

ELECTRONICS

sourcing

OCTOBER 2021

NORTH AMERICA

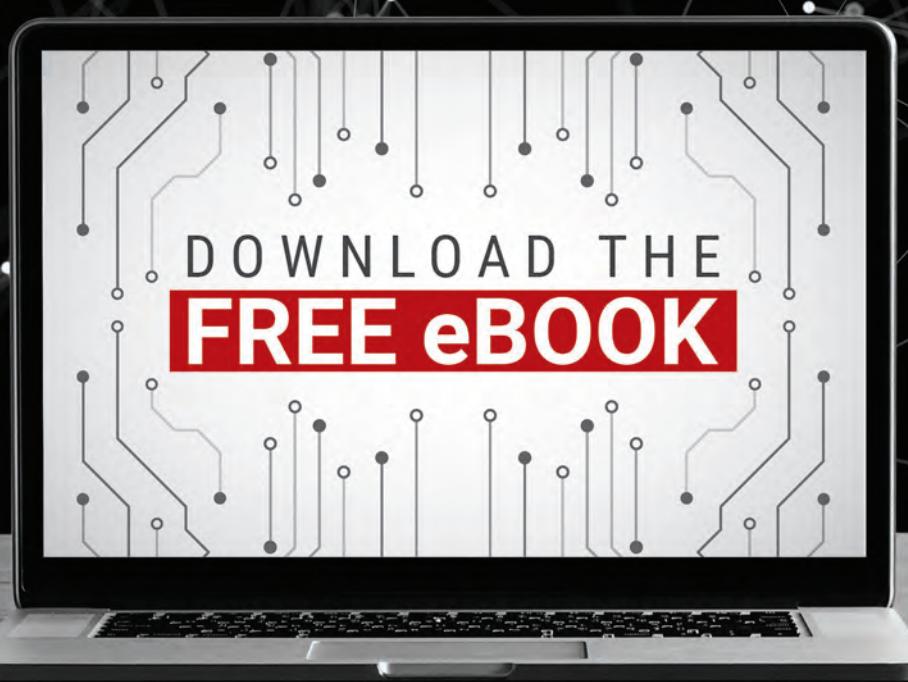


**INFLATION,
LEAD-TIMES
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On the cover – October 2021

Inflation, lead-times and the drive for innovation
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Editor's Word



What is money?

For the past 30-years I've a standard opening question for people who introduce themselves as working for the financial services industry: what is money? For every person I ask I get a different reply, it's a: store of wealth; medium of exchange; tool of power; casino; etc, etc. It seems like money is whatever you want it to be.

I've decided to abandon any hope of rationalising all these possible meanings and focus on a simple explanation which I can understand, remember and seems to be in touch with my reality. Firstly, I see money simply as just another 'thing'. Secondly, I believe the more of a 'thing' there is, the less people want it and vice versa.

So, applying the actions of governments and citizens over the last 18-months there are significantly more 'money things' and significantly less 'product things'. I believe this is called inflation.

In the electronics distribution industry this means longer lead times and rising prices at a scale which some distributors state they have never witnessed looking back over 40-years of data. Looking at the duration of these challenges, some commentators are quoting 2023 as a minimum.

So, what can be done? In my opinion, now is the time for the distribution industry's innovators to make their moves. Standard cost reduction is one thing, redefining where new value can be found in tomorrow's component distribution model is another.

Am I seeing this? Yes I am. I'm talking to new people, about new technologies and new business models which will be appearing in this magazine over coming months. Just wait and see.

Jon Barrett

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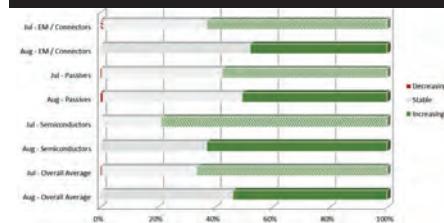
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Product combinations reduce time-to-market

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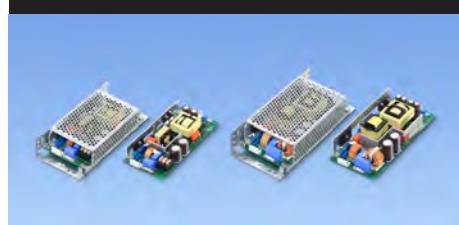
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Product combinations reduce time-to-market

Digi-Key has confirmed its continued support of the Renesas Electronics and Dialog Semiconductor product portfolio, following their merger. As an immediate benefit, Digi-Key has announced five new product combinations from Renesas and Dialog, including: 100W adapter with power delivery and wireless charger; smart asset tracking label; smart connected pulse oximeter; smart ToF-based rangefinder with mobile app; and smart lock with super low power Wi-Fi and BLE.

These designs showcase both Renesas' and Dialog's complementary, and now combined, product portfolios for embedded processing, analog, power and connectivity. With these engineering-vetted designs, customers can take advantage of an elevated platform for their design ideas, accelerating the product development cycle and lowering the overall risk to bring their designs to market.

Digi-Key's vice president of global supplier management, David Stein, said: "We are proud to support the completion of the merger between Renesas and Dialog by offering new winning combinations from their extensive product portfolio. These combinations capture and highlight the technological advantages provided by the newly combined company."

www.digikey.com



Power for cost-critical applications

Sager Electronics is now stocking Traco Power's TXLN series of AC/DC power supplies. Delivering 12 power levels covering 18 to 960W, the TXLN series AC/DC power supplies are designed for cost-critical applications. Its low-profile metal case and screw terminal block connection are designed for easy installation. The series features efficiencies of up to 91 per cent, with a universal input, active PFC starting at 150W and output voltages ranging from 3.3 to 48VDC.

www.sager.com



Supporting antenna solutions worldwide

Following last year's announcement of the acquisition of SANAV by Unictron Technologies Corporation, RFMW and Unictron have announced their continued distribution relationship, allowing RFMW to promote and sell the full portfolio of Unictron antenna solutions worldwide.

Under the agreement, RFMW will support Unictron's antenna activity, including sales of their GPS, GNSS, UHF, WiFi, 4G, 5G NR and MIMO antennas. Unictron offers internal and external antenna solutions for applications including telematics, smart home, public safety, M2M, wearables and smart agriculture.

With this announcement RFMW will continue to support former SANAV solutions under the Unictron brand, plus the expanded Unictron portfolio of antenna solutions.

www.rfmw.com

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In Brief

Mobile friendly connector website

CDM Electronics, an authorized distributor of mission-critical connectors and cables, has launched a mobile friendly website. The platform lets users filter over 133,000 part numbers, corresponding photos, drawings and spec sheets. Up-to-the-minute pricing and availability further simplify the online purchasing process.
www.cdmelectronics.com

New component website and branding

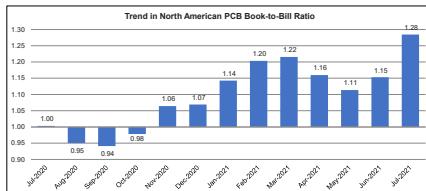
RCD Components has announced a new website and brand identity. The rebrand reflects RCD's new perspective as it joins the iNRCORE family of companies. The three letters of the company's name are interconnected to illustrate the infinite. The revamped website incorporates a new navigation menu and extensive technical information designed to enhance visitor interaction.
www.rcdcomponents.com

Buying into design

Exponential Technology Group has acquired engineering design company Paragon Innovations. XTG president, Michael Knight, said: "Paragon has a remarkable reputation helping OEMs bring innovative new products to market. Paragon's involvement runs from conceiving through full product design, proof of concept, testing/certification and readiness for manufacturing."
www.paragoninnovations.com

Investing in local motor production

Vacuumschmelze has partnered with EuroGroup to establish local production in the Americas. The expansion of VAC's soft magnetic alloy capability, including cobalt iron stator solutions, coupled with EuroGroup's stamping and manufacturing expertise provides a locally integrated supply chain for aerospace, automotive, medical and industrial sectors.
www.vacuumschmelze.com



Note: 2020 ratios have been revised since their original publication due to updated statistical program participation.

North American PCB sales up 7.3 per cent in July

IPC has announced the July 2021 findings from its North American Printed Circuit Board (PCB) Statistical Program. Book-to-bill ratio stands at 1.29. Total North American PCB shipments in July 2021 were up 7.3 per cent compared to the same month last year. Compared to the preceding month, July shipments fell 15.8 per cent. PCB year-to-date bookings in July were up 18.6 per cent compared to last year. Bookings in July fell 4.3 per cent from the previous month.

IPC's chief economist, Shawn DuBravac, said: "The North American PCB sector continues to see strong demand, but supply chain shortages are slowing shipments, leading to a growing backlog. The book-to-bill of 1.29 is a historic high, going back to the start of the IPC PCB report in 1991."

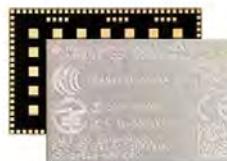
www.ipc.org

Tiny proximity sensor in stock

Mouser is now stocking ams' TMD2712 ambient light and proximity sensor which incorporates an infrared VCSEL and factory-calibrated VCSEL driver in a tiny 1 by 2mm module. The TMD2712 features proximity detection that provides object detection by photodiode detection of reflected IR energy (sourced by the integrated VCSEL).

Applications include mobile phone display and proximity management, and user proximity detection and ambient light measurement for wearables.

www.mouser.com



Compact power management solution ready to ship

Newark has expanded its Nordic Semiconductor portfolio with the nPM1100 Power Management IC (PMIC). Typical applications include wearable electronics, remote controls, personal medical devices and smart home sensors.

The nPM1100 can be used as a generic PMIC for any application using rechargeable Li-ion/Li-Po batteries. Its compact form factor, with PCB space requirements as low as 23mm², suits advanced wearables, connected medical devices and other space constrained applications. The device requires no configuration software to operate as settings are pin configurable.

Newark's global head of semiconductors and single board computing, Lee Turner, said: "The new-to-market nPM1100 is an ideal solution to help our customers reduce energy consumption in their designs. The ability to charge small batteries and extend battery life while providing efficient power management within small, space constrained applications, such as wearables and connected medical devices, is now of critical importance."

www.newark.com





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Global semiconductor sales up 29 per cent year-to-year

Significant increase in global semiconductor sales is underpinned by the industry's efforts to address high demand across regions and product categories

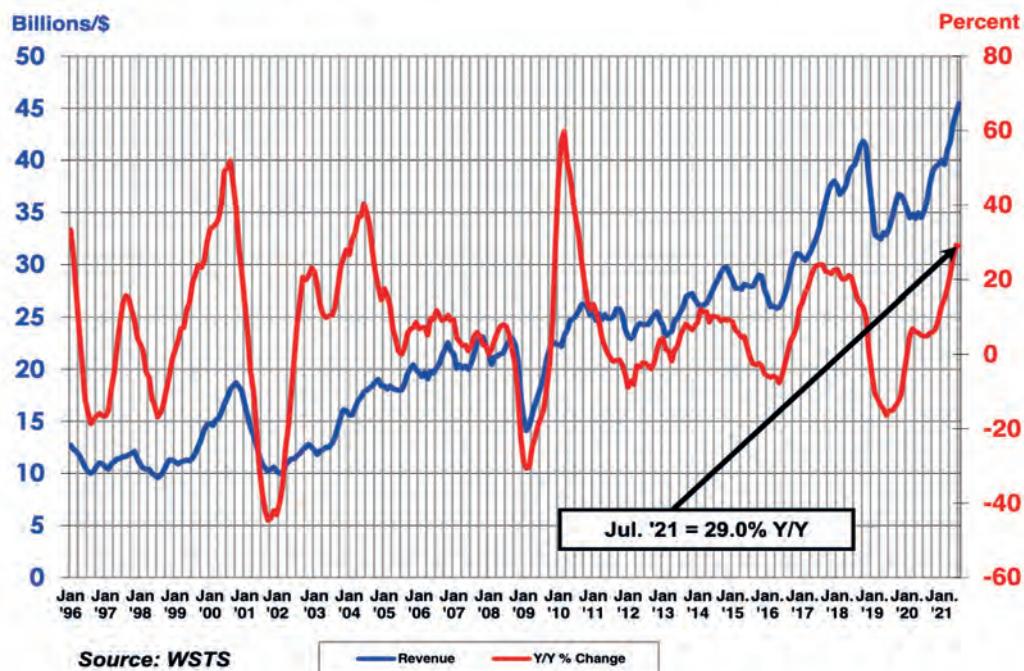
The Semiconductor Industry Association (SIA) has announced global semiconductor industry sales in July 2021 were \$45.4 billion, an increase of 29 per cent over the July 2020 total of \$35.2 billion and 2.1 per cent more than the June 2021 total of \$44.5 billion. Monthly sales are compiled by the World Semiconductor Trade Statistics (WSTS) organization and represent a three-month moving average.

