

ELECTRONICS

MARCH 2022

# sourcing

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NORTH AMERICA



**QUEST FOR SUSTAINABLE  
ELECTRONICS – PAGE: 23**



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## On the cover – March 2022

Quest for sustainable electronics

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## Editor's Word



### Rise of the repair

There are now generations of people moving through life with little or no concept of repair. Instead, when something breaks it is replaced. However, if people's desire for sustainability is genuine, then surely the idea of repairing a product once, twice or more must return.

In the electronics arena there are many barriers to repair. For example, manufacturers often don't design products to be repaired, refuse to publish official repair manuals and won't make spares available. Yet, as more manufacturers sign up to new environmental and greenhouse gas certifications, it's difficult to see how they can avoid addressing the issue for long.

Which brings me to the reason for writing this leader. Over the past few weeks, I've encountered a number of events relating to product repair. Firstly, bubbling away in the background, is right-to-repair legislation. Secondly, in this issue (quite by coincidence) John Denslinger's article is on sustainability. Thirdly, an article in a recent issue by an authorised aftermarket component manufacturer stated its expectation of repair related demand. Fourthly, I was surprised by an article about an electronic sub assembly who's USP was its repairability. Finally, I've started seeing adverts for domestic appliance repair services.

It's almost as if the idea of extending the useful life of an electronic product is limping back into fashion.

What does that mean for this industry? Well, if repair gains pace, at some point in the future high volume, low value component sales to offshore manufacturing centers will start to cede some ground to high value, low volume sales to local repair facilities.

Maybe, maybe not. Time will tell.

*Jon Barrett*

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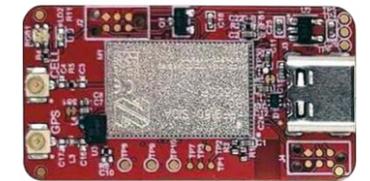
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## NEWS



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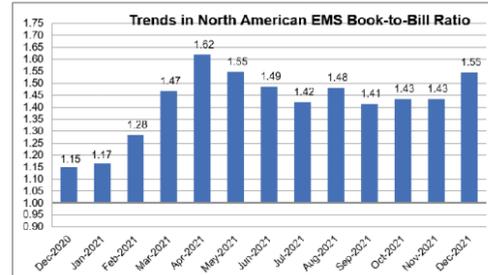
## Focused on medical safety

Sager Electronics' Custom Solutions Centers in Carrollton, TX and Lisle, IL have received ISO13485:2016 certification.

Medical device manufacturers value the ISO13485 standard that certifies an organization's ability to provide products that consistently meet customer and applicable regulatory requirements. The certification opens a new growth path, letting Sager reach leading customers in the rapidly evolving medical sector where safety is paramount.

Sager Electronics' vice president of custom solutions, Don Fincher, said: "The ISO mark is recognized for conveying quality, confidence, trust and safety. Earning ISO13485:2016 certification for our power, battery and thermal final assemblies makes Sager an even stronger player in the medical device assembly space. We're excited by the opportunities now open to us by having achieved this certification."

[www.sager.com](http://www.sager.com)



## EMS industry up 0.9 per cent

IPC December 2021 findings from its North American Electronics Manufacturing Services Statistical Program shows a book-to-bill ratio standing at 1.55. Total EMS shipments in December 2021 were up 0.9 per cent compared to the same month last year. Compared to the preceding month, December shipments rose 8.0 per cent.

EMS bookings in December rose 47.1 per cent year-over-year and rose 13.8 per cent from the previous month.

IPC's chief economist, Shawn DuBravac, said: "IPC recorded the strongest monthly North American EMS bookings on record in December 2021. Strong bookings pushed the book-to-bill to near record levels, tying levels in May 2021 and only slightly below the all-time record high set in April 2021."

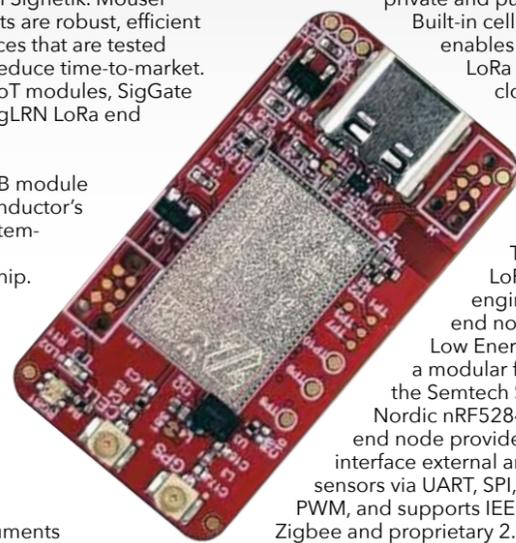
[www.ipc.org](http://www.ipc.org)

## Reduce IoT time-to-market

Mouser Electronics has announced a global distribution agreement with Sigmetik. Mouser states Sigmetik's IoT products are robust, efficient and production-ready devices that are tested and certified, which helps reduce time-to-market. Mouser is offering SigCell IoT modules, SigGate LoRaWAN gateways and SigLRN LoRa end nodes.

The SigCell cellular BLE USB module is based on Nordic Semiconductor's nRF9160 LTE-M/NB-IoT system-in-package and nRF52840 multi-protocol system-on-chip. Supporting LTE-M/NB-IoT, GPS/GNSS and Bluetooth Low Energy 5.0, the device is designed for intelligent IoT applications with the capability of interfacing host systems via the USB interface.

Incorporating a Texas Instruments AM3352 processor, the SigGate long-range IoT gateway is an industrial grade



LoRa gateway supporting scalable private and public LoRa networks. Built-in cellular networking enables engineers to connect LoRa sensors to the cloud even in remote locations. The IP67-rated gateway is available in four or eight-channel options.

The Sigmetik SigLRN LoRa end node lets engineers add LoRa end node and Bluetooth Low Energy connectivity in a modular fashion. Based on the Semtech SX1262 and the Nordic nRF52840 SoC, the SigLRN end node provides various ways to interface external analog and digital sensors via UART, SPI, I<sup>2</sup>S, ADC, GPIO and PWM, and supports IEEE 802.15.4, Thread, Zigbee and proprietary 2.4 GHz protocols.

[www.mouser.com](http://www.mouser.com)



# 1887

Emile Berliner receives the patent for the gramophone.

James Blyth builds the first electricity generating wind turbine.

Herman Hollerith receives a U.S. patent for his punch-card calculator.

**Sager opens its first location in Boston, Massachusetts.**



All great things begin with a single step – or in Sager's case a single storefront.

Recognized as the first distributor in the industry, Sager opened for business one hundred thirty-five years ago in downtown Boston, Massachusetts, servicing the growing interest in radio technology.

Under the vision and leadership of Joe Sager, the company established a thriving business that put the needs of its customers first. Since then Sager has grown into a North American distributor of interconnect, power, thermal and

electromechanical products and a provider of custom design and manufacturing solutions.

And after 135 years, Sager still operates just as Joe envisioned – based on a commitment to exceeding expectations and keeping the customer at the center of its business philosophy.

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## In Brief

### Discussing solutions to business challenges

ECCO was recently visited by 11th District Representative Bill Foster. Bill and ECCO president, Bernard Gizzi, discussed potential solutions to the many USA small business issues that exist today, including labor challenges, trade/tariff woes, and logistics/supply chain problems. The ECCO team was delighted Bill took time out of his schedule to see the facility.

[eccoconnectors.com](http://eccoconnectors.com)

### Certified for aerospace

Ventec has announced its US facility in Fullerton CA, is now certified to AS9100 Revision D and ISO 9001:2015, the quality-management standard for the aviation, space and defense industries. The facility provides prepreg and laminate handling including a laminate cutting area and a temperature/humidity-controlled clean-room for prepreg cutting and packing.

[www.ventec laminates.com](http://www.ventec laminates.com)

### Part search upgrade

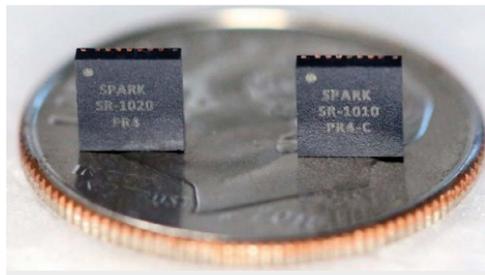
ECIA has added time-saving enhancements to its TrustedParts.com component search function. Stock Alerts let users know when the stock quantity of an electronic component has met, exceeds or falls below a specified number. Price alerts notify users of price changes to selected electronic components.

[trustedparts.com](http://trustedparts.com)

### Investing in GaN sales support

Innoscience Technology has announced international operations in the USA and Europe. The company will support customers through design and sales support facilities in Santa Clara, California and Leuven, Belgium. Current capacity is 10,000 8-inch wafers per month, rising to 70,000 by 2025. Devices range from 30 to 650V.

[www.innoscience.com](http://www.innoscience.com)



## Wireless transceiver agreement

Digi-Key Electronics has secured a global distribution agreement with Spark Microsystems to offer ultra-low power wireless communications for personal area networks and IoT-connected devices. With its patented technologies, Spark Microsystems' ultra-wideband wireless transceiver is designed to enable next generation wireless products.

Digi-Key's vice president of global supplier management, David Stein, said: "We are thrilled to offer the cutting-edge ultra-wideband technology that Spark Microsystems delivers to our global customer base. We know that our customers fuel the world's innovation. They now have a flexible, low latency and more power-efficient wireless solution with Spark Microsystems' game-changing products."

Spark Microsystems' chief revenue officer, Tom Spade, added: "Spark Microsystems' distribution partnership with Digi-Key allows us to engage the global market primed for the adoption of Spark Microsystems' products. Through Digi-Key's reputable platform, we can reach the worldwide design community, particularly those designing technology for industries such as AR/VR, audio, gaming and IoT sensors."

[digikey.com](http://digikey.com)

## Fuse clips designed for safety and integrity

Keystone Electronics is offering UL recognized fuse clips with end stops designed to ensure safety and integrity. Available for 1AG thru 8AG cylindrical glass fuses, these low profile, space saving clips can accommodate any product design requiring UL components, including solar protection fuses. Clips are suitable for applications from six to 30A in a variety of environments.

The brass clips feature tin or nickel plate to ensure low contact resistance. Designed to mount easily and retain a stable position during wave soldering, the clips are available in snap-in and press-in thru-hole mounting configurations, plus rivet and surface mounting styles.

[www.keyelco.com](http://www.keyelco.com)



## Ready for aviation, space and defense

Absolute EMS has successfully completed its 2022 surveillance audit for the AS9100 Rev D SAE International Aerospace Standard, with zero findings. The company manages, controls and audits its own processes, in addition to outside certification bodies verifying that its QMS meet the requirements.

Director of quality, Michele Mountain, said: "AEMS is known for consistent quality and process control. The fact that we have completed our AS9100 surveillance audit with zero findings is a tribute to the team, hard work, process control and our commitment to excellence."

This standard includes ISO 9001:2015 quality management system requirements and specifies additional aviation, space and defense industry requirements, definitions and notes. Absolute EMS continues to take the necessary steps to improve the quality of its products and services and to enhance customer satisfaction.

AS9100 is based on seven quality management principles: customer focus; leadership; engagement of people; process approach; improvement; evidence-based decision making; and relationship management.

