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On the cover – July 2018

Unlocking the secret to successful outsourcing
page 22

Contents

04

Careers

A good time to be a buyer

06

News

Wireless mesh modules ready to ship

18

CEM Sourcing

Managing supply chain trends

35

Displays

Purchasing touch technology

52

Buyers' Guide

All the facts and figures to help you buy

Editor's Word



Efficiency rules

A recent Dyson advert caught my eye where the company announced it was ceasing development of corded vacuum cleaners to focus on its rechargeable models. On reflection I wasn't surprised. I'm the proud owner of a Dyson V8 vacuum and since buying it my old corded model has sat redundant and unloved in the boiler room.

If you had asked me five years ago whether I would have been willing to replace a corded vacuum with a cordless I would have chuckled at the thought. Yet, I haven't used a corded power drill in a decade and soon there will be electric motors attached to my bicycle and car wheels. Ultimately, it's all down to efficiency and power density.

I guess the future of the planet relies on every individual's ability to, day-after-day, improve the efficiency of everything they do. Given how much of a person's day is powered by electricity this is a heavy burden for the electrical and electronics industries but something they appear willing to shoulder.

Over coming years I'm expecting to see gains in circuit and motor efficiency and even bigger leaps in energy storage technology. The companies that achieve the biggest gains will be the new 'oil barons' of the future.

As an aside, my own weight loss campaign has highlighted how annoyingly efficient the human body is and how energy dense food is. I'm staggered by how little food the human body needs to function. If only my appetite would be willing to listen.

Jon Barnett

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A Good Time to be a Buyer



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

Procurement and supply managers reap the benefits of a strong employment economy, but professional pressures mount in a tough sourcing environment

Careers • By Victoria Kickham

It continues to be an employee's market, and those in the supply chain profession are reaping the benefits of the trend in 2018. The economy remains on its upward trajectory worldwide, and U.S. unemployment levels were at historic lows heading into the summer months, as wages continued to increase across the board. For buyers and supply managers, the story is even better.

In early June, the Institute for Supply Management released its *Annual Salary Survey*, revealing higher than average salaries and wage increases for supply management professionals—those responsible for buying and managing a wide range of products and services for companies of all sizes—as compared to the larger professional workforce. On average, supply management salaries rose more than four percent last year, versus three percent for professionals generally, according to ISM, which represents 50,000 supply management professionals who manage about \$1 trillion in corporate supply chain procurement annually. What's more, buyers and supply managers' average overall compensation was close to \$120,000 last year, the ISM survey showed.

So what does this mean, aside from the likelihood that buyers are bringing home a bigger paycheck these days? ISM points to the value the profession brings to the table and companies' understanding of and willingness to pay for that value, especially in today's climate.

"In today's global economy, excellence in supply management improves both top- and bottom-line performance, and advances companies' leadership on the worldwide stage," Paul Lee, director of ISM Research & Publications said in a statement announcing the results this spring. "Supply management professionals' higher-than-average wage growth reflects the significant value they add every day."

Such value plays an increasingly important role in the electronic components supply channel, as companies and their purchasing departments face a tougher sourcing climate in 2018. Longer lead times and the threat of shortages are putting pressure on buyers to expand their sourcing networks while also managing the supply chain risks such practices often entail, including slower production lines due to delays and the danger of sourcing counterfeit parts. In short, supply chain risk is rising right alongside employment levels and wages. Another recent industry study shows that procurement leaders are prioritising risk management as one of their most strategic responsibilities in 2018, based on a host of factors affecting global supply chains. The study, *Managing Supply Risk: Are You Prepared for a Black Swan Event?* by consulting firm A.T. Kearney and research/analytics firm RapidRatings, also showed that most companies expect their procurement organisations to be given more responsibility for managing risk over the next two years.

Such challenges are here to stay, and will be exacerbated by other market factors. Employment growth is expected to continue, even as some industries find it challenging to fill both skilled and unskilled jobs. This remains a thorn in the side of many manufacturing and industrial firms, which is another factor threatening productivity. Although manufacturing employment levels saw 20 straight months of growth as of May 2018, procurement professionals at manufacturing firms said the labor market remains a constraint to their production and that of their suppliers, according to separate ISM data also released in early June.

The bottom line? Buyers and supply managers can count on both a rewarding and challenging work environment ahead.

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North East centre of excellence to enhance NPI

TT Electronics is to create a centre of excellence at its Bedlington facility in the North East of England. The location will provide engineering, manufacturing and operational expertise to support the company's anticipated growth. The AS9100 certified facility is already home to the design and production of TT Electronics' high reliability microelectronic hybrid circuits and specialist current sensing, circuit protection and signal conditioning product lines.

During the initiative, TT Electronics will be investing circa £3 million to create a fit-for-purpose facility in the North East over decades to come. This follows over £1 million already invested to create a Class 6 clean room in 2016 and a multi-chip module automated production line, which supports production for global aircraft engine manufacturers.

The current site is being consolidated and redeveloped, with an improved space for efficient engineering and manufacturing operations.

Commenting on the centre of excellence, chief executive officer, Richard Tyson, said: "Bedlington is the home of our global current sensing, circuit protection and signal conditioning development team and it is an important centre for innovation in new product introduction and customisation. Our specialist design skills, reputation for high reliability and strong customer relationships provide an excellent opportunity for growth in the North East." www.ttelectronics.com

Sourcing for harsh and high-end applications

Charcroft Electronics has launched a new website which enables buyers to simplify the selection of rugged and high-reliability components for use in specific applications: military and defence; space; oil and gas; rail and transportation; industrial; specialist automotive; audio and instrumentation. Director, Debbie Rowland, said: "Rather than trying to find high-reliability versions among thousands of consumer-grade devices, buyers can quickly find parts across a range of reliability levels. These include Commercial-Off-The-Shelf (COTS), AEC-Q, CECC and space-approved devices with the option of additional high-level testing to support fail-free operation."

Access can be via PC, mobile and tablet. Online procurement tools include: current lead-times; an inventory list and stock search in addition to Parts Change Notices (PCNs); online quotations; subscriptions to Charcroft Intelligence emails and account applications. A Live Chat service provides online support for commercial or technical questions.

Online purchasing of passive components manufactured in Charcroft's UK-based CECC-approved manufacturing facility and Vishay Precision Group (VPG) Approved Precision Centre is offered via eBay. www.charcroft.com



Wireless mesh modules ready to ship

Mouser Electronics is now stocking a pre-certified, multi-protocol solution for wireless networking in the form of Silicon Labs' MGM13P Mighty Gecko wireless mesh modules. Featuring secure and flexible mesh protocol stacks, an integrated chip antenna, and radio frequency regulatory certifications, the modules can help reduce cost, complexity and time when designing mesh networking applications.

Modules incorporate a low-power wireless system on chip with a 32-bit Arm Cortex-M4 core with DSP instruction and floating-point unit for efficient signal processing. The SoC offers 64kbytes of RAM, 512kbytes of flash and up to +10dBm output power, as well as a selection of peripherals. Integrating the crystals, RF passives and antenna for a system-level implementation of wireless internet of things mesh networks eliminates the need for complex antenna design and testing.

The module is supported by a starter kit and a suite of development and debugging tools to help accelerate design of IoT products such as connected home lighting and security, smart metering and health and wellness devices. www.mouser.com

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In Brief

Inventory investment

Premier Farnell has invested almost \$100M in additional inventory over the past 12 months, increasing availability of in-demand products and the latest new components. Overall, an additional 77,000 product identification codes have been added. Several new franchises have also been added including suppliers such as Xilinx, Nordic Semiconductor and Arduino. www.premierfarnell.com

Perfect timing

Further to these additions, Premier Farnell has also announced a new global franchise with SiTime, giving Farnell element14 customers access to the latest silicon micro-electrical-mechanical systems timing products. Benefits are said to include short lead-times, effective features, low power, small size and high reliability. Farnell element14 will stock over 200 SiTime oscillators, said to be 30 times more robust than quartz oscillators. www.element14.com

Enhanced ADAS support

Konrad Technologies is expanding its UK presence with new locations offering regional expertise and support in test and measurement. Set to support growth in automotive and internet of things markets within Northern Europe, the new UK operation will provide enhanced commercial and technical support in areas such as test solutions to validate advanced driver assist systems. www.konrad-technologies.com

Design-in displays

Display manufacturer, Midas Displays, has appointed Yorkshire-based Easby Electronics as a franchised distributor. Easby will market, promote and supply Midas Displays' complete portfolio of products, value-added services and solutions. With its technical experience and its focus on service, Easby is expected to provide sales growth through pro-active demand creation activity. www.midasdisplays.com



Act now to prepare for chip resistor famine

Anglia Components warns of an impending chip resistor famine and urges purchasers to ensure they have sufficient orders or inventory to cover their needs. With global demand massively outstripping supply due to the increased electronics content in automotive, industrial and consumer applications, shortages and price increases are already impacting the supply chain.

Chief executive officer of Anglia, Steve Rawlins, commented: "We foresaw that a shortage in chip resistors was coming about six months ago and invested heavily in inventory to protect our customers. A chip resistor might be one of the cheapest items on the BOM, but without it, you can be looking at thousands in lost revenue if you are not able to complete assembly of the end-product.

"I would strongly advise customers to get their orders in or take on inventory now, while stock is still available."
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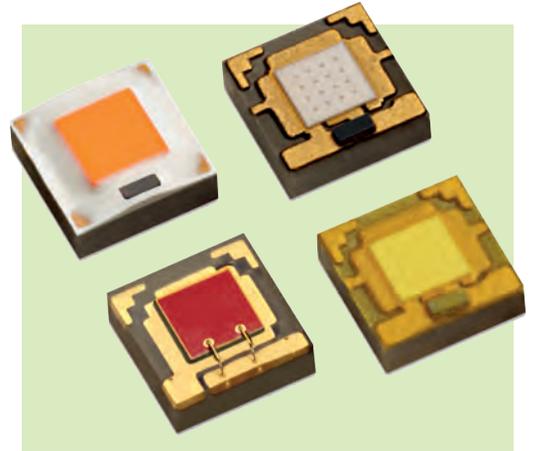
Plug into high voltage portfolio

XP Power has expanded its product offering to include standard, modified and custom high voltage, high power conversion products following its acquisition of US-based Glassman High Voltage. Typical applications for the new products include semiconductor manufacturing, vacuum/plasma processing, analytical instrumentation and medical diagnostics equipment.

The two companies already share several customers and while there is no direct overlap in product lines, their power supply solutions are complementary.

Chief executive of XP Power, Duncan Penny, said: "Glassman fits with our strategy of growing our high power and high voltage capabilities. This is our third such acquisition in just over two years and means we can now offer a full suite of products from miniaturised low power modules to high power rack mount high voltage solutions."

www.xppower.com



Powerful LEDs on the shelf

RS Components has announced availability of the Lumileds Luxeon CZ portfolio of colour and white LED emitters. Designed to deliver significant candela and lumen density, the portfolio caters for a range of lighting sectors including: architecture and entertainment; colour-tunable lamps; and speciality lighting for emergency vehicles.

A full spectrum of colours is available including red, red-orange, amber, phosphor converted amber, mint, green, cyan, blue and royal blue. Peak wavelengths for the devices range from 624 to 634nm for red, 520 to 540nm for green, to 440 to 460nm for royal blue.

The white LED series includes devices with 3000, 4000, 5000 and 5700K colour temperatures with respective typical luminous flux measurements of 99, 109 and 110mW. www.rs-online.com

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Adding value through outsourcing

Electrocomponents has announced its acquisition of IESA, an organisation specialising in outsourced procurement, inventory and stores management

IESA is a UK-based provider of value-added outsourcing services to industrial customers. The move will enhance and accelerate the group's value-added services offering, giving it additional capabilities to service those customers who choose to outsource their maintenance, repair and operations, as well as other indirect purchases and inventory management.

In addition to the procurement, inventory and stores management services that can be outsourced to IESA, the company also provides transactional processing services to manufacturing and process industries. Its fully integrated indirect supply and stores solutions are expected to complement the Electrocomponents Group's

existing product and value-added service capabilities, allowing it to offer a full-service, end-to-end solution.

Upgrading e-commerce solutions

Purchasers opting to use IESA's services will be able to improve their efficiency and consolidate their indirect procurement vendor base via a cloud-enabled proprietary marketplace solution, MyMRO.

Chief executive officer of Electrocomponents, Lindsley Ruth, commented: "The acquisition of IESA will improve our value-added services proposition, enhancing our offer for customers. We believe the combined digital capability of IESA and Electrocomponents is a market differentiator and will greatly enhance the experience

we offer our customers and suppliers, with a much wider range of e-commerce-led solutions.

"We intend to continue to run IESA as a separate business unit within the group, allowing it to retain its supplier independence, which customers value."

Accelerating digital capabilities

As Lindsley explained, IESA will run as a separate business unit within Electrocomponents, with the existing IESA CEO, Glenn Timms, at the helm. As part of Electrocomponents, IESA customers will benefit from the international reach of the broader group. Meanwhile, the group's relationships with international suppliers will enable IESA to enhance

its offering to purchasers, as well as accelerating its digital capabilities.

Chief executive officer of IESA, Glenn Timms, concluded: "As a proud new member of the Electrocomponents family, we will retain our existing leadership team and will continue to operate as an independent unit, which is crucial to our business model.

"In addition, we will have significant opportunities to leverage the Group's global infrastructure, resources and digital capability. This will enable us to drive faster growth and benefits for our clients, vendors and employees, and we look forward to the next phase of our development."

www.electrocomponents.com



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Distributors' sales soar as component demand remains robust

Distributors say component supply could remain tight until 2019 and shortages could worsen as component manufacturers slowly add capacity



James Carbone

Some distributors say that shortages of passive components and discrete semiconductors that began last year should start to ease in the second half of this year, but others believe supply will remain tight until 2019.

