	UMC	Saitama, Japan				
19	Kimball Electronics	Jasper, IN				
20	Integrated Micro-Electronics, Inc.	Laguna, Philippines				
21	Sumitronics	Tokyo, Japan				
22	ATA IMS Berhad	Johor Bahru, Malaysia				
23	Kaga Electronics	Tokyo, Japan				
24	VTech Communications	Hong Kong				
25	NEO Tech	Fremont, CA				
26	V.S. Industry Berhad	Senai, Malaysia				
27	Global Brands Mfg.	New Taipei City, Taiwan				
28	Asteelflash	Neuilly, France				
29	Pan International	Taipei, Tawian				
30	Scanfil	Sievi, Finland				
31	3CEMS Group	Taipei City, Taiwan				
32	VIDEOTON	Székesfehérvár, Hungary				
33	Creation Technologies	Burnaby, BC Canada				
34	Katolec	Japan				
35	TT electronics	Rogerstone, Wales, UK				
36	Enics AG	Zurich, Switzerland				
37	Neways Electronics	Son, The Netherlands				
38	DBG	Huizhou, China				
39	Shenzhen Zowee Tech	Shenzhen, China				
40	SKP Resources	Batu Pahat, Malaysia				
41	Katek SE	Munich, Germany				
42	Integrated Micro-Electronics, Inc.	Bangkadi, Pathumthani, Thailand				
43	Key Tronic	Spokane Valley, WA				
44	WKK Technology	Hong Kong				
45	Computime	Hong Kong				
46	Hana Microelectronics	Bangkok, Thailand				
47	GPV Group	Aars, Denmark				
48	Kitron	Billingstad, Norway				
49	Wong's Intl Holding, Ltd.	Hong Kong				
50	Ducommun, Inc.	Santa Ana, California				

Trends and challenges in fleet electrification

Director of sales engineering for the TTI Transportation Business Unit, Brian Dickerson and transportation sales engineer, Gabe Osorio, explore the electrification of mid-class' trucks

TTI's director of sales engineering Transportation Business Unit, **Brian Dickerson**

Readers may be familiar with the unique and amazing things happening in fleet electrification, from companies building new EVs to those converting diesel trucks and busses to BEV powertrains. The real inflection point, however, is in the last-mile fleet space. During the next two years, these Class 4 to 6 'mid-class' trucks will be prime targets for electrification.

In part, this is due to grants and cost-sharing agreements which help with installation of charging infrastructure.

More importantly, these fleets suit EV applications. Last-mile delivery trucks and vans serve predictable routes and travel fewer than 50 miles per day: well within the range capabilities of today's battery technology. These regional fleets serve needs in the electrification 'sweet spot', expending their batteries during the day and returning to the yard to charge overnight.

In these applications, the efficiencies of switching from diesel/gasoline to EVs are obvious and significant: elimination of fuel costs; reduced spending on IC engine wear and tear; lower maintenance costs and more.

However, for EV fleet end-users, there are many questions to answer which, in turn, pose challenges to those designing infrastructure for integration into the electric grid.

Having taken part in discussions with suppliers and customers in recent months, we are hearing that charging-related challenges are top-of-mind. Those investing in EV charging infrastructure want to know how to maximize efficiency and which partners they should work with to design and install their charging systems.

While a lot of answers relate to the selected trucks, safety is also a primary concern. Fleet owners want to know who is qualified, from a tier-supplier standpoint, to produce EV charging solutions. Many people say they can build these systems, but customers need to know who can build them safely, to manufacturer standards.

Customers also need to understand how specific components in and around the battery pack contribute to battery health and system safety, avoiding thermal runaways and maximizing the life of their EV investment. These include sensors and harsh-environment interconnects, designed to withstand the heat associated with high-voltage applications and the environmental challenges of being exposed to the elements.

Production scalability is also a challenge. OEMs can struggle to navigate the breadth of available components to select the best options, to get access to data sheets or samples, and to learn about new releases.

A distribution partner with a strong inventory position helps clear away many of the obstacles and deliver the information that buyers and engineers need to know right now. Distributors build strategic partnerships with manufacturers of components, both on and off the board. We also help overcome inventory and supply-chain challenges by supplying multiple options for particular solutions.