[www.absolute-ems.com](http://www.absolute-ems.com)



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# Market opportunities for passive components

In this article, Paumanok Research's Dennis M. Zogbi offers buyers a glimpse into the industrial end-use market segment for passive components

Industrial applications constitute about 20 per cent of the worldwide value of passive components. The supply chain is a grand ecosystem where pricing and volumes are respectable. Industrial is not as demanding as defense and medical segments, nor as intense as the trillion-piece communications, computers and consumer electronics markets. The following describes the various levels of supply chain for components in the industrial end-use market segment.

## Power transmission and distribution

Components used for power transmission and distribution are generally employed in circuits between 3kV and 745+kV. Distribution-class capacitors are generally pole-mounted in series and parallel to achieve voltage requirements from 3 to 15kV, while transmission-class capacitors are rack mounted in both series and parallel to be used in power transmission systems to 745kV or higher.

Power transmission and distribution capacitors are large global markets, requiring power utility and government investment for growth. The renewable energy portion is more open and diverse with more opportunities for merchant vendors to sell capacitors to manufacturers of inverters who are not under the auspices of major power transmission and distribution turnkey projects.

Developments in high voltage direct transmission are impacting the size and weight of power-factor correction capacitors for offshore wind projects. Another important market is metal oxide varistors for circuit protection. Large blocks of zinc oxide are consumed for lightning and power protection of switchgear and transmission architecture.

## Motors and drives

The motor run capacitor market has traditionally grown with new home building globally, which drives sales of large home appliances, such as air conditioning equipment and refrigerators. Motor run capacitors are consumed in the split capacitor motors found in refrigerator and air conditioner motors.

The market for large home appliances and HVAC systems is driven primarily by new home sales but aftermarket sales are also influenced by a quest for improved energy efficiency. The motor run capacitor business has been showing signs of improvement in response to the global movement to make white goods' appliance motors more efficient because they are responsible for a large portion of global electricity consumption.

Clear market opportunities exist for industrial capacitors used in industrial motor drives, especially variable frequency drives that provide the greatest level of power

efficiency in industrial environments. Both AC plastic film capacitors and large can aluminum electrolytic capacitors are positively affected by this growth market.

Large can aluminum electrolytic capacitors are consumed in industrial motor drives. These are generally high-capacitance, high-voltage, high-ripple current and long-life aluminum electrolytic designs with rated voltages from 10 to 500V with capacitance values from 84 to 100,000 microfarads. AC plastic film capacitors used in industrial drives can handle thousands of volts per cell but at extremely low capacitance, generally in the 1 microfarad range. Both are used primarily for smoothing the signal and are considered primary components for efficiency and are therefore of great importance and subject to continual research and development.

Wirewound, nichrome and tin-oxide resistors are also found in motors and drive assemblies, plus metal oxide varistors and thyristor type circuit protection components (used for overvoltage protection), as well as NTC and PTC thermistors for inrush current limiting.

## Renewable energy components

Readers should note similarities between circuits in automotive, solar and wind renewable energy systems, primarily in the inverter,

Continues on page 10 ->



Dennis M. Zogbi has authored over 260 market research reports on the worldwide electronic components industry



**Power transmission and distribution capacitors are large global markets, requiring power utility and government investment for growth**



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converter, battery management, charger and DC link circuits. Since long-term growth is expected for all renewable technologies, the opportunity for capacitors is significant and should not go overlooked, especially by manufacturers of plastic film capacitors, aluminum electrolytic capacitors and double layer carbon supercapacitors all of which are consumed in renewable energy systems for power factor correction and burst power.

**Power supplies, adapters and DC/DC converters**

Switch mode power supplies and DC/DC converter modules require capacitor smoothing for the input filters (usually plastic film or ceramic) and output filters (usually aluminum electrolytic but sometimes tantalum). This is an enormous global market because every electrical device usually requires a power supply of some type and every power adapter and transformer requires capacitors. The greatest market value is output filtering because of the required combination of voltage

and capacitance, which is a narrow area for the aluminum capacitor manufacturers to compete in but represents a significant portion of the overall aluminum capacitor market on a global scale.

There is significant activity in making power supplies, adapters and converters smaller and more efficient and capacitors are an important part of that equation. Power supply customers for both aluminum and plastic film capacitor manufacturers are so critical to the larger capacitor market that competition among the relatively few major manufacturers in power supplies makes the market aggressive and competitive. These power supply markets are also critical end-markets for resistors and inductors, with nichrome film, wirewound and tin-oxide resistors as well as ceramic chip coil inductors.

**Lighting capacitors**

Both AC and DC film capacitors have counted lighting as a major end-use market for

decades. AC film capacitors have been historically consumed in two separate lighting ballast industry markets: the PFC magnetic ballast business; and the high intensity discharge lighting business. DC film capacitor markets are heavily invested into all ballast types including electronic ballasts and LED drivers. Capacitors used in lighting are for signal smoothing, interference suppression and, in some instances, burst power. They can be either plastic film, ceramic or aluminum and, in many instances, a combination of all three can be found in a single ballast.

**Hidden gems: fragmented sub-markets**

Pulse capacitors are DC circuit capacitors that absorb or supply strong current surges. They are charged sporadically and briefly discharged in relation to the charge time or vice versa. Discharge capacitors are subjected to high loads, high field strength and large peak currents because of the fast discharge and require advanced

technical knowledge to build. Pulse capacitors find their niche in various forms of research and development for generating strong magnetic fields; for high-energy light flashes; high-temperature electronics and high pulses of electrical energy.

The following applications for pulse components illustrate the variation in end markets for capacitors in various granular sub-segments of the larger markets: laser (industrial and medical); defibrillator (external only); x-ray machines (pulsed); ultrasonics (pulse welders, cleaners); airport runway strobes; pulse forming networks for radar; water purification; railgun power; missile power-up; food sterilization; Marx generators; television and radio transmitter capacitors.

[www.tti.com](http://www.tti.com)

*A version of this article originally appeared in TTI's MarketEYE Resource Center.*

# EXPLORE

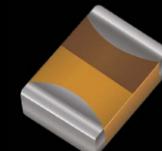
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# Independent distributors post record sales growth

Component allocations and long lead times resulted in buyers turning to the open market for hard-to-find parts and paying exorbitant prices



James Carbone

While 2021 was the worst of times for many electronics purchasers because of component shortages and high prices, it was the best of times for independent distributors.

So many parts were in short supply with some component manufacturers quoting lead times of over a year. As a result, buyers flocked to the open market looking for microcontrollers, power management ICs, discretes, MLCCs and other parts. When they were able to find parts, in some instances they had to pay four or five times the normal price.

Because of such unprecedented supply conditions, most independent distributors had record sales years with some reporting their sales doubled or tripled compared to 2020. The bad news for buyers is that the supply conditions of 2021 have carried over to the first quarter of 2022 and may continue through all of the year, according to independent distributors.

One independent distributor that posted record-breaking sales growth last year was Smith, based in Houston. Smith's sales tripled from about \$1 billion in 2020 to \$3.4 billion in 2021, the company said. Sales were strong because of super strong demand and a lack of adequate manufacturing capacity from chipmakers such as NXP, Microchip, STMicroelectronics, Xilinx, Altera/Intel and Texas Instruments among others. Stellar demand for chips crossed multiple industries including industrial, automotive,

communications and defense and aerospace.

#### Strong passives demand

Some independent distributors have also seen growing demand for passives. "We have seen very strong demand for everything from capacitors to resistors," said Steve Calabria, founder and CEO of PC Components Company, based in Seaside Park, N.J. Lately the market has been especially hot for selected Vishay CRCW thick-film surface mount resistors," he said. PC Components sells excess inventory owned by its OEM and electronics manufacturing services clients.

Another independent distributor that saw strong robust growth in 2021 was Fusion Worldwide, based in Boston. "By any measure, 2021 was a strong, historic year," said Luke LeSaffre, chief revenue officer for Fusion.

Fusion more than doubled its annual sales. "Last year our business just kept growing. Each month was better than the previous month," he said. Strong component demand and revenue growth continued in January.

One reason independent distributors saw a sharp increase in demand was that there were more electronics buyers who entered the open market for the first time because of shortages caused in part by the pandemic. "The pandemic gave us an opportunity to demonstrate what we can do," said LeSaffre.



Carleton Dufoe, CEO of NewPower Worldwide

**"Customers want to do business with companies that are reputable and are doing the right thing. NewPower is open and transparent with everything with our audited financials and our books"**

The independent distribution channel is becoming more of "an integral part of a supply chain rather than where a buyer goes in case of emergency and as a last resort," he said. The independent distribution market "is becoming mainstream and not viewed with as much skepticism," according to LeSaffre.

Another distributor that posted strong sales is NewPower Worldwide, based in Nashua, N.H. The distributor's sales increased from \$456 million in 2020 to more than \$800 million last year, according to Carleton Dufoe, CEO of the company.

#### Expansion and growth

He said that one reason for growth was NewPower's global expansion. NewPower has

opened offices in Hungary and India where it has added a new warehouse. It also expanded in Mexico and will soon have offices in Germany.

NewPower's non-North American sales have been growing, "because a lot of manufacturing goes on in Asia and Europe and our customer base throughout Asia and Europe has expanded over the last year" and will continue to grow, said Dufoe. He said NewPower's business model is different than other independent distributors. "We are open and transparent with everything with our audited financials and our books," said Dufoe. Auditing and tax firm RMS audits NewPower annually and customers can view audit results.

"When we show them our audited financials by RSM, they can see that everything we've done is transparent. Every business transaction is above-board and everything is according to Generally Accepted Accounting Principles (GAAP)," said Dufoe. He added customers like to see transparency. "They want to do business with companies that are reputable and are doing the right thing," said Dufoe.

#### Tight supply continues

However, transparency is not enough. Buyers also need their independent distributors to be able to supply the shortage parts because shortages are not going to disappear anytime soon.

"Business has not shown any signs of slowing down," said LeSaffre. I am hesitant to make any predictions beyond three months, but it would be shocking to see any sort of regression or reversion over the next six months," he said. There are no signs that there will be any change in supply and demand for the year, according to LeSaffre. As a result, buyers will continue to look to independent distributors for chips and other components. "Every indication that we have is these current supply conditions are going to continue through the year and into 2023," he said.

Todd Burke, president Americas for Smith, agrees that supply will be tight in 2022. He expects strong demand to continue through at least the first half of the year. There could be some loosening in supply later in the year, but "we are expecting a very robust year," he said. Key indicators such as quantity of requirements from customers, the number of customers, new customers coming on board "are where they were at the end of

last year if not increasing early in 2022," said Burke.

Smith gets calls daily from new customers and business segments that had been underserved by Smith. While there are "brand new customers" reaching out to Smith, there are also many customers that have "increased their business with Smith in a significant way," according to Burke.

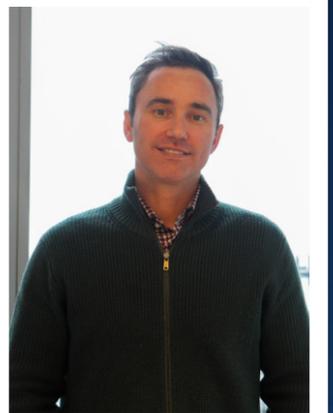
Some independent distributors say the current tight supply situation will get worse before it gets better. "Component manufacturers are still quoting very long lead times, sometimes 86 or 99 weeks," said Calabria. At the same time available inventory from the open market is nearing an all-time low level.