Shortages that began last year because of strong demand from multiple customer segments continued into the first half of this year and will remain robust through 2018, according to distributors and component manufacturers.

Most distributors believe that supply constraints will ease, but there is a difference of opinion on when. Some expect tight supply of resistors, capacitors and discretes will loosen in the second half because component manufacturers are adding capacity. Others say enough capacity has yet to be added to significantly impact supply so component constraints will continue into 2019.

"Component shortages are going to get worse before they get better," said Michael Knight, president of TTI Semiconductor Group. "Demand is going to exceed capacity through next year," he said during a presentation to TTI suppliers at the annual Electronics Distribution Show. He noted there was double booking occurring and predicted that

"customer line downs are going to escalate in the second half of the year." As a result of continuing strong demand, "2018 will be an amazing year," said Knight.

While economic growth is forecast to slow in 2019, underlying demand for components "is going to be just fine for some time," he said. "Regardless of what happens to the economy 2019, it will be a good year for us as well, and hold onto your seats, 2020 is going to take off!"

Knight is not the only distribution executive who believes that demand will continue to be healthy if not stellar and supply will be tight for a while.

Underlying demand will continue to be strong even if new capacity is added and lead times for components shrink, according to Karim Yasmine, corporate vice president, strategic supplier development at Future Electronics, based in Montréal.

He said component demand was stellar in 2017 and continues to be strong this year. "We have been in an unbelievable environment for the last six quarters. Demand is coming from every market segment, every application space," he said. Growth is especially strong in automotive, industrial and Internet of Things applications, according to Yasmine.



Michael Knight, president of TTI Semiconductor Group

"Component shortages are going to get worse before they get better and demand is going to exceed capacity through next year"

With automotive, there is "phenomenal content growth" of electronic components because of proliferation of Advanced Driver Assistance Systems (ADAS) in vehicles and rising shipments of electronic vehicles and hybrids, which have more electronics than traditional vehicles.

IoT takes off

Another reason why supply will remain tight is IoT is starting to take off as more companies want to connect their products to the Internet, requiring them to be designed with sensing and wireless capabilities.

"IoT asset tracking, agricultural applications, wearables, smart factories, smart homes, smart appliances, require more sensing capability" to collect data and to analyse it, he said.

"IoT is a tremendous opportunity for the industry," said Yasmine.

While strong component demand is resulting in more business for larger broad line distributors such as Future, it is also helping drive business at small-volume catalog distributors that usually sell parts to engineers designing new products. However, because



Karim Yasmine, corporate vice president, strategic supplier development at Future Electronics, based in Montréal

of allocations, many buyers have reached out to catalog distributors such as Mouser, Digi-Key, Newark and Allied.

"Our first quarter was up 46 per cent over Q1 last year," said Mark Burr-Lonnon, senior vice president global service EMEA, & APAC at Mouser Electronics. "It was 10-15 per cent over what we expected." Much of that growth was due to Mouser's core business of selling components to engineers designing products, but some of the sales growth was due to buyers looking for shortage components.

While Mouser and other distributors undoubtedly welcome the extra business caused by tight supply, if the current shortages continue it could result in declining sales of other components in the future.

"Up until now everyone has been euphoric about the market," said Burr-Lonnon. He said all the components that Mouser can get from manufacturers can easily be sold. However, supply constraints of multilayer ceramic capacitors (MLCCs), resistors and memory chips are severe.

At some point if an electronic systems manufacturer can't buy resistors, capacitors and memory, the company won't be able to manufacture its products, said Burr-Lonnon. If that happens there will be no need for them to buy other components.

Add capacity with caution

Component manufacturers are aware of this and report that they are adding capacity, although some distributors say they are being cautious about how quickly they bring capacity online.

"We are not seeing a lot of manufacturers adding a whole a lot of capacity," said Burr-Lonnon. "One manufacturer said their

capacity was up 30 per cent this year and will go up another 16 per cent next year, but they're not suddenly laying in huge amounts of capacity." A lot of component manufacturers are adding capacity for parts and smaller packages such as 0201, he said. Shortages could continue for parts in larger packages.

Component manufacturers say they are being judicious about how much capacity they are adding. "We are adding capacity and so are our competitors and we are trying to do it in a responsible way," said Dave Valletta, executive vice president worldwide sales at Vishay Intertechnology, based in Malvern, Pa. "None of us want to get stuck with overcapacity. It doesn't do anyone any good."

He said MOSFETs "are a real problem but we have additional capacity coming and that should be on line in the second half." Resistor chips continue to be an issue, but supply is improving for them, said Valletta. "We are making meaningful increases in capacity."

The biggest supply issue is with multilayer ceramic capacitors. Valletta said Vishay is a "niche player" with MLCC and supplies some MLCCs to the auto industry. However, it is considering adding more MLCC capacity to serve automotive customers and other segments.

The amount of capacity being added varies by product. "In some cases, we're talking 10 per cent increases. With other products it's 30 per cent," said Valletta.

He noted that Vishay had a six-month backlog of orders. Increases in capacity will start to ease supply conditions in the second half of the year, according to Valletta. However, some component manufacturers say supply will remain tight longer.

"We have been in an unbelievable environment for the last six quarters. Demand is coming from every market segment, every application space"



Wait until 2019

"Constrained supply will not ease in 2018 and will probably remain constrained in the first half of 2019, according to Jeffrey Thomson, vice president global supply chain sales for ON Semiconductor in Phoenix. He said supply could remain constrained for components used in the "automotive and industrial space" even longer. "I'm not sure it's going to be truly back to what I would consider normal lead times of eight weeks over the next several years. There are a lot of new designs kicking in and a lot more content going into cars," he said.

ON is adding capacity, but at a lesser rate than demand, said Thomson. He said ON focuses on industrial, IoT and automotive and those markets "are incredibly strong. It is phenomenal how much they are growing."

ON's most constrained products are power products including intelligent power modules and MOSFETs, said Thomson.

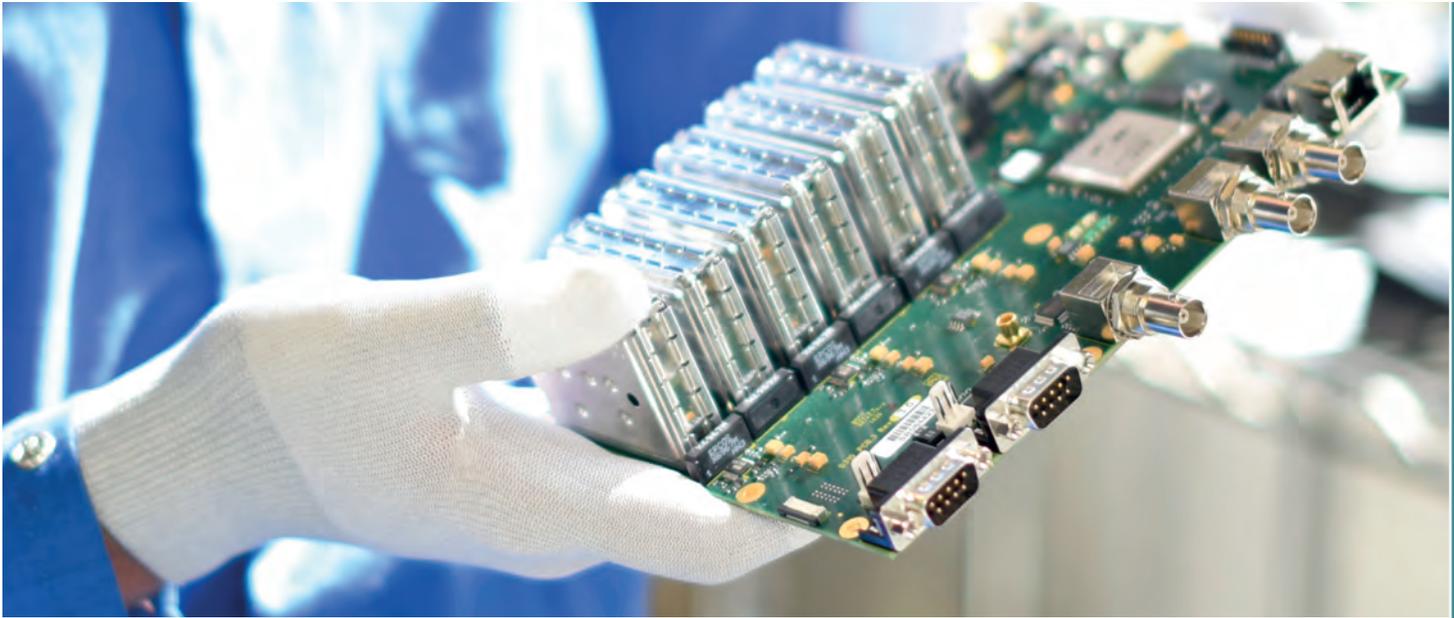
Besides MOSFET, MLCCs and resistors, supply is also tight for connectors but supply conditions aren't as acute as with other components. "We do have allocations from time to

time, but we're not seeing the type of allocations anywhere close to what's happening with semiconductors," said Brian Krauss, vice president marketing and communications for Molex, based in Lisle, Ill. "We are not seeing double ordering and cancellations," he said. Molex is adding capacity at its facilities in Mexico and China because it expects continued strong connector demand.

"In meeting with our distributors, no one is talking bloom and doom," said Krauss. "No one is talking about this thing coming to an end. Everyone is saying that business continues to grow," he said.

Krauss said the connector industry is growing about 4 per cent per year, although Molex's growth rate is "more than 2X the market."

Strong demand will continue. "We feel that the global economy is continuing to go up and to the right and we don't over the next year see any reason that we would take a step backwards," he said.



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Prioritising performance

From first-time users to experienced OEMs looking for cost reductions, purchasers keen to establish a new CEM partnership should prioritise supplier performance, says Corintech sales manager, Martin Skinner

Q What sectors does Corintech serve?

A) Corintech has been providing expert electronics design and manufacturing services for over forty years. With highly skilled design, product and electronics engineers and sophisticated manufacturing facilities, Corintech can take on a variety of project types for an array of industries including defence, aerospace, automotive and gas and fire detection.

Q Are new customers mainly existing CEM users or companies

looking to outsource for the first time?

A) A mixture of both. Most of our business comes from established companies looking to find a better supplier, hoping for cost reductions and improved quality and delivery times, but we do work with some start-up companies. There are many points for an original equipment manufacturer to consider when qualifying a replacement contract electronics manufacturer. We understand that this can be a sensitive and risky process and always do our utmost to



Sales manager, Corintech, Martin Skinner

ensure that we are the right contractor for the customer.

Q What is the usual process when a new client engages with Corintech?

▶▶ continued on page 16

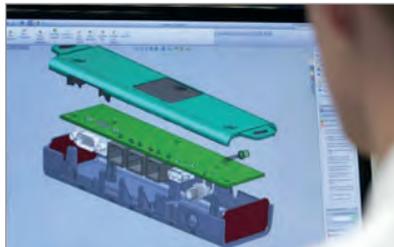
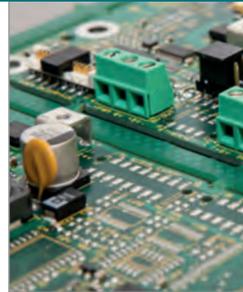


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- A) Usually, a meeting or conference call to run through requirements and expectations followed by a written specification and bill of materials. Corintech would review this in detail before providing a proposal, along with suggestions for cost savings or improving lead times.

We would then produce a sample for approval, complete with a first article inspection report, before proceeding to full production.

Q What have been the biggest challenges for CEMs over the last five years?

A) The US dollar exchange rate has caused cost fluctuations, which affects components that are purchased in USD. We're also seeing increased volatility in the component supply chain, with significantly increasing lead times.

Q What special or unusual products has Corintech worked on over the years?

A) Corintech has been involved with lots of research and development projects. We have several niche capabilities, such as thick film hybrid production, and customers sometimes challenge us to use this technology in new ways, in new applications that have never been tried before. We

are frequently able to provide successful solutions, often for industries with harsh environment applications such as defence, aerospace or automotive.

Q How do you see CEMs evolving in the next 10 years?

A) I predict far more automation, involving faster, lower cost assembly methods. Advancing technology will improve quality and repeatability in component placement, soldering, coating and inspection results. Overall, components are also getting smaller and PCB assemblies more heavily populated.

Q Has Corintech experienced long component lead-times and how are you managing this?

A) Longer lead times are a problem, but we work closely with suppliers to make sure that buffer stocks are in place on problem parts. Understanding a customer's forecast helps us to plan around any long lead-time items by holding stock of the parts. We also have the advantage of UK, HK and USA purchasing teams, which provides full global reach with franchised distribution chains.

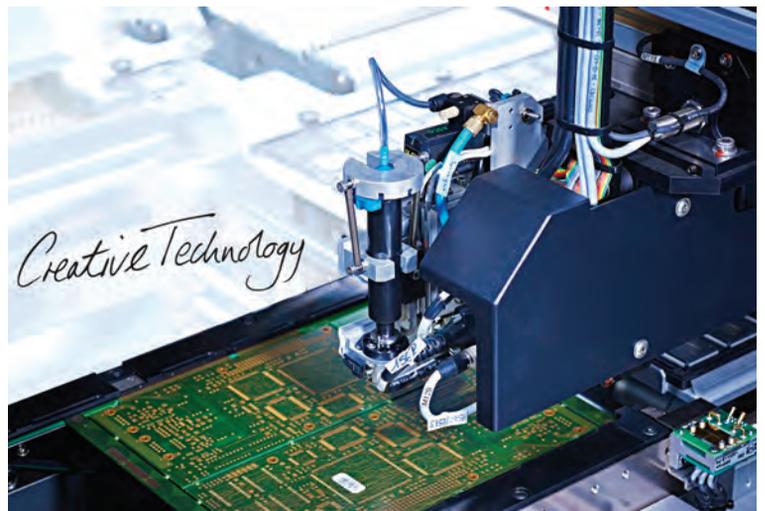
Q Which sector of Corintech is experiencing the most growth?