SIA president and CEO, John Neuffer, said: "Global semiconductor sales remained strong in July, with robust demand across all major regional markets and semiconductor product categories. Chip production and shipments have reached all-time highs in recent months as the industry works to address sustained high demand."

www.semiconductors.org

Worldwide Semiconductor Revenues

Year-to-Year Percent Change



July 2021				Worldwide semiconductor revenues sales breakdown			
Billions							
Month-to-Month Sales				Year-to-Year Sales			
Market	Last Month	Current Month	% Change	Market	Last Year	Current Month	% Change
Americas	9.38	9.77	4.2%	Americas	7.71	9.77	26.8%
Europe	3.87	3.84	-0.8%	Europe	2.78	3.84	38.0%
Japan	3.50	3.62	3.2%	Japan	2.99	3.62	20.9%
China	15.66	15.85	1.2%	China	12.30	15.85	28.9%
Asia Pacific/All Other	12.12	12.37	2.0%	Asia Pacific/All Other	9.45	12.37	30.9%
Total	44.53	45.44	2.1%	Total	35.23	45.44	29.0%



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Component sales growth sees continued cooling trend

ECIA's Electronic Component Sales Trend (ECST) surveys for August and Q3 2021 show a continuing but moderating cooling of sales expectations

Following the 157.7 peak in overall component average sentiment in March 2021, the index began a decline that saw a significant drop in June. However, the index for July, August and the September forecast has seen a moderating decline of month-to-month sales growth momentum. The average decline was -2.2 points compared to June's -19.2 points drop.

The assessment of overall end-market demand provides an encouraging sign as the index score remains stable between August and the outlook for September at 115.4. It is important to remember a score above 100 indicates growth expectations. However, the decline shows an ongoing cooling in growth expectations.

The quarterly survey results present a similar picture through the end 2021. A comparison between growth expectations for Q3 2021 and Q4 2021 shows continued optimism for sales growth in both Q3 and Q4. The more modest growth picture for the remainder of 2021 should offer some relief to suppliers and supply chain managers as they have been challenged by demand outstripping supply in many areas, resulting in inventory shortages and extended lead times.

Concerns and uncertainty related to the economy, emergence of inflationary pressure and resurgence of Covid-19 with potential

shutdowns could account for the continuing shift of sentiment. Also, supply chain challenges likely add to the concerns as supply constraints in one category have a ripple effect on demand in other areas.

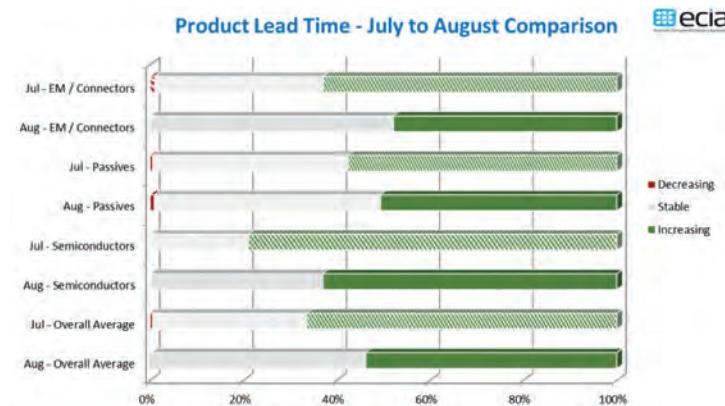
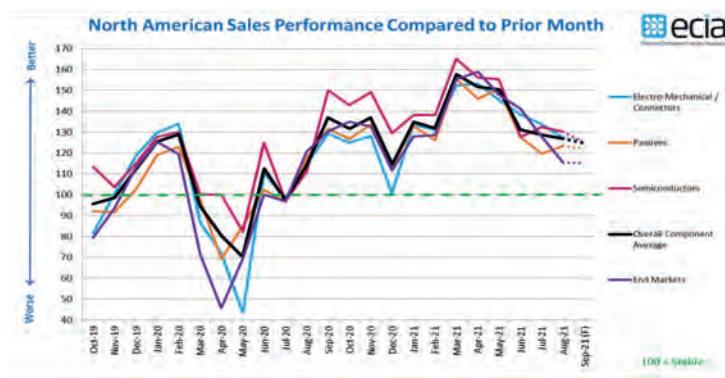
Within individual market segments avionics/military/ space and medical equipment have the brightest outlook for September followed by telecom networks and industrial electronics. Expectations for consumer electronics and telecom mobile phones are essentially flat. Automotive electronics saw the biggest drop in expectations for September compared to August.

There is certainly cause for optimism looking forward as the continued introduction and market adoption of exciting new technologies should motivate both corporate and consumer demand for next-generation products over a growth cycle that appears to have legs.

Given the decreasing pressure on growth it would be expected that upward pressure on lead times might be reduced. This was not the case between the June and July assessments. But the most recent survey shows significant easing on product lead time pressures across all categories moving from July to August. The data presented in the full report show that discrete semiconductors and

capacitors experienced the strongest lead time pressure in August. However, all product categories saw a notable reduction in lead time pressure in August compared to July. But a note of caution, in a separate question on the level of inventories, survey participants reported low to extremely low inventories for between 66 and 93 per cent across component categories. DRAM and data flash memory were under the greatest pressure.

ecianow.org



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Semiconductor distributors see strong demand, higher sales

Integrated circuit and discrete semiconductor revenue growth for distributors may top 25 per cent in 2021



James Carbone

Distributors that specialize in semiconductors or derive a large percentage of their revenue from sales of integrated circuits and discretes are posting strong revenue growth in 2021 and some may post record chip revenue.

Demand for semiconductors is robust across a wide range of customer segments including industrial, wireless communications, consumer, computer, automotive, commercial, aerospace and defense. Strong demand has outpaced production capacity resulting in higher prices, which is contributing to revenue growth for distributors.

Distributors are seeing strong sales of microcontrollers, MOSFETs, power ICs, discretes and analog chips. World Semiconductor Trade Statistics says overall semiconductor revenue will rise 25 per cent in 2021 as sales reach \$551 billion. Memory ICs will have the strongest growth areas as sales rise 36 per cent. Analog sales will increase 29 per cent; logic, 26 per cent; sensors, 24.8 per cent and discretes, 23.5 per cent, according to WSTS.

Many distributors are expecting strong chip sales for the rest of 2021 and into the first quarter of 2022. One specialist distributor that has posted strong sales this year is RFMW which specializes in RF and microwave semiconductors.

"RFMW has definitely seen

major sales growth on all of our lines," said Joel Levine, president and CEO of the distributor. He said demand and prices are rising especially on the RF/MW semiconductors needed for the telecom markets. "Demand is up, deliveries are long, and people are scrambling for devices," said Levine.

Strong demand, longer lead times
He said demand is up across all segments particularly for wireless telecom, aerospace and defense. "Commercial avionics customers are coming back finally as well as emerging applications for RF in the industrial space," he said.

He said there are long lead time for many silicon-based semiconductors and delivery times are projected to continue into the middle of 2022. He noted that semiconductor manufacturers are adding capacity but "it probably won't affect the near-term deliveries." It's a different case with gallium arsenide (GaA) and gallium nitride (GaN) semiconductors. "We don't see as much constrained supply for those segments except for package supply issues in some instances," said Levine.

He said the slowdown in demand that occurred in March and April of last year was due to the pandemic, but sales came "roaring back with major bookings and shipments increasing and growing each quarter." He said deliveries that were affected by COVID were primarily due to factories in Asia being closed from time to time with



Greg Peloquin, executive vice president of Richardson Electronics' power and microwave technologies group

outbreaks. He added there are still some "delivery glitches" due to COVID-19 but the bigger problem is strong demand and limited available capacity in wafer fabs and in packaging because of some of the unique packages and materials used in RF/MW devices, Levine said.

Strong demand for RF, MW ICs
At Richardson Electronics, sales of RF and power ICs are growing 30-40 per cent so far this year, said Greg Peloquin, executive vice president of Richardson Electronics' power and microwave technologies group. Richardson derives about 50 per cent of its revenue from semiconductors including RF, microwave and power semiconductors. Last year when the pandemic slowed production of a number

"I don't think we will see anything close to normal lead-times until the second half of 2022"

of electronics manufacturers Richardson's chip business was healthy. "As I said to our team many times last year, demand for our products and capabilities did not go away with the pandemic."

In 2021 business is better. "On the RF side, 5G infrastructure rollout has been expedited while satellite communications (Satcom) is exploding," which is driving demand. He noted that the "go to market" strategies for businesses are changing because of the pandemic. He said there is growing demand for people to be able to "send and receive large amounts of data fast in remote locations."

"As a result, there is greater need for 5G infrastructure or satellite communications when



Joel Levine, president and CEO of RFMW

"RFMW has definitely seen major sales growth on all of our lines"



5G is not available. The buildout of 5G infrastructure satellite communications is helping drive RF and power management chips among other semiconductors.

EVs help drive chip sales
Peloquin added that electric vehicles, and battery chargers are also helping drive demand for power management chips. Healthy, if not stellar demand for semiconductors will likely continue until at least the first half of 2022.

"Our book-to-bill for the first six months of 2021 is 1.48 and business is growing 40 per cent," said Peloquin.

Peloquin said there are shortages of semiconductors that Richardson carries but "we have been able to manage our power management and RF and wireless products from our franchised suppliers." He added Richardson is working with its suppliers daily sharing forecasts to make sure "we are able to meet our current new customers' needs."

Peloquin said supply tightness will continue through the year to 2022. "I don't think we will see anything close to normal lead-times until the second half of 2022," he said. "We will continue to see improvement but will not get back to historical lead-times until the second half of 2022."

Rick Marano, president of Arrow Electronics' Americas components business, agrees and said there are no indications that supply will loosen any time soon. He noted many chipmakers have announced they were increasing capacity. "This is true with the products that Arrow sells including embedded and connectivity products," he said. However, "given the complex nature of the semiconductor manufacturing process, it will take time for these investments to come online," said Marano.

The pandemic impacted Arrow's business last year and "we are still feeling the effects today." The semiconductor supply chain is global and reliant on multiple industries and vendors who are geographically dispersed, Marano noted. "As the pandemic moved its way around the world and increased in severity, national and local governments dealt with the situation as they best saw fit," he said. Shutdowns impacted nearly every portion of the supply chain. "This has a compounding effect, with the end result being significant delivery delays," said Marano.

Demand evenly spread
It's a different scenario this year. Demand is stronger and the increase is relatively evenly split across our various customer segments, primarily due to the

fact that most manufacturing companies are seeking to bolster their supply chain," he said. However, it is hard to "point to any specific segment outperforming others," said Marano.

With Avnet strong semiconductor demand is coming from industrial, consumer, automotive and commercial aerospace, said Tony Roybal, president, Avnet Americas. "Industrial is one of our largest segments and is very diverse," said Roybal. Industrial includes more than just factory automation.

"In the industrial segment we're seeing a long tail customers in applications that you wouldn't normally think of," said Roybal. For example, in the dairy industry, companies need chips to help track livestock with IoT applications.

In the beer distribution industry, they are tracking uses and consumption of beer on taps. "Produce is another interesting application as there is significant waste from spoilage in produce with significant percentage going bad before it gets to market," said Roybal.

Using available technology, crop yields can be improved by farmers by carefully monitoring temperature and soil conditions and making necessary adjustments in watering and fertilizing crops, he said.

He said in the consumer segment, connectivity is driving demand. The fastest growing segment in consumer is gaming. "Not only are more people at home, but there's more demand for immersive, virtual experiences in this ever-growing work-learn-play from home environment," said Roybal.

Avnet is also seeing rising demand from the automotive supply chain. "Automotive is unique in that demand for electronic components from automotive prior to the coronavirus downturn," he said. Demand continues to rise because of advanced driving systems and electric vehicles. "Add to this trend the government regulatory requirements for more electric vehicles to be produced going forward and we can expect steady growth in this segment for years to come," said Roybal. Avnet is also seeing "a spike in demand that parallels the automotive industry from commercial aerospace due to major satellite constellation and ecosystem deployments," said Roybal.

Big and growing bigger

In this article New Venture Research explores the magnitude and future growth of China's original equipment market

Virtually every nation has felt the effects of Covid-19 but some appear to be recovering faster than others. China has proven to be a resilient nation, bouncing back strongly. After seeing its economy shrink by nearly seven per cent in Q1 2020—the first contraction of China's economy since records began in 1992—the centrally controlled economy almost immediately began rebounding, ending the year by growing its real GDP by 2.3 per cent, the highest among the G20 according to the OECD. This meant China's electronics assembly value reached a new high of nearly

\$346.3 billion in 2020, nearly half of the entire Asia/Pacific (APAC) market according to NVR's latest report, *OEM Electronics Manufacturing in China, 2021 Edition*.

