

ELECTRONICS

MAY 2019

# sourcing

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## AEROSPACE PURCHASING: GOING ABOVE AND BEYOND

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## On the cover – May 2019

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## Editor's Word



### Nudge in the right direction

For the first time in my life I moved from a house connected to gas to an all-electric apartment. To be honest I wasn't keen on the idea based on the imagined operating costs and the potential for a single point of failure following a power cut.

Interestingly my fears were unfounded. Firstly, our apartment is relatively new and well insulated compared with my previous property which was old and draughty. Secondly, the national electricity grid appears to be more reliable than my old gas boiler.

So, I'm not too worried that the UK government is making noises about banning new properties from joining the gas grid from 2025. Instead they will draw their energy from an increasingly renewable electricity grid, supplemented by heat pumps and extreme insulation standards.

I would like to add that the UK electronics industry has the potential to add plenty more to the mix, particularly in the form of smart building products. It would be sad if all new housing stock was moved to renewable electricity without then offering the ability to control the consumption to ever increasing levels of precision.

To me, current smart building technology feels like it is second gear of a five-speed box. There is plenty of room for further innovation in both the hub and peripherals. Ultimately, it needs to become a fit-and-forget intelligent solution which automatically preconfigures itself and then automatically adapts to changing circumstances.

Let's roll.

*Jon Barrett*

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Issue 167, Vol.15 No.05

Published 12 times per year by MMG Publishing Limited  
ANNUAL SUBSCRIPTION:  
EU Countries £60 Rest of World £90

MMG PUBLISHING LTD  
Suite 2, 1-3 Warren Court, Park Road,  
Crowborough, East Sussex TN6 2QX  
Tel: +44 (0)1892 613400  
Fax: +44 (0)1892 613402  
Printed by: Pensord Press Ltd  
Electronics Sourcing is printed on sustainably sourced paper stock  
ISSN 2043-9504  
© 2019 MMG Publishing Ltd



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## Connectors sound great for industrial buyers

Anglia has expanded its specialist connector range with the addition of Neutrik interconnect products for professional audio and video applications as well as industrial applications including higher current designs.

Technical director at Anglia, David Pearson, commented: "Neutrik is known and loved by many audio and video customers, but will also prove a welcome extension for general and industrial customers who may not be aware of the capabilities they offer. Of particular interest is the innovative range of powerCON connectors designed for handling high currents in demanding environments."

Head of sales and marketing at Neutrik UK, Andy Croucher, added: "We are appointing Anglia to strengthen and extend distribution of our professional interconnectivity products into market sectors beyond our established broadcast, film and television and professional audio video markets."

Highlights of the Neutrik range include the etherCON ruggedized and lockable RJ45 connector system and the powerCON series of lockable, robust and reliable three-pole equipment AC connectors.

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

## Cutting the cost of industrial IoT



Farnell element14 is to offer a new Raspberry Pi-powered industrial IoT gateway designed to provide low cost yet secure cloud

connectivity. The Avnet SmartEdge Industrial IoT Gateway operates using Avnet's IoT Connect platform running on Microsoft Azure and is ideal for industrial automation applications such as remote monitoring, predictive maintenance, process control and automation.

According to Farnell, the gateway addresses key industrial requirements, including additional



## Buy it with bitcoin

Avnet is working with global blockchain payment provider, BitPay, to accept cryptocurrency for its products and services, a move it says will offer buyers a more convenient payment method.

Vice president of demand creation, Avnet, Sunny Trinh, said: "We're working with BitPay to facilitate secure blockchain payments for all types of customers so they can focus on developing their products, not how to pay for them. Whether it's bitcoin or bitcoin cash, we can handle it."

When a purchaser elects to make a blockchain payment, Avnet will work with BitPay to verify the funds, process the order and complete the transaction. The two companies will process cryptocurrency requests outside the US on a country-by-country basis.

Chief commercial officer, BitPay, Sonny Singh, added: "Not only is paying with bitcoin easier and faster than with credit cards and bank wires, it is less expensive and acceptance of it is growing."

To cement acceptance, Avnet is also working with Bitcoin.com to develop a new hardware wallet that will further enable cryptocurrency storage and provide the highest level of security for transactions.

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

ports to handle industrial protocols and a trusted computing module for added security. Various connectivity options are incorporated, including a full set of industrial peripherals, wireless connectivity via an integrated antenna and an mPCIe interface for cellular modems.

Avnet vice president, internet of things, Lou Lutostanski, commented: "Developers familiar with prototyping on a Raspberry Pi device will find it a straightforward task to bring their designs to a production environment without ever having to switch platforms."

[www.element14.com](http://www.element14.com)

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### In Brief

#### End-to-end support

Farnell element14 has changed its name to Farnell, An Avnet Company, in recognition of its role within the Avnet eco-system. It illustrates that the two companies can add value at every stage of the product lifecycle by working as one. End-to-end solutions from this distributor can support an idea from prototype to mass production.

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

#### Training for tomorrow

Harwin has established an academy in partnership with Havant and South Downs College with the aim of encouraging new engineering talent. The two-year course, which prepares students for a STEM sector career results in an internationally recognised qualification. Students will garner practical experience at Harwin's production facility with the opportunity to apply for a further Harwin apprenticeship.

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

#### Smart EMS services

Electronics manufacturing service provider, Smart Made Simple, has announced a management buyout, enabling the company to continue its growth and productivity initiatives. Supported by HSBC UK, the buyout will energise SMS's efforts to streamline supply chain touch-points, reduce risk and costs, improve responsiveness, maximise transparency and traceability, and accelerate entry to the market for clients.

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

#### Rail products ready to roll

Relec Electronics has released a new product catalogue highlighting its railway power supplies and displays. The catalogue features various power conversion products including fully packaged formats, plus a host of rail display solutions addressing poor visibility, direct sunlight, high reliability and extended life. Alongside standard products, Relec also offers expert guidance on customisation for optimum performance.

[www.relec.co.uk](http://www.relec.co.uk)



### Power-saving MCUs in stock

Mouser Electronics is now stocking the STM32WB wireless microcontroller from STMicroelectronics, suitable for a range of internet of things applications. Supporting Bluetooth 5.0, ZigBee 3.0, and OpenThread connectivity, this dual-core microcontroller could potentially be used in wearable devices, home security products, smart lighting, medical devices, industrial appliances, or asset tracking.

Designed to offer power-conscious performance, STM32WB microcontrollers feature a 64MHz Arm Cortex-M4 application processor core and an Arm Cortex-M0+ network processor core, with up to 1Mbyte of on-chip flash and 256kB of SRAM. They also integrate a 2.4GHz radio transmitter optimized for low power consumption and high RF performance.

For further energy savings, the microcontrollers feature multiple power saving modes, including adaptive voltage scaling, 13nA shutdown mode, and an adaptive real-time accelerator to enable zero-wait-state execution from flash memory.

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



### Pre-wired connectors simplify purchasing

RS Components has introduced a new range of pre-wired, single-end-terminated cable assemblies designed to quickly and easily address basic cabling requirements. The assemblies offer a range of commonly used cable and connector combinations based on Harting's Han series of connector components.

By eliminating the need for customers to assemble their own connectors from basic components, RS claims the new pre-wired cable assemblies not only reduce ordering complexity but also lead times and labour, allowing faster connection to end user equipment. They also allow customers to reduce the level of cable inventory held on site.

The new pre-wired connector range comprises six-way and 10-way single-ended assemblies with either 1.5 or 2.5mm<sup>2</sup> wire gauge, available with one, three or five metre lengths of cable. Harting Han 6B and 10B series hoods, 6E and 10E inserts, silver plated crimp contacts, and cable glands can also be incorporated in the assemblies.

[uk.rs-online.com](http://uk.rs-online.com)

### Looking for RJ45 options?

Now available from TTI, Amphenol ICC's broad range of I/O registered RJ45 modular jack and RJ magnetic solutions meet demand for faster speeds and greater bandwidth for VoIP, Ethernet, WLAN, medical, and industrial applications.



Devices are available in vertical and right angle format, including the

latest RJ magnetic connectors and IP67 rated RJ45 connectors for harsh environments. The connectors are also PoE and PoE+ compatible, as well as being RoHS and IEC 60603-7 compliant.

Designed to meet Cat5e, Cat6, and Cat6A specification performance levels per EIA-568-C.2, these RJ45 connectors allow for easy upgrade from Cat5e to Cat6 or Cat6A. They are available with various shielding and LED options and provide up to 750 mating and unmating cycles.

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



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# Tips for confident counterfeit detection

*Unfortunately, receiving counterfeit components is not a rare occurrence. Drawing on its extensive inspection experience, AERI offers an insider's guide to detecting counterfeits*

From experience and discussion with AERI customers, it seems almost every manufacturer has experienced a counterfeit nightmare. Sometimes manufacturers are not even aware that their failures were due to a counterfeit, seeing only a higher than normal failure rate during production, without identifying a fake.

Thus, it has become necessary for distributors of electronic components and manufacturers of electronic equipment to inspect all incoming electronic components for authenticity. But are you sure you know how to inspect for counterfeits properly? The following guide draws on years of inspections at AERI's facility and extensive involvement in industry committees to enlighten readers and ensure they feel confident in their evaluations.

### Basic equipment

Counterfeit electronic components are most prevalent in mainland China, however, it is not unlikely a broker down the street is selling them too. Often the counterfeits supplied to AERI are from long time, good standing suppliers that are just not trained or prepared to avoid the fakes. To start with, there are some simple tools that are essential for counterfeit

detection. In addition to all the standard safety equipment for handling electrostatic sensitive parts, you will need a microscope with at least 30x magnification. It is also important to have a camera built into the microscope since some processes may require photos to be sent for evaluation. You will also need a solvent to check for part marking permanence. Acetone is commonly used to determine if the part has been remarked, but a less harsh solvent is a combination of three parts mineral spirits and one part alcohol. This is the mixture that MIL-STD-883 method 2015.13 requires part markings to withstand.

### Inspect packaging

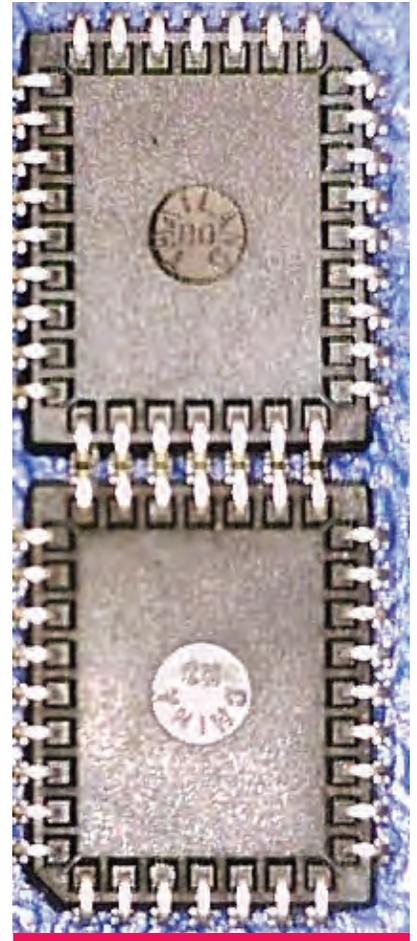
To begin avoiding counterfeit electronic components, start with a visual inspection of the packaging. Verify that the date code on the label matches dates codes on the parts and ensure there are no impossible date codes, such as 1857, which denotes the 57th week of 2018, or dates in the future. Next, check for logos on the packaging material that do not look correct, bar codes that don't match the type written part information or countries of origin that are incorrect per the manufacturers' information.

If parts are moisture sensitive, they require a dry pack and a humidity indicator card. Often counterfeiters forget some piece of the moisture sensitive packaging requirements, but part specific requirements can usually be found on the datasheet. Finally, misspellings on the manufacturers' labels are also a give-away.

### Examine indents

With the packaging removed, it's time to start inspecting the actual parts. Most plastic integrated circuits have cavities purposefully made during the mold process. Some indicate pin one, or other designations for use during placement, but others are just part of the plastic molding process. Mold cavities should be clean from the manufacturer.

Examining these indents is a primary way of detecting counterfeit components since the counterfeiters have a difficult time keeping indents clean and consistent during their refinishing process. For example, look out for parts in the same lot with indents of a different size or shape. These differences are due to the amount of sanding required to remove old part markings and blacktopping paint fill.



Parts with the same lot code cannot be manufactured in different countries



**To begin avoiding counterfeit electronic components, start with a visual inspection of the packaging**

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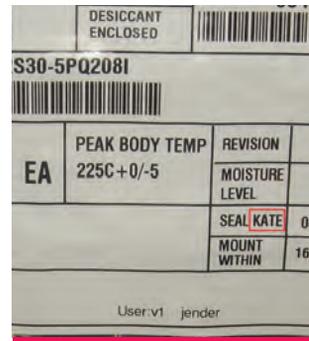
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- Telegärtner offers 24 MPO/MTP® fibre patch cords (MPO/MTP® 24 unpinned to MPO/MTP® 24 unpinned) and harness cables (MPO/MTP® 24 pinned to 2 x MPO/MTP® 12 pinned).
- Telegärtner product solution comes with 24 OM3 or OM4 multimode fibres per MPO/MTP® connector for still higher fibre density.
- Pre-terminated cables for quick installation without the need for tools or special equipment.
- As a standard, Telegärtner offers components according to fibre polarity type A for a clear, consistent fibre sequence. Components according to fibre polarity type B or C are also available at the same high product quality.

[www.telegaertner.co.uk/contact](http://www.telegaertner.co.uk/contact)

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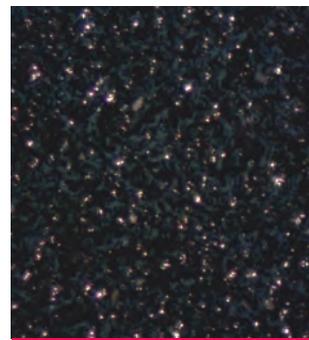
## Anti-Counterfeiting



Misspellings on manufacturer labels are a give-away



This sloppily labelled part features an out of proportion Siliconix logo



When painted with blacktopping material, peaks and valleys are smoothed over and filled in



The shape and size of indents may be different due to the amount of sanding to remove old part markings

### Country of origin

Most parts will display where they were manufactured somewhere on the component; often this information is placed in the indents. Having questioned component manufacturers extensively, they all concur that a part with the same lot code as another cannot be manufactured in different countries.