A) Predominantly we build-to-print, however, we are currently seeing steady growth across our whole business. Continual investment in our staff, processes and production capabilities enable us to exceed the service levels our customers expect.

Q What advice would you give to readers looking for CEM services?

A) Find a CEM with quality accreditations; ISO 9001 is a minimum but look for higher level quality certification such as AS9100. Prioritise suppliers that understand the way you want to work and are flexible enough to meet your needs while being proactive enough to look for improvements at every opportunity.

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Longer lead times are a problem, but we work closely with suppliers to make sure that buffer stocks are in place on problem parts

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Managing supply chain trends: a guide for EMS users

Managing director of Dynamic EMS, John Dignan, reveals the supply chain trends currently affecting the electronics manufacturing service industry and gives his views on how to remain competitive

Managing mergers

Aggressive mergers and acquisitions have provided a recipe for growth for original component manufacturers since 2015, especially semiconductor manufacturers. This consolidation, combined with a changing distribution sales model, have left end-customers with fewer supplier options and fewer qualified design resources. Likewise, in the chip industry, mergers have created mega-suppliers with considerable power.

When two OCM suppliers with common portfolios merge, the vendor base for those devices is reduced by a factor of one and mature lines are often phased out in favour of newer, more profitable ones. Consequently end-of-life notices from OCMs have accelerated within the past year.

The reality therefore, is that we operate in a market with fewer OCMs. Where once

we had several choices, we now have one or two, or sometimes a sole supply only, resulting in the thinning or damming of the sourcing stream.

Contingency forecasting

The current component shortage is now expected to last through 2018. Passives lead-times are stretching to 30-plus weeks, with some orders quoted for delivery into mid-2019. That's a long time for buyers to live hand-to-mouth. This leads to a 'bunker mentality' within the procurement department, which double, and even triple, orders to stock up on supply.

For the first time in years, the term 'allocation' is back. Of course, in any scenario when demand exceeds supply, there is an impact on cost, with prices rising at an extraordinary rate. We are beginning to see price increases in chips, making buyers anxious. Naturally, business is booked well in

advance to avoid absorbing an increase, especially in a margin-sensitive business such as electronics manufacturing services.

Involvement at the design stage allows your EMS partner to consider which components might be challenging to secure. Products can be designed with an alternative component, one that could be easier to source, or one that isn't approaching its end of life, or obsolescence.

Plan for tech migration

Component demand is up thanks to internet of things growth and the rise in automotive, mobile and industrial markets. Technology migration, particularly within the already-volatile memory market, has a ripple effect on availability.

There is currently, for example, a transition in the

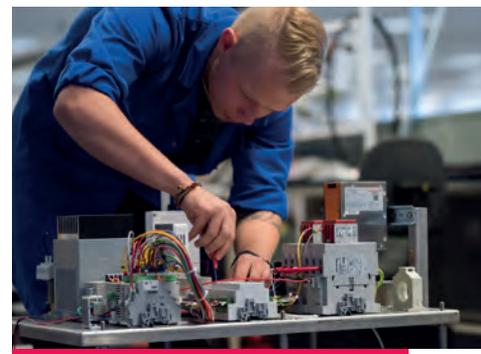
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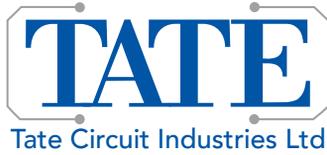
End-customers have fewer supplier options and fewer qualified design resources



Look for cost-effective solutions to reduce waste including component waste



Allow your EMS partner to consider which components might be challenging to secure



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“““
Component demand is up thanks to internet of things growth and the rise in automotive, mobile and industrial markets

▶ flash market from 2D to 3D technology. Flash is the key component in SSDs and this movement is naturally driving a shortage in flash memory, with a knock-on effect on SSDs. Demand gradually puts pressure on established technology, such as DRAM, with DIMM modules for servers in short supply at a time where cloud technologies are driving demand up for server production.

This shouldn't be a show-stopper. Take a sustainable approach by forging open book and transparent relationships with your OCM partners.

Tough choices

We're now seeing shortages across a range of products: in passives, MLCCs and tantalum; and some resistors and diodes. The industry's largest DRAM supplier, Samsung, is considering increasing its DRAM output, even as it adds capacity for newer technologies.

But how should it do this? Adding capacity is expensive and takes time to ramp-up. If the required capacity is not added, however, the OCM could run the risk of losing the sale.

And it's not just OCMs who face challenging decisions; EMS buyers do too, as suppliers and distributors are allocating products, using customers' buying history as a baseline. The solution, to reduce or eliminate risk, is to take control of the parts of the supply chain that can be controlled. Work with like-minded OCM partners and form a two-way relationship. Look for cost-effective solutions to reduce waste including component waste, e-waste, packaging and process inefficiencies.

Furthermore, design products with the circular economy in mind. This model is increasingly important to Dynamic EMS and to its customers, who often request the company's mission statement on environmental policies, for example, just-in-time.

With experience in the EMS supply chain spanning over 35 years, we recognise that what we are experiencing currently, is part of a continuous cycle. As this develops, we will see new, smaller component manufacturers emerge and grow. These companies are born as developmental spin-offs from larger companies, with the talent, experience,

and resources to transform and disrupt the market once more.

It's a cycle, so do what you can to sail through it with the minimum disruption; belt up and hold on tight, as it could be a bumpy ride.

www.dynamic-ems.com



Take a sustainable approach by forging transparent relationships with your OCM partners

It makes sense to stay local

Successful new product development relies on close co-operation with manufacturing partners, explains UK electronics manufacturing services provider, Smart Made Simple



When it comes to sourcing electronics manufacturing services, location makes a real difference, with many customers prioritising geographical positioning in their search criteria.

Based on customer feedback, chief operating officer at SMS Electronics, Graham Shaw, explained: "Developmental customers prefer to be within a two-hour drive of their manufacturing partner and on the whole, our original equipment manufacturing customers selected SMS because it is within a 200-mile radius of their operations and resources."

SMS UK business development manager, Robert Colclough, agreed, adding: "SMS has the advantage of being close to the main innovation clusters within the UK technological landscape. SMS is at the intersection of the innovation triangle, in a prime position at the centre of the UK's design, development, electronics manufacturing and supply chain activities."

Based in Nottingham, SMS is in a vibrant enterprise area, surrounded by engineering universities where many of the technology patents of tomorrow are being developed, and where supply chain management and business courses are held in high regard. There are also several key industry associations close by that drive the company's knowledge network, including Nottingham Innovation Park, Tech North and The Smart Group, as well as UK innovation hot spots that have pioneering spirit within their DNA.

For those UK OEMs that spend time travelling to their contract manufacturer, whose suppliers operate in different time zones, or that simply cannot respond quickly enough, SMS claims to offer an alternative; an indigenous electronics manufacturing service provider that does business locally for a global market.

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Creative Technology

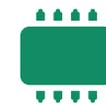


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How to find 'the one'

With the social and political landscape constantly changing, selecting the right manufacturing partner is more important than ever, says contract electronics manufacturing director at Trojan Electronics, David O'Keeffe

The way that organisations source and sell goods and services globally is evolving, thanks to a changing socio-political landscape. Selecting the right manufacturing partner is vital, says David O'Keeffe, CEM director at Wales-based Trojan Electronics and although price matters, it is the whole package that organisations should focus on when considering outsourcing manufacturing services.

David explained: "When selecting the best candidate, it is attitude rather than the aptitude that invariably determines the outcome. If the supplier has the requisite skills and capabilities, great; but does it go the extra mile?"

Is it the right fit for your organisation now and in the future?"

Relationships matter

In choosing the right-fit contract electronics manufacturing partner, David suggests looking at existing relationships. "To determine trust levels," he explained "look at the length of other customer relationships. If the company has relationships going back several years, that is usually a good indicator that it values partnership and customer retention."

Look also for a flexible CEM that can meet changing requirements. When altering a product for example, establish whether the CEM



can accommodate design changes, shorter product runs or make prototypes.

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Explore capabilities

As David explained: “Any organisation choosing to outsource its manufacturing, assembly or end-of-life management, wants to be certain that the CEM does what it would have done — perhaps just a little more efficiently.”

A CEM that acts like an extension of your organisation, has adopted the necessary operational and industry best practice frameworks and is focused on proactive planning to achieve delivery of quality and reliable products, on time and in full at competitive cost, should tick quite a few boxes.

Organisations looking to scale production, run several different product lines, or move from assembly to box build, need a CEM with the capacity to accommodate this. A site visit will demonstrate what facilities are available to accommodate customer growth.

When it comes to quality, a CEM that uses aerospace and automotive industry best practice frameworks such as SC21 or TS16949 should go to the top of the list. This demonstrates a commitment to use world-class working and quality practises to proactively identify and manage risks, explained David.

Sustainable partnerships

Given the rapid socio-political changes today, a CEM with enough financial strength to ensure a sustainable partnership is essential. Regular financial checks and a close working

relationship within the organisation’s supply chain can help ensure this. Another key factor is whether the CEM can guarantee that IP will be protected. This could mean keeping products in the UK rather than offshoring to other countries.

A productive partnership may depend on integrated manufacturing services. Establish whether the CEM is proactive in using lean

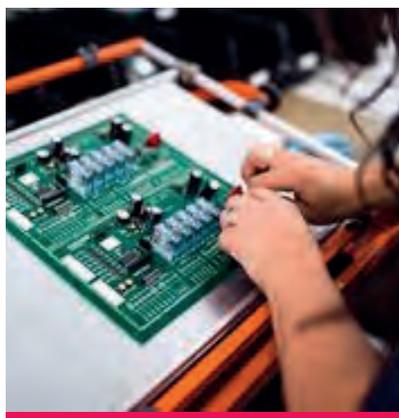
principles to ensure customer value and whether it can remove cost while building-in safety and reliability.

“Last, but by no means least,” David concluded, “look for a CEM with a culture of collaboration, participation and innovation, happy to work with customers throughout every stage of the product and supply chain cycle.”

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CEM director at Trojan Electronics,
David O'Keeffe



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Face the facts: the truth about component shortages

No-one wants to hear that component prices are rising, or that lead times are extending, but ignoring the problem won't help. Work closely with your EMS provider to mitigate the risks, advises JJS Manufacturing

Taking an ostrich-style, head in the sand, approach to sourcing might seem pretty appealing right now, but ultimately, it's time to face facts: component prices are rising and lead times are extending by the day. The electronic components market is in poor shape and

the sooner you wake up to this news, the sooner you can put plans in place to mitigate the risk to your business.

So, instead of ignoring all those e-mails and phone calls from supply partners until they sort everything out and things go back to normal,

it could be time to work more closely with your EMS provider to make the best out of a tough situation.

As an OEM, it can be easy to lose touch with what's going on in the component marketplace, particularly if you have taken the decision



The electronic component market is becoming increasingly difficult in terms of stock availability



to outsource manufacturing to an EMS provider. Of course, one of the primary benefits of outsourcing is relinquishing control of material procurement, but when supply challenges occur, you'll need to collaborate with your EMS provider to resolve issues caused by allocation.

Here we examine the current state of the market and share seven ways in which you can work more closely with outsourcing partners to deal with shortages.

Where are the shortages?

The electronic component market is becoming increasingly difficult in terms of stock availability. Furthermore, it's becoming hard for suppliers further down

the chain to maintain pricing over longer periods of time. Unfortunately, this is an industry-wide problem not just something that's affecting a handful of suppliers or product lines.

Memory, especially NOR and NAND Flash, has been an ongoing issue for at least 18 months, with minimal improvement on conditions. Some device manufacturers have

even cancelled 'last time buy' stock that had been on order for over six months.

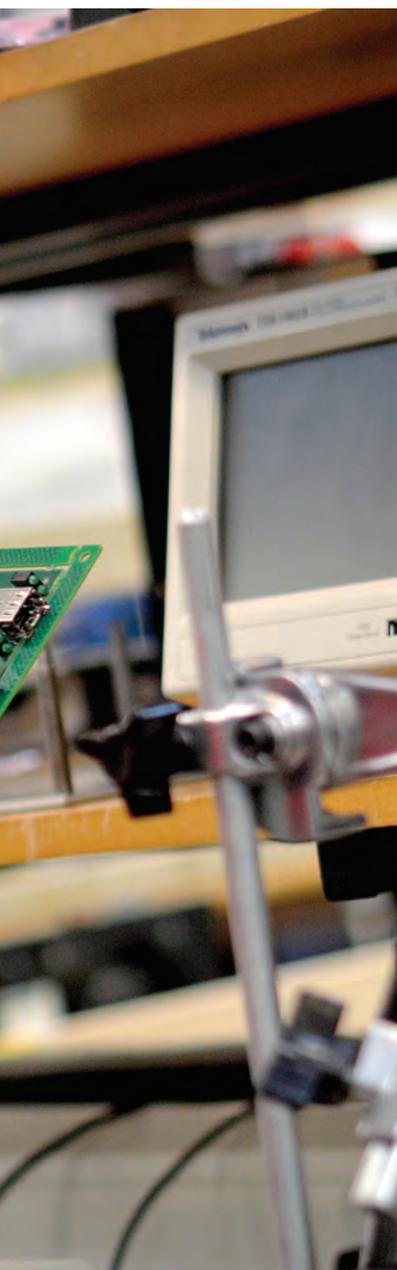
In addition to memory product, other commodities are now following this trend. In some cases, entire product families are on allocation, with price increases being advised at point of shipping and extended lead-times on most lines.