"In 2021 when customers called us for a quote, it was common that 20-30 other independent distributors had stock. In 2022, we often see only one or two other suppliers advertising stock," he said. He said open market inventory levels are decreasing because product is being purchased as fast as OEMs with excess can provide inventory to their consignment partners such as PCC.

PC Components sells excess inventory owned by its OEM and electronics manufacturing services (EMS) clients.

With such conditions, buyers may face even more price increases. Calabria said with shortages such as the current one, independent distributors may sell a \$3 part for \$9, or more, he said. The price the buyer pays depends upon how many companies create the competition. "As open market inventory dries up, buyers should expect prices to skyrocket.

**"The independent distribution market channel is more of an integral part of a supply chain rather than where a buyer goes in case of emergency and as a last resort"**



Luke LeSaffre, chief revenue officer for Fusion Worldwide

The same \$3 part will be quoted at \$30," said Calabria.

Independent distributors say besides shortage parts, OEMs and EMS providers are also looking for inventory management programs.

"We are seeing quite a few requests for inventory management models," said Burke. Customers are looking for ways right now "more than ever to secure inventory and to be sure that they will have inventory six months to a year from now," he said.

Burke added customers may not necessarily want to own the inventory but just have access to it. "So, we are having those discussions where it makes sense for both parties. We try to engage with them in some sort of a model that works for both of us," said Burke.

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	L37A26-1-0-3WA3	3.7	2600	1	Single cell - 1S1P	2600	"C"	CALL
N	L37A26-1-0-2W	3.7	2600	1	Single cell - 1S1P	2600	"A"	CALL
N	L37A34-1-0-2W	3.7	3400	1	Single cell - 1S1P	3400	"A"	CALL
	L37A52-2-1-2WX	3.7	5200	2	Side by Side - 1S2P	2600	"B"	CALL
	L37A52-2-1-3WA3	3.7	5200	2	Side by Side - 1S2P	2600	"C"	CALL
N	L37A52-2-1-2W	3.7	5200	2	Side by Side - 1S2P	2600	"A"	CALL
	L74A26-2-1-2WX	7.4	2600	2	Side by Side - 2S1P	2600	"B"	CALL
	L74A26-2-1-2W	7.4	2600	2	Side by Side - 2S1P	2600	"A"	CALL
N	L74A34-2-1-2W	7.4	3400	2	Side by Side - 2S1P	3400	"A"	CALL
	L74A26-2-1-3WA3	7.4	2600	2	Side by side - 2S1P	2600	"C"	CALL
	L37A78-3-2-2WX	3.7	7800	3	Side by Side - 1S3P	2600	"B"	CALL
N	L37A102-3-2-2W	3.7	10200	3	Side by Side - 1S3P	3400	"A"	CALL
	L111A26-3-2-2WX	11.1	2600	3	Side by Side - 3S1P	2600	"B"	CALL
	L111A26-3-2-3WA3	11.1	2600	3	Side by Side - 3S1P	2600	"C"	CALL
N	L111A26-3-2-2W	11.1	2600	3	Side by Side - 3S1P	2600	"A"	CALL
N	L37A136-4-3-2W	3.7	13600	4	Side by Side - 1S4P	3400	"A"	CALL
	L74A52-4-3-2WX	7.4	5200	4	Side by Side - 2S2P	2600	"B"	CALL
	L148A26-4-3-2WX	14.8	2600	4	Side by Side - 4S1P	2600	"B"	CALL
	L148A26-4-3-3WA3	14.8	2600	4	Side by Side - 4S1P	2600	"C"	CALL
	L148A26-4-3-2W	14.8	2600	4	Side by Side - 4S1P	2600	"A"	CALL
N	L148A34-4-3-2W	14.8	3400	4	Side by Side - 4S1P	3400	"A"	CALL

# LITHIUM ION PACKS AND CHARGERS COST SHEET

New Item	Part Number	Volts	Pack mAh	# of cells	Configuration	Cell mAh	Termination*	Dist Cost
N	L185A26-5-4-2W	18.5	2600	5	Side by Side - 5S1P	2600	"A"	CALL
	L74A52-4-10-2WX	7.4	5200	4	Square Pack - 2S2P	2600	"B"	CALL
N	L74A68-4-10-2W	7.4	6800	4	Square Pack - 2S2P	3400	"A"	CALL
N	L148A26-4-10-2W	14.8	2600	4	Square Pack - 4S1P	2600	"A"	CALL
N	L111A68-6-11-2W	11.1	6800	6	Six Pack - 3S2P	3400	"A"	CALL
N	L148A52-8-12-2W	14.8	5200	8	Eight Pack - 4S2P	2600	"A"	CALL
N	L148A68-8-12-2W	14.8	6800	8	Eight Pack - 4S2P	3400	"A"	CALL
	L148A26-4-18-3WA3	14.8	2600	4	2 Sticks of 2 - 4S1P	2600	"C"	CALL

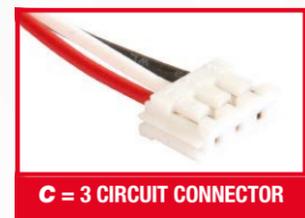
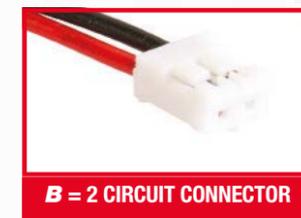
## CHARGERS

Part Number	Volts	Input Volts	Charging Current	Dist Cost
F037-010-W	3.7	100-240Vac	1000mAh	CALL
F037-015-W	3.7	100-240Vac	1500mAh	CALL
F074-010-W	7.4	100-240Vac	1000mAh	CALL
F074-015-W	7.4	100-240Vac	1500mAh	CALL
F111-010-W	11.1	100-240Vac	1000mAh	CALL
F111-015-W	11.1	100-240Vac	1500mAh	CALL
F148-010-W	14.8	100-240Vac	1000mAh	CALL
F148-015-W	14.8	100-240Vac	1500mAh	CALL

## UNIVERSAL ION LITHIUM CHARGER

LICHG-37-14810	3.7 / 14.8	100-240Vac	1000mAh	CALL
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## TERMINATION



# Preparing for growth in space and aviation

*TTI's vice president military/aerospace segment, Gia Hayes, presents factors manufacturers should prepare for during post-pandemic disruption and growth*

These are unprecedented times for commercial spaceflight. In addition to highly-publicized flights of SpaceX, Blue Origin and Virgin Galactic, smaller firms are striving to gain market share, including small-satellite launch provider Rocket Lab and launch vehicle company Astra Space.

At the same time, we are seeing new investments and innovations from industry leaders such as Boeing and Northrop Grumman. These contributions include rockets, engines, cargo/crew spacecraft, defense systems and the technology to support them.

This competition to bring future people and vehicles to low Earth orbit and beyond has the potential to make the dreams of science fiction become reality.

For example, with NASA's recent announcement that the International Space Station will be decommissioned after 2030, new space stations like Blue Origin's Orbital Reef concept could begin to move us toward a dream of more humans living and working in space.

This boom period in spaceflight will have far-reaching impacts beyond commercial space, creating new demand for mil-spec and space-rated components beyond anything we have experienced before.

Another factor to consider is the speed of recovery in commercial air. We do not yet know how quickly business travel will trend back toward pre-pandemic levels, nor do we know how rapidly aircraft production will ramp back up.

Current trends seem to suggest that demand for single aisle and regional aircraft will continue to recover, reaching pre-pandemic levels much sooner than wide body aircraft. Although everyone agrees there are still many challenges to overcome, most of TTI's customer base is expecting to see some growth in 2022.

Recovery in air travel will prompt new aftermarket service revenue streams. Out-of-storage checks and return-to-service maintenance continue to drive an incremental 2022 aftermarket which could deplete existing inventory.

Even for components with shorter lead times, a rapid ramp-up in aircraft production alongside high demand from commercial space and defense could cause delays in manufacturers' programs. With the current long lead times for capacitors and other critical parts, this combination might create a new wave of supply-chain uncertainty and complications.

Now is the time for buyers to make sure their company has strong partnerships and assurance of component supply. As a specialist distributor serving the defense and aerospace industries, TTI is working with customers to make sure they understand the current state of the supply chain and help them plan in pace with market conditions.

Responding to the pandemic's supply chain disruptions, TTI has encouraged customers to share forecasts—by part number—to ensure they remain up-to-date with realistic lead times and inventory positions.

Also, while we frequently hear customers have on-hand inventory that needs to be consumed, we also want to make sure that demand during this critical period is as accurate as possible.

Solid planning and partnerships now can position a business to make the most of the recovery and growth in space, aviation and defense that we expect.

[tti.com](http://tti.com)



TTI's vice president, military/aerospace segment, **Gia Hayes**

**Responding to the pandemic's supply chain disruptions, TTI has encouraged customers to share forecasts—by part number—to ensure they remain up-to-date with realistic lead times and inventory positions**

# Obsolescence management strategies in aerospace and defense

*A2 Global's CEO Frank Cavallaro shares strategies designed to help long-term planning, informed decision making and avoiding redesigns*

Though exacerbated by the current chip shortage, the defense and aerospace industry's position in the electronic components market has significantly reduced over the years. Rapid technological advancement is driving suppliers to abandon low-demand, older technology products at a faster pace, while the US Department of Defense (DoD) seeks to prolong the life of weapon systems. This means components used in military systems are becoming obsolete before the product lifecycle is finished, making it increasingly difficult to find replacement parts.

Commonly known as Diminishing Manufacturing Sources and Material Shortages (DMSMS), it is a critical consideration when planning an obsolescence strategy. As component lifecycles decrease, defense and aerospace manufacturers are left with limited options to keep end products functioning reliably.

Obsolescence management is key in this industry as manufacturers strategically plan to source components and track component end-of-life (EOL) to ensure they have inventory.

There are three strategies manufacturers should consider to stay ahead of component obsolescence:

- Strategize for obsolescence at the design phase
- Leverage supply chain networks to plan appropriate inventory needs and storage
- Expand sourcing channels and vendors to account for specific part needs

Strategize at the design phase: Up-to-date information on obsolete parts is only useful when used at the right time. Having a full picture of product lifecycle forecasts at the design stage lets manufacturers build their systems accordingly and avoids potentially costly fixes at the production stage. It also sets defense manufacturers on a path for long-term strategic planning knowing components are viable for a definitive time.

Leverage supply chain networks: Manufacturers cannot know everything in a supply chain ecosystem to manage obsolete parts perfectly, especially in defense and aerospace which relies on legacy parts that can be difficult to find. Without a firm understanding, they may not know how much inventory to have on hand, where their best sourcing options come from or market conditions they should be aware of. It is critical they reach out to those active

in supply chain analysis in real-time to make informed decisions.

Branch out sourcing channels: There is no 'one-size-fits-all' obsolescence management solution. It is easy to constantly rely on the same distributors but defense needs, market forces, product type, time in market and product volume mandate individualized planning by part. Branch out supplier lists, source information from third-party partners and be willing to adapt to changing supply chain circumstances to stay agile.

Obsolescence management is a complex issue for defense and aerospace, made more difficult by DMSMS. Having a strong obsolescence management system in place can help with long-term planning, making informed decisions quickly and avoiding costly redesigns or fines.

