

ELECTRONICS

SEPTEMBER/OCTOBER 2019

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EUROPE

**PLUGGING-IN TO
AN EV FUTURE**



ALSO INSIDE: NEWS • MARKET WATCH • LEDS • PURCHASING • BUYERS' GUIDE

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INSTRUMENTS





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Buyers' Guide

All the facts and figures to help you buy

Editor's Word



Take caution with NOS

Having spent plenty of years refurbishing classic vehicles I'm well versed with the acronym NOS which stands for 'new old stock'. In essence it's a process where unused obsolete stock finds its way back into the market, having been hidden on a shelf for years, if not decades. NOS parts are hard to find and priced accordingly but they remain the gold standard for refurbishment projects.

This process is replicated in the electronics industry. However, buyers need to remain cautious. Aside from counterfeiting, which is a major risk, I consider invisible degradation the biggest potential problem.

For example, I recently decided to test my spare wireless car key which has remained unused in a draw for seven years. Unsurprisingly it didn't work. I changed the battery and it burst into life, but intermittently. I stressed the battery contacts and tried again. No luck. Then I checked the contacts under a microscope to ensure the surface was intact. They passed visual inspection.

Finally, I turned to the nuclear option and dug out my DeoxIT pen. A quick wipe across the contacts and the key was as good as new. Oxidation was clearly the problem.

So, just because a component is genuine NOS and passes a detailed visual inspection doesn't mean it will work reliably, if at all, without some form of restoration to combat the wear and tear of thermal degradation and corrosion.

NOS parts can dig an electronics manufacturer out of trouble but they need to be treated with care. Pay particular attention to contact surfaces and rubber/elastomer elements.

Jon Barnett

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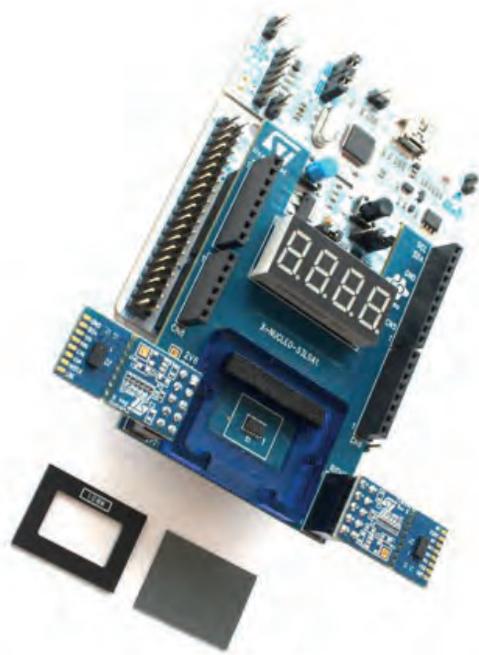
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Targeting ToF demand

Farnell is now shipping a range of Time-of-Flight sensors designed to address demand for 3D information and extended range. Today's ToF devices support applications such as gesture sensing, distance measurement, robotics, industrial automation and process control, enabling solutions such as monitoring the position of objects on a conveyor belt.

Available for next day delivery from Farnell, the latest ToF devices are designed to increase distance capabilities irrespective of the colour and surface of the item tracked, satisfying the high-speed, small size and low power demands driven by industrial IoT applications.

Global head of semiconductors and SBC at Farnell, Lee Turner, said: "Farnell's strong supplier relationships with ST and Broadcom, and new addition Renesas, give access to the latest technologies in Time-of-Flight sensing options. Our technical support team are available 24/5 to help identify the most suitable device for an application, no matter how complex the design or requirement."

www.premierfarnell.com



Hi-rel EMS invests in expert placement

High reliability electronics manufacturing services provider, Cirtech, has expanded its component placement capability by investing in additional equipment from ASM Assembly Systems. The American EMS, which specializes in hi-rel mil/aero, medical and industrial assembly, purchased a Siplace SX1 and Siplace SX2 to supplement its existing equipment of the same configuration from ASM.

Cirtech vice president of operations, William Sirois, explained: "A few years back, we replaced older-generation Siemens placement systems with two Siplace SX platforms. The new platforms are exceptionally low maintenance and more than equipped for our broad technology range which includes placement of metric 0201s all the way up to large connectors, so choosing ASM a second time was a no-brainer. In total, we replaced six older systems with four Siplace SX's and have significantly increased throughput."

Vice president and general manager for Cirtech, Rick Pelletier, added: "The more high-yield PCBs we can build, the more successful we are. Reduced downtime, component accuracy, resource utilization and scalability are all critical considerations; the Siplace SX solution aligned better than other platforms for our operation."

www.asm-smt.com



Download the latest passives info

Würth Elektronik Electronic Components has released a new 2019 catalogue detailing its passive components, optoelectronics and power modules. The new catalogue is available as a print version and can also be downloaded from the Würth website as a PDF with links to further online information. The catalogue is also available as an iOS app for iPhones and iPads.

Throughout the 152-page document, purchasers can find details of individual products as well as further information on the design and functionality. All products are available from stock and samples are free of charge.

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In Brief

One sensor, multiple uses

Alps Alpine has started mass-producing the HSPPAD143A waterproof digital pressure sensor for applications in wearable devices and IoT equipment such as flow meters. The new device has a pressure measurement range of 300 to 2100hPa and a water-resistant design, allowing measurement in both open air and water with a single sensor. Current consumption is 1.8µA. www.alpsalpine.com

Optimised e-procurement

Conrad Electronic now offers B2B customers such as MRO and R&D engineers the choice to source products electronically, saving time and money. Customers can engage with the entire catalogue in digital form, with different classification and export formats providing efficient access to 800,000 business products. Options include the Open Catalogue Interface webshop, electronic catalogues and Conrad's proprietary electronic procurement solution. conrad.com

Uncertainty weakens orders

The FBDi association has revealed that turnover of German component distributors decreased by two per cent in the second quarter of 2019. The order situation also remains poor, especially in semiconductors and passive components. FBDi chairman, George Steinberger, believes general uncertainty and political confusion have led to mixed prospects for short-term market development. www.fbdi.de

More products shipped faster

Harting Technology Group has opened a new European distribution centre in Espelkamp. Up to 20,000 order items will be processed every day, with goods dispatched to customers on the day of order. The warehouse can accommodate approximately 7,000 pallets and 120,000 containers. Highlights of the centre include a highly-automated picking system and a driverless transport for optimised, flexible movement of goods. www.harting.com



New source for vibration sensors

Mouser Electronics has signed an agreement with Wilcoxon Sensing Technologies to distribute its vibration monitoring products and sensing solutions. Wilcoxon products now available from Mouser include a range of general-purpose, hazardous-area certified, and highway addressable remote transducer HART-enabled sensors, plus intelligent vibration transmitters and enclosures.

Vice president of supplier management at Mouser Electronics, Krystal Jackson, said: "Mouser is pleased to deliver Wilcoxon's newest, innovative products to our customers. Design engineers now have easy access to Wilcoxon's advanced components, backed by Mouser's unsurpassed customer service and best-in-class logistics."

Highlights of the new line up include Wilcoxon's 786 series sensors, PCH420 HART-enabled digital velocity sensors, Wilcoxon's iT series of intelligent vibration transmitters, and CB series cable termination junction boxes.

www.mouser.com



BaseCamp team supports start-ups from scratch

Rutronik24 has set up a dedicated team to focus on start-ups, dealing exclusively with the needs of young, innovative companies. In addition to supplying components, the new BaseCamp team also offers consulting services.

Director sales global at Rutronik24, Andrea Bissinger, explained: "Rutronik24 focuses on small and medium-sized companies with corresponding needs—so start-ups are precisely our target audience. All our processes are tailored exactly to their requirements. This allows us to support entrepreneurs and their projects with customized solutions. Thanks to our large network, this not only includes the required components and consulting services, but we also help put them in touch with suitable partners, such as for production, marketing and sales."

To enhance access to the newly formed team, Rutronik has added a button to the www.rutronik24.com website that allows start-ups to contact the team directly.

Team leader field sales at Rutronik24, Marek Fuchs, leads the three-person team. He commented: "I like to try out new things and enjoy thinking outside the box—and that goes for our entire team. We look forward to collaborating with start-ups from a variety of sectors, hopefully helping them bring their product to market and make their company a success."

www.rutronik24.com



New centre supports trend-setting products

Omron Electronic Components has launched a new application centre in Europe as the next step in its long-term value generation strategy. Located in the Netherlands, the Application Centre will focus on four growing markets: energy, automation, healthcare and mobility and will offer trend setting and innovative technologies.