The report focusses on China's original equipment manufacturer (OEM) market. These companies are often large corporations manufacturing products using their own brand or label. While often outsourcing assembly, OEMs design and ultimately own their products' intellectual property rights. Table 1 shows the forecast of assembly value (electronics

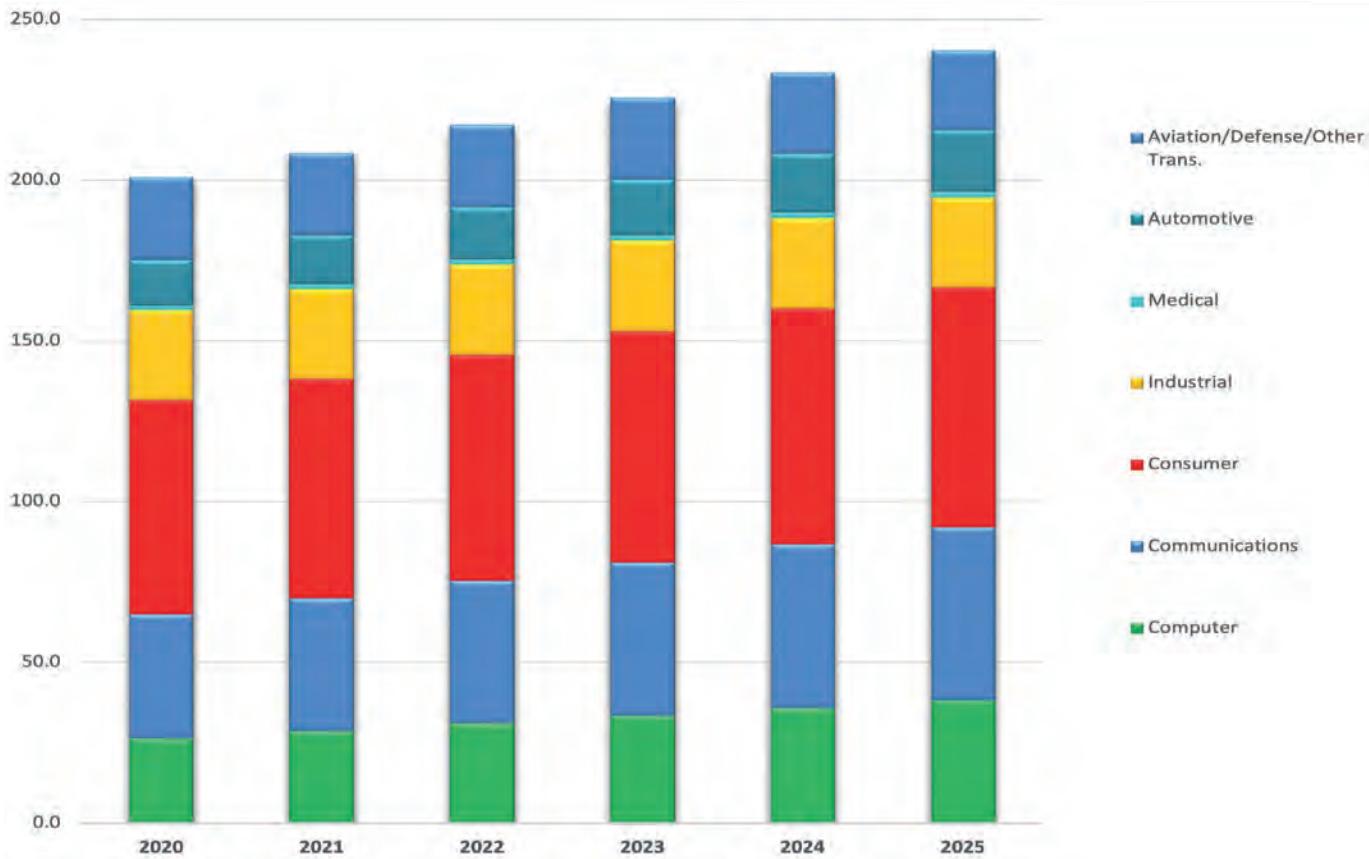
cost of goods sold, COGS) of this category. In 2020, the total market for OEM suppliers was about \$201.1 billion, accounting for more than 58 per cent of the total China electronics market. OEMs will grow through 2025 at a CAGR of 3.6 per cent, to a total of \$240.5 billion. However, it's per cent of the total market will decline slightly as more suppliers rely on contract manufacturing, and especially EMS, firms.

Figure 1 shows the forecast of China's OEM assembly value by industry segment for 2020 through 2025. The total



Virtually every nation has felt the effects of Covid-19 but some appear to be recovering faster than others

Figure 1: China OEMs' assembly value by industry segment (\$B), 2020-2025



Market Research

China OEM market was nearly \$201.1 billion in 2020 and will grow to \$240.5 billion by 2025, a CAGR of 3.6 per cent, more than three times the rate of growth of COGS outside China.

Computers will be the fastest growing industry segment as the industry recovers from a shortage of semiconductor components and a gradual shift away from consumer electronics products. Thus, computer products will grow fastest with a CAGR of 7.6 per cent. The communications sector will also grow sharply, though slightly less quickly, at a CAGR of 6.9 per cent. Medical and automotive products will also grow at a CAGR of 6.7 per cent and 6.0 per cent, respectively. Consumer products are by far the largest industry segment for China OEMs in 2020. However, in part because of increasing outsourcing among consumer OEMs to

large EMS firms, the growth of this industry segment will be much slower—just 2.3 per cent CAGR.

OEMs profiled in this report include many of the world's largest electronics companies. Leading OEMs with Chinese assembly facilities include Samsung, Sony, Panasonic and Robert Bosch. However, China-based OEMs dominate within the China domestic market. Table 2 shows the China-only revenues of the top ten OEM suppliers operating in China in 2020. Although there are hundreds of OEMs manufacturing in China, the top ten alone accounts for more than half of revenues earned through operations in China, and based on 2020 revenues, eight of the top ten OEMs in China are headquartered in China.

www.newventureresearch.com

Table 2
Leading China OEM Suppliers, 2020

Company	Headquarters	China Rev. (\$M)	Market Share (%)
Huawei Investment & Holding Co., Ltd.	Shenzhen, Guangdong, China	84,718.0	16.5%
China Aerospace Science and Technology Corp. (CASC)	Beijing, China	34,328.9	6.7%
China Electronics Technology Group Corp. (CETC)	Beijing, China	32,679.3	6.4%
Samsung Electronics Co., Ltd.	Suwon, South Korea	32,024.3	6.3%
Midea Group Co., Ltd.	Foshan, Guangdong, China	23,174.3	4.5%
Haier Smart Home Co., Ltd.	Qingdao, Shandong, China	15,596.0	3.0%
Gree Electric Appliances, Inc. of Zhuhai	Zhuhai, Guangdong, China	14,816.8	2.9%
Robert Bosch GmbH	Gerlingen, Germany	12,402.3	2.4%
Lenovo Group Limited	Hong Kong, China	10,858.0	2.1%
ZTE Corporation	Shenzhen, Guangdong, China	9,856.5	1.9%
Others		241,573.9	47.2%
Total		\$12,028.4	100.0%

Table 2: Leading China OEM suppliers, 2020

Table 1: China OEM electronics assembly value, 2020-2025

Table 1 China OEM Electronics Assembly Value, 2020–2025

	2020	2021	2022	2023	2024	2025	CAGR
Assembly Value (\$M)							
Total China Market	346,255.8	361,432.9	378,037.6	394,004.9	409,105.9	423,302.3	4.1%
OEM Assembly Value	201,066.5	208,506.0	217,263.3	225,737.6	233,512.9	240,460.7	3.6%
Percent of Total Market (%)	58.1%	57.7%	57.5%	57.3%	57.1%	56.8%	

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Breathing life into obsolete medical device designs

Rochester Electronics' technical sales manager EMEA, Ken Greenwood, provides a step-by-step guide to managing obsolescence in medical environments

Biomedical devices are categorized in terms of risk to the patient. Class I devices with low/moderate risk to health; Class II intermediate risk equipment such as Ultra/CT scanners; and Class III/IV devices critical to sustaining life such as dialysis equipment and pacemakers.

As the risk to patients rises, so do the certification costs. Original designs need to be maintained 'as-is' for as long as possible. Semiconductor obsolescence presents a serious challenge to the support of biomedical products with long in-service lives and committed maintenance periods.

It is not uncommon for large medical systems to have a concept-to-end-of-life lifecycle of 20 years, including in-service support. By contrast, semiconductor lifecycles continue to shorten especially those of the key processor/FPGA/memory components. It is inevitable that a supply gap of some kind will need to be bridged.

Component obsolescence might be undesirable, but it is generally manageable, at a cost. Typically, end-users commit to a last-time-buy of finished components and the safe long-term storage of the semiconductors—often through a third party because the storage and handling of ICs require special conditions. While this solution ties up cash in long-term component and storage costs, at least precious design and qualification resources are spared. Where future demand exactly matches last-time-buy supply, this is a perfectly adequate solution.

However, as the pandemic took hold, there was a sudden and unpredicted demand for ventilators. Component stocks at the main-line distributors were quickly consumed, and when the semiconductor suppliers themselves were unable to increase capacity, a critical supply gap soon developed.

During this time, approving alternative IC sources, or a full product redesign was not possible given the re-qualification timescales. This is especially true where component obsolescence also impacted software performance.

To bridge the supply chain gap, ventilator manufacturers looked to breathe life into discontinued systems to fulfill this critical need. By using previously approved ICs, such as older die iterations, or by resurrecting older system designs, production was able to continue.

Authorized distributors, such as Rochester Electronics, are the trusted source for discontinued semiconductors after end-of-life. Stock remains fully authorized, stored under AS6496 conditions, providing a risk-free source of supply.

Additionally, partnering with a licensed semiconductor manufacturer, such as Rochester Electronics, can mitigate the risks of component end-of-life. A licensed manufacturer can produce devices no longer supplied by the OCM. When a component is discontinued, the remaining tested wafer and

die, the assembly processes, and the original test IP, are transferred to the licensed manufacturer by the OCM. This means that previously discontinued components are still available newly manufactured, and 100 per cent in compliance with the original specifications. No additional qualification is required or software changes.

It is essential for companies in the medical sector to:

- Insist on the maximum number of cross-references from the design phase onwards
- Plan component purchases further in advance
- Consider carrying more inventory of critical semiconductors
- Monitor lead-times and component lifecycles regularly
- Understand supply risks and prepare dual/multi-sourcing strategies to cover all eventualities
- Partner with an authorized distributor and/or licensed manufacturer to help manage and maintain consistent longevity of supply

www.rocelec.com



Rochester Electronics' technical sales manager EMEA, Ken Greenwood





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Crystal and oscillator supply disrupted too

In this article, Dove Electronic Components explains how the crystal and oscillator market has been impacted by issues ranging from the pandemic to factory fires

Dove Electronic Components has never seen anything like this market in its 38-years. As a pioneer of distribution-based sales of frequency control products, the company has seen a lot in its four decades in business. The closest comparable period was the hyped market 20-years ago during the dot.com bubble of 1999/2000. At that time the longest delivery was 32-weeks on products that were normally 10 to 12 weeks. This market is another animal entirely, with multiple factors converging to create disruptions and delays never before seen.

Deliveries are now quoted in months. In electronic component distribution we're all accustomed to deliveries quoted in weeks. Crystal and oscillator devices, in normal conditions, would run from eight to 16-weeks with complex devices (often military or space) running 20 to 30-weeks. In this market 20-weeks is considered a good delivery that we encourage customers to jump on when we quote. We joke 20-weeks is the new four weeks and 32-weeks is the new eight to 12-weeks.

How did we get here? Obviously, the overwhelming global impact of Covid-19 provides the backdrop. We are mindful of those affected by Covid-19. We get information from suppliers, associations, publications and day-to-day dealings with customers. We feel the rollout of the China Tariffs in July 2018 was a starting point. It seemed this industry had just weeks' notice to deal with this enormous logistical issue.

Suppliers shipping to the US felt pressure from customers to produce products anywhere but China. Moving production or selecting another supplier partner doesn't happen overnight.

The widely used 32.768kHz tuning fork crystal is produced by a small number of volume manufacturers yet sold by probably hundreds of crystal and oscillator companies. This puts an enormous demand

on the few manufacturers. One larger company exited the market, accounting for 20 per cent of production from reports we've heard. Remaining manufacturers had to pick up the slack. The 32.768kHz crystal was already on allocation in some cases well before Covid-19.

Rolling closures due to the pandemic started in March 2020. We did not know how the industry would react. We were pleasantly surprised with the initial uptick in business driven by medical electronics. Business has remained strong, but disruptions affecting lead-times are much worse. Pent-up demand for all product types has pushed the industry to the limit.

In late October 2020 there was a fire at Asahi Kasei Micro Devices (AKM) in Japan. The company manufactured circuits



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used in TCXOs. AKM supplied a huge percentage of the ICs used in this device, basically rendering it undeliverable. OEMs scrambled for other solutions and fought for remaining ICs. The fire contributed to panic buying across the industry whether the OEM used TCXOs or not.

Lastly, ongoing shortages of raw materials continue, including: crystal blanks, ceramic packaging, plastic packaging, IC substrates etc.

Solutions

At Dove Electronic Components we always want to offer our customer a solution for their needs.

As a Distributor we support our suppliers and always try to stick with who has the design & top spots on the AVL. We encourage customers to get their product on order no matter how long the lead-time may be. Once on order we'll do what we can to get the product sooner for the customer. During that time we'll try to offer solutions to get the customer through until they can get delivery. This can range from accepting a tolerance that is not as tight or a narrower temperature range and other the concessions the customer may be able to make. Dove's extensive line card of Authorized Crystals & Oscillator Suppliers has really been worked during this time. As a company we do not condone double ordering and we feel customers would be better served to accept additional product as no one knows when this market will return to more normal delivery cycles. Product costs have increased up 25% to 40% in some cases, a few devices have no resemblance to their former pricing. Dove does the best it can with keeping pricing as competitive as possible when passing along these increases.