### Magnify texture

Plastic electronic components are typically made with a mix of fine glass and plastic. The surface of the molded package is textured when it is removed from the mold. Unfortunately, counterfeiters have come up with a mixture to create a very similar effect on top of the original surface. With the naked eye, it is almost impossible to determine the difference

between the original surface and a fake surface, however, with the help of a microscope, there are signs that can help determine component authenticity.

Under the microscope, the differences between a typical blacktopped fake and an authentic part are clear. The surface of a true part has a sharper and duller look, with the glass in the mixture making for sharp little peaks and valleys. When painted with the blacktopping material, however, the peaks and valleys are smoothed over and filled in, like if you were to put a coat of paint on sand paper. Although this is not relevant to every part, the majority will have this type of finish.

Other textures to look for are directional sanding marks,

parts that are sandblasted, exposing the silicon spheres, and blacktopping that has a visible line where it stops on the sides of the part.

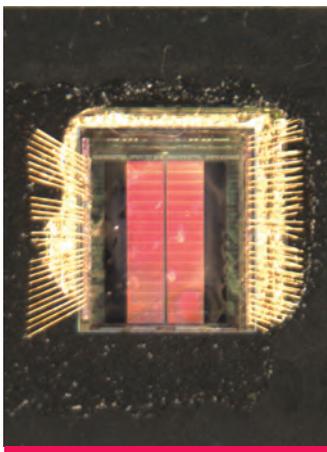
### Identify imperfections

All genuine component manufactures have high quality standards that preclude major imperfections. Part numbers must be in a certain location on the part and they cannot be crooked, misspelled, or out of alignment. Logos are also monitored very closely and should not vary from part to part. In addition, the markings are designed to withstand tough environments and still be legible.

### Internal characteristics

With counterfeiters now so successful in their external efforts to deceive, it is essential to inspect the internal characteristics of any part destined for a high reliability application. The equipment and personnel required to perform these tests are much more advanced and therefore costlier.

Decapsulation is the most important tool for internal evaluation to see that at least one of the die in the lot is correct. Following this, x-ray inspection of a large sample of the balance of the lot is



Decapsulation shows whether at least one of the die in the lot is correct

required to confirm that the entire lot is the same.

### Physical composition

Another helpful process to confirm a part's authenticity is by identifying if the leads are constructed with the correct material. Counterfeit parts can be either re-tinned to cover up previous use or constructed with a different material because they are not

the actual part as marked. An x-ray fluorescence analyser can help to identify this anomaly. A report regarding XRF analysis makes it possible to compare results with the original manufacturer's specifications.

Hopefully this overview will provide those involved with the purchase and receipt of electronic components with a

better idea of how to detect counterfeit parts. Counterfeits threaten every facet of our industry and it is important that we work together to stop the problem.

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# Smaller OEMs and EMS providers need more from distributors than just parts

*Often smaller companies need the same services as larger electronics manufacturers but on a smaller scale*



James Carbone

Small and medium size OEMs and electronics manufacturing services (EMS) providers have always been the bread-and-butter business of electronics distributors as component manufacturers are unable to directly service the hundreds of thousands of electronics manufacturers that distributors do.

While smaller companies have always relied on distributors for components, increasingly they are becoming dependent on distributors for design expertise and assistance, value-added services, inventory management, demand forecasting, market intelligence and managing component obsolescence and supply chain risk.

Many smaller EMS providers also rely on distributors for bill of materials (BOM) scrubbing. Often, EMS providers get BOMs from their OEM customers. It's not unusual for part numbers on the BOM to not be industry-standard or be inaccurate because of the wrong number or letter in the part number.

Smaller customers often need such help because they lack the internal resources and abilities that larger OEMs and EMS providers have. Distributors are the go-to option for many such companies.

Distributors say for the most part, the needs and requirements of smaller customers are the

same as larger companies that may have the purchasing volumes to buy directly but choose to go through distributors in some cases.

Sue Leece, purchasing manager at EMS provider Saline Lectronics, based in Saline, Mich., said her company builds many types of board assemblies and has many quality certifications.

"It is very important for our suppliers to provide the same services to us as they would to any large EMS provider," she said. Saline manufactures printed circuit boards and electromechanical devices and provides testing and inspection services.

## High expectations

Sean Sisson, vice president, North America, for distributor Rutronik, said that all customers including small ones expect a high level of service and quality. "They also are interested in supply chain programs and need support managing the supply chain," he said.

Sisson said value-added and supply chain services are just as important for small customers as large customers although "the level of services varies based on the customer needs."

Those programs are important because they reduce total cost for OEMs and EMS providers and allow them to operate leaner.



Sue Leece, purchasing manager at Saline Lectronics

**"It is very important for our suppliers to provide the same services to us as they would to any large EMS provider"**

Many smaller customers also want technical support from their distributors. Some distributors offer design services to customers or can refer them to a design house. Many have field applications engineers to work with customers, and most provide data sheets, reference designs and development tools on their websites.

Sisson says customers expect Rutronik to provide them with insight about which parts are the best fit for a given application. Rutronik can assist them in the design of a board or subsystem through its technology center and with FAEs, said Sisson.

## Wanted information, tools

Many companies, big and small, purchase from small-volume distributors, who specialize in selling components for design. Often, they come to distributors, not just for parts, but for design tools and for information on technology trends and for help with part selection for a new design.

Mouser Electronics, based in Mansfield, Texas, provides a plethora of development tools for a wide range of products, including power management ICs, RF chips, optoelectronics, analog-to-digital ICs among others as well as bill of material tools



**Sean Sisson**, vice president, North America, for distributor **Rutronik**



**“They (smaller companies) also are interested in supply chain programs and need support managing the supply chain”**

“We try to put as much content and tools on our website as possible to make it easy for them to find a part that they are looking for, and be able to see the cost, and the data sheets,” said Kevin Hess, senior vice president of marketing for Mouser. “We are giving them lots of what they need in order to source product,” he said.

Hess noted that Mouser has customers of all sizes and its business is not dependent on a few large companies. In fact, it has 650,000 customers “buying from us in small amounts,” he said. The average order is about \$350.

Distributors say that their smaller customers often look to them for market intelligence to keep them apprised of developments in the supply chain that may impact supply, prices and lead times. Leece says Saline buys components from six distributors that help keep Saline informed about developments in the supply chain.

“In this market, the more eyes and ears to help us fulfill our customers’ requirements the better,” she said. “Our distributors keep us informed on price increases, availability, obsolescence, lead times and substitutions and that helps us keep our customers informed,” said Leece.

**Dealing with tough issues**

She added that some distributors visit Saline weekly to “build relationships and assist our buyers with tough issues. This helps maintain the communication as well as providing us with the help we need to get the materials and the most aggressive pricing required by our customers,” said Leece.

Some of the “tough Issues” involve managing risks in the supply chain including shortages, long lead times, component obsolescence, and supply disruptions caused by severe weather or natural disasters.

Matt Clark, global head of ecommerce for Newark, said Newark can provide sourcing assistance in shortage situations, as well as allow for some order scheduling. “We have inventory available from 8+ global distribution centers,” he said.

**A perfect forecast?**

Paul Dosser, vice president business development for Digi-Key, said many tier “3 and 4 size customers are definitely asking for supply-chain support because of forecasting inaccuracy. “Smaller EMS companies can have heightened challenges because a lot of times their customer base that they support doesn’t necessarily provide a lot of strong

forecasting. There’s never a perfect forecast,” he said.

A lack of accurate forecasting can mean an EMS provider may not have enough parts on site if there is a sudden uptick in demand. The problem can be especially acute if parts that are needed, such as multiplayer ceramic capacitors or chip resistors, are in short supply.

He said Digi-key can provide customers with an “array of supply chain solutions” because of its “normal high in-stock model.” Such solutions could include inventory management. “We offer a strong lineup of bonded inventory supply chain programs that cater to customer needs,” said Dosser. “The key thing is whether you are small or large, there is no one size fits all solution,” he said.

Besides inventory management, many smaller companies need assistance managing component obsolescence. Obsolescence is a problem for all size companies, but it may impact smaller OEMs and EMS providers more because they may not have the resources to keep track of end-of-life notices issued by component manufacturers when they decide to stop producing a part.

Dosser says Digi-Key keeps track of those notices and sends them to customers. “If someone bought a part from us over the last 1 to 2 years and we are notified by the

manufacturer that the component is going EOL, we send customers an email about the notification and provide information about substitute parts,” he said. In fact, obsolescence is becoming more of a problem, according to a purchasing manager at an EMS provider based in Canada. “It’s more of a problem because with the consolidation of manufacturers that has occurred over the last few years, they are obsoleting more and more components” and it’s hard to keep track of them, she said.

Besides inventory management services and help with obsolete parts, many smaller companies also appreciate traditional distributor value-added services. One service that many customers use is custom tape and reel, said Dosser. Digi-Key takes parts from a large reel and puts them on a smaller reel as per the customer’s needs. The customer does not need to buy a full manufacturer’s reel.

# Could your PCB partnership deliver more?

*Most purchasers are keen to reduce costs, but to realise sustainable PCB savings requires collaboration between engineering, production, design and purchasing, together with your PCB supplier*

When it comes to sourcing PCBs, two factors remain consistent: one is the push for reducing costs, the other is a lack of engagement between customer and PCB supplier. It's unfortunate, because although cost management is crucial, the goal should be to achieve sustainable cost reductions that enable all partners in the supply chain to make a fair profit—sustainable costs in a sustainable supply chain.

So, why does this happen? Most PCB suppliers are asked to review costs on a regular basis. Often, they make suggestions for cost reduction initiatives that are rejected by the customer due to the concerns of the various engineering, production, and purchasing teams involved.

There are several ways to achieve savings, often much greater than the few percentage points that a renegotiation may achieve, yet many companies don't engage with their board

provider. Purchasing teams only have so much influence and what's really required is collaboration between engineers, production, designers and purchasing, all working hand-in-hand with the volume PCB supplier.

## Sustainable savings

The initial step is the design. While PCB designers often seek support, this is usually at the prototype stage. The key to longer term competitive pricing is to look at the total demand and engage with a PCB supplier who can provide support at prototype and volume levels. PCB trading companies are in a great position to do this as they work with prototype and volume factories, giving one contact.

Alternatively, buyers should engage both the prototype and volume supplier from the start. Material choices should be focused on long-term demand and selected to ensure best costs, even if this means prototype costs are

slightly higher or deliveries a few days longer.

Challenge the status quo. Ask, for example, why an ENIG surface finish is specified on a simple design. Lower cost solutions are available and can yield savings of over 15 per cent. Similarly, panel formats may be set up the same as always, but SMT lines have advanced to provide greater flexibility. Changes could realise significant savings.

Consider stock managed batch builds, calculating risks versus benefits. A supplier with established vendor managed inventory solutions can support cost reductions, reduce working capital, deliver on demand, and achieve reduced pricing through effective batch size management.

Finally, treat the supplier as a partner. Involve all departments and consider long term demands, even at the prototype stage. Proactive



companies that address these issues will achieve their commercial goals and build a true value-add partnership with their PCB provider.

It's a fine line choosing the right partner. Pick one that can provide appropriate support, engage with them and they can support you to achieve your commercial goals.

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# Fast turnaround wins approval

*NYK Component Solutions has extended its value-add offering to include connector backshells, configured from stock for a fast, flexible approach to delivering mil-spec parts*

In addition to assembling its existing range of MIL-DTL-38999 Series III Conesys circular connectors, NYK Component Solutions has now expanded its approved value-add distribution capability to include Compaero backshells.

Available in both straight and 90deg options, these D38999 III connector backshells are configured from stock to achieve a fast and flexible service. The aluminium piece parts are plated in either, cadmium olive drab, electroless nickel or black zinc nickel, with other platings available on request. Buyers can choose from a range of options, including

nine shell sizes with 17 different cable entries, and backshells can be supplied with either a constant force spring or stainless band screen trap facility, all in the same bag, under one part number.

Purchasers can build and cross-reference part numbers on the NYKCS website, with access to a range of options to meet diverse requirements, in a short timeframe and at a competitive price. With components stocked un-plated and finished to meet specific requirements, orders can be turned around within 15 days.

Running alongside the AS9100 Rev D facility for D38999 III circular connectors, this new capability allows customers to order backshells and connectors on one order from a single supplier.

Chief executive officer of NYKCS, Kevin Wells, said: "Trusted supply of approved product in short timeframe with competitive pricing is most important to our customers. This new service for backshells, alongside our existing capabilities for connectors, enables us to do exactly that."

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



Components are stocked un-plated and finished to order



Both straight and 90deg backshells are available



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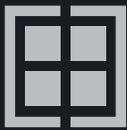


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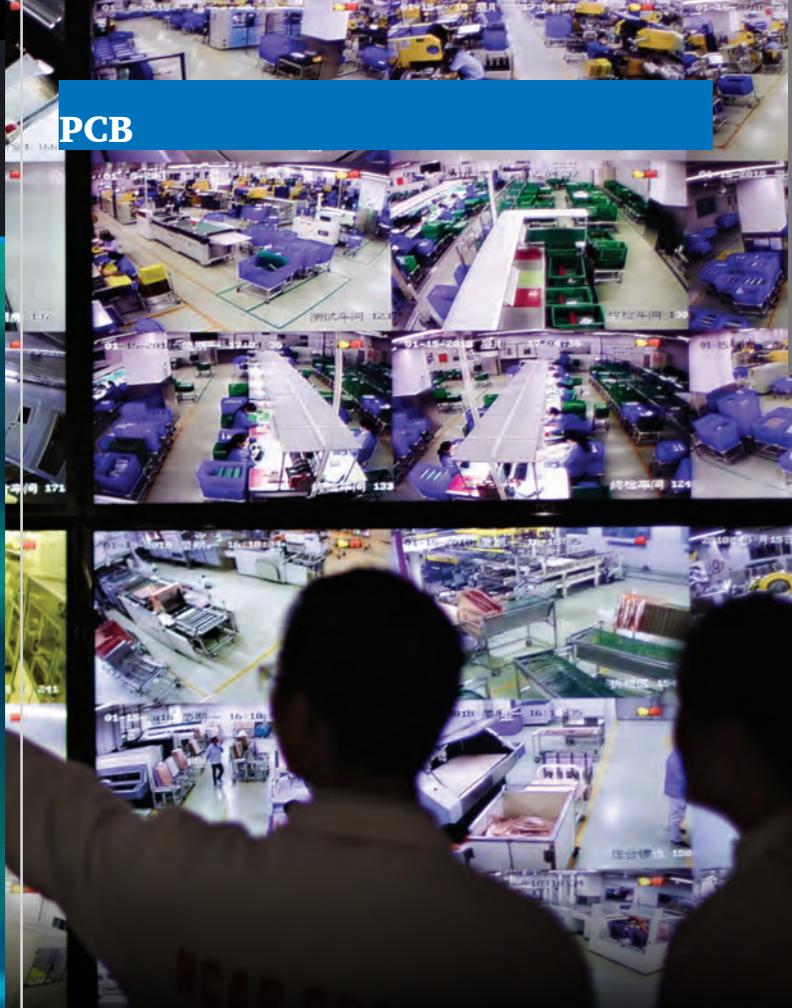
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# Are you seeing the bigger picture?