From a buyer standpoint, a distributor partner gives you a strategic edge in design decisions, making it easier to get the necessary parts. Case in point: for a single HV connector, suppliers may offer ten or more different iterations based on cable size, connector angle, keying options or key codes, etc. A distributor with a strong technical team works with customers to help them select the best cable assembly to meet their production timelines.

www.tti.com

Transportation sales engineer, **Gabe Osorio**

Strong demand will drive sensor sales to new heights

The good news for buyers is that 16-18 per cent annual increases in sensor unit demand will not increase prices

James Carbone

Buyers can expect flat to slightly declining prices and tight but mostly ample supply for sensors over the next several years despite double-digit annual increases in demand.

Unit shipments of sensors will increase 18 per cent this year, 16 per cent in 2021 and 18 per cent in 2022, according to researcher IC Insights. Strong demand means the global sensor market will increase from $10.2 billion in 2020 to $12 billion in 2021. Sales will climb to $13.7 billion in 2022. By 2025, worldwide sensor sales will reach $18.4 billion, a compound annual growth rate (CAGR) of 12.6 per cent for the years 2020-2025, said IC Insights.

With strong demand, buyers may have to deal with longer-than-normal lead times and flat rather than declining prices. The average price of a sensor was $0.36 in 2020 and will be the same in 2021. By 2022, the average prices will be $0.35 and stay flat though 2024, according to IC Insights. Many buyers had gotten used to declining sensor prices. In 2010, the average price for a sensor was $0.60. Price declines over the years have mostly stabilized.

Sensor demand will be strong from multiple customer segments including automotive, consumer, industrial and communications. Sensor revenue growth will be the strongest in commercial/industrial systems in the next five years, according to Rob Lineback, senior market analyst for IC Insights.

One reason is the expected strong economic rebound in 2021 following the economic slide that resulted from the coronavirus pandemic.

Both automative and industrial struggled in 2020 and that "sets the stage for stronger growth in the 2021-2023 time period," said lineback. More and more sensors are also being designed into vehicles and industrial equipment, he said.

Lineback added that many companies delayed equipment purchases and expansion because of uncertainty during the pandemic. "We now have total sensor and actuator sales in the industrial segment climbing by a CAGR of 15.2 per cent between 2020 and 2025." Second in sensor growth is the automotive segment, which is expected to rise by a CAGR of 12.2 per cent.

Sensor demand rises

Sensor CAGR in computers, communications (including smartphones), and consumer electronics equipment will be 8.8 per cent, 10.1 per cent and 10.5 per cent, respectively, said Lineback. "Cell phones have been a strong platform for sensors," said Lineback. "There is still good growth with cell phones, especially with 5G."

Demand will be strong for pressure, acceleration, yaw and magnetic field sensors. Pressure sensors account for about 37 per cent of the overall sensors market because they are used in a wide range of applications including smart phones, industrial equipment and automotive systems. They are also used in combination with other sensors.

"There's a thing called sensor fusion which is basically putting together one or two or three sensors together to detect something and then using an algorithm to take multiple readings of something," said Lineback. "It gives a very precise and maybe three-dimensional or a multidimensional reading."

Automotive demand rebounded

While demand has been strong so has sensor production, but there have been some allocations, shortage and lead time issues. Most of the issues were caused by changing demand from the automotive market last year. Automotive semiconductor demand declined sharply in the second quarter of last year but rebounded robustly in the third and fourth quarters,

By the Numbers

Source: IC Insights

$0.36
The average price of a sensor in 2021

$12.2 billion
The forecasted size of the worldwide sensor market in 2021

-2.2%
The average rate of decline for sensor prices from 2020-2025

$18.5 billion
The forecasted size of the global sensor market in 2025

33.5 billion
The number of sensors that will ship in 2021

12.6%
The growth rate for sensor revenue from 2020-2025

said Manuel Tagliavini, principal analyst MEMS & sensors market research for Omdia.