Programmable Oscillators

Dove's in house oscillator programming center has been invaluable during this time. We can configure the package and the frequency a customer needs and ship the same day if we have the un-programmed oscillator blank in stock. The programmable oscillator still remains a great option.

www.doveonline.com



Dove Electronic Components has never seen anything like this market in its 38-years

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A port in the DRAM storm

Alliance Memory's president, CEO and founder, David Bagby, explains how the company has maintained deliveries while other suppliers have been plagued by shortages

Every storm has a bright spot. Current DRAM shortages are a great example. While shortages have posed a challenge for every supplier some, like Alliance Memory, have thrived. In fact, our lead times have been going down, while finished inventory has been growing. The company just had its best Q3 ever. It's not because we're putting customers on allocation, it's because we're delivering parts. So, what factors lead to this exception?

Alliance's market focus certainly plays a key role. When the company was founded 15-years ago, I felt there was a need for legacy-type memory components but no major players servicing that niche. It started with SRAMs which, in 2006, were being EOL'd across the board by several manufacturers. This was followed by expansion into DRAMs. Even though Alliance's market share is probably less than one per cent, our offering includes more densities, organizations, speeds and temperature ranges than most competitors. Our 5,000 or so customers aren't all 'little guys' but neither are they PC manufacturers ordering millions of parts. Thus, we're positioned to serve customers in markets like industrial and medical, who might find themselves pushed aside elsewhere.

Another differentiator is inventory, which upholds the company's promise to maintain short lead times. This approach is the opposite of larger suppliers, whose boards are focused on maximizing stockholders' profits. In the current market, no supplier can serve its customers well unless they have inventory and wafers to support upsides.

Today, we're working to build as much as possible, as soon as possible, and one reason we can is because we're not being pressured by Wall Street about inventory. We know our customers well, which makes it possible to anticipate future demand. Thus, we don't mind building parts months ahead of demand because we know they will be sold.

I believe a key reason for current shortages is that companies with their own fabs are forced to produce whatever is most profitable now, such as Flash instead of DRAMs or DRAMs instead of SRAMs. They're constantly shifting capacity around and, as it goes up and down, shortages are inevitable. Alliance Memory has half a dozen geographically dispersed foundries that can supply more capacity if required.

Nobody can anticipate every business hiccup. Who could have imagined a year ago

that lead frames would have gone from a 4/6-week lead time to 52 weeks? That said, companies like Alliance Memory that can reduce lead times are the ones with a wafer sourcing strategy, smart inventory management and real commitment to serving customers.

www.alliancememory.com



When the company was founded 15-years ago, I felt there was a need for legacy-type memory components but no major players servicing that niche



Alliance Memory's president, CEO and founder, **David Bagby**



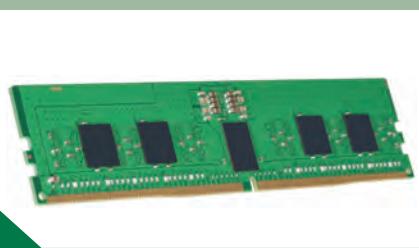
Industrial-grade DDR5 DRAM modules

Innodisk has released its industrial-grade DDR5 DRAM modules, touting performance improvements and power savings. Hyperscalers are likely early adopters but, long term, most industries should see benefits of DDR5 in 5G, deep learning, AI, edge computing, smart medical, supercomputing and mission-critical applications.

Innodisk's corporate VP and GM of global embedded and server DRAM business unit, Samson Chang, said: "Our customers are excited about the potential DDR5 has to invigorate their application developments. Innodisk brings quality products to the industry by introducing new DDR5 DIMMs with original ICs, anti-sulfuration, heat spreader, and conformal coating technologies with industrial-grade reliability they've come to expect from us."

The JESD79-5 DDR5 SDRAM specification signalled the transition to DDR5, with significant improvements in capacity, speed, voltage and ECC functions. The DDR5 specification details up to four times as much capacity per IC, raising the maximum achievable per die capacity to 64Gb and bringing the maximum potential capacity for a single DDR5 DIMM to 128GB.

www.innodisk.com



DDR5 tested for extremes

Smart Modular Technologies has announced the introduction of new DDR5 modules that feature enhanced endurance and stability for industrial applications. The company states the modules combine DDR5's advanced technology with its unique, rigorous test processes.

Smart Modular Technologies applies its testing processes to ensure reliable operation at industrial-grade temperatures (-40 to 85°C). Customized test programs and test flows, combined with specialized burn-in equipment, are used to screen out DRAM components that are likely to fail under temperature stress, resulting in modules that exhibit some of the lowest DPPM rates in the industry.

These industrial-grade modules are 100 per cent system tested at high speeds, starting with a cold boot at -40°C and ramping to 85°C ambient operation. High-utilization customized testing software fully stresses all cells in the DRAM through the complete temperature cycle.

Smart Modular Technologies' director of product marketing, Arthur Sainio, said: "Smart applies all of its proven industrial-grade feature sets, including burn-in, conformal coating, anti-sulfur resistors and other processes to these new modules. These added features ensure that our DDR5 modules can operate reliably in the harshest operating environments."

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Supplying medical components in the pandemic era

TTI supplier marketing manager, John Sandy, explores how the pandemic has changed the market for electronic components in the medical space

Supplying hard-to-find components during a pandemic has been very challenging, especially when those components are destined for medical devices. Demand for raw materials has increased, resulting in shortages and longer lead times, even as manufacturers order components in higher volumes. Compounding the issue for medical device makers is the difficulty of substituting components that require FDA or other regulatory approval.

While these issues impact medical device manufacturing in the near term, we should also be looking to the future. According to US government figures, national health spending is projected to grow at an average annual rate of 5.4 per cent through 2028 to a forecast \$6.2 trillion.

Globally, the medical technology industry is expected to see consistent growth driven by aging populations in developed nations and expanding markets in other countries. Connected devices and home health devices will be strong contributors to that growth.

Recent months have seen high demand for many components used in medical applications, including UVC emitters for anti-viral and disinfecting applications, as well as sensors used in clinical diagnostic equipment.

While we are still helping manufacturers work through shortages of important components, we have been able to help a number of customers find solutions. Demand for temperature and pressure sensors, in particular, seems to be stabilizing as we look ahead to 2022.

Beyond the near term, however, we will continue to see more demand for medical monitoring and treatment devices outside of hospitals and care facilities. The current in-home healthcare trend that was accelerated by the pandemic is going to continue.

For example, remote patient monitoring devices such as wearable sensors can be used to record a wide range of data: temperature and pulse, blood oxygen concentration, step counts, sleep quality and more. The combined impacts of smartphone integration,

wireless technologies, smaller dedicated medical devices and low-cost, disposable sensors and probes are all enabling in-home patient treatment and monitoring.

Medical device manufacturers, and their electronic component distributor partners, will face the challenges of meeting this new demand with a ready supply of electronic components. From a distribution standpoint, this will include helping manufacturers find substitutions for those components that may be in high demand or short supply: not only due to the coronavirus, but as a result of competing demand from other industries.

Thanks to Roland Chapa and Brian Wellhouse of TTI who contributed material to this article.

tti.com



TTI supplier marketing manager, John Sandy



Stocking Industry's Widest Breadth of Inventory with Focus on New Products

Mouser Electronics specializes in the rapid introduction of new products and technologies for engineers and buyers worldwide

The company's extensive product offering includes semiconductors, sensors, optoelectronics, embedded solutions, interconnects, passives, test and measurement, and electromechanical, plus a vast range of other components from more than 1,100 manufacturer brands. Mouser sells millions of tiny parts that function as the essential building blocks of new product design, with leading-edge components that are smaller, faster and smarter.

During this challenging period of supply chain issues across the industry, Mouser teams are doing a great job trying to stay ahead of product availability issues. Some sources are very limited in their component offerings, but that's not the case with Mouser. The company's wide breadth of inventory allows choices and alternative solutions for customers. Along with a focus on new product introductions, Mouser continues to expand its industry-leading website, mouser.com, with search enhancements, tools and technical resources for buyers and engineers.

Order with Confidence
Buying from an authorized distributor today is the only way to eliminate the risk of counterfeit or gray market products. With product supply shortages

impacting many sectors, it has never been more important to select genuine products that are 100% certified and fully traceable from each manufacturer.

As an authorized distributor with a commitment to customer service excellence, Mouser offers 27 global Customer Support Centers and has the professionals, products and procedures in place to assist throughout the design and buying process.

Mouser also offers a full suite of online tools to help simplify the purchasing process, such as the Price and Availability Assistant, which makes online buying quick and efficient. It's the latest addition to a library of productivity and pricing tools from Mouser that includes the FORTE intelligent BOM tool, ECAD design resource solution, inventory management tool, API services and order automation.

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- **Stocking industry's widest selection**
- **27 global branch offices**
- **57 million visitors came to mouser.com in 2020**



Mouser stocks the widest selection of products in the industry. All orders ship from Mouser's Global Headquarters and Distribution Center in Texas.



Solutions to global shortages

In this article, Brevan Electronics recommends OEMs nurture relationships with dedicated sourcing partners who can offer personalized services during shortage markets

Shortages are the new normal and show no sign of alleviating their grip on supply chains. From semiconductors to OEMs, long lead times continue to plague manufacturers on multiple levels as even the most elite struggle to add capacity. Faced with increasingly high demands from multiple sectors, supply remains tight across all markets, resulting in increasing shortages in all industries—not just the semiconductor industry.

Using the power supply market as an example. Covid safety protocols and workforce shortages have affected most power supply manufacturers, with many at production capacity well into 2022.

With the average power supply using 50 or more components, it only takes one shortage or allocation to affect lead times. Electrolytic capacitors, a key

component for many power supplies (switches and linear), are facing lead times of up to 40 plus weeks. Adding insult to injury, international transportation lead times have increased by five to 10-weeks beyond the four to seven weeks pre-Covid.

Planning to meet consumer demand has always been a key aspect of sourcing components to avoid production slowdowns. Now it is more important than ever. It is getting more difficult to source parts needed to keep production lines moving, leaving no industry spared. With predictions of continued component shortages, challenged production capacity and extended transportation lead times, many predict the continuation of long lead times well into 2022 and possibly beyond.

While there's no quick solution to dealing with the domino effects

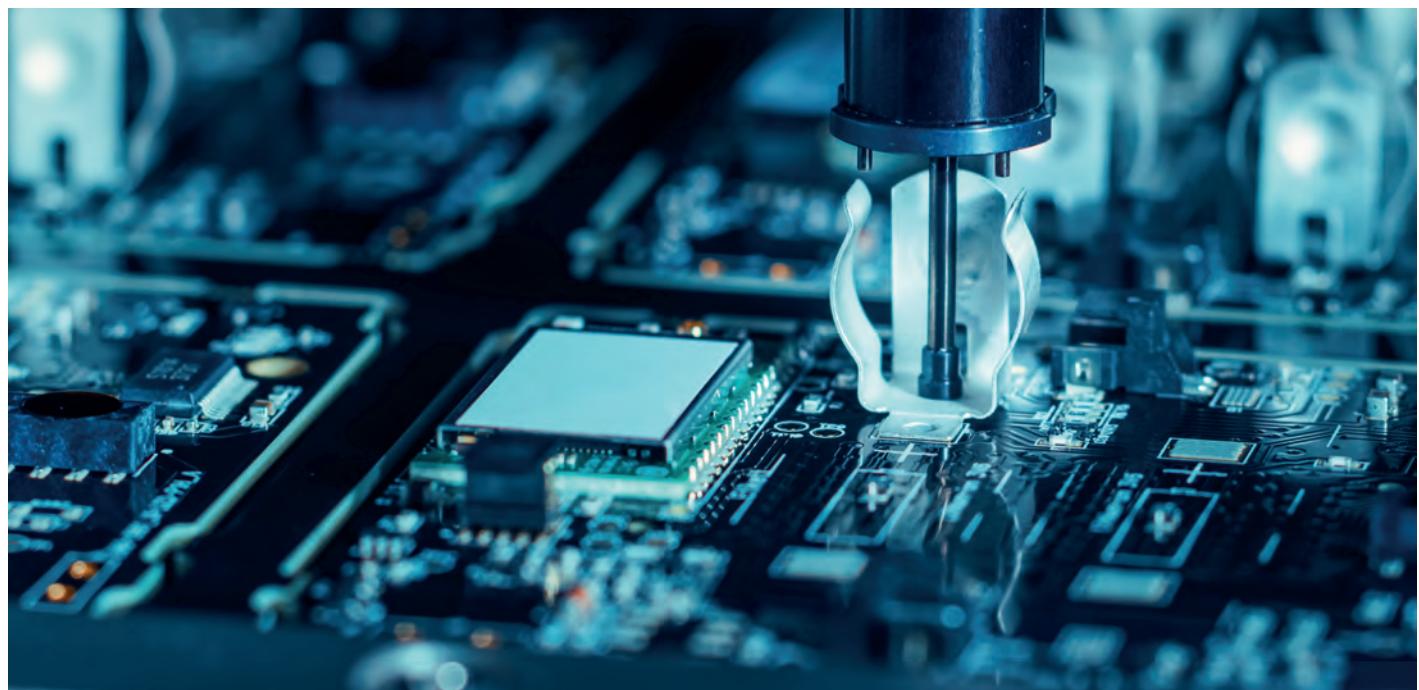
of this shortage market, OEMs are exploring all avenues to help find components to keep production lines moving. In addition, both franchised and independent electronic component distributors are offering their services to assist with sourcing shortages and long-lead-time components.