*When sourcing PCBs from China, it's not just technical capabilities that count. Price, quality, reliable service and sustainability all come into the equation. Here's how NCAB tackles the selection process*

An ever-increasing percentage of the world's printed circuit board production is concentrated in China. There are about 1,600 dedicated PCB factories, a figure which rises to 3,000, if we include those focused on specific sub-processes such as surface finishes, lamination or drilling.

Purchasers looking to source PCBs in China therefore have a wealth of options to choose from, yet finding the right factory, capable of meeting

specific needs, can be a challenge. NCAB assesses various factors when sourcing factories, including their ability to deliver at the right price, with the right quality, whether they can deliver on time consistently and reliably, and how well the factory adheres to sustainability standards. It is also imperative to keep the sourcing process continuous by conducting audits and reviewing delivery, quality and service performance, as well as following up corrective actions.

### Measuring performance

Using these guidelines, NCAB Group looks for the best factories in each of the growth areas it has identified. Throughout the process, it applies a points system, based on a number of criteria. The scoring covers all relevant parameters, which enables NCAB to zoom in on the best alternatives for each specific case. In any case, the first step is to evaluate the factory's performance in terms of factors such as quality, capacity, price and service. What is their customer support like and how are they structured? What are their objectives and how well does this match with NCAB's expectations?

With technology developing exponentially, it is also important to select factories that are investing in emerging techniques and processes. Solutions that were previously considered advanced are now becoming more prevalent, including high density interconnect, rigid-flex boards, multi-level microvias and buried vias. NCAB also sees increased demand for high-signal speeds, optimised power consumption and RF signals.

Miniaturisation is another important driving factor. With components shrinking in size and the consumer electronics industry driving a general trend towards miniaturisation, an increasing number of features having to be accommodated in a smaller and smaller space. Increasingly, this also applies to industrial electronics, with sensors found in consumer products such as smart phones, now found in various industrial applications. Audio-



A good PCB supplier will help you perfect your design right at the start

visual or tactile sensors, for example, offer growing levels of accuracy, thus improving the performance of electronic industrial equipment.

### Supplier support

Lead times are always impacted when working with advanced technologies, and with reliability and quality also major factors, NCAB believes it's important to get the design right from the start. This includes working

with your PCB supplier from the outset. A good supplier should highlight issues when a design is submitted, such as changes that could result in cost savings or any potential manufacturability issues, providing an accurate lead time that fits with requirements. Once the design is perfected, the manufacturing process will be seamless.

Ultimately, to be successful, it's imperative to team with a

knowledgeable and reliable partner for your PCB needs. Continuously evaluate their performance and consistently be looking for increasing capabilities.

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# Keep pace with PCB progress

From prices to processes, we asked managing director of GSPK Circuits, Steve Lloyd, which drivers most affect purchasers in the printed circuit board industry

**Q** What are the five most important things purchasing professionals should consider when looking for a new PCB supplier?

It's a good idea to start by asking how long the supplier has been established. Knowing a supplier has been around for several years is reassuring. Next, look closely at capabilities. A PCB supplier's abilities can range from single sided all the way up to 30 layers with stacks and micro vias. Which one you choose depends on your technical requirements.

Accreditation is another important factor to consider, depending on market requirements for your product. It's important that buyers know their supplier has the correct accreditations for their business. Investment in equipment can also be revealing. It's a fast-moving market, so knowing your supplier invests in new technology is good. Manufacturers are rapidly changing from standard photographic processes to laser direct imaging and direct digital imaging.

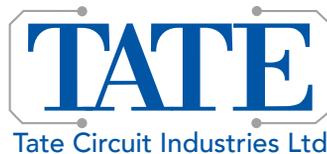
Lastly, establish whether the supplier can manufacture in Europe and lower cost countries, with compatibility between factories and dual tooling to provide a range of shipping options.

**Q** Are PCB prices increasing due to rises in global mineral costs?

We see more influential factors such as labour rates, copper and precious metal increases. We have also seen rapidly increasing prices in US based special laminates.



Managing director of GSPK Circuits, Steve Lloyd



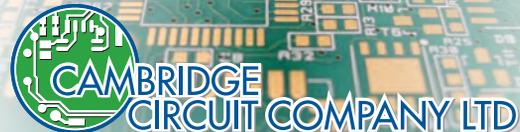
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## Q What are lead times like in the PCB sector?

Very interesting question. Buyers must realise that PCBs are not a commodity product; each item is customer and drawing specific. Depending on quantities and technology, lead times can be as low as 24 hours for rapid prototypes, or around 15 days for a standard UK manufacturing lead time, extending to a Far East lead time, including shipping by sea, of 12 weeks.

## Q What are the current trends in the PCB sector?

Not a day goes by where a PCB supplier doesn't receive requests to populate the boards it manufactures. Most PCB fabricators, however, do not have the facilities to accommodate this. There is a growing trend to replace conventional cable assembly work with flexi-rigid and flexible PCBs. Also, due to micro BGAs and high-powered micro components, there is a real drive towards high density interconnect PCBs.

Knowledgeable buyers increasingly accept that these trends can raise the cost of PCBs but reduce the buyer's overall process costs, due to labour savings.

## Q What other advice would give to our 9,000 readers sourcing PCBs?

I genuinely believe that because of the importance of cost effective and reliable PCBs, customers and suppliers need to work together with design and process solutions to ensure that products meet customer specific requirements. Design for manufacture and value engineering are therefore an essential element of the PCB supplier's offering, as is the approachability of any decision makers within the supplier.

[www.gspkcircuits.ltd.uk](http://www.gspkcircuits.ltd.uk)



**Not a day goes by where a PCB supplier doesn't receive requests to populate the boards it manufactures. Most PCB fabricators, however, do not have the facilities to accommodate this**

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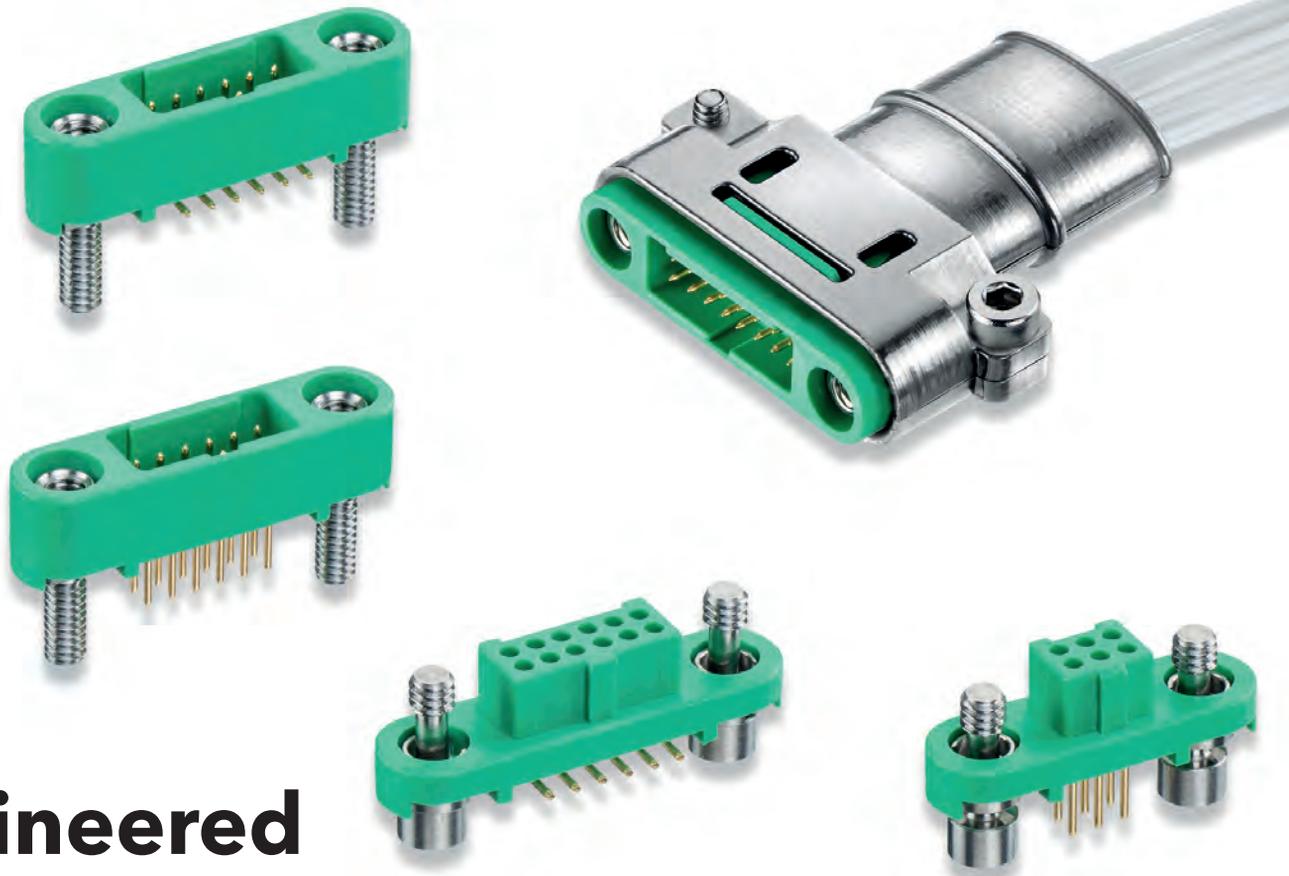
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# Engineered for space

*When buyers are looking for compact lightweight interconnect products, capable of withstanding extreme and harsh environments, TTI has a space-saving solution up its sleeve*

Continued miniaturisation of electronic systems places considerable pressure onto connector suppliers to meet an increasingly acute need for more compact and lightweight solutions that also support elevated power density and still exhibit considerable robustness too. Harwin's Gecko series has become a go-to solution in harsh application scenarios where there are space/weight limitations to contend with. It boasts a compelling mix of both reliability and performance that has proved attractive to the motorsport, aerospace and satellite engineering sectors.

Available in cable-to-board, board-to-board and cable-to-cable options, these 1.25mm pitch connectors are extremely well optimised for the demands of high-density electronic systems – providing a solution that is claimed to be up to 45 per cent smaller and 75 per cent

lighter than standard Micro-D connectors.

### Rugged construction

Each of the constituent beryllium copper plated contacts is capable of supporting currents of 2A simultaneously, or 2.8A individually. Thanks to their rugged construction, Gecko products can cope with exposure to considerable shocks and vibrational forces. Their specs allow for 1,000 mating cycles, and they have an operational temperature range of -65 to 150°C.

TTI also states that the Gecko's outgassing properties make them ideal for hardware that is being deployed in space. In order to address applications where further vibrational resilience is required, the Gecko-SL series provides an effective alternative to the original latched products. These versions feature stainless steel screw-lok

fixings to ensure even greater interconnect integrity.

Based on customer feedback, the Harwin engineering team have further enhanced the Gecko portfolio for applications where space is severely restricted. To mitigate potential mating difficulties in space-constrained locations and for maximum design flexibility, Gecko-SL connectors can now be supplied with a reverse fix orientation.

Here, the male connectors serve as the floating fixings, screwing into the female connectors, rather than vice-versa. The Gecko-SL Reverse Fix can is offered in either male or female cable housings, as requested. The female connectors can be utilised in a panel-mount arrangement where a threaded stud is positioned on the rear of the screw-lok, with the slotted nuts and hexagonal nuts needed to

accompany these connectors supplied separately. Surface mount and through board versions of both the male and female connectors are also offered. The threaded stud on the female connectors is used to provide board mount strain relief.

For maximum convenience, Gecko-SL connectors can be shipped with cabling pre-attached. Cable assembly versions help customers avoid difficult and time-consuming work, as well as the tooling charges that would otherwise be involved. A variety of pin counts and cable lengths can be selected to broaden the potential scope of this solution. Both male and female single-ended versions are available, plus double-ended male-to-male, male-to-female and female-to-female configurations.

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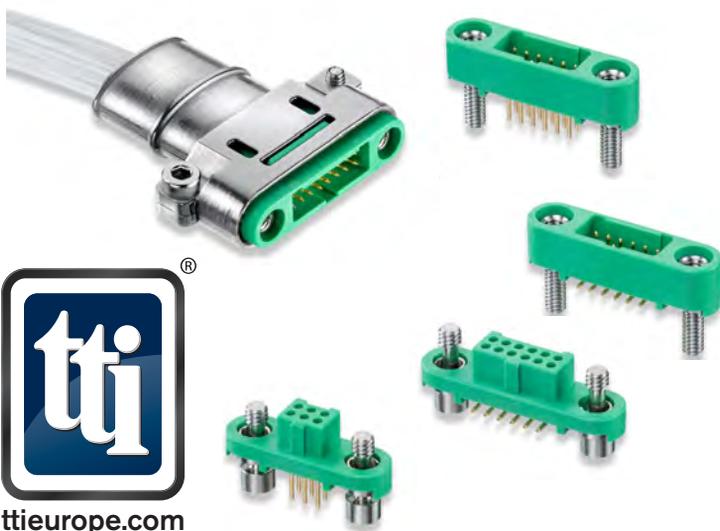
## Gecko-SL—High-Performance Connectors 1.25mm Pitch Screw-Lok System

Designed to perform under extreme conditions of shock and vibration, Harwin's award winning Gecko connectors have become the go-to solution in harsh environment applications.

Smaller and lighter than Micro-D, but supporting 2A per contact, the range has been expanded to include reverse gender fixings, adding yet more flexibility.

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**Increased Design  
Flexibility for  
High-reliability  
Applications**

# A flexible approach solves sourcing problems

*An ability to order multiple variants, with different pole counts, housings, contacts and accessories, ensures Harting delivers flexible connector solutions, backed by easy online purchasing*

Harting has been supplying electronic connectors in the UK for over thirty years. During that time, customers have come to rely on its proven products including connectors from the DIN 41 612 series, designed to create cost-effective and reliable connections between two printed circuit boards or a cable and a printed circuit board. Thanks to a variety of shell housings and accessories, including full metal versions, this range provides both flexibility and robustness.

