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All the facts and figures to help you buy

Editor's Word



Shoot for the stars

So, the UK is going to get a shiny new spaceport for launching micro satellites and horizontal takeoff space craft. About time too.

Over recent decades, when I questioned the logic of outsourcing high volume, low value production to lower cost economies I was always told that the true nature of UK manufacturing was low volume, high value products.

I could have accepted that argument if, for every low value production line that left these shores, a new gold-plated high value line was built. However, I've never felt it was a balanced transaction. Yes, we build parts of aircraft that are finally assembled elsewhere. Yes, we build vehicles for foreign owned brands. However, in terms of rolling out new UK-owned, high technology sectors on an industrial scale I've been disappointed.

A new space port might just be the first tiny step in the right direction.

As an aside, the reason I wanted to retain the high volume, low value production capacity is that without an army of cheap employees, backed by questionable health, safety and environmental standards, this type of work is really, really hard to do profitably. It would require huge amounts of investment, thought, innovation, automation and scale. Just the sort of activity that lays the foundations for nation building.

However, I do have new hope. If the past government's original target of 50 per cent of the nation's youth educated to degree level has worked its way through the system, surely, we must now have the collective brain power to shoot for the stars and beyond. If this isn't the case I'd really like to know where we went wrong.

Jon Barnett

Contact

ELECTRONICS
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EDITORIAL

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

ADVERTISING

Area Sales Executive: Emma Poole
emma.poole@electronics-sourcing.co.uk
Director of Sales: Charlotte Morgan
charlotte.morgan@electronics-sourcing.co.uk
Marketing Manager: Amy Leary
amyleary@electronics-sourcing.co.uk

CIRCULATION

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

DESIGN

Graphic Designer: Jeremy Roberts
jeremy.roberts@electronics-sourcing.co.uk

PUBLISHER

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

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Keeping up *with* the good times



Victoria Kickham is a freelance writer specializing in manufacturing, distribution and supply chain issues

Supply chain services, technology take centre stage as buyers keep pace with the strong economy

Economy • By Victoria Kickham

Buyers face a different set of challenges as the economy continues its upward climb, particularly when it comes to managing their supply chains. Strong demand across just about every end market has extended lead times for many electronic components and created pricing pressures as well as labor challenges—especially in the manufacturing sector, where employment is expanding and skilled workers are hard to find.

It all adds up to busy times for buyers at organizations of all sizes, who face both fundamental and technological challenges in mid-2018. Fundamentally, today's challenges come down to constraint: Demand is high, and it's placing distributors in a "chief expediter" mode, says Phil Gallagher, global president, electronic components, for Avnet.

"We're doing what we can to feed the lines for our customers," Gallagher says, pointing to the key challenges facing buyers in today's marketplace. "Right now, [this is] one of the top [issues] that may not have been [an issue] two years ago because inventory and parts were plentiful."

Traditional supply chain services such as forecasting and inventory management come into sharp focus in times like these, he adds, as customers concentrate on keeping production lines running smoothly and efficiently.

Still, as business challenges go, Gallagher says these are good ones to have.

"I see them as positive ... because it means things are good," he says, pointing to strength across Avnet's end markets and regions. "Most of our customers are doing well ... There are some exciting things going on. We're seeing it in all regions."

Technology challenges persist during the current good times, as well. Gallagher and others say there continues to be a growing need for electronics expertise among engineering and buying organizations large and small, particularly as customers seek to create increasingly sophisticated products or add Internet connectivity to non-traditional applications. Gallagher points

to transportation, medical, and agricultural markets as just a few examples of areas where Avnet is seeing an increase in demand for technical service, from design all the way through to production. The distributor unveiled a suite of IoT services this year aimed at meeting such needs; they include advisory, design and build, cloud and digital, and lifecycle services.

Such capabilities are part of a larger transformation at Avnet over the last 18 months that has included the addition of engineering communities such as element14 (via its acquisition of Premier Farnell) and Hackster.io as well as manufacturing solutions provider Dragon Innovation.

Avnet's transformation underscores a continuing evolution of the distribution sector, as distributors seek to move beyond providing products and services to offering customers complete solutions.

"[We tell customers], 'We want to be your solution provider. If you have an issue, a challenge, call [us],' " Gallagher explains. "It's really what we're moving toward."

Other headlines over the summer emphasize the trend as well. Interconnect, passive, and electromechanical specialty distributor TTI announced an expansion of its semiconductor specialty business, TTI Semiconductor Group (TSG), in July with its purchase of California-based distributor RFMW Ltd. The deal is expected to close this fall, and will add RFMW's focus on radio frequency and microwave components, semiconductors and related engineering support to TTI's lineup of specialty services. TTI launched TSG in 2017 with its purchase of Symmetry Electronics as a way to evolve its specialist model to include semiconductor products and services.

"RFMW will be an important addition to the TTI family of companies and our semiconductor distribution group," said Michael Knight, senior vice president, TTI Business Development and TSG President. "The company culture, focus, and reputation for superior customer service and technical expertise complement TTI extremely well and are a perfect fit for our specialty distribution model."

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Agreement maximises M2M focus

Outsourced manufacturing and distribution specialist, Components Bureau, has been appointed as sole UK distributor for Bivocom's industrial wireless transmission terminals for internet of things and machine to machine applications.

Bivocom manufactures NB-IOT, 4G/3G/2G industrial wireless modems, data terminal units, gateways, routers and Android industrial personal computers, which are widely used within smart grid, smart city, oil and gas,

irrigation, intelligent transportation, kiosk and vending, mining, agricultural monitoring and industrial automation applications.

Commenting on the announcement, general manager at Components Bureau, Andrew Ferrier, said: "Backed by an experienced research and development team, Bivocom delivers innovative and reliable solutions. We feel its product range is a great addition to our portfolio as we look to expand into new markets."

www.componentsbureau.com

Wireless partnership extends IoT expertise

Avnet Silica has been appointed as a franchised distributor in the EMEA region for Digi International, a provider of internet of things connectivity products and services. Under the agreement, Avnet Silica will supply Digi International's advanced wireless and system-on-module solutions for industrial markets along with Digi XBee RF modems and cellular modems. As a preferred partner for NXP, Digi International will also augment Avnet Silica's portfolio of wireless solutions based around NXP's advanced semiconductor technologies.

Although all Digi International technologies will be available via Avnet Silica, radio frequency and embedded SOMs for industrial IoT applications will be a key focus for the distributor.

Director supplier management at Avnet Silica, Laurence Dellicott, said: "Digi International is fast making itself into one of the world's leading vendors of secure and highly reliable wireless components, technologies and solutions for a range of industrial markets, including food services, facilities monitoring, retail and healthcare, as well as the transportation and logistics sectors. The portfolio is also an excellent complement to our existing industrial IoT solutions, and we look forward to bringing these innovative technologies to market."

www.avnet-silica.com



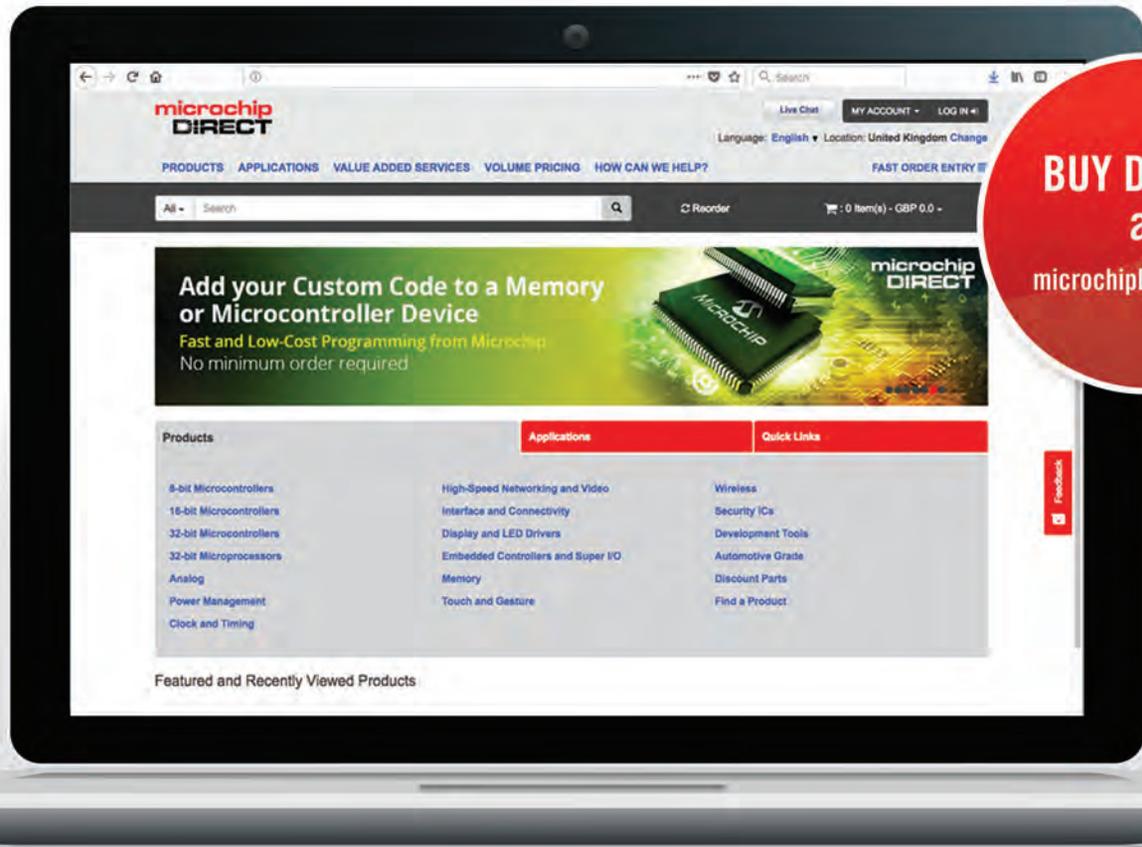
Motion sensor available now

TTI now offers a high-density, long-distance Panasonic pyroelectric sensor, extending its EKMB and EKMC series of passive infra-red motion sensors. The new sensor is ideal for use in lighting control equipment, offices, high-bay motion sensors for warehouses, public and industrial buildings, plus street lighting and security cameras.

A quad-sensor-based design with a detection zone density of 128 is said to guarantee a reliable response, even over large distances. Lens diameter is only 20.45mm, yet the detection distance is up to 17m, and detection area is 16m at an installation height of 12m. The device also features a symmetrical detection area, which simplifies sensor integration because of the independence of sensor orientation within the final product.

www.tti-europe.com

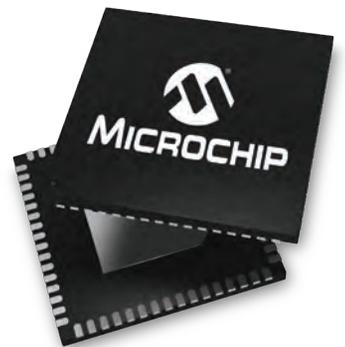
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In Brief

More MEMS microphones

Infoholic Research forecasts that the global market for micro-electromechanical systems microphones is expected to witness a compound annual growth rate of 11.7 per cent to reach \$2,878.4 million by 2024. Growth will be driven by mobile handsets, voice assistance solutions, and internet of things and automotive applications. www.infoholicresearch.com

IT boosts availability

Purchasers of Ecopac Power's AC/DC power supplies and LED products are enjoying speedier delivery and more competitive pricing thanks to the company's investment in a bespoke IT solution. Software developer, DBLogic, helped Ecopac switch its overstretched Sage system to a custom purchase order processing and stock control system, prompting availability to go up by 11 per cent. www.ecopacpower.co.uk

Crying out for cryogenics

Intelliconnect's new CryoCoax division specialises in connectors and cable assemblies for cryogenic systems, including measurement and testing, system quantum computing, space and instrumentation. The stainless steel interconnect range provides SMA, SMP and custom products with standard, IP68 and glass sealed hermetic adapters and attenuators from zero to 30dB, configured to withstand temperatures of 2K and below. cryocoax.com

Report supports responsible sourcing

Drive Sustainability and the Responsible Minerals Initiative have released a study examining responsible sourcing in the automotive and electronics industries. The report, entitled *Material Change*, assesses the importance of 37 materials, evaluating environmental, social and governance risks at industry levels. It aims to help businesses understand raw material supply chains and reduce pressures on vulnerable ecosystems in resource-producing countries. drivesustainability.org



Portfolio extended with 900 industrial products

Farnell element14 has added IDEC, a manufacturer of industrial automation and control products, to its range in Europe. The launch adds more than 900 IDEC products, including new 16 and 22mm industrial switches, emergency stop safety products, safety enabling switches, stack lights, panel instrumentation, relays, power supplies and laser scanners.

Apem and IDEC sales and distribution manager, Ian Mcstay, said: "IDEC has a longstanding reputation for manufacturing high quality products, to suit varied applications within the industrial automation and safety critical environments from design-in to maintenance and repair operations. We see the addition of these IDEC ranges as a key factor in the continued growth of our two successful companies."

Head of product management IP&E, Farnell element14, Dave Beck, added: "IDEC's high-quality products for the industrial market are an excellent addition to our portfolio, and we expect to see strong demand from our customer base."

www.element14.com



Dedicated to quality

Following a recent BSi audit, electronics manufacturing services provider, Wilson Process Systems, has been awarded ISO 9001:2015 certification. During the audit, the company, which is based in the South East of the UK, demonstrated 100 per cent compliance in its transition from ISO 9001:2008 to ISO 9001:2015 for the manufacture of electronic assemblies to customer specifications.

Testament to the ongoing effectiveness of the company's quality management system, the award demonstrates WPS' dedication to providing the highest possible quality products and services to clients. It gives customers confidence in the consistent quality of WPS products and demonstrates it has the means to satisfy statutory and regulatory requirements.

Quality manager, Jim Hobbs, who has been with WPS since 1996, commented: "I am delighted we have been successful in achieving this certification, which demonstrates the commitment of the entire team at WPS as well as reassuring current and prospective customers of our continued determination to maintain and develop our quality management system."

www.wps.co.uk

Sensor modules ready to ship

Mouser Electronics is now stocking the AmbiMate MS4 sensor module series from TE Connectivity. Incorporating four core sensors on a single printed circuit board assembly, TE's AmbiMate sensor modules are designed for easy integration in a variety of host products in building automation, lighting, and smart home applications. Modules are pre-engineered and assembled so manufacturers can devote valuable design resources elsewhere.

MS4 series modules all include sensors for motion, light, temperature, and humidity, while optional additions include sensors for sound, CO₂, and volatile organic compounds. Multiple attachment options are available to integrate the pre-assembled PCB into the host board. The modules also share a common seven position connection, allowing a single PCB footprint to accommodate every available sensor configuration.



Ideal for building automation applications, modules can be used to capture VOC and CO₂ concentrations to evaluate air quality. Modules with an integrated microphone can augment motion detection by listening for sound events. A network of modules can detect occupancy, humidity, temperature, and light levels, allowing building controllers to adjust indoor lighting, HVAC equipment, energy management and other zonal environmental controls.

www.mouser.com



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3D memory drives automotive data storage

Uncompromising performance and reliability are required for today's autonomous automotive systems, prompting rapid acceleration in memory technology development

Technology is radically changing the driving experience by enhancing comfort and safety through driver monitoring systems and autonomous technologies. These sophisticated systems generate unprecedented volumes of data that need to be stored, retrieved, transmitted, processed and analysed. Given the safety and life-critical challenges of automotive applications, what storage options are available?

High-capacity memory cards are the obvious choice, as they are small, light and can hold vast amounts of data. Just as well, since self-driving cars generate about 4TB of data in just an hour and a half of driving.

Extreme reliability

Interestingly, 3D NAND technology is increasingly being adopted in flash storage, but does 3D measure up to the tried-and-tested planar 2D and is it the right time to switch?

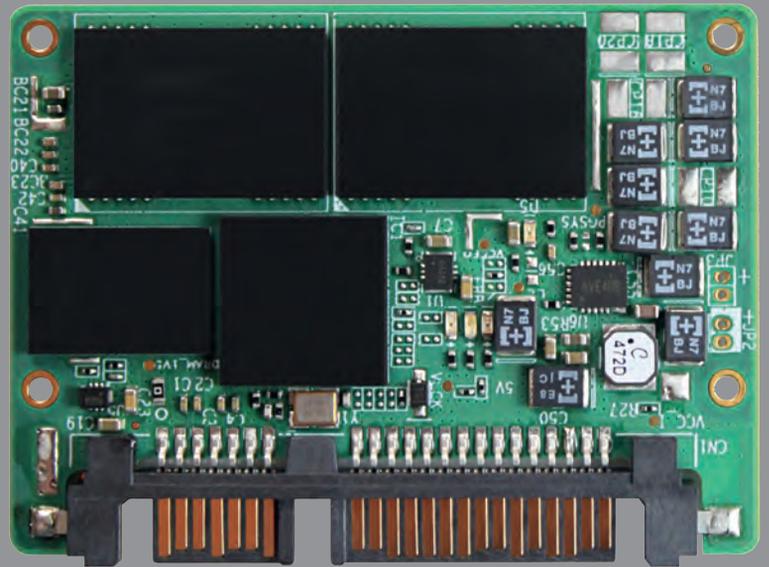
Firstly, 3D NAND provides higher reliability than 2D NAND due to lower cell-to-cell interference, achieved by stacking memory cells vertically. There is, however, a choice of architectures, with 3D NAND memory cards employing either charge trap or floating gate designs. In theory, CT's thinner tunnel oxide requires lower tunnelling voltage, resulting in higher overall endurance. FG, on the other hand, is more suitable for data retention at high temperature. Ultimately, only test data should be trusted to determine which solution

is suitable for automotive requirements.