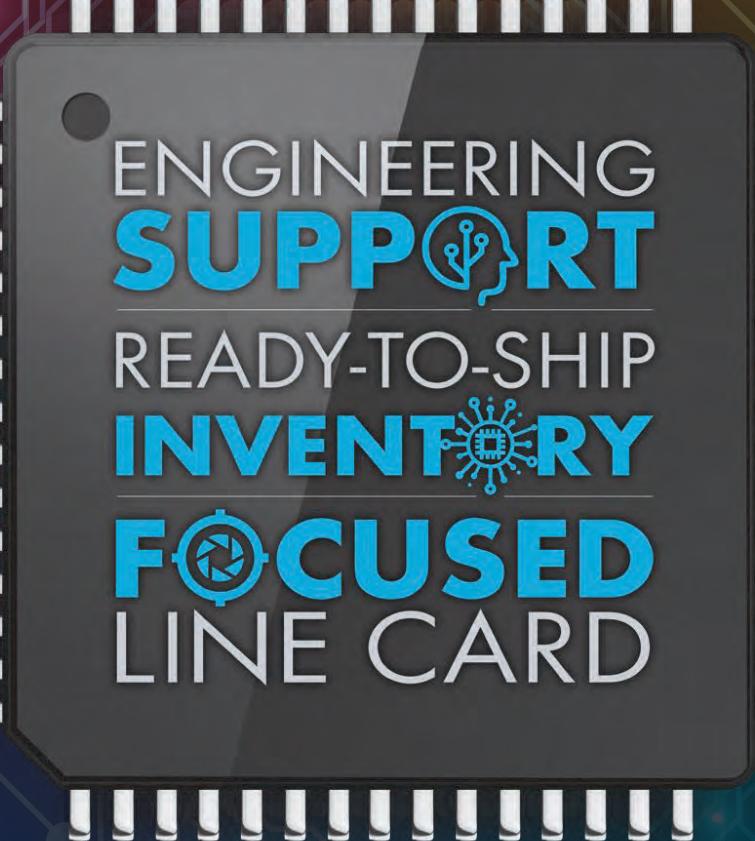
More sophisticated OEMs are continuously augmenting their sourcing strategies to adjust to this consistently turbulent market, utilizing a variety of strategies aimed to maneuver this shortage market. However, many OEMs are only focused on addressing short-term shortages to mitigate the near-term effect of a line-down scenario. The savvy ones are investing in resources to help in the short term, but that also provide insight on how the market is evolving in real-time, which often includes raw materials monitoring and sourcing.

With the market consistently changing, it takes a keen eye to find sufficient solutions to overcome the ongoing shortages. To continue to thrive in this market, businesses need more than a distributor—they need a dedicated partner that will work closely with them to develop solutions that meet their unique needs by positioning them to find hard-to-find parts quickly and efficiently.

Brevan Electronics is positioned to provide a personalized solution to both mitigate the short-term risks of the shortage market while also safeguarding for the long term.

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Additive manufacturing: a sourcing solution

This month John Denslinger looks at the growing influence of 3D printed components in the manufacturing supply chain



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

Additive manufacturing • By John Denslinger

Across the industrial spectrum, sourcing 3D printed components is on an upward trend. Once relegated to single-use jigs, fixtures and the occasional prototype builds, it's now a viable sourcing option for end-use functionality.

From the beginning, the pandemic created troublesome gaps in supply lines. That same unpredictability continues today as a Delta variant rages on in many parts of the industrialized world. Indiscriminate closures and labor shortages are surfacing once again. Given this uncertainty, procurement should consider 3D printing solutions as a supplement to current production shortages or perhaps replacing chronic delivery problem suppliers altogether.

The picture keeps getting better and better for 3D printing. Perhaps it's time to make the argument 3D printing is merely the tool, while it's sparsely used alter-ego—additive manufacturing—more aptly describes the current adoption and coverage reality from product concept through EoL.

The role of additive manufacturing can be expanded within most production systems. However, the key to optimal adoption begins with proven 3D printable materials. While research continues on more exotic options, a variety of polymers, plastics, composites, metals, ceramics and glass already have successful track records. The material scope is bound to explode as application technology, equipment, and production expertise catch up.

If your company is not ready to establish in-house 3D printing design and support systems, out-sourcing is available, and not surprisingly, there are multiple pathways. The most obvious path is contract manufacturing. Jabil and Flex have done a great job highlighting their additive manufacturing expertise, scale, finishing

services and range of material capabilities on their websites. Other CMs likely have similar capabilities, so it's worth checking around. This avenue also offers a distributed manufacturing platform and global services if that is a need as well. If not, another viable path are companies that strictly specialize in additive manufacturing. A few like ProtoLabs, Fictiv and Rapidmade offer both synthetic and metal 3D printing in prototype and production quantities.

So, how do I choose the right supplier for my situation? First, check the supplier's design capability, knowledge of materials and record of successful applications. Next, understand their scale and experience in additive manufacturing especially if you seek production level quantities. Some secondary operations may be necessary to finish a 3D printed part for end use, such as, machining, plating, polishing and/or painting. If that is a need, confirm that capability and explore your own in-house resources. Lastly, map their supply chain. The last thing you need is to source 3D printing as a solution to your own supply line gap only to experience another disaster.

The value of 3D printed parts is projected to grow at a compound annual rate of 15 per cent through 2030 to \$51B according to Boston-based, Lux Research, and that number may be conservative if we add the eco-friendly/sustainability benefits of 3D printing recycled materials.

Given the flexibility, customization and potential cost savings of 3D printing over conventional injection molding, casting and machining, additive manufacturing is an indispensable sourcing solution.

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Broad product availability distinguishes Digi-Key from other electronic component distributors. New products are added every day in a continuous effort to offer the full range of electronic components and automation products required by customers. From semiconductor to passive and interconnect, electromechanical to wireless and lighting components, Digi-Key carries the parts you need when you need them.

Digi-Key is finalizing construction of a 2.2 million square foot Product Distribution Center expansion in Thief River Falls, Minnesota that will

enable the company to broaden inventory even further to meet the current and future demands of customers. It will also empower the company to search out new and innovative technologies and products from both existing and new supplier partners, allowing Digi-Key to continue being a one-stop-shop for customers in all industries.

Digi-Key's Marketplace gives customers access to even more products and services, including bare PCB boards and industrial robotics. This added solution provides a singular shopping experience to serve customers in applications such as industrial automation, test and measurement, IoT solutions, and virtually all things related to technology innovation.

The company offers a vast selection of online resources including a range of EDA and design tools, reference design library, product selectors, parametric search, on-demand multimedia library, comprehensive article library, community forums, conversion calculators, and more. Digi-Key also provides numerous Supply Chain solutions such as APIs, EDI, and Punchout

eProcurement options, bonded inventory, and just-in-time shipping. The website is updated regularly with new features in response to customer feedback and industry needs.

Digi-Key recently launched myLists, merging the features and capabilities from several previous list management tools into a single solution. New features include the ability to incorporate up to 1,000 parts, in-line suggestions of alternative parts when available, and an attrition calculator to plan for overages needed for parts lost or damaged during manufacturing.

Digi-Key prides itself on its ability to provide the best possible service to customers, who can order electronic components and automation products or reach the talented Digi-Key customer support team 24 hours a day, seven days a week, 365 days a year, by phone, fax, e-mail, or webchat.

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Digi-Key recently launched myLists

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Ruggedized converters offer reinforced isolation

Traco has announced its new THR-WI series of 3, 10, 20 and 40W DC/DC converters with double/reinforced insulation up to 3,000VAC. These products operate over a 4:1 input range, with up to 90 per cent efficiencies and operating temperatures from -40 to 80°C.

Three watt models offer DIP 24 footprints, while the 10, 20 and 40W come in 2 by 1in footprints. Input ranges include 9 to 36, 18 to 75 and 40 to 160VDC and provide single and dual outputs ranging from 5 to 24VDC.

Models are fully encapsulated to withstand shock and vibration standards per IEC/EN 61373. Internal input filters enable EN 55032 class A compliance (3, 10 and 20W) and overload, overvoltage and short-circuit protection. With the latest IT safety certifications (IEC/EN/UL 62368-1), the THR-WI series suits demanding applications in the industrial, transportation and instrumentation sectors.

www.tracopower.com



Baseless module improves aircraft efficiency

Microchip's family of BL1, BL2 and BL3 baseless power modules are designed to provide greater efficiency in AC/DC and DC/AC power conversion and generation via silicon carbide power semiconductor technology. Forty per cent lighter than other modules due to the modified substrate, the design also produces an approximate 10 per cent cost saving over standard power modules that incorporate metal baseplates.

Vice president of Microchip's discrete products business unit, Leon Gross, said: "Microchip's powerful new modules will help to drive innovation in aircraft electrification and, ultimately, progress toward a future of lower emissions. This is an enabling technology for the systems ushering in a new era of flight."

The devices meet mechanical and environmental compliance guidelines set in RTCA DO-160G 'Environmental Conditions and Test Procedures for Airborne Equipment' Version G (August 2010).

The modules are available in low-profile, low-inductance packaging with power and signal connectors that can be soldered directly on PCBs, helping to speed development and increase reliability.

www.microchip.com



Free-air cooled supplies offer 200 per cent peak-power

Cosel has announced 150 and 300W free air convection cooled power supplies. Designed for industrial applications requiring high levels of safety, the LHP150F and the LHP300F are certified according to EN62477-1 (OVC III). The products work over a wide universal input voltage range of 85 to 264VAC and have a typical efficiency rating of 93 per cent.

The supplies are available in five different output voltages commonly used in industrial automation and processes, with 200 per cent peak power capability for up to 10s for dynamic loads. The standard product is an open frame PCB type, with a chassis and cover available as an option.

The LHP150F and LHP300F are certified to the EN62477-1 Over Voltage Category Three (OVC III), meaning that final equipment powered by the products can be connected directly to the main distribution panel without adding an extra level of isolation. This simplifies the system designer's task, reducing cost and guaranteeing the highest level of efficiency.

www.coseleurope.eu



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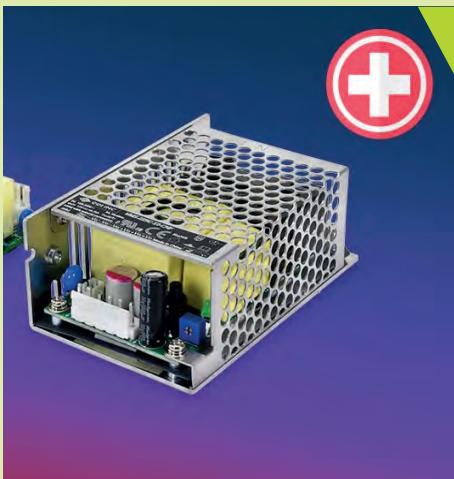
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Medical supplies suit space constrained applications

CUI has announced twelve new models of VMS-C and VMS-C-CNF internal medical AC/DC power supplies. These higher power models are chassis mount units available in open frame or metal case variations and suit medical and home healthcare applications such as ultrasound machines and medical beds. The supplies are compact for use in small spaces.

Featuring a universal input voltage up to 264VAC, and output voltages of 12, 15, 24, 27, 36, and 48V, these power supplies can also be adjusted using an onboard trim pot. Operating temperature range is -40 to 70°C (85°C for 100/120W products). All units feature a 5,000m altitude operational ability. Active power factor correction is included. Standby power consumption is 0.5W.

The supplies are medical/household certified to 60601, 61558 and 60335, suitable for safety class I/II installations and apt for medical applications where a low leakage current of less than 0.1mA is specified.

belf.com



Certified for aerospace and defense power

Custom Power is now certified to AS9100D, the aerospace and defense industries' most stringent quality management system accreditation. The certification demonstrates the company upholds the practices demanded for the engineering and production of its customized battery solutions for defense and commercial aerospace customers.

Custom Power's CEO, Mel Weis, said: "This accreditation builds on our ISO9001 certification and further validates our already strong 55-year commitment to quality and safety. AS9100 provides international recognition for our engineering, manufacturing and quality teams' commitment to excellence and affirms our dedication to serving defense and aerospace customers. The accreditation is an important milestone in Custom Power's continued growth strategy and expanded reach into this market segment."

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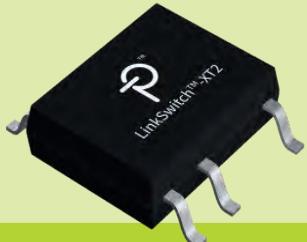
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Safeguarding meters from magnetic tampering

Utility meters need to work without interruption and often under adverse conditions. A new design example report (DER-711) addresses these challenges with a 6.6W dual-output flyback converter using a LinkSwitch-XT2 offline switcher IC. With a low-RDS (ON), 900V MOSFET, LinkSwitch-XT2 improves efficiency at full load, maintains efficiency at light load, and resists magnetic tampering.