Another resilient, all-purpose classic is the D-Sub.

Whether it's PCB or cable connectors, purchasers have access to a huge choice of pole counts, variants, housings and contacts. As a long-time supplier of D-Sub connectivity for industrial environments, Harting can create almost unlimited variants to satisfy specific requirements, helping customers to solve problems and save space.

### Smaller solutions

In addition to these established products, Harting has also been investing continually in technological advancements. For example, as devices decrease in size,

circuit boards and device innards have also shrunk. Harting has responded with reliable, practical solutions.

One of these developments is the Har-flex range, a series of PCB connectors for all-purpose use in and on the device. These scalable devices are available with any number of pins in increments of two. What's more, customised Har-flex IDC cable assemblies enable purchasers to choose pin counts, cable lengths and mating faces.

Further space-saving solutions focus on Ethernet



Scalable Har flex devices are available with any number of pins in increments of two

delivery at speeds of up to 10Gb/s. The ix Industrial is a robust connector developed to replace the traditional RJ45. It boasts a 70 per cent smaller PCB jack and a high current-carrying capacity that supports both existing and future power over Ethernet applications.



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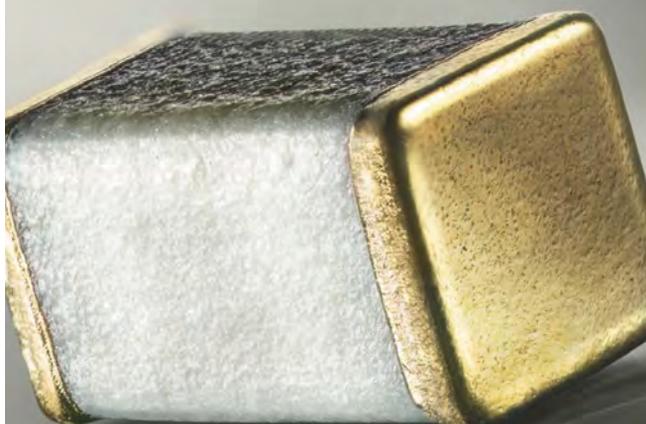
### Simpler purchasing

It is not only in the realm of product design where Harting is driving advances; it is also committed to making partner collaboration and purchasing easier. Customers with direct accounts can now register for an eShop account, which puts key features at buyers' fingertips. As well as placing orders, users can check pricing, stock and delivery, see order history, manage invoice addresses and track deliveries. Purchasers can access their eShop account 24/7 to manage workflows conveniently.

Customers without a direct account can buy from several franchised UK distributors: Anglia, Avnet Abacus, Farnell, Futura Electronics, Northern Connectors and RS Components. These distributors hold stocks of Harting products in the UK and are ready to serve all kinds of requirements with short lead times. They can also offer technical support, an approach which manages customer expectations and provides vital support.

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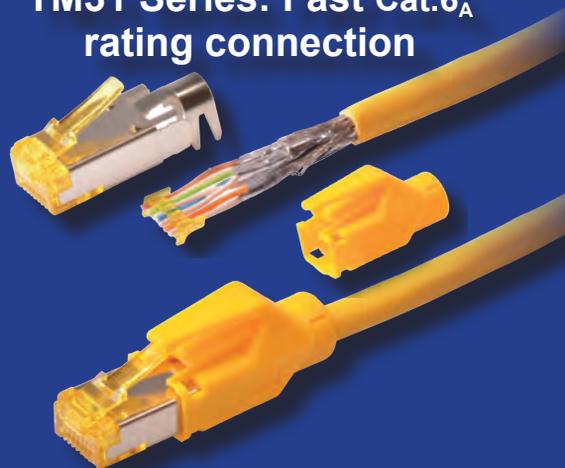
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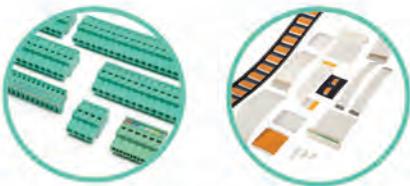


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## Connectors



Simplified screening cuts the component count and makes assembly easier

# Multiple contacts in a single shell

*Aerco aims to simplify both purchasing and design with a new high speed Ethernet connection from TT Electronics that can accommodate several Ethernet contacts in a single insert*

With the ever-increasing demand for high speed Ethernet connection, there is a growing challenge to screen multiple Ethernet contacts within a single connector shell.

TT Electronics' Steadi-Shield series, stocked by Aerco, solves this issue. It utilises a metallised insert, designed to provide instant 360deg screen termination through a common ground. Using the metal insulator results in a high reliability, simplified screen termination process, claimed to be easier than traditional methods that employ extra components such as braiding and clamps and require operator skill and experience to complete successfully.

Up to seven high speed 10Gb Ethernet contacts

can be housed in a single Steadi-Shield series insert, as well as combinations of coax, twinax, triax and quadrax contacts and standard single contacts. The inserts are designed for use in the high performance ABMP connector series, which is EN45545-2 compliant and derived from MIL-C-5015 and VG95234 reverse bayonet specifications.

Specifying Steadi-Shield with ABMP is said to provide high speed, high reliability, data communication with IP67 sealing, shock and vibration protection and a 500 mating cycle performance. This makes it the ideal choice in demanding industry sectors such as the military and rail markets. It can also be used across a diverse range of applications such

as power distribution, lighting, trackside signalling and detection systems, driver and passenger information systems, CCTV, and braking systems.

Aerco offers Steadi-Shield and ABMP with next day delivery, no minimum order quantities and comprehensive technical and design support.

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# Simple steps to rule out risk

*Counterfeit connectors can damage your products and your brand. We asked CamdenBoss marketing technical adviser, Lewis Letchford, how to safeguard your BOM and what to look out for when sourcing connectors*

## Q What type of connectors are available from CamdenBoss?

Our connector range extends from terminal blocks to waterproof connectors. CamdenBoss manufactures quality through hole and wire-to-wire connectors, including our core range of PCB and pluggable terminal blocks available in various pitch sizes, plus IP68 field/panel connectors and terminal strips.

## Q What accreditations does CamdenBoss hold for its various connector ranges?

Alongside UL and VDE approvals that test the safety and electrical rating of components, CamdenBoss is fully RoHS and REACH accredited ensuring that we use non-hazardous, non-conflict materials in the manufacture of our products. Materials are also tested to UL flammability ratings to provide safety in high heat applications.

Accreditations from leading approval bodies are a sign of authenticity. They ensure that not only are the parts genuine, they are also safe to use within electronic systems.

## Q Has CamdenBoss experienced counterfeit connectors?

Ultimately no, we haven't had an experience of counterfeit connectors. Although we ensure all our products have logos on them so that they are physically recognisable, there have been instances where a customer with our product has asked us to

check stock. We were able to identify and trace the samples directly back to our factory, which is a level of traceability all manufacturers should have.

## Q How does CamdenBoss ensure that only genuine products are supplied, including from its distributors?

Counterfeit connectors enter circulation through illegal manufacture and illegal representation of an authorized brand, leading consumers to think they are purchasing a genuine product. They can also enter through unauthorised distribution.

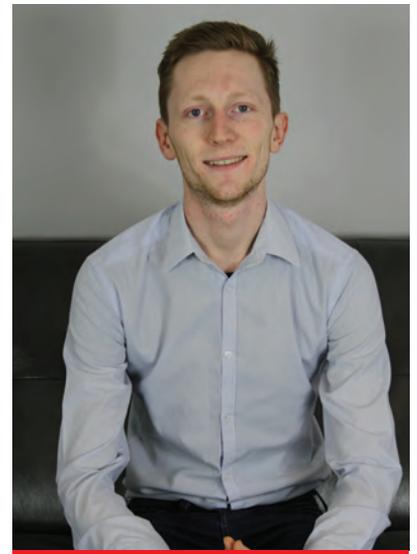
To ensure that counterfeit parts do not enter circulation in this way, CamdenBoss authorises only trusted distributors to sell its connectors. This means purchasers can instantly dismiss unauthorised distributors selling counterfeit connectors online. The trusted distributors chosen by CamdenBoss can be found on our website.

Products purchased through unlawful distributors are not covered by compliance tests and therefore run the risk of damaging your products and brand as they are unfit for use. Parts do not undergo the same quality checks as genuine connectors, which can cause serious issues if implemented into electrical circuits and systems. A lack of quality may also be a sign the part is not genuine.

## Q What advice would you offer purchasers to avoid counterfeit product?

To avoid these issues, we urge that only authorised distributors are used to purchase connectors. Contact the manufacturer if you become aware of a suspicious distributor and they can quickly tell you if there is a problem to be addressed. Finally, be aware that packaging can also be an indicator that parts are inferior.

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



Marketing technical adviser, **CamdenBoss**, Lewis Letchford



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# Protecting against connector counterfeits and copies

*Safeguarding your company and customers from counterfeit connector products is paramount. Here Lemo explains some common issues and how to avoid them*

Knock-off electronic components, such as connectors, can cause big problems for purchasers. Particularly when parts are deliberately designed to superficially resemble or imitate premium components that have been manufactured with more stringent design specifications.

Unwittingly using them in an otherwise quality product could lead to accelerated equipment failure or malfunction, or to deficits in end-product

performance, such as lower quality broadcast or recorded video, less accurate testing or measurements, or other detrimental consequences that could impact the manufacturer's reputation.

More concerning still is when these components find their way into medical devices, aerospace, and military applications, that may have life or death implications. This issue, however, can be surprisingly complicated, with many nuances.

### Counterfeit vs copy

The term 'counterfeit' is a legal term, meaning an item produced using form or functional aspects protected under formal intellectual property rights that have not been granted to the producer by the rightful IP owner. Whether or not an item is technically a counterfeit is usually decided on a case by case basis in a local court of law. The onus can be on the rights holder to prove that they had previously applied for the appropriate rights, and that these rights



*In this counterfeit the receptacle and plug can mis-mate, potentially causing mechanical damage to contacts*



Authentic Redel on the left and counterfeit on the right

are properly maintained in accordance with local laws.

Companies found to be producing counterfeit goods can face potential civil and criminal liability, such as fines and payments of damages, as well as the confiscation of their goods. More importantly, purchasers and users of these parts can also face similar civil and criminal liability, often regardless of whether they knew the purchased parts were counterfeit or not.

Reading between the lines, if a local government does not accept a particular IP legal protection; if a third party is able to copy a product aspect that is not protected in their jurisdiction; or if the original manufacturer in other ways fails to protect their IP under local laws, then these copies may be technically legal in that country, even if specific aspects are brazenly recreated.

Of significant note, however, is that even if a product is deemed legal under local laws, it may be considered an illegal counterfeit as soon as it crosses the border into a country where those aspects are properly protected. This immediately exposes both the seller and the purchaser to potential legal ramifications in that country.

While the legal status of a component is obviously of critical importance to a purchaser, there are many other component

characteristics that can also cause significant damage, even if said copy is technically legal.

### How copies fail

**Inferior mechanical performance**—Quality connectors often provide several thousand mating/de-mating cycles, however, connector copies may become hard to operate and fail after just a few hundred operations, with pins bent or worn away.

**Inferior electrical and temperature performance**—Premium connectors need to withstand the applications for which they are intended. In one case, a genuine Lemo connector was rated for a temperature of more than 300°F at the outer housing and more than 480°F at the insulator. One customer contacted Lemo because their connectors were melting at temperatures as low as 200°F; however, on examination, the components turned out to be knock-offs. Fake connectors can blacken or melt during processes such as soldering, or in the heat generated by standard operating use, creating overheat conditions and/or shorts between contacts.

**Inferior materials**—Unlike genuine connectors, which use high performance materials, knock-offs may use gold tinted metal to replace real gold, reducing conductivity and inviting short term corrosion. In plastic connectors, high

quality engineering polymers such as PEEK insulator materials are replaced by lower performance materials, sometimes even coloring the plastic to mislead the eye.

**Dangerous materials**—Much has been written about radioactive scrap metals contaminated with dangerous isotopes finding their way into the supply chain. Premium manufacturers have reliable sources for safe and proven materials, however, those looking for the cheapest materials may demand less information on traceability and raw materials. Similarly, premium suppliers adhere to international directives such as the Restriction of Hazardous Substances Directive (RoHS), which maintains agreed upon limits on substances such as lead, mercury and cadmium. Knock-off manufacturers might not.

**Sloppy machining and finishing**—Knock-off manufacturers sometimes make use of less skilled labor; use low quality, non-maintained tools; or don't take time to properly complete each part. Stray metal burrs or chips that are conductive, uneven machining, and improperly packed insulation material can all lead to shorts or loss of signal. Inconsistent polishing or plating and subsequent lack of overall sheen are also common.

**Ethical considerations**—Quality component



Authentic Redel on the top and counterfeit on the bottom. Counterfeit Redel - 150° C max operating rated temperature. Clearly these materials are sub-standard



**Connector copies may become hard to operate and fail after just a few hundred operations**

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Whitepaper: Edge-based industrial machine vision applications



Industry is placing ever-greater emphasis on automation, particularly with the increasing deployment of Industry 4.0 technology. The following article investigates the role AI has to play in machine vision systems, and outlines the various hardware options available for edge-based machine vision applications.

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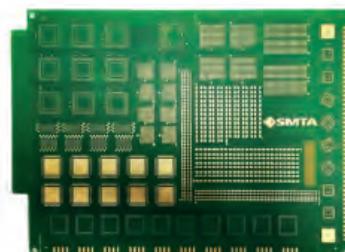
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# Counterfeit defence: a two-pronged approach

Independent inspection and test solution provider, Cupio, suggests a combination of both x-ray and electrical tests to provide an effective defence against counterfeits of all kinds

Counterfeit electronic components have long been an issue for OEMs in all sectors, even the military, mostly due to the pressures of supply and demand. Ideally, OEMs would simply buy directly from the component manufacturer or their authorised distributors, however, component shortages, can drive them to use other, unauthorised, channels, where counterfeits can enter the supply chain.

Counterfeits can take many forms. Some, although correctly functional, are standard components sold as higher specification types. Others are relabelled with no regard to their internal functionality – if any functionality exists. Yet more may be the right parts, but with manufacturing faults. Correctly functional types represent the biggest threat, because they could pass factory tests, only to fail in service, with possibly catastrophic consequences for both user and supplier.

Cupio therefore offers two counterfeit detection solutions. Both are effective defence tools, but, together, they provide a comprehensive ability to detect counterfeits, whether their functionality is right but inadequate, wrong, failed, or non-existent.