Perhaps the most concerning

issue of 2018 so far, however, is the lack of availability of chip capacitors and resistors. These are no longer widely available as ex-stock items, be it from high service suppliers or from authorised distributors.

As common value chip resistors and capacitors are integral to most printed circuit board assemblies, it's hard to believe

► continued on page 26





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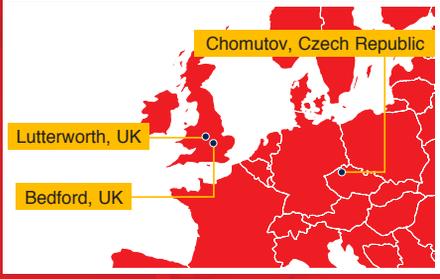
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they are no longer readily available in significant quantities.

What's more, where once these parts used to cost less than a penny, now that figure has already reached double digits in some cases.

What are the solutions?

Hoping to escape electronic component allocation by simply ignoring the issue is a risky strategy. Instead, JJS Manufacturing advises buyers to work closely with assembly partners, as there are several steps buyers can take to help them provide support.

1. Share demand forecasts as far out as possible so that your EMS provider can replicate your component demand with their supply chain partners. If you only give your EMS provider short term visibility of your requirements, they may not be able to secure the stock levels you need when you place your next order, which

will ultimately impact overall lead-time back to you.

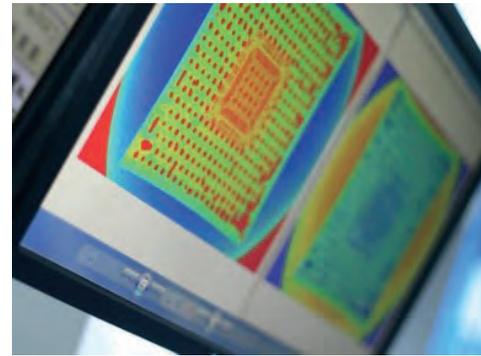
2. Respond to price and lead-time issues quickly. Unfortunately, what little stock is currently in the marketplace can go within minutes. If your EMS provider identifies a source of stock but needs you to agree up front to a short-term price increase or extended lead-time, you won't have much time to decide.

3. Ask your engineering team to suggest alternative components. Some OEMs list alternative devices on their bill of materials or on a separate approved vendors list. This makes it easy for EMS providers to explore all options when they hit a supply issue, but unfortunately, some OEMs keep this knowledge locked away, meaning acceptable alternatives are overlooked. A good EMS provider will always ask if there are alternative components

approved, but it's still worth asking your engineering team to review the parts list to ensure every option can be explored in detail when allocation strikes.

4. Be sure to keep your customers and sales team up-to-date with what's going on in the component market. If you, or your EMS provider, are unable to absorb the price increases associated with allocation, you might need to pass them on. While price increases are unwelcome, explaining the reasoning behind them to your customer in plenty of time, can sometimes help soften the blow, or at least give them time to review their options.

5. Avoid 'heating up' the market by placing artificial demands on your EMS provider. This is always the advice when demand outstrips supply, but unfortunately some OEMs ignore the message and



Buyers should work closely with assembly partners, as there are several steps buyers can take to help them provide support



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continue to ‘panic buy,’ usually leading to problems further down the line. When the market bounces back, you could end up swimming in excess stock liabilities that you can’t then cancel.

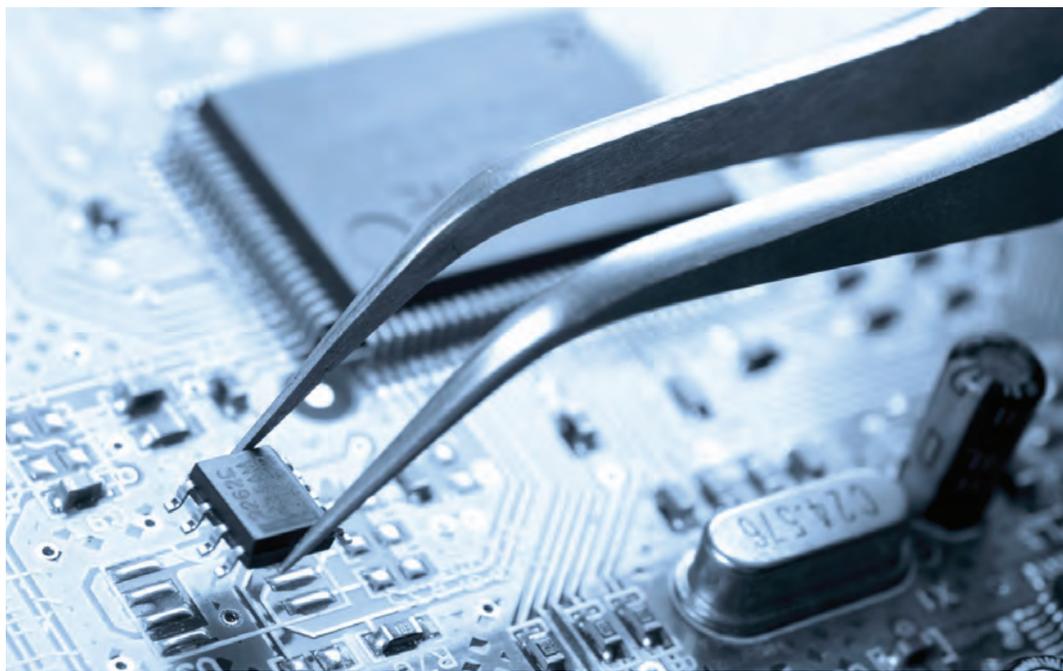
6. Trust your EMS provider and their buying team. If you are working with a reputable EMS provider with demonstrable experience over many years, it should have the supply chain covered. That doesn’t necessarily mean it will be able to magic up all the stock required, but it should have exhausted all trusted avenues. Remember, a quick search online will nearly always find a broker claiming to have components you are struggling to source, but in most cases, this stock doesn’t exist.

7. Ask your EMS provider to re-validate its quotations, even if you have been buying the same product regularly. If you have a service level agreement in place, pricing,

delivery and stock liabilities should already be listed and reviewed on a monthly or quarterly basis. If, however, you place back-to-back orders against quoted lead-times, then ask your EMS provider

to re-quote before you send an official order, to make sure the provider can still meet your price and delivery expectations.

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About

Electronic Technicians LTD (ETL) is a total solution contract electronics manufacturer (CEM) operating from modern premises in Ferndown, Dorset.

A key focus at ETL, thanks to our AS9100 accreditation, is the demanding timescales of the aerospace sector, with its stringent quality standards and rigid traceability requirements. The same is true of the defence and commercial sectors. We

perform flawlessly in all.

Yet our production facilities also address a range of diverse customer needs from rapid prototyping applications through to total product assembly, complete with turnkey project management and logistics support for direct ship-to-user. All manufacturing benefits from our company-wide total quality culture – itself a function of our ISO quality certifications.

Our core areas of manufacturing expertise include PCB assembly comprising both surface mount placement with advanced SMT equipment and through-hole, selective conformal coating and encapsulation, cable and wiring harness assembly, and a documented test and inspection regime that covers all our work to deliver the quality our customers expect.



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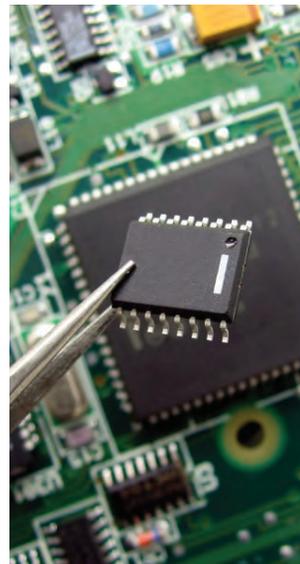
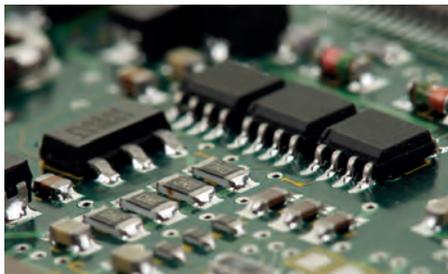
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excess of a further 70,000.

Q Supply chain shortages are becoming more common – how can Rochester help?

A) Through authorised distribution and licensed manufacturing we provide a continuous source of supply to solve supply chain disruption and end of life semiconductors to meet long term needs. Focusing on our active components, we have over five billion devices in

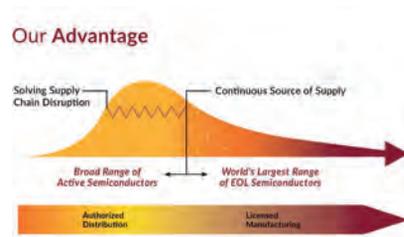
stock ready for immediate dispatch. During shortages when lead times are long and when faced with line down situations, it is important that purchasers can identify and obtain product risk free and not be tempted to procure outside authorised channels.

Q How can Rochester support ongoing product needs after EOL?

A) Supplier authorisation means we offer a large supply of finished semiconductor devices, all traceable and guaranteed. Over 10 billion of our in-stock devices are classed as EOL by the original manufacturer. Rochester is also able to offer a continuous source of supply to customers whose end application extends the availability of a device. Our factory direct offering negates the need for re-design, re-qualification and re-certification and avoids the risk of sourcing hard to find products on the open market.

Q When EOL finished goods supply is exhausted, what can Rochester offer?

A) As a licensed semiconductor manufacturer, Rochester has over 12 billion die in stock. By carefully analysing ongoing customer requests we manufacture a range of in stock semiconductors



Rochester Electronics addresses both immediate supply chain disruption and long term supply needs

ready for immediate dispatch, in addition to our build to order devices, which we manufacture on request.

Q What does Rochester's licensed manufacturing solution involve?

A) Using information and technology transferred directly from the original component manufacturer, we utilise the original die or fab processes to provide a range of ongoing stocked and built to order product. The result is 100 per cent certified, guaranteed and sold with full approval under the original manufacturer's part number with no need for customer re-design or re-qualification. Our process flows include commercial, industrial, mil temp, Rochester R and B, MIL-STD 883, SMD/QML and space level s/v in addition to a range of industry standard packaging with a variety of lead finishes.

www.rocelec.com

Advertorial

Light pipes simplify status display

Schurter has improved its classic IEC outlet offering with a new product featuring integrated light pipes. The 6600-5 series outlets are an intelligent, space and cost-saving solution for power distribution units in data centres and other multi-distributed power applications.



be clearly and independently represented. An outlet could, for example, signal an outage with a red LED, or a critical power consumption pattern with a yellow LED. Optionally, the 6600-5 is also available with only one, or without, a light pipe.

Today, PDUs often use LEDs mounted in between outlets to display a current status. The high packing density of servers in data centres demands the same of power distribution units. With Schurter's appliance outlet, the integrated light pipes provide space and assembly cost savings over conventional strip designs. Service technicians can clearly see which systems are working or respond to maintenance adjustments. LED triggers are freely configurable, so each state can

In order to prevent unintentional removal of a power cord, the sockets offer a pull-out safety device. Depending on the arrangement of the sockets in the bar, the Schurter V-Lock or other cord retention systems can be used.

www.schurter.com

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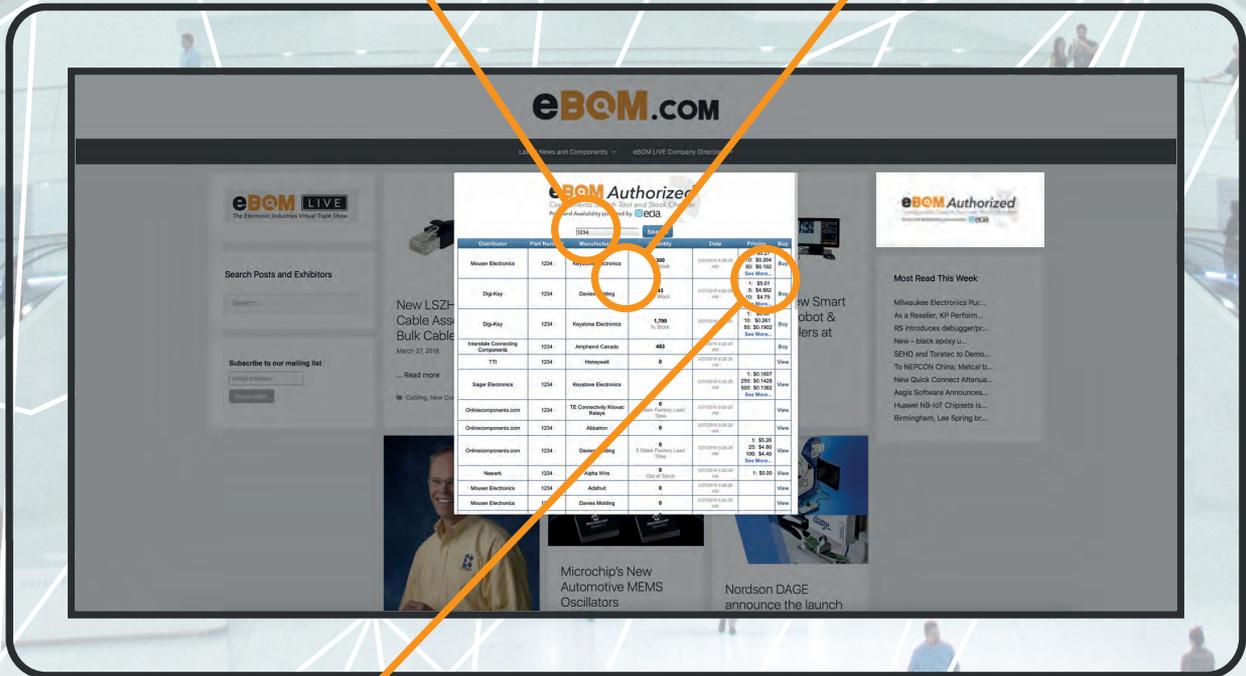
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3 Purchase

Buy components and parts directly from the distributor's website

Eliminate sourcing uncertainty

There is little change on passive component lead-times, but there are a few rays of hope for buyers desperate to secure product, explains director of Charcroft Electronics, Debbie Rowland

Unfortunately, extended lead-times on multilayer ceramic capacitors and other passive components are not about to change. Some manufacturers are not taking any more orders until the third quarter of this year. Others are quoting lead-times out until the end of 2020 and often imposing 'non-cancellable, non-returnable' conditions on the orders.