In addition, while automotive demand dropped off abruptly in the second quarter, demand for sensors and other semiconductors increased in other segments. The drop in demand from automotive "was quickly balanced by an increasing demand from data centers IT infrastructures, which saw an unprecedented load during the lockdown period," said Tagliavini. In addition, laptops and tablets and consumer electronics gear such as televisions and video game consoles became top selling products as people worked at home and attended school virtually which boosted sensor demand.

When automotive demand rebounded in the third quarter, sensor lead times stretched, not just for the automotive market but for other segments such as consumer electronics and mobile communications. However, sensor allocations for sensors were only temporary, according to Tagliavini.

Sensors are made on 150-200mm wafers as are many other semiconductors. However, the manufacturing processes for sensors are different than processors used for other semiconductors. "The processes for sensors are a little bit more specialized so those fab lines do not get diverted" to production of other semiconductors, said Lineback.

The rebound in automotive sensor demand that occurred in the second half of last year carried over to 2021. Tagliavini noted there is a migration to hybrid and full electric powertrains by automakers as well as to Advanced Driver Assistance Systems (ADAS), which will further drive sensor demand in 2021 and the next several years.

EVs will boost sensor demand

He said increased production of electric vehicles (EVs) and hybrids will boost demand for magnetic sensors. However, fewer pressure and flow sensors, which are used in internal combustion engine vehicles, will be needed.

Tagliavini noted that automotive is not the only segment that will require more sensors. Omdia expects stable growth for consumer electronics applications such as headsets, earbuds and others featuring voice-controlled functions which use sensors. In addition, there has been a "revived interest for environmental sensing linked to applications for air quality monitors such as smart thermostats, HVAC, air purifiers, etc. especially after the recommendation from the scientific community to minimize the spread of the COVID-19 pandemic," he said.

Texas Instruments says it expects strong demand for temperature and position sensors. Will Cooper, TI marketing and applications manager, said temperature sensors continue to be used across almost every market. "We see trends toward many more temperature and humidity sensors in automotive over the coming years, both for better efficiency and performance of the various sub-systems," said Cooper.

IoT and 5G are large drivers for temperature sensing. "Humidity is a newer technology but is definitely starting to see more and more pull from IoT in building automation and HVAC applications," he said. Five-G continues to be deployed worldwide and leverages temperature for monitoring of power systems and processors to ensure the systems operate reliably."

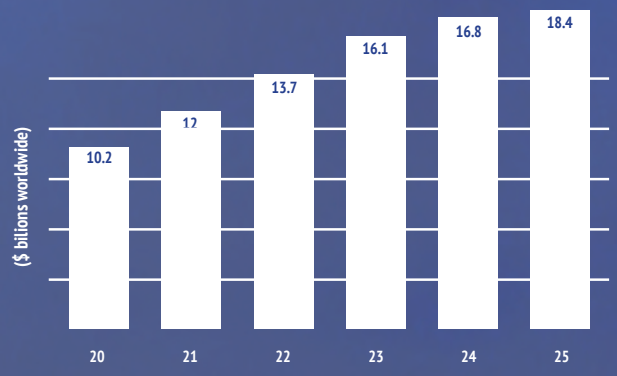
Position sensors are in strong demand from automotive and industrial OEMS as electrification of mechanical systems continues across many markets, said Steven Loveless, marketing and applications manager for TI. The trend is not only about propulsion in vehicles, but "all sorts of systems that were previously only mechanical are now increasingly electrically driven," he said. "IoT is related to this demand in industrial and personal electronic products, as smarter systems require more sensor modalities, including sensing and control of motion and position," said Loveless.

He added higher expectations on performance from both consumers and industrial users also continues to drive increased demand for higher precision position sensing capabilities in these systems.

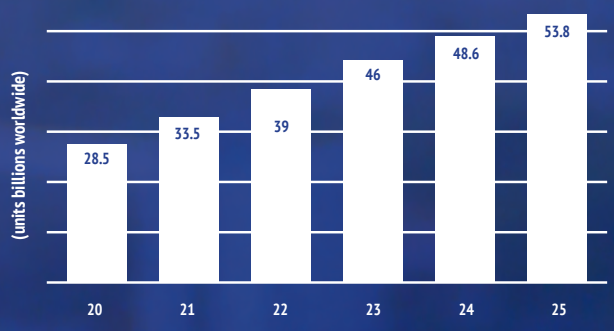
Marcellino Gemelli, general manager of automotive electronics for the Americas at Bosch, said that while Industrial IoT uses a lot of sensors "that sector uses far less when compared to automotive products and consumer electronics." He said stimulus packages in the U.S. and the EU are encouraging consumers to sustain spending in both automotive and consumer electronic products." In fact, the introduction of 5G has been a main driver for the public to replace smartphones" which is helping drive sensor demand.