## X-ray inspection

The Nordson Dage Explorer One allows users to quickly see inside incoming components and compare the results with known good images. Importantly, devices can be inspected while still sealed in their shipping packs, making them physically and commercially easier to return if incorrect.

Anomalies in lead wires, die sizes and positions, and truncated pins can all be spotted by the Explorer One's x-ray inspection. High quality images are generated using proprietary technology, which allows detailed images down to 2µm resolution.

Explorer One can also be used with minimal training to maximise throughput. Image feedback is provided in real time, while automated inspection routines can be set up to save time when inspecting batches of components.

## Electrical testing

A device can be identified as a counterfeit if its performance doesn't meet its published specification. This can be checked using electrical testing using ABI Electronics' Sentry Counterfeit IC Detector. Sentry operates by acquiring so-called PinPrints of a reference device, for storage and comparison with other components.

A device's PinPrints are the electrical characteristics of each of its pins when submitted to a dynamic stimulus. Each pin's response is related to the device's nature, internal structure and manufacturing processes.

The Sentry can apply pin to multi-pin checks to ensure that it finds the best combination of tests, to look at the input and output construction of the component. These tests give the user a strong indication that the bond wire and die configuration within the device are the same as the master sample.

Goods inward staff with no electronics knowledge can

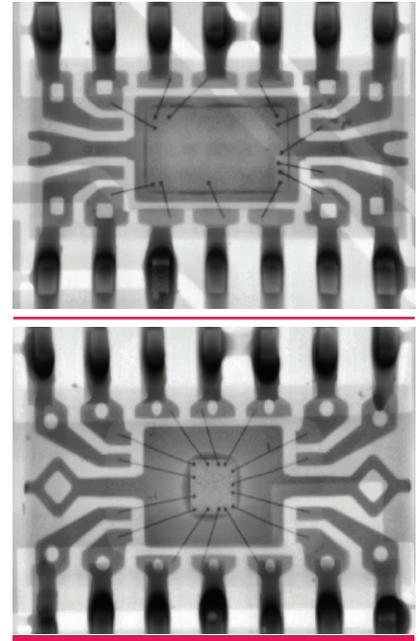
use Sentry to check incoming components' validity. Engineers and technicians can also apply it to generate in-depth reports for failure analysis or discussion with suppliers.

## Catching counterfeits

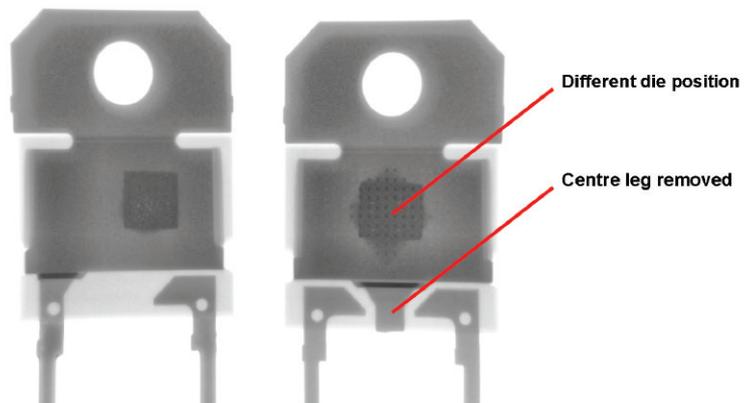
Technical director at Cupio, Andy Bonner, commented: "It makes sense to use x-ray inspection to quickly verify the die and pin configuration without unpacking parts while electrical testing can identify faults that inspection alone cannot reveal, such as bad inputs and outputs on the die, while also allowing more in-depth analysis.

"Irrespective of the strategy chosen, the benefit of capturing substandard parts before they can fail in the field is enormous; this prevents risk to the user and cost to the supplier, but also the ineradicable loss of reputation that would ensue."

[www.cupio.co.uk](http://www.cupio.co.uk)

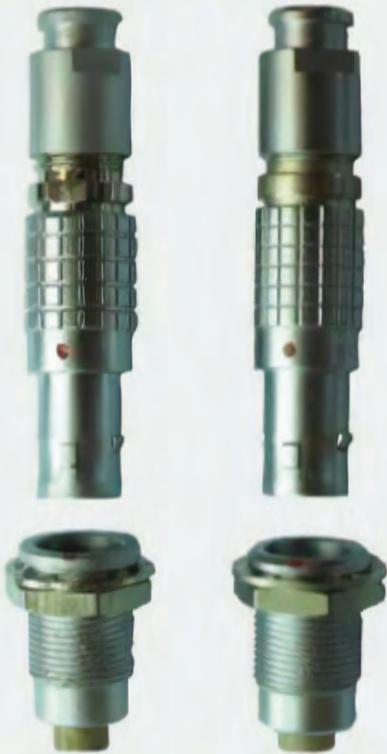


Issues with lead wires can be identified at goods-in



Automated x-ray inspection routines quickly spot anomalies

## Connectors



Connector on the left is counterfeit and on the right is authentic. Note on counterfeit connector the red dot is out of alignment and the finish is inferior

manufacturers avoid purchasing from suppliers that may not eschew child or slave labor, or that make use of conflict materials, and they maintain compliance with initiatives such as the EU directive on Registration, Evaluation, Authorisation and Restriction of Chemicals. Top tier suppliers back these assurances with documentation, while knock-off companies may not.

Indeterminate Underwriters Laboratory recognition—Top tier component manufacturers spare no effort to ensure that their products meet or exceed these stringent requirements. Knock-off companies often do not go to this trouble, nonetheless, some have been found to claim UL recognition, even fallaciously quoting the UL file number of their knock-off ‘victims.’

No FDA approval—Medical devices usually need to be approved by the Food and Drug Administration when

sold in the US, and/or by similar medical oversight organisations in other countries. Knock-offs might not be submitted for approval, despite erroneous claims.

Inconsistent products—Top tier suppliers provide components that are consistent in specifications and performance, lot to lot, even years later. This matches demand from equipment production life cycles, which may be measured in decades. Knock-off companies can change specs based on their latest batch of raw materials or suddenly discontinue a component to chase a higher profit opportunity.

Missing documentation—Top tier suppliers maintain lot traceability back to the source of raw materials for connector purchases from vetted authorised suppliers. Manufacturers of electronic components should be able to provide documentation such as a certificate of conformance covering information such as the manufacturer,

distributor, quantity, date code and inspection date, signed by the supplier’s approved signatory.

### Genuine supplier advantages

Not only will connectors sold by top tier companies carry appropriate documentation, they are usually supported by value added services as well. Lemo, for example, has a network of support and design experts located near key customer bases. They provide fast trouble-shooting assistance, as well as face-to-face product development expertise, along with samples and technical guidance.

Knock-off companies, on the other hand, often operate out of a single location and offer limited, if any value-added services. Furthermore, with no proven business track record, knock-off companies may be relative newcomers with a tendency to disappear, potentially leaving customers in the lurch.

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# All angles covered

*From component vendors to system integrators and end users, the International Institute of Obsolescence Management's biennial conference helps delegates mitigate obsolescence risks from every angle*

This June, the International Institute of Obsolescence Management will host its biennial conference in London, titled: *'Managing the Cost of Obsolescence - Developing Strategies for Obsolescence Management to Mitigate Risk and Reduce Through-life Cost.'*

Described as the largest event dedicated to obsolescence anywhere in the world this year, this international, multi-sector conference covers the entire supply chain, from component vendors to system integrators and end users.

### Update your strategy

The three-day event starts on Tuesday 11 June with two workshops: *'Designing to Avoid Obsolescence at the Concept and Proposal Stage'* and *'Obsolescence Management and Supply Chain resilience.'*

Conference proceedings begin on 12 June, during which there will also be an exhibition area with stands from more than a dozen companies offering obsolescence solutions and training.

In all, twenty-four papers will be presented at the conference on all aspects of obsolescence management. Speakers come from globally recognised companies, including Alstom, Arrow Electronics, BAE Systems, BP, Honeywell Technology Solutions, IHS Markit, Lockheed Martin, Safran Electrical and Power, US Department of Defense and Ultra.

Managing director of electronics interconnect specialist, Winslow Adaptics, Teri-Ann Winslow, commented: "We are pleased to be principal sponsor at this year's event. Obsolescence management is a fundamental part of any successful business

today and there is always something new to learn."

### Make global connections

Advance registration has attracted delegates from more than fifteen countries, mainly from Europe, but also India, New Zealand and the USA.

This international flavour reflects IIOM's efforts as a global community. The organisation comprises more than 240 companies and more than 600 individuals that discuss best practice, practical solutions, generate standards and guidance. IIOM has active chapters in the UK and Germany and will soon have operating chapters in India and the USA.

Since 2015 when IIOM was formed, it has been developing a process for obsolescence professionals to be internationally recognised as an associate, member or fellow. This international recognition enables career mobility and is increasingly important in the context of multi-national projects. The associate grade is already in place, with the first candidates successfully completing an accredited course delivered by one of IIOM's endorsed trainers.

Delegates can find out more about the scheme at the event, which will also see a broad array of experienced personnel presenting, exhibiting and networking. In this way, the conference combines education, knowledge-share and the opportunity to develop new business opportunities—can you risk missing out?

To register go to <https://lnkd.in/gZ-wnsD>

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**Conference proceedings begin on 12 June, during which there will also be an exhibition area with stands from more than a dozen companies offering obsolescence solutions and training**

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## Astute - 30 Years of Global Growth

**Astute Electronics is an exciting and bold success story - and a British one at that**

There's a long history of mergers and acquisitions within electronics distribution. Consolidation remains one of the easiest ways to grab new customers and inventory while diversifying your markets, but it also provides a way out of a challenging business landscape. With rapidly changing technology, component shortages, global competition and ever tougher compliance legislation, little wonder so many distributors seek acquisition.

To remain not only proudly independent but expand your global reach into new territories, investing in new facilities, services and talented staff in 10 countries, while staying true to your core values, is no small achievement. This year, Astute Electronics, headquartered in Stevenage, celebrates 30 years in business

as an independent electronics distributor with a global reach. There's an exciting and bold success story - and a British one at that.



Founder and Managing Director, Geoff Hill, says their success is driven by a single principle: adding value in the supply chain. "When I set up the business in 1989, it was about component sourcing targets for high-reliability customers, particularly defence and aerospace. 30 years later this remains the same, but the

complexity of our customers has changed and their demands are greater.

**"We help customers to weed out these threats and focus on Safe Supply"**

"As a business, we've always asked the question: what benefits can we bring? Everything I've done in 30 years is customer-led. For instance, counterfeit product has been a growing problem, especially in the last two decades. It exists in most industries but it's particularly hazardous in aerospace and defence equipment. That's why we set up component test labs in the UK and US and we incorporate the AS6081 standards into our extensive ACAP Anti-Counterfeit Avoidance Programme." With current volatility in the component supply chain, extended lead-times and rapid obsolescence cycles, it's even more important that we help customers to weed out these threats and focus on Safe Supply, says Geoff.

Astute electronics was the first European distributor to attain the AS6081 standard and proudly the only distributor with AS6081 accreditations across either side of the Atlantic. It is a key member of the UK's Ministry of Defence Anti-Counterfeit Working Group as well as ADS Group, ERAI and the Anti-Counterfeiting Forum.

**"We are the people who keep our customers on the right lines"**

"In our business, the majority is high mix, low volume and high complexity," says Geoff. "You have to recognise there's long-term platforms and long-term design cycles in the context of a fast-moving technology landscape. If you're building 50 or a 100, against a market where they might be making 100,000s or millions, it's hard for manufacturers to get excited over smaller volumes. But it's critical you continue to get support, so we keep the manufacturer interested and excited, acting as the conduit to make sure that support remains in place. Our goal is to be a technology solutions provider. We've added a dozen electronics engineers to advise customers at the design-in stage, providing technology inputs as well as advice on long-term availability. We are the people who help to keep our customers on the right lines."

**"UK manufacturing - not the cheapest but technologically superior"**

What other changes has Geoff seen during the last 30 years? "Innovation is the drive - UK manufacturing may not be the cheapest but

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MT41K512M16SN-125 :A TR	AS4C512M16D3L-12BCNTR
MT41K1G8SN-125:A	AS4C1G8MD3L-12BCN
MT41K512M16HA-125 IT:A*	AS4C512M16D3L-12BIN

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## Direct Alternative Available at Astute

The above Micron single-die 8G DDR3L SDRAMs (and Alliance Memory identical replacements) are now available at Astute Electronics.

you'll get something technologically superior and we'll get it to market quicker," he says. "There's little advantage to our customers just handling and buying product - they excel at design and marketing. If they want something done, they want it engineered, programmed, modified, kitted or shipped somewhere in specific consignments, Astute is here to help.

"We come in with design-in skills, agility, value, and then when it gets into production we provide efficiencies - vendor reduction, logistics and legislation compliance, which is all part of the complexity of today's business." The support goes from cradle to grave, extending throughout the entire product life-cycle to include help with stock management and obsolescence. Astute is an active member of the IOM (International Institute of Obsolescence Management) and they've recently added 19 nitrogen long-term storage cabinets to their Stevenage facility. They can advance purchase on behalf of customers or provide facilities for their existing stock.

"I wish I was 20 years younger.

Everything is so exciting!"

Geoff concludes by saying, "It doesn't feel like 30 years because I'm so excited about the business - I wish I was 20 years younger! Everything is so exciting - the global stage is available to everybody, perhaps even more so after Brexit - if it happens - and I just think it's a fantastic time to be in business. I've had many years when the industry was up and down, but I now see a hunger for investment and working together. I think the next five years will be the best five years the business has seen."



[www.astute.global](http://www.astute.global)

## 30 Years Supporting Obsolescence Management

Astute has been navigating the global component markets for three decades, helping customers through difficult, rapidly-changing conditions, challenges and threats such as counterfeit components, obsolescence and allocation. Our priority has been, and always will be to safeguard our customers' supply-chains and provide proactive solutions.

the need for a more flexible, agile distribution model. Our aim is to support customers in high-reliability industries on a wide variety of commodities. Services including Safe Supply, Design Support, Astute 3PL and Obsolescence Management will continue to adapt to our customers' requirements and take us into the next decade, as we meet an age of rapidly evolving technologies.