The centre will be led by Tomonori Morimura, who has relocated from Japan to take up the position of application centre general manager. Commenting, he said: "The goal of Omron Electronic Components Europe is to maximize customer's value through our component business. Our new application centre will help achieve this goal. First, it enables our development teams to deeply understand our local customers' current and future business and product needs. Second, it will bring a higher level of engineering support to Europe, enabling faster response to customer needs and requests."

As well as co-ordinating application-driven sales activities, the centre will help improve logistics and delivery time by providing flexibility in production.

components.omron.eu

Production improvements cut delivery times

ERNI has expanded and optimised its production capacity over the last few months in order to meet high demand for certain product lines, ensuring customers are supplied reliably and punctually with the desired volume. The delivery time for many product lines is now only a few weeks and this also applies to orders already placed.

To achieve these measures, ERNI has invested heavily in automated production facilities and in the optimisation of processes to shorten throughput times. The company has also made capital investments and recruited new staff in its purchasing department. Using an international procurement network makes purchasing more target-oriented and reliable. This ensures an optimised alignment between incoming orders, warehousing and production.

For product lines such as M8/M12 circular connectors, SMC connectors with a 1.27mm pitch, MaxiBridge cable connectors or the ERmet series, delivery times have been reduced to a few weeks, depending on the type. Current delivery times can be viewed online.

www.erni.com



Expanded industrial connector choice

RS Components has extended its industrial connector portfolio with new solutions from Harting including the recently launched Han 1A connector.

Developed to meet demand for smaller interfaces used with the latest power engineering equipment in modern networks, the new Han 1A is a significantly smaller than the Han 3A, requiring 30 per cent less space than the manufacturer's previous smallest rectangular industrial connector.

Designed to offer versatility, this modular system is constructed from a lightweight and durable polyamide plastic. The connector integrates contacts for data, power and signal transmission with modules available for Cat 5 or 6A data transmission. It can handle a maximum of 16A and 400V and has up to 12 D-sub contacts for signal interfaces. A shielded version is available for application environments that are susceptible to interference.

Overall, the Han 1A provides an efficient solution for applications such as heating and cooling units, fans, control terminals, lighting systems, drives and vibration conveyors. It also meets the EN45545-2 standard for fire protection on railway vehicles, making it ideal for door openers, lighting and screens.

de.rs-online.com/web

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Looking for high pixel-density displays?

Kaohsiung Opto Electronics has introduced a new 13.3in TFT display module featuring 4K2K resolution, in-plane switching technology, a 16:9 wide aspect ratio and a super slim design. With a pixel density of 332ppi, the 3840 by 2160 resolution TX34D200VM0BAA module is said to provide a significantly higher pixel density compared to a full HD display.

Ideal for high resolution monitoring, machine vision and media applications, IPS technology helps ensure image stability, colour saturation and deep black levels. Viewing angles of up to 176deg are supported in all directions. The fully integrated white LED backlight delivers a specified brightness rating of 350cd/m², which combined with a contrast ratio of 1500:1, ensures display images are colourful and accurate.

Marketing manager at KOE, Benson Huang, said: "The new 13.3in 4K2K TFT display provides exceptional optical performance in a highly compact mechanical form factor which aids integration into a range of equipment and systems."

Typical applications will include in-vehicle and in-flight entertainment, broadcast equipment, medical monitors, industrial machine-vision and security systems.

www.koe.j-display.com



Bright ideas for automotive instrument panels

Rohm has announced availability of compact, high output, surface mount LEDs designed to eliminate the need for light leakage countermeasures in vehicle instrument clusters. The new line-up includes 18 devices, comprising the CSL0901 standard brightness series and the high brightness CSL0902 series.

These automotive-grade products help ensure high reliability in vehicle instrument clusters that operate under harsh environments. According to Rohm, raising the light source position from 0.18mm in standard products to 0.49mm significantly reduces light leakage. Meanwhile, size was also significantly reduced compared to conventional reflector-type LEDs.

All devices are designed to prevent light degradation even under high temperature environments with Rohm developing a new type of resin for blue, green and white LEDs to achieve higher reliability. Furthermore, achieving higher precision during the manufacturing process while maintaining the 1608 size made it possible to increase core brightness by five to seven times over conventional LEDs, says Rohm.

www.rohm.com/eu



Wireless light management made easy

Tridonic and Casambi have teamed up to develop a wireless light management solution. The new basicDIM Wireless system from Tridonic is based on Casambi's Bluetooth low energy technology, offering an interconnected and interoperable solution for hassle-free wireless connectivity of luminaires.

Designed to enhance flexibility for luminaire manufacturers, installers and end-users, the basicDIM Wireless range of devices consists of LED drivers, communication modules, sensors, a user-interface as well as software in the

form of the 4remote BT app.

Tridonic's basicDIM Wireless technology provides wireless luminaire communication with no additional wiring or construction. Controlled via Bluetooth, it can provide on/off switching as well as dimming functions, grouping luminaires and creating lighting settings. It is ideal for office buildings or classrooms, where each room and zone benefits from the system's multi-functional intelligence.

www.tridonic.com

Super small, super bright LEDs

Würth Elektronik has expanded its LED portfolio with a new compact model series. WL-SMCC surface mount chip LEDs are available in 0402 and 0603 packages featuring a full-surface lens design said to offer a significantly higher light intensity than competitor products. Both WL-SMCC package types are available in five colours: red, yellow, light green, green and blue.

The small size and full-surface

lens make the LEDs ideal for miniaturised and mobile devices. The 0603 version, at just 0.2mm high, is also perfect for space-saving backlighting, such as in dashboards, entertainment consoles and industrial switches. WL-SMCC series LEDs are optimized for high performance and durability, featuring 2.5µm gold-plated contacts.

www.we-online.com



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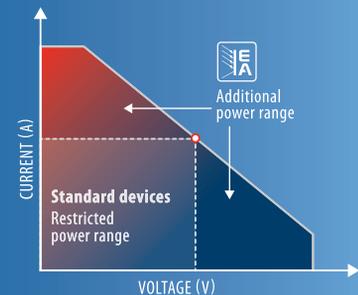


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High-service distributors expand operations and grow their customer count

Small-volume, catalog distributors have become more important to the supply chain as engineers and buyers rely on them for components and technical expertise



James Carbone

The role of the small-volume, high-service electronics distributor has evolved over the years and become more integral to OEM and electronics manufacturing services (EMS) providers.

Distributors such as Mouser, Digi-Key, Newark and Premier Farnell are often key go-to partners to many OEMs and EMS companies, providing components for new designs, prototype builds and small production runs. During shortages, high service distributors are often a reliable source for hard-to-find parts for many buyers.

Most high service distributors have been expanding, adding more suppliers, product lines and warehouse space in an effort to make sure they have parts on their shelves when engineers and buyers need them. Some of the expansion is driven by the need to satisfy demand from emerging technologies and growing applications involving Internet of things, artificial intelligence and autonomous driving. For instance, many small volume distributors have increased their product portfolios involving sensors and wireless solutions because of the growth of IoT.

High service, small volume distributors have extended their global reach. Some of them have been acquired by larger global broad-line distributors, while others have expanded operations in Europe, China and other Asian countries to reach new customers and existing ones that

have expanded their worldwide operations.

All have enhanced their websites in an effort to provide the necessary data for customers to make sound design decisions as well as to provide the tools to make it easier for engineers and buyers to effectively do their jobs.

High service distributors often say they are in a unique position in the electronics supply chain. When the electronics industry is thriving, small-volume, catalog distributors will often post sales growth that outpaces the overall industry. When the industry is in a downturn, high-value distributors may still post modest sales growth or suffer a small sales decline while high-volume distributors' revenue declines more sharply. While an economic downturn often means that volume production of electronics slows, OEMs are still designing new products and continue to buy components from high-service distributors.

Weathering downturns

In addition, high-service distributors weather downturns better because they don't cater to a few customer segments, but to a wide range of OEMs in different industries.

"We don't depend on a few thousand customers for our business. We had 691,000 buyers last year," said Kevin Hess, senior vice president of marketing for Mouser Electronics, "So we don't depend on one small group of customers for the opportunities

Pete Shopp, senior vice president, business operations for **Mouser**

"Eastern Europe is an opportunity. There's a lot of contract manufacturing in Hungary"



that we have with these new designs. That's always going to be happening," he said.

Mouser's customer base is growing especially in Europe and Asia, and the Mansfield, Texas company will continue to expand globally and has plans to grow its business in the Philippines, Vietnam, Poland and South America. "Eastern Europe is an opportunity. There's a lot of contract manufacturing in Hungary," said Pete Shopp, senior vice president, business operations for Mouser. He said Australia could also be an opportunity for growth in the future.

"Eventually we probably will need to provide local customer service

in those growing areas," he said. To grow business, it is necessary to have a robust website and local customer service, according to Shopp.