Meter tampering is often done by placing a strong magnet close to the meter's power supply to interfere with transformer inductance. LinkSwitch-XT2 features an On/Off control that compensates for the primary inductance reduction by increasing operating frequency to maintain output power level. The On/Off control enables high efficiency at light load, allowing utility providers to minimize energy consumption during normal meter operation.

The DER-711 circuit design utilizes the high current limit of LinkSwitch-XT2 to operate at very low frequency, making it capable of withstanding severe magnetic tampering.

power.com



High efficiency fanless operation

Jasper Electronics has introduced a line of compact convection cooled power supplies featuring 28 new model series with output power rated from 200 to 500W. Designated the GPAD Series, the supplies are designed to provide high efficiency fanless operation in low voltage, high current, high power density applications, including medical equipment, industrial systems, communication systems and LED power supplies.

Jasper Electronics' president, Robert Nishimoto, said: "Our new GPAD Series convection cooled power supplies deliver high efficiency fanless operation in a compact form factor. With a wide range of input and output power ratings, a flame-retardant and moisture-proof design, and a three-year warranty, these power supplies will give customers an ideal solution for an extensive range of applications."

The supplies include four configurations with output voltages from 12 to 54VDC and power factor ≤ 0.95 .

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3.7V LITHIUM ION PACKS WITH PCB PROTECTION						
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DANTONA PART NUMBER	L37A26-1-0-2WX	L37A26-1-0-3WA3	L37A52-2-1-2WX	L37A52-2-1-3WA3	L37A78-3-2-2WX
VOLTS / CAP / WATT HRS	3.7V / 2600 / 9.6WH	3.7V / 2600 / 9.6WH	3.7V / 5200 / 19.24WH	3.7V / 5200 / 19.24WH	3.7V / 7800 / 28.9WH
NO OF CELLS / CONFIG	1 / 1S1P	1 / 1S1P	2 / 1S2P	2 / 1S2P	3 / 1S3P
WIRES / THERMISTOR	2 WIRES	3 WIRE / THERMISTOR	2 WIRES	3 WIRE / THERMISTOR	2 WIRES
TERMINATION	2 CIRCUIT CONN	3 CIRCUIT CONN	2 CIRCUIT CONN	3 CIRCUIT CONN	2 CIRCUIT CONN
LITHIUM ION PACK CHARGERS	Part Number	Voltage	Input Volts	Charging Current	Certificate
	F037-010-W	3.7v	100-240Vac	1000mAh	
	F037-015-W	3.7v	2 / 1S2P	1000mAh	

7.4V LITHIUM ION PACKS WITH PCB PROTECTION						
DANTONA PART NUMBER	L74A26-2-1-2WX	L74A26-2-1-2W	L74A26-2-1-3WA3	L74A52-4-3-2WX	L74A52-4-10-2WX	
VOLTS / CAP / WATT HRS	7.4V / 2600 / 19.24	7.4V / 2600 / 19.24	7.4V / 2600 / 19.24	7.4V / 5200 / 38.5	7.4V / 5200 / 38.5	
NO OF CELLS / CONFIG	2 / 2S1P	2 / 2S1P	2 / 2S1P	4 / 2S2P	4 / 2S2P	
WIRES / THERMISTOR	2 WIRES	2 WIRES	3 WIRE / THERMISTOR	2 WIRES	2 WIRES	
TERMINATION	2 CIRCUIT CONN	RED / BLACK WIRES	3 CIRCUIT CONN	2 CIRCUIT CONN	2 CIRCUIT CONN	
LITHIUM ION PACK CHARGERS	Part Number	Voltage	Input Volts	Charging Current	Certificate	
	F074-010-W	7.4v	100-240Vac	1000mAh		
	F074-015-W	7.4v	100-240Vac	1500mAh		

11.1V LITHIUM ION PACKS WITH PCB PROTECTION				14.8V LITHIUM ION PACKS WITH PCB PROTECTION					
DANTONA PART NUMBER	L111A26-3-2-2WX	L111A26-3-2-3WA3	DANTONA PART NUMBER	L148A26-4-3-2WX	L148A26-4-3-2W	L148A26-4-3-3WA3	L148A26-4-18-3WA3		
VOLTS / CAP / WATT HRS	11.1V / 2600 / 28.9	11.1V / 2600 / 28.9	VOLTS / CAP / WATT HRS	14.8V / 2600 / 38.5	14.8V / 2600 / 38.5	14.8V / 2600 / 38.5	14.8V / 2600 / 38.5		
NO OF CELLS / CONFIG	3 / 3S1P	3 / 3S1P	NO OF CELLS / CONFIG	4 / 4S1P	4 / 4S1P	4 / 4S1P	4 / 4S1P		
WIRES / THERMISTOR	2 WIRES	3 WIRE / THERMISTOR	WIRES / THERMISTOR	2 WIRES	2 WIRES	3 WIRE / THERMISTOR	3 WIRE / THERMISTOR		
TERMINATION	2 CIRCUIT CONN	3 CIRCUIT CONN	TERMINATION	2 CIRCUIT CONN	RED/BLACK WIRES	3 CIRCUIT CONN	3 CIRCUIT CONN		
LITHIUM ION PACK CHARGERS	Part Number	Voltage	Input Volts	Charging Current	Certificate				
	F111-010-W	11.7v	100-240Vac	1000mAh					
	F111-015-W	11.7v	100-240Vac	1500mAh					
	F148-010-W	14.8v	100-240Vac	1000mAh					
	F148-015-W	14.8v	100-240Vac	1500mAh					
UNIVERSAL LITHIUM ION CHARGER	LICHG-37-14810	3.7v / 14.8v	100-240Vac	1500mAh					

NAND flash memory market soars as demand rises

NAND flash revenue will break an all-time record this year



James Carbone

Despite an expected 1 per cent decline in average selling prices, the global NAND flash memory market will post strong sales growth and NAND revenue will grow 22 per cent to \$67.1 billion in 2021 as unit shipments increase 23 per cent, according to researcher IC Insights. In 2020, unit shipments increased only 4 per cent but sales soared 25 per cent to \$55.1 billion because of a 21 per cent increase in the average selling prices. This year revenue growth will be strong despite a 1 per cent decline in the average NAND price, according to the researcher.

The average price increased from \$3.57 in 2019 to \$4.30 in 2020. In 2021 the average price will dip to \$4.26, IC Insights forecasts. Demand for NAND is rising across all segments that use flash memory including data centers, computers mobile phones, consumer electronics, automotive and industrial.

Flash memory manufacturers including Samsung, Kioxia,

Micron and SK Hynix and others are seeing surges in demand, according to Brian Matas, vice president of market research for IC Insights. As a result, there are long lead times and some shortages for NAND.

Supply will remain tight for the rest of the year for NAND used in data centers, he said. In addition, supply could become tight for some consumer applications particularly 5G cell phones.

More capacity added
But overall, "I think things are doing pretty well in terms of NAND supply," said Matas.

One reason is NAND flash manufacturers have been adding capacity. He noted suppliers such as Samsung, SK Hynix and Micron increased capital expenditures for NAND in 2017 and 2018 and "that's what caused the big downturn in 2019" when there was oversupply and declining prices. But that capacity is now being used and utilization rates are in the 90 per cent plus range, said Matas.

Flash suppliers are continuing to increase capacity this year, he said. "Samsung built a gigantic fab that has several floors to it and each of the floors can manufacture NAND or DRAM," said Matas. A lot of the fab capacity has been committed to NAND. The fab uses 300mm wafers and the "smallest process geometries" that are available for NAND, he said.

"I'm not sure how much Samsung is going to spend on NAND capacity this year, but in the second quarter alone the company made \$11.1 billion in capital expenditures," said Matas

Other NAND manufacturers are also adding capacity, although not as much as Samsung. Micron is spending \$4.5-\$5 billion for the year and Hynix is making about \$7 billion in capital expenditures for the year, according to Matas.

By boosting capital spending and increasing NAND capacity, Samsung is keeping the pressure on its competitors including

Chinese companies that have entered the NAND flash market, said Matas.

NAND demand to rise

By most accounts the extra capacity will be needed, as demand for NAND shows no signs of letting up. Demand for NAND flash from data centers, 5G phones, PCs, tablets, consumer electronics and other customer segments is growing.

Data centers spending on NAND was strong in the first half of last year but cooled in the second half, said Walt Coon, vice president of NAND and memory research, for researcher Yole Développement, based in Lyon, France. "Demand this year from data centers is rebounding as cloud service providers are once again building out their data centers and purchasing a lot of memory," said Coon.

Another important driver for NAND is 5G cell phones. Five-G cell phone shipments are expected to grow from 255

By the Numbers

Source: IC Insights



\$4.26

The forecasted average selling price of a NAND flash memory chip in 2021



\$67.1 billion

The projected size of the NAND flash memory market this year



22%

The rate of growth of NAND flash memory in 2021



15.7 billion

The number of flash memory chips expected to ship in 2021



\$97 billion

The forecast size of the worldwide NAND flash memory market in 2025.



12 per cent

The expected compound annual growth rate of the NAND flash market from 2020-2025



million in 2020 to 570 million in 2021 to 770 million in 2022, according to researcher IDC. In addition, 5G handsets will be equipped with more memory than previous generations.

PC and tablet shipments are expected to be strong through the rest of this year and into 2022 and will help drive NAND demand. The new Microsoft Windows 11 operating system, which will be released in October, will help drive NAND sales later this year and in 2022.

"New microprocessors for systems that operate Windows 11 will be required to have more memory in them" which will mean more NAND will be needed, said Matas.

A small but growing segment for NAND flash is automotive. Less than 1 per cent of NAND chips are used by automotive. "But it is growing fast," said Coon. As more cars "progress into different autonomous levels from L1 to L2 to L3, L4 and L5 there is more need for storage on the vehicle but that will not occur for a while," he said. A L5 level vehicle would be totally autonomous and would not need a driver and

would be equipped with more semiconductors including NAND flash memory.

"We look at autonomous vehicles as one of the next big drivers like smart phones," he said. Smart phones were a boon to NAND memory and L4 and L5 vehicles will have a similar impact, he said.

Today most NAND going into vehicles is for infotainment systems. "Basically, you have a tablet PC on a lot of these newer cars and it has anywhere from 32 to 256 GBs of storage," said Coon. About 100 million cars ship in a year compared to 1 billion smart phones, he said. So automotive is using a relatively small amount of NAND.

More NAND for cars

In fact, while NAND use in automotive systems will grow, it will remain a relatively small percentage of the overall NAND market at least for the next five years, according to Coon. In five years, automotive will represent about 3 per cent of the NAND market, he said.

For this year, strong demand from automotive and all other

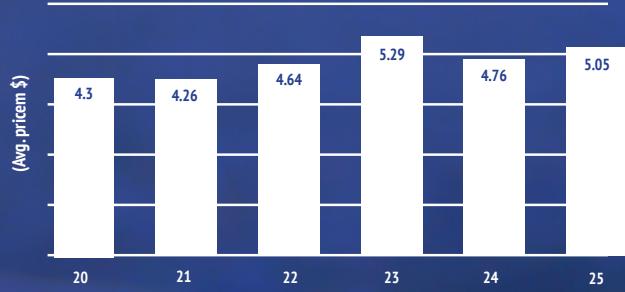
The NAND flash memory market will reach nearly \$100 billion by 2023.

Source: IC Insights

NAND market to post strong growth through 2023



NAND ASP to peak in '23



The average price for a NAND flash memory chip will increase until 2023 because of strong unit demand.

Source: IC Insights

segments will mean continued tight supply of NAND flash memory, at least for the rest of the year. He said that NAND supplier inventory is "very lean which is helping drive supply/demand balance in a better direction" for suppliers, said Coon. "Revenue is going to break an all-time high this year," he said. Yole forecasts that NAND revenue will grow 25 per cent.

Strong growth for NAND will continue in 2022 but at a slower rate than in 2021, according to Coon. "I'm of the opinion that things will slow down a little bit," said Coon. "I think some of the things that have been boosting up demand this year may soften as we go into next year," he said.

He noted that PCs have been a "surprise market" over the past two years. PCs had been a slowly declining market prior to 2020 but sales rebounded when the pandemic hit as more people worked at home or attended school virtually.

PC growth to slow

Coon said strong growth in the PC market will not continue every year. In addition, demand for NAND from data centers will also slow. Spending by data center

companies is "fairly lumpy," said Coon. "They will spend a lot for two or three quarters and then they will go through an inventory digestion phase," he said. "So, I would not be surprised to see one of those inventory digestion phrases next year."

He said while demand may lessen next year, so will NAND production. NAND bit production usually increases about 40 per cent per year.

Slower bit growth will occur because of technology transitions that NAND suppliers will be going through in 2022. For instance, Samsung is transitioning to its 176-layer, 3D NAND node, "which is going to be a very difficult transition for them," said Coon. "They are changing their architecture as well. They are moving to a double stack. They are going through a difficult transition and they are the biggest supplier in the market." He said the second biggest supplier, Kioxia, is going through a similarly difficult transition where the node that they are moving to is very complex.