From day one, Astute became an integral part of the UK electronics industry, as company-founder, Geoff Hill, recognised

Freddie Roe  
 Director - Aerospace & Defence

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

# Anti-counterfeiting: protect the brand

In this article, John Denslinger argues that when faced with difficult purchasing decisions, buyers should make brand protection a prime objective

Anti-counterfeiting • By John Denslinger

**F**or several years now, a lot has been written about the perils of counterfeit components. Countless articles have extolled the virtues of buying solely through the authorised channel. 'Caution and concern' are the typical descriptors employed by many raising and maintaining awareness. I too strongly recommend the procurement community should always source directly from suppliers and their authorised distributors. The authorised channel is still the best and only safeguard against counterfeit components entering the supply chain. Helping the industry resolve counterfeiting is a core tenant of ECIA, with its initiatives and recommendations presented at [www.ecianow.org](http://www.ecianow.org).

Under any buying scenario I can think of, caution and concern is a normal reaction. The next step though, taking action, is more about protecting the brand. Too often that one per cent sourcing problem consumes one hundred and ten per cent of your sourcing energy. I can easily appreciate the need to move swiftly when the heat is on. If you're the buyer, it's one thing to mistakenly purchase counterfeit components or take calculated risks with the best intentions, but it is a whole different matter when that action injures the company: injures its brand.

Brand is nothing more than your company's good name, goodwill, reputation and alike. Brand is how you want your company perceived by your customers, suppliers, employees, investors, shareholders, etc. In short, when the logo appears how do others see, feel, think, and regard the company. Historically, companies will go to great lengths to:

- Build the brand via promotion, image advertising, community engagement, education, etc
- Enhance the brand via product development, commitment to exceptional quality and customer service strategies, acquisitions, etc
- Protect the brand externally via patents, litigation, partnerships, etc

- Protect the brand internally via policies, procedures and processes

To a company, establishing and maintaining a best-in-class brand is everything and arguably most expensive.

Perhaps a sidebar is in order at this stage. It's important to connect two global dots that are often overlooked: is it counterfeit or is it fake? A little more than a year ago, I had the opportunity to address a large group of local Chinese and international component distributors and manufacturers in Shenzhen at an event hosted by CEDA. In the course of that presentation, I quickly realised fake was the term most commonly used in that part of the world, not counterfeit. Also of note, they too expressed a similar frustration in policing fake products similar to their western counterparts. So if your supply chain tends to be global in nature, keep in mind counterfeit and fake are one and the same.

So in summary, every counterfeit or fake product situation still demands a measure of caution and concern. Perhaps it is not realistic to say each and every shortage has an authorised channel solution, but if you find yourself in that situation, be vigilant. Protect your brand first and foremost. Make that the prime motivation for your sourcing decision.



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# Why fan choice matters

*Working methodically through system requirements helps buyers identify the right fan for their cooling needs, as John Roe of fan manufacturer, Micronel, explains*

Fans rotate to provide airflow that cools electronics. It sounds simple, but when it comes to purchasing the correct fan, buyers must consider all the specifications. Taking a step by step approach is essential.

**Fan input voltage:** A fan won't work if you can't power it, so make sure you know the voltage input first. Common voltage inputs are 12, 24, or 48V DC, and 115 to 220V AC. Micronel also offers lower voltages, which can be used in battery and portable equipment. Make sure the fan current is not too high for your power supply.

**Fan size:** Fan size may be determined by available space but bigger doesn't always mean better cooling. Conventional frames list the sizes in millimetres, with the most common being 40 by 40, 60 by 60, 80 by 80, and 120 by 120. Micronel offers very small options down to thumbnail sizes such as 16 x 16.

**Bearings:** Your choice of bearings can influence life and noise. Ball bearing fans are durable at high temperatures and relatively quiet at high speeds, with a long lifespan, often over 60,000 hours. Sleeve bearing fans are quieter and less

expensive but can have a shorter life.

**Speed, pressure and airflow:** Combine the fan speed with the static pressure capability to find the airflow of the fan. This tells you which fans push around the most air and can overcome system resistance to provide the most cooling. Micronel specialises in high pressure fans that can force air around densely packed electronics or along tubes to ensure cooling airflow reaches all parts of a system.

**Guards, filters and connections:** Most fans have a simple two-lead



Your choice of bearings can influence life and noise

positive/negative connection, but some may include extra leads for a tachometer, non-operating signal, locked rotor protection or speed control. Fan guards and filters provide physical protection from debris and the environment to prolong fan and system life.

[www.micronel.co.uk](http://www.micronel.co.uk)

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# Distributors become more strategic to buyers through acquisitions

*Electronics purchasers are finding that consolidation in distribution is improving the capabilities and enhancing the value of distributors*

Many strategic electronics purchasers are often skeptical when they hear about one large electronics supplier acquiring another, fearing it may lead to less competition, higher prices and poorer service.

In recent years, buyers have been especially concerned with consolidation in the semiconductor industry where there have been 74 mergers and acquisitions over the last four years, some of them involving the world's largest chipmakers, according to researcher IC Insights. However, there also has been consolidation in electronics distribution as larger distributors have acquired smaller, sometimes specialised distributors that have the product families that supplement the acquiring company's own portfolio or provide larger distributors with entry into an underserved geography.

Mergers and acquisitions in distribution aren't just about one distributor acquiring another. Distributors' acquisition strategies are changing because the needs of customers are changing. Some large distributors are acquiring software companies or companies that specialise in providing services to OEMs to help them bring products to market faster and more efficiently. Other acquisitions have involved distributors buying companies that help OEMs develop and implement Internet of Things or artificial intelligence

products and applications. Some acquisitions are for companies that provide product refurbishment and asset recovery and disposal services.

Large distributors are making acquisitions to help them service customers throughout the product lifecycle from product design to product disposal. They believe they need to have such capabilities to succeed in an ever-increasing competitive electronics marketplace.

This can be good news for buyers who purchase the bulk of their production requirements through distribution because distributors may be able to serve as a one-stop shop not only for semiconductors and other components, but for services throughout the lifetime of a product.

The acquisitions that large distributors have made in recent years reflect change in their M&A strategies as well as their overall business strategies. Arrow Electronics, based in Englewood, Colo., says it makes strategic acquisitions to grow sales faster than the market, increase the markets served, grow profits faster than sales, and increase return on invested capital. The idea is to broaden Arrow's product and value-added service offerings, increase its market penetration, and expand its geographic reach.

The distributor says acquisitions supplement its organic growth and broaden its digital capabilities to meet the evolving needs of customers and suppliers. "These acquisitions also expanded the global components business segment's portfolio of products and services offerings at every phase of technology deployment, including custom hardware and software, and new Internet of Things based business models," the company said in a recent 10-K filing.

Arrow's recent acquisitions include eInfochips, Immixgroup, and Commtech. Einfochips is a product engineering and semiconductor design services house that specialises in IoT, and product transformation capabilities. Immixgroup is a value-added IT distributor. Commtech is a value-added distributor specialising in infrastructure and securities focusing on data centers.

One distributor that has been active with acquisitions is Avnet. Over the past four years, Avnet has acquired distributors Premier Farnell and Orchestra Service GmbH, a specialist German IT distributor of storage solutions and services focusing on EMC products. But it has also acquired software and services companies including Softweb Solutions, Hackster Inc. and Dragon innovation. Softweb



Avnet CEO  
Bill Amelio



**We want to be able to service customers from the inception of an idea all the way through full-scale production and then to end-of-life, the full lifecycle of a product**

is a software and artificial intelligence company that provides software solutions for Internet of Things (IoT) applications and systems to ramp up efficiency and speed time to market for businesses. Dragon Innovation helps hardware companies of all sizes move from prototype to high-volume production quickly.

Hackster.io is an online community that helps users learn to design, create and program Internet-connected hardware.

### Servicing the lifecycle

Avnet CEO Bill Amelio said that the acquisitions have helped Avnet better serve its customers. “We want to be able to service customers from the inception of an idea all the way through full-scale production and then to end-of-life, the full lifecycle of a product,” he said. At the same time, Avnet has been able to “take out complexity, cost and improve time-to-market for our customers because we have pieced together acquisitions in a very thoughtful way,” he said.

The acquisitions have also positioned Avnet “to be a technology solutions company and not just a distributor,” said Amelio.

In 2016, Avnet acquired Premier Farnell, a small-volume, high-service distributor that focuses on design and new product introduction. Premier Farnell is helping Avnet to grow organically because Premier Farnell works with OEMs on design of new products. Once those new products go into volume production, Premier Farnell can “hand over leads to Avnet,” he said.

Amelio said that it is rare for Avnet to make acquisitions to acquire product lines. “We already have kind of the Who’s Who of suppliers. When we do an acquisition, it’s typically to pick up a geography or to improve its footprint within a certain geography,” he said.

Amelio added when Avnet considers acquiring a company, it factors in whether the acquisition will help Avnet improve its business in high-growth vertical markets.

With Avnet’s existing customer base, those vertical markets include automotive, industrial, mil-aero, “and to a lesser extent, communications, consumer. We see plenty of growth potential in industrial and automotive space as more things are electrifying” and more components are needed for those products, Amelio said. For instance, even though unit sales of cars were “muted this past year, the electronic components inside the cars continue to accelerate. That’s a great growth position for us,” he said.

Avnet also factors in whether an acquisition will help attract new customers. One example is Internet of Things. “There probably isn’t a day that goes by when you don’t hear something about IoT,” said Amelio.

Many companies with little or no previous experience with electronics want to connect their products to the Internet. Startups are building new IoT products. “IoT is very difficult to implement for most companies,” he said.

One of the things that Avnet has done with its acquisition strategy is “put together one-stop shopping at Avnet” for customers looking for an IoT solution, said Amelio. “We’re able to do the device, the network, the gateway, the cloud, the analytics, write the applications and give the customer insights,” he said.

Another distributor that has made significant acquisitions is TTI, based in Fort Worth, Texas. TTI acquired Mouser Electronics in 2000 and a number of other distributors since then including Astrex, Sager, and Capsco. In 2017 TTI acquired semiconductor specialist Symmetry

Electronics, and last year TTI bought RFMW, another semiconductor specialist and Changnam, a specialty distributor of semiconductors for the automotive, consumer electronics, industrial and wireless end markets, based in South Korea. It also acquired Compona AG of Switzerland and Compona’s German subsidiary Cosy Electronics GmbH. Both Compona and Cosy are specialty distributors of interconnect products and provide services such as in-house assembly of specific connector ranges and full support on custom cable harnesses.

### Some say no to M&A

Many distributors make acquisitions to grow sales and market share, but not all are convinced that acquisitions are necessary to improve financial performance. For instance, Future Electronics, based in Montréal, has only made about five acquisitions in the entire history of the company, said Dan Casey, executive vice president. All of the acquisitions were small.

“Sometimes it was for a supplier line or to gain immediate entry into a region of the world,” he said.

For instance, about 15 years ago, Future purchased Austrian distributor Steiner. “We thought rather than putting an office in Austria we would acquire a local Austrian distributor that was very strong on demand creation side, but didn’t have a big warehouse, didn’t really have an IT infrastructure,” said Casey. Future acquired some small distributors in China in the 1980s and acquired a company that specialised in production supplies. Its last acquisition was 2008 when it bought PN Electronics in France, a distributor of electromechanical, passives and semiconductors.

It has not made big acquisitions as Arrow, Avnet and some other global



**Dan Casey**, executive vice president at **Future Electronics**



**We have found that the acquisitions have not been accretive to our business**

distributors have. “We have found that the acquisitions have not been accretive to our business,” said Casey. “Acquisitions are a lot of work unless you have a team that specialises in M&A and we don’t. We’ve always grown organically, which suits us,” he said.

While acquisitions can be beneficial because a distributor can gain access to customers, acquire new product lines and boost sales, there are some advantages to not pursuing them, said Casey.

When a distributor acquires another, there can be issues with warehouses, inventory, and supplier alignment, according to Casey. In addition, the acquired company has to adapt to being part of a larger company “where maybe they (the acquired company) doesn’t make all the decisions at all times. That can be challenging for the management of the ownership of the company that was acquired,” said Casey.

He noted that Future has “a unique, very deep culture. It is one of our strengths globally and then when you bring someone in who is used to just doing things differently, it is quite a big adaptation for them to learn and accept,” said Casey.

Casey acknowledges that large global distributors such as Arrow, Avnet, WPG have been very “acquisitive” and have

increased their top lines by purchasing other distributors and other companies. “They have bought companies that were well in excess of \$1 billion. Overnight they certainly added to the top line,” said Casey.

However, as more acquisitions occur, eventually it will be impossible to consolidate, according to Casey. “I don’t know if they can make any other acquisitions in North America except for some small regional distributors. If there is consolidation, it likely will be in Asia,” he said.

#### Organic growth only

Another distributor that is averse to acquisitions is Digi-Key, based in Thief River Falls, Minn. Digi-Key has chosen to grow organically, not through acquisitions. Dave Doherty, Digi-Key president and chief operating officer, said Digi-Key has had robust growth for years without acquisitions.

“We’ve been fortunate that organic growth has been more than sufficient to satisfy our needs and bring value to our customers,” he said. He noted there are several reasons why a distributor acquires another and they often are directed at serving the needs of shareholders, not customers.

Sometimes a distributor will acquire another distributor to grow market share or enter a region that the distributor is not currently serving. Some companies

need to make acquisitions to be economically viable. For whatever reason, the distributor may be “in a difficult situation” financially and may decide to acquire a company to improve its economic standing.

“Often that goes hand-in-hand with cutting costs,” he said. “If they can acquire and consolidate backroom offices, whether it’s HR, IT or whatever” it can help improve the distributor’s financial status, said Doherty.

He said because Digi-Key is privately owned, it only has to serve its customer base, not shareholders. “I don’t know if you can serve shareholders and customers the same way,” said Doherty. “They have disparate needs and often times you’re compromising one versus the other,” he said.

Doherty added that there’s something about staying “smaller and nimble and to stick to what you’re good at.” He noted that while Digi-Key has not acquired companies, it works with IT and web partners to address the needs of customers.

While, Digi-Key has not made acquisitions to grow sales, “this is not a never strategy. We have just never found a need to have to do it,” said Doherty.



**Dave Doherty**, president and COO of **Digi-Key**



**We’ve been fortunate that organic growth has been more than sufficient to satisfy our needs and bring value to our customers**



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# Going above and beyond



ESD precautions include ionisers, gloves and wrist straps

*When servicing the aerospace, military and space market, suppliers must adhere to stringent quality requirements. Here Falcon Electronics explains how it strives to meet and exceed those expectations*

Companies that service the aerospace, military and space sector must adhere to the stringent quality requirements and flow downs that AMS customers rightfully demand. The quality needs of this market are increasingly challenging and although third-party audits are performed, distributors such as Falcon are also frequently audited by customers to ensure compliance.