[a2globalelectronics.com](http://a2globalelectronics.com)



A2 Global's CEO **Frank Cavallaro**

**Obsolescence management is key in this industry as manufacturers strategically plan to source components and track component end-of-life**

# How audits instill confidence

*Falcon Electronics' quality manager, Susan Bocci, explains how regular audits underpin purchasing confidence in the high reliability component distribution channels*

AMS (aerospace, military and space) companies will perform annual audits, assessments and/or spot checks throughout the year. These audits are not contract based and are usually performed by a quality engineer or manager to confirm the distributor/authorized supplier is compliant to different aspects of the AS9100 specification—even though the distributor/authorized supplier is certified as such. Mostly auditing documentation records, flow downs, counterfeit avoidance procedures, ESD precautions and cybersecurity.

These audits are not typically onsite (especially due to Covid-19) but are handled with questionnaires. Some AMS quality managers may request a conference call. Based on the audit type, corrective actions are created if a non-conformance is found. Other types of audits/assessments are simple, with a series of questions and a request for documentation via email. These audits are not punitive but ensure the distributor/authorized supplier is meeting its customer's standards.

Do the distributor/authorized supplier's processes reflect documented procedures? Documented procedures must have a clear description of quality processes and is the best way to provide objective evidence during an audit. Along with quality records of the ordering and shipping process.

How does a distributor/authorized supplier incorporate its customer's specific requirements to meet their quality specifications? Some AMS companies request specific language in the distributor/authorized supplier's

procedures to ensure their quality specifications that are flowed down on their purchase orders are met. Specific language can be added to the procedure or simply create a customer specific procedure/s to this requirement. These procedures should be kept up to date and reviewed in a one-to-three-year cycle.

An important type of audit—counterfeit detection and avoidance—may occur several times a year, with the possibility of the same type of audit by different buyers within the same AMS company. A detailed procedure is required, which describes quarantining counterfeit and suspect counterfeit parts and how returned material is handled to prevent counterfeit product getting back into the supply chain. An approved vendor list with scope of approval is necessary and should be updated annually. Also, annual training for all employees is recommended.

Are accurate records maintained? As part of the counterfeit assessment, order traceability is usually requested. AMS companies select a random shipment and request the documentation required to trace the parts to the manufacturer. They need this objective evidence to ensure parts were purchased from an authorized supplier that matches their original purchase order.

SAE International Standards for Counterfeit Electronic Parts, Avoidance, Detection, Mitigation and Disposition: AS5553 and AS6496 (Authorized/Franchised Distribution) may be used to perform the audit. Both specifications are excellent resources to help develop a

counterfeit program and/or an internal audit checklist for your counterfeit program.

How are requirements flowed down to the OEM? Flow down verification is another key area that AMS companies audit. Purchase orders are audited, and flow down objective evidence is required to ensure their requirements are flowed down to the OEM. The easiest way to comply with standard flow downs is to add quality terms and conditions and display them on your company website.

Cybersecurity is an AMS priority. Both OEMs and distributors/authorized suppliers are mandated by the DOD to comply with CMMC requirements. Since the CMMC specification is still being developed, only questionnaires and surveys are sent at this time. Implementing the NIST 800-171 standard and maintaining good support procedures, training and documentation is a necessity which can be used as objective evidence for a desk audit.

Distributor/authorized suppliers which pass such audits receive a high rating and are assured future business. This helps the AMS company buyer streamline and simplify the process of ordering and receiving products shipped directly from the distributor/authorized supplier's warehouse. It provides confidence in the consistency of quality and guarantees that new requirements are being reviewed and flowed down to meet the AMS customer's needs.

[www.falconelec.com](http://www.falconelec.com)



Falcon Electronics' quality manager, Susan Bocci



**AMS companies select a random shipment and request the documentation required to trace the parts to the manufacturer**

# Sourcing plastic enclosures for touchscreen applications

*OKW Enclosures' vice-president of marketing, Robert Cox, walks readers through their purchasing options when sourcing enclosures for touchscreen-based products*

Touchscreens are everywhere but housing them can be challenging. Until recently there were few dedicated standard enclosures for touch displays. But smart new standard enclosures are changing that. They suit a broad spectrum of applications and they can be customized quickly and cost-effectively, even in smaller volumes.

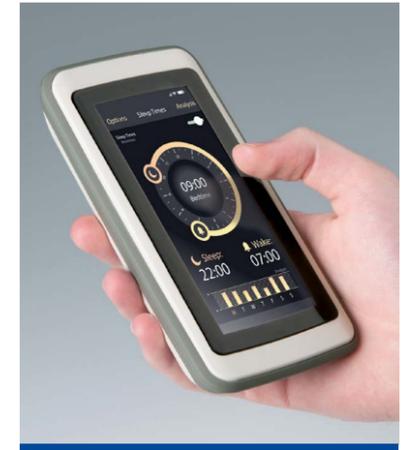
Touchscreens are tactile so their enclosures must be ergonomic, whether handheld, wall-mounted or desktop.

That means soft contours and other desirable features such as: ingress protection to IP65; UV stability; choice of model versions and sizes; tamperproof assembly (especially for medical applications) and plenty of customization options.

Users expect a handheld touchscreen device to be as good as their mobile phone. However, what if the electronics won't fit a mobile-sized case? OKW has created Slim-Case, a mobile touchscreen enclosure that's

bigger than it first appears. Viewed from above, it looks like a mobile phone housing: low profile, virtually frameless design and a soft-touch TPE intermediate ring. Closer inspection reveals a sculpted rear section that offers more space and makes the enclosure more comfortable to hold. The operating panel can be flat (for displays, buttons and LEDs), have a 0.06in recess for a touchscreen or membrane keypad, or a 0.04in recess for thinner product labels.

[Read more ->](#)



Slim-Case enclosures

# Beyond Capable.

For over 25 years, Falcon has specialized in supporting the leaders that drive the aerospace, military, and space markets. Our extensive knowledge and proficiency with procurement processes, technical requirements, quality flow downs, and T&Cs - as well as all government procurement guidelines (FARs, DFARs, ECCNs, etc.) - is only surpassed by our focus on schedule commitment (OTD), quality (DPPM), and the highest levels of customer service.

This is what makes Falcon an invaluable partner in your AMS supply chain.

- ISO 9001:2015/AS9120:2016 REV B Certified
- NMSDC Certified Small Disadvantaged Business
- Aerospace Self-Release Programs - AS13001-Certified Employees
- ESD Compliant including Class Zero - JESD625B-Trained Operators
- Counterfeit Risk Mitigation - AS5553B Compliant
- Cyber Security - NIST SP 800-171 Compliant CMMC Level 3 Certification in process
- JEDEC Member • ECIA Member • ITAR Registered
- AECA Compliant • GIDEP Member • DLA QSLD Certified



[www.falconelec.com/BeyondCapable](http://www.falconelec.com/BeyondCapable)

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electronics



Evotec enclosures

For larger products, the company's Carrytec is a small, medium or large attaché case for monitoring, diagnostics, communications and data collection. It can be carried, docked in a charging station, clipped to a hospital bedrail or mounted on a suspension arm. An outdoor version is available in UV-stable ASA+PC-FR for agriculture and forestry applications.

For building control applications, OKW's Smart-Panel flush-fits into standard-sized cavity wall boxes, leaving just the top to frame a touchscreen. Screwless assembly means no visible fixings. The product's creator, polyform Industrie Design's Martin Nußberger, said: "Only a narrow frame surrounds the user interface and the base of the enclosure blends in. Nothing is revealed about how this enclosure is screwed on to the wall – no fixing points, no joints."

These UV-stable ASA+PC-FR enclosures can also be specified for desktop electronics by adding non-slip feet.

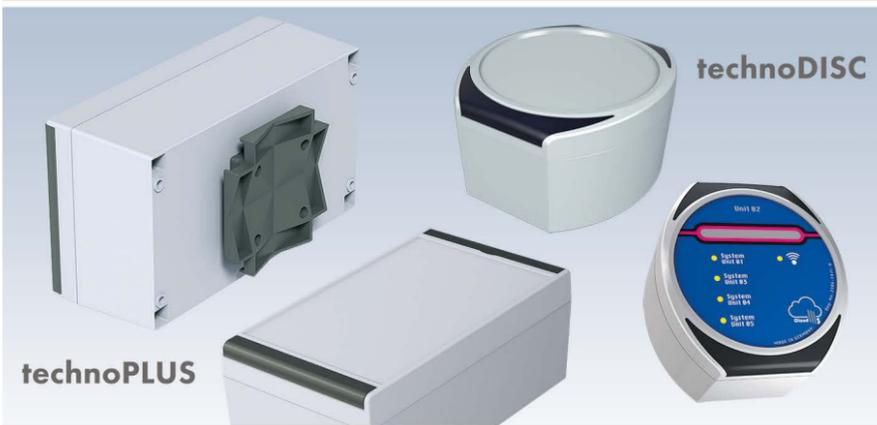
Desktop enclosures must be easy to view and operate but touchscreens more so because they can be prone to glare. OKW's Protec square control center has a 20-degree sloping front for easy viewing and operation. Three versions offer either: a large rear recess for connectors; a flush-fit cover that hides the recess; or an extra-deep cover that doubles as a desk stand.

Another desktop enclosure, Evotec, is available with a flat or sloping top. The soft-contoured large operating area is inclined by 12-degree, ideal for desktop applications and also for wall mounting.



Protec enclosures

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Smart-Panel enclosures

For maximum flexibility, OKW's modular Interface-Terminal lets customers specify their perfect enclosure by selecting the preferred pieces. Choose the bottom section and cover, then add a front/glass panel (if required), seal and installation kit (for flush-mounting in walls).

Using the same model for different roles ensures design continuity – and creates cost efficiencies (larger numbers of the same enclosure sections can be ordered).

By partnering with an enclosures manufacturer that provides the full range of customization services (machining, finishing, digital printing and laser marking etc), customized housings can be shipped straight to the production line ready for component installation.

OKW Enclosures' vice-president of marketing, Robert Cox, said: "One expert manufacturer is fully accountable for the consistent quality of your enclosures from start to finish. You'll get peace of mind and a more streamlined order process."

[www.okwenclosures.com](http://www.okwenclosures.com)

**Touchscreens are tactile so their enclosures must be ergonomic and smart**



Plastic enclosures for touchscreen electronics



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# Leveraging digital solutions for strategic procurement

Margaret Cunha is senior director, supply chain solutions, for Digi-Key Electronics. Digi-Key is both the leader and continuous innovator in the high service distribution of electronic components and automation products worldwide, providing more than 13 million components from over 2,200 quality name-brand manufacturers.



These days, procurement professionals have a more difficult job than ever. Products and materials across all industries are often difficult to obtain, subject to supply chain delays and challenges. The ability to match purchasing needs with available supply may fluctuate by the minute. With so many issues at hand, it can be difficult to think strategically beyond the tactical needs of today.

Strategic procurement is critical to the sustained success of an organization. It goes beyond the day-to-day tasks and looks several years ahead to help determine what is needed to help your organization be successful.

To be sure, tactical, daily procurement tasks like filling purchase orders must still be completed to keep business moving, but finding time to be strategic and plan for the future is just as important to ensure you are poised for success down the road.

## Digital Transformation

Over the past several years, purchasing has become increasingly more digital and increasingly more automated. Digital solutions like Digi-Key's APIs, EDI, and Punchout Catalog bring data in faster, helping purchasers make better supply chain and procurement decisions.

Some purchasers may be intimidated by the idea of automation, but what it ultimately comes down to is bringing in a digital machine-to-machine connection and letting computers do what they do best – make simple, tactical decisions – thus freeing up valuable time for humans to take on more critical and creative thinking, connecting with business partners and ideation.

