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NORTH AMERICA
Supply chain
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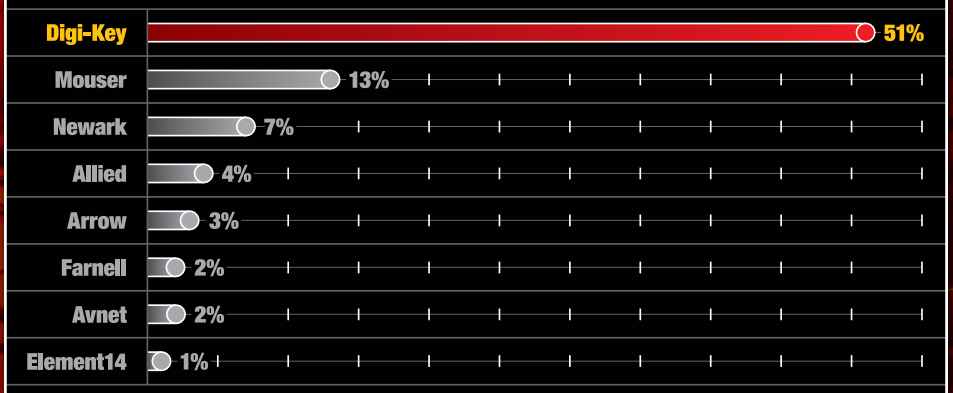
Immediate Access!

Best in Class: In Stock for Immediate Shipment?*



*AspenCore's 11th Design Engineer and Supplier Interface Study gathered information from engineers regarding their need for product information and other services, as well as how and when they interface with suppliers and how they see the quality and value of that interface. 1,750 U.S. engineers participated in this year's web-based survey. The results represent those surveys completed by April 2016.

When asked "Best in Class: Parts in stock available for immediate delivery?" The chart above shows the results among the industry's electronic component distributors.

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editor's word

Front cover - January 2017
Supply chain page 12

Print (plastic) and be damned

I moved recently, from a house with a shed, to an apartment without. It's a short-term event while the children make their own way in life but it has had consequences: I've had to mothball my engineering workshop. I haven't made anything for months and cracks in my personality are starting to appear.

For some time, I've been discussing the 'democratisation' of design and production, where anyone can turn an idea into a manufactured product if they want to. It's time to put my money where my mouth is, so I asked Santa if he could bring me a 3D printer.

I'm swapping a workshop of metal cutting equipment for a dining room full of additive production systems. I'm in charge of CAD and production. My daughter (15) is looking after design thanks to her inquisitive mind. My son (18) is managing the consumer marketing via social media. Last but not least my wife will attempt to hold the whole thing together using advanced people management skills.

We have deliberately chosen a low-cost, open-source kit (sub £200) with a good build volume (200 x 200 x 250). The machine can self-replicate so once the first is built it can start making clones.

Some products will be mechanical, some electronic. If any make it through the Kickstarter process I'm especially pleased that the pages of *Electronics Sourcing* magazine itself will play an important role in helping me find the right distributors and manufacturing partners.

Jon Barrett

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Think *positive*

ECIA president and chief executive officer, John Denslinger, explains what can be deduced from the current market indicators and asks what a Trump presidency will mean for the future

Looking ahead at the year to come, it's important to get to grips with two key leading indicators: the purchasing managers index and gross domestic product.

Passives and semiconductor shipments have actually been tracked against PMI since 2004 by Custer Consulting. This comparison has consistently shown strong correlation between global PMI and component shipments. According to Markit Analytics, global PMI turned positive at mid-year and assuming PMI is a bellwether of component shipments at least six to nine months out, the positive trend suggests solid global growth through most of 2017.

Focusing specifically on US PMI, the story is almost the same. The Institute of Supply Management shows the uptick in US PMI started three months ago. That being the case, the US lags the global trend by one quarter. Perhaps the conclusion here is to expect a slower start to 2017, but continuous growth nonetheless.

A resilient industry

In the seven years following the recession of 2008 to 09, US GDP averaged a meager 2.3 per cent. It remains the slowest post-recession recovery period on record with under-employment astonishingly high. Unfortunately, our professional politicians have tended to diminish expectations of strong economic growth by suggesting this is 'the new normal' rather than addressing real economic stagnation.

The reason GDP is so important is that electronic component growth trends follow the rate of GDP growth closely. In the post recovery period, the North American electronic component industry grew slightly better than three per cent. Considering prices have fallen throughout, it's definitely a testament to the resilience of our industry.

Currently, the 2017 forecast for US GDP is around 2.3 per cent or less. Similarly, global GDP, according to latest figures from the International Monetary Fund, is projected at 3.4 per cent in 2017, up 0.3 per cent from 2016. Under ordinary circumstances then, it seems reasonable to project 2017 global electronic component growth to be around four per cent, with the US a little less, assuming a slower out-of-the gate start.

Election boost

Of course, any discussion of the forthcoming year must also take into account the impact of the unexpected, Brexit-like, US presidential election.