"So, it looks like it would be tough to grow bit shipments with the technology transitions," said Coon.

PCB purchasing: fast to order, easy to track

Rush PCB's president, Abker Roy, introduces a new PCB portal designed to let buyers quote and order PCBs in less than 10 minutes

PCB Portal is a new PCB purchasing system which offers autonomous quoting and ordering in under 30 minutes, plus real-time tracking via text or WhatsApp. It offers quotes from 1=1 day lead-times to 10+10 days lead time for quantities ranging from five to 50 pieces, plus production volumes on longer lead times.

Rush PCB's president, Abker Roy, said: "Imagine this, a customer can come to the PCB Portal on our site and quote just about any board, just about any quantity and just about any delivery time and get a quote in a matter of minutes. Then place the order with us immediately. No hassles or worries.

"Then, and this is what I think is the best part of PCB Portal, they will get constant real-time updates of where their order is in the system. These updates come to the customer automatically by either Text or WhatsApp. And the systems will also track the entire history of the order including when the order was placed, and if it was put on hold for any reason.

"When an order is put on hold the system notes the time the order

was on hold and recalibrates a new date instantly. We feel that our new system is going to revolutionize board buying."

The website carries out reference designator checks on the BoM, comparing them with quantities, checking for duplicates and looking for errors. The system then reaches out to 40 different vendors in real-time, allowing up-to-date pricing, while computing in-house stock and lead time information.

The system can handle consigned parts and do-not-integrate (DNI) parts for extra control. It also adds overages automatically based on component footprint.

Rush PCB states it takes responsibility for the entire contract manufacturing activities, procuring components from several genuine suppliers and maintaining an in-house parts inventory. Depending on a customer's Gerber files and net list, the company's assembly services range from simple two-sided rigid boards to 40-layer HDI boards, 20-layer rigid-flex boards, or metal-clad boards.

www.rushpcbinc.com

Choose Kit/Lead Time Review Order BOM Parts Review Shipping/Billing Details Finalize Order

< Go Back

Click the unit price below to place online order

Kit Qty\Days	(1+1) 2-4 Days	(2+2) 4-6 Days	(3+3) 6-8 Days	(4+4) 8-10 Days	(5+5) 10-12 Days	(6+6) 12-14 Days	(7+7) 14-16 Days	(10+10) 20-22 Days	(12+12) 24-26 Days	(15+15) 30-32 Days	(17+17) 34-36 Days	(20+20) 40-42 Days
5	\$1606.83	\$1268.49	\$1103.96	\$978.08	\$782.44	\$746.26	\$736.41	\$726.56	\$721.87	\$632.23	\$612.23	\$632.23
10	\$1605.93	\$1090.64	\$946.28	\$828.43	\$651.47	\$635.71	\$630.67	\$626.64	\$623.25	\$538.19	\$538.19	\$538.19
25	\$955.90	\$756.08	\$635.38	\$589.16	\$444.22	\$437.46	\$425.33	\$431.19	\$432.17	\$371.24	\$371.24	\$371.24
50	\$757.63	\$586.46	\$501.02	\$451.41								
100	\$617.71	\$478.58	\$410.86	\$373.40								
250	\$444.28	\$343.47	\$298.59	\$271.69								

Instant quotes from 1+1 day lead time to 10+10 days lead time for quantities varying from five to 500 pieces

Part Number: Revision: Quantities:

PCB Quote
Informations about your PCB requirements.

Number of Copper Layer, please request stackup if you want to review before manufacturing

Enter information about your board

Advanced Options (Optional)

Finalize Order
Review information before placing order

Next Step >

PCB Portal calculates PCB prices and delivery times

Enter Assembly Information

Click Here to download the processed BOM file ; RushPCB processed 750 line items across several vendors within 1 Minute & 13 Seconds!

Assembly Sides: Both Total Line Items: 750 Total Components: 985

Please provide a breakdown of your component types below, also ensure sum of those components equals the Total Components.

PTH Components: 24	QFN Per Board: 6	IGAs Per Board: 4	Standard SHOs: 939	Components Defined: 985/985
Pin Pitch 10x: 8	Urgent Components (incl. next day): 2	Pressfit Connectors/Modules: 2		
Hip SMD Pitch (mm): 19 mil	TSOP: YES	Gloss (I): YES	Q1005 Package Used: YES	Q1011 Package Used: NO
4402 Package Used: YES	Conformal Coating: NO	De-panel after assembly: NO		

Please Note : If your board contains transformers, heat-sinks or pogo pins, screws or thickness is greater than 0.125mil then prices are subject to review.

< Go Back Next Step >

PCB Quote
Information about your PCB requirements.

BOM Parts
Information about your parts destination.

Assembly Details
Information about your parts placement.

Finalize Order
Review information before placing order

Enter information about your BOM

Upload your BOM file Define your BOM Finalize your BOM data Reviewing your BOM data

< Go Back Next Step >

Ensure all the data read from your BOM file is accurate before it is processed by our systems

Total Parts : 985 Total Unique Parts : 750
Total Items including DNI : 985 Unique Items including DNI : 750

Action
Mark Consigned parts/Parts that will be provided by

Full turnkey quotes are available in minutes, regardless of BoM size

Buyer beware. Supply shortages mean more counterfeit parts, fraud

Reports of fake semiconductors and passives in the supply chain increased in the first half of the year as counterfeits and criminals exploited tight supply conditions

Some electronics buyers who search for shortage parts online may unwittingly be venturing into the black market and are at greater risk of buying counterfeit or substandard parts or becoming the victims of fraud.

There are cases of criminals setting up fake professional-looking websites that claim to have inventories of shortage parts. In some cases, buyers will purchase parts from those sites and the components turn out to be counterfeit. In other cases, buyers may wire funds to an account on the site but parts are never sent because the inventories did not exist.

While component counterfeiting is not new in the electronics supply chain, it

thrives when there are severe shortages of parts, which is the current supply scenario. ERAI, a global information services organization that monitors, investigates, and reports issues affecting the global electronics supply chain, says that the number of reported counterfeit, suspect counterfeit nonconforming parts was up in the first and second quarters of 2021. ERAI maintains a database of such parts that are reported to be suspect or counterfeit.

"The number of reported parts was down last year presumably due to the COVID-19 shutdowns, so we expected an increase in 2021 with or without a chip shortage," said Kristal Snider, vice president of ERAI, Inc.

Since 2000, ERAI has tracked the proliferation of counterfeit components in the supply chain through reports from ERAI members including distributors, brokers, trading companies, manufacturers, test labs and government agencies in 40 countries. It also receives reports of suspected counterfeit parts from non-members.

"Counterfeiting is constant and consistent in that counterfeitors always seem to exploit any and all market conditions to their advantage," said Snider. She notes that current market conditions "where demand seriously exceeds supply" has occurred many times over the decades and is one of many factors that drive counterfeit



There are more opportunities for counterfeit products to enter the supply chain and we are doing due diligence. We are doing a lot of due diligence

Kirk Wehby, chief operating officer for independent distributor Smith

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activity. Others are obsolescence, availability of materials, component prices and the rise and fall of global sales.

The bad news for buyers is the current wave of counterfeiting will get worse before it gets better. Faiza Khan, executive vice president of the Independent Distributors of Electronics Association, says there is always a lag from the time there are shortages to when counterfeit parts are introduced into the open market.

"Counterfeitors are working as hard as they can to get counterfeit parts out there," said Khan. "I don't think we've reached the peak yet. I think there are more to come," she said.

Khan said one reason there are many reports of counterfeit parts is there are a lot more buyers purchasing components in the open market. "There is a lot more than there ever has been." She said although there is an increase in reports of bogus parts, reliable independent distributors that are members of IDEA are not seeing as many counterfeit components as are being reported by the ERAI because of the way they screen and evaluate potential new sources of components. She said IDEA members – and some nonmembers – use a vendor rating system before they do business with potential new vendors. "They have a very stringent way of evaluating their vendors" to make sure

the potential source of a part is legitimate and carries genuine quality products.

"They're not going to buy from someone they found on Google who says he has 1,000 pieces of a part that cannot be found anywhere in the world," said Khan. "They know better than that."

More due diligence needed

Counterfeit parts have become a part of the electronics supply chain landscape and it is incumbent on electronics purchasers to double down on their due diligence efforts of potential new sources of shortage components.

Obviously, many buyers turn to independent distributors for hard-to-find components. Many purchasing organizations have vetted and qualified a select few non-franchised independent distributors that they use during times of shortages. Many of those responsible distributors have beefed up their efforts to screen and test for parts to try to stop the proliferation of them in the supply chain.

Some have invested heavily in decapsulation, X-ray imaging and microscopy imaging equipment. Others send parts to third-party labs to determine if components are genuine. Some independent distributors try to seek the assistance from original component manufacturers (OCMs) for help in determining if a part is authentic, although often they do receive much help from the OCMs.

One independent distributor that has boosted its investment in equipment to identify bogus parts is Smith, based in Houston. Kirk Wehby, chief operating officer for Smith, said currently there are "more opportunities for counterfeit products to enter the supply chain" so Smith is seeking more information about the sources of parts before it purchases them.

"We are being more proactive. We are digging a little deeper" to determine if there is some additional traceability of parts, said Wehby. In addition, Smith has invested in more equipment to test and screen components. "In the last 6 to 8 months we have probably tripled our equipment globally," he said. The distributor has purchased new X-ray equipment and an XRF machine.

"We have a counterfeit detection lab in each one of our operations in Hong Kong and Amsterdam. Each one of those labs has seen an increase in capacity" in testing and screening of parts, he said.

Seeking help from OCMs

Wehby also said that Smith will also ask for help from original component manufacturers (OCMs) to identify whether a component is authentic. However, he said Smith does not receive much assistance from component manufacturers unless the part was purchased directly from the OCM or from a franchised distributor. That has been the experience of other independent distributors as well.

"Component manufacturers continue to show independent distributors a cold shoulder when contacted to determine whether a part is authentic," said Steve Calabria, founder and CEO of independent distributor PC Components, based in Seaside Park, N.J. Few component manufacturers "offer any help to thwart the spread of counterfeit parts," he said.

Some independent distributors are good at finding "indicators" of counterfeit parts, according to Calabria. However, only the component manufacturer can confirm that a suspect part is counterfeit and most manufacturers will not cooperate with the distributors, he said. Calabria said "blacktopping" is a common indicator that a part is counterfeit. When parts sourced on the open market are determined to be blacktopped, they are commonly classified as suspect, "even though it is well-known that component manufacturers actually blacktop and remark authentic parts for valid reasons," he said.

"One reason is to fix mistakes," said Calabria. For example, an incorrect date code or lot code may have been marked on the part. "However, more commonly remarking is required due to binning operations." he said

Binning operations take place when a component manufacturer sells the same part with different speed, temperature, power, or test grades. In these cases, the parts are tested and put in different "bins"

“Counterfeiting is constant and consistent in that counterfeiters always seem to exploit any and all market conditions to their advantage”

Kristal Snider, vice president ERAI

“



depending upon which tests they pass, he said.

An OEM or electronics manufacturing services customer may place an order for a slower speed DRAM. The OCM may not have the slower speed part but could substitute a faster speed part which would also work. However, the customer may not accept parts marked with any part number that is not on their approved part list to prevent problems during QC inspection, said Calabria.

Good parts destroyed

Manufacturing a new batch of components might take 12-26 weeks, so remarking the faster part with the number of the slower part number may be the best solution.

An independent distributor that purchased blacktopped parts needs an OCM to verify that a part was or wasn't blacktopped at the manufacturer's factory to determine if it was authentic. Without such cooperation, “good parts located on the open market are literally being destroyed every day, forcing OEMs to redesign, or to wait for stock to become available through the authorized supplier,” said Calabria.

Snider said because component supply is so tight, many buyers, perhaps unwittingly, venture into the black market in search of scarce parts and become

victims of fraud. “Untrained, overwhelmed buyers that are under pressure to keep manufacturing lines moving are an easy mark,” she said. Buyers are using Google and Internet-based part sourcing platforms to search for parts. However, they may not be able to distinguish between the black market and the open market, which is comprised of verified independent distributors with legitimate parts availabilities and OEM excess parts, said Snider. “The black market is comprised of fraud, e-waste and counterfeit parts,” said Snider.

Buyer beware!

With the black market, criminals set up fraudulent websites, which “are visually appealing, extremely well-designed, and offer huge amounts of hard-to-find inventory which seem to lull buyers into a false sense of security,” she said. At such sites buyers receive an almost immediate response to their requests for quotes. The criminals are quick to respond and know exactly what to say to put the buyer at ease, according to Snyder.

“They offer a generous warranty and inspection period, promise supply chain traceability will accompany the shipment and offer net payment terms, for future orders,” she said. Only the first order is a wire transfer in advance to establish a relationship. “This is the only

order they will be placing” because the website and the inventories are bogus. Since 2017 ERAI has received complaints from 273 victims representing 48 different countries with losses exceeding one million dollars, said Snider. She said the number of victims of such fraud is actually 10 times the number reported.