"Most engineers read and write English data sheets, but it doesn't mean they want to," said Shopp. "They would much rather talk to someone in their local language and local time zone. They would like someone who knows them culturally," he said.

As it grows its customer base worldwide, Mouser plans to expand its facility to house more products to meet rising demand. The distributor will add 200,000 square feet of warehouse and will increase the breadth and depth of products and perhaps



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add different types of products that it currently does not have, said Hess.

Adding new suppliers, products

Shopp said Mouser is adding new products from its existing supplier base as well as from “small, niche suppliers. We are not one for resting on our laurels,” said Shopp.

Expanding product lines and growing inventory will give us “more opportunities to find new customers,” said Hess.

Hayne Shumate, senior vice president, Internet business for Mouser, said the distributor has three major sets of customers: engineers, buyers and engineers/buyers. He said Mouser was “constantly building tools for buyers who are not engineers and building content and tools for engineers,” he said. Such tools include a bill of materials management tool as well as MouserMobile, which lets buyers browse and search for parts, view product pricing, availability, specifications and images and buy from a mobile device.

Of course, Mouser is not the only small-volume distributor that is growing its sales, customer base and reach.

Digi-Key is expanding its facilities in Thief River Falls, Minn. to better service existing customers and attract new ones by offering more product lines and component manufacturers. It is building a 1 million square foot facility adjacent to its current distribution center in Thief River Falls. The new facility is scheduled to be completed by 2021.

As it expands its facilities, Digi-Key is also adding new suppliers and more products to its portfolio. “Over the last 15 months we’ve added 118 suppliers,” Doherty said in May. Digi-Key already has most of the traditional-board level suppliers. Many of the new suppliers are component manufacturers that build sensors, or other activity components that are used in IoT applications. Some are “very niche leading-edge suppliers,” said Doherty.

The new facility will help Digi-Key fulfill demand as its sales in Europe and Asia increase and as it adds new customers in North America. In addition, the facility will help Digi-Key meet new demand created by industrial IoT, the automotive supply chain and the maker movement.

Meet the makers

“The maker movement is interesting,” said Dave Doherty, president and chief operating officer of Digi-Key. “When we first got into the maker space, we thought it would be great to establish our brand with the speakers as they become professional engineers” and then be recognized and remembered by them as they work on projects in the future, he said. “But it turned out to be more than that,” said Doherty.

Makers often use boards such as Raspberry Pi to design a product. Raspberry Pi is a single-board computer that runs Linux, but it also provides a set of general-purpose input/output pins that can control electronic components for physical computing and for Internet of Things (IoT) applications. Raspberry Pi and other open source board such as Arduino,

Dave Doherty, president and chief operating officer for Digi-Key

“Over the last 15 months we’ve added 118 suppliers. Some are very niche, leading-edge suppliers”



which distributors sell, allow rapid prototyping of products. While such boards are often purchased by makers, they are not the only ones buying them, according to Doherty.

“There are a lot of traditional OEMs buying these boards,” he said. Engineers at established OEMs are buying the boards, too.

“What we find is a high percentage of the folks that buy these initial maker boards, come back to us and purchase traditional components,” which helps drive business, he said.

Another high service distributor that is adding suppliers and products and growing its warehouse capacity is Allied Electronics, based in Fort Worth, Texas.

More space needed

“We just expanded our warehouse,” said Dan Stewart, vice president of marketing and eCommerce. “We broke ground back in the August/September timeframe last year and we are roughly doubling the footprint of our warehouse and will triple the product capacity because we are going to be adding a lot of automation,” he said.

Along with the warehouse expansion, Allied will expand its product portfolio. It will

carry more products from its existing suppliers and will add new suppliers to its roster, said Stewart.

The goal of increasing its number of suppliers and products is to reach new customers. Allied is also enhancing its website to make it easier for customers to find parts, and necessary data to make design and sourcing decisions.

“One thing we have done is launch a new section of our website called Expert Advice which is focused in industrial automation,” he said.

The section is design to help customers answer questions about products they are considering buying.

For instance, a customer may be looking for proximity sensor. “Well, there are a number of different proximity sensors,” said Stewart. There are inductive and capacitive sensors” and others, he said.

The site helps guide the customers, provides information to help the customer make the right sensor choice for the application.

Smart ideas for EV charging

Standardizing the charging connection for plug-in hybrid and battery electric vehicles will increase adoption, but as Digi-Key Electronics' Rich Miron explains, EV charging still presents some challenges

Extensive use of electric vehicles could significantly reduce emissions without sacrificing the freedom of personal transport. Standardizing the physical charging connections will help consumer adoption and there are currently three charging specifications in the international standard IEC 62196-2. These include the Type 1 SAE J1772 plug, widely used in North America, and the IEC Type 2 plug, primarily used in Europe.

Make charging simple

The J1772 specification and IEC 61851-1, the global standard for EV charging electrical interfaces, specifies basic electrical signaling across a pilot connection between the charging point and the vehicle's on-board charger electronics. These interactions confirm connection and negotiate power delivery based on criteria such as available ventilation to guard against potential hazards like overheating. To simplify the design process, TI has produced a

reference design for J1772 compliant electric vehicle service equipment. It uses features in the MSP430F6736 microcontroller to facilitate control and monitoring of the pilot signal line. These include a timer module for generating a PWM signal and a successive approximation register analog-to-digital converter to read the response of the vehicle on the pilot wire.

To drive the pilot signal across several meters of cable and through the load resistance applied by the vehicle when connected, the reference design uses an OPA171 operational amplifier. The MSP430 microcontroller monitors the output of the OPA171 to detect the load resistance applied by the vehicle.

All the electrical functions of a J1772 charging interface are covered by the reference design, including: power management to generate $\pm 12V$ DC and 3.3V logic supplies from the main AC line, and a TPL7407L low-side driver that manages a

two-stage output relay. The design also leverages the MSP430F6736 to provide protection against potentially dangerous ground faults and to integrate power metering.

Plugging EVs into the smart grid

Standardizing the charging interface will go a long way towards encouraging greater use of electric vehicles, however, as the number of such vehicles increases, so too will the load on the power grid. On the other hand, if charging is managed intelligently, EVs could support active demand response programs that work to prevent excessive peak loads and could also be used as storage for surplus renewable energy. Negotiations between the vehicle and charging point utilize communication with grid management systems to determine energy capacity and tariffing.

After charging commences, communication allows the vehicle and its charge point to exchange information such as control and configuration

data, access privileges, time-stamp, tariff information, customer ID and location, and meter readings.

One approach for communication between the vehicle and grid management systems uses the IEC 61850 protocol. The Fraunhofer Institute has developed a reference system using ISO/IEC 15118 and IEC 61850 standards, as well as HPGP and IPv6, for V2G communication via a smart charging station. With these measures in place, intelligent EV charging is increasingly within reach.

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Are EVs ready to go the distance?

The ratio of EV cars to charging stations is fast approaching a tipping point where users can drive without range anxiety. Mouser Electronics' Robert Huntley, examines some of the factors affecting infrastructure rollout

Rolling out nationwide electric vehicle charging infrastructure is a critical success factor in speeding EV consumer adoption. EV range is a key selection criterion for prospective EV owners, so state and federal authorities are keen to promote investment and incentives as part of a broader carbon-reduction climate change objective.

In fact, research conducted over the period January to June 2019 points to a continued year-on-year growth in EV sales across the US. This is good news for the EV industry generally,

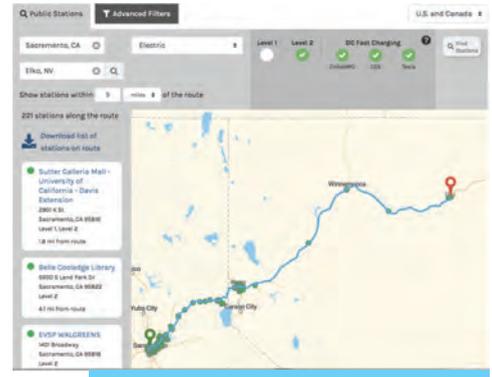
although dig a little deeper and it seems the growth is solely down to the Tesla Model 3, with other EV brand sales not faring so well. The reason appears to be Tesla's 300+ mile range; the majority of other EV contenders, unfortunately, don't currently come anywhere near that.

There is no doubt EV sales will continue to grow, but it's wise to benchmark the figures against overall US vehicle sales. In 2017, just over 200,000 EVs were sold in the US compared to overall sales of 17,340,700, making EV sales roughly 1.15 per

cent of total vehicle sales.

What's influencing EV adoption?

For the consumer, there are many considerations when opting for an EV. First, cost has a major influence, with EVs attracting a premium over their internal combustion counterparts. Some of the cost premium may be discounted by rebates or incentives offered at a city, state or federal level, as is the case in some European countries, but these are not always clear and may change without warning. There is also the comparison between filling up with gas and the



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Various EV charging connectors are in use

cost to charge an EV, which can be pretty complex to figure out, leading most consumers to take a more holistic view that buying an EV is the right thing to do for the planet.