Might there actually be an immediate upside? Prior to the election, US PMI suggested optimism. Now we see small business optimism go off the charts. This is important because small businesses are the primary job creator in the US and perhaps central to renewed growth.

The reasons for their optimism were listed as infrastructure investment, corporate and individual tax relief and expanded energy resource development. There were also high hopes for a business approach to government decision making, with a removal of job limiting regulatory barriers and trade reform.

If President-elect Trump is able to move the GDP needle just one point, we could see electronic component industry growth in the four to 4.5 per cent range. Wouldn't that be awesome!

www.ecianow.org

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news

The latest industry news from the North American electronics marketplace

Distributor adds custom lighting solutions

A variety of Opulent North America's LED modules, heatsinks and starboards are now available through Digi-Key Electronics as a result of a global distribution agreement between the two companies. Multiple color temperatures and configurations are available, along with the ability to provide custom solutions on request.

Vice president of global semiconductor at Digi-Key, David Stein, commented: "We are excited to offer full custom lighting solutions. Engineers around the world will value the ability to use the starboards and modules as either project starters or volume solutions."

Opulent's products are said to provide an entire lighting solution including the light source, heatsink and power source and are ideal for lamp replacements as well as high bay, low bay, outdoor, street, stadium and auditorium lighting applications.

www.digikey.com

Electronics event attracts 73,000 visitors

A total of 2,913 companies from more than 50 countries presented their solutions at the Electronica trade fair, which was held in Munich in November. The theme for the show, which attracted approximately 73,000 visitors was: 'Connected worlds — safe and secure.'

According to chairman of Electronica's technical advisory board, European vice president and general manager automotive, NXP Semiconductors, Kurt Sievers: "Smart technologies and applications make it vital for new security solutions to keep up with developments. Security by design is an important guiding principle for the industry."

Automotive was another prominent theme at the event. One-third of all exhibitors presented solutions for this sector, while a total of 228 visitors from 20 countries participated in the Electronica automotive conference.

Electronica hosted a strong conference program with an interesting CEO Roundtable on the first day. The discussion showed that security is important, but also highly complex. The internet of things and cyber security were also key themes of the embedded platforms conference, which saw an increase in attendance.

www.electronica.de

Wireless module speeds secure IoT development

Mouser Electronics is now stocking Laird Technologies' BL652 Bluetooth 4.2 and near field communication module. Described as small and energy-efficient, the module boasts robust security and an easy-to-use programming language supporting rapid development of secure connectivity for the enterprise internet of things.

Modules are based on the Nordic nRF52 series system-on-chip. Users can develop using either Nordic's software development kit for the nRF52 or Laird's SmartBASIC programming language. SmartBASIC offers built-in functions that replace lines of C code and acts as a bridge between software and hardware, allowing designers to take applications developed on other Laird BL600 series solutions and port them seamlessly to the BL652 module.

Advantages of the BL652 include an industrial temperature rating of -40 to +85°C and choice of an integrated antenna or an IPEX MHF4 connector for external antennas.

www.mouser.com

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Agreement promotes M2M rollout

Future Electronics has announced a new franchise agreement with Gemalto, a digital security specialist based in Amsterdam. Its technologies are used to authenticate identities and to encrypt and protect data in personal devices, connected objects, the cloud and in between. The new agreement for the Americas includes Gemalto's full portfolio, encompassing M2M products, cellular technologies and internet of things solutions.

Vice president marketing, Future connectivity solutions, Matthew Rotholz, (pictured) said: "The addition of Gemalto will bring our embedded cellular business to new levels. Its M2M portfolio is at the forefront of new cellular technologies that will enable us with complete solutions for the internet of things."

Head of M2M sales for Americas at Gemalto, Juan Carlos Lazcano, said: "We want to make it easier for M2M companies, like Future Electronics, to offer a complete, go-to-market portfolio without the complexity of working with multiple vendors."

www.futureelectronics.com

Over 2,500 power products added

XP Power has signed a distribution agreement with Electrocomponents covering its AC-DC power supplies, DC-DC converters and high voltage power supplies. As a result, over 2,500 products will now be available through Electrocomponents' trading brands RS Components and Allied Electronics.

XP Power's AC-DC power supply range covers power outputs from five to 3,000W and includes desktop, plug-in wall mounted, DIN rail, open-frame and enclosed chassis mount supplies. DC-DC converters, including those certified for use in medical and railway applications, range from 0.25 to 600W output. DC to high voltage DC converters covering both regulated and proportional ranges up to 10kV will also form part of the offering.

www.xppower.com

Hi-rel sourcing made simple

Manufacturer of high reliability connector products, Positronic, has appointed Powell Electronics as an authorized distributor in the North America market.

Powell is now authorized to sell the entire Positronic connector offering, including power and hybrid, D-sub, rectangular, modular and circular connectors. Many configurations of these series types will be stocked in the Powell Electronics warehouse in New Jersey for immediate shipping. Customized or tailored solutions are available as well.