Source: IC insights

Sensors market takes off



Sensor shipments push upward



Source: IC insights

It's not just semiconductors that are in short supply

Lead times are stretching and prices are rising for passives, connectors and power supplies

It's no secret that electronics purchasers are being challenged by allocations, shortages and long lead times for a variety of semiconductors including microcontrollers, diodes, graphics RAM chips and power semiconductors, among others.

However, while chip shortages seem to be garnering most of the attention, supply is tight and lead times are stretching for many capacitors, resistors, and other passive components, connectors, electromechanical devices and power supplies. Prices are also increasing for many electronic components , ranging from the mid-single digits to 30 per cent.

David Stein, vice president, global supplier management for Digi-Key Electronics, said the "supply situation with passives is tight" with lead times stretching to 35 weeks for some passives. For instance, in March multilayer ceramic capacitor (MLCC) lead times were about 16 to 20 weeks. In early May they moved out to 30 to 35 weeks, he said.

One reason is strong demand from automotive systems manufacturers. "Automotive demand has put a strain on most suppliers to some degree depending on how entrenched a supplier is to the automotive area," he said. Stein added there is also tight supply for thick-film resistors with some suppliers and not so tight with others. "It varies with their engagements with the automotive industry as well," said Stein.

He added there is also tight supply with "a different type of resistors called sense resistors. Those lead times are hovering around the one-year mark," said Stein. "You can blame automotive for that as well."

A sense resistor helps measure the amount of current that is flowing in an electrical system. It senses the current and can moderate the current if necessary if the current is too high.

He said another challenge for buyers is aluminum capacitors because demand is up significantly. "The problem with aluminum caps is that they are pretty heavy so shipping them by air is not an option," according to Stein. "They have been constrained because some of the supply-chain limitations involving ocean freight," he said. Lead times have been extended by 6-10 weeks because of the backlog in the supply chain" relating to ocean freight including a lack of containers and port delays."

Relays are also experiencing extended lead times. Lead times for general-purpose relays are 24-28 weeks. Automotive relays have been extended to the past 12 months to about 35 weeks, said Stein.

Lead times vary by product

Eric Pratt, senior vice president of global marketing for component manufacturer AVX, said one reason for rising lead times is robust demand. Demand for tantalum, ceramic and polymer capacitors "has been very strong and we are projecting demand to remain strong through the balance of the calendar year and probably through the first half of next year," he said.

AVX's lead times "vary by product and can vary by a customer or where we have contracts. But our general lead times for passives have gone out 6 to 8 weeks" since the first of the year. Lead times range from 12 weeks to 22 weeks, depending on the product. Normally AVX's lead times would be off the shelf to 2-8 weeks.

"Supply is very tight. Some parts are in shortage situations, including certain mixes of ceramic capacitors, and tantalum capacitors," said Pratt.

While demand for AVX's components is strong, the passive manufacturer's business is being impacted by the semiconductor shortage. "If OEMs are not building boards because of a shortage of semiconductors, they don't need passive components either," said Pratt. However, some electronics manufacturing services providers seem to be very aggressive in trying to secure an inventory position for passives. "A materials manager does not want a build to be

We need 30 to 50 different components and you only need one on allocation to sabotage our lead times

Christoph Wolf, president of power supply manufacturer **RECOM's** American business unit

held because some lower-cost passive component" was not in stock, he said.

AVX's business is also being impacted by tight supply and rising prices for raw materials. Pratt noted that the price of copper has tripled over the last year and the price of palladium has doubled. Prices for rubidium, silver and resins also have increased. "Resins have gone up significantly because of the petroleum industry. With the price of oil increasing that has a direct impact on the price of resin," said Pratt.