Overall, the US government is focused on meeting carbon-reduction climate change objectives with incentives to encourage EV adoption, but it has yet to sign up to the rather extreme goal of setting a date after which no internal combustion-based

vehicle will be permitted. Vehicle manufacturers also have their own struggles with balancing investment in EV technologies and being seen as a progressive brand with a viable and credible EV portfolio, while continuing to milk the cash cow of internal combustion engine (ICE) sales and offering ongoing support to their legacy customers.

Other factors include the geopolitical complexities of global oil prices. US

consumers enjoy a \$4 billion/year subsidy, for example, and with the current \$54/barrel oil price, a significant drop to \$20/barrel would swing the running cost to favor internal combustion engine vehicles. An EV typically has an electricity-dollar rate of 43 miles, this being roughly a quarter of an ICE-powered car or SUV.

What is range anxiety?

By far the greatest concern that potential EV consumers ponder is range. The context

to this is the availability of charging infrastructure that suits the consumer's choice of EV. Wondering whether your EV can make it to the next charging station can create unnecessary anxiety, not to mention introducing delays to your journey while the vehicle charges.

Many consumers also hope that their chosen EV manufacturer will deploy



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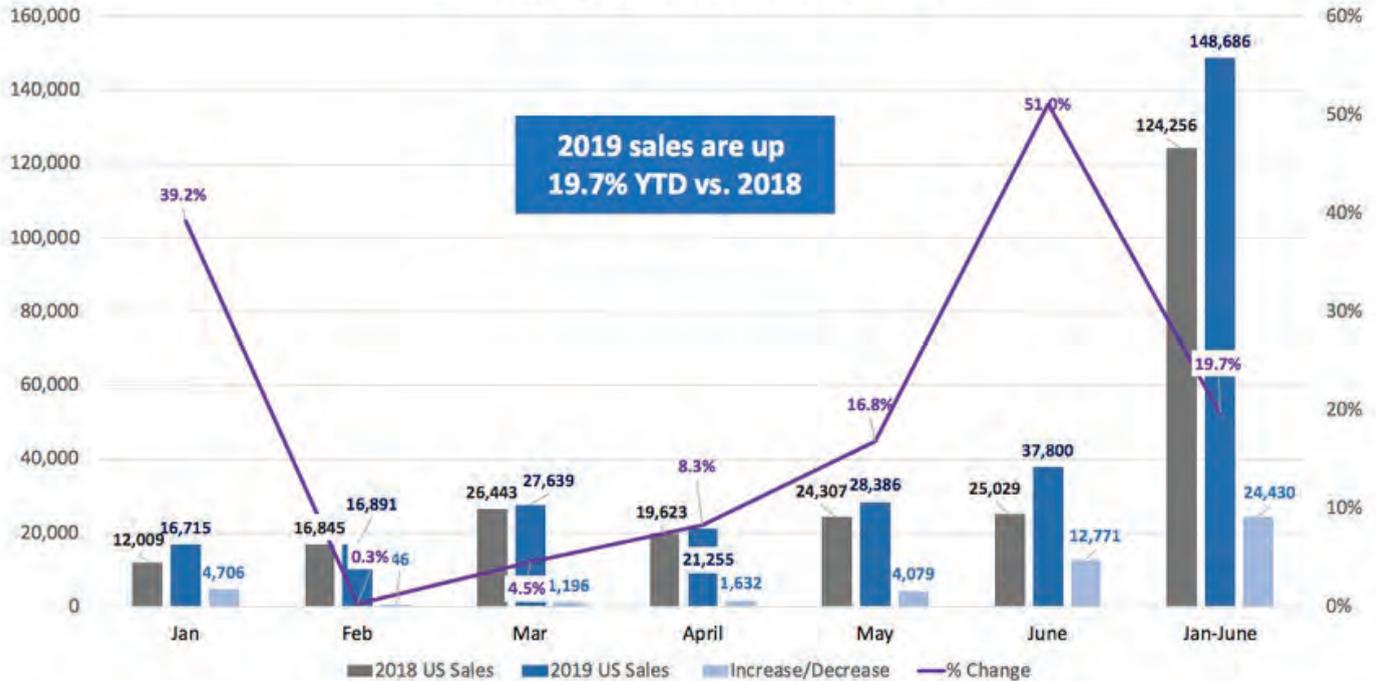


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US EV Sales: Jan-June 2019 vs 2018

Data: InsideEVs | Chart: Loren McDonald/EVAdoption.com



January to June 2019 year-on-year US EV sales growth (Source: Loren McDonald/EVAdoption.com)

capital-intensive charging infrastructure across the nation, adding an additional burden for the vehicle manufacturer but also creating opportunities for third-party services with an ongoing subscription model. Some states have made charging infrastructure availability a matter of priority in order to accelerate EV adoption. This year, California announced a \$2.5 billion initiative to bring five million EVs onto state roads by 2030 and to install 25,000 EV charging points by 2025.

What standards apply to charging?

To aid multi-agency and commercial charging deployments, the US Department of Energy hosts the Alternative Fuel Data Center, which provides guidelines, specifications and infrastructure sizing tools to help plan charging infrastructure. It also provides an EV journey planning tool.

The AFDC stipulates the AC and DC connector for use in Level 1, Level 2 and DC fast charging methods. For AC Level 1 and 2 charging the J1772

charge port is used, with DC fast chargers utilizing a combination termed the J1772-CCS. While the CHAdeMO connector is popular, already used by Nissan, Mitsubishi and Toyota, Tesla has created its own connector arrangement used across all its charging options. An additional standard J3068 is in development for extremely high charge rates using three-phase AC supplies. Procurement professionals working on EV charging equipment will find a research report hosted on the DoFE website of particular interest when specifying for this future method of rapidly charging EVs.

Looking ahead, the next few years will see the ratio of EV charging infrastructure to EVs pass today's near-unity position. As the many initiatives from EV manufacturers, government authorities and charging infrastructure service providers gather momentum, the industry is set to remove range anxiety from the minds of EV owners.

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America's supply chain: hostage to tariffs



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

John Denslinger takes a closer look tariffs, their impact on the electronics supply chain and some of the actions companies are taking

Tariffs • By John Denslinger

The on-again, off-again negotiations between the US and China are on-again according to published reports from the recent G20 meetings. That being the case, I'll bet there are a number of procurement departments shaking their heads as they assess and re-assess supply chains. Does it adjust easily to these challenging conditions? Is it still cost efficient? Will it survive the seismic shifts that seem to be the routine now rather than the exception? Bottom line, do I have a robust supply line or is it hostage to tariffs?

If you're having trouble distinguishing rhetoric from fact, welcome to the club although the key point remains: both sides have committed to resuming talks. President Xi said: "China and the US both benefit from cooperation and lose in confrontation." In his own style, President Trump concurred: "Talks with China are back on track." Whether the stalemate is resolved any time soon is debatable, but the good news, talks have restarted.

So, where do we go from here? A CATO Institute study at the end of last year, listed more than 200 US based companies adversely hurt by tariffs. For the electronic component industry, that included a broad customer segment particularly hard hit: automotive, aero, medical devices, contract assembly, white goods, marine, industrial and heavy equipment. Perhaps more bad news from Torsten Slok, chief economist for Deutsche Bank, who was quoted as saying semiconductor sales are proving to be a reliable indicator of the broader US tariff economy and unfortunately semi sales are trending down in 2019.

It's worth noting both Presidents have significant tariff policy discretion, so the future is anything but certain. Even if an agreement were inked tomorrow, tariffs would likely remain for some time as the logical compliance enforcement tactic. The hope of many for a quick settlement is gone and so too the ability to fully absorb the cost arising from this tariff war. With short term options seemingly exhausted, it's time to consider long run countermeasures.

So what countermeasures are most commonly discussed? Again, referencing the CATO study, the composite of companies identified five distinct actions:

- Super-aggressive cost reduction including downsizing
- Accelerating the shift of supply out of China to other regions
- Postponing capital investment and R&D projects planned for 2019 and 2020
- Redesigning products purposely eliminating components made in China
- Re-writing contracts making it easier to pass tariff related costs onto customers

You might have noticed 'just raise prices' is totally absent. I would imagine that's the American dream but reality would suggest otherwise. To the surprise of no one prices are bound to rise.

And, production is not coming back. While companies may be reconfiguring supply chains, US trade balance data suggests the tariff war is not creating any meaningful shift of production to the US. Declining imports from China have been completely offset by increased imports from other countries.