The reasons behind this are understandable. As buyers become more desperate to secure delivery, they are placing orders on multiple distributors for the same

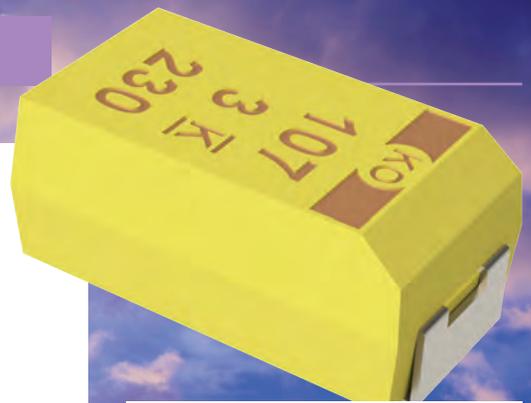
parts. When these duplicate requirements appear on the component manufacturers' orderbooks they create a false bubble of demand that will burst as soon as capacity catches up and lead-times are normalised. Buyers will then cancel the duplicate orders, leaving the component manufacturers with excess inventory.

Rising fallouts

The full impact of the situation can be seen in the number of enquiries that Charcroft receives to cover fallouts from other distributors. A fallout is an

item on a bill of materials that is past its 'on-time delivery to need' date. This is when parts are required to meet the OEM's production commitments and differs from the 'on-time delivery to commitment' date, which is the lead-time date promised by the distributor. As many as 50 per cent of the fallouts that Charcroft sees are over their on-time delivery to need date, putting customers at risk of a potential line stop.

Typically, Charcroft would expect to see a handful of such requests, however, the number of fallout requests is currently 40 times higher than usual.



Polymer alternatives can offer shorter lead-times than MLCCs

consolidating smaller requirements with high-volume orders. When Charcroft knows that a component manufacturer is producing a large order, we may suggest to an OEM that a slight tweak to its specification could allow it to piggy-back the larger order to achieve a faster delivery. This will only be possible if the order has been placed by the customer, so buyers who are tempted to postpone placing an order in the hope of finding a shorter lead-time may miss out on an earlier delivery.

Maintain dialogue

For the distributor, the key is to maintain an intense dialogue with both the component manufacturer and the OEM or CEM customer. This is, perhaps, easier for a specialist, UK distributor, than for a global broadband distributor, which has competing demands from many customers in different countries.

So, what can buyers do in the short-term to secure deliveries? The best advice is to check whether the lead-time quoted by a distributor is the actual lead-time for a specific component, or a generic lead-time for that device family. Buyers can also check the 'on-time delivery to commitment' performance for each of their distributors.

Checking key delivery metrics and engaging closely with a trusted supplier can often ensure better delivery than placing panic orders on multiple distributors.

www.charcroft.com

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Alternative solutions

In these situations, we look for an alternative part with better availability, such as one with a tighter specification or from a different manufacturer. Another option would be to consider a completely different technology. For example, high-reliability applications may find it quicker to design-out multilayer chip capacitors and replace them with a polymer alternative, than to wait for an MLCC delivery.

The good news is that some deliveries are being received, often due to a manufacturer

Purchasing touch technology

The ubiquitous TFT touch screen has made its way into every aspect of our lives. Here Inelco Hunter reveals how end-use application affects the display purchasing process

Thin film transistor displays are found in many applications, from mobile devices, domestic appliances and medical equipment, to instrumentation, aircraft, computers and TVs. We are so familiar with this technology, we often don't give it a second thought, but when it comes to sourcing the humble TFT screen, there is much to consider.

Different applications will require different levels of protection. For example, hazardous industrial applications require sealing of the screen bezel and protection of the circuit electronics. An IP54 rating

is a typical requirement, offering protection against particles and water ingress, while for applications where food hygiene is important, stainless steel casings and bezels will be obligatory. For military and aerospace applications, products will need to meet rugged MIL-STD standards.

Touch technologies
Inelco Hunter TFT displays range from 3.5 to 12.1in in a variety of resolutions, with both capacitive and resistive touch versions offered. Resistive touchscreens work using a top screen surface that flexes under a finger or stylus and is pushed

back onto a layer behind it. Capacitive touchscreens don't rely on pressure. They sense the conductive properties of an object such as finger or stylus.

If your application requires multi-touch capabilities such as zoom, rotate, flick and swipe, capacitive touch panels provide a solution. They are durable in most environments, whereas resistive touch panels are commonly used in more commercial, less demanding applications, such as office equipment and domestic appliances.

▶ continued on page 36



IoT products often require some form of display



High Quality Panel Mount Indicators

CML IT continues to be the number one supplier of panel mount indicators, LED lamp replacements and LED tower lamp solutions. PMI highlights include:

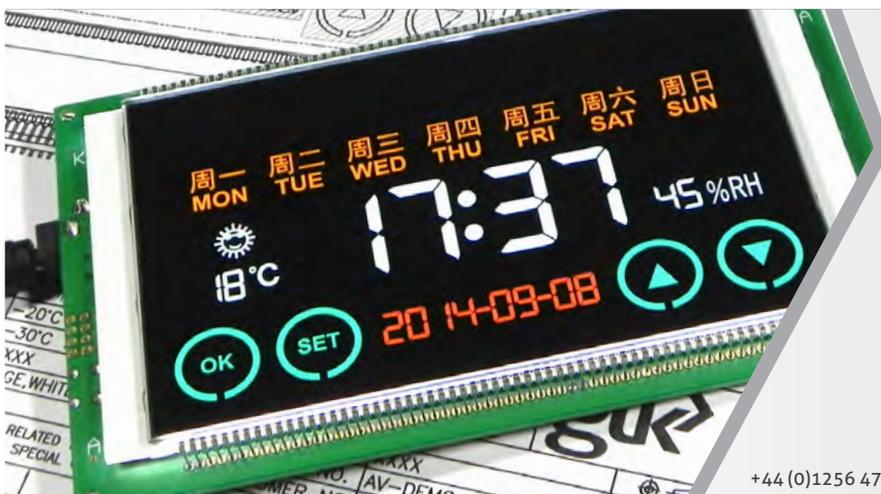
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► Fortunately, the features of capacitive touch can now be combined with the benefits of resistive technology. Fujitsu's light/feather touch solutions, for example, can emulate a dual-touch input and add a flush-finish screen to the application. Regardless of the technology choice, Inelco Hunter's engineering team can

aid in the development of full- or semi-custom TFT display solutions, addressing characteristics such as image quality, wide viewing angles and faster response times.

Common queries

But it's not just technology challenges that need to be resolved. Take a look at some of the common sourcing issues



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Industrial automation settings require a rugged solution



Inelco Hunter's engineering team can work with purchasers to address specific application challenges

faced by purchasers when looking to source display solutions.

Q) I want to buy a replacement screen. What do I need to consider?

For a simple replacement screen, you will need just the display specification sheet and/or part number to ensure you buy the correct screen. Consider your target price; how many you will need; and how quickly you will need them. Some displays have a long lead time, so take this into consideration if you are working to a deadline.

Q) I want to make some changes to my current display. How do I do this?

You may be limited in the changes you can make if your application is fixed in any way, such as, if the display

needs to be a certain size to fit an existing application. A custom solution maybe an option. Inelco Hunter's information gathering list can help with questions like preferred contrast ratio and character dimensions.

Q) It is more cost effective to buy higher volumes, but I don't want to hold surplus stock. What are my options?

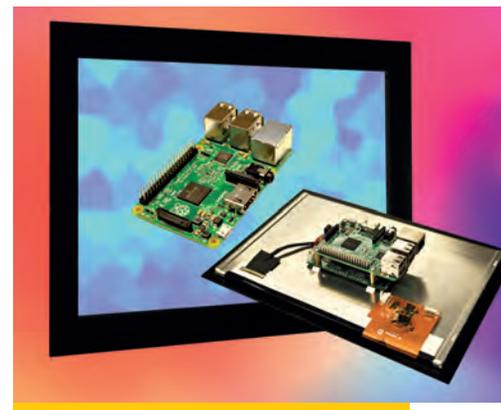
One option would be to place your order for the higher quantity and then arrange a 'call-off' with your supplier. This way you benefit from the lower price without the need to hold large surplus stocks and you avoid any long lead times.

Q) My display is going obsolete. What are my options?

Manufacturers can never guarantee which products will become obsolete, but they try to minimise disruption, so it shouldn't be an issue to find a replacement if your product is a standard display. Custom solutions can be trickier, however, the engineering team at an experienced supplier should have considered this and should be able to provide an alternative drop-in replacement.

Finally, it is helpful to state at the start of a project if you require a specific product longevity. It is also important to establish with your design engineer how they can minimise the risk to custom products.

www.inelcohunter.co.uk



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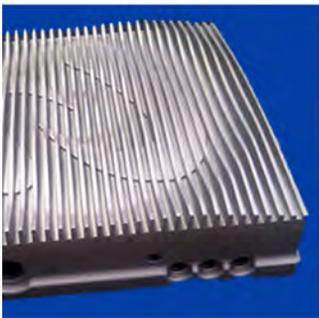
More choice on cable and chassis connectors

Lane Electronics is offering several series of Neutrik cable and chassis connectors ideal for professional audio and lighting systems, as well as many industrial applications.

Said to be both easy to assemble and use, Neutrik's XLR connectors are available with a variety of contact layouts. Recent additions to the series include the EMC variant, which is a three-pole female or male cable connector with an integrated capacitive shield to shell connection to avoid radio frequency interference and low frequency noise.

Other additions to the XLR family include the XX and DLX series, both of which feature a new female cage type contact on the three-pole versions. This is designed to increase conductivity with the male connector and gives a more robust latch on the female cable connector, which guarantees ground to the chassis.

www.fclane.com



Driving demand for digital output transducers

LEM has completed its range of open-loop Hall effect current transducers with digital outputs for drives applications. The digital output versions of LEM's HO and HLSR open-loop Hall effect current transducers feature analogue to digital conversion performed by an on-board sigma-delta modulator, giving a 1-bit serial bitstream output. These new components are available with various nominal current measurements in four different mechanical designs and provide up to 12-bit resolution with 20kHz bandwidth.

The transducers also supply various possible digital outputs. These include, the single-bit output two wires CMOS, RS422 Manchester or LVDS Manchester, which minimises the connections required. Alternatively, users can specify the four wires mode according to the LVDS or RS 422 standards. The digital output allows the user to choose the filter on the bitstream to optimise between resolution and response time, according to the application. Digital outputs are also intrinsically immune to noise in hostile environments.

www.lem.com

Smart sensor simplifies condition monitoring

Thermal management specialist, Stego has introduced a new 'plug-and-play' sensor product designed to support predictive maintenance and condition monitoring in enclosures and control cabinets

Developed specifically to go beyond climatization, Stego's new sensor technology helps users take action before problems arise. This makes the Smart Sensor CSS 014 ideal for monitoring installations, including remote monitoring, where it allows an immediate response to any unwanted changes.

The sensor works by detecting ambient temperature and humidity and converting this data into

a standardised analogue four to 20mA signal. This is then passed to a control and monitoring unit, which interprets the signal and initiates appropriate measures.

Said to provide high accuracy results, the Smart Sensor CSS 014 boasts a wide temperature and humidity range, from -40 to 60°C and zero to 100 per cent relative humidity respectively. The device incorporates a sensor, interface and transmitter in

a single package measuring just 140 by 40 by 38mm. This can be fitted into a cabinet with either DIN clip or screw mounting and connected via an M12 interface.

The Smart Sensor CSS 014 is not only suitable for installation in enclosures or control cabinets, it can also find use in a variety of application areas according to IEC 61010-1/DIN EN 61010-1.

www.stego.co.uk



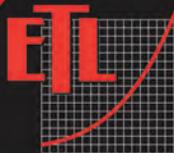
The Smart Sensor CSS 014 is ideal for monitoring installations

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Retro styling appeals to high-end hi-fi

JPR Electronics has introduced two new desktop enclosure ranges from Hammond Electronics featuring retro styling. They offer manufacturers of high-end hi-fi equipment, set-top boxes and industrial instrumentation an alternative to conventional cases, in applications where appearance is important.

HWCAS enclosures consist of a walnut frame fitted with an aluminium top and optional base panels, available with either a black powder coat or natural finish. The 1444CWW and the 1441CWW families are fabricated from aluminium or steel respectively and are fitted with walnut end panels.