## Getting Started

Strategic procurement can help you start developing the building blocks today that you'll need to reach your goals in the future. Some questions to consider when it comes to strategic procurement include:

- What does the market look like 1-2 years out?
- What does your purchasing department look like 5-10 years from now?
- Which suppliers do you want to align with?
- What tools do you need to be the best at what you do?

From there, you can begin reviewing which digital solutions might be best to implement for your business. Here's how to get started with Digi-Key's digital solutions:

- Identify the processes you want to improve and automate.
- Consider your current technology infrastructure and resources.
- Evaluate the return on investment with tools such as the API Solutions Calculator.
- Get in touch with any questions.

## Digi-Key Solutions

The supply chain is brimming with data, and strategic, digital procurement processes can leverage that data to optimize outcomes. Digi-Key offers a variety of digital solutions designed to reduce costs and errors and increase efficiency, accuracy, and time to market. If your business could benefit from APIs, EDI, or Punchout Catalog, Digi-Key is ready to help take your eProcurement requirements to the next level.

Learn more at [www.digikey.com/digitalsolutions](http://www.digikey.com/digitalsolutions)

Digi-Key offers a variety of digital solutions designed to reduce costs and errors and increase efficiency, accuracy, and time to market.

# Quest for sustainable electronics



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

As consumers escalate environmental, social and governance expectations for publicly traded companies, John Denslinger argues there is only one downside: failure to act

Sustainability • By John Denslinger

ESG, carbon neutral, zero emissions, e-waste, sustainability and similar environmental stewardship labels are more than just talking points in company boardrooms and investment communities. Maybe it was the pandemic that elevated consciousness and the social value of safeguarding the health/safety of employees, workplace, consumer and environment. To be that socially responsible is not a small undertaking. It requires unconditional resource allocation and perhaps a total revamp of business. One only needs to look at the epic investment by our industry in more eco-friendly products, processes, material procurements and end-of-life considerations as evidence that being sustainable matters. It's truly a seismic shift in management priority.

While the pandemic may have opened eyes, it wasn't the only contributor to a social awakening. In 2013, CEA reported the average household made use of 28 electronic products in everyday life. Since then, advances in digitalization, connectivity, fitness, robotics, drones, VR, AI, EV, and smart home added to that household list: and that just typifies the point. Manufacturers constantly promote and condition consumers to continually buy the latest technology. Unfortunately, what's good for the economy tends to be an undesirable pathway to early obsolescence. A 2018 BCC Research paper identified global electrical/electronic waste at 6.5 per cent CAGR but noted recycling was not keeping pace. EPA's most recent data reports domestic recycling at 30 per cent. Europe is doing better per EEA reports at 40 per cent. Assuming global electronics consumption doubles by 2050 as forecasted, pre-emptive measures are needed now. Introducing more sustainable electronics could be that game changer.

So, what is sustainable electronics? A description search offers a few key words: absent toxic chemicals, reduced carbon footprint, recyclable. Sustainability starts with raw materials, product design, manufacturing techniques, recovery methods

and ends with environmental impact considerations. Most companies utilize ISO14000/14001 for structure and planning. This guidance has been available for some time providing the necessary environmental management system with standards to measure and drive improvement.

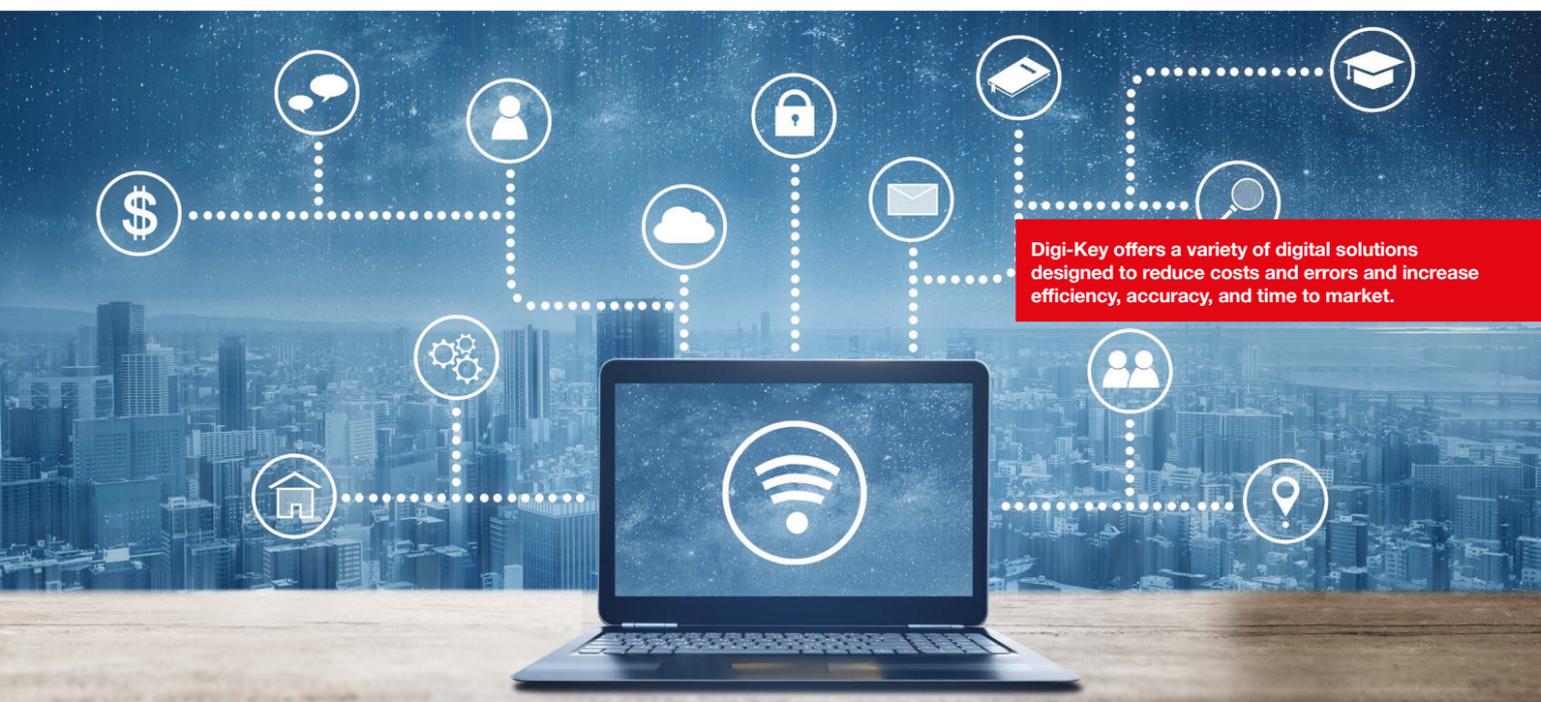
Launching a sustainability initiative but question where to start? One might do well talking with companies that already:

- Designed and implemented comprehensive programs
- Measured all elements in detail
- Published results against goals
- Showed total transparency throughout

These are the real environmental leaders and each offers valuable insight into sustainable electronics. My former employer, Murata Manufacturing Co has one of the most developed initiatives I've researched, a worthy standard for the industry. Check it out by clicking at the top of their global website: [corporate.murata.com/en-global](http://corporate.murata.com/en-global) on Corporate Social Responsibility for a complete mapping of ESG initiatives. Remarkable work.

There is plenty of upside to sustainable electronics. The spawning of renewable technologies will be amazing: bio-based materials; biodegradable components; additive manufacturing; recyclable substrates; textile and graphene integrated electronics; cellulose sensors; sustainable batteries; bio-batteries based on printed enzymes; and much more.

If there is one downside, it would be failure to act. Consumers have escalated ESG expectations for publicly traded companies and there is no going back. That pressure is rippling across the industry and down supply chains. Before long, corporate policy will dictate procurement selection based on supplier demonstrated ESG achievement. So, it's not too early to begin the quest for sustainability.



ELECTRONICS **sourcing family**



# Semiconductor shortages: avoiding line stops

In this issue, Rochester Electronics encourages buyers facing shortage and obsolescence issues to focus on suppliers authorized by the original component manufacturer

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

Customers are under pressure to guarantee supply and at times grey market or unauthorized sources are perceived as the only solution. This could not be further from the truth. Authorized after-market suppliers, like Rochester Electronics, offer risk-free sourcing and alternative solutions to keep lines running.

In times of supply shortage or where component obsolescence limits availability, the prevalence of counterfeit devices often multiplies. Counterfeit parts are an ever-present concern when sourcing. How do buyers identify counterfeit parts and avoid them?

In the semiconductor world counterfeit parts include: non-functional or scrap

product which is re-marked as good and re-sold; functional yet sub-standard product purchased by the counterfeiter remarked and re-sold as full grade product at an increased price; and recycled and recovered components re-sold as new.

In all these cases, the process of etching back the original external markings with aggressive chemicals or even mechanical grinders can result in internal damage and device contamination causing in-service failures.

Recycled components are simply used semiconductors with a return-for-recovery route through an uncontrolled storage environment. Exposure to excessive humidity, water and salt is routine. Even authenticity does not guarantee reliability.

Identifiable surplus stock and traceability provides no guarantee of storage conditions.

Consequences of sub-standard product entering the supply chain may include: reduced production yields and

increased rework; increased in-service failures and reduced reliability; and heightened risks and financial liability associated with catastrophic system failure.

Though no one likes to be fooled by counterfeit products, in the world of components, procuring one could prove disastrous. It is uncomfortable to imagine a commercial airliner, missile or life-saving medical device receiving a critical component replacement which is fake and fails in the field, but these are the stakes and they are high.

The ultimate tool in avoiding counterfeit is buying from suppliers authorized by the original component manufacturer.

Buying from an authorized source who partners with the original component manufacturer eliminates these risks. Fully authorized distributors, like Rochester Electronics, identify themselves as compliant with the SAE aerospace standard AS6496. Simply stated, they are authorized by the original component manufacturer



**Semiconductor market shortages are widespread and few manufacturers and product families have been spared extended lead-times and even allocation**



(OCM) providing traceable and guaranteed products with no quality or reliability testing required because the parts are sourced from the OCM.

Providers who are not may market themselves as AS6171/4 compliant. This source, though better than no compliance, follows standardized inspections and test procedures with minimum training and certification requirements to detect suspect or counterfeit components. This is an indication parts are not sourced to the supplier from the OCM but have passed testing to minimize, not eliminate, risk.

The only way to eliminate these risks is to purchase from a fully authorized source who is AS6496 compliant. Semiconductor manufacturers have partnered with and authorized these suppliers to manage their surplus active stocks during times of plenty. In some instances, Rochester Electronics has taken control of all material after last-shipment. As the market moves from surplus to deficit, this authorized stock is an essential buffer to help customers avoid line-stops.

To avoid line-stops consider the following.

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 and different packages; older die iterations or build versions; and reverting to a previous design or making minor design modifications (which do not trigger a full system re-qualification).

In addition, consider a licensed semiconductor manufacturer who can build end-of-life (EOL) product families. Licensed manufactured products are built using original known-good-die; are tested using the original test processes; and are 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 fulfill market demands.

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# Take control of your supply chain

*NewPower suggests buyers start protecting their supply chains from an economic downturn that could rival the 2008 financial crisis*

The circumstances of an economic collapse have been building as the economy's outlook remains uncertain. In 2020 overall demand plummeted as the pandemic kept everyone in hibernation. Many businesses had mass-layoffs and others were forced to close.