Unfortunately, tariffs have become a potent economic weapon. The goal of worldwide free trade is an honorable one and worth the work-arounds. Let's hope for a USMCA-like settlement and soon. Being a hostage does have endurance limits.

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Rising demand from automotive OEMs should not crimp integrated circuit supply

However, electronics purchasers may face shortages again for discrete semiconductors because of increasing demand from the automotive OEMs

Electronics buyers in non-automotive industries may face tight supply conditions for power transistors, diodes and some passives if sales of automobiles pick up sharply over the next years

Increased vehicle sales, coupled with rising electronics content in cars and light trucks, would likely result in tight supply for a number of discrete semiconductors and integrated circuits (ICs). Of course, buyers had to deal with similar issues in 2017 and 2018, but tight supply conditions eased this year as suppliers added capacity and overall demand weakened. But the question is has enough capacity been added if demand picks up again?

Electronics content in vehicles will continue to rise even if car sales slump, according to analysts. If vehicle sales rebound, supply will likely tighten again for power transistors, diodes, and some passives such as multilayer ceramic capacitors because automotive systems require large volumes of those components.

The good news for buyers, but bad news for automakers, is U.S. automobile and light truck sales are expected to fall 1.4 per cent to \$16.8 billion in 2019, according to the National Automobile Dealers Association. In Europe, passenger car sales were expected decline 1 per cent to 15 million units, said the European Automobile Manufacturers' Association (ACEA).

However, while car sales may

decline in the short term, electronics content in vehicles will continue to increase in virtually all car models, ranging from low-end economy cars to high-end luxury vehicles.

The added electronics content has led to a rise in the number of semiconductors and other components that are being shipped to automobile systems manufacturers and that trend will continue for at least the next five years.

As a result, component demand from the automotive manufacturers will rise. "Automobile sales may be flat to down or increase 10 per cent, but there still will be growth in automotive segment semiconductors because of the growth in functions in vehicles," said Nina Turner, research manager, semiconductor applications forecaster enabling technologies: automotive and energy for IDC. Automotive systems require a range of chips from basic small signal transistors to microprocessors.

Auto chip market rises

The automotive semiconductor market is expected to rise from \$41.7 billion in 2018 to \$43.5 billion in 2019, according IDC. The automotive chip market will continue to increase through 2023 when revenue reaches \$62.5 billion, the researcher said.

"Automotive is one of the strongest growth areas for the semiconductor market," said Turner. "Computing and mobile phones are flat

to down, but demand from automotive continues to rise," because electronics content in vehicles is increasing, she said.

More semiconductors are being designed into cars because of the growth of Advanced Driver Assistance Systems (ADAS), infotainment and connective systems in vehicles as well as development of autonomous vehicles and electrification of vehicles.

Those trends mean more integrated circuits and discrete semiconductors are needed by automakers and their suppliers. The automotive segment is becoming more important to more chipmakers. For instance, semiconductors, excluding memory ICs, that were sold to automotive companies represented about 11 per cent of all semiconductor sales in 2015, according to IDC. By 2023, that percentage will increase to 15 per cent, said Turner.

Increased demand for semiconductors by automotive companies could impact supply of certain, but not all chips. Automotive systems use a lot of microcontrollers and analog semiconductors. Microcontrollers account for about 39 per cent of the automotive IC market, while analog semiconductors represent about 24 per cent, according to researcher IC Insights.

"When you get beyond that, memory, microprocessors, and digital signal processors and standard logic are small

segments of the automotive chip market," said Brian Matas, vice president of market research firm IC Insights.

Automakers have used microcontrollers in their systems for decades, but ADAS, infotainment and other sophisticated systems require more of them.

MCU demand increases

Automotive MCU sales revenue will total about \$6.4 billion this year. "Probably 75 per cent of that is expected to be 32-bit MCUs," said Matas. Sixteen-bit MCUs will account for about 19 per cent of all microcontrollers used in automotive applications, while 8-bit or less MCUs will make up the rest of the auto MCU market.

"That has that changed over the years. Ten years ago, 8-bit MCUs were primarily used in automobiles," he said. But as prices declined and automotive electronics systems became more complex and needed a lot more computational power, 32-bit MCUs were more widely used. Such systems include ADAS, infotainment systems and GPS maps.

MCU suppliers "made it pretty easy to step from their 8-bit families to the 32-bit family" by reducing cost, so prices became more competitive, which encouraged automotive OEMs to upgrade to 32-bit devices, said Matas.

With analog semiconductors, power management ICs are widely used in automotive systems. "It's really critical in

a car to make sure nothing is using more power than it needs to," said Matas. "You don't want to draw more power from the battery that is necessary. With 12-volt and even 42- and 48-volt systems, it's necessary to maintain the minimal amount of power to make sure that proper power is distributed," he said.

Power management IC demand from the electric vehicle market will continue to grow over the next several years "although the EV market is small and may be just 2 to 4 per cent of total car sales," said Matas. However, there are twice as many power management ICs and other semiconductors in an EV as there is in an internal combustion powered vehicle, he said. Hybrids have a little more semiconductor content than conventional cars.

"If the EV market takes off there will be much greater demand for microcontrollers and for power management devices," said Matas.

Automotive growth discrete shortages

Automotive is also driving demand for discrete semiconductors and optoelectronics, including high brightness LEDs and image sensors. "Automotive is a high-growth area for discretes and has always been an important segment especially with power transistors and diodes," said Rob Lineback, senior market analyst for IC Insights.

"Automotive was the prime culprit over the last couple years for shortages and tight supply of power transistors," he said. Lead times for power MOSFETs exceeded 40 weeks, as more power transistors were designed into more automotive electronics systems.

He said automotive demand for power transistors, diodes and other discretes is continuing to grow despite a weak automotive market. One reason for continuing growth is their use in electric vehicles (EV), which require more power transistors than traditional internal combustion engine vehicles, said Lineback.

EVs and hybrids will also result in greater demand for diodes, which are often "teamed up" with insulated gate bipolar transistors (IGBTs) in electric vehicles, said Lineback. In addition, other discretes are also needed in electric vehicles including small signal and regular transistors and rectifiers, he said.

Discrete semiconductor purchasers at automotive companies can expect to be purchasing more power transistors that are based on silicon carbide (SiC) and gallium nitride (GaN) compounds. GaN and SiC technologies are really taking off and getting a real stronghold in automotive, said Lineback. "It seems that every single supplier is announcing something

every other month about those technologies, and new products or some type of partnership with automotive customers, he said. *See related story page 20.*

Because of strong demand chipmakers have added some new capacity for discretes, "but don't want to overbuild capacity because they don't want a supply glut. On the other hand, they can't afford to let business go to competitors," said Lineback. As a result, chipmakers are taking a cautious wait-and-see approach before making large investments in new production.

Automotive demand for optoelectronic components, including high-brightness LEDs, infrared emitters, and CMOS image sensors, is also growing, said Lineback.

Wanted: more image sensors

Demand for image sensors by automakers is especially strong and will continue to rise over the next several years. Last year, automotive accounted for a relatively small percentage of image sensor demand. However, more vehicles are being equipped with ADAS including such features as crash avoidance, and backup warning as more image sensors are needed in such systems. In 2018 only about 6 per cent of all image sensors were used in automotive applications, while 60 per cent were used in smart phones. By 2023, the

percentage of image sensors used in automotive will increase to 15 per cent and smart phones will account for 45 per cent of image sensors, according to IC Insights.

The compound annual growth rate over the next five years for image sensors used in automotive applications will be 30 per cent as revenue rises from less than \$900 million to \$3.2 billion in 2023, the researcher said.

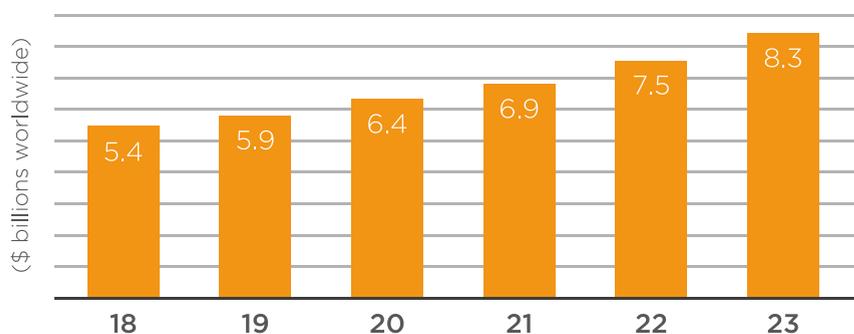
Automotive demand will also rise for other types of sensors, including pressure, motion detection, accelerometers, magnetic field, temperature sensors and gyroscopes. In fact, while smart phones and video games are growing segments for sensors, automotive is still the biggest market for sensors, said IC Insights.