Director of JPR Electronics, Paul Raynor, said: "Many prestige products require aesthetically pleasing packaging to meet end-user expectations. Such products rarely have the volumes to justify a bespoke enclosure. The new Hammond retro styled enclosures offer an ideal solution for these low volume, high quality designs."

www.jprelec.co.uk



Shockproof covers protect hand-held cases

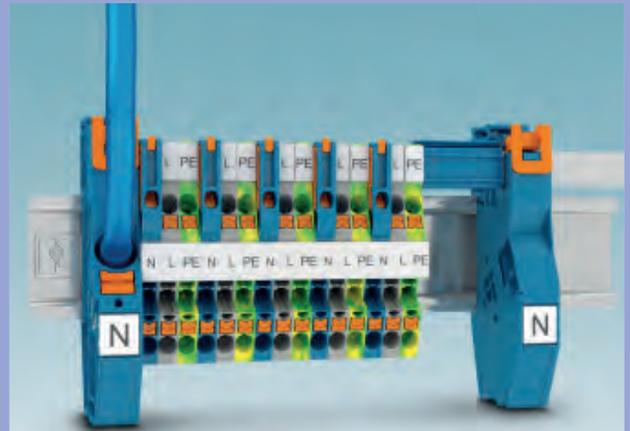
CamdenBoss has added shockproof covers and new sizes for its Takachi 87 series hand-held enclosures, along with more sizes for its 90 series IP67 waterproofed cases.

Ideal for measuring instruments, test equipment, wireless communications and medical devices, 87 series enclosures are moulded from off-white or dark grey, high impact, UL94-V0 flame retardant ABS. The new shockproof silicone covers are available in five standard colours and nine sizes, fitting tightly over the base, sides and around the lid edges. Standard colours include green, orange, navy blue, light grey and dark grey, with pantone matched custom colours available for minimum order quantities of 500.

The three new sizes for the 87 series are 145 by 96mm in heights of 20, 27 and 35mm and these can be supplied with or without battery compartments.

CamdenBoss has also added sizes to the IP67 waterproof Takachi 90 series hand-held cases. New sizes are 126 by 79 by 20 or 28mm and 171 by 95 by 25 or 33mm, all available with or without a battery compartment. Applications could include measuring instruments, inspection machines, transmitters and medical equipment.

www.camdenboss.com



Multi-level terminal blocks save space

Phoenix Contact has expanded its range of installation terminal blocks with the new UTI 6 multi-level blocks, suitable for conductors up to 10mm². Products in the range boast a low, compact design, ensuring building installations can be quickly set up in a space-saving way.

Double function shafts on each level ensure a time-saving three-phase distribution in the terminal strip. Every terminal point can be clearly marked and seen in every terminal block mounting position.

All neutral conductor disconnect terminal blocks are fitted with a screw-less disconnect slide for easy and secure N disconnection, which latches in the end positions. The UTI installation terminal blocks with screw connection are compatible with Phoenix Contact's installation system and have the same system features as the Cliqueline complete terminal block system.

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Side bags support instruments on the go

OKW has added optional side bags to its Carrytec portable instrument enclosures, to help make sensors, probes and scanners available on the move.

Ideal for applications such as medical and wellness, communications and data recording, Carrytec enclosures now feature zip-opening side bags in left- and right-hand configurations. Their design enables sensors and other cabled equipment to remain connected to the main instrument enclosure when packed away, ready for instant use.

The side bags can be attached to screw connections on the main enclosure. They are manufactured from moulded plastic and a hard-wearing textile fabric. Each bag features dual zips with corded loops and orange toggles for swift access. An eyelet on the top of each case enables a shoulder strap to be added.

Side bags are available in two sizes: 82 by 180 by 65mm and 99 by 214 by 64mm.
www.okw.co.uk



Simplify the switch to GRP with 13 size options

Rolec's polyTOP glass-fibre reinforced polyester enclosures are now available in 13 standard sizes. Featuring a halogen-free GRP construction for resistance to chemicals, these tough IP66 enclosures are suitable for a range of electronics applications in harsh indoor and outdoor environments.

The enclosures are designed to be size compatible with the aluNORM range of diecast aluminium enclosures, making a switch to GRP easy. Like aluNORM, all polyTOP enclosures feature a single-channel lid and assembly fastening system to maximise internal space. Rolec also offers polyTOP with a choice of four different polyamide fixings: slotted; triangular or square head to prevent tampering; or hand screws for fast access.

The 13 standard polyTOP's sizes range from 82 by 82 by 60mm to 404 by 404 by 160mm.
www.rolec-enclosures.co.uk

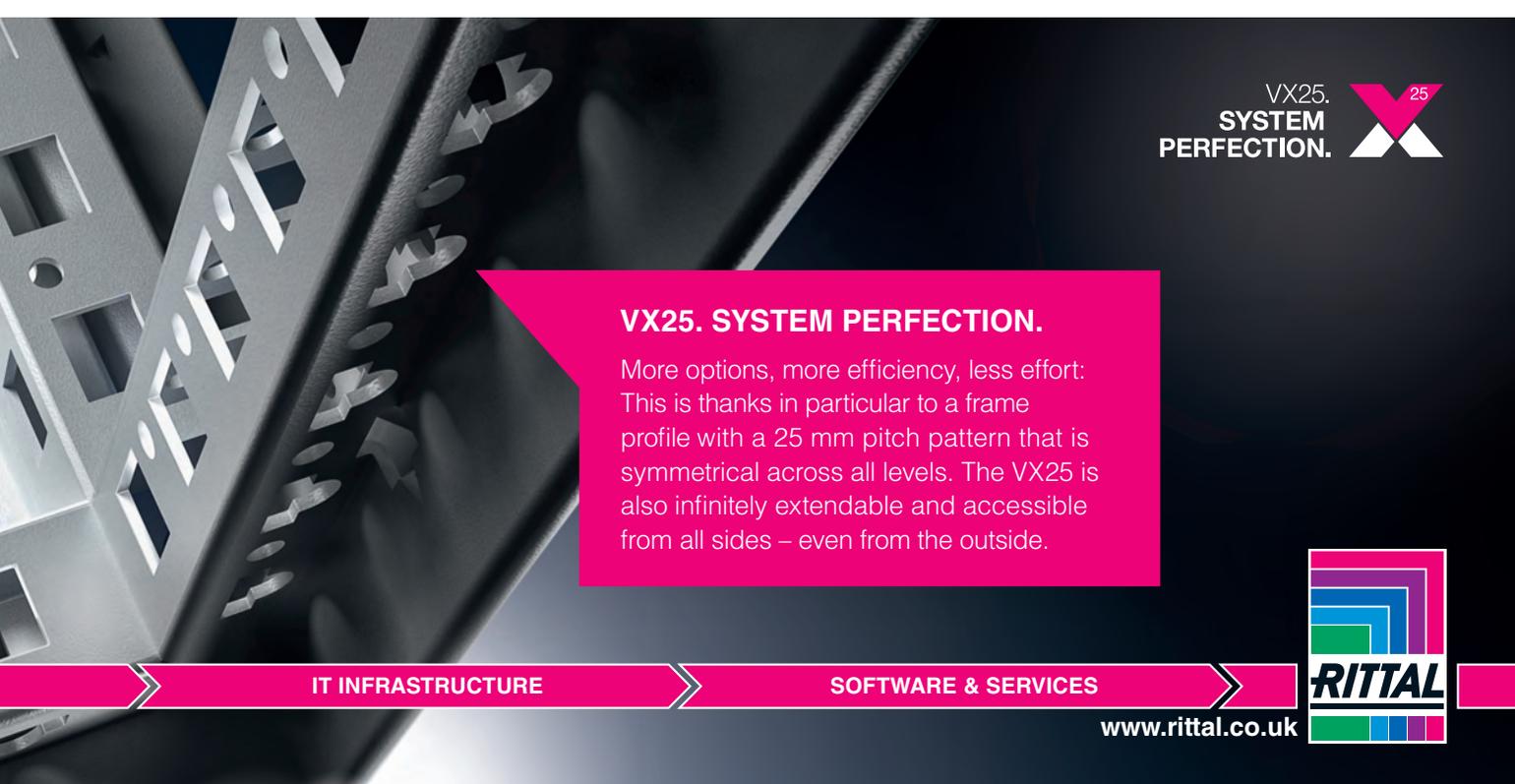
Outdoor enclosures offer smart energy solutions

Rittal offers several enclosures for the secure integration of control and power electronics applications such as photovoltaics, energy storage solutions and e-mobility infrastructures.

With its outdoor enclosure system, for example, Rittal offers two variants for the installation of central converters in photovoltaic systems. One is designed for extreme environmental conditions and is manufactured from stainless steel and aluminium. It features a double-walled construction and corrosivity category C4-H/C5-M in accordance with DIN EN ISO 12944.

The second variant is for moderate ambient conditions. Manufactured from sheet steel, it features a single-walled construction and corrosivity category C3.

Rittal also offers PK small enclosures made of polycarbonate and KS compact enclosures made of plastic. These can also be used in photovoltaics as robust outdoor enclosures for the protection of controls for solar-tracking systems and as distribution enclosures for power cables from the PV module.
www.rittalenclosures.com



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First impressions count

Enclosure aesthetics are a vital component of product identity. We asked UK field sales manager at CamdenBoss, Michael Crowther, how this emphasis on appearance is changing the industry

Q What should purchasers prioritise when they approach an enclosures manufacturer?

A) Enclosures often define a product but are frequently the least thoroughly specified part of a project compared to electronics and software design. As the enclosure is also one of the highest cost items on a bill of materials, it often attracts scrutiny from purchasers.

Bearing this in mind, opt for an enclosure partner that can provide an extensive range, from simple, low cost enclosures up to premium offerings. A range of material options, mounting options, ingress protection ratings, electromagnetic compatibility protection and price points will maximise the chances of finding the perfect option. Purchasers should also consider any secondary processes such as machining, printing, or painting. If these options are not available from a standard catalogue, find out whether custom options are available. Finally,

consider commercial support such as stock availability, minimum order quantities and manufacturing capacity.

Q What are the most frequent questions purchasers ask CamdenBoss?

A) As enclosure selection often occurs late in the design process, we are frequently asked for help in solving enclosure problems. Often the customer is looking for an enclosure that is 'similar to' something already available, but non-standard. More and more, we are asked for unique visual design.

CamdenBoss is a solution provider and has many years of experience guiding customers to the most effective solution for their needs. Whether this is a standard product, a standard product with some customisation, or a unique design using either flat sheet plastic technology or a bespoke mould tool, CamdenBoss works closely with customers to help them achieve their needs.

Q What are the latest enclosure trends?

A) Primarily, that customer expectations have grown and aesthetics play a huge role in today's requirements.

Q With multiple authorised distributors in the UK, can customers deal directly with CamdenBoss Enclosures?

A) We work closely with trusted distributors to ensure that the customer's needs are satisfied and the best route for service or product and supply is offered, but we are always happy to talk to purchasers and advise.

Q How are lead times holding up at CamdenBoss?

A) Despite some recent challenges to enclosure deliveries caused by plastics supply problems, our team is dedicated to ensuring we offer the best possible lead-times. A huge amount of work therefore takes place behind the scenes to ensure



UK field sales manager, Michael Crowther



Enclosures often define a product but are frequently the least thoroughly specified part of a project

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we mitigate such supply risks. Fortunately, we can combine our efforts with trusted distribution partners to ensure that smooth delivery is maintained.

Q Have there been any changes to enclosure safety legislation or industry kitemarks?

A) As the enclosure market is spread over several sectors and regions, the requirements for environmental, health and safety are continually changing. Enclosures must adhere to these new demands, while also meeting any regulation specific to the enclosures market. CamdenBoss is constantly monitoring such things to ensure products are designed accordingly.

Q How will enclosure design and materials develop in the future?

A) Interesting question. The need for aesthetically pleasing designs has already changed the market and will continue to do so. Increasingly, customers are looking for enclosures that provide an identity for their product. Glossy and curved enclosures have seen a dramatic increase over recent years, with customers attempting to move away from more traditional 'boxy' enclosures.

From a materials perspective, on one side there is a need to be more eco-conscious and we have

already seen changes to that effect regarding raw materials. On the other side, as enclosures reach new avenues and technologies, there is a need for new materials to withstand the harsh environments in which they are sometimes used.

Q Finally, what advice would you

give purchasers looking to engage with an enclosure manufacturer?

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Rising demand from multiple segments drive analog IC market

Strong demand and mostly firm prices will result in steady revenue growth for analog ICs through 2021



James Carbone

The global analog integrated circuit market will grow 8 per cent in 2018 due to rising demand from automotive, cell phones and Internet of Things and other applications.

The market will increase from \$53.1 billion in 2017 to \$57.1 billion in 2018 as unit shipments rise 6.2 percent, according to Semico Research. Analog demand will continue to grow through 2021 when analog chip revenue reaches \$62.8 billion for a compound annual growth rate of 4.3 per cent.

The good news for semiconductor buyers is despite growing demand for analog chips, the overall average selling price won't increase through 2021, although there could be selective price increases for some analog ICs.

"Fabs want to build products that generate the most return," said Brian Anderson, senior analyst, power management, technology, media, for market researcher IHS Markit. "Their ability to do that is bound by contractual agreements." Because demand for analog is strong, chipmakers are going to want to "maximise return so I expect there will be tougher negotiations this year than in the past" which could mean higher prices for some analog chips. At the very least, it will mean prices won't decline as they have in previous years.