Federal Governments across the globe invested large amounts of cash into their economies to keep people afloat. This cash also set the stage for unprecedented demand. Cloud-based/stay-at-home services drove a steep incline in demand and the trickle-down effect of people staying home and isolating created a labor shortage.

The pandemic highlighted the imperfections in the global logistics system, leading to wider spread issues. Supply chains were thrown out of sync globally, causing product shortages and price increases for transportation and storage capacity. Companies around the world are dealing with these very issues today.

This situation is leading global economists and supply chain veterans to contemplate the recession-like effects of a bullwhip and what it would do to the world's leading economies.

Historically, recessions are typically triggered by a massive increase in demand, almost exactly like what we're experiencing now.

An increase in demand coupled with companies struggling to manage through it with supply, logistics, pricing, labor, etc., is causing businesses to place huge orders with distributors to ensure supply. As a result, distributors are placing even larger orders with manufacturers to make sure they have inventory to support further forecasted demand. Uncertainty of product availability and delivery times are also at play.

In the end, orders and inventories are overdone at every step in the supply chain, creating an overinflated result. Demand for products will most certainly drop as the pandemic wanes, and when that happens, orders will also drop off tremendously. Companies will desperately try to offload bloated inventories and the impacts on organizations will only worsen moving up the chain. Similar to 2008's financial crisis, the sudden decrease in demand will cause significant company issues and job losses.

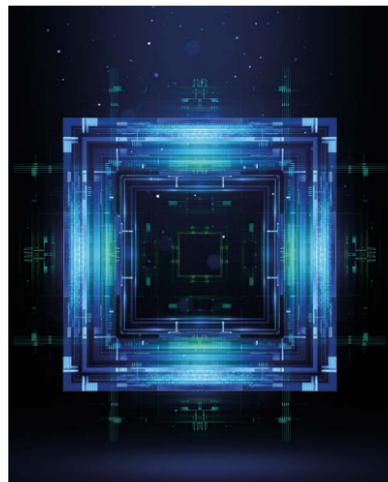
However, companies can act now to avoid the impacts of these impending issues. Businesses need to identify their critically important suppliers and monitor them closely, specifically investigating their financial health. They may be frightened by what they learn and realize the need to do more than contemplate financial methods to ensure essential suppliers can survive a recession-like period.

Forward-looking companies have begun thinking about surviving and thriving in such an environment. Throughout the pandemic, these companies have streamlined their supplier base. For other companies to make it through, now is the time to establish supply chain control and transparency.

For example, inventory management solutions, like those offered by NewPower Worldwide, are designed to minimize supply chain issues and related challenges encountered if a recession impacted their supplier base. Controlling inventory and stabilizing the supply of electronic components ensures an organization thrives in an uncertain future.

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**Forward-looking companies have begun thinking about surviving and thriving in such an environment**



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# Semiconductor purchasing under the spotlight

Mouser Electronics' SVP of products, Jeff Newell, walks readers through the semiconductor sector, from lead time updates to game changing technologies

**Q** What is the latest intel on semiconductor lead times from Mouser's perspective?

**A:** Lead times are showing small signs of improvement, however we do expect supply chain instability and inflationary pressures to persist for the better part of 2022. Customers are placing orders many months ahead and the industry outlook shows robust demand for semiconductors and electronic components, particularly in the data, communication and transportation sectors.

At Mouser, our inventory position and wide selection continues to set us apart. This continues to send customers our way as they know we are an authorized distributor with the widest selection of semiconductors in the world. We do expect continued growth in semiconductor products this year as the on-order inventory becomes available to ship out to customers. The Semiconductor Industry Association (SIA) is projecting growth of about 8.8 per cent in 2022.

**Q** Are some branded components worse than others for availability?

**A:** Many of the most sought-after new products and technologies from major manufacturers are in demand and supply is strained. Of course, inventory and selection are key in times of shortages. Last year, Mouser added a record 100-plus new manufacturers to our lineup, and we stock the industry's widest product selection. In 2022, we will continue to invest in inventory and new products to serve our customer base.

Still, we are not immune to global factors and there have been extended lead times and restricted allocation on some product lines. Our teams are closely monitoring shortages and are working with manufacturers to replenish products as quickly as possible.

**Q** What customer facing on-line and software systems does Mouser offer?

**A:** Our industry-leading website offers a wealth of data for customers, including availability of

stock and lead times on products. Customers can order products and get on a waiting list to receive stock once available. Our website also provides product alternatives. Customers can expect to receive 100 per cent genuine products that are fully traceable from each manufacturer.

We also continue to develop online services and tools to assist designers and purchasing professionals. We offer an extensive library of technical resources, including a Technical Resource Center and content hub, along with product data sheets, supplier-specific reference designs, application notes, technical design information, engineering tools and other helpful information.

**Q** What are the game changing semiconductor technologies driving the sector?

**A:** It is definitely an exciting time in our industry. Whether it's new quad-channel analog-to-digital converters from Analog Devices or mixed-signal microcontrollers from Texas Instruments, buyers can count on today's manufacturers to



Mouser Electronics' SVP of products, Jeff Newell

continue to introduce smaller, faster and more powerful semiconductors with more capabilities. At Mouser we stock the widest selection in the world and are the go-to resource for buyers, whether it's to purchase new products or ask technical questions. Our technical teams can provide in-depth understanding of the latest solutions, providing customers with valuable guidance and advice.

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# Sourcing semiconductors in the age of shortages

4 Star Electronics' director of operations, Scott McKee explores the role of specialist component suppliers as buyers continue to wrestle with supply chain disruptions

Prudent procurement strategy always prioritizes purchasing through original component manufacturers or their authorized distribution partners but obsolescence, counterfeiting, shifting demand and the extreme supply chain disruptions of recent months complicate this strategy.

Aftermarket manufacturers are another authorized source not always considered by buyers searching for obsolete or long lead-time parts. Aftermarket manufacturers are authorized by the original component manufacturer (OCM) to produce and sell replacement parts, after regular production has been discontinued. Parts supplied are produced from materials that have been either transferred from the OCM to the aftermarket manufacturer or produced by the aftermarket manufacturer using OCM tooling and intellectual property.

Aftermarket manufacturers also sometimes produce parts that meet OCM specifications

by reverse engineering or redesigning the part without violating the OCM's intellectual property rights.

The open market, while inherently higher risk than authorized channels, can also be used effectively, if buyers carefully choose quality independent distributors. They help procure material from the open market when other options are unavailable and provide value with thorough purchasing support. Top tier independent distributors have sophisticated processes in place for bill-of-material and lifecycle analysis, vendor management, kitting and full purchasing outsourcing—effectively acting as purchasing departments for their customers. These distributors provide fully validated material and support counterfeit avoidance initiatives through in-house inspection and test or by partnering with established test labs.

Most quality independent distributors have developed comprehensive inventory

management programs that can identify sources of material. This is a result of years of experience dealing with counterfeit and obsolete components, plus an understanding of how to get components from people who have them to people who need them.

While independent distributors may have many sources of supply, including excess or surplus OEM inventory, OCM direct purchases, authorized distributors and multiple open market stocking sources, buyers need to use some discretion when sourcing from the open market. There are two reasons for this: thorough management of a large number of vendors can be difficult and costly; and utilizing a large number of broker or independent sources tends to drive up component costs when only a limited source of supply exists for obsolete parts or parts affected by the shortage.

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4 Star Electronics' director of operations, Scott McKee

**The open market, while inherently higher risk than authorized channels, can also be used effectively, if buyers carefully choose quality independent distributors**

# Buying bi-directional power supplies

Sager Electronics' Don Baldwin introduces bi-directional power supply technology and how, through knowledge and proper sourcing, purchasing professionals can save both time and money

It is safe to say that power supplies and power conditioning are used in every electrical and electronic application. But while many choices exist for basic power supplies, there is a newer technology on the market that warrants further education.

Descendants of the uninterruptable power supply, bi-directional power supplies are a new technology that can deliver or return energy between a load and source, adding elasticity to an always-on electronic system. What this means is when power is available from a primary source, it is used to power the load and any control circuitry. When primary power is cut, the secondary power source, normally housed by the load, can take over and keep the load and the control circuitry alive.

Like a UPS for computers, bi-directional power keeps a computer from dying if line power fails. There are

many other applications for bi-directional power supplies including solar power grid tier conversion, hybrid solar systems for households, and plug-in hybrids for electric motors with regenerative braking.

Purchasing professionals sourcing power supplies for equipment and devices that are always on should understand and consider the benefits of bi-directional power, especially those supporting requirements for communications equipment, utility-powered homes and appliances, satellites, radar, automotive and military systems. These designs are often of critical use, and lives and equipment depend on the survivability of the electronics.

While this technology is newer to the market, designing in a bi-directional power supply has a number of benefits that make it an excellent choice. AC/DC and DC/DC converters are

complex products with a large bill of materials that includes semiconductors, transformers and passive products. They typically have an 8-12 week manufacturing lead time, but over the last two years lead times have stretched from 12 to 40 to 52 weeks and beyond.

Bi-directional power supplies such as the BIC-2200 from MEAN WELL or the Calnex BCA 3000 W are complete solutions, reducing the need for multiple units and multiple parts, thereby reducing reliance on other component requirements while decreasing the weight of the overall power supply package. The timing of discharging of the BIC-2200 can be programmed to achieve peak-shaving and valley-filling, reducing electricity costs while increasing energy utilization. Another plus is that certain manufacturers such as Calnex are manufacturing bi-directional power supplies in North America, reducing



transportation issues and costs while also eliminating overseas tariffs.

With extended lead-times, ever-existent supply chain issues and mounting certification requirements, partnering with the supply chain is more critical than ever before, especially with evolving technologies like bi-directional power supplies. A distributor with a commitment to technology makes a difference, and having access to a broad power supply offering and quick-turn samples, an educated sales and engineering team, custom manufacturing solutions, and inventory services like bonded inventory, scheduled shipments, and just-in-time delivery, can help alleviate the power supply sourcing concerns of many purchasing professionals.

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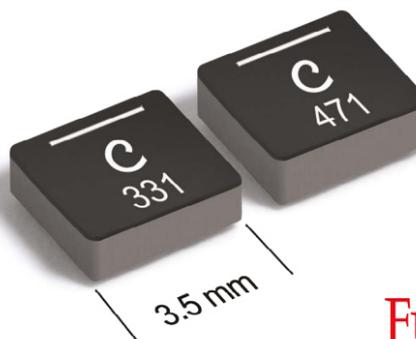
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## MANUFACTURERS ARE BECOMING RESOURCEFUL AND PLANNING FOR THE LONG-TERM TO COUNTER INDUSTRY-WIDE SHORTAGES

**A**ligning supply with surging demand in various sectors is an ongoing challenge for many manufacturers due to persistent supply chain issues. From ongoing COVID-19 outbreaks to extreme weather, workforce shortages and geopolitical conflicts, supply chain disruptions keep mounting.

The consequence: surging prices across various commodities and lead times that extend from months to years. The result: manufacturers becoming more resourceful in their supply chain strategies.