More IC supply added

While semiconductor demand from automotive companies increased and caused some supply shortages for discretes in recent years, it did not cause acute problems with integrated circuits supply and IC supply should not be a problem over the next several years. One reason is that IC makers that derive a large percentage of their sales to the auto industry are adding capacity or have acquired other chipmakers and fabs in an effort to meet rising semiconductor demand from their automotive customers.

Such chipmakers include IC industry heavy hitters such as

Revenue rises for automotive sensors



Increasing use sensors in automotive systems will drive revenue for sensors and actuators to more than \$8.3 billion by 2023.

Source: IC Insights

Infineon, STMicroelectronics, ON Semiconductor, Texas Instruments, and NXP and SONY, among others.

Automotive can represent 20-35 per cent of such chipmakers' businesses. "All the major semiconductor suppliers have automotive as a top priority," said Lineback.

Infineon is a leading automotive supplier "and they want to maintain that level," said Matas. "SONY is the world's largest CMOS image sensor maker and they have set a target to be the number one supplier of automotive sensors by the middle the next decade," said Lineback. TI makes a lot of analog chips used by auto companies and STMicroelectronics has a robust automotive business, too.

Such companies are making investments to make sure their automotive businesses grow as more electronics

systems are designed into vehicles. For instance, Infineon announced in June it would acquire Cypress Semiconductor which makes microcontrollers among other chips. Infineon's decision to buy Cypress is largely driven by growth in the automotive segment, said Matas. "They are interested in what Cyprus brings in terms of microcontrollers."

Infineon is planning to build a 300mm fab for analog and "a lot of that is driven by the

automotive market," he said.

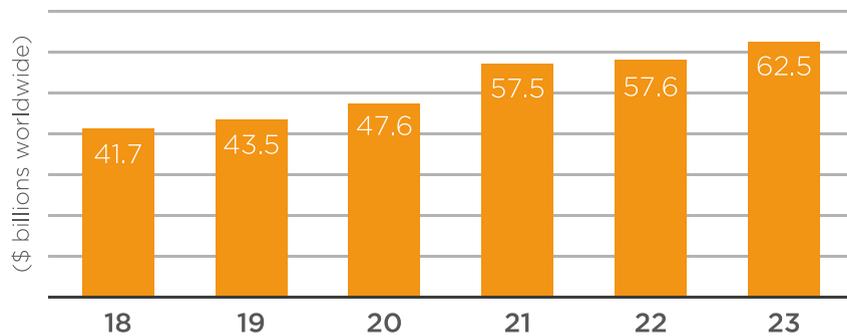
In addition, ON Semiconductor announced in April that it would purchase the East Fishkill, N.Y. fab from GlobalFoundries, which builds chips on 300mm wafers.

"One reason they bought the GlobalFoundries fab is they see the automotive segment expanding and they want to use their 300mm capability in that fab to produce cheaper power management devices,"

said Matas. ON wants to produce more parts for automotive over the next five or 10 years as the segment grows, he said.

"The biggest automotive IC suppliers are not standing still. They are preparing facilities for what they see will be a pretty good expansion" in automotive, said Matas.

Auto semiconductor sales take off



The global market for automotive semiconductors will post robust growth through 2023 when revenue reaches \$62.5 billion.

Source: IDC

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Standard logic will post modest growth through 2023

Not all standard logic functions can be integrated on other chips, so demand for logic gates, buffers, encoders and other logic parts will grow albeit at a slow rate



James Carbone

While standard logic chips are mature products, they will post steady, but slow growth over the next several years as the prosaic parts continue to be used in equipment ranging from inexpensive electronic toys to high-end servers.

Semiconductor buyers can expect standard logic tags to be mostly steady as supply will remain ample. There could be short-term price increases if demand temporarily rises due to inventory building by distributors, OEMs and EMS providers, but that is unlikely to occur for the rest of 2019. Standard logic chips include logic gates, buffers, bus transceivers, inverters, flip-flop ICs, encoders among other chips.

The global market for standard logic was \$1.45 billion in 2018 when about 20.3 billion units shipped, according to Semico Research. Guy Rahamim, product line manager for ON Semiconductor, said standard logic demand was strong across the board in 2018, "in line with

the overall semiconductor market. We experienced higher demand across all industries, but did see higher demand growth" in automotive, networking, cloud computing and industrial segments including factory automation, said Rahamim. He added there was an increase of components per system based on added functionality.

Standard logic is needed in many systems because it is the "glue that allows compatibility between components and circuits that weren't designed to work together," said Rahamim.

In 2019, about 19 billion units will ship and revenue should decline slightly to \$1.4 billion because of overall weaker demand for all semiconductors including standard logic according to Semico. However, demand for standard logic will increase next year and for several years thereafter. By 2023, standard logic, sales will reach \$1.9 billion and 24 billion units will ship, the researcher said.

Up and down market

The standard logic market has been up and down over the past five years. In 2014 it was a \$1.5 billion market as 18.4 billion standard logic chips were sold. Then in 2015, demand declined as 17.3 billion units shipped. In 2016 manufacturers sold 17.9 billion standard logic chips.

"Interesting in 2015 there was a shortage, and we saw prices jump quite a bit," said Jim Feldhan, Semico president. "We saw prices went from 8.2 cents to 11.3 cents. In 2016 we saw prices fall to 8.4 cents."

In 2017, there were some shortages of wafers and that was followed by some inventory building by distributors, OEMs and EMS providers, resulting in 20.2 billion units being shipped, the researcher said. However, average selling prices declined and revenue totaled \$1.66 billion, according to Semico.

In 2018, standard logic sales

declined to \$1.45 billion although unit shipments increased slightly to 20.3 billion. Revenue fell because of price erosion as the average price for a standard logic chip was 7.1 cents. "It was the first time since 2013 when the ASP got into the 7-cent range," said Feldhan.

Ironically, the standard logic market in 2018 grew in terms of dollars and units from January through September. But after September, "we saw a continued degradation of dollars and units through December 2018," said Feldhan.

The slowdown continued into 2019. About 1.3 billion units shipped in January and shipments declined to 1.1 billion in February. Prices have also declined to 6.8 cents in June.

"I think the last time we saw prices in the 6-cent range was 2011," said Feldhan. However, the average for the year has been about 7.2 cents.

By the Numbers



19 billion

The number of standard logic chips that will ship in 2019.



\$1.9 billion

The forecasted size of the standard logic market 2023.



\$1.45 billion

The size of the global standard logic market in 2018.



7.1 cents

The average selling price for a standard logic chip in 2018.



24.3 billion

The number of standard logic chips that are forecasted to ship in 2023.

Source Semico Research



More integration

Growth in the standard logic market will remain slow because standard logic functionality is being designed into system-on-chip (SoC) solutions. However, not all standard logic functions will be integrated onto SoCs.

“There is always some little fix that needs to be applied to a circuit board because an engineer doesn’t want to redesign an SoC,” said Feldhan. Often, a standard logic part can be used rather than an SoC being redesigned.

“In a perfect world, a chip designer would never make a mistake and an engineer would think of all the features” an SoC would need. So, a separate standard logic chips would not be needed, Feldhan said. However, often a standard logic chip will be used to “fix a bug” or add some feature after the “chip is designed and taped,” said Feldhan. It’s often cheaper just to add a standard logic part than redesign the SoC.

However, standard logic is being integrated into more chips as products become more standard and feature sets get more stable. “But there are always new applications, new edge devices coming on that need standard logic.

As a result, there will continue to be modest growth for standard logic. “I think the overall market is growing and we’re still bullish that IoT and smart cities, and edge devices” will help drive the need for standard logic, said Feldhan.

Widely used parts

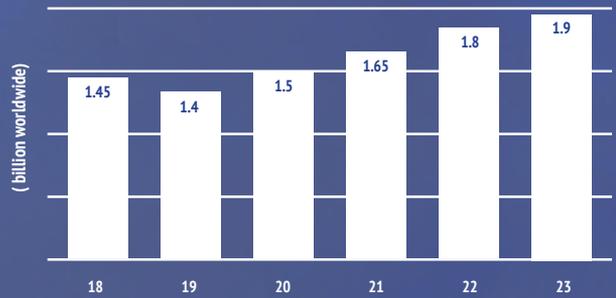
He noted that “around every system-on-a-chip or MCU, there are always a few standard logic parts” and standard logic is used in most electronics equipment. “Even in high-end servers you will see some standard logic,” said Feldhan. Standard logic is also used in computers, cell phones, networks and lower cost products such as remote controls, game controllers, garage door remote controls, toys, appliances, smart switches for lighting systems among many other products.

Rahamim said 5G handsets will create a temporary increase in demand for standard logic. However, 5G networks will have a more significant and longer lasting effect on the standard logic market, he said.