## Quality processes

One of the main requirements for aerospace clients is AS9120, a certification specifically designed for electronic component distributors that service this industry. Certification covers quality processes, procedures, and training, with customers such as Boeing, BAE, Honeywell, and Lockheed conducting audits based on the standard. Non-conformance could involve training records not updated, procedures not followed, ESD testing not performed, or a scale not properly calibrated. Annual internal audits must therefore cover all areas of the quality management system to mitigate non-compliance.

ESD procedures at Falcon comply with ANSI S20.20 and JESD625 B, which dictate strict handling protocol. The company can also handle class zero product, which requires specialised work areas and extra precautions such as ionisers, gloves, wrist straps, appropriate storage and ESD class 0 labels.

Another major concern is foreign object debris prevention. Auditors look for food, water, dust, or other debris on and around the work station, as well as scrutinising the physical condition of storage boxes and of the warehouse itself. At Falcon, a clean-as-you-go policy supports the required housekeeping and all employees are trained annually about FOD so they understand the problems it can cause.

## Eliminating risk

AS6496 establishes procedures for the avoidance, detection, and disposition of counterfeit products in authorised distributors and their supply chain. Auditors begin by verifying where product is from so an approved vendor list with only authorised OEMs and distributors is essential. Auditors will also review manufacturers' certificates of conformity to ensure full traceability.

Falcon records manufacturers' lot and date codes in its QMS for all product. A Falcon generated lot code can trace product back to the original manufacturer's purchase order and these records are kept for a minimum of 10 years.

Falcon's return merchandise authorisation process is also strict. All returns are inspected to verify the product was originally purchased from Falcon, ensuring product from brokers cannot enter Falcon's

inventory. All employees receive counterfeit training, so they understand the risks and potential damages counterfeit parts can cause for customers.

## Staff training

In addition to regular in-house training, the quality inspectors and quality manager at Falcon all hold AS13001 certification, which is the first step to becoming a delegated product release inspector. Delegated product release verification is the process whereby a supplier has the authority to act on behalf of another to release products or services directly to the customer's production floor.

Falcon's DPRV process is compliant with SAE AS9117, which combined with the extra AS13001 training and any customer specific training, gives Falcon's quality inspectors a higher-level qualification.

With these processes, policies and procedures in place, non-conformance can be eliminated and customer audits go smoothly, working effectively to provide protection across the supply chain.

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**Auditors will review manufacturers' certificates of conformity to ensure full traceability**



Falcon can handle class zero product, which requires specialised work areas and extra precautions

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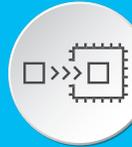


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# Safe supply is paramount in a volatile marketplace

*With extended lead times and rapid obsolescence cycles, the risk of encountering counterfeit components just keeps mounting. Safe supply has never been so important, says Astute Electronics*

Counterfeit material exists in most industries but nowhere is this issue more threatening than in life critical systems in aerospace and defence equipment. The importance of a secure, warranted supply chain cannot be overstated — problems caused by counterfeit electronic components represent an unacceptable risk of catastrophic failure.

Effective counterfeit mitigation is paramount to identify any counterfeit activity such as re-marking or refurbishing components to disguise bad quality, old branding and part numbers. In extreme cases, components may be completely reprogrammed to deliberately compromise the integrity of an aerospace or defence application.

The ERAI recently announced that independent distributor, Rogelio Vasquez, aka Roger Vasquez, aka James Harrison, pleaded guilty to knowingly supplying counterfeit parts to the US military, including parts that were historically used in military applications such as the B-1 Lancer Bomber aircraft.

This is just one of many examples. Counterfeiting is hugely profitable and although there have been some high profile cases resulting in substantial fines and criminal sentences, the threat is still very real. It is therefore an industry-wide responsibility to strategically eliminate risk from the supply chain.

**Eliminating risk**  
Monitoring counterfeit activity via forums such

as ERAI is an effective way of keeping informed. Since 2001, ERAI has been collating a non-conformance image library, which enables users to understand and identify various types of counterfeit material for themselves. Participants can also report any counterfeit material, with information fed back to thousands of industry professionals that will benefit.

Distributors supplying components into the aerospace industry should have a clear understanding of suitable standards or be AS6081 accredited. Astute Electronics incorporates the AS standards into its anti-counterfeit avoidance programme, which also offers additional tests such as scanning electron microscopy and energy dispersive x-ray

spectroscopy, Dataman, solderability testing and Diagnosys for part authentication.

Accredited test labs should issue reports for non-traceable products. A key rule of thumb is that components should be either traceable or come with an adequate test report. If a supplier cannot provide either of these, then it should be considered a risk to supply the parts into any aerospace application.

Astute sales and marketing director, Mark Shanley, concluded: "With current volatility in the component supply chain, extended lead times and rapid obsolescence cycles, it's even more important to be aware of the threats."

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# Aerospace: a no-fly zone for counterfeits

To reduce supply chain risk, authorised distributor, Mouser Electronics, has been certified to the aerospace industry's uber-vigilant AS6496 anti-counterfeiting standard

Understandably, the aerospace industry has high standards regarding anti-counterfeiting measures in authorised electronic component distribution, as set out in the AS6496 accreditation process. Now Mouser Electronics has achieved this certification, demonstrating its commitment to quality in this exacting industry sector.

Mouser received accreditation in fall 2018 from the Performance Review Institute as part of the Counterfeit Avoidance Accreditation Program. The CAAP audit was based on audit criteria AC7403, created jointly

by PRI, the Electronic Components Industry Association and aerospace OEM representatives.

Designed to mitigate the risk of introducing counterfeit parts into the supply chain, CAAP is a cooperative industry effort reducing the cost of compliance throughout the aviation, space and defense industries. The program was established to enable organisations that purchase components and assemblies to demonstrate they have systems in place to identify counterfeit products, and to minimise the risks associated with them. CAAP accreditation reassures

customers of a supplier's vigilance and ability to act appropriately. Efforts made all the more important by the Defense Federal Acquisition Regulation Supplement issued by the US Department of Defense.

Vice president of quality at Mouser Electronics, Chuck Amsden, explained: "By becoming accredited to AS6496, Mouser demonstrates commitment to providing customers with only authorised, genuine components. At Mouser, we



AS6496 requires authorised distributors to have a counterfeit mitigation policy and parts control plan

can provide full traceability to the manufacturer on everything we sell. From sales to shipping, Mouser is committed to providing customers with the right product, on time, every time."

To achieve these goals, the AS6496 aerospace standard sets requirements for the avoidance, detection, mitigation and disposition of counterfeit products in the authorised distribution supply chain. It requires authorised distributors to have a counterfeit mitigation policy and a counterfeit electronics parts control plan, making it relevant to all industries and individuals looking to reduce the risk

of counterfeit electronic parts entering the supply chain.

In addition to AS6496, Mouser Electronics is also registered to AS9100D/ISO 9001:2015 and ANSI/ESD S20.20-2014, the industry's gold standards for quality, control and electrostatic discharge. Mouser's quality management system also sets down additional aviation, space and defense industry requirements demonstrating its ability to provide traceability, risk management, process control, customer support, product availability, document and record control.

Thus, despite growing concerns over counterfeit parts, purchasers can order with confidence, knowing that Mouser has rigorous processes in place to prevent counterfeit products from entering inventory.

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# High-brightness LED shipments will rise, but tags will fall

*Expect a buyer's market for LEDs through 2019 despite healthy unit demand*



James Carbone

Despite healthy unit demand, prices for high-brightness light emitting diodes (LEDs) will decline an average of 3.2 per cent in 2019 because overcapacity has resulted in a supply glut.

While LED tags will decline, the worldwide high-brightness LED market will grow 7.6 per cent because of strong demand from automotive systems and interior and exterior lighting applications.

The global high-brightness LED market grew 11.8 per cent to \$13.5 billion in 2018 and will rise to \$14.5 billion in 2019, according to researcher IC Insights. LED shipments will increase from 233 million units in 2018 to 257.5 million in 2019 and to 274.2 million in 2020, the researcher said.

However, overall slower economic growth that is expected in 2020 will result in only 2 per cent revenue growth for LEDs when the market will total \$14.8 billion. "Then the LED market will start to recover after 2020," said Rob Lineback, senior research

analyst for IC Insights. "We won't see a real setback in 2020, but a slowing," he said.

Continuing overcapacity will also contribute to slower growth for LEDs. "We had a glut of high brightness LEDs for a few years and we still do," said Lineback. "Oversupply resulted in all suppliers cutting prices, which is good for buyers, but not for LED manufacturers," he said. Such suppliers include Nichia, Osram, Lumileds, Seoul Semiconductor and Samsung among others.

Buyers can expect oversupply to continue for a while. Some manufacturers may transition LED production to larger size wafers which would result in more LED chips per wafer. Most LEDs are produced on 100mm and 150mm wafers. "There's been a lot of talk about moving to 200mm wafers," said Lineback. "Samsung has done some work on it and a Chinese manufacturer has said it is developing the technology."

If LED production switches to 200mm wafers, it will result in

more capacity at a time when the LED industry is trying to deal with overcapacity. "Extra capacity is not needed," said Lineback.

Another issue with moving to a larger wafer is quality. "The long-term quality and reliability of these devices is getting a lot more attention. As you keep increasing the wafer size it puts pressure on maintaining some consistency," said Lineback.

#### Demand stays strong

While there is an overabundance of capacity, demand for LEDs remains strong. Interior and exterior lighting are the biggest end market segments for high brightness LEDs. Interior lighting represents 18 per cent of total sales, while exterior lighting applications account for 13 per cent of LED revenue.

"Those segments are growing pretty well, but the high growth is really in automotive," said Lineback. "It was 11 per cent of total sales last year and will grow to 15 per cent in 2023," he said.

"LED is not close to saturation in automotive," said Lineback. "They keep adding sockets in cars for LEDs." Headlamps have been in to a big area of growth because LEDs are increasingly being designed into less expensive cars and not just luxury models, he said.

However, while automotive is designing in more LEDs into more vehicles, other market segments have already become saturated with the devices and growth in those segments will be muted over the next several years. Those segments include cell phones, computers and televisions.

Backlighting in cell phones and mobile devices like tablets account for about 16 per cent of the LED market. LEDs used in computer and televisions represent 13 per cent of global LED revenue, according to IC Insights. "Backlighting in televisions was really a hot area that was driving a lot of sales at the beginning of the decade," said Lineback. "However, that is one segment that got saturated

## By the Numbers



**7.6%**

The expected rate of growth for the global high-brightness LED market in 2019 Source: IC Insights



**6.1¢**

The forecasted average selling price of a LED in 2019 Source: IC Insights



**\$19.4 billion**

The forecast size of the high-brightness LED market in 2023 Source: IC Insights



**2.6%**

The forecasted annual decline of the average price of an LED from 2018-2023 Source: IC Insights



**\$13.5 billion**

The size of the worldwide high-brightness LED market in 2018 Source: IC Insights



because Chinese manufacturers started to build LEDs for televisions as televisions reached LED saturation.

“Chinese poured a lot of money to increase their capacity to become more self-sufficient and to take a position as well as a global supplier,” said Lineback. “That put a lot of pressure on the average selling price because there was a glut of capacity for backlighting in televisions and computer displays,” he said.

Then the PC market stalled out and there were over optimistic forecasts for televisions sales. As a result, there was excess LED capacity and supply which drove down prices, said Lineback. That overcapacity continues today.

The industry is working through overcapacity but there is still price pressure on ASPs. In fact, the average selling prices is expected to drop 3.2 percent in 2019 and 4.4 percent in 2020. From 2018-2023, the average LED selling price will decline 2.6 percent, the researcher said.

**New construction drives LEDs**  
Besides automotive, more

LEDs will be used in general illumination applications in homes and businesses. LED lighting fixtures are often used when new houses and businesses are built. In 2018, the installed base of LEDs in residences, businesses was about 20 per cent. By 2023 will grow to 50 per cent, said Lineback.

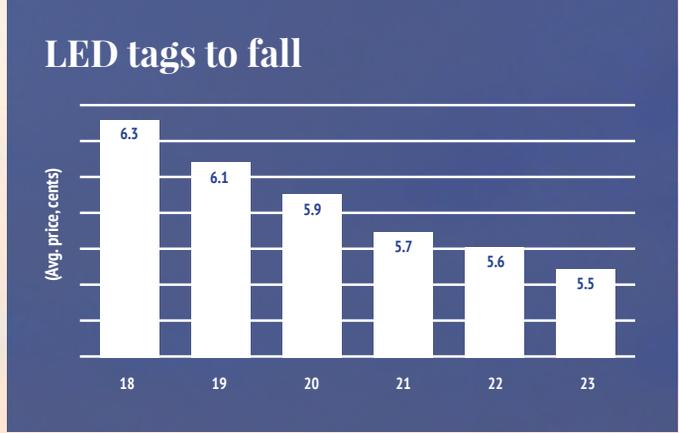
“The U.S. Department of Energy has forecast that light emitting diodes will account for 86 per cent of installed lights by 2035, said Lineback.

However, while there is growth in LED demand for new construction, LED demand may drop off over time because LEDs have lifecycles of 8 to 10 years. That means they don’t have to be replaced as much as other types of illumination such as incandescent, fluorescent and halogen.

Because of saturation in some market segments and a long replacement cycle, the growth rate overall for LEDs is slowing compared to 10 years ago.

**LED market matures**  
Analysts say slower growth

Prices for LEDs will fall through 2023 when the average price is 5.5 cents  
*Source: IC Insights*



rate is indicative of a mature market. “You used to be able to characterise the LED market as a high growth market,” said Jamie Fox principal analyst technology for IHS Markit. “But things have changed a little bit and you can more or less characterise it now as a more mature market,” he said. But that doesn’t mean it’s a steady market.

“There is still a long way to go to the point where it’s become a stable market,” said Fox. “Even though there is unit growth, there is price erosion. It has its up and downs. Some years there’s double-digit growth. Some years it has declined,” he said.

While the LED market may be considered mature, it does not mean it won’t grow in the future. In fact, future growth is likely as LED technology changes which will boost demand.

One technology that buyers should keep an eye on because it could increase LED demand is microLEDs, according to Fox. Micro-LEDs are comprised of an array of microscopic LEDs

that deliver better contrast, higher brightness, greater energy efficiency and response times than LCDs.

MicroLEDs will be used in small, low-energy devices such as smart watch and smart phones as well as large screens. In fact, Samsung has displayed a 146-inch TV that uses micro-LEDs. MicroLEDs used in televisions will have greatly reduced energy requirements. Micro-LEDs could also be used in large outdoor displays such as stadium displays.