Regardless of the solution, it is important that the cards perform reliably in extremely low or high temperatures as vehicles go through different thermal cycles. Additionally, considering the massive random data transactions, memory cards are well suited to the high storage demands of future autonomous vehicles.

Tailored technology

Not all memory cards are created equal. Typical



consumer cards are not built for rigorous driving conditions, while industrial cards made specifically for automotive applications are meticulously tested, from IC to mass production. This ensures they will withstand extreme temperatures, vibration/shock, humidity, sudden power loss and other challenges.

Furthermore, with 3D NAND technology, industrial memory cards boast higher densities and lower cost per bit. They are also highly customizable, allowing an increase in performance and lifespan, depending on customer requirements and device configuration.

These benefits combined, mean 3D NAND cards are ideal for data-rich applications such as road recorders, in-vehicle infotainment, navigation systems and advanced driver assistance systems. Selecting the right card can maximise uptime,

3D NAND provides higher reliability than 2D NAND due to lower cell-to-cell interference

engineering resources and customer satisfaction, so it's important to select application-tailored solutions from industry experts.

Aiming to meet this demand head on, ATP manufactures 3D MLC memory cards at its purpose-built factory. With over 25 years' expertise in handling critical processes from IC screening and validation through to production, ATP offers a full range of NAND flash products that meet and exceed the stringent requirements of automotive applications including high densities, tolerance to wide temperature ranges and excellent data retention.

www.atpinc.com

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Cutting to the core of ferrite demand

Purchasers of ferrite products often require a bespoke solution, from non-standard materials to gapped cores. Technical manager at Gateway, Joshua Bailey, explains how the company's core capabilities meet this demand



Q What are the main uses for ferrites and associated magnetic products?

A) Ferrite products come in two main material types: hard ferrites and soft ferrites. Hard ferrites are predominantly used in the production of permanent magnets, while soft ferrites feature in products used to suppress electromagnetic interference and those used as the 'core' element of an assembly in high frequency inductors and transformers.

In noise suppression applications, a ferrite bead, chip, ring or clamp will often be used to ensure that conducted, and in some cases radiated, noise is removed or limited from the circuit. High noise can lead to signal degradation and problematic excess heat.

In inductor and transformer

applications, ferrite 'cores' are mainly used in high frequency power supply designs, due to their high permeability, high current resistivity and low eddy current losses.

Ferrite transformers come in a range of geometries, sizes and materials. The two main base materials for ferrite cores are manganese zinc and nickel zinc. These form the basis for hundreds of variations of ferrite grades, with each grade being designed for certain applications, such as high frequency power supplies, wide band power supplies, and signal transformers.

Q Are ferrites and cores usually sourced by buyers or selected by design engineers?

A) Ferrite cores must perform to key electrical

characteristics to suit the application circuit in which they are being used. These characteristics are critical to the performance of the end-product and poor product selection or mis-design could be costly or even catastrophic. The design and build of transformer and inductor products is a highly specialised field and the UK has a reputation for designing and building some of the most advanced, rugged, and reliable transformer and inductor products in the world.

Q Are ferrites and cores manufactured overseas and, if so, how are delivery times and stock holdings standing up?

A) European manufacturers have a long-established reputation, with the two largest being Ferroxcube

▶▶ continued on page 14

The Gateway machine shop can offer a gapping service for non-standard dimensional gapping or specific inductance values



The two main base materials for ferrite cores are manganese zinc and nickel zinc. These form the basis for hundreds of variations of ferrite grades



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Ferrites & Cores



Gateway and its main suppliers have invested in significant inventory growth to protect customers from some of the vagaries of supply and demand

▶ and TDK, formerly parts of Philips and Siemens. These manufacturers have advanced development programmes for new materials to ensure their products keep pace with the demands of new application areas.

Both companies have manufacturing facilities in Europe and in the Far East and this benefits markets in each zone by being able to maintain 'controlled' leadtimes. As with all other electronic components however, global demand for ferrites is being driven by emerging products in the internet of things arena, by electric vehicles, and by the increased use of sensor products across smart applications.

Ferrite leadtimes have been impacted, but not as badly as some other products. Gateway and its main suppliers have invested in significant inventory growth to protect customers

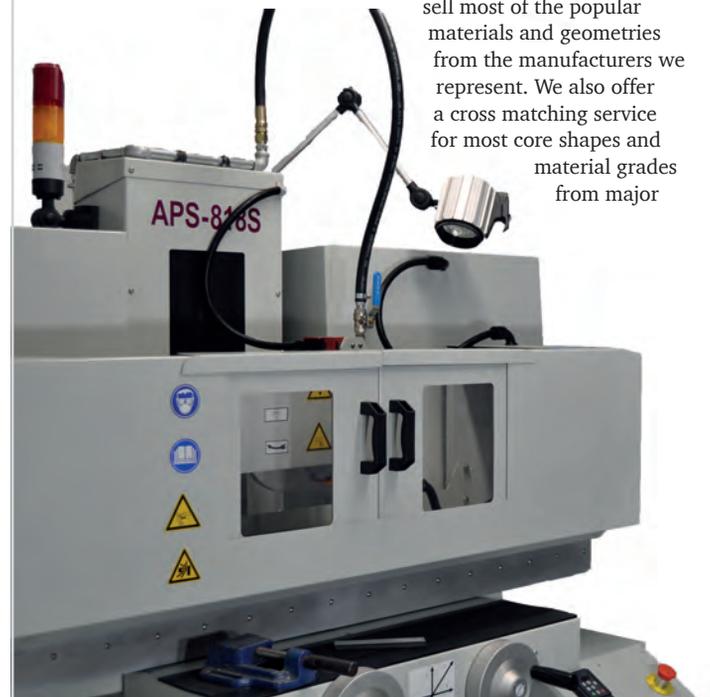
from some of the vagaries of supply and demand.

Q Why is material choice important when sourcing ferrites?

A) Quite simply, the material determines the performance characteristics of the device, whether that's a noise suppressor, inductor, or transformer, ensuring product performance matches the application in which it will be used. The wrong material selection may result in underperformance, losses and inefficiencies, and will result in shorter product life and inevitably higher costs.

Q Aside from cost, what are the three most frequent questions buyers ask when sourcing ferrites and cores?

A) Can you offer alternative materials? We stock and sell most of the popular materials and geometries from the manufacturers we represent. We also offer a cross matching service for most core shapes and material grades from major



manufacturers. There may be minor differences, but we can work with customers to determine the impact these differences may have on the circuit and application.

Can you offer non-standard gapped cores and AL values? We offer a vast range of ungapped cores and many standard gapped cores from stock. We can also supply manufacturers' bespoke gapped cores, although these often come with a high minimum order quantity and a manufacturing leadtime. For low to medium volume requirements however, the Gateway ferrite machine shop can offer a gapping service for both non-standard dimensional gapping or specific inductance values. Turnaround time is between two and four weeks, with sample turnaround often in a matter of days.

Can you offer geometric machining? Many customers require unusual geometric machining for mechanical or electrical purposes. We have built up an extensive library of machined products, and further investment in the machine shop will extend our capabilities. We rarely turn anything away and we rarely fail to deliver satisfaction.

Q Why do customers require gapping services and what does this involve?

A) Gapping and machining provide a bespoke solution on either dimensional characteristics or inductance values, or both. Gapping involves reducing the centre limb of the core to the required dimension or to achieve the required AL value. Machining involves the use of CAD systems

and CNC machinery to modify the ferrite to achieve a specific shape.

Since we opened the machine shop we have modified cores and ferrite materials to achieve some very unusual geometries: splitting toroids in half; creating bull rings; reducing rod lengths; creating new core geometries by combining one or more cores; making air slots; and expanding inner limb dimensions. As a rule, if you can draw it, we can machine it. We can also

manufacture our own tools and work holdings in-house to meet detailed machining demands and we provide a CAD service, if drawings are not provided. We hold most of the major core geometries in stock and there are rarely high minimum order levels.

www.theferritegateway.com



Technical manager, Gateway, Joshua Bailey





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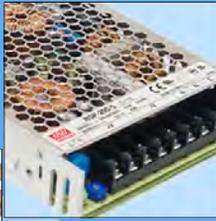
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Requirements of distributors evolve and get more complicated

OEM and EMS customers want their distributors to help them cut total cost, reduce time to market and help them solve component allocation issues



James Carbone

Distributors, whether they are big or small, know they have to do more than sell parts if they want to increase sales and grow their number of customers.

While distributors obviously have to stock the components customer need, they must also help them compete in the marketplace by aiding their efforts to reduce total cost and get new products to market faster. In addition, over the past year helping customers compete means helping them manage long lead times and shortages.

Such assistance sometimes comes in the form of value added, supply chain, inventory management, and design services. Information is key. Distributors provide technical and market information on their websites crammed with, not only part numbers and market data, but also with spec sheets, tutorials and design tools to make it easier for customers to find the most technically fit, cost-effective solutions.

It's not just brand-name distributors, such as Arrow, Avnet, Future, Mouser and TTI that provide services that help customers reduce their total cost of ownership and reduce time to market. Even small, lesser known, specialised distributors provide value-added, supply chain services and design expertise to customers.

For instance, Joel Levine, president and founder of distributor RFMW, based in San Jose, Calif., said his company provides many services that reduce cost for customers including custom cable assemblies, visual inspection of die, tape and reeling, some kitting, and private labelling. RFMW, which is being acquired by TTI, specialises in RF and microwave components.

"Some things that we do that traditional distributors don't do is handling die and doing visual inspection of the die," he said. "A customer may want a visual inspection because the part might be going into an environment that can't have any dirt or dust or scratches or things like that. We have a clean room in-house and after visuals" the die is re-plated and serialised, he said.

Another specialist distributor, Symmetry Electronics based in Hawthorne, Calif., has inventory programs to help reduce cost for customers. "We have the ability to do all the standard inventory bonds," said Mark Zack, vice president and general manager of Symmetry Electronics, based in Hawthorne, Calif. "We can do proximity warehousing. We can do one-day or two-day shipments," he said. Symmetry is also increasing inventory for customers.



Mark Zack, vice president and general manager of Symmetry Electronics

"We have the ability to do all the standard inventory bonds. We can do proximity warehousing"

Shortening lead times

Helping customers to reduce cost by carrying inventory for customers is also a focus for Integra Electronics, a small distributor based in Anaheim, Calif.

"We carry the inventory. We try to shorten the lead times so customers always have products on the shelf," said Victor Montez, president of Integra, which carries a range of components including capacitors, connectors, diodes and transistors, frequency control devices and LEDs among other parts.

"If a customer needs a half million pieces and we know that they're using them we are going to have" the parts in stock, he said. "Some of the inventory is bonded, but most of it is dedicated to our customer base."

Montez said Integra's customer base is limited, but it offers a high level of services to its customers. Integra understands customer forecasts and "is in tune with their products" and what parts they will need for new designs that are going into production, he said.



Montez said customers are “looking for boutique type of service.” When they have a new design, “we understand what they need,” he said. If a part being considered for a new design is going end of life, Integra offers alternative solutions.

“We know the strengths and weaknesses of our products and where the technologies are going,” he said.

Requirements change

Distributors say customer requirements have evolved over the years and are more complex than in the past and there is no one-size-fits all solution to satisfy requirements. For instance, some OEM customers want to use the web exclusively to do business with distributors and are not interested in face-to-face meetings with field application engineers, sales reps or account executives. Others insist on in-person meetings with both sales and technical support.

Because of the web, customers have a lot of information but they “don’t want to have to hash through hundreds of thousands of pages to understand what’s

the best technology for their requirements, for their challenges and for the boards” that they are building, said Karim Yasmine, corporate vice president strategic supplier development for Future Electronics based in Montréal.

As a result, Future and other distributors have highly trained field application engineers to help customers find the best solution for a design. “The FAEs are not driving one manufacturer over another. They are driving the best solution for the customer,” and helping reduce the time it takes to bring a new product to market, he said.

On the supply chain side, OEM and EMS providers’ reliance on distributors has become more acute over the past year because of market conditions. There are shortages and allocations of semiconductors and passives and many buyers are looking to distributors for shortage parts, or alternative components or solutions.

“In this environment you get a lot of face-to-face contact because they are struggling” to find parts, said Yasmine. “We have to support

“We know the strengths and weaknesses of our products and where the technologies are going”

– Victor Montez, president of Integra Electronics

those customers that have been good at communicating their MRP requirements.” With many customers, “we sit down and we talk to them directly part by part to understand their needs,” he said. Future tries to make sure it has the inventory of parts that the customer needs “to keep lines running,” he said. “It’s a tough situation but we’re spending more time than ever on the phone with customers” about shortage parts.

“The mandate from our ownership is, success coming out of this market environment by means of all regular customers being taken care of,” said Yasmine. “Number two is if we can pick up additional customers through support with our inventory programs without impacting our loyal customers” then Future will do that. But the priority is regular customers.

The same is true will smaller distributors. Montez said during the current shortage, Integra is getting calls from buyers at many companies that it has not done business with before looking for parts.

“We went from the back of the Rolodex to the front of it,” he joked. Buyers seem to say “we haven’t called these guys before so let’s give him a shot.” But Integra focuses on its existing customers. “We want our customers to understand we are going through this with them, we want to be in business with them when everything is said and done,” said Montez.

Yasmine said with current tight supply market conditions, “we’re

spending more time than ever on the phone with customers” about shortage parts and some customers “are open to second sourcing and alternatives and that requires a lot of conversations.”

One particular problem area is multilayer ceramic capacitors. MLCC supply is tight and some manufacturers are not taking orders. Some are discontinuing production of capacitors in larger case sizes in favour of smaller case sizes which are more in demand.

Often distributors have inventory to meet the needs of their regular customers. However, in instances where a part has been discontinued, a board may need to be redesigned and distributors suggest alternate parts for the component that’s going end-of-life (EOL).

However, another solution may be just changing suppliers. For example, there are extended lead times for some microcontrollers from certain manufacturers. In some cases, lead times are out to 36 weeks. However, similar parts from other manufacturers have more traditional lead of 8 to 10 weeks, according to Yasmine.

“Everything is not on allocation. You can’t say that all technologies of one type or another are on allocation. You need to get down to the vendor, and the package to understand where the issues may be,” he said.



“Some things that we do that traditional distributors don’t do is handling die and doing visual inspection of the die”

Joel Levine, president of RFMW

Collaborate to innovate

Community-driven innovation is accelerating the development of single board computers, explains element14's global director of Raspberry Pi, single board computers and software, Peter Wenzel



Global director of Raspberry Pi, single board computers and software at element14, Peter Wenzel

Innovation is accelerating in single board computers, thanks largely to creativity within the communities that support them. Whether that stems from a brilliant individual or a hive-mind collaboration, communities provide fertile ground for developers looking to push the envelope of these compact, low-power, open-source computers.

Some of today's SBC platforms with the strongest community support include the Raspberry Pi, Beagleboard, Arduino, and micro:bit, though other SBCs enter the market every year, many focused on specific applications like robotics, artificial intelligence, or internet of things.

This community effect has segmented SBC development into three naturally aligning markets: education, hobbyists, and original equipment manufacturers, with innovation occurring across all three markets.

Driving performance innovation

Clearly, communities are driving performance innovations. The recently introduced Raspberry Pi 3 Model B+, for instance, addresses demand from the professional and maker communities for faster and

more powerful computers to be used as embedded devices. In addition to a faster quad-core Broadcom BCM2837 64-bit application processor, innovations for this platform are aimed at connectivity, with features like dual-band wireless LAN, faster ethernet over USB, modular compliance for the wireless subsystem and Power over Ethernet.

Another key area of innovation is in industrial-grade performance, such as providing improved thermal management for high temperature or low temperature environments. The BeagleBone Black Industrial with extended temperature range caters to this requirement.

Expect also to see more developments focused on internet of things applications. The Arduino community now has access to two new MKR-family SBCs with wireless connectivity for rapid IoT development: the MKR WiFi 1010 and MKR NB 1500. These boards provide improved WiFi and RF performance as well as lower power consumption for embedded wireless deployment, with some designed to work over cellular/long term evolution networks.

New architectures

Communities are also welcoming new architectures, beyond boards based heavily on ARM processors. Field-programmable gate arrays or open source RISC-V cores, such as in the Snickerdoodle and HiFive1 SBC, enable more complex projects like drones and robotics.

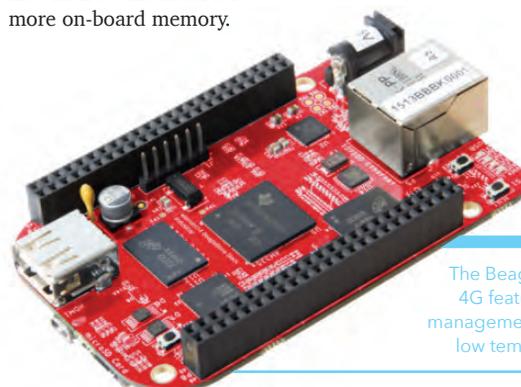
Another trend is SBCs sporting more on-board memory in lieu of using SD cards, for a higher level of reliability, like the Raspberry Pi Compute Module 3 and Compute Module 3 Lite. Futurehome, for example, is a smart home solution that leverages the Raspberry Pi Compute Module to connect to smart devices such as lighting, heating, alarms and electronic locks. Embedded multi-media controllers sporting both flash memory and a flash memory controller on the same silicon also address the need for more on-board memory.