“Whether it is more sophisticated antenna systems, more back plane equipment to manage the flow of data, or cloud computing to store and analyze the vast amounts of data collected, it will lead to

Standard logic revenue growth will grow slowly through 2023. Source: Semico Research

Standard logic market will dip, then rise



a boost in standard logic for a sustained period of time,” said Rahamim.

Feldhan noted that more base stations will be needed for 5G networks than were needed for 4G networks. Base stations use standard logic, but “we’re talking about tens of millions and not billions of base stations,” according to Feldhan.

Fifth generation cell phone technology will enable more IoT and edge devices and those products could help drive standard logic over the next several years.

Consumer IoT products such as health monitors and smart watches use highly integrated SoCs and “aren’t heavily reliant on standard logic,” said Rahamim. “For home automation and industrial IoT there is higher consumption and growth” of standard logic, he said.

EVs will help drive demand

Automotive is adding to standard logic demand as more vehicles being built are hybrid or electric vehicles. “Electric and hybrid engine systems have an increase in standard logic components primarily in the communication portion of the system,” said Rahamim.

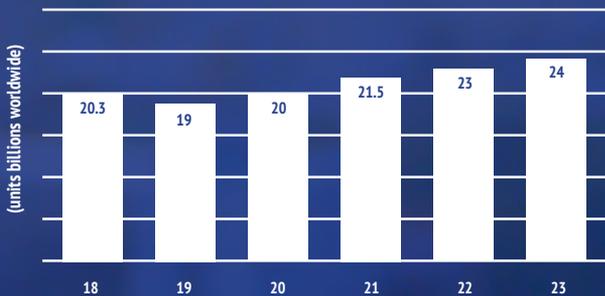
EVs will use more standard logic in the instrumentation panels and for power management systems than internal combustion engines. In addition, Advanced Driver Assistance Systems (ADAS) also require standard logic.

Autonomous driving will directly lead to an increase in usage of standard logic because self-driving cars will be enabled by ADAS and such systems are “heavy users of standard logic,” said Rahamim. ADAS systems require multiple sub-systems such as cameras and sensors which increase the overall usage of electronics, including standard logic, according to Rahamim.

Because standard logic is used in mature systems such as computers, and networking equipment as well as in new automotive and IoT applications, standard logic will remain a viable product category that will grow at a modest pace.

Standard logic chips may be “jellybean parts but they are used everywhere,” said Feldhan. “Standard logic is going to be here for the foreseeable future. I just don’t see a time when standard logic would go away,” he said.

Unit demand will rise



Standard logic unit demand will decline this year, but then increase again in 2020 for several years after. Source: Semico Research



Manufacturer	Distributor	Telephone	Website	Location	Franchised Distributor	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Buffer Stock Facility
CABLE ASSEMBLY												
FTDI	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €		50	1,500+	Y
Molex	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	300	N/A	0 €	97%	50	1,500+	Y
CIRCUIT PROTECTION												
Bourns	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,000	N/A	0 €	58%	50	1,500+	Y
EPCOS/TDK	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,000	N/A	0 €	58%	50	1,500+	Y
Littelfuse	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	35,000	N/A	0 €	67%	50	1,500+	Y
ENCLOSURES												
Bud	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,500	N/A	0 €	80%	50	1,500+	Y
Hammond	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	12,500	N/A	0 €	100%	50	1,500+	Y
Metcase Enclosures	OKW Enclosures	+44 (0) 1489 583858	www.metcase.com	EU	N/A	288	£40K	0 €	100%	5	22	Y
FREQUENCY												
ABRACON	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,000	N/A	0 €	91%	50	1,500+	Y
ECS	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	500	N/A	0 €	99%	50	1,500+	Y
Epson	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	500	N/A	0 €	59%	50	1,500+	Y
HEAT SINKS												
Aavid	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	67%	50	1,500+	Y
ICs & SEMICONDUCTORS												
Altera	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,600	N/A	0 €	60%	50	1,500+	Y
Analog Devices Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	9,500	N/A	0 €	83%	50	1,500+	Y
Atmel	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,700	N/A	0 €	58%	50	1,500+	Y
Avago Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	400	N/A	0 €	84%	50	1,500+	Y
Broadcom	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	69%	50	1,500+	Y
Central Semiconductor Corp.	Future Electronics	0049 40 547 277 000	www.futureelectronics.com	EU, UK	Y	N/A	N/A	N/A	N/A	N/A	N/A	Y
Cirrus Logic	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	300	N/A	0 €	80%	50	1,500+	Y
Cypress Semiconductor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,400	N/A	0 €	63%	50	1,500+	Y
Diodes Incorporated	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,600	N/A	0 €	98%	50	1,500+	Y
Exar	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,100	N/A	0 €	95%	50	1,500+	Y
Fairchild Semiconductor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,500	N/A	0 €	90%	50	1,500+	Y
Freescale Semiconductor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,500	N/A	0 €	42%	50	1,500+	Y
FTDI	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	97%	50	1,500+	Y
IDT (Integrated Device Technology)	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,100	N/A	0 €	97%	50	1,500+	Y
Infineon	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	800	N/A	0 €	66%	50	1,500+	Y
Intel	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	500	N/A	0 €	78%	50	1,500+	Y
International Rectifier	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	600	N/A	0 €	87%	50	1,500+	Y
Intersil	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,900	N/A	0 €	50%	50	1,500+	Y
ISSI	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	98%	50	1,500+	Y
Lattice	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	69%	50	1,500+	Y
Maxim Integrated	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	11,200	N/A	0 €	67%	50	1,500+	Y
Microchip	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	12,600	N/A	0 €	91%	50	1,500+	Y
Microsemi	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	400	N/A	0 €	90%	50	1,500+	Y
Monolithic Power Systems (MPS)	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	600	N/A	0 €	40%	50	1,500+	Y
NXP	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,900	N/A	0 €	91%	50	1,500+	Y
ON Semiconductor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,100	N/A	0 €	87%	50	1,500+	Y
Power Integrations	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	600	N/A	0 €	59%	50	1,500+	Y

Manufacturer	Distributor	Telephone	Website	Location	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
Qorvo	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	300	N/A	0 €	90%	50	1,500+	Y
ROHM Semiconductor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,400	N/A	0 €	55%	50	1,500+	Y
Silicon Laboratories	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,500	N/A	0 €	96%	50	1,500+	Y
Skyworks	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	300	N/A	0 €	91%	50	1,500+	Y
Spanson Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	600	N/A	0 €	93%	50	1,500+	Y
STMicroelectronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	4,500	N/A	0 €	99%	50	1,500+	Y
Texas Instruments	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	36,900	N/A	0 €	41%	50	1,500+	Y
Toshiba	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	500	N/A	0 €	100%	50	1,500+	Y
INTERCONNECTION												
3M	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,100	N/A	0 €	16%	50	1,500+	Y
Amphenol	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	25,600	N/A	0 €	53%	50	1,500+	Y
Amphenol	PEI Genesis	+44 8716060	www.peigenesis.com	EU	Y	N/A	£1.3m	10 €	N/A	N/A	85	Y
Anderson Power Products	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	800	N/A	0 €	50%	50	1,500+	Y
Cinch Connectivity Solutions	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,900	N/A	0 €	82%	50	1,500+	Y
Delphi Connection Systems	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,300	N/A	0 €	67%	50	1,500+	Y
FCI	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	4,300	N/A	0 €	94%	50	1,500+	Y
Glenair	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,900	N/A	0 €	76%	50	1,500+	Y
HARTING	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	4,700	N/A	0 €	31%	50	1,500+	Y
Harwin	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,200	N/A	0 €	79%	50	1,500+	Y
Hirose Electric	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	6,100	N/A	0 €	99%	50	1,500+	Y
Hirose Electric Europe B.V.		0031-(0)2 655 7460	www.hirose.com/eu	EU	Y	50,000	N/A	0 €	N/A	N/A	4,190	Y
ITT Cannon	PEI Genesis	+44 8716060	www.peigenesis.com	EU	Y	N/A	£1.3m	10 €	N/A	N/A	85	Y
JAE Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,200	N/A	0 €	32%	50	1,500+	Y
Kycon	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	99%	50	1,500+	Y
LEMO	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,900	N/A	0 €	65%	50	1,500+	Y
Molex	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	16,900	N/A	0 €	75%	50	1,500+	Y
Neutrik	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,000	N/A	0 €	86%	50	1,500+	Y
ODU		+49 8631 6156-0	www.odu.de	EU, USA, ASIA			N/A	0 €	N/A	50	1,650	
Phoenix Contact	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	12,000	N/A	0 €	99%	50	1,500+	Y
Switchcraft	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,200	N/A	0 €	69%	50	1,500+	Y
TE Connectivity	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	30,900	N/A	0 €	40%	50	1,500+	Y
OBSOLESCENCE / HARD TO FIND												
	America II Electronics	01462 707070	www.americaii.com	EU, G, UK	N	1,900	\$1B	0 €	75%	59	550+	Y
	Chip 1 Exchange	949-589-5400	www.chip1.com		Y	850,000	N/A	\$0	85%	20	150	
OPTO ELECTRONICS												
Avago Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	8,200	N/A	0 €	89%	50	1,500+	Y
Cree, Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	22,500	N/A	0 €	74%	50	1,500+	Y
Dialight	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	9,800	N/A	0 €	99%	50	1,500+	Y
Kingbright	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,100	N/A	0 €	100%	50	1,500+	Y
Lumileds	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,100	N/A	0 €	99%	50	1,500+	Y
Newhaven Display	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	65%	50	1,500+	Y
Osram Opto Semiconductor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,800	N/A	0 €	99%	50	1,500+	Y
VCC	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,000	N/A	0 €	92%	50	1,500+	Y
Vishay	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,100	N/A	0 €	99%	50	1,500+	Y
PASSIVES												
AVX	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	70,700	N/A	0 €	58.00%	50	1,500+	Y