“MicroLEDs could add multi millions of dollars into the LED market,” said Fox. However, it may not happen for a while as microLEDs are difficult to manufacture. “Micro-LEDs are in the development stage and not yet mass-produced,” said Fox. “Mass production is negligible.” It may take five years before they are produced in large volumes.



The worldwide market for high brightness LEDs will post healthy growth through 2023 when the market totals \$19.4 billion.  
*Source: IC Insights*

# Fanatical about cooling

*As components grow more powerful and enclosures continue to shrink, heat dissipation can limit performance. Active cooling is essential for successful operation, explains Gelec*

Choosing a suitable fan at the outset of any project can help to avoid costly future repairs or returns. A specialist distributor should offer useful advice on fan selection by understanding the application and operating environment.

### Maximise fan life

In order to maximise the life of a fan it is important to fit the largest frame size achievable within the available space, run at the lowest speed to deliver sufficient cooling. This will also help to keep sound pressure levels to a minimum. Frame sizes should be considered; choosing a common frame size of 40,

60, 80 or 120mm will help to secure optimum pricing. Similarly, when selecting the depth of the fan, it is important not to choose an unusual size unique to just one supplier. Due to the complexity of the manufacturing process small fans can attract high pricing, and the increase in material costs for large fans can have the same effect.

Bearing selection is another important consideration. A sleeve bearing fan will often be available at the cheapest unit price, however these are limited in mounting orientation, will get louder over time and often have

a comparatively lower life expectancy compared to other bearing choices. Sleeve bearings should be avoided in applications involving moisture, dust or high temperatures. A ball bearing fan is generally considered the most robust option. These can be mounted in any orientation and should offer the longest life – but at a higher unit price. When seeking a balance between cost, life and performance, Sunon's patented MagLev bearing may offer a compromise, providing many benefits of a ball bearing fan at a cost closer to that of a sleeve.

### Low power technology

The shift from traditional AC fans to new, low power EC technology looks to be gathering momentum. While EC fans are currently subject to a premium front end, the efficiency during use in comparison to AC allows for long term benefits on power saving, which in turn will reduce user operating costs. In cost sensitive markets where the initial unit price of EC fans is too steep, Sunon's new low power AC range can provide an alternative when seeking a reduction in power consumption. Improvements in winding methods and materials have



It's important not to choose a size unique to just one supplier



**Due to the complexity of the manufacturing process small fans can attract high pricing**

Early distributor collaboration can help avoid long lead times



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produced an offering with nearly twice the efficiency of standard AC fans, and at no increase in cost.

## Enlist distributor support

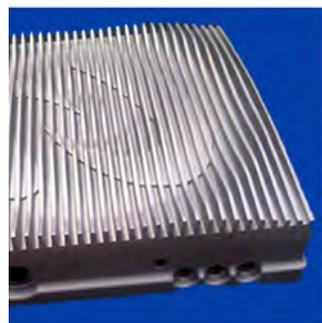
Purchasing fans from an official vendor that has direct contact with the manufacturer will be the most cost effective method of supply. Online catalogue distributors offer a fast turnaround that can be essential during concept design, however pricing will be at a premium. If collaboration between the purchaser, engineers and a specialist distributor is initiated early in the design stage, it can help provide useful warnings over end of life issues and long lead times.

Before use, most fans are customised, commonly in the form of adjustments to the lead length and/or the addition of a connector. An official vendor will be able to implement these customisations during the manufacture of the fans, not only providing a cost saving benefit, but also removing the risk of damage through mishandling during any secondary processes. Although customised fans will be subject to lead time, careful forecasting and a stock holding arrangement with your distributor should help circumvent this issue.

Ongoing economic and political uncertainty has resulted in most forecasts anticipating slow growth this year in UK manufacturing. From a global perspective, however, an array

of developing technology in areas such as electric vehicles, 5G infrastructure, computing and automated manufacturing has helped fuel the increasing demand for electronic components. Partnering with a responsible distributor will ensure you are kept abreast of any component shortages and lead time issues, helping to guarantee uninterrupted supply.

[www.gelec.co.uk](http://www.gelec.co.uk)



An official vendor can implement customisations during manufacture providing a cost saving

[www.gelec.co.uk](http://www.gelec.co.uk)

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
<b>CABLE ASSEMBLY &amp; HARNESSING</b>											
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
<b>CIRCUIT PROTECTION</b>											
Bourns	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	5000	N/A	£0	58%	50	1,500+	Y
EPCOS/TDK	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	5000	N/A	£0	58%	50	1,500+	Y
Littelfuse	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	35000	N/A	£0	67%	50	1,500+	Y
<b>DISPLAYS &amp; LEDs</b>											
NLT Technologies Ltd	Review Display System Ltd	01959 563345	www.review-displays.co.uk	Y	All	N/A	£0	N/A	6	25	Y
<b>ENCLOSURES</b>											
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
<b>FREQUENCY MANAGEMENT</b>											
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
<b>HEATSINKS</b>											
Aavid	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	67%	50	1,500+	Y
<b>ICs &amp; SEMICONDUCTORS</b>											
Altera	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,600	N/A	£0	60.00%	50	1,500+	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
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
Diodes Incorporated	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,600	N/A	£0	98%	50	1,500+	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
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



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<b>ICs &amp; SEMICONDUCTORS (Continued)</b>											
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
Lattice	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	700	N/A	£0	69%	50	1,500+	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
Microchip	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	12,600	N/A	£0	91.00%	50	1,500+	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
NXP	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	3,900	N/A	£0	91%	50	1,500+	Y
ON Semiconductor	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	5,100	N/A	£0	87%	50	1,500+	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 Semiconductor	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,400	N/A	£0	55.00%	50	1,500+	Y
Silicon Laboratories	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,500	N/A	£0	96%	50	1,500+	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
Texas Instruments	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	36,900	N/A	£0	41%	50	1,500+	Y
Toshiba	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	500	N/A	£0	100.00%	50	1,500+	Y
<b>INDUSTRIAL GRADE MEMORY MODULES</b>											
InnoDisk	Simms	01622 852 848	www.simms.co.uk	N	300+	N/A	N/A	N/A	3	N/A	Y
<b>INTERCONNECTION</b>											
3M	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	3,100	N/A	£0	16%	50	1,500+	Y
Amphenol	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	25,600	N/A	£0	53%	50	1,500+	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
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
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
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
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
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



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<b>INTERCONNECTION (Continued)</b>											
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 Connectivity	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	30,900	N/A	£0	40%	50	1,500+	Y
<b>OBSOLESCENCE / HARD TO FIND</b>											
	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
Rochester Electronics	Rochester Electronics	+44.1480.408400	www.rocelec.com	Y	299	N/A	\$250		10	400+	Y
<b>OPTO ELECTRONICS</b>											
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
<b>PASSIVES</b>											
AVX	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	70,700	N/A	£0	58.00%	50	1,500+	Y
Bourns	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	49,500	N/A	£0	98%	50	1,500+	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
EPCCOS / 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
Kemet	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	135,800	N/A	£0	93%	50	1,500+	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 Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	1,800	N/A	£0	50.00%	50	1,500+	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
Ohmite	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	17,300	N/A	£0	99.00%	50	1,500+	Y
Panasonic	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	67,900	N/A	£0	69.00%	50	1,500+	Y
Taiyo Yuden	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	6,400	N/A	£0	82%	50	1,500+	Y
TDK	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	25,300	N/A	£0	85.00%	50	1,500+	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	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	119,800	N/A	£0	76%	50	1,500+	Y
Würth Electronics	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	4,500	N/A	£0	63%	50	1,500+	Y
Yageo	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	45,300	N/A	£0	99%	50	1,500+	Y
<b>POWER &amp; BATTERIES</b>											
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



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<b>POWER &amp; BATTERIES (Continued)</b>											
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
<b>SENSORS</b>											
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
<b>SWITCHES &amp; KEYBOARDS</b>											
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
<b>TERMINAL BLOCKS</b>											
Marathon Special Products	Global Supply Services	01904 436 488	www.global-supply-services.com	Y	8,000	£800,000	£100	100%	3	11	Y
<b>THERMAL MANAGEMENT</b>											
ADDA	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	800	N/A	£0	59.00%	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
<b>THERMAL MANAGEMENT (Continued)</b>											
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		2,900	N/A	£0	N/A		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
<b>TRANSFORMERS &amp; INDUCTORS</b>											
Best Windings	Best Windings	0044 (0)1394 448424	www.bestwindings.co.uk	N	300	N/A	£100	N/A	2	14	Y
<b>WIRELESS SOLUTIONS</b>											
Anaren	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	86.00%	50	1,500+	Y
B&B Electronics	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	87%	50	1,500+	Y
Bluegiga Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	93.00%	50	1,500+	Y
Digi International	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	200	N/A	£0	92%	50	1,500+	Y
Laird Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	76%	50	1,500+	Y
Linx Technologies	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	99%	50	1,500+	Y
Microchip	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	85%	50	1,500+	Y
Murata	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	100%	50	1,500+	Y
Panasonic	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	91%	50	1,500+	Y
Redpine Signals	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	94%	50	1,500+	Y
RF Digital	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	100%	50	1,500+	Y
Texas Instruments	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	75%	50	1,500+	Y
Wi2Wi	Mouser Electronics	0044 (0)1494-467490	www.mouser.co.uk	Y	100	N/A	£0	36%	50	1,500+	Y

## Contract Manufacturers Buyers' Guide

Manufacturer	Telephone	Website	Turnover	Location	Employees	Number of Surface Mount Lines	Approvals	BGA Capacity	Lead Free Manufacturer	Prototyping	Design Capability	Full Turnkey Cables and Harnessing
AWS Electronics Group	01782 753200	www.awselectronicsgroup.com	£40m	UK & Slovakia	430	11	AS9100, ISO9001, 13485, 14001, TS16949, IPC-A-610 Class 3, NADCAP	Y	Y	Y	Y	Y
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
Briton EMS Ltd (OSI Electronics)	01234 266300	www.britonems.com	£12m	Bedford & Singapore	100	3	ISO: 9001, 13485, 14001. AS9100. BSI Kitemark IPC610	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
CML Innovative Technologies (uk) Ltd	01284 714700	WWW.CML-IT.com	£12M	UK/EU/China	65		ISO9001 TS16949 UL	N	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
CSI EMS Ltd	01376 500050	www.csiems.co.uk	£5m	Essex	50	3	ISO 9001, UL, IPC610	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
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
Dynamic EMS Ltd	01583 822911	www.dynamic-ems.com	£9m	Scotland	94	3	ATEX, ISO9001:2015, OHSAS18001, IPC-610-F class 3, ISO14001, ISO 13485, UL	Y	Y	Y	Y	Y



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## Contract Manufacturers Buyers' Guide (continued)

Manufacturer	Telephone	Website	Turnover	Location	Employees	Number of Surface Mount Lines	Approvals	BGA Capacity	Lead Free Manufacturer	Prototyping	Design Capability	Full Turnkey	Cables and Harnessing
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.etluk.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 6652 7172	www.elitees.com	£20m	UK	230	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, IPC7711/7721, BS EN 61340-5-1 (ESD)	Y	Y	Y	Y	Y	Y
Hallmark Electronics Ltd	01782 562255	www.hallmarkelectronics.com	£2m	M	26	2	ISO9000/UL, IPC610/D	Y	Y	Y	Y	Y	Y
Icon Electronics Limited	01423 798294	www.iconelectronics.co.uk	£6.5m	Hampshire & Yorkshire	70	6	AS9100, ISO9001, BS EN ISO/IEC 80079-34:2011 ATEX, IPC-A-610 Class3	Y	Y	Y	Y	Y	Y
Industrial Electronic Wiring Ltd.	+44(0)1793 694033	www.iwew.co.uk	£5.5m	Swindon, UK	60	N/A	ISO9001:2015, 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, 81-J-STD-001, Space Addendum)	Y	Y	Y	Y	Y	Y
JIS Manufacturing Ltd	01455 555500	www.jismanufacturing.com	£35m	Bedford, Lutterworth, (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	£13.4m	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, TÜV, UL	Y	Y	Y	Y	Y	Y
Protronix EMS	01582 418490	www.protronix.co.uk	£2.5m	Luton	10	2	ISO9001:2015, IPC-A610	Y	Y	Y	Y	Y	Y
Season Electronics Limited	02392 452222	www.seasongroup.com	£5m/£95m	Havant/Global	65/1800	2/18	(AS9100 & ISO9001 in UK) (TS16949 & ISO13485 at sister sites)	Y	Y	Y	Y	Y	Y
Simtek EMS Ltd	01843 233120	www.simtekms.co.uk	£6m	SE	60	3	ISO9001:2008, ISO13485, IPC-A-610 Class 3 & IPC-7711	Y	Y	Y	Y	Y	Y
Speedboard Assembly Services	01753 746700	www.speedboard.co.uk	£12.8m	Windsor, SE	99	4	IPC610 to Class 3, ISO9001:2015	Y	Y	Y	N	Y	Y
Tenkay Electronics Ltd	01903 855455	www.tenkay.co.uk	£4.1m	West Sussex	50	1	ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007	N	Y	N	N	Y	Y
TEXCEL TECHNOLOGY PLC	+44(0)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	ISO9001:2015, IPC-A-610 Class 3	Y	Y	Y	Y	Y	Y

## PCB Buyers' Guide

Manufacturer	Telephone	Website	Service Provided (ie Broker, Manufacture &/or Repair)	Location	Approvals	Volume - Small, Medium, Large	Double-sided	Multi-layer 4-10/10-20-30	Metal PCBs	Flex / Flexi-Rigid	Obsolescence 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	UK, Europe, Asia, USA	UL, ISO9001:2008, TS16949:2009	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
Fineline VAR Ltd	+44 (0)1249 815 815	www.fineline-global.com	B	UK / Global	ISO9001:2015 / UL / TS16949 / Nadcap / AS9100 / ISO14001	SML	Y	4-60	Y	Y	Y	Y	Y
GSPK Circuits Ltd	+44(0)1423 321100	www.gspkcircuits.ltd.uk	M/R	UK, Europe, Asia	IS 9001:2015, WAF 16949:2016, EN (AS) 9100	SML	Y	4-16	Y	Y	Y	Y	Y
LEF Circuits	0116 2891122	www.lefcircuits.co.uk	M/R	M	ISO 9001:2015, 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
Stevenage Circuits Ltd	01438 761811	www.stevenagecircuits.co.uk	M/B	UK/China	ISO 9001:2008, ISO 14001, EN9100:2009, UL, OSCAR	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
Tecbridge Circuits	0207 993 6503	www.tecbridgecircuits.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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