Secure solutions

Naturally, security is a growing concern for community members developing real-world applications in which data must be protected. Accessories like the Zymbit module for Raspberry Pi, address this need, while next-generation SBC platforms are being introduced with on-board encryption.

As these examples illustrate, innovation in SBC development doesn't happen in a vacuum. Passionate communities of all sizes are leading the charge in creating, or demanding, solutions for every stage of the development process.

www.element14.com



The BeagleBone Black Industrial 4G features improved thermal management for high temperature or low temperature environments

Reclaim Memory Devices & High Value IC's from obsolete, damaged or old revision PCB's

There is a lot of excitement in the electronics sector currently about the huge strides forward being made with new innovations such as driverless cars, augmented reality, artificial intelligence, smart homes, voice control etc. But none of this works without the progression of memory silicon and the ability to transfer that data quickly and reliably, this is the key that drives it all. For all the latest IoT devices to be a success and grow as predicted we must rely on the memory market and the communication/connectivity market, but without the

memory market, none of this progression would be possible.

Over the course of the last year, we consistently heard reports surrounding DRAM and NAND shortages, causing a strain on supply and ultimately, pricing. When these shortages first crept up in late 2016, it was thought that everything would go back to normal in the second half of this year. That no longer seems to be the case, with shortages now expected to see us through to 2019/20.

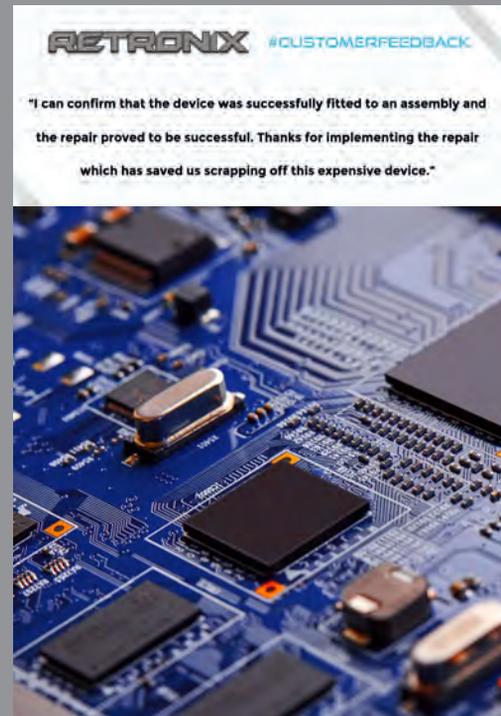
As a result Retronix are

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Weighing up the alternatives

In the past decade, some major capacitor OEMs have ceased production or discontinued products, leaving purchasers in a tight spot. Marketing manager at API Capacitors, Annastasia Love, provides a guide to alternative sources



Why would someone need obsolete, discontinued or replacement parts?

A) Often, it's to refurbish or maintain older equipment or machinery. The problem is that equipment originally manufactured 10, 20 or 50 years ago will typically include components that have been discontinued.

Similarly, a part in a piece of equipment may have reached the end of its life or experienced a failure. In situations like this, end users may seek to buy a

one-off part rather than placing a batch order, which would typically be the only type of order an original manufacturer will accept.

Although you may be safe if the required item is a legacy part, certain parts, for example diodes or fuses, are much easier to replace than an item such as a high voltage capacitor. Trying to find an exact replacement part can present obstacles including strict minimum order quantities and unknown specifications for discontinued items.

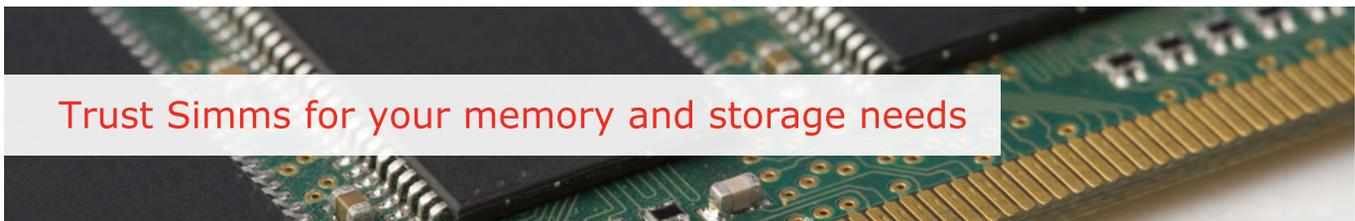
Where can I find electrical components that have been discontinued?

A) If you are in doubt about the availability of an item, call the original equipment manufacturer or a trusted distributor. Bear in mind, however, that the original manufacturer may not be too helpful when it comes to an obsolete part. An OEM will always try to sell a new part, rather than help you keep an obsolete part in your equipment design. You

▶▶ *continued on page 22*



If a part is no longer available to buy through its original manufacturer, an alternative manufacturer may be able to match the design



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may just have to trawl the manufacturer's archive of old specifications and provide this to an alternative source manufacturer.

If a part is no longer available to buy through its original manufacturer, an alternative manufacturer may be able to match the design and produce an interchangeable part to fit the equipment that needs servicing.

Alternatively, in some instances it may be possible to source obsolete components from a distributor, often with a large mark up. If capacitors are stored correct to manufacturer's instructions, most types will not age, however if you are sourcing electrolytic capacitors from a distributor with an inventory of old stock, be aware there is a shelf life on this component type.

Q Is it possible to manufacture a direct replacement?

A) Some independent capacitor manufacturers can manufacture interchangeable parts to replace discontinued OEM capacitors. Typically, capacitors can be manufactured and designed to order as per application requirements, which means a solution can be provided for almost any spare or replacement capacitor request.

Q What information do I need to provide to my alternative source?

A) With the design or specification for the original part, your alternative source will be able to manufacture the part to your requirement with no problems.

If the original design or full specification is not available, it may still be possible to design an equivalent part, if you can provide details of the following:
 - product and capacitor application

- required capacitance and tolerance
- any temperature or humidity requirements
- whether the capacitor will be subject to any high current discharge
- the physical part measurements or size
- the rated voltage
- the actual working voltage which will be applied to the part

While some purchasers may not have these technical details, your engineering department will certainly know the conditions under which the part will need to perform.

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Changing the status quo on long-term storage

Recent advances in storage materials are transforming long-term storage options, allowing companies to store products for years with zero degradation and no hefty costs

As semiconductor manufacturers look to rationalise their product lines, last time buys and end-of-life programmes are on the increase. Sadly, issues don't end with a last time buy—many supply chain managers share horror stories of last time buy inventory being destroyed or lost, with all the incumbent costs that creates. Unless product is stored correctly, it may not be fit for production when required, so long-term third-party storage is often a cost-effective solution, compared to the alternatives of redesign or minimum requalification.

Current LTS methods, including humidity-controlled and

nitrogen purged cabinets, are highly effective, however, they are also costly to install and run. Furthermore, any maintenance failures can have devastating effects. Recent advances in storage materials, such as those used by Solid State Supplies, are therefore transforming long-term storage, allowing companies to store semiconductors and many other products for up to 15-years with zero degradation and no hefty costs.

Designed to provide permanent electrostatic and moisture protection, these specially impregnated packaging materials protect ferrous and non-ferrous materials, electronic

components, optical components and plastics. Solid State's secure facility, combined with these revolutionary packaging materials, provide supply chain managers with a low-cost alternative, making this solution viable for a wider range of products than was previously economically possible.

Tested by NASA to NASA SP-R-0022A and approved to other standards, including DEF STAN 81-41 and MIL-81705D, these packaging materials and methods have a proven and well-documented record.



Solid State Supplies' secure long-term storage facility in Redditch

Solid State Supplies, which is also certified to AS9100 and AS9120, now uses these advanced materials as part of the sourcing and obsolescence services offered at its secure warehousing facility in Redditch.

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Strength in numbers

Solid State Supplies emphasises that a component's price, lead-time, longevity and security of supply are just as important as its technical specification

In recent years, traditional sectors such as security and industrial automation have evolved to encompass emerging technologies like wireless communication and low-power battery-backed solutions. Newer market sectors have also emerged from the wireless communications market, such as driver and vehicle tracking and monitoring. At Solid State Supplies, this evolution has been driven by manufacturers bringing out innovative new products and by the addition of new manufacturers to the line card.

Expanding expertise

Accordingly, Solid State has prioritised acquisitions that allow the company to address new product areas or significantly expand its business. In recent times, this has seen Solid State buy out 2001 Electronics and Ginsbury Electronics. Customers have benefited from an increase in scale, with each acquisition enabling Solid State to supply a greater number of devices, thus reducing the vendor base.

The acquisition of technical expertise has also allowed Solid State to work as an extension of customers'

design departments and to be recognised as subject matter experts. Free training is now offered across a wider range of subjects and the scale of the business allows Solid State to carry significantly larger stock profiles. Ultimately, the company continues to be acquisitive and is always looking for businesses that can bring a good level of superior technical support.

Lead time extensions

A number of lead times are extending, with the worst affected customers being those that rely heavily on capacitors or certain types of memory. Those with little or no reliance on these technologies are less affected, but even in these cases, Solid State Supplies is seeing lead times move out in general. Lead times are monitored constantly and Solid State works closely with manufacturers to ensure that customers are protected as much as possible from the disruption that lead time extensions cause. This can mean that Solid State holds higher-than-usual stock on a speculative basis or carries dedicated buffer stocks to insulate the customer from

extending lead times.

Any supply chain is only as good as its weakest point; unexpected lead time extensions will always be one of those. To this end, Solid State also works intimately with its customer base to get as much forward-looking information as possible, enabling it to make informed decisions on stock provision. Under the expectation that the reliance on a robust supply chain will continue, Solid State believes it is well placed with both customers and manufacturers to mitigate these fluctuations.



Working closely with manufacturers helps protect customers from the disruption caused by lead time extensions



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Solid State has prioritised acquisitions that allow the company to address new product areas



Solid State has enhanced its value-add capabilities by investing in upgraded in-house programming and tape and reel facilities

Investing in value-add

Over the last few years, Solid State Supplies has invested heavily in the value-added area, from upgrading its in-house programming and tape and reel facilities, to increasing sourcing and obsolescence services. Customers benefit from the flexibility that smaller reel sizes can bring and also appreciate the security of working with a UK programming centre, fully approved to AS9100, particularly in the military and aerospace sectors. Focussing on obsolescence, Solid State provides a range of solutions, from basic sourcing of obsolete parts, to electrical testing and re-qualification of devices. Other services include LCD testing, long-term storage and anti-corrosion storage solutions, alongside such things as version control on modules.

In nine out of 10 cases, Solid State Supplies engages with a customer's engineering department first. It aims to provide knowledgeable advice on both technology and component selection, then continues to assist through the design process, into prototype and pre-production, through full production, to end of life and obsolescence management. Judging by the close relationships and high levels of repeat business, customers clearly value this support. Price, lead-time, longevity and security of supply are as much of a part of the specification as any device parameter.

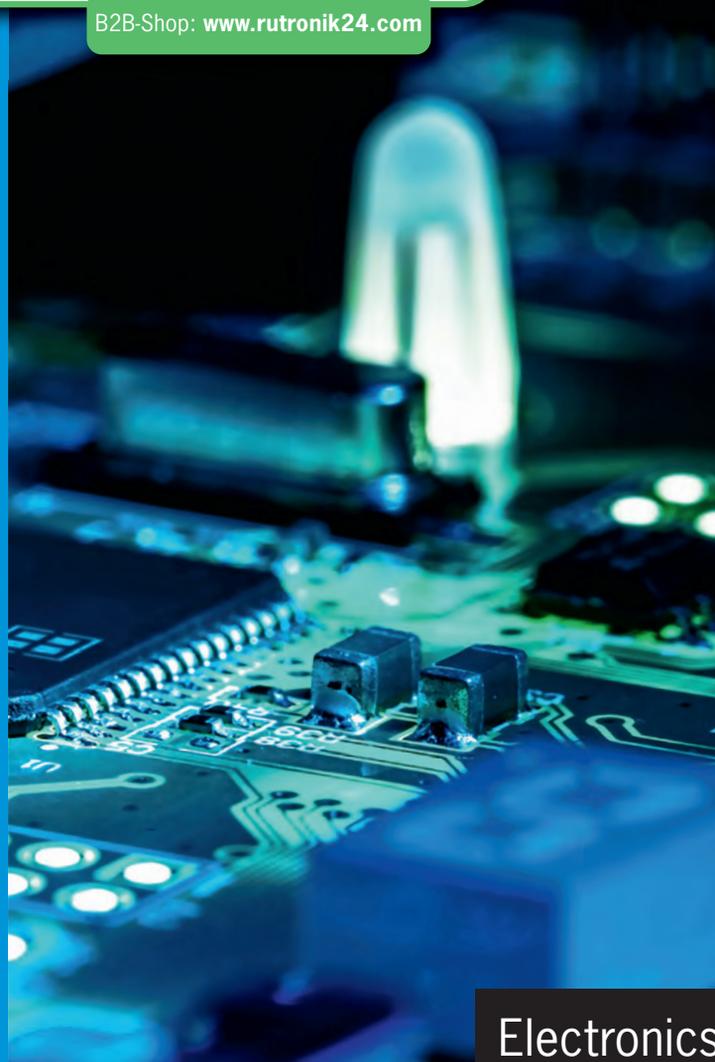
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When the going gets tough

Purchasers looking to specify approved product for demanding environments are often working to equally demanding timeframes. Interconnect provider, NYK Component Solutions tackles the problem head on

Connector and interconnect specialist, NYK Component Solutions, specialises in providing complete solutions to a variety of challenging interconnect requirements. As a fully franchised assembling distributor of Conesys MIL-DTL 38999 series III connectors and Compaero's sole European distributor of backshells and connector accessories, it has a number of options available, all backed by AS9100 Rev D, AS9120 Rev B and ISO9001 2015 approvals.

Efficient assembly

Working with Conesys headquarters in the USA and Conesys Europe in France,

NYK Component Solutions has set up an assembly facility and is approved as an assembling distributor of MIL-DTL 38999 series III at its UK headquarters.

This enables NYKCS to supply approved product quickly and efficiently. It meets demand for customer specific requirements by holding extensive stock of three shell styles, three plating variants and 49 insert arrangements. To back this up, NYKCS also stocks a range of Compaero circular connector backshells and accessories, providing an alternative to product offered by companies such as, TE/Polamco and Glenair.

The Compaero range covers adapters, protective covers, cable clamps and other connector accessories, from simple strain reliefs to submersible EMI/RFI shielded backshells for use in harsh environments. These mil-spec or commercial products are typically used in the aerospace, defence, industrial and automotive industries. Working with Compaero also enables NYKCS to provide custom designed products in a range of materials and finishes to meet specific requirements.

Adding value

This 'value-add' approach helps maintain competitive prices and short lead times for a range of products. Coupled with NYKCS' large volume of finished product, and the fact that NYKCS is a value-add distributor for Conesys MIL-DTL-38999 series III, this is good news for customers that require approved product in a demanding timeframe. The ability to supply quick turnaround connectors alongside complementary accessories positions NYKCS as a 'one stop shop' for customers' complete interconnect requirements.

To complete the picture, these capabilities are offered alongside other approved



As an assembling distributor for Conesys, NYKCS can supply approved product quickly and efficiently

connector and interconnect products and services including: MIL-DTL-26482, MIL-DTL-83723, EN2997, ESC10, MIL-DTL-5015 and hyperboloid contacts and connectors.

Finding solutions

To support buyers sourcing these demanding solutions, NYKCS provides an online resource with product specifications and cross-referencing tools. With a focus on technology and efficiency, NYKCS can help find the right product for any application at the right price. An integrated quality management and order workflow system also helps provide customers with dependable access to a flexible inventory of approved and certified components that meet the needs of the most demanding supply chain.

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- Optical
- Power
- Automotive



Global insight underpins local support

Backed by global supply chain expertise and a sophisticated anti-counterfeiting strategy, Astute aims to provide solutions to the most pressing sourcing challenges in evidence today

Q What challenges has Astute faced in building its current offering and how has the company changed?

A) We have overcome various challenges during our expansion, but our progress has always been reactive according to our customer's demands as we strive to provide a flexible and agile service. Very early on, we had to address the counterfeit issue so we introduced inspection laboratories that work to AS6081 standards.

As part of our globalisation, it was key to understand different cultures and behaviours and although this has been challenging at times, we now have successful footholds in our selected locations. We remain self-financing, which eliminates complexity and we have also relocated to larger premises, future-proofing our growth with a new 85,000ft² company-owned headquarters in Stevenage.

Furthermore, we have recently introduced a new enterprise resource planning system, company-wide. This presented various obstacles during implementation, but now delivers a much greater functionality than we've had previously, promising improved efficiency in all areas.

Q How are Astute's overseas divisions in Australia, China, India, Israel, Mexico and the USA performing and how do buying habits differ?