### Adjusting as the World Seems to be Running Out of Everything

The raw material shortages that have been haunting the electronic component manufacturing supply chain show little signs of subsiding. DigiTimes reports “the supply of ABF substrates will continue to be at least 20% short of demand in 2022.” Worse, new capacities are unlikely to alleviate the strain until 2023. The shortage of ABF substrate is a concern that manufacturers like Intel, Nvidia and Advanced Micro Devices Inc. (AMD) have voiced as a primary setback to their GPU, CPU and IC component production. As the competitors battle for allocation, a 20% price increase is anticipated. To alleviate some of the stress on its production, Intel is diversifying its ABF substrate sources from various suppliers in Vietnam, Japan, Taiwan and southwestern China.

Similarly, silicon price and availability are impacting silicon wafer production, which has been tight since Q3 2019. Siltronic AG, Shin-Etsu Chemical Co. Ltd and SUMCO Corporation are among the top silicon wafer manufacturers that supply wafers to chipmakers. With their output limited due to silicon shortages, the trickle-down effect is exacerbating current silicon wafer bottlenecks. For example, lead time of Diodes Incorporated parts is up to 80 plus weeks as the limited wafer availability stifles capacity.

As a result of industry-wide difficulties to allocate raw material supply for component builds, prices are expected to increase in the coming months.

### Planning to Face Workforce Shortages Head-On

In 2021, many manufacturers turned to long-term planning, leading to factory expansion as a solution to align supply with demand. This included Intel Corporation, Samsung Electronics, Micron Technologies and others investing billions of dollars to build new chipmaking facilities. However, once the factories are built, the concern is a growing scarcity of talent to fill them. As a result, some governments and regional manufacturers are investing in feeder institutions.

For example, the local Taiwanese government and chipmakers like TSMC are investing up to \$300 million in connected universities; the US passed a bill providing billions of dollars to scholarships, workforce programs and technology institutions to invest in the future semiconductor workforce; and the EU is moving to implement a Chips Act in the interest of growing its stake in semiconductor manufacturing. These investments will take time to make an impact, which means manufacturers will have to adapt to the current workforce shortages that have been plaguing production lines since 2021.

### Bracing for the Long-term

Although manufacturers are re-assessing supply chain strategies to build more resilient processes, the results will take time to manifest. This means operational setbacks will likely be felt from manufacturers to consumers throughout 2022 until a balance between supply and demand can be reached.

## PCB

# PCB sales up 16.9 per cent in December

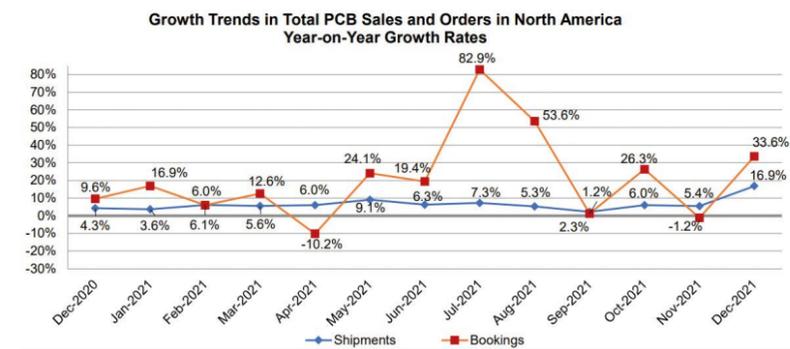
IPC has published the December 2021 findings from its North American Printed Circuit Board Statistical Program, with book-to-bill ratio standing at 1.17

Total North American PCB shipments in December 2021 were up 16.9 per cent compared to the same month last year. Compared to the preceding month, December shipments grew 21.5 per cent. PCB year-to-date bookings in December were up 33.6 per cent compared to last year. Bookings in December grew 47.1 per cent from the previous month.

IPC’s chief economist, Shawn DuBravac, said: “PCB bookings rose sharply in December 2021, the strongest month of bookings since December 2005. For the calendar year, bookings rose 19.3 per cent and shipments rose 6.7 per cent.”

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**PCB year-to-date bookings in December were up 33.6 per cent compared to last year. Bookings in December grew 47.1 per cent from the previous month**



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# Power management IC demand will slow in 2022

With slower demand, semiconductor buyers can expect modest price decreases for PMICs

James Carbone

Strong demand and a sharp increase in average prices resulted in the power management integrated circuit (PMIC) market growing 30 per cent to \$18.9 billion in 2021, according to Semico Research.

Some chipmakers reported record demand for certain power management ICs in 2021. However, unit demand and revenue growth will slow in 2022 because many OEMs and electronics manufacturing services (EMS) providers may have overbought PMICs and now have the parts in inventories and won't be placing orders at the same rate as last year, the researcher said. In 2021, unit demand increased 20 per cent to 81.8 billion units but will grow just 1.3 per cent in 2022 to 82.9 billion, according to Semico.

PMICs include linear and switching regulators, power management application specific standard products, battery charging and management chips, supervision/sequencing/motor control devices and voltage reference products.

The decline in demand growth will impact prices. Average selling prices for PMICs, which increased from \$0.211 in 2020 to \$0.232 in 2021 will fall back to \$0.221 this year, the research firm said. Weaker demand and lower prices will mean the power management IC market will decline about 3.4 per cent to \$18.3 billion, according to Semico.

However, some chipmakers say robust demand for PMICs has carried over to 2022 and demand for PMICs will continue to grow in 2022. For instance, onsemi had record demand for some PMIC chips with demand "being well beyond our capacity," according to Matthew Tyler, senior director strategy & marketing, advanced solutions group for onsemi. He said demand for multi-phase power conversion and smart power stages (SPS) has been the strongest. "We see extremely high demand for switching point-of-load regulators as well. Switched capacitor converters are emerging in some applications like high-power pre-regulation and we see growing demand.

We also see continued strong demand for linear regulators," said Tyler.

### More supply in Q2?

Jim Feldhan, Semico president, said weaker demand growth and modest declines in prices could be indicators that PMIC supply will improve for buyers, especially in the second half of 2022.

"With inventory increasing, supply should loosen up," he said. "So, for 2022 our scenario is the industry will realize that they have enough inventory and buying will ease somewhat" which may mean lower prices for some PMICs but not all. For instance, the average price of a linear regulator will decline from about \$0.089 in 2021 to \$0.082 in 2022, while the battery charging and management chip average price will drop from \$0.434 in 2021 to \$0.410 in 2022. However, switching regulator tags will increase slightly from \$0.336 to \$0.338, according to Semico.

Tyler said onsemi has "experienced significant cost increases at multiple points in our supply

chain. PMIC price increases are an unfortunate byproduct of input-cost increases." He added for now the "pricing trend in 2022 has stabilized as most suppliers have completed supply negotiations for the year. Longer term, buyers should expect modest price changes annually over the next four years, but by 2026 the average price of a PMIC will be \$0.221, the same as it was in 2021, according to Semico.

In the short term, tight supply will continue for a while, according to Tyler. "Demand for PMICs in general remains at record high levels," said Tyler. "We have experienced challenges with external suppliers who continue to see capacity limitations, which has lead onsemi to accelerate product releases in our internal factories," he said. "Given the current demand profile" for PMICs, onsemi anticipates long lead-times and supply constraints to persist through the rest of 2022 and likely beyond, said Tyler.

He added onsemi is making "significant investments" to

expand capacity by moving key technologies into 300mm manufacturing lines in an effort to optimize manufacturing efficiencies. Other chip companies are also adding capacity.

For example, Texas Instruments will begin construction of two 300mm fabs in Texas this year. But the bad news for buyers is the impact of that investment won't be felt until 2025 when the fabs are expected to begin producing chips.

### PMIC shipments to rise

The extra capacity will likely be needed because PMIC demand over the next four years will be healthy as unit shipments rise from 81.8 billion in 2021 to 101 billion in 2026, according to Semico. A lot of demand will come from several industries: smart phones, automotive and computer.

The migration from 4G to 5G cell phones will have a positive impact on power management IC demand. About 900 million 5G cell phones are expected to ship in 2022 and account for about half of all smartphone sales, according to researcher CCS Insights.

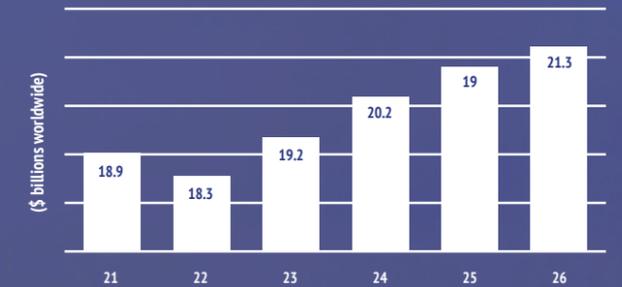
Paul Pickering, practice lead, semiconductors: power, automotive, industrial, MEMS & sensors for research firm Omdia, said 5G smartphone handsets and 5G infrastructure will drive power management usage over the next several years. The migration from 4G cell phones to 5G will result in higher PMIC demand, because 5G phones use more power management chips.

In addition, 5G infrastructure is more complex than 4G and also requires more PMICs, Pickering said. He noted because 5G phones operate at higher frequencies than 4G phones. The higher frequency meter wave frequencies used in 5G don't penetrate walls as well as 4G frequencies. That means cell phone carriers have to install many micro-base stations for 5G, which will increase overall semiconductor demand including PMICs.

Automotive will also be an important driver for power management chips for years as more electric and hybrid vehicles are built. There are more electric motors in EVs to control functions such as air conditioning and steering requiring greater power management.

The power management IC market will post continuous growth after 2022 and revenue will reach more than \$21 billion by 2026. Source: Semico Research

## PMIC to post mostly steady growth



In addition, compared to internal combustion engine vehicles, more electric vehicles are equipped with advanced driver assistance systems (ADAS). "We are finding that on a per-unit vehicle basis, electric vehicles, not only have power management in the traction part of the vehicle, but they also have higher rate of ADAS functions," said Pickering. Such systems, with features such as automatic emergency braking, and lane change and collision warning, also require more power management ICs.

need PMICs to help minimize power consumption and maximize battery life, said Pickering.

Some analysts say artificial intelligence could result in more semiconductor demand including power management ICs, but Tyler is not so sure. "Artificial intelligence has become the buzz-word du-jour and everyone is promoting a solution using "AI," he said.

"But most of that is just marketing words to describe an algorithm. AI itself beyond large scale cloud-based computing is not really a driver of upside demand," said Tyler.

Global trends including the migration to electric vehicles, industrial automation, cloud computing and 5G "continue to expand and the resulting demand for PMICs will continue to accelerate for the foreseeable future," said Tyler.

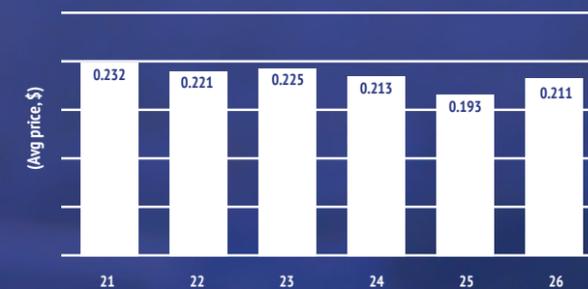
Tyler added that autonomous driving could also boost PMIC content in vehicles in the future, but "that segment is years away from driving meaningful volumes."

### Look to the cloud

Cloud-based data centers will also be a key driver of PMICs over the next four years. Data centers need PMICs to maximize energy and efficiency and reduce heat at the centers.