Higher material costs mean higher component prices. "When we see materials cost increases we certainly have to react to that," he said. Component prices have increased mid-single digits to 30 per cent due in large part to increased cost in raw materials and logistics costs, according to Pratt. "We don't do opportunistic pricing to the channel," he said. "We have long-term contracts with most of our partners and we honor all those contracts," said Pratt.

AVX is adding capacity which could help to lower lead times and prices eventually. "We have a long-term capacity expansion plan and we are holding to that. We are doing big investments in ceramic caps, tantalum and some other products," said Pratt.

He added AVX has 30 operational facilities. "Almost all of our facilities are now operating very close to 100 per cent" after production slowed or stopped last year because of the pandemic, he said.

Longer waits for power supplies

Long lead times for passives are impacting power supplies. Lead times for power supplies have stretched to about 30 weeks, according to Stein.

Christoph Wolf, president of power supply manufacturer RECOM's Americas business unit, said power supply lead times are stretching because of shortages of some semiconductors and passives used in power supplies. RECOM builds power supplies for industrial, medical and transportation systems.

"There are allocations for many of the components that we need to build our power supplies," said Wolf. "We need 30 to 50 different components and you only need one on allocation to sabotage our lead times." He said logistics is also an issue that is driving lead times. Demand for logistics services is surpassing capacity, which is contributing to longer wait times for parts and to higher prices.

Strong demand is also contributing to longer lead times and higher prices for power supplies and in sales increases for RECOM.

Despite the pandemic, which temporarily halted a lot of electronics equipment production last year, RECOM's power supply sales increased 18 percent in 2020 and the company expects to post a 20 per cent increase in revenue in 2021, said Wolf.

RECOM was not the only power supply manufacturer that had robust sales in 2020. Mohan Mankikar, president of power supply research firm Micro-Tech Consultants, said the power supply market did better than expected last year. He said the global switching power supply market had been expected to decline about 1 per cent because of the disruption caused by COVID-19. However, revenue ended up rising about 4.5 per cent for the year. Switching power supplies should grow another 7.5 per cent in 2021, he said. However, there is uncertainty in the market.

Mankikar said the first half of 2021 will likely be strong "but we don't know what's going to happen in the second half. It could be the same as the first half of 2021 but nothing is simple anymore. Business is up and down. There are so many variables," because of the pandemic, he said.

Power supply demand strong

Still, Mankikar forecasts the global switching power supply market will rise to $35.4 billion in 2021 and will post a compound annual growth rate of 5.9 per cent through 2025. Strong demand, however, most likely means lead times will likely remain long for the year for power supplies and components.

"There are many verticals that need components besides automotive, " said Stein. Applications involving 5G, industrial automation, medical, and others all require components and demand for them continues to grow.

Stein said lead times will not get any shorter before the end of this year. If demand continues to grow, "I would not be surprised in a month or two suppliers might use the allocation word and a capacity reservation order will be necessary. It certainly is heading that way," he said.

Longer lead times for connectors

Strong demand is also occurring with connectors. Don Hnatyshin, senior vice president supply chain for connector manufacturer Molex, said connector demand is rising for a range of reasons including cloud and data center expansions, Industry 4.0 requirements, electric vehicle growth, greater adoption of factory automation, and advancements in technology such as artificial intelligence.

Strong demand combined with "force majeures" in the resin supply chain have contributed to long lead times for connectors. Production of resin, which is used in many components, connectors and printed circuit boards, slowed or shut down earlier in the year after a major storm knocked out power in Texas where a lot of resin is produced.

The impact is still being felt. Hnatyshin said lead times for some connectors, such as FAKRA connectors used by the auto industry, have increased byalmost 100 per cent.

"Lead times for mini-FAKRA connectors are expected to increase as this technology ramps in automotive," he said. Capacity constraints for custom connectors also will occur without long-term forecasts in place. Lead times for off-the-shelf connectors have increased from 12 to 26 weeks, while lead times for USB connectors now are stable, according to Hnatyshin.

Some of the tight supply of connectors is due to extended lead times from material suppliers, he said. Metals used for contacts and assemblies and resins are in very tight supply. "Due to the February storms in the southern and central parts of the United States, many resin suppliers have applied force majeure contract clauses and are not able to supply materials," said Hnatyshin.