Last year the average price for an analog IC was 34.6 cents and will rise to 35.1 cents in 2018 and remain steady until 2021 when the price will drop to 34.2 cents, according to Semico. However, in 2012 the average price was 43 cents and it then dropped to 38

cents in 2013 and fell each year steadily through 2017 when it was 34.6 cents.

One reason for the price decline is that in recent years more analog IC production has moved to 300mm production which has increased supply and reduced cost for some analog semiconductors. Analog chip manufacturers such as Texas Instruments, Infineon, STMicroelectronics and foundries including TSMC, UMC, Globalfoundries, TowerJazz and Powerchip have 300mm capabilities for analog, according to Semico. "In 2018, 45 per cent of the silicon processed for analog will be on 300mm wafers," said Jim Feldhan, Semico president.

TI, the world's largest analog IC manufacturer with \$9.9 billion analog sales in 2017, has been

steadily increasing production of analog ICs on 300mm wafers over the last six years. In 2017, About 40 per cent of its analog chips were produced at two 300mm fabs and the percentage will likely continue to rise over the next several years.

The cost of analog ICs produced on 300mm wafers is 40 per cent less than the cost of the same chip on 200mm wafers, according to TI. In addition, TI's gross margin on analog chips produced on 300mm wafers is about six percentage points more than ICs made on a 200mm wafer.

While more production is moving to 300mm production, many analog chips are still produced on 150/200mm wafers. Buyers could see some supply issues for those parts because demand for many analog ICs produced on 200mm

By the Numbers

Source: Semico Research



The compound annual growth rate for analog ICs through 2021



The forecasted size of the analog semiconductor market in 2021



The average selling price for an analog IC in 2018



The percentage growth weight of analog chip unit shipments in 2018



The percentage of analog ICs that will be produced on 300mm wafers in 2018



wafers is running high across multiple segments including automotive, IoT, cell phones and industrial.

"The 200mm wafer market is at capacity," said Anderson. "New capacity is not coming out very quickly." Capacity expansion for 200mm production is a challenge because of tight supply of equipment needed to produce 200mm wafers, he said.

Driving growth

While supply is limited, demand continues to grow including from the automotive segment. "From a revenue standpoint, 29 per cent of all analog revenue is derived from the automotive market," said Feldhan. "It has been slowly increasing each year as more electronics are used in vehicles. You have more electrification in cars and it requires a substantial amount of analog," he said.

Even though the smart phone market is slowing, it is still helping drive analog chip demand. The low-end smart phone market is still growing at double-digit rates, about 16 per cent," said Feldhan. The high-end "flagship products" of cell phone manufacturers are growing about 2.4 per cent. Cell phones use application-specific and general-purpose analog ICs, including

operational amplifiers, signal conditioning, interface circuits, A to D and D to A converters. Linear regulators, switching regulators among others.

The continuing growth in the number of data centers used by Internet services providers (ISPs) and large companies is also having an impact on the analog IC market and may be contributing to tighter supply, according to Anderson. Data centers typically are equipped with hundreds or thousands of servers, mainframes and storage units.

"Right now, we are seeing some pretty good growth having to do with data centers. That's a huge growth area right now for the overall semiconductor market including analog ICs," said Anderson.

Recent semiconductor industry consolidation may also be playing a part in supply conditions for some analog ICs. In some cases, two chipmakers may produce a similar product. When those two companies merge, often one of the production lines of the chip that is made by both suppliers is shut down, decreasing supply of the part.

Anderson said there have been some fab closures as a result

Analog prices will stabilise in 2018, but will decline again in 2019 and beyond

Source: Semico Research

Analog price erosion will resume



of mergers and acquisitions and some products have been discontinued. "But it's typically been older products" and newer versions of the discontinued products are available to OEMs, he said.

"From a supply standpoint I don't think consolidation has much impact," said Anderson.

He added consolidation made it a little easier for analog IC manufacturers to maintain pricing, but there are still a healthy number of suppliers and "more suppliers are coming on board in Asia."

More consolidation within the analog market is possible. "I think we will continue to see a bit more consolidation probably focusing on some of the smaller players," said Feldhan. Larger players may try to "solidify their offerings" by acquiring a smaller company that makes some analog chips that the larger acquiring company doesn't.

Analog ICs will prosper

Because of continuing strong growth for multiple customer segments, the analog IC market will thrive for years despite the trend toward more system on chip (SoC) products.

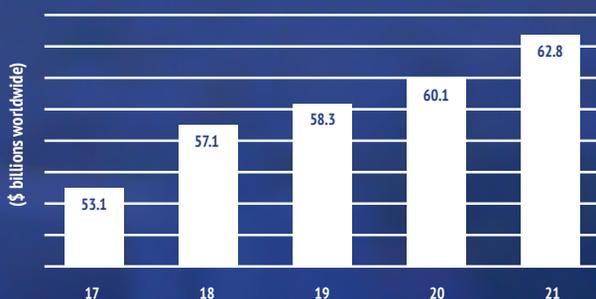
"Several years ago, the idea was to add more analog to SoCs

and integrate everything into a massive chip," said Feldhan. "It seemed like a good idea when chips were made on 65nm process technology."

But now leading-edge chips use 10nm and 7nm technology and analog "does not scale well and it's getting more expensive to make SoCs," said Feldhan. As a result, the industry is looking at moving to advanced packaging and putting multiple chips such as an analog and memory IC in a stacked chip, and not including the functionality of the devices in an SoC, he said.

Analog chipmakers are also manufacturing analog ICs in smaller packages. For example, TI recently introduced what it says is the industry's smallest operational amplifier (op amp) and low-power comparators in a X2SON package, which measures just 0.8x 0.8mm. The amplifier is the first to use the tiny package and allows OEMs to reduce system size and cost. The devices will be used in a range of Internet of Things (IoT), personal electronics and industrial applications, including mobile phones, wearables, optical modules, motor drives, smart grid and battery-powered systems.

Analog chip market to rise steadily



The worldwide analog IC market will grow at a 4.5% annual rate through 2021 when analog revenue will reach \$62.8 billion
Source: Semico Research

Not all EMS providers offer same services

Buyers involved in outsourcing decisions must match their companies' design, supply chain and manufacturing needs with the capabilities of EMS providers

By James Carbone

Most electronics OEMs have an outsourcing strategy to help them reduce cost, improve time-to-market and reduce risk in their supply chains.

Some outsource a relatively small amount of manufacturing to EMS providers such as cable and board assembly. Others may rely on EMS providers for manufacturing the entire system and for testing and fulfillment. Some OEMs involve their EMS providers in new product development efforts and depend on them to design boards and other subsystems

Many electronics companies turn to EMS providers to handle strategic sourcing for many of the components on a bill of materials and to help them manage risk in the supply chain. Often, EMS providers also must handle aftermarket services including reverse logistics, repair and refurbishment and recycling and disposal of old equipment.

The decision on which EMS provider to use can be challenging because EMS providers offer different manufacturing, design and supply chain services. Electronics purchasers are often involved in such decisions. Some OEM buyers help evaluate the capabilities of contract manufacturers and recommend which ones best meet the needs of the OEMs.

Services among EMS providers can vary based on the size of the contract manufacturer. "The larger guys are doing soup to nuts," said Virginia Howard, supply

chain research for market research firm Gartner Inc. "That's where they make their money. They don't make it on board assembly because the profit on board assembly is very low," she said

Besides printed circuit board assembly and box build, large global EMS providers provide other manufacturing services including plastic injection and molding, mechanical and electromechanical assembly, tooling, molding. However, even smaller EMS providers have expanded their capabilities. One example is Knight Electronics, a Dallas-based EMS provider with \$25 million in annual sales. Knight does small to medium-volume production for customers in the food equipment, aircraft, rail, bus and truck and automotive industries. Manufacturing facilities in Dallas, Taiwan and China.

"We do short run stuff in Texas, and then when we go to medium volume, we prefer to move production to our facilities in Asia," said John Knight, president of the company.

Besides board assembly and box build, the EMS provider has injection molded plastics, stamping and diecasting and extrusion capabilities, said Knight.

Howard said with EMS providers—whether they are big or small—"not everyone necessarily does the same thing," she said. Some have invested in power supply technology and can design and manufacture a power supply. Others have invested in sensor technology and can build sensor subsystem



solutions for customers, said Howard.

She said with the growth of Internet of Things, such capabilities are "attracting customers from outside the high-tech industry who may want to put sensors on wristbands or on detergent bottles," she said. "EMS providers have purposely invested in expanding the value that they bring" to new and old customers, said Howard.

Providing options

The wide range of services that suppliers offer is important to many companies, especially startups. Startups may have a great idea for a product but have little design expertise and need EMS providers to help them develop the product concept, build prototypes and source components for the product before volume production begins.

With established OEMs that have in-house manufacturing,



We've offered services across the whole product realisation value stream over the last 40 years

- Todd Kelsey, Plexus CEO

the plethora of EMS services gives OEMs options. The companies can decide how much they want to outsource to external manufacturing partners and how much they want to retain in-house.

“It’s all about what the OEM considers to be its core competencies,” said Howard. Often established OEMs consider design and marketing as core competencies and look to EMS providers to handle all the manufacturing and a lot of the management of the supply chain. Many OEMs also turned over strategic sourcing of lower value commodity components to EMS providers. Contract manufacturers typically combine the volumes of multiple OEM customers and negotiate a lower price for the parts.

However, it’s a different story for higher value, higher technology components such as microprocessors, memory and storage devices that are vital to the OEM’s products. Most OEMs consider strategic sourcing of process DRAM, NAND and storage devices as key to the success of the company and keep control of those critical components. Those components often represent 80 per cent of the bill of materials value and most OEMs “don’t want to give that away” to an EMS provider, said Howard.

“The primary reason is that OEMs need the relationships with the Intels, the AMDs and the Samsung’s of the world,” she said. OEMs need to establish and maintain close relationships with such suppliers to get access to the latest and greatest technology and to get world-class pricing for those parts from the suppliers. In addition, having strong relationships with major chipmakers usually means the OEM will get allocation of parts when there are shortages and production lines can keep running.

Sourcing popcorn parts

It’s a different case for low value “popcorn parts”, said Howard. OEMs often let EMS providers handle sourcing of passives, discrete semiconductors and connectors. Many of the parts

are commodity items that cost less than a penny and there are often multiple suppliers for the components.

However, during shortages, OEMs will get more involved in strategic sourcing of passives to make sure the OEM gets its fair share of parts. In fact, that’s what’s happening now because of allocations of multilayer ceramic capacitors (MLCCs), resistors and some discrete semiconductors.

Over the years, most EMS providers have added to their menu of services that they provide. However, one EMS provider that has offered a wide range of services since it was founded 40 years is Plexus Corp. based in Neenah, Wisc. The company specialises in low to mid-volume, higher complex products for OEMs in the healthcare/ life sciences, industrial, commercial, aerospace and defense and communications industries. It provides board assembly and box build at its manufacturing facilities in North America, Europe and Asia.

“We are global and probably 70 per cent of our facilities are outside of the U.S. but all of them have really advanced technical capability,” said Todd Kelsey, Plexus CEO. Besides manufacturing, Plexus also offers a wide range of design and supply chain services.

“We’ve offered services across the whole product realisation value stream over the last 40 years,” said Kelsey. Plexus was started with product development and product conceptualisation engineering as part of its core competency, he said. The EMS provider can help an OEM design a new product, develop prototypes and make small production runs in addition to handling strategic sourcing of components and volume production. It also provides aftermarket services such as repair and refurbishment.

Design services are integral to Plexus’s business model. With its engineering capabilities, Plexus can take an idea for a product

▶▶ *continued on page 48*



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► and “write the spec and potentially do a full turnkey design,” said Kelsey. “It’s could be highly complex products where there could be teams of 30 to 50 engineers developing an idea into a new product, said Kelsey. He said a third of Plexus manufacturing originates from the design work that Plexus does for customers. Other times, Plexus will “co-engineer” with the customer and handle design of part of the new product.

Sometimes a customer’s product idea may be “very advanced, while other times the customer may have a rudimentary idea for a product and “we help them turn that idea into a product,” said Kelsey.

Sourcing for customers

While design capabilities have been offered by Plexus to customers for 40 years, so have procurement services. “The whole idea of sourcing and procuring for our customers was there from day one,” he said. Today it’s even more so. It’s a big focus of ours,” said Kelsey.

Once a product is designed, Plexus can strategically source all the components on a bill of material if necessary.

He said that for products that it designs for customers, Plexus sources the entire bill of materials (BOM). For other customers, it sources 30-50 per cent of the BOM with its own preferred suppliers, “particularly if it’s a localisation effort where for example a US designed product is manufactured in Malaysia,” said Kelsey.

“We set up a big focus on providing alternate suppliers and localising the supply chain, using our sourcing capability to drive a better overall total cost for customers,” he said.

Of course, Plexus isn’t the only EMS provider that sources on behalf of OEM customers. Sanmina, based

in San Jose, Calif., provides comprehensive strategic sourcing services for OEMs. The level of services varies from customer to customer, said Sushil Dhiman, Sanmina’s executive vice president NA Gateway IMS Operations, U.S., Canada & Brazil.

“When a customer asks us to do a turnkey design of a system, we may select all of the suppliers,” he said. “When we engage in joint designs or provide access to technology, we partner with customers to select component manufacturers,” said Dhiman.

He added that even if an OEM handles a complete product design, the OEM can “benefit from using Sanmina’s supplier network, supply chain design and component engineering services to introduce multiple suppliers for each component, reduce lead-times and increase flexibility.” Such services “not only enhance Sanmina’s value proposition, but can solve some significant customer problems,” he said.