Other trends that will contribute to PMIC growth worldwide are devices such as smartwatches, physical activity monitors such as Fitbit-type products and portable home medical monitors. Those devices tend to be battery-operated and use less power and

## Expect small price changes for PMICs



The average price of a power management IC will be somewhat volatile over the next four years. Source: Semico Research

## By the Numbers

**\$0.221**  
The expected average selling price of a power management IC in 2022

**\$18.9 billion**  
The size of the worldwide power management integrated circuit market in 2021

**30%**  
The rate of growth of the power management IC market in 2021

**\$18.3 billion**  
The forecast size of the worldwide power management integrated circuit market in 2022

**4.4%**  
The compound annual growth rate of power management IC unit shipments from 2021-2026

**81.8 billion**  
The forecasted number of power management IC unit shipments in 2021

# Houston launchpad for APEC 2022

With APEC 2022 returning to an in-person event after two-years, electronics purchasing professionals have the opportunity to network, learn and explore new suppliers

Attendees of the Applied Power Electronics Conference (APEC 2022) will converge in Houston, TX, 20 to 24 March 2022, returning to an in-person event after two-years. The conference and exhibition will continue the long-standing tradition of addressing issues of immediate and long-term interest to the practicing power electronic engineer.

Technical content, including technical program papers,

industry sessions and professional education seminars, is offered at one of the lowest registration costs of any IEEE conference. APEC 2022 promises to provide attendees with a significant professional experience. Complete details for registering and hotel booking can be found at APEC Registration.

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Attendees at APEC technical sessions learn of the latest advances in power electronics technology

# Chip inductors suit power applications

Gowanda Electronics is using APEC 2022 to showcase the SMP0603 ceramic core chip inductor series which is designed for markets as diverse as commercial and medical

Gowanda Electronics has introduced its first ceramic core chip inductor series for power applications, the SMP0603. This series suits test and measurement, industrial control and automotive sectors. The chips can also be used in RF applications in commercial, medical and military markets.

The series was designed for power electronics needing high current ceramic chip inductors. The performance range covered by the 37 parts in the series includes 1.8nH to 27nH inductance, 0.01 to 0.04 DCR ohms and 1750 to 3400mA DC current rating.

All Gowanda chip inductors, including this series, meet a TML outgassing requirement of 1.0 per cent max when tested to ASTM E595. Standard terminations are gold-plated nickel and RoHS-compliant.

The inductors are designed with a flat top cover for pick and place assembly and suit reflow soldering. Operating temperature range is -40 to 125°C.

Gowanda's chip inductors utilize co-fired terminations and fully encapsulated designs to address needs for chemical resistance, vibration/

shear resistance, electrical/mechanical integrity, durability during handling/processing and implantable device components (human body).

This product line expansion leverages the company's similarly-sized CC0603 ceramic chip RF inductor series which has been optimized for higher current to suit power applications.

Gowanda offers numerous RF chip inductor series including QPL versions for military applications.

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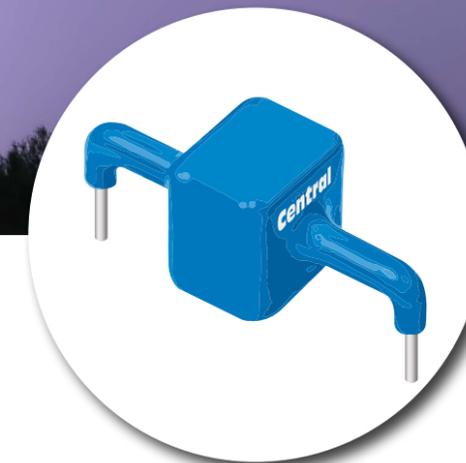


Gowanda SMP0603 Series

# When damage from high power transients is not an option



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## Protect your designs with high power transient voltage suppressors

CAK3-012C Series: 3kA | 12V-380V  
CAK6-042C Series: 6kA | 42V-240V

The CAK3 & CAK6 series transient voltage suppressors (TVS) are bi-directional glass passivated junction devices, designed to protect voltage-sensitive components from high energy transients most directly associated with lightning strikes and inductive load switching. These highly energy efficient devices also feature a tight clamping ratio ( $V_C/V_{RWM}$ ) to ensure fast and precise protection of sensitive electronics, and have no inherent wear-out mechanism, common with metal oxide varistor (MOV) type components.

### Features

- Bi-directional TVS
- Wide voltage range
- ESD protection of data lines in accordance with IEC 61000-4-2
- RoHS and REACH compliant
- Halogen free

### Applications

- High power AC/DC line surge protection
- 5G telecom systems

### Benefits

- Energy efficiency
- Glass passivated chip for optimum reliability
- Very low clamping voltage (as low as 28V)

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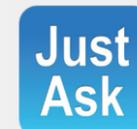
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Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
<b>ACOUSTIC COMPONENTS</b>											
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
<b>CABLE &amp; WIRING</b>											
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
<b>CIRCUIT PROTECTION</b>											
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
<b>DISPLAYS &amp; LEDs</b>											
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
<b>ELECTROMECHANICAL</b>											
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

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# Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
<b>ELECTROMECHANICAL (Continued)</b>											
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
<b>ENCLOSURES</b>											
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
METCASE Enclosures	OKW Enclosures, Inc. (800) 965-9872	www.metcaseusa.com			322	N/A	\$0	N/A	10	20	Y
New Age Enclosures	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
OKW Gehäusesysteme GmbH	OKW Enclosures, Inc. (800) 965-9872	www.okwenclosures.com			2,450	N/A	\$0	N/A	10	20	Y
ROLEC Gehäuse-Systeme GmbH	ROLEC Enclosures Inc (888) 658-5774	www.rolec-usa.com			1,960	N/A	\$0	N/A	4	6	Y
<b>FREQUENCY MANAGEMENT</b>											
Abracorp Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,780	N/A	\$0	100%	50	1,000+	Y
CTS Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,889	N/A	\$0	100%	50	1,000+	Y
ECS Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,070	N/A	\$0	100%	50	1,000+	Y
Epson Toyocom	Mouser Electronics	800-346-6873	www.mouser.com	Y	178	N/A	\$0	100%	50	1,000+	Y
IQD Frequency Products	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Kyocera	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Silicon Labs	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
<b>ICs &amp; SEMICONDUCTORS</b>											
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

# 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
<b>INTERCONNECTION</b>											
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
Active (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
JA 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
<b>OBSOLESCENCE / HARD TO FIND</b>											
	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
<b>OPTO ELECTRONICS</b>											
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
<b>PASSIVES</b>											
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											

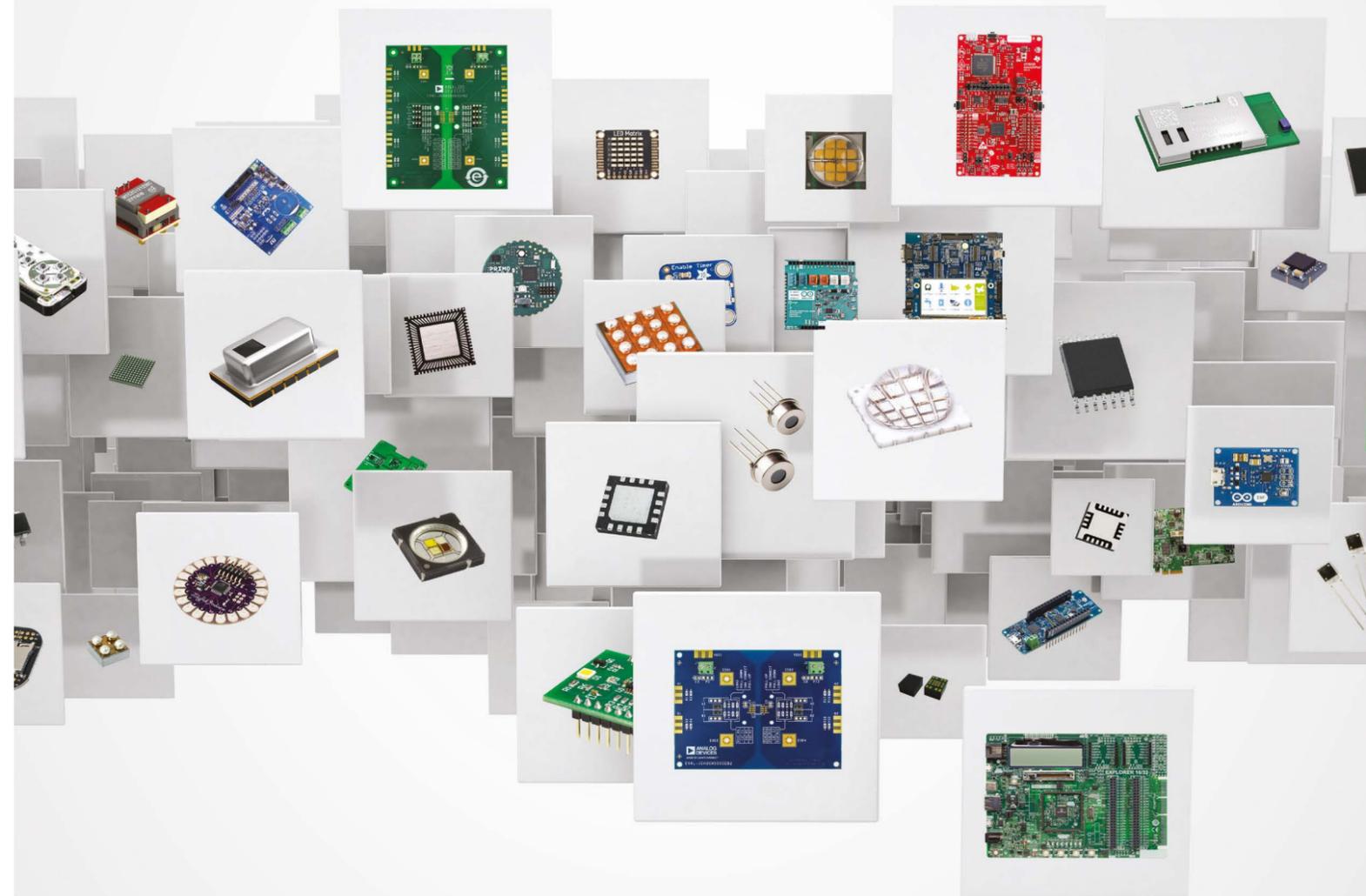
# Buyers' Guide

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
<b>PASSIVES (Continued)</b>											
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,663	N/A	\$0	100.00%	50	1,000+	Y
TT Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
United Chemi-Con (UCC)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	102,917	N/A	\$0	64.00%	50	1,000+	Y
Würth	Mouser Electronics	800-346-6873	www.mouser.com	Y	934	N/A	\$0	99.00%	50	1,000+	Y
Yageo Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,246	N/A	\$0	100.00%	50	1,000+	Y
<b>POWER &amp; BATTERIES</b>											
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
<b>REED SWITCHES</b>											
HSI Sensing	HSI Sensing	405-224-4046	www.hsisensing.com	M	75	N/A	\$200	100.00%	15	275	N
<b>SENSORS</b>											
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
<b>SWITCHES &amp; KEYBOARDS</b>											
OTTO	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>TEST &amp; MEASUREMENT</b>											
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
Lasca 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
<b>THERMAL MANAGEMENT</b>											
Materials Direct	Materials Direct	+44 (0)1908 222 211	www.materials-direct.com	N/A	N/A	£1,000,000	N/A	N/A	5	55	Y
Universal Science	Universal Science	+44 (0)1908 222 211	www.universal-science.com	N/A	N/A	£1,000,000	N/A	N/A	5	55	Y

## Contract Manufacturers Buyers' Guide

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

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## Inside Sales

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