He said many metal and resin suppliers were unprepared for the "quick snap back in demand, particularly in automotive segments" and most are extending their lead times.

Prices increase

He said connector prices are rising because of higher materials and logistics costs. "Copper, gold, zinc, aluminum and other metals, in addition to resins are all at multiyear record highs," said Hnatyshin. Some of the cost has been absorbed by connector manufacturers but some are being passed along to customers.

The same is true with increased freight and logistics costs. "The cost of air freight since the beginning of the pandemic has increased as much as 4X, in some cases," said Hnatyshin. At the same time, overall capacity has been drastically reduced, due to commercial airlines operating fewer transpacific and transatlantic routes. As an alternative, relying on ocean freight has added to lead times in the supply chain that then have been compounded by port backups, he said.

Connector supply will likely remain tight this year due in part to the auto industry, said Hnatyshin. In fact, the largest demand for connectors for Molex will be the auto industry. " Primarily, this is due to the rapid increase in the production of electric vehicles (EVs)," he said. "Electronic content in EVs is considerably higher than combustion engine vehicles and both are getting tailwinds from the growth of autonomous capabilities."

Strong demand from automotive combined with growing demand from other customer segments could mean tight supply and long lead times for several years unless substantial capacity is added.

"We see demand for connectors continuing to increase, especially for 5G and 5G-related systems and device implementation in computers, communications and consumer electronics," said Hnatyshin. " The rollout of 5G technology is gaining momentum at all levels, spanning infrastructure to handsets, he said.

Also contributing to greater connector demand by automotive is the quickening pace of "new product cycle times, which will result in the full-scale transformation of cars and the entire automotive industry," said Hnatyshin This includes everything from electrification, autonomous vehicles, ridesharing, 5G communication and other functions delivered via the cloud, he said.

We see demand for connectors continuing to increase, especially for 5G and 5G-related systems and device implementation in computers, communications and consumer electronics.

Don Hnatyshin, senior vice president supply chain for connector manufacturer **Molex.**

As these trends accelerate, so does the need for more connectors, resulting in a positive outlook for the connectors market from a long-term perspective, according to Hnatyshin. "We estimate a compound average annual growth rate of greater than 5 per cent percent for the next three-to-five years as the market expands to fulfill continued demand."

Single source of truth

NiceLabel's VP marketing, Ken Moir, explains how automated, centralized labeling delivers a 'single source of truth' in manufacturing and supply chain environments

A global study of IT directors in manufacturing organizations commissioned by NiceLabel and carried out by Loftware has revealed that, on average, US manufacturers incur losses of around $1,174,000 per year due to production line shutdowns caused by label printing problems. The global average is $1.31M.

The study of 300 IT directors, including 100 from the US, found that on average 67 per cent of manufacturers were shutting down their production line for over an hour due to label printing problems. An additional 21 per cent said the line had to be shut down for more than 30 minutes. Recovery time was slightly faster but still problematic for US manufacturers, with 51 per cent experiencing downtimes of 60 minutes or longer.

The study also revealed that, on average, manufacturers were pausing production lines just under six times a year due to such problems. Some 77 per cent globally and 69 per cent in the US said their production line was paused four times or more in the past year due to labeling issues.

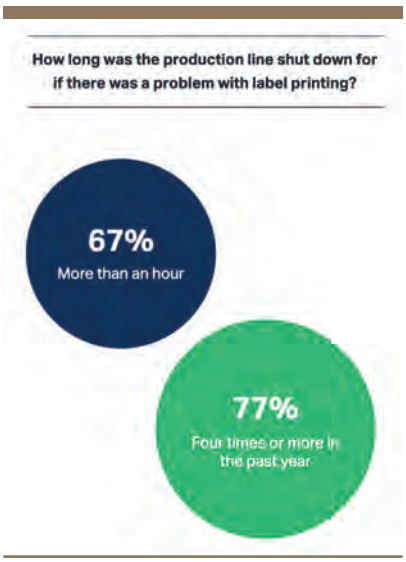
NiceLabel's VP marketing, Ken Moir, said: "Any business disruption or shutdown can significantly impact any manufacturer causing loss of revenues and ultimately even putting the business itself in jeopardy. The danger of that being caused by mislabeling becomes a growing concern as labeling becomes a key part of business and supply chain strategy."