A) The overseas territories have performed extremely well over the past few years. Understanding different markets and specific local habits provides insight about supply chains that benefit other regions. We have a healthy mix of end customers, from our traditional aerospace and defence clients to global EMS and industrial companies.

Extending to the USA was a natural step that complements our quality focused, electronics service model in the UK. Astute Virginia is now self-sufficient, mirroring an anti-counterfeiting test laboratory just like the one in Stevenage, and is also certified to AS6081. Through this US hub, our business has successfully expanded into Canada and Mexico.

Our most recent global leap is to Germany. Located just south of Munich, we are now well positioned to extend our offering to Europe by delivering solutions to high-mix, low-volume industries through supply chain innovation.

It is important to understand unique global markets in order to successfully penetrate them. Regions may have mature or emerging supply chains and while some international supply chains are price driven, others prioritise quality and efficient inventory solutions. Our strategy is to familiarise ourselves with these unique conditions and key players, then provide solutions to the gaps that add value to the



Geoff Hill, founder and managing director of Astute

customer's existing supply base.

Overall, international trade has seen double-digit growth, year on year for the past 10 years. We will continue to expand into new territories, to extend our global reach, support our major customers and offer localised support. International business director, Aran Coker, is looking into key markets in Europe and the Middle East, which both have high-demand environments in which Astute can thrive.

Q With lead times still high in the UK, how does Astute ensure smooth supply chain logistics?

A) The current marketplace presents challenges that were unanticipated by the majority. Our insight from working closely with original component manufacturers and global partners allowed

►► *continued on page 30*



As part of our globalisation, it was key to understand different cultures and behaviours and although this has been challenging at times.....



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Acceptability of Electronic Assemblies



Requirements for Soldering Electrical and Electronic Assemblies



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us to pre-warn customers of the ensuing problems almost two years in advance of their impact. Our customers trust us to plan effectively and commit to a long-term schedule and our understanding of the global supply chain has helped us to source safely. We are encouraging customers to look at buying ahead of forecast and refrain from double ordering. It is imperative that companies only buy passive and military products from authorised and trusted suppliers, as there are undoubtedly more counterfeit parts on the market now.

Q Is Astute 100 per cent franchised or can it also provide procurement services?

A) We have created a transparent trading model that allows us to support our 40-plus franchise partners buying exclusively with the OCM direct. Additionally, we act as a distribution channel for over 200 OCMs where we buy direct, with full traceability. We then offer a global sourcing service where we will procure product from franchised distributors around the world. If we are unable to provide stock from any of these sources due to obsolescence or allocation, we will quote the product as non-traceable and process this through our test laboratory to assess the integrity of the parts. Our expertise in these fields and ability to source via multiple methods provides great flexibility and reassurance to our customers.

Q What percentage of Astute sales are contract purchased compared to one-off buys?

A) The majority of our business is contracted, especially through our 3PL team. 3PL general manager, Andrew Quigley, has created various supply chain solutions, changing our service offering significantly. Our scope of supply has

also increased to cover a vast number of commodities within the supply chain.

Benefits of this contracted business include the ability to offer solutions such as vendor managed inventory, consignment stocking, Kanban storage, pricing security and lead-time reduction. When trading conditions are normal, a large percentage of our business is contracted over one to five years. This allows proactive options, such as filling our pipeline on a need by date basis, based on stock history and customer partnerships.

Q Astute is in the Ministry of Defence counterfeit avoidance working group and is a member of aerospace, defence and security trade organisation, ADS. How does this benefit buyers?

A) Our involvement with the CAWG promotes awareness of the threat of counterfeit parts entering the supply chain. It allows us to highlight the challenges we face every day, as well as the solutions we have developed with key customers. It's a chance for the electronics industry and government to work together to safeguard the supply chain and educate people that the cheapest source of supply is not necessarily the best source. The development of the DEF Stan 05-135 demonstrates that the UK is standing strong against this threat and we were able to work with the US legislation to create a robust standard that didn't tie people up in knots. We are proud of our contributions and the MOD quality award, which we won last year.

Q What kind of counterfeit testing is carried out to detect fraudulent components and ensure authenticity?

A) The test criteria is set by and customised to customer specifications. Our destructive and non-destructive testing options meet AS6081

standards and are designed to identify any non-conformity, or re-work indicators that define a 'suspect' counterfeit part, such as RoHS status, coplanarity issues, re-marking, re-surfacing and lead quality issues. Tests can include: visual checks, marking permanency, solderability testing, scrape testing, scanning electron microscopy, energy dispersive x-ray fluorescence spectrometry, real time x-ray and de-cap, which is the chemical and physical destruction of a part to observe die marks, topography, manufacturer's logo, die date and part number.

Our model differentiates between traceable and non-traceable product. Parts are classified by supplier class, which automatically creates our criteria for inspection. When the part is non-traceable, it is subject to a number of tests, following the AS6081 guidelines, for which we are certified. This includes non-destructive as well as destructive part analysis.

Our success depends on our £1m-plus investment in test equipment, but also on our skilled inspectors and



It's even more important to be vigilant now, as we are seeing lots of bogus stock availability on allocated lines





surrounding the supply chain right now that it is difficult to predict how it will evolve. OCMs are largely responsible for the current market predicament, having either reduced their line offerings or underinvested in yield and subsequently taken the opportunity to increase prices. The consequences of this will probably mean that the double ordering that is occurring now will affect them at the end of 2020.

Mergers and acquisitions will likely continue, resulting in these organisations targeting the mass volume market and leaving smaller companies without support. The current USA-China trade tariff dispute will also further disrupt the industry and again, OCMs will likely use this to increase prices.

Of course, we also have the implications of Brexit to digest when the results of the

negotiations become apparent. No trade deal would be hugely detrimental and anything that would affect the electronics' slick supply-chain requirements would have disastrous consequences.

In short, the next five years will be a challenging, ever developing environment, which will keep our global supply group busy and solution-providing for a long time.

www.astute.global

lab technicians who interpret the results from these tests. We have also built up an extensive library of part images and test data for effective comparison and identification, as well as for training purposes. We encourage customers to participate in our counterfeit awareness training and we recently had a delegation of 24 MoD quality professionals attend a day session where we shared our expertise and resources.

In today's market conditions, the need for part authentication is crucial. It's even more important to be vigilant now, as we are seeing lots of bogus stock availability on allocated lines.

Q How do you envisage the electronics supply chain evolving in the next five years?

A) There are so many issues



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Immerse yourself in innovation

In today's online world, What's New in Electronics Live, running 25 to 26 September at the NEC, provides an opportunity to really interact with the electronics industry

With dedicated conferences and exhibition areas for the embedded software and EMC industries, as well as electronics manufacturing, What's New in Electronics Live, aims to deliver a comprehensive event covering the entire spectrum of the electronics industry. Its goal is to provide an immersive experience, bringing business to life through face-to-face meetings and by enabling visitors to see machines in a live environment.

Show highlights

The event is structured to enable visitors and vendors alike to make connections, network, and hopefully, have some fun. Highlights of the event include:

- An international exhibitor list of over 100 companies showcasing a host of products and services from all corners of the electronics process.
- EMC UK expo and conference providing a designated area for electromagnetic compatibility issues.
- Embedded Live offering a mix of exhibitors and a range of products and services for embedded software, supported by four half-day conference programmes.
- WNIE TV roundtable debates covering a range of pertinent industry topics.
- The IPC hand soldering competition, the winner of which will be flown to San Diego to take part in the global championship final.
- A Female Leaders in Tech Everywhere networking event with leadership expert Alison Reid as guest speaker. Alison specialises in helping senior managers and directors conquer new leadership challenges and drive business growth. In addition to speaking, Alison will be hosting clinics for FLITE members following the event.

- The UK debut of the IPC Connected Factory eXchange industrial internet of things experience. Working alongside The Hermes Standard and The Manufacturing Technology Centre, this interactive experience will showcase global equipment suppliers.



Be inspired to innovate

In addition to the above, a visitor badge ensures free access to all events running in conjunction with WNIE Live, including Sensors and Instrumentation, production line event PPMA, and TCT, the event for design to manufacturing innovation. This allows delegates to easily circulate from one to the other, without having to re-register.

Together all these events combine to bring the electronics industry to life and allow companies to join with like-minded individuals who want to connect and source new contacts. Likewise, visitors can see new products in action and meet suppliers offering services to improve and innovate their business.

All events are free to attend by registering online.

wnielive.com



How to stay competitive in a challenging climate

Managing director and owner of Dynamic EMS, John Dignan, speaks candidly on the steps he believes EMS providers should take to remain competitive in the changing UK landscape

Reinvent your business

Manufacturers in the Western world have moved up the value chain to concentrate on more technically advanced industries or products. They compete with low wage economies by meeting customer needs through innovation and flexibility.

In 2017, Dynamic EMS undertook several marketing and communication initiatives to position the company as more than

a printed circuit board assembler dedicated to a build-to-print model. This service as a standalone is no longer competitive within the UK because China is becoming increasingly good at the low volume/high mix production that was traditionally a UK sweet spot. There has been a global shift in manufacturing from West to East, with the manufacturing sector growing rapidly in India and China and shrinking in most

advanced economies.

EMS providers therefore need to examine their business to see where they can add value along the production lifecycle and embed this service into their DNA.

Become a mentor

Over the past five years, innovation has been identified as one of the main drivers of growth.

▶ continued on page 34



Managing director and owner of Dynamic EMS, John Dignan



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This goes hand in hand with continuous reinvention, but it also dictates that companies need to be continuously connected to innovation and technology hubs.

EMS providers should consider offering their services as a supply chain consultant. After all the EMS industry is in its 60th year, which is the same amount of time that Dynamic EMS has been operational, albeit under other brand names. Companies that boast this kind of experience will have amassed engineering expertise, mastered the supply chain and attracted science boffins and technology gurus. Many team members are part of an aging

generation of technology talent in an industry that does not attract the next generation. Education is the key to addressing this looming skills gap, so EMS providers need to share their story.

Bearing this in mind, Dynamic EMS has found that forging strong connections to governmental authorities can help to change the market perception of electronics manufacturing in the UK. Our open-door policy ensures local authorities, incubators, seed funders, universities and colleges can see manufacturing in action in 2018. It can be quite surprising for some to see the vast range of technology,

from industrial large form factor equipment, through to handheld medical devices, robotic arms, internet of things, safety and security equipment.

So, although this is a competitive environment and the EMS business is cloaked in non-disclosure agreements and privacy policies, it also helps to share. It's my personal belief that there is enough total available market for us all to succeed and grow, but beyond that, perhaps we should consider the health and well-being of the entire industry #BeDynamic #MakeItEasy.

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Our open-door policy ensures local authorities, incubators, seed funders, universities and colleges can see manufacturing in action in 2018

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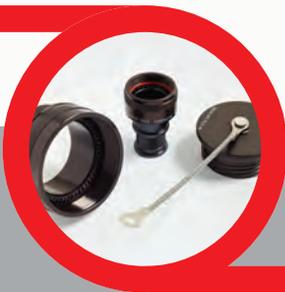
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Sourcing bright ideas

We talk display technologies and supply related issues with Review Display Systems to find out what buyers really need to know about this vital piece of equipment

Q What are the biggest game changers in display technology?

A) Passive liquid crystal displays have now been superseded by thin film transistors when it comes to small graphic modules. In fact, a small 3.5in QVGA TFT is now cheaper than a similar passive mono module, however, simple icon and numeric LCD solutions are still in demand where display costs need to be at a minimum.

For colour displays, there are really only two technologies: TFT and OLED. TFT is a mature display technology, although improvements are still taking place to achieve wider viewing angles, wider colour gamut, brighter displays and sunlight readability. Being mature also provides a stable supply chain, standard formats and long term availability. TFTs are not going to disappear from the industrial market any time soon.

Organic light emitting diodes are the promising new technology which still have a few issues to overcome such as production yield, lifetime to half brightness, burn-in



and true colour control. Although there have been huge investments in OLED production facilities, most of the output is still consumed by mobile phones.

Q What's the best display technology for use in harsh conditions?

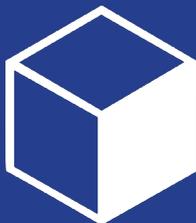
A) When it comes to extreme environmental conditions such as temperature,

shock and vibration electroluminescent displays are unbeaten. This tough, solid-state display has no fluid between the two glass sheets like TFT and OLED. It boasts an operating temperature range from -60 to 105°C and viewing angles of 179deg all round. As a self-illuminating technology, it offers high

▶▶ continued on page 38

Mature TFT technology provides a stable supply chain, standard formats and long term availability

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contrast compared to TFT, however, sizes are limited up to 10.4in, as is resolution. These monochrome displays typically feature a yellow pixel colour.

In the food industry, temperature range, shock and vibration are not as critical as waterproofing. Here, the enclosure forms a water proof unit for easy wash down, while the safe polycarbonate windows ensure no glass shards enter the working area.

Q Can RDS provide prototypes?

A) RDS has over thirty years' experience in developing displays, touch panels and embedded hardware solutions. We represent many leading display and embedded board manufacturers, enabling us to offer the best technical and commercial solution for any display system requirement.

Q What should be on a buyers' shopping list when sourcing displays?

A) First, consider what the product is going to be used for and its environment. Second, research the background of any potential suppliers. Most are in the Far East so you need to know how long they have been in existence, whether they outsource manufacture, whether they offer credit facilities, or buffer stock and

whether they can supply within the time frame? It's a jungle out there and without actually visiting a potential supplier, you don't know for sure what you are getting.

Q What are the main three questions buyers ask RDS and what are the answers?

A) Typical questions centre on lead times, long term availability and second sources. Lead time depends on the nature of the manufacturer, as does long term availability, with all suppliers offering an end of life or life time buy policy. The more mature industrial suppliers offer up to two years EOL and two years LTB notification, five to seven years for a product life time and a backwards compatible replacement. More commercial suppliers say three years life span and a much shorter LTB notification of three to six months. If you stick to industrial sizes and formats, second sources will be available, but no matter how close the specification, there are likely to be adjustments required.

Q How are lead times holding up in the displays market?

A) Lead times range from 10 to 22 weeks, depending on the capacity and backlog in the factory. No factory has stock. Everything is produced back-to-back based on orders,

so even popular formats, like the seven inch, will be on a lead time. Make sure you are aware of current lead times from your supplier.

Q Finally, what advice would you give to readers buying displays?

A) It can be a real problem for purchasers to identify the best solution to meet the required specifications. Whatever the display requirement, it is better to talk to a local display specialist rather than going to a general distributor or a Far East operation because most of the work has already been done for you, making your life easier!

www.review-displays.co.uk



It's a jungle out there and without actually visiting a potential supplier, you don't know for sure what you are getting



Monochrome electro-luminescent displays typically feature a yellow pixel colour

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Sidestepping the inevitable

With leadtimes on many discrete semiconductor products still extending, TTI Europe's business development manager for discrete components, Markus Walz, advises buyers to take action now to secure supplies and avoid shortages

Back in early 2016, my colleagues at TTI and I predicted that discrete components would suffer extended leadtimes, and even allocation issues, before very long. We made that forecast based on: increasing demand from Asia; massive demand from a new sector in the form of electric and hybrid vehicles; significant mergers and acquisition activity removing competing suppliers with many lines being made obsolete; and moth-balled manufacturing facilities that were not being turned on. In other words, a perfect storm of under capacity and over-demand.

Extended leadtimes

TTI's policy has always been to carry large stocks of freely-available products and to forge strong relationships with both supplier manufacturers and customers. This enabled us to plan ahead and increase our inventory in Europe ahead of the shortages. What we did

not expect however, was the severity of the shortages and how long the situation would last. We expected to see a return to normal conditions by the end of 2017: six months on, and if anything, the situation has got worse, with no one feeling confident about predicting when it will end, but most commentators believing it will be well into 2019 at the very soonest.

Currently we are seeing leadtimes for small signal and Zener diodes out from 30 to 70 weeks; TVS diodes at 40 to 60 weeks and mosfets and transistors also out to 30 to 70 weeks. Of course, all significant manufacturers, including TTI's main franchises Vishay, Bourns, Toshiba, Littelfuse, Kingbright and TT Electronics, are now ramping up production and developing new facilities.

Inventory investment

At TTI, we were prepared for this situation as early as the middle of 2016. At that time,

we immediately increased our stocks of discretes and our backlog orders. TTI has always believed in stocking wide and deep across our franchise base and in working closely with customers and partner suppliers so we have accurate demand and supply forecasts. Therefore, despite the tough market situation, TTI still has large stocks of over 15,000 different discrete semiconductors. We believe we are in good shape for 2019 and further, although naturally, we are constantly renewing our inventory and placing orders in line with supply chain conditions.

What does this mean for purchasers? Quite simply, that any customer, existing or new, can still buy the most popular discrete products off-the-shelf from TTI, or on 10 to 20-week leadtimes. Furthermore, because TTI only sells from franchise channels, there is no chance of us supplying counterfeit product. That does not mean, however, that we will not offer an alternative, if a first-choice part is not available. Where required, TTI's technically-qualified staff can cross-reference databases to search for an exact or suitable replacement component.