Positronic president and CEO, John Gentry, said: "We are pleased to establish a formal partnership with Powell Electronics, knowing its long-standing reputation and expertise for service and distribution."

www.connectpositronic.com

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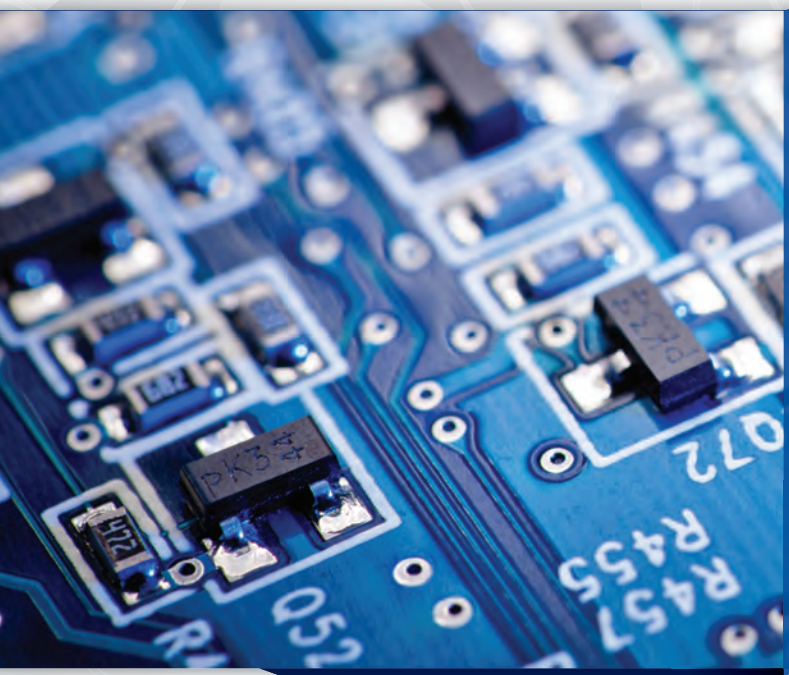

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Go wild with wireless

Wireless technology is integral to virtually every aspect of modern society, from cordless telephones to satellite communications devices. Naturally, the emergence of the internet of things (IoT) will give rise to a new generation of battery-powered devices from radios to smartphones and a multitude of wireless sensors.

To help purchasers navigate the wireless technology map, here is a brief review of some of the most common forms of wireless communications.

Stay mobile
Commonly used in 4G wireless smartphones, WiMAX enables web surfing at data rates of more than 30MB/s without connection to either cable or digital subscriber line.

Wi-Fi provides a wireless solution with limited range due to low power. It is mainly used in laptops, smartphones and in-home technologies where users are within range of a router or signal repeater. The Wi-Fi Alliance has established various Wi-Fi standards, including IEEE 802.11, IEEE 802.11A, IEEE 802.11G, and IEEE 802.11N. Its main advantages include ease of integration, convenience, mobility and expandability compared to hard-wired networks.
The disadvantages of Wi-Fi, however, include possible signal interference, data security, limited range and low speed data transmission.

When it comes to transferring or sharing data over moderate distances from smart phones to hands-free devices, wireless keyboards and laptops, Bluetooth technology is extremely popular. Compared to Wi-Fi, Bluetooth connections are typically less prone to interference.

ZigBee, LoRa and WirelessHART communications protocols are designed to operate with very low power consumption, thus serving to extend battery life. This is especially valuable for remote wireless sensor applications involving hard-to-access locations.

Transmitting data
Various mediums are utilized to transmit wireless data, including wireless routers, adaptors, repeaters, microwave and radio frequency and infrared technologies.

Wireless routers convert data to RF signals and are used to create wireless local area networks that feature built-in security, including data encryption and firewalls. Wireless repeaters serve to amplify the strength of wireless signals, thus extending the range of a wireless router.

Microwave signals transmit data via Earth orbiting satellites within an operating frequency range of 11 to 14GHz and with transmission speeds of one to 10Mbps. They can also be transmitted directly between microwave towers with a clear line of sight between them, operating within a frequency range of four to 6GHz or 21 to 23GHz.

Data signals are transmitted via light emitting diodes or lasers when using infrared technology. Between two fixed points with a straight line of sight between them, IR signals can be transmitted within a frequency range of 100kbps up to 16Mbps. IR signals can also broadcast widely within a frequency range of 100GHz to 1,000THz with a signal transmission speed of approximately 1Mbps.

As 4G wireless technology proliferates, and 5G starts to emerge, designers and purchasers must work together to stay abreast of ongoing wireless developments in order to provide solutions that are relevant to increasingly tech-savvy consumers.

www.memoryprotectiondevices.com

President of Memory Protection Devices, Thomas Blaha, takes a look at the evolution of wireless and the plethora of technologies that exist today

President, Memory Protection Devices, Thomas Blaha

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Opportunities for cost reduction can be identified during the assessment phase of developing