Given the losses they are incurring due to shutdowns, it is unsurprising that 29 per cent of the US survey sample see 'reducing costs' and 22 per cent see productivity gains among the main benefits of modernizing/automating their manufacturing processes, including labeling, with technology, while 31 per cent reference 'eliminating errors' as a key driver.

Moir added: "Ultimately, the risks to production operations extend well beyond full shutdowns. Decentralized labeling for example, also adds risk to production operations. An ERP system is supposed to provide 'a single source of truth' to business users. However, at many organizations there are as many versions of the truth as there are labeling locations. That is because in decentralized labeling operations, each facility may not be integrated with ERP and will be creating their own label formats and duplicated product and customer data.

"After all, without centralization, manufacturers are generally not integrated to the same source of truth and that creates redundancies of data making enterprise-wide updates unmanageable and adding significantly to inaccuracies and inconsistencies."

www.nicelabel.com
www.loftware.com



Any business disruption or shutdown can significantly impact any manufacturer causing loss of revenues

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											
Bel Fuse	Bel Fuse	+1 201 432 0463	belfuse.com/circuit-protection	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,462	N/A	$0	68.00%	50	1,000+	Y
Eaton	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,487	N/A	$0	100%	50	1,000+	Y
Littelfuse	Mouser Electronics	800-346-6873	www.mouser.com	Y	28,790	N/A	$0	67%	50	1,000+	Y
Schurter	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	31,445	N/A	$0	68%	50	1,000+	Y
DISPLAYS & LEDs											
BIVAR	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,390	N/A	$0	99.00%	50	1,000+	Y
Dialight	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,179	N/A	$0	84.00%	50	1,000+	Y
Displaytech	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Electronic Assembly	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Kingbright Company, LLC	Mouser Electronics	800-346-6873	www.mouser.com	Y	301	N/A	$0	100.00%	50	1,000+	Y
Lumileds	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Newhaven Display	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,690	N/A	$0	100.00%	50	1,000+	Y
VCC	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
ELECTROMECHANICAL											
ALPS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Apem, Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,326	N/A	$0	83.00%	50	1,000+	Y
C&K Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	27,230	N/A	$0	90.00%	50	1,000+	Y
E-Switch	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Grayhill	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Honeywell	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
IXYS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Keystone Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y

Advert Index

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

mouser.com/ti

MOUSER ELECTRONICS

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
ELECTROMECHANICAL *(Continued)*											
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
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