Secure supply

That said, it's still a very difficult market and we see no signs of any downturn in the market—quite the opposite. My advice for buyers of discrete semiconductor components would therefore be to secure supply lines now for the foreseeable future.

www.ttieurope.com



Business development manager, TTI Europe, discrete components, Markus Walz



TTI has always believed in stocking wide and deep across our franchise base and in working closely with customers and partner suppliers so we have accurate demand and supply forecasts





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Buyers can expect 30-week lead times and higher tags to continue for MOSFETs

Chipmakers are increasing production, but it won't be enough to reduce lead times until the fourth quarter at the earliest



James Carbone

Semiconductor manufacturers are adding more capacity of metal oxide semiconductor field emitting transistors (MOSFETs), but supply will likely remain tight and prices will rise until the end of the year.

The addition of more capacity likely won't be felt for several more months because of continuing strong demand across a wide range of customer segments, especially automotive and industrial.

"Demand for MOSFETs in 2018 is pretty strong across all segments, but it's the highest in automotive, industrial, and communications systems," said Rob Lineback, senior market research analyst for IC Insights, based in Scottsdale, Ariz. He added MOSFET demand is weakest from computer manufacturers while "military/government and consumer apps are in the middle," he said. MOSFETs are used to switch and

amplify electronic signals in electronics equipment. They provide a very high input impedance and are able to be used in very low current circuits. They are widely used in switch mode power supplies, variable frequency drives, lighting intensity controls, motor controls, and home and automobile sound systems among other applications.

Strong demand and limited capacity for MOSFETs means that prices are increasing and lead times have stretched to 30-40 weeks depending on the product and the manufacturer. Dave Valletta, executive vice president worldwide sales for Vishay Interotechnology, based in Malvern, Penn., said Vishay's average lead times for MOSFETs were about 35 weeks in July. He said MOSFET supply began tightening in the second half of last year. Vishay and other chipmakers are adding capacity, but so far demand continues to outpace supply.

"We added capacity and expected that in Q2 (2018) we would be back to normal, but it did not happen," said Valletta.

Lineback said Vishay and several other companies "are working to increase capacity because they don't want MOSFET business and revenue to move to someone else." He said MOSFETs are commodity products and there are second sources.

One reason supply remains tight is because MOSFETs are built on 150mm and 200mm wafer production lines. Other chips, such as display drivers, microcontrollers and mixed-signal semiconductors, are also built on 150mm and 200mm wafer production lines and there's not enough capacity to go around, said Lineback.

"Some companies that might have had some capacity earmarked for MOSFETs" but

decided to use some of that capacity for other products such as display drivers or mixed signal chips, he said.

Move to 300mm

At least one manufacturer—Infineon—is producing MOSFETs on 300mm wafers instead of 200mm or 150mm wafers. The company has been making chips on 300mm wafers for several years at its facility in Dresden, Germany and plans to start construction of a new 300mm facility in 2019 in Austria. However, production won't begin until 2021, according to the chipmaker.

With larger size wafers chipmakers can produce more chips per wafer effectively increasing supply. Over the next five years, other chipmakers will likely follow suit and also produce MOSFETs on 300mm wafers, said Lineback.

However, in the short term MOSFET makers are depending

By the Numbers



4.4%

The compound annual growth rate for MOSFETs through 2022



\$9.6 billion

The forecast size of the global MOSFET market in 2022



8%

The percentage increase of MOSFET unit shipments in 2018



17.1 cents

The average selling price for a MOSFET in 2018



14%

The percentage increase of global MOSFET sales in 2018

Source: IC Insights



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on 200mm wafer production for MOSFETs. The problem is chipmakers are having trouble ramping up additional production capacity because lead times for wafer fab equipment are long.

“Some lead times for new equipment are out past one year,” said Valletta. “It makes it harder to get capacity on line. Supply is even tight for used fab equipment,” he said. As a result, it will be a while before lead times return to normal, which is about 12 weeks.

In the meantime, Valletta said Vishay is “trying to protect customers that have long-term agreements with Vishay and who are providing us forecasts.” For customers who are trying to make spot buys, lead times are about 35 weeks, he said.

Supply may start to loosen in the fourth quarter, but it “won’t be a dramatic turn because demand is increasing across all geographies markets,” said Lineback.

Demand is strong across the board especially with automotive and telecommunications. Valletta said that demand will stay healthy for a long time because there are growing and emerging applications for MOSFETs.

“I think we are in for a long-

term period of growth,” said Valletta. “Automotive has been the biggest driver in the past year or so.” MOSFET demand from automotive will continue to grow because more automotive systems are electronic and more electric vehicles (EVs) are shipping. EVs typically have a higher semiconductor content than gasoline-powered cars and many of those chips are MOSFETs.

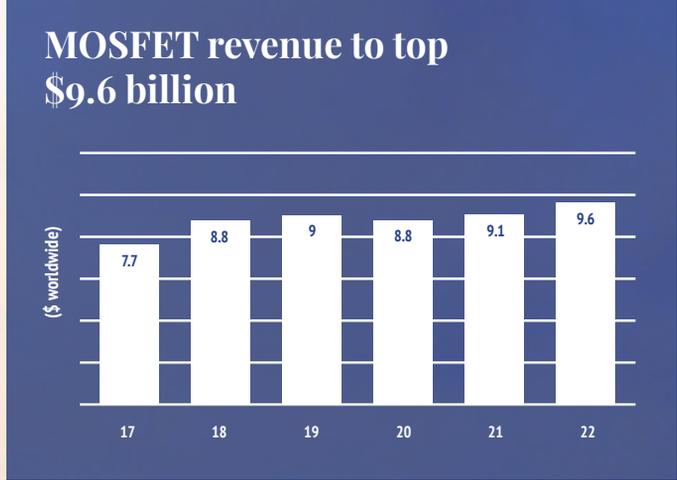
In addition, 5G networks are starting to be built which will require a variety of semiconductors including MOSFETs. Emerging applications involving artificial intelligence, augmented reality and graphics processing are emerging which will further drive demand for MOSFETs, said Lineback.

Tags, revenue increase

As a result, industry analysts are bullish about MOSFET growth. The global power MOSFET market will rise about 14 per cent to \$8.8 billion in 2018, according to IC Insights. MOSFET revenue will increase at compound annual growth rate of 4.4 per cent until 2022 when the global MOSFET market will reach \$9.6 billion.

Strong demand and limited capacity have resulted in higher average selling prices and overall higher revenue for MOSFET manufacturers. Prices, which have

The global MOSFET market will post mostly steady growth through 2022 when sales revenue surpasses \$9.6 billion
Source: IC Insights



increased the last two years, will end 2018 increasing by about 5 per cent to 17.1 cents.

Strong economic growth in many regions is helping drive demand for electronics equipment and semiconductors, including MOSFETs. “The global economy controls so much of what goes on in the semiconductor industry these days, especially in commodity type products such as MOSFETs,” said Lineback. “We see the economy as being the biggest factor in semiconductor growth.”

The global economy will continue to grow in 2019, but at a slower pace and MOSFET revenue will slow as well. For instance, gross domestic product (GDP) in the United States increased 4.1 per cent in the second quarter and is expected to grow 2.9 per cent for the year and decline to 2.7 per cent in 2019, according to International Monetary Fund (IMF). GDP in Europe in 2019 is forecast to fall to 1.9 percent from 2.2 per cent in 2018 and economic growth in China will fall from 6.6 per cent in 2018 to 6.4 per cent in 2019, the IMF said.

MOSFET growth will slow

Less economic growth will mean less growth for semiconductors including MOSFETs, said

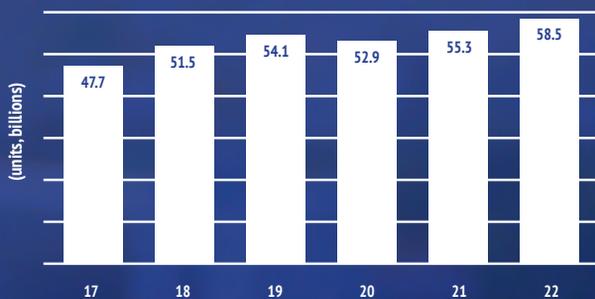
Lineback. MOSFET revenue will rise 2 percent in 2019 and then decline 1 per cent in 2020 before increasing 3 percent in 2021 and 5 per cent in 2022 when the market will total \$9.6 billion. Unit shipments will rise 5 per cent in 2019 but drop 2 per cent in 2020 before climbing 4 per cent in 2021 and 5 per cent in 2022, the researcher said.

The good news for semiconductor buyers is that while the average price for MOSFETs will grow 5 per cent in 2018, tags will drop 3 per cent in 2019 and 2 per cent in 2020. From 2017 to 2022, the average price of a MOSFET will rise only .2 per cent. However, for 2018, higher prices are welcome news for MOSFET manufacturers.

“MOSFET suppliers are having good sales this year because of higher average selling prices (ASPs), resulting from robust demand and tight supply. However, there is concern that once more capacity is added, demand will slow down.

“That’s what typically happens in our industry,” said Valletta. “We add capacity then all of a sudden demand goes away. We want capacity to be in balance with demand without overshooting it,” he said.

MOSFET unit demand rises



OEMs and electronics manufacturing services providers will buy more than 58 billion MOSFETs by 2022
Source: IC Insights

Resourceful buyers eliminate risks

Taking a flexible approach to sourcing semiconductors can help avoid the risks of the gray market, as microchipDIRECT global sales manager, Martin Warmington, explains

It is a familiar problem: when there is simply no inventory in the secure supply chain, the gray market can appear attractive.

But, is this a necessary risk?

Every buyer is aware of some of the issues associated with

buying from the gray market, the most important being the high possibility that the parts are counterfeit. Buying from the



microchipDIRECT global sales manager, Microchip Technology, Martin Warmington

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gray market also means there is no guarantee that parts have been stored in suitable conditions and they will certainly no longer be covered by the manufacturer's warranty.

This lack of a manufacturer warranty can have serious implications if the OEM has a product failure. A gray market or unauthorised source will have limited or no backup from the manufacturer in resolving any faults and is unlikely to reveal their source because component manufacturers act swiftly to close off unauthorised gray market sources. This makes it impossible to know whether a failure is due to a batch fault, or if the parts have deteriorated under unsuitable storage conditions.



Loss of traceability could also jeopardise an OEM's certification to quality standards such as ISO 9000-9001, which mandate that parts must be fully traceable to the point of manufacture.

Widen the search

A more resourceful option is to check the part on a referral website. These multi-supplier search engines provide a useful tool for an immediate comparison of the latest availability and pricing on parts. Looking at inventory across a range of suppliers can also give the buyer a bigger picture of how much stock is actually in the supply chain. For example, the microchipDIRECT online channel issues inventory updates every 15 minutes, with referral sites typically updating their information at least once a day.

Most referral sites also minimise the risk of buying counterfeit

parts because manufacturers and distributors arrange to have their parts listed. Some, however, will include unfranchised sources, so it's best to also visit the component manufacturer's website to confirm that a source is fully franchised and warranted.

Although referral sites are free to use and don't add to the price of parts, it is worth remembering that the price shown is a guide. The actual price will depend

on volume, so contact the component manufacturer via the referral site to check the cost for the actual order volume.

Be flexible on quantity

When product is on allocation, buyers can be tempted to increase their order quantity. A more effective route to avoiding a line-stop is to discuss the minimum number of parts required to prevent an impending line-down. Even though the

buyer may have ordered 50,000 devices, the reality could be that 1,000 parts delivered this week, and 2,000 next week, could keep the lines running.

By using referral sites and maintaining dialogue with suppliers, buyers may be able to source enough stock to avoid line-downs, as well as eliminating the risks of gray market sourcing.

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Looking at inventory across a range of suppliers can give the buyer a bigger picture of how much stock is actually in the supply chain



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Toyota buyers mitigate risk to avoid managing supply chain crises

For Toyota, two-way communication with suppliers is imperative in order to identify and mitigate supply chain risk
By James Carbone

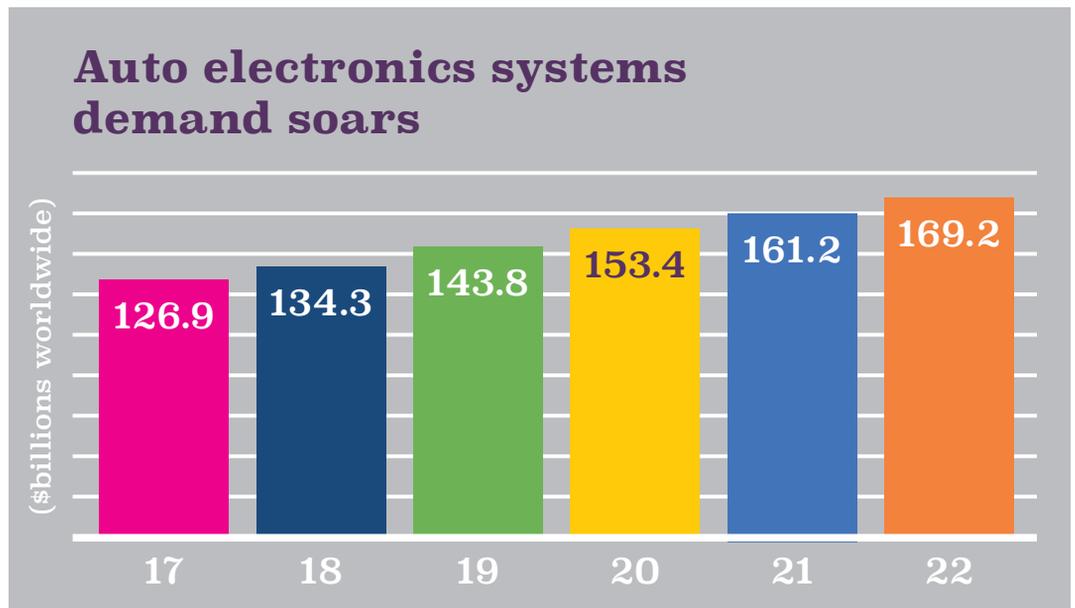
Managing risk in the supply chain is a tough task for purchasers in all industries, but it is especially challenging for buyers at automakers because the auto industry has multiple tiers of suppliers.

Purchasers at carmakers such as Ford, General Motors, Honda and Toyota often purchase electronics systems or assemblies from tier 1 suppliers such as Denso, Continental, ZF/TRW, Harman, Panasonic, Pioneer and Bosch among others.

Tier 1 suppliers build systems such as car computers, anti-lock braking, airbags, infotainment, radios, climate control, advanced driver assistance systems (ADAS), rear backup cameras, Wi-Fi and other systems.

Buyers at automakers don't purchase semiconductors, passives and other components used in those systems. Rather they depend on their tier 1 suppliers to buy the chips, capacitors, resistors and electronic components needed for production and to manage the relationships with those electronic parts suppliers.

However, when it comes to managing supply chain risk that could impact components used in automotive systems, vehicle manufacturer buyers are more involved and have developed risk management strategies that affect not only their tier 1 suppliers, but tier



2 and tier 3 suppliers as well.

Automaker buyers need to be involved with supply chain risk management to make sure their supply chains maintain continuity of supply if a natural disaster disrupts production of components or other materials, or market conditions result in shortages of needed parts.

Most vehicle manufacturers, as well as OEMs in other industries, beefed up supply chain risk management efforts following the devastating earthquake and tsunami in Japan in March 2011 and the flooding in Thailand later that year. Besides killing thousands of people, those disasters shut down production of many electronic components and other products used by many industries, including automotive.

“Basically, the tsunami in and of itself really kicked us into this activity of risk

management,” said Blaine Lewis, senior manager of electronics purchasing for Toyota Motor North America, based in Plano, Texas. “At that point time we did not have an established countermeasure system for those types of events,” said Lewis, who is based at Toyota’s Research and Development Center in Saline, Mich. With a lot of effort, “we did fare well” through the disaster, he said. “We did have some impact and had to do some adjustments to make sure we made it through without completely stalling production,” said Lewis.

Bridge the gap
After the earthquake and tsunami in Japan, Toyota challenged its first-tier suppliers to look at their supply base and determine if there was another catastrophic event that disrupted production, how long it would take them to recover. The automaker also

The global market for automotive electronics hardware will rise from \$126.9 billion in 2017 to \$169 billion in 2022

“”
Buyers at automakers don't purchase semiconductors, passives and other components used in those systems

wanted to know how suppliers could bridge the gap between recovery and the immediate needs of Toyota as an automotive maker buying parts.

“Once they determined that, they also told us what their countermeasures would or should be,” said Lewis. When Toyota received those countermeasure ideas from all of its suppliers, the company evaluated them and identified “some fantastic countermeasures” that could help mitigate risk and keep supply of parts flowing, said Lewis. Other supplier ideas “needed some improvements” and Toyota made suggestions on how the ideas could be enhanced.

To reduce risk, it is important to have two-way communication with suppliers, said Lewis. Suppliers need to inform Toyota if they see a potential risk problem occurring and communicate the information as quickly as possible, he said.

“The earlier we know about a potential problem, the more opportunity we have for risk mitigation,” said Lewis. Toyota can query other suppliers if they are seeing the same problem in the supply chain. “This will help us determine if it is an issue with one supplier or is it an issue that spans across our supply base,” said Lewis.

Jim Holloway, general manager purchasing responsible for electronics, electrical and powertrain procurement for Toyota, said prior to the tsunami “we had strong collaboration with our suppliers for information sharing. But it was more crisis management” than risk management. “The real change for us was shifting from managing crises to mitigating risk,” he said.