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Bourns	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	49,500	N/A	0 €	98%	50	1,500+	Y
Coilcraft	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	10,400	N/A	0 €	98%	50	1,500+	Y
Cornell Dubilier	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	33,000	N/A	0 €	65.00%	50	1,500+	Y
EPCOS / TDK	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	31,000	N/A	0 €	74%	50	1,500+	Y
Fair-Rite	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,000	N/A	0 €	94%	50	1,500+	Y
Kemet	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	135,800	N/A	0 €	93%	50	1,500+	Y
Kemet	RS Components	08457 201201	www.rs-components.com	EU	Y	N/A	£161m	0 €	N/A	50+	2,500	Y
KOA Speer	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	107,900	N/A	0 €	82%	50	1,500+	Y
Laird Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,800	N/A	0 €	50%	50	1,500+	Y
Murata	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	67,300	N/A	0 €	99%	50	1,500+	Y
Nichicon	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	21,600	N/A	0 €	47%	50	1,500+	Y
Ohmite	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	17,300	N/A	0 €	99%	50	1,500+	Y
Panasonic	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	67,900	N/A	0 €	69%	50	1,500+	Y
Taiyo Yuden	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	6,400	N/A	0 €	82%	50	1,500+	Y
TDK	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	25,300	N/A	0 €	85%	50	1,500+	Y
TT Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	32,800	N/A	0 €	55%	50	1,500+	Y
United Chemi-Con (UCC)	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	13,900	N/A	0 €	99.00%	50	1,500+	Y
Vishay	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	119,800	N/A	0 €	76%	50	1,500+	Y
Würth Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	4,500	N/A	0 €	63%	50	1,500+	Y
Würth Elektronik	Würth Elektronik	+49 (0) 7942 945 0	www.we-online.com	EU	Y	N/A	N/A	0 €	100%	250	4,000	Y
Yageo	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	45,300	N/A	0 €	99.00%	50	1,500+	Y
POWER & BATTERIES												
Bel Power Solutions	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,400	N/A	0 €	94%	50	1,500+	Y
Cincon	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,500	N/A	0 €	60%	50	1,500+	Y
Cosel	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	11,800	N/A	0 €	99%	50	1,500+	Y
CUI Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,900	N/A	0 €	100%	50	1,500+	Y
Mean Well	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	4,500	N/A	0 €	75%	50	1,500+	Y
Murata	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,200	N/A	0 €	93%	50	1,500+	Y
RECOM	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	23,300	N/A	0 €	92%	50	1,500+	Y
Sanyo Electronic Industries Co., Ltd	Sanyo Electronic Industries Co., Ltd.	+81 36699 8080	www.eta.co.jp	JP	N	1,000	€3000k	20 €	90%	10	100	Y
Schaffner	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	900	N/A	0 €	98%	50	1,500+	Y
SL Power	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,100	N/A	0 €	87%	50	1,500+	Y
TDK-Lambda	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	4,600	N/A	0 €	99%	50	1,500+	Y
TRACO Power	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	3,400	N/A	0 €	95%	50	1,500+	Y
SENSORS												
All Sensors	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,300	N/A	0 €	70%	50	1,500+	Y
ams	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	400	N/A	0 €	77%	50	1,500+	Y
Analog Devices Inc.	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	500	N/A	0 €	78%	50	1,500+	Y
Bosch	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	94%	50	1,500+	Y
Freescale Semiconductor	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,000	N/A	0 €	66%	50	1,500+	Y
Honeywell	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	15,500	N/A	0 €	80%	50	1,500+	Y
Maxim Integrated	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	900	N/A	0 €		50	1,500+	Y
Melexis	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €		50	1,500+	Y
Omron	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	5,700	N/A	0 €		50	1,500+	Y
Sensirion	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €		50	1,500+	Y
TE Connectivity	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,100	N/A	0 €		50	1,500+	Y
SWITCHES & KEYBOARDS												
ALPS	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	400	N/A	0 €	70%	50	1,500+	Y

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Apem	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	96%	50	1,500+	Y
C&K Components	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,500	N/A	0 €	84%	50	1,500+	Y
Carling Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	300	N/A	0 €	87%	50	1,500+	Y
CHERRY	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	200	N/A	0 €	77%	50	1,500+	Y
CHERRY	RS Components	08457 201201	www.rs-components.com	EU	Y	600	N/A	0 €	N/A	50+	3,500+	Y
E-Switch	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	94%	50	1,500+	Y
Grayhill	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	400	N/A	0 €	84%	50	1,500+	Y
Honeywell	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	700	N/A	0 €	98%	50	1,500+	Y
NKK Switches	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	1,100	N/A	0 €	94%	50	1,500+	Y
Omron	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	900	N/A	0 €	68%	50	1,500+	Y
Rubbertech 2000	Rubbertech 2000	+44 1594 826019	www.rubbertech2000.co.uk	EU	N/A	N/A	£40k	100 €	N/A	N/A	25	Y
TE Connectivity	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	400	N/A	0 €	98%	50	1,500+	Y

THERMAL MANAGEMENT

ADDA	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	800	N/A	0 €	59%	50	1,500+	Y
Delta Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	500	N/A	0 €	28%	50	1,500+	Y
ebm-papst	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,200	N/A	0 €	99%	50	1,500+	Y
Sanyo Denki	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	2,900	N/A	0 €		50	1,500+	Y

WIRELESS

Anaren	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	86%	50	1,500+	Y
B&B Electronics	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	87%	50	1,500+	Y
Bluegiga Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	93%	50	1,500+	Y
Digi International	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	200	N/A	0 €	92%	50	1,500+	Y
Laird Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	76%	50	1,500+	Y
Linx Technologies	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	99%	50	1,500+	Y
Microchip	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	85%	50	1,500+	Y
Murata	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	100%	50	1,500+	Y
Panasonic	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	91%	50	1,500+	Y
Redpine Signals	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	94%	50	1,500+	Y
RF Digital	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	100%	50	1,500+	Y
Texas Instruments	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	75%	50	1,500+	Y
Wi2Wi	Mouser Electronics	0049 (0)89 520 462 110	www.mouser.com	EU	Y	100	N/A	0 €	36%	50	1,500+	Y

PCB Buyers' Guide

Manufacturer	Telephone	Website	Service Provided (i.e. Boiler Manufacture &/or Repair)	Location	Approvals	Volume - Small, Medium, Large	Double-sided	Multi-layer 4-10/10-20-30	Metal PCBs	Flexi / Flexi-Rigid	Obsolescence Solutions	Modifications	Prototyping
Elvia PCB Group	+33 233 765 200	www.gepcb.com	M/B	France, Tunisia, China	AS9100, PRI-NADCAP, ISO-TS16949, ESA, UL, ISO9001, ISO14001	S/M/L	Y	1-30	Y	F, F/R	Y	Y	Y
Graphic Plc	00441363 774874	www.graphic.plc.uk	M	UK/China	AS9100, NADCAP, ISO 9001, AISI 4001, OHSAS 18001, MI 31032, MI 55110, MI 50884	S/M/L	N	4-10	Y	Y	N	Y	Y

Contract Manufacturers Buyers' Guide

Manufacturer	Telephone	Website	Turnover	Location	Approvals	Employees	Number of Surface Mount Lines	BGA Capacity	Lead Free Manufacturer	Prototyping	Design Capability	Full Turnkey	Cables and Harnessing
AWS Electronics Group	+44 (0)1782 753200	www.awselectronicsgroup.com	£40m	UK & Slovakia	AS9100, ISO9001, 13485, 14001, TS16949, IPC-A-610 Class 3, NADCAP	430	11	Y	Y	Y	Y	Y	Y

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