For example, Sanmina helped a tier-one industrial controls OEM enter new markets and meet existing demand with a shorter lead-time. “We did so by re-designing a supply chain with 1,200 components, 130 suppliers and a cumulative lead-time of 34 weeks,” said Dhiman. The result was a build-to-order industrial control system that consistently delivered within a 10-day lead-time. The new supply chain design included demand flexibility of 20 per cent, he said.

Expanding services

While EMS providers have always offered a wide range of procurement, supply chain and design services to customers, those services have expanded over the years to include helping OEM customers navigate the maze of government regulations.

Kelsey notes that the number of regulations concerning



We get a lot of good market intelligence that’s not generally available to the press or online. We get a pretty good gauge what’s up and what we need to plan for

- John Knight, president of Knight Electronics

conflict minerals, hazardous substances and recycling and regulations in industries such as life sciences and defense and aerospace have increased over the years. With more regulations there are more risks.

Regulated industries, including the medical, automotive and aerospace markets, require that design and manufacturing risks are identified and mitigated in advance, according to Dhiman. He said Sanmina uses a “failure mode effect analysis” (FMEA) to identify, rate and mitigate risks. Risks are rated based on the level of potential impact if the risk materialised and the probability of the risk occurring.

“Multiplying the severity by the probability allows risks to be prioritised so that mitigation strategies are developed for the most serious risks first,” said Dhiman. Sanmina’s IT and quality systems have been developed over many decades to eliminate the possibility of many risks from happening. “For example, the forced routing feature in our 42Q MES system (a cloud-based manufacturing execution system) ensures that each product is built according to

a defined protocol," he said. Scanning and verification of components ensures that a mistake cannot be made by loading an incorrect component, said Dhiman.

Besides helping OEMs reduce risk, some EMS providers have expanded their role in providing aftermarket services. Aftermarket services typically involve repair and refurbishment of products that have been out in the field. However, in the medical segment, products have to be decontaminated before they can be refurbished because they come in contact with bodily fluids or diseases. "That's relatively new. We've gone down the path of providing decontamination services," said Kelsey.

In addition to aftermarket services, more customers are looking for assistance with obsolescence and shortage

issues. OEM buyers want their EMS providers to make sure there is continuity of supply. They also want EMS partners to provide market intelligence that can give them a heads up if there are upcoming supply issues that could jeopardise continuity of supply.

Dhiman said part of Sanmina's value proposition to OEMs is identifying supply issues of passives, discretes and other components through "our network of sources and recommend solutions to customers, said Dhiman.

Analysing BOMs

Sanmina also reviews "A-Class parts" that are critical to a customer's product every week. With the review, a product's bill of materials and approved manufacturer lists are analysed to ensure that

multiple sources are designed into the supply chain when possible, said Dhiman. In addition, Sanmina's component engineering team identifies alternate components for shortage parts, he said.

"In the case of passives and discrete semiconductors, alternate components identified are usually electrically and mechanically, pin-to-pin compatible, with no design changes required," said Dhiman. In cases where design changes are necessary, Sanmina's component engineers work with the customer or Sanmina design engineers to make and validate the changes, he said.

Knight said his company has "feet on the street" in Asia and Europe to monitor the electronics market. "We get a lot of good market intelligence that's not

generally available to the press or online," he said. By talking with component and raw material suppliers, "we can actually get a pretty good gauge what's up and what we need to plan for. Recently we have definitely beefed up our inventory" because of supply conditions for MLCCs and other passives and discretes, said Knight.

Kelsey said with the current constrained supply of passives and discretes, Plexus works with customers to find alternate suppliers when necessary. Plexus also is working with the key passive suppliers to make sure it gets the supply of capacitors and resistors it needs for its customers' products.

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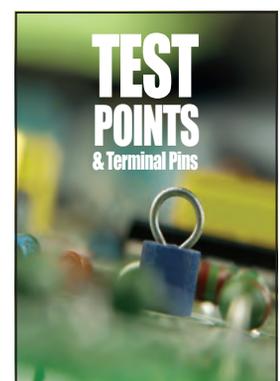
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Formica Optoelectronics Inc.
Fox Electronics
Foxconn Optical Interconnect
Technologies
Free2move
Freescale Semiconductor, Inc.
(NXP Semiconductors)
Fremont Micro Devices
FTDI (Future Technology Devices
International, Ltd.)
Fujitsu Electronics America, Inc.
Furuno (Kaga Electronics USA)
Future Designs, Inc.
Future Technology Devices
International, Ltd.
GainSpan Corporation
GC Electronics
GE Critical Power
General Cable
General Semiconductor (Vishay)
GeneSIC Semiconductor
Genuino (Arduino)
GHI Electronics, LLC
Global Power Technologies Group
Global Specialties
Grayhill, Inc.
Greenlee Communications
GWconnect - a Molex company
H&D Wireless
H.G. Schaevitz, LLC / Alliance
Sensors Group
Hamlin / Littelfuse
Hammond Manufacturing
HARTING
Harwin
Heatron
Helium
HellermannTyton
Henkel/Loctite
Heraeus Sensor Technology USA
Hillcrest Labs
HiRel Systems / Vishay
Hirose
Hirschmann
Hittite (Analog Devices)
Hoffmann
Hologram
Holsworthy Resistors /
TE Connectivity
Holt Integrated Circuits, Inc.
Honeywell Microelectronics &
Precision Sensors
Honeywell Sensing and Productivity
Solutions
I/O Interconnect
IAR Systems Software Inc
ICC Nexergy (Inventus Power)
IDEC
IDT (Integrated Device Technology)
II-VI Marlow
Illinois Capacitor
ILLUMRA
Industrial Fiber Optics, Inc.
Infineon Technologies
Initial State Technologies, Inc.
Innovasic Semiconductor /
Analog Devices, Inc.
Inolux
Inphi
Insight SIP
Inspired LED
Integrated Device Technology (IDT)
Integrated Silicon Solution, Inc. (ISSI)
Intel® FPGAs
Intematix
Interconnect Systems -
a Molex company
Interlink Electronics
International Rectifier (Infineon
Technologies)

Intersil (Renesas Electronics America)
InvenSense / TDK
Inventek Systems
Inventus Power
Io Audio Technologies
IQD Frequency Products
IR (Infineon Technologies)
IRC / TT Electronics
IRTOUCH Systems Co., Ltd.
Isocom Components
ISSI (Integrated Silicon Solution, Inc.)
ITT Cannon, LLC
ITT Interconnect Solutions
ITW Chemtronics (Chemtronics)
IXYS Corporation
IXYS Integrated Circuits Division
IXYS RF
J.W. Miller / Bourns
JAE Electronics, Inc.
Jinlong Machinery & Electronics
Co. Ltd.
JKL Components Corporation
Johanson Dielectrics, Inc.
Johanson Technology
Johnson / Cinch Connectivity
Solutions
Jonard Tools
JRC Corporation / NJRC
JST
Judco Manufacturing, Inc.
Kaga Electronics USA
Kavlico Pressure Sensors /
Sensata Technologies
Keil (ARM)
KEMET
Kennedy Labs
Kester
Keystone Electronics Corp.
Khatod
Kilo International
Kilovac Relays / TE Connectivity
Kingbright
Kings (Winchester Electronics)
Kionix
Klein Tools
Knowles
Knowles DLI
Knowles NOVACAP
Knowles Syfer
Knowles Voltronics
KYOCERA Corporation
Kyocera Display
Laird
Laird - Antennas
Laird - EMI
Laird - Signal Integrity Products
Laird Connectivity
Laird Connectivity (LSR)
Laird Thermal Materials
Lantronix
LAPIS Semiconductor
Lattice Semiconductor
Leader Tech Inc.
LeCroy (Teledyne LeCroy)
LED Engin
LEDynamics, Inc.
LEDiL
LEM USA, Inc.
LEMO
Lighting Science
Lime Microsystems
Linear Technology / Analog Devices
Link Labs
Linx Technologies
Lite-On, Inc.
Littelfuse
LMB Heeger, Inc.
LOCTITE / Henkel
Logic PD, Inc.
Logical Systems
LTW (Amphenol LTW)
LulzBot
Lumberg Automation
Lumex, Inc.
Lumileds
Luminary Micro / Texas Instruments
Luminus Devices
Luna Optoelectronics
Luxe
MACOM Technology Solutions
Macraigor Systems LLC
Macronix
Maestro Wireless Solutions
Mag-LED Solutions
Magnasphere Corp.
Makeblock
Mallory Sonalert Products
Marktech Optoelectronics
Marlow Industries, Inc.
Martel Electronics

Marutsuelec
 Master Appliance Corp.
 Matrix Orbital
 MaxBotix Inc.
 Maxim Integrated
 MaxStream (Digi International)
 Maxwell Technologies, Inc.
 MCB Industrie / Vishay
 McGraw-Hill Education
 MEAN WELL
 Measurement Specialties /
 TE Connectivity
 MEC switches
 Mechatronics
 MegaChips
 Melexis
 Memory Protection Devices
 MEMSIC
 Menda/EasyBraid
 Mentor Graphics
 Metelics (MACOM Technology
 Solutions)
 METZ CONNECT
 MG Chemicals
 Micrel / Microchip Technology
 Micrium
 Micro Commercial Components (MCC)
 Microchip Technology
 microEngineering Labs Inc.
 Micro-Measurements (VPG
 Micro-Measurements)
 Micron Technology
 Micronas / TDK
 Microsemi
 Microwave Technology
 Midcom / Wurth Electronics
 Mide Technology
 Midwest Microwave / Cinch
 Connectivity Solutions
 MikroElektronika
 Mill-Max
 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 Birtcher
 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
 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
 ON 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 Conдор / 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.
 Staco 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
 Riedon
 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 ALCOSWITCH
 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
 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
 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
 UDOO
 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
 Winbond Electronics Corporation
 Winchester Electronics
 Wintec Industries
 Wiss
 WIZnet
 Wolfsspeed - 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/TKD	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



widest Selection

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
Spanion 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.americaii.eu.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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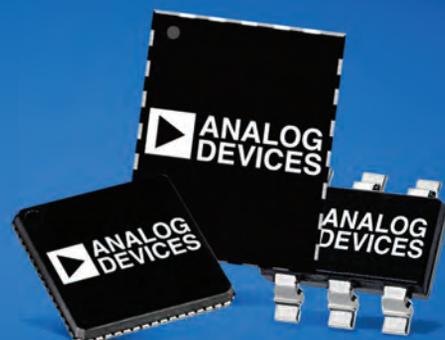
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Manufacturer	Distributor	Telephone	Website	Franchised Distributor	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Buffer Stock Facility
OPTO 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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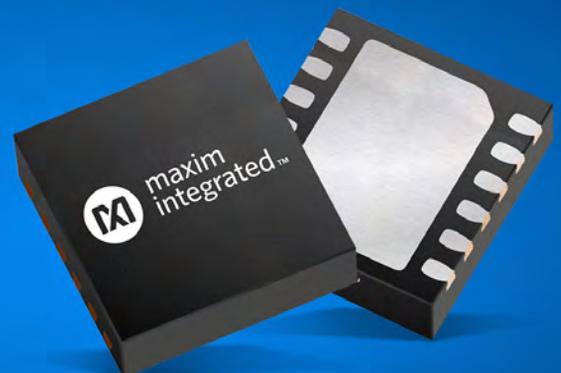
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PASSIVES (continued)											
Yageo	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	45,300	N/A	£0	99%	50	1,500+	Y
YAGEO	Digi-Key Electronics	0800 587 0991	www.digikey.co.uk	Y	147,833	N/A	£0	84.31%	150	3500+	Y
POWER & BATTERIES											
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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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
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											
3m / Laird / Henkel / Brightview / Luminit / Universal Science	Materials direct 247	01908 222211	www.materialsdirect247.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	Y
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	BCA 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, IUL	Y	Y	Y	Y	Y	Y

Continues on next page

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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 61340-5-1/2 (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
JIS Manufacturing Ltd	01455 555500	www.jismanufacturing.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
Sedgewall	01582 475555	sedgewall.com	£1.2m	Bedfordshire	25	2		Y	Y	Y	Y	Y	Y
Simtek EMS Ltd	01843 233120	www.simtekems.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	£12.5m	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)1322621700	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	ISO9001:2008, 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, JOSCAR	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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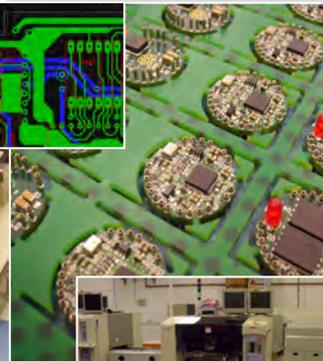
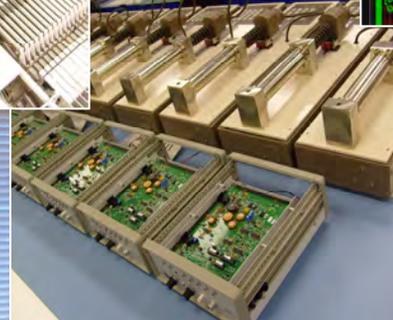
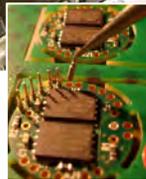
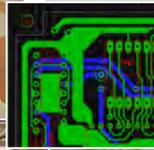
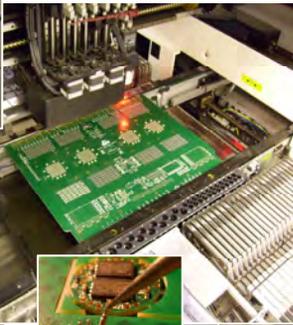
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