She said there are steps purchasing organizations can take to avoid counterfeit parts and becoming the victims of fraud. Snider said purchasing from component manufacturers and their authorized sources is the best way to avoid counterfeit electronic parts.

“However, in times like this where there is a global chip shortage, buying from authorized sources is not always possible,” she said. As a result, buyers should receive training using “an internally designed training program that specifically addresses supplier selection, counterfeit screening and reporting,” said Snider.

Look for certifications

Buyers should look for independent distributors that have attained certifications to ISO 9001:2015, AS9120 and SAE AS6081. Distributors with the certifications will have established best practices and procedures for selecting suppliers and testing parts,” said Snider.

Watch for red flags when searching for parts online

It's no secret that during the current component shortages, buyers are scouring the Internet trying to find parts that are on allocation or that have very long lead times.

Before buying from any website of an unfamiliar company, buyers need to do their due diligence and carefully research the company to determine if it is a legitimate source for electronic components. ERAI, which maintains a database of counterfeit and suspected counterfeit parts, says there are certain red flags buyers should watch for before doing business at any website that purportedly has stock of hard-to-find components. Red flags include:

- The website offers below market pricing during a shortage.
- The seller will only accept a wire transfer in advance payment.
- The so-called supplier is unable to provide a photograph of the parts they say they have in stock.
- A website offering millions of parts as “in-stock” that has been operational for less than a year.
- The seller refuses to provide trade references.
- The supplier refuses to issue an RMA without an electrical test report.

Buyers' Guide

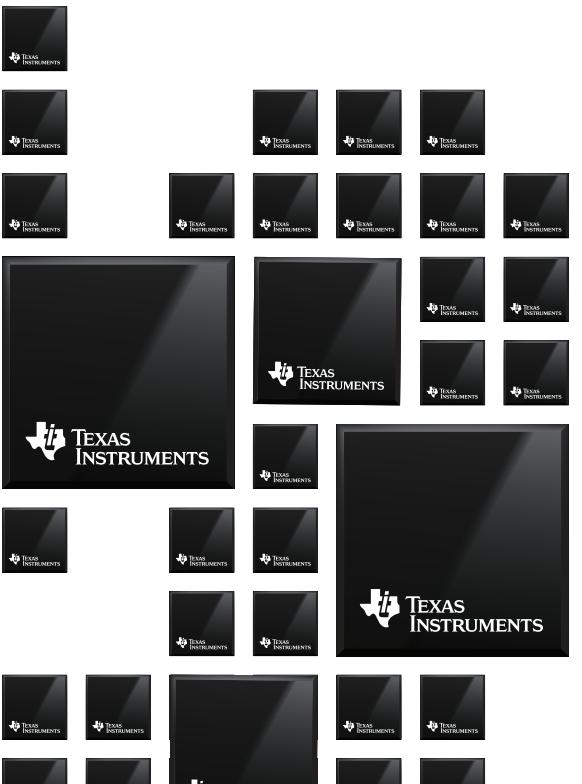
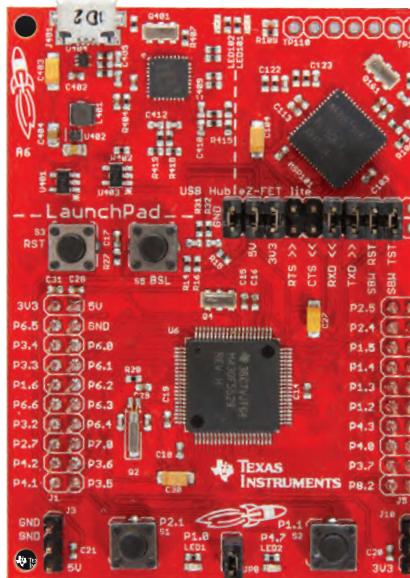
Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
ACOUSTIC COMPONENTS											
BeStar Electronics Ind. Co. Ltd.	BeStar Technologies Inc.	520-439-9204	www.bestartech.com	Y	N/A	\$250,000	N/A	100.00%	50	900	Y
CABLE & WIRING											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23235	N/A	\$0	0.46	50	1,000+	Y
Alpha Wire	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,106	N/A	\$0	93.00%	50	1,000+	Y
Belden Wire & Cable	Mouser Electronics	800-346-6874	www.mouser.com	Y	5,863	N/A	\$0	97%	50	1,000+	Y
Molex	ECCO	773-767-2200	www.eccocomponents.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Molex	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
CIRCUIT PROTECTION											
Bel Fuse	Bel Fuse	+1 201 432 0463	belfuse.com/circuit-protection	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,462	N/A	\$0	68.00%	50	1,000+	Y
Eaton	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,487	N/A	\$0	100%	50	1,000+	Y
Littelfuse	Mouser Electronics	800-346-6873	www.mouser.com	Y	28,790	N/A	\$0	67%	50	1,000+	Y
Schurter	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	31,445	N/A	\$0	68%	50	1,000+	Y
DISPLAYS & LEDs											
BIVAR	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,390	N/A	\$0	99.00%	50	1,000+	Y
Dialight	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,179	N/A	\$0	84.00%	50	1,000+	Y
Displaytech	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Electronic Assembly	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Kingbright Company, LLC	Mouser Electronics	800-346-6873	www.mouser.com	Y	301	N/A	\$0	100.00%	50	1,000+	Y
Lumileds	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Newhaven Display	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,690	N/A	\$0	100.00%	50	1,000+	Y
VCC	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ELECTROMECHANICAL											
ALPS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Apem, Inc.	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,326	N/A	\$0	83.00%	50	1,000+	Y
C&K Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	27,230	N/A	\$0	90.00%	50	1,000+	Y
E-Switch	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Grayhill	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Honeywell	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
IXYS	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Keystone Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y

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MOUSER ELECTRONICS



Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
ELECTROMECHANICAL (Continued)											
NKK Switches	Mooser Electronics	800-346-6873	www.mooser.com	Y	13,976	N/A	\$0	86.00%	50	1,000+	Y
Omron	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Panasonic	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Phoenix Contact	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
PUI Audio	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Schneider Electric	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Sensata	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
TE Connectivity	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Teledyne Relays	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ENCLOSURES											
Bud	ECCO	773-767-2200	www.eccococonnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bud Industries	Mooser Electronics	800-346-6873	www.mooser.com	Y	1,325	N/A	\$0	80.00%	50	1,000+	Y
Hammond Manufacturing	Mooser Electronics	800-346-6873	www.mooser.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	Mooser Electronics	800-346-6873	www.mooser.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
FREQUENCY MANAGEMENT											
Abracor Corporation	Mooser Electronics	800-346-6873	www.mooser.com	Y	1,780	N/A	\$0	100%	50	1,000+	Y
CTS Electronic Components	Mooser Electronics	800-346-6873	www.mooser.com	Y	3,889	N/A	\$0	100%	50	1,000+	Y
ECS Inc	Mooser Electronics	800-346-6873	www.mooser.com	Y	2,070	N/A	\$0	100%	50	1,000+	Y
Epson Toyocom	Mooser Electronics	800-346-6873	www.mooser.com	Y	178	N/A	\$0	100%	50	1,000+	Y
IQD Frequency Products	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Kyocera	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Silicon Labs	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ICs & SEMICONDUCTORS											
Analog Devices, Inc	Mooser Electronics	800-346-6873	www.mooser.com	Y	18,749	N/A	\$0	95%	50	1,000+	Y
Broadcom Limited	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Central Semiconductor	Mooser Electronics	800-346-6873	www.mooser.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.	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cypress Semiconductor Corp	Mooser Electronics	800-346-6873	www.mooser.com	Y	1,325	N/A	\$0	81.00%	50	1,000+	Y
Digi International	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Diodes Incorporated	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
FTDI	Mooser Electronics	800-346-6873	www.mooser.com	Y	94	N/A	\$0	100%	50	1,000+	Y
IDT (Integrated Device Technology)	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Infineon	Mooser Electronics	800-346-6873	www.mooser.com	Y	1,580	N/A	\$0	63%	50	1,000+	Y
Intel	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ISSI	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
IXYS	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Lattice	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
MACOM	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Maxim Integrated	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Microchip	Mooser Electronics	800-346-6873	www.mooser.com	Y	5,800	N/A	\$0	100%	50	1,000+	Y
Microsemi	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Monolithic Power Systems (MPS)	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Nexperia	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
NXP	Mooser Electronics	800-346-6873	www.mooser.com	Y	7,205	N/A	\$0	100%	50	1,000+	Y
ON Semiconductor	Mooser Electronics	800-346-6873	www.mooser.com	Y	7,486	N/A	\$0	96%	50	1,000+	Y
Power Integrations	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Qorvo	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Renesas Electronics	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ROHM Semiconductor	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
SanDisk	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Silicon Laboratories Inc	Mooser Electronics	800-346-6873	www.mooser.com	Y	1,141	N/A	\$0	100.00%	50	1,000+	Y
Skyworks	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
ST Microelectronics	Mooser Electronics	800-346-6873	www.mooser.com	Y	8,145	N/A	\$0	96.00%	50	1,000+	Y
Swissbit	Mooser Electronics	800-346-6873	www.mooser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Texas Instruments	Mooser Electronics	800-346-6873	www.mooser.com	Y	29,676	N/A	\$0	94%	50	1,000+	Y
Toshiba	Mooser Electronics	800-346-6873	www.mooser.com	Y	800	N/A	N/A	N/A	N/A	N/A	Y
Vishay	Mooser Electronics	800-346-6873	www.mooser.com	Y	53,781	N/A	\$0	77%	50	1,000+	Y

Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
INTERCONNECTION											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23,235	N/A	\$0	46.00%	50	1,000+	Y
Aero Conesys	ECCO	773-767-2200	www.eccocomponents.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amphenol	ECCO	773-767-2200	www.eccocomponents.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Amphenol	Mouser Electronics	800-346-6873	www.mouser.com	Y	165,853	N/A	\$0	31%	50	1,000+	Y
Anderson Power Products	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Aptive (Delphi)	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Bel Magnetic Solutions	Bel Fuse	+1 858 676 9650	belfuse.com/magnetic-solutions	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cinch	ECCO	773-767-2200	www.eccocomponents.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.eccocomponents.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ITT Cannon	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
JAE Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,02	N/A	\$0	100%	N/A	N/A	Y
JST	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
LEMO	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Mill-Max	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Molex	Mouser Electronics	800-346-6873	www.mouser.com	Y	85,634	N/A	\$0	89%	50	1,000+	Y
Neutrik	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,563	N/A	\$0	100%	50	1,000+	Y
NorComp	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	30,044	N/A	\$0	77.00%	50	1,000+	Y
Radiall	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Souriau	Mouser Electronics	800-346-6873	www.mouser.com	Y	10,744	N/A	\$0	27%	50	1,000+	Y
Stewart Connector	Bel Fuse	+1 717 235 7512	belfuse.com/stewart-connector	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Switchcraft Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	300	N/A	\$0	55%	50	1,000+	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	123,613	N/A	\$0	69%	50	1,000+	Y
OBSOLESCENCE / HARD TO FIND											
Lansdale	602-438-0123	lansdale.com		Y							
Lantek Corp.	973-579-8100	www.lantekcorp.com		M	186,000	\$22M	\$0	75.00%	5	62	Y
Rochester Electronics	978-462-9332	www.rocelec.com		Y	N/A	\$250			10	400+	Y
OPTO ELECTRONICS											
Broadcom	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	582	N/A	\$0	99.00%	50	1,000+	Y
Finisar	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,927	N/A	\$0	99%	50	1,000+	Y
ROHM Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
PASSIVES											
ABRACON	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
AVX	Mouser Electronics	800-346-6873	www.mouser.com	Y	42,454	N/A	\$0	72%	50	1,000+	Y
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	38	N/A	\$0	78%	50	1,000+	Y
Cornell Dubilier	Mouser Electronics	800-346-6873	www.mouser.com	Y	24,145	N/A	\$0	71%	50	1,000+	Y
Coilcraft	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	26,533	N/A	\$0	98.00%	50	1,000+	Y
Fair-Rite	Mouser Electronics	800-346-6873	www.mouser.com	Y	N/A	N/A	\$0	N/A	50	1,000+	Y
Kemet	Mouser Electronics	800-346-6873	www.mouser.com	Y	77,568	N/A	\$0	66%	50	1,000+	Y
KOA Speer	Mouser Electronics	800-346-6873	www.mouser.com	Y	34,078	N/A	\$0	58%	50	1,000+	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	33,780	N/A	\$0	99%	50	1,000+	Y
Nichicon	Mouser Electronics	800-346-6873	www.mouser.com	Y	20,389	N/A	\$0	84.00%	50	1,000+	Y
Ohmite	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,293	N/A	\$0	55.00%	50	1,000+	Y
Panasonic Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,948	N/A	\$0	100.00%	50	1,000+	Y
Signal Transformer	Bel Fuse	+1 516 239 5777	belfuse.com/signal	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Taiyo Yuden	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,620	N/A	\$0	98.00%	50	1,000+	Y

Buyers' Guide

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

Contract Manufacturers Buyers' Guide

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



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Field Application Engineer

Midwest, East Coast, West Coast, Florida, Texas

Internal Sales Assistant

Texas, Florida

Material Manager

Texas, Florida