A resilient supply base
After the disaster, the car maker identified some key characteristics of its supply base. Toyota recognised the

“resilience of our supply base to be able to recover through a crisis collaboratively with us,” said Holloway. Toyota also learned that it did not have good information about its first-tier suppliers’ supply chain.

“A lot of tier 1 suppliers view that information as proprietary. Their supply chain is confidential to them,” said Holloway. But since the tsunami, Toyota has worked with its suppliers to understand their supply base and where some “pinch points might be” if there is another disaster.

“Now we see those pinch points and we can proactively work with our suppliers to mitigate risk rather than manage crisis,” said Holloway.

Holloway said Toyota expects its tier 1 suppliers to manage their supply chains and provide “continuous supply to us despite multiple avenues of potential interruption.”

One way of reducing risk and providing continuous supply is have more than one supplier for a needed part or have multiple manufacturing locations for the components. Lewis says Toyota has discussions with its tier 1 suppliers about this issue.

If a component supplier to tier 1 manufacturer has a single manufacturing site for a needed part used in a system that Toyota buys, the automaker wants to know how the tier 1 is going to protect Toyota if something happens to disrupt manufacturing of the part.

“It’s a big burden for them if they have a single-source manufacturing facility versus a dual source and they recognise that,” said Lewis. He said that automotive suppliers including tier 1, 2 and 3 suppliers are doing a much better job “making sure there are multiple manufacturing sites or some manufacturing flexibility.”

Secondary source needed
Holloway said there are “different scenarios” on how tier 1 suppliers protect the supply-chain and supply flow and collaborate with them to understand what their approach is to guarantee supply. “For example, if their approach is to approve a secondary source, then they need our approval of that,” he said. “We will collaborate and cooperate with them on that, but the ownership (of the relationship with the secondary source) is theirs.”

Collaboration and cooperation with suppliers are not just needed to manage risk. Rather it permeates the entire relationship Toyota has with its suppliers including new product development. “We work very closely with suppliers in the very early stages of new product development,” said Lewis.

Toyota generates new ideas for future vehicles, but its suppliers also do research and development and make suggestions for new features as well. “In the end it is a combination” of ideas that result in new features in Toyota models, he said.

Because Toyota’s supply base is stable and partners with key tier 1 suppliers, the automaker rarely changes suppliers. It may add a supplier if it has a new technology or for competitive reasons.

Toyota has an open-door policy with potential new suppliers because the automaker recognises that there are companies that are developing new and advanced technologies that Toyota needs to know about, said Holloway. “We have an open-door policy to make sure that we understand what the competitive environment in the marketplace is,” he said. He added if Toyota’s current supply base “can’t keep pace with that, in some cases we may have to make a change.”

►► *continued on page 48*



The earlier we know about a potential problem, the more opportunity we have for risk mitigation

- Blaine Lewis, senior manager of electronics purchasing for Toyota Motor North America



The real change for us was shifting from managing crises to mitigating risk

- Jim Holloway, general manager purchasing responsible for electronics electrical and powertrain procurement for Toyota

► However, Toyota rarely changes suppliers because of performance issues. “Once you are supplier partner, we have long-term relationships and we work diligently with suppliers to make sure that suppliers are successful,” said Lewis.

He said Toyota has key performance indicators and “we constantly evaluate our suppliers on safety, quality,

and cost,” said Lewis. “If we see a supplier is struggling in an area then purchasing may form a new cross functional team that includes various areas of our company such as quality or logistics” or other functions depending what the issue is to support the supplier, he said.

Holloway said Toyota provides clear expectations to suppliers. “If suppliers

are struggling with our expectations, we partner with them on identifying ways to meet them. One of our core philosophies is continuous improvement,” he said.



Have more than one supplier for a needed part or have multiple manufacturing locations for the components

Is strong component demand from automotive causing shortages?

It is no secret that automakers are building more models of vehicles equipped with sophisticated electronics systems to enhance safety, vehicle performance and overall driver and passenger experience.

Features such as lane change warning, collision avoidance, rear-view cameras, automatic braking, self-driving, as well as infotainment used to be confined to higher end, luxury vehicles, but now are being designed into lesser expensive models.

Those systems are loaded with semiconductors and other components and some buyers in non-automotive industries and some distributors say demand by automotive is causing, or at least contributing to, component shortages of MOSFETs and other discrete semiconductors, multilayer ceramic capacitors, resistor chips and other parts.

In fact, demand for chips, passives and other components by the auto industry is rising as a result of the growth of sophisticated, high-tech electronics systems. Global revenue of automotive electronics systems increased from \$87.3 billion in 2011 to \$126.9 billion in 2017, according to researcher IHS Markit. By 2022 sales of automotive electronics systems will rise to \$169.2 billion, the researcher said. Automotive electronics systems include advanced driver assistance systems (ADAS), chassis, safety, infotainment, powertrain, automotive body and convenience features.

Strong demand for automotive electronic systems is boosting sales of components used in those systems. For instance, the automotive integrated circuit market will have a compound annual growth rate of 12.5 per cent, according to IC Insights. Automotive accounted for 7.4 per cent of total IC sales in 2017 and is forecast to account for 7.5 per cent in 2018 and 9.3 per cent in 2021, the researcher said.

While demand for automotive chips and other components is growing, not all buyers agree that the auto industry is responsible for causing shortages parts for other industries.

Blaine Lewis, electronics purchasing manager for Toyota, says while electronics use in vehicles is increasing, the demand for semiconductors and other components in other industries is growing as well.

“Yes, we are increasing electronics content in cars, adding more advanced driver assistance systems and more complex communication systems to vehicles,” he said. However, he disputes that automotive is responsible for component shortages.

“The thought that automotive electronics is making an impact on overall electronics industry [supply] is false in my opinion,” said Lewis. He said there is an “exponential explosion” of demand for consumer electronics products.

“Smart watches, Alexa, all the new gadgets that are available in the home that are electronic in nature are in competition for capacity in the electronics market,” he said. In fact, demand for such devices, which tend to use components based on new technologies, is causing some issues with the auto industry.

Lewis said because of that “draw on the capacity for consumer electronics products, manufacturers are trending towards newer style of electronic components, or next-generation.” Such products have short life cycles.

“You get a new smart phone every two years, or new smart watch every three years or something like that,” said Lewis. However, automotive systems have longer lifecycles.

“We may build a particular electronic product for up to five years maybe seven so the componentry that’s in some of our electronics can be five to seven years old.

He said electronics manufacturers often obsolete other components in favour of parts based on newer technology.

“That makes it more difficult for automotive get our share,” said Lewis.

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 Mills / Vishay
 Milwaukee / Vishay
 MMB Networks
 Molex
 Molex Affinity Medical Technologies
 Molex Beau Interconnect
 Molex Brad Harrison
 Molex FCT Electronics
 Molex Flamar
 Molex GWConnect
 Molex Interconnect Systems
 Molex NuCurrent
 Molex Oplink Communications, LLC.
 Molex Phillips-Medisize
 Molex PolyMicro Technologies
 Molex Temp-Flex
 Molex Woodhead
 Monnit
 Monolithic Power Systems
 MPD (Memory Protection Devices)
 MPS (Monolithic Power Systems)
 Mueller Electric Co.
 Multicore / Henkel
 Multi-Tech Systems, Inc.
 Murata Electronics
 Murata Power Solutions
 Nakagawa Manufacturing USA, Inc.
 National Semiconductor /
 Texas Instruments
 Navman Wireless (Telit)
 NDK
 Nearson
 Neohm Resistors / TE Connectivity
 Neonode
 Nesscap Co., Ltd
 NetBurner, Inc.
 Newava Technology
 Newhaven Display, Intl.
 Nexperia
 Nichicon
 Nidec Copal Electronics
 NimbeLink
 Nippon Chemi-Con
 NJR Corporation / NJRC
 NKK Switches
 NMB Technologies Corp.
 NorComp
 Nordic Semiconductor
 NOVACAP

NovaSensor / GE Measurement &
 Control
 NuCurrent - a Molex company
 Nuvoton Technology Corporation
 America
 NVE Corporation
 nVent Bircher
 nVent Calmark
 nVent Hoffman
 nVent Schroff
 NXP Semiconductors / Freescale
 O.C. White Co.
 Octavo Systems
 ODU
 OEG Relays / TE Connectivity
 Ohmite
 OK Industries (Jonard Tools)
 Olimex
 Omron Automation & Safety
 Omron Electronic Components
 ON Semiconductor
 On-Shore Technology, Inc.
 Oplink, a Molex company
 Optek Technology / TT Electronics
 Option NV
 Opto Diode Corporation
 Opulent Americas
 O'Reilly Media, Inc.
 Orion Fans
 OSRAM Opto Semiconductors, Inc.
 Packet Digital LLC
 Paladin Tools (Greenlee
 Communications)
 Panasonic
 PanaVise
 Panduit
 Parallax, Inc.
 Parlex Corp.
 Particle
 Patco Electronics
 Patco Services
 PCD / Amphenol
 Peerless by Tympany
 Peregrine Semiconductor (pSemi)
 Pericom Semiconductor Corp.
 (Diodes Incorporated)
 Pervasive Displays
 PHIHONG USA
 Phillips-Medisize - a Molex company
 Phoenix Contact
 Phoenix Mecano
 Phoenix Passive Components /
 Vishay
 Phytion, Inc.
 Pi Supply
 Pimoroni
 PolyMicro Technologies -
 a Molex company
 Polytech / Vishay
 Pomona Electronics
 Pontiac Coil, Inc.
 Portescap
 Potter & Brumfield Relays /
 TE Connectivity
 Power Integrations
 Powerex, Inc.
 Power-One (Bel Power Solutions)
 PowerStor (Eaton)
 PRD Plastics
 Preci-Dip
 Precision Design Associates, Inc.
 Precision Electronic Components Ltd.
 Precision Technology, Inc.
 ProAnt
 Products Unlimited Transformers &
 Relays / TE Connectivity
 Protektive Pak
 pSemi
 PUI Audio, Inc.
 PULS
 Pulse Electronics Corporation
 PulseCore Semiconductor /
 ON Semiconductor
 PulseLarsen Antennas
 Pycom
 Q-Cee's / TE Connectivity
 Qoitech
 QT Brightek
 Quadcept
 Qualcomm
 Qualcomm (RF360 - A Qualcomm &
 TDK Joint Venture)
 Qualtek Electronics Corp.
 Quatech / B+B SmartWorx
 Rabbit Semiconductor
 (Digi International)
 Radial Magnet, Inc.
 Radiocrafts
 RAF
 RAFI
 Ramtron (Cypress Semiconductor)

Raspberry Pi
 Raychem Cable Protection /
 TE Connectivity
 RayVio
 RECOM Power
 Red Lion Controls
 REDEL / LEMO
 Renesas Electronics America
 RF Digital
 RF Solutions
 RF360 - A Qualcomm-
 TDK joint venture
 Richco, Inc. (Essentra Components)
 Richtek
 Riedon
 Rigado
 Roederstein / Vishay
 ROHM Semiconductor
 Rose Bopla
 Rose Enclosures
 Rose+Krieger
 Rosenberger
 Roving Networks / Microchip
 Technology
 RPM Systems
 Rubycon
 RushUp
 Sagrad
 Samsung ARTIK
 Samsung Electro-Mechanics
 Samsung Semiconductor
 Samtec, Inc.
 Sanken Electric Co., Ltd.
 Sanyo Denki
 Sanyo Semiconductor /
 ON Semiconductor
 Schaffner EMC, Inc.
 Schrack Relays / TE Connectivity
 Schroff / nVent
 Schurter
 SCS
 Seeed
 Segger Microcontroller Systems
 Seiko Instruments, Inc.
 Semflex / Cinch Connectivity
 Solutions
 Semtech
 Sensata Sensors Thermal Sensors
 and Switches
 Sensata Technologies
 Sensata Technologies - Airpax
 Sensata Technologies - BEI Sensors
 Sensata Technologies - Crydom
 Sensata Technologies - Kavlico
 Pressure Sensors
 Sensirion
 Sensitron Semiconductor /
 SMC Diode Solutions
 Seoul Semiconductor
 Serious Integrated
 Serpac Electronic Enclosures
 SGX Sensortech
 Sharp Microelectronics
 Sierra Wireless
 Sigfox
 Sigma Designs
 Sigma Inductors / TE Connectivity
 Signal Transformer
 Silego Technology
 Silicon Labs
 SINE Systems / Amphenol
 Siretta
 SiTime
 Skytek
 Skyworks Solutions, Inc.
 SL Power Electronics - Manufacturer
 of Condor / Ault Brands
 SMC Diode Solutions
 Soberton, Inc.
 SOC Technologies (System-On-Chip
 Technologies)
 Socle Technology Corporation
 SolidRun
 Souriau Connection Technology
 Spansion (Cypress Semiconductor)
 SparkFun
 Spec Sensors
 Spectra Symbol
 Spectra-Strip (Amphenol
 Spectra-Strip)
 Sprague Goodman
 SSI Technologies, Inc.
 SST Sensing
 Stackpole Electronics, Inc.
 Stantec Energy Products Co.
 Standex-Meder Electronics
 Stanley Electric
 Steinel
 steute Wireless
 Stewart Connector
 STMICROELECTRONICS

Storm Interface
 Sullins Connector Solutions
 Sumida Corporation
 SunLED
 Sunon
 Susumu
 SV Microwave (Amphenol SV
 Microwave)
 Swanstrom Tools
 Swissbit
 Switchcraft / Conxall
 Syfer
 Synapse Wireless
 System-On-Chip Technologies
 Tag-Connect
 Taica Corporation
 Taitien
 Taiwan Semiconductor
 Taiyo Yuden
 Talema
 Tallysman Wireless
 Talon Communications, Inc.
 Tamura
 Taoglas
 TAOS / ams
 TDK Corporation
 TDK InvenSense
 TDK Micronas
 TDK RF360
 TDK Tronics (Tronics)
 TDK-Lambda Americas, Inc.
 TE Connectivity
 TE Connectivity Aerospace Defense
 and Marine
 TE Connectivity ALCSWITCH
 Switches
 TE Connectivity AMP Connectors
 TE Connectivity Corcom Filters
 TE Connectivity DEUTSCH Connectors
 TE Connectivity DEUTSCH
 INDUSTRIAL & COMMERCIAL
 TRANSPORTATION
 TE Connectivity Measurement
 Specialties
 TE Connectivity Potter & Brumfield
 Relays
 TE Connectivity Raychem Cable
 Protection
 TE Connectivity Raychem Circuit
 Protection / Littelfuse
 TE Connectivity's Agastat Relays
 TE Connectivity's Axicom Relays
 TE Connectivity's Buchanan
 Terminal Blocks
 TE Connectivity's CGS Resistors
 TE Connectivity's CII
 TE Connectivity's Elcon Connectors
 TE Connectivity's Holsworthy
 Resistors
 TE Connectivity's Kilovac Relays
 TE Connectivity's Neohm Resistors
 TE Connectivity's OEG Relays
 TE Connectivity's Products Unlimited
 Transformers & Relays
 TE Connectivity's Q-Cee's
 TE Connectivity's Schrack Relays
 TE Connectivity's Sigma Inductors
 Teccor / Littelfuse
 Techflex
 TechNexion
 Techno / Vishay
 Techspray
 TechTools
 Telcodium
 Teledyne LeCroy
 Telit
 Temp-Flex - a Molex company
 Tensility International Corporation
 Terasic Technologies
 Test Products International (TPI)
 TEWA Sensors LLC
 Texas Instruments
 t-Global Technology
 Thales Visionix, Inc.
 Thermometrics / GE Measurement
 & Control
 ThingMagic, a JADAK Brand
 Thinxtra Solutions Limited
 Thomas Research Products
 TinyCircuits
 TOKO / Murata
 Torex Semiconductor Ltd.
 Toshiba Memory America, Inc.
 Toshiba Semiconductor and Storage
 Touchstone Semiconductor
 TPI (Test Products International)
 TPK America LLC

TRACO Power
 Transphorm
 Trenz Electronic
 Triad Magnetics
 TRINAMIC Motion Control GmbH
 Tripp Lite
 Trompeter / Cinch Connectivity
 Solutions
 Tronics
 TRP Connector
 TSC (Taiwan Semiconductor)
 TT Electronics
 TT Electronics / BI Technologies
 TT Electronics / IRC
 TT Electronics / Optek Technology
 TT Electronics / Welwyn
 Tuchel / Amphenol
 Twin Industries
 TXC Corporation
 Tyco Electronics
 Tympany (Peerless by Tympany)
 U.S. Sensor/Littelfuse
 UD00
 Ultra Librarian®
 Ungar / Weller
 United Chemi-Con
 US-Lasers, Inc.
 Varitronix International Ltd.
 VCC (Visual Communications
 Company)
 VEAM
 Vector Electronics & Technology, Inc.
 Verivolt
 VersaLogic Corporation
 VersaSense
 Vicor
 Vicotee
 Vifa (Peerless by Tympany)
 Viking Technology
 Virtium Technology Inc.
 Vishay
 Vishay / BCcomponents
 Vishay / Beyschlag
 Vishay / Cera-Mite
 Vishay / Dale
 Vishay / Huntington Electric, Inc.
 Vishay / Semiconductor -
 Diodes Division
 Vishay / Semiconductor -
 Opto Division
 Vishay / Sfernice
 Vishay / Siliconix
 Vishay / Spectrol
 Vishay / Sprague
 Vishay / Thin Film
 Vishay / Vitramon
 Visual Communications Company, LLC
 Vitelec / Cinch Connectivity Solutions
 Volgen (Kaga Electronics USA)
 Voltronics (Knowles)
 VPG Foil
 VPG Micro-Measurements
 VPG Sensors
 Wakefield-Vette
 Walsin Technology
 Wandboard
 WeEn Semiconductors Co., Ltd
 Weidmuller
 Weller
 Welwyn / TT Electronics
 Wickmann / Littelfuse
 Wiha
 WIMA
 Winbond Electronics Corporation
 Winchester Electronics
 Wintec Industries
 Wiss
 WIZnet
 Wolfspeed - a Cree company
 Woodhead - a Molex company
 Wurth Electronics
 Wurth Electronics iBE
 Wurth Electronics Midcom
 Xcelite
 Xeltek
 Xilinx
 XMOS
 XP Power
 Xsens
 Yageo
 Zentri (Silicon Labs)
 Zetex Semiconductors
 (Diodes Incorporated)
 ZF Electronics
 Zilog



DIGIKEY.CO.UK LINECARD

Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor	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	Buffer Stock Facility
CABLE ASSEMBLY & HARNESSING											
FTDI	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	N/A	50	1,500+	Y
Molex	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	300	N/A	£0	97%	50	1,500+	Y
CIRCUIT PROTECTION											
Bourns	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	5000	N/A	£0	58%	50	1,500+	Y
EPCOS/TDK	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	5000	N/A	£0	58%	50	1,500+	Y
Littelfuse	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	35000	N/A	£0	67%	50	1,500+	Y
DISPLAYS & LEDs											
Lascar Electronics		+44 (0)1794 884567	www.lascarelectronics.com/				£1		10	90	
NLT Technologies Ltd	Review Display System Ltd	01959 563345	www.review-displays.co.uk	Y	All	N/A	£0	N/A	6	25	Y
ELECTROMECHANICAL											
ALPHA WIRE	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	26,919	N/A	£0	97.04%	150	3500+	Y
CINCH CONNECTIVITY/Bel	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	31,120	N/A	£0	78.21%	150	3500+	Y
CUI INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	17,410	N/A	£0	92.21%	150	3500+	Y
DELTA PRODUCT GROUPS	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	3,215	N/A	£0	99.95%	150	3500+	Y
KEYSTONE ELECTRONICS	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	6,315	N/A	£0	95.17%	150	3500+	Y
Laird	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	15,187	N/A	£0	97.20%	150	3500+	Y
Murata	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	66,179	N/A	£0	99.79%	150	3500+	Y
OMRON ELECTRONICS INC-EMC DIV	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	74,369	N/A	£0	95.47%	150	3500+	Y
Panasonic	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	154,777	N/A	£0	94.42%	150	3500+	Y
TDK	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	60,769	N/A	£0	99.20%	150	3500+	Y
TE	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	338,106	N/A	£0	79.40%	150	3500+	Y
ENCLOSURES											
Bud	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,500	N/A	£0	80%	50	1,500+	Y
Hammond	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	12,500	N/A	£0	100%	50	1,500+	Y
Hammond	Switch Electronics	01482 862255	switchelectronics.co.uk	Y	500	N/A	£0	70%	2	6	Y
Metcase Enclosures	OKW Enclosures	01489 583858	www.metcase.co.uk	N	288	£40,000	£0	N/A	5	22	Y
OKW Enclosures Ltd	OKW Enclosures	01489 583858	www.okw.co.uk	N	1,955	£40,000	£0	N/A	5	22	Y
Rolec Enclosures	OKW Enclosures	01489 583858	www.rolec-enclosures.co.uk	Y	935	£40,000	£0	N/A	5	22	Y
Teko Enclosures	OKW Enclosures	01489 583858	www.teko.co.uk	Y	1,860	£40,000	£0	N/A	5	22	Y
FREQUENCY MANAGEMENT											
ABRACON	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,000	N/A	£0	91%	50	1,500+	Y
AEL Crystals Ltd	AEL Crystals Ltd	01293 789200	www.aelcrystals.co.uk	N	N/A	£200,000	£50	100%	3	15	Y
ECS	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	500	N/A	£0	99%	50	1,500+	Y
Epson	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	500	N/A	£0	59%	50	1,500+	Y
Golledge Electronics Ltd	Golledge Electronics Ltd	01460 256 100	www.golledge.com	N	N/A	£800,000	£0	100%	3	24	Y
Jauch Quartz	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	500	£250,000	0	100	15	130	Y
HEATSINKS											
Aavid	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	67%	50	1,500+	Y
ICs & SEMICONDUCTORS											
ALLEGRO MICROSYSTEMS, LLC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	3,090	N/A	£0	87.22%	150	3500+	Y
Altera	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,600	N/A	£0	60.00%	50	1,500+	Y
ALTERA	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	10,901	N/A	£0	84.86%	150	3500+	Y



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Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor	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	Buffer Stock Facility
ICs & SEMICONDUCTORS (continued)											
ANALOG DEVICES INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	52,308	N/A	£0	73.79%	150	3500+	Y
Analog Devices Inc.	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	9,500	N/A	£0	83.00%	50	1,500+	Y
Atmel	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,700	N/A	£0	58.00%	50	1,500+	Y
Avago Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	400	N/A	£0	84.00%	50	1,500+	Y
AVAGO TECHNOLOGIES US INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	16,512	N/A	£0	91.38%	150	3500+	Y
Broadcom	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	69%	50	1,500+	Y
Cirrus Logic	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	300	N/A	£0	80.00%	50	1,500+	Y
Cypress Semiconductor	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,400	N/A	£0	63.00%	50	1,500+	Y
CYPRESS SEMICONDUCTOR CORP	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	27,423	N/A	£0	92.54%	150	3500+	Y
DIGI INTERNATIONAL	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	4,355	N/A	£0	95.30%	150	3500+	Y
Diodes Incorporated	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,600	N/A	£0	98%	50	1,500+	Y
DIODES INCORPORATED	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	38,292	N/A	£0	90.02%	150	3500+	Y
Exar	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,100	N/A	£0	95.00%	50	1,500+	Y
Fairchild Semiconductor	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,500	N/A	£0	90.00%	50	1,500+	Y
Freescale Semiconductor	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,500	N/A	£0	42.00%	50	1,500+	Y
FTDI	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	97%	50	1,500+	Y
FTDI	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	569	N/A	£0	100.00%	150	3500+	Y
IDT (Integrated Device Technology)	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,100	N/A	£0	97%	50	1,500+	Y
Infineon	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	800	N/A	£0	66.00%	50	1,500+	Y
INFINEON TECHNOLOGIES	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	28,850	N/A	£0	93.70%	150	3500+	Y
Intel	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	500	N/A	£0	78%	50	1,500+	Y
International Rectifier	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	600	N/A	£0	87.00%	50	1,500+	Y
Intersil	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,900	N/A	£0	50.00%	50	1,500+	Y
ISSI	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	98.00%	50	1,500+	Y
Laird	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	15,187	N/A	£0	97.20%	150	3500+	Y
Lattice	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	69%	50	1,500+	Y
LINEAR TECHNOLOGY	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	37,479	N/A	£0	77.62%	150	3500+	Y
Maxim Integrated	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	11,200	N/A	£0	67.00%	50	1,500+	Y
MAXIM INTEGRATED	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	68,021	N/A	£0	78.22%	150	3500+	Y
Microchip	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	12,600	N/A	£0	91.00%	50	1,500+	Y
MICROCHIP TECHNOLOGY	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	86,517	N/A	£0	86.12%	150	3500+	Y
Microsemi	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	400	N/A	£0	90%	50	1,500+	Y
Monolithic Power Systems (MPS)	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	600	N/A	£0	40%	50	1,500+	Y
NEXPERIA USA INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	23,513	N/A	£0	99.29%	150	3500+	Y
NXP	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	3,900	N/A	£0	91%	50	1,500+	Y
NXP USA INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	36,258	N/A	£0	93.55%	150	3500+	Y
ON Semiconductor	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	5,100	N/A	£0	87%	50	1,500+	Y
ON SEMICONDUCTOR	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	87,298	N/A	£0	85.61%	150	3500+	Y
Power Integrations	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	600	N/A	£0	59%	50	1,500+	Y
Qorvo	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	300	N/A	£0	90.00%	50	1,500+	Y
Rohm	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	55,139	N/A	£0	99.85%	150	3500+	Y
ROHM Semiconductor	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,400	N/A	£0	55.00%	50	1,500+	Y
Samsung	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	37,336	N/A	£0	100.00%	150	3500+	Y
Silicon Laboratories	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,500	N/A	£0	96%	50	1,500+	Y
SILICON LABORATORIES INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	19,667	N/A	£0	96.54%	150	3500+	Y
Skyworks	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	300	N/A	£0	91%	50	1,500+	Y
Spansion Inc.	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	600	N/A	£0	93.00%	50	1,500+	Y
STMicroelectronics	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	4,500	N/A	£0	99%	50	1,500+	Y
STMICROELECTRONICS	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	39,201	N/A	£0	97.79%	150	3500+	Y



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Manufacturer	Distributor	Telephone	Website	Franchised Distributor	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	Buffer Stock Facility
ICs & SEMICONDUCTORS (continued)											
TDK	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	60,769	N/A	£0	99.20%	150	3500+	Y
Texas Instruments	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	36,900	N/A	£0	41%	50	1,500+	Y
TEXAS INSTRUMENTS	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	180,012	N/A	£0	91.94%	150	3500+	Y
Toshiba	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	500	N/A	£0	100.00%	50	1,500+	Y
Vishay	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	581,798	N/A	£0	87.71%	150	3500+	Y
XILINX INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	8,213	N/A	£0	51.46%	150	3500+	Y
INDUSTRIAL GRADE MEMORY MODULES											
InnoDisk	Simms	01622 852 848	www.simms.co.uk	N	300+	N/A	N/A	N/A	3	N/A	Y
INTERCONNECTION											
3M	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	3,100	N/A	£0	16%	50	1,500+	Y
3M	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	62,421	N/A	£0	93.42%	150	3500+	Y
Amphenol	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	25,600	N/A	£0	53%	50	1,500+	Y
AMPHENOL RF DIVISION	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	443,368	N/A	£0	75.92%	150	3500+	Y
Anderson Power Products	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	800	N/A	£0	50%	50	1,500+	Y
Cinch Connectivity Solutions	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,900	N/A	£0	82%	50	1,500+	Y
CINCH CONNECTIVITY/Bel	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	31,120	N/A	£0	78.21%	150	3500+	Y
Delphi Connection Systems	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	3,300	N/A	£0	67.00%	50	1,500+	Y
FCI	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	4,300	N/A	£0	94%	50	1,500+	Y
Glenair	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,900	N/A	£0	76.00%	50	1,500+	Y
HARTING	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	4,700	N/A	£0	31%	50	1,500+	Y
Harwin	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,200	N/A	£0	79%	50	1,500+	Y
Hellermann Tyton	Lane Electronics	01403 790661	www.fclane.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	Y
Hirose Electric	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	6,100	N/A	£0	99%	50	1,500+	Y
HIROSE ELECTRIC CO LTD	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	37,215	N/A	£0	90.98%	150	3500+	Y
Huber+Suhner	Lane Electronics	01403 790661	www.fclane.com	Y	766	£116,000	£0	100%	6	38	Y
ITW McMurdo	Lane Electronics	01403 790661	www.fclane.com	Y	866	£219,000	£0	100.00%	6	38	Y
JAE Electronics	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,200	N/A	£0	32%	50	1,500+	Y
JST SALES AMERICA INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	5,109	N/A	£0	84.32%	150	3500+	Y
Kycon	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	99%	50	1,500+	Y
LEMO	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,900	N/A	£0	65%	50	1,500+	Y
Molex	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	16,900	N/A	£0	75%	50	1,500+	Y
MOLEX, LLC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	120,034	N/A	£0	97.98%	150	3500+	Y
Neutrik	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,000	N/A	£0	86%	50	1,500+	Y
Phoenix Contact	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	12,000	N/A	£0	99.00%	50	1,500+	Y
PHOENIX CONTACT	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	54,845	N/A	£0	99.99%	150	3500+	Y
Polamco	Lane Electronics	01403 790661	www.fclane.com	Y	218	£146,000	£0	100%	6	38	Y
Positronic	Lane Electronics	01403 790661	www.fclane.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	Y
SAMTEC INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	427,448	N/A	£0	99.99%	150	3500+	Y
Souriau	Lane Electronics	01403 790661	www.fclane.com	Y	1,929	£806,000	£0	100%	6	38	Y
Switchcraft	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,200	N/A	£0	69%	50	1,500+	Y
TE	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	338,106	N/A	£0	79.40%	150	3500+	Y
TE Connectivity	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	30,900	N/A	£0	40%	50	1,500+	Y
OBSOLESCENCE / HARD TO FIND											
	America II Europe	01462 707070	www.americaiiurope.com	N/A	1,900	\$1B	£0	75%	59	500+	Y
	Cyclops Electronics	01904 415 415	www.cyclops-electronics.com	N/A	177,232	£5M	£100	75%	3	78	Y



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OPTO ELECTRONICS											
Avago Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	8,200	N/A	£0	89%	50	1,500+	Y
Cree, Inc.	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	22,500	N/A	£0	74%	50	1,500+	Y
Dialight	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	9,800	N/A	£0	99%	50	1,500+	Y
Kingbright	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	3,100	N/A	£0	100%	50	1,500+	Y
Lumileds	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,100	N/A	£0	99%	50	1,500+	Y
NEC	Review Display System Ltd	01959 563345	www.review-displays.co.uk	Y	200	£200,000	£0	100%	5	20	Y
Newhaven Display	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	65%	50	1,500+	Y
Osram Opto Semiconductor	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,800	N/A	£0	99%	50	1,500+	Y
VCC	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	5,000	N/A	£0	92%	50	1,500+	Y
Vishay	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	3,100	N/A	£0	99%	50	1,500+	Y
PASSIVES											
ABRACON LLC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	41,991	N/A	£0	100.00%	150	3500+	Y
AVX	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	70,700	N/A	£0	58.00%	50	1,500+	Y
AVX CORPORATION	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	70,131	N/A	£0	89.28%	150	3500+	Y
Bourns	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	49,500	N/A	£0	98%	50	1,500+	Y
BOURNS INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	59,314	N/A	£0	82.47%	150	3500+	Y
CINCH CONNECTIVITY/Bel	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	31,120	N/A	£0	78.21%	150	3500+	Y
Coilcraft	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	10,400	N/A	£0	98%	50	1,500+	Y
Cornell Dubilier	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	33,000	N/A	£0	65.00%	50	1,500+	Y
EPCOS / TDK	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	31,000	N/A	£0	74.00%	50	1,500+	Y
Fair-Rite	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,000	N/A	£0	94.00%	50	1,500+	Y
HONEYWELL MICROELECTRONICS & PRECISION SENSORS	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	28,560	N/A	£0	89.87%	150	3500+	Y
Kemet	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	135,800	N/A	£0	93%	50	1,500+	Y
KEMET	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	101,257	N/A	£0	91.57%	150	3500+	Y
KOA Speer	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	107,900	N/A	£0	82%	50	1,500+	Y
Laird	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	15,187	N/A	£0	97.20%	150	3500+	Y
Laird Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,800	N/A	£0	50.00%	50	1,500+	Y
LITTELFUSE INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	59,517	N/A	£0	91.54%	150	3500+	Y
Murata	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	66,179	N/A	£0	99.79%	150	3500+	Y
Murata	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	67,300	N/A	£0	99%	50	1,500+	Y
Nichicon	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	21,600	N/A	£0	47.00%	50	1,500+	Y
NICHICON	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	39,747	N/A	£0	96.70%	150	3500+	Y
Ohmite	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	17,300	N/A	£0	99.00%	50	1,500+	Y
Panasonic	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	154,777	N/A	£0	94.42%	150	3500+	Y
Panasonic	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	67,900	N/A	£0	69.00%	50	1,500+	Y
Rohm	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	55,139	N/A	£0	99.85%	150	3500+	Y
Samsung	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	37,336	N/A	£0	100.00%	150	3500+	Y
Taiyo Yuden	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	6,400	N/A	£0	82%	50	1,500+	Y
TAIYO YUDEN	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	21,540	N/A	£0	99.97%	150	3500+	Y
TDK	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	60,769	N/A	£0	99.20%	150	3500+	Y
TDK	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	25,300	N/A	£0	85.00%	50	1,500+	Y
TE	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	338,106	N/A	£0	79.40%	150	3500+	Y
TT Electronics	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	32,800	N/A	£0	55%	50	1,500+	Y
United Chemi-Con (UCC)	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	13,900	N/A	£0	99.00%	50	1,500+	Y
Vishay	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	581,798	N/A	£0	87.71%	150	3500+	Y
Vishay	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	119,800	N/A	£0	76%	50	1,500+	Y
Wurth Electronics	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	4,500	N/A	£0	63%	50	1,500+	Y
WURTH ELECTRONICS INC	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	23,733	N/A	£0	100.00%	150	3500+	Y



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PASSIVES (continued)											
Yageo	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	45,300	N/A	£0	99%	50	1,500+	Y
YAGEO	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	147,833	N/A	£0	84.31%	150	3500+	Y
POWER & BATTERIES											
Bel Power Solutions	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,400	N/A	£0	94.00%	50	1,500+	Y
Cincon	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	5,500	N/A	£0	60%	50	1,500+	Y
Cosel	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	11,800	N/A	£0	99%	50	1,500+	Y
CUI Inc.	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	3,900	N/A	£0	100%	50	1,500+	Y
FRiWO Gerätebau GmbH	Haredata Electronics	01423 796240	www.haredata.co.uk	Y	250 - 500	€1M	£250	100%	7	14	Y
Jauch Quartz		01276 605900	www.jauch.com			£500,000	0	95	15	130	Y
Mean Well	Ecopac (UK) Power Ltd	01844 204420	www.ecopacpower.co.uk	Y	6,000	£2M	£0	100%	8	30	Y
Mean Well	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	4,500	N/A	£0	75%	50	1,500+	Y
Murata	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	5,200	N/A	£0	93%	50	1,500+	Y
RECOM	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	23,300	N/A	£0	92%	50	1,500+	Y
Schaffner	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	900	N/A	£0	98%	50	1,500+	Y
SL Power	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,100	N/A	£0	87%	50	1,500+	Y
TDK-Lambda	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	4,600	N/A	£0	99%	50	1,500+	Y
TRACO Power	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	3,400	N/A	£0	95%	50	1,500+	Y
SENSORS											
All Sensors	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,300	N/A	£0	70.00%	50	1,500+	Y
ams	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	400	N/A	£0	77%	50	1,500+	Y
Analog Devices Inc.	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	500	N/A	£0	78%	50	1,500+	Y
Bosch	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	94.00%	50	1,500+	Y
Freescale Semiconductor	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,000	N/A	£0	66%	50	1,500+	Y
Honeywell	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	15,500	N/A	£0	80%	50	1,500+	Y
Maxim Integrated	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	900	N/A	£0	N/A	50	1,500+	Y
Melexis	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	N/A	50	1,500+	Y
Omron	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	5,700	N/A	£0	N/A	50	1,500+	Y
Sensirion	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	N/A	50	1,500+	Y
TE Connectivity	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,100	N/A	£0	N/A	50	1,500+	Y
SWITCHES & KEYBOARDS											
ALPS	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	400	N/A	£0	70.00%	50	1,500+	Y
Apem	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	96%	50	1,500+	Y
C&K Components	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,500	N/A	£0	84%	50	1,500+	Y
Carlting Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	300	N/A	£0	87%	50	1,500+	Y
CHERRY	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	200	N/A	£0	77%	50	1,500+	Y
EAO Ltd	EAO Ltd	01444 236000	www.eao.co.uk	N	5,000	£500,000	£150	100%	6	22	Y
E-Switch	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	94%	50	1,500+	Y
Grayhill	EAO Ltd	01444 236000	www.eao.co.uk	Y	2,300	£150,000	£150	99%	6	22	Y
Grayhill	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	400	N/A	£0	84.00%	50	1,500+	Y
Honeywell	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	98%	50	1,500+	Y
NKK Switches	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,100	N/A	£0	94%	50	1,500+	Y
Omron	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	900	N/A	£0	68%	50	1,500+	Y
TE Connectivity	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	400	N/A	£0	98%	50	1,500+	Y



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TERMINAL BLOCKS											
Marathon Special Products	Global Supply Services	01904 436 488	www.global-supply-services.com	Y	8,000	£800,000	£100	100%	3	11	Y
THERMAL MANAGEMENT											
ADDA	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	800	N/A	£0	59.00%	50	1,500+	Y
Delta Electronics	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	500	N/A	£0	28%	50	1,500+	Y
ebm-papst	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,200	N/A	£0	99%	50	1,500+	Y
Sanyo Denki	EAO Ltd	01444 236000	www.eao.co.uk	Y	300	£150,000	£150	99%	6	22	Y
Sanyo Denki	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	2,900	N/A	£0	N/A	50	1,500+	Y
Sunon	G.English Electronics Ltd	0208 855 0991	www.gelec.co.uk	Y	3,500	£1,000,000+	£0	100%	10	28	Y
Sunon	Thermaco Ltd	01684 566163	www.thermaco.co.uk	Y	3,500	£230,000	£100	100%	6	12	Y
TRANSFORMERS & INDUCTORS											
Best Windings	Best Windings	0044 (0)1394 448424	www.bestwindings.co.uk	N	300	N/A	£100	N/A	2	14	Y
WIRELESS SOLUTIONS											
Anaren	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	86.00%	50	1,500+	Y
B&B Electronics	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	87%	50	1,500+	Y
Bluegiga Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	93.00%	50	1,500+	Y
Digi International	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	200	N/A	£0	92%	50	1,500+	Y
Laird Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	76%	50	1,500+	Y
Linx Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	99%	50	1,500+	Y
Microchip	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	85%	50	1,500+	Y
Murata	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	100%	50	1,500+	Y
Panasonic	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	91%	50	1,500+	Y
Redpine Signals	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	94%	50	1,500+	Y
RF Digital	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	100%	50	1,500+	Y
Texas Instruments	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	75%	50	1,500+	Y
Wi2Wi	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	36%	50	1,500+	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
AWS Electronics Group	01782 753200	www.awselectronicsgroup.com	£40m	UK & Slovakia	430	11	AS9100, ISO9001, 13485, 14001, TS16949, IPC-A-610 Class 3, NADCAP	Y	Y	Y	Y	Y	Y
Axiom Manuf. Services	01495 242130	www.axiom-ms.com	£40m	SW	300	3	ISO9001, AS9100, ISO13485, ISO14001, SC21, IPC610E, BSI Kitemark, NADCAP, ISO27001	Y	Y	Y	Y	Y	Y
Briton EMS Ltd (OSI Electronics)	01234 266300	www.britonems.co.uk	£12m	Bedford & Singapore	100	3	ISO: 9001, 13485, 14001, AS9100, BSI Kitemark IPC610	Y	Y	Y	Y	Y	Y
Challenger Solutions Ltd	01245 325252	www.challengersolutions.com	£5m	Essex/SE	55	7	ISO 9001, 14001, UL IPC-610, SC21	Y	Y	Y	Y	Y	Y
CML Innovative Technologies (uk) Ltd	01284 714700	WWW.CML-IT.com	£12M	UK/EU/China	65		ISO9001 TS16949 UL	N	Y	Y	Y	Y	Y
Contract Production Limited	01751 475950	www.contract-production.co.uk	£1.9m	North Yorkshire	20	2	ISO9001:2008, IPC-A-610 Class 3	Y	Y	Y	Y	Y	Y
Corintech Ltd	+44 (0)1425 655655	www.corintech.com	£7.5m	UK	72	3	AS9100, ISO9001, IPC-A-610 Class 3	Y	Y	Y	Y	Y	Y
CSI EMS Ltd	01376 500050	www.csiems.co.uk	£5m	Essex	50	3	ISO 9001, UL, IPC610	Y	Y	Y	Y	Y	Y
CT Production Ltd	01202 687633	www.ctproduction.co.uk	£4.5m	Poole, Dorset	55	3	ISO9001:2015, AS9100, SC21 Bronze Award	Y	Y	Y	Y	Y	Y
Custom Interconnect Ltd	01264 321321	www.cil-uk.co.uk	£14m	Andover (Hampshire)	130	6	ISO 9000, IPC610, ISO 13485	Y	Y	Y	Y	Y	Y
DJ Assembly	01904 436 456	www.djassembly.com	£1.25m	North Yorkshire	15	2	ISO9001:2008, IPC-A-610 Class 3	Y	Y	Y	Y	Y	Y
Dynamic EMS Ltd	01383 822911	www.dynamic-ems.com	£9m	Scotland	94	3	ATEX, ISO9001:2015, OHSAS18001, IPC-610-F class 3, ISO14001, ISO 13485, UL	Y	Y	Y	Y	Y	Y

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Contract Manufacturers Buyers' Guide (continued)

Manufacturer	Telephone	Website	Turnover	Location	Employees	Number of Surface Mount Lines	Approvals	BCA Capacity	Lead Free Manufacturer	Prototyping	Design Capability	Full Turnkey	Cables and Harnessing
Electrica Limited	0161 343 7575	www.electricalimited.com	£1.75m	Cheshire	26	3	BSI ISO 9001:2015, IPC-A-610 to Class 3, IPC-J-STD-001, Cert IPC Trainer, UL	Y	Y	Y	Y	Y	Y
Electronic Technicians Ltd	01202 897722	www.etuk.co.uk	£3.5m	SE	55	2	AS9100, ISO9001, ISO14001, IPC610/620 Class 3	Y	Y	Y	Y	Y	Y
Elite Electronic Systems Ltd	028 6632 7172	www.elitees.com	£20m	UK	200	5	ISO9001, ISO13485, UL, IPC610/620 Class 3	Y	Y	Y	Y	Y	Y
Esprit Electronics Ltd	02380 455411	www.espritelectronics.com	£9m	S/Malaysia	80	4	ISO9001:2008, IPC610 to Class 3	Y	Y	Y	Y	Y	Y
Fabrinet UK	01249 814081	www.fabrinetuk.co.uk	£21m	UK/Thailand/US	210	5/31/2	AS9100/NADCAP/EN13485/OHSAS18001/14001/9001/TS16949/FDA/ATEX	Y	Y	Y	Y	Y	Y
FermionX Ltd	+44(0)1903 524600	www.fermionx.com	£5m	Worthing, W. Sussex	40	4	ISO9001, ISO14001, IPC-A-610	Y	Y	Y	Y	Y	Y
G&B Electronic Designs Ltd	01420 474188	www.gandbelectronics.co.uk	£4.2m	Hampshire	60	2	ISO9001, ISO13485, IPC-A-610, IPC-J-STD-001, IPC 7711/7721, BS EN 61340-5-1 (ESD)	Y	Y	Y	Y	Y	Y
Hallmark Electronics Ltd	01782 562255	www.hallmarkelectronics.com	£2m	M	26	2	ISO9000/UL, IPC610/D	Y	Y	Y	Y	Y	Y
Icon Electronics Limited	01423 798294	www.iconelectronics.co.uk	£6.5m	Hampshire & Yorkshire	70	6	AS9100, ISO9001, BS EN ISO/IEC 80079-34:2011 ATEX, IPC-A-610 Class3	Y	Y	Y	Y	Y	Y
Industrial Electronic Wiring Ltd.	+44(0)1793 694033	www.view.co.uk	£4.5 m	Swindon, UK	60	N/A	ISO9001:2008, IPC610, IPC620	N	Y	Y	N	Y	Y
Jaltek	01582578170	jaltek.com	£8m	UK	80	3	AS9100, ISO9001, ISO13485, IPC-A-610 Class 3, Certified IPC Trainer (IPC-A-610, J-STD-001 & J-STD-001 Space Addendum)	Y	Y	Y	Y	Y	Y
JJS Manufacturing Ltd	01455 555500	www.jjsmanufacturing.com	£35m	Bedford, Luttworth, (CZ)	420	3	ISO9001:2015, ISO14001:2015, IPC 610 A class 2&3	Y	Y	Y	Y	Y	Y
Lacon Electronic	+44 (0) 7836 338122	www.lacon.de/en	50m	Germany/Romania	500	13	ISO9001, ISO14001, ISO13485, TS16949, OHSAS18001, VG96927, UL	Y	Y	Y	Y	Y	Y
Nemco Limited	01438 346600	www.nemco.co.uk	£11.25m	SE	120	6	AS9100, ISO9001:2008, IPC610/620 to Class 3, ISO14001:2004, SC21	Y	Y	Y	Y	Y	Y
NOTE	01453 797580	www.note.eu	£100m	UK/EU/China	1,000	14	ISO9001, 13485, 14001, 18001, IPC-610 Class 3	Y	Y	Y	Y	Y	Y
M-TEK (Assembly) Ltd	01189 455377	www.mtek.co.uk	£2.4m	SE	30	4	ISO9001:2008/IPC-A-610 Class 3/WHMA-620/ISO14001:2004/IPC-7711/7721	Y	Y	Y	Y	Y	Y
Pektron	01332 832424	www.pektron.com	£50m	E-Midlands	350	8	ISO9001, ISO14001, TS16949, BEAB, VCA, TUV, UL	Y	Y	Y	Y	Y	Y
Protronix EMS	01582 418490	www.protronix.co.uk	£2.5m	Luton	10	2	ISO9001:2015, IPC-A610	Y	Y	Y	Y	Y	Y
Season Electronics Limited	02392 452222	www.seasongroup.com	£5m/£95m	Havant/Global	65/1800	2/18	(AS9100 & ISO9001 in UK) (TS16949 & ISO13485 at sister sites)	Y	Y	Y	Y	Y	Y
Simtek EMS Ltd	01843 233120	www.simtekms.co.uk	£6m	SE	60	3	ISO9001:2008, ISO13485, IPC-A-610 Class 3 & IPC-7711	Y	Y	Y	Y	Y	Y
Speedboard Assembly Services	01753 746700	www.speedboard.co.uk	£12.8m	Windsor, SE	99	4	IPC610 to Class 3, ISO9001:2015	Y	Y	Y	N	Y	Y
Tenkay Electronics Ltd	01903 855455	www.tenkay.co.uk	£4.1m	West Sussex	50	1	ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007	N	Y	N	N	Y	Y
TEXCEL TECHNOLOGY PLC	+44(0)132621700	www.texceltechnology.com	£14.5m	SE	126	7	ISO9001, ISO14001, IPC610 Class 3,	Y	Y	Y	Y	Y	Y
Tioga Limited	01332 360884	www.tioga.co.uk	£15m	Derby	110	6	ISO 9001:2015, ISO 13485:2016, IPC 610, IPC 7711/7721	Y	Y	Y	Y	Y	Y
Trojan Electronics Limited	01792 469020	www.trojanelectronics.co.uk	£2m	South Wales	20	2	BS EN ISO 9001 2008, ISO 14001 2007	Y	Y	Y	Y	Y	Y
Wilson Process Systems	01424 722222	www.wps.co.uk	£12m	SE	100	4	ISO9001:2015, IPC-A-610 Class 3	Y	Y	Y	Y	Y	Y

PCB Buyers' Guide

Manufacturer	Telephone	Website	Service Provided (ie Broker, Manufacture &/or Repair)	Location	Approvals	Volume - Small, Medium, Large	Double-sided	Multi-layer 4-10/10-20-30	Metal PCBs	Flexi / Flex-Rigid	Obsolete Solutions	Modifications	Prototyping
ABL Circuits Ltd	01462 894312	www.ablcircuits.co.uk	M	SE	ISO 9001:2008	SML	Y	4-10	Y	Y	Y	Y	Y
Cambridge Circuit Company Ltd	01223 423100	www.cambridge-circuit.co.uk	M	SE	ISO9001:2015, UL	SML	Y	4-16	Y	Y	Y	Y	Y
Daleba Electronics Ltd	+44(0)1992 510000	www.daleba.co.uk	B/M	SE	ISO9001:2008, TS, UL	SML	Y	4-30	Y	Y	Y	Y	Y
DK Thermal Ltd	+44(0)1992 514200	www.dkthermal.co.uk	M/R	UK, Europe, Asia, USA	UL, ISO9001:2008, TS16949:2009	SML	Y	N	Y	N	Y	Y	Y
GSPK Circuits Ltd	+44(0)1423 321100	www.gspkcircuits.ltd.uk	M/R	UK, Europe, Asia	BSEN, ISO9001:2008, TS16949:2009, UL, CECC release, Queens Award	SML	Y	4-16	Y	Y	Y	Y	Y
LEF Circuits	0116 2891122	www.lefcircuits.co.uk	M/R	M	ISO 9001:2008, UL	SML	Y	4-30	Y	F/R	Y	Y	Y
Photronix Group	01903 231901	www.photronix.co.uk	B	SE	ISO9001:2015, ISO14001:2004, AS9100-B, NADCAP, TS16949:2002	SML	Y	4-58	Y	F, F/R	Y	Y	Y
Prestwick Circuits GPS Ltd	01294 224631	www.prestwickgps.com	B	UK, Portugal, China	ISO 9001, ISO-TS16949, AS9100, IPC610 Class I/II, UL	SML	Y	4-48	Y	Y	Y	Y	Y
Stevenage Circuits Ltd	01438 761811	www.stevenagecircuits.co.uk	M/B	UK/China	ISO 9001:2008, ISO 14001, EN9100:2009, UL, IOSCAR	SML	Y	4-44+	Y	F, F/R	Y	Y	Y
Tate Circuit Industries Ltd	01889 583627	www.tatecircuits.com	B	UK/China	ISO 9001:2015, UL	SML	Y	4-20	Y	Y	Y	Y	Y
Techridge Circuits	0207 993 6503	www.techridgecircuits.co.uk	M Rep.	UK Europe	UL, TS16949(2009), ISO14001(2004), ISO9001(2008)	SML	Y	4-16	Y	N	Y	Y	Y

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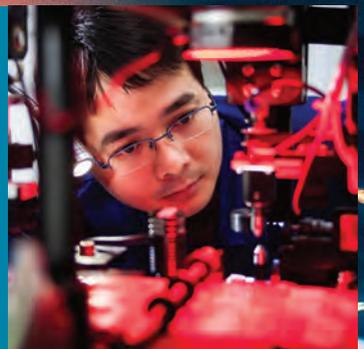
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