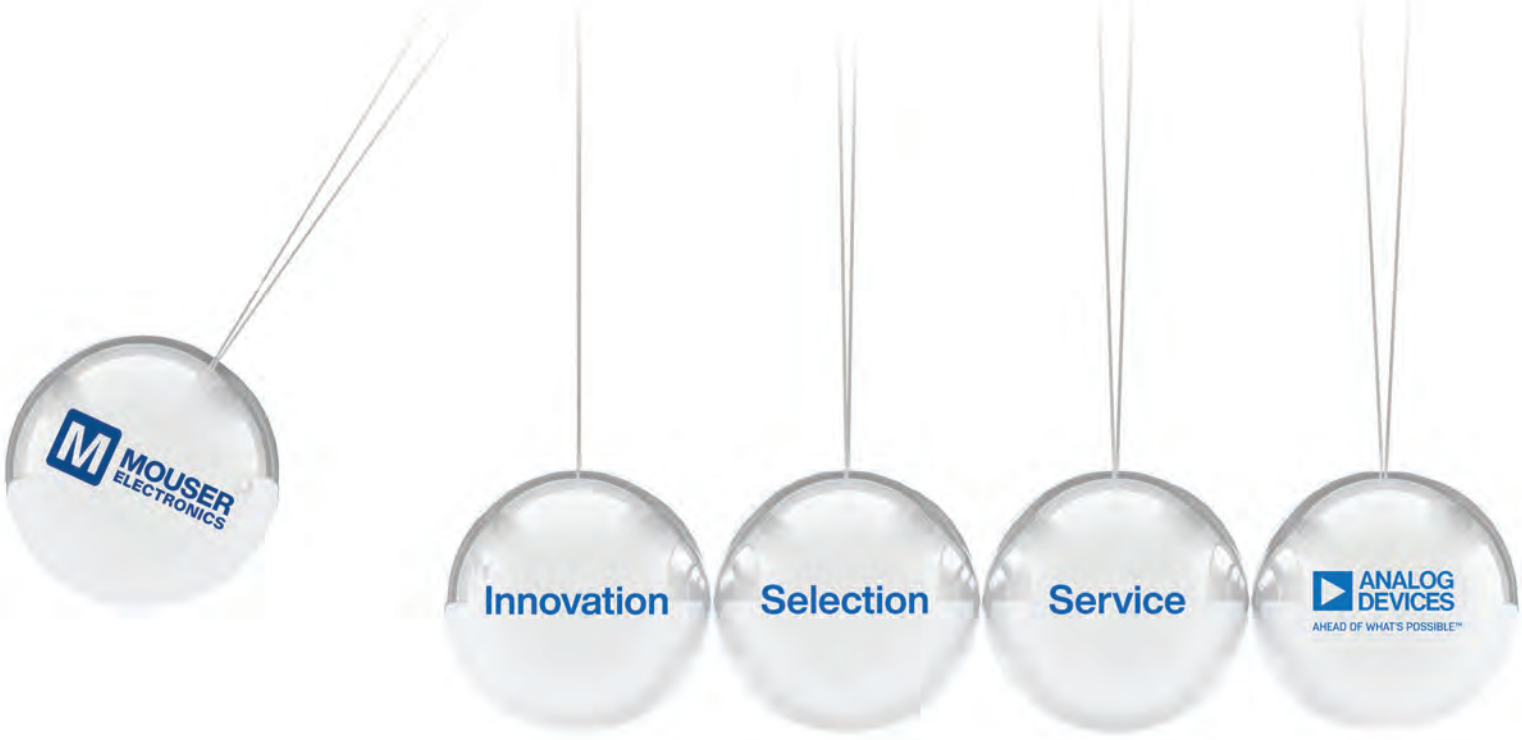
Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
INTERCONNECTION											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23,235	N/A	$0	46.00%	50	1,000+	Y
Aero Conesys	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amphenol	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amphenol	Mouser Electronics	800-346-6873	www.mouser.com	Y	165,853	N/A	$0	31%	50	1,000+	Y
Anderson Power Products	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Aptive (Delphi)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Bel Magnetic Solutions	Bel Fuse	+1 858 676 9650	belfuse.com/magnetic-solutions	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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
Cinch Connectivity Solutions	Bel Fuse	+1 507 833 8822	+1 507 833 8822	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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	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
Stewart Connector	Bel Fuse	+ 1 717 235 7512	belfuse.com/stewart-connector	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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											
	Lansdale	602-438-0123	lansdale.com	Y							
	Lantek Corp.	973-579-8100	www.lantekcorp.com	M	186,000	$22M	$0	75.00%	5	62	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
Signal Transformer	Bel Fuse	+1 516 239 5777	belfuse.com/signal	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Taiyo Yuden	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,620	N/A	$0	98.00%	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)*											
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,663	N/A	$0	100.00%	50	1,000+	Y
TT Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
United Chemi-Con (UCC)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	102,917	N/A	$0	64.00%	50	1,000+	Y
Wurth	Mouser Electronics	800-346-6873	www.mouser.com	Y	934	N/A	$0	99.00%	50	1,000+	Y
Yageo Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,246	N/A	$0	100.00%	50	1,000+	Y
POWER & BATTERIES											
Artesyn Embedded Technologies	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	$0	N/A	50	1,000+	Y
Bel Power Solutions	Bel Fuse	Power & Batteries	belfuse.com/power-solutions	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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	N/A	$0	100%	N/A	2000+	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
TRACO Power	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



Innovation, selection and service in perfect harmony

Millions of products
Limitless design options

Available to ship today
mouser.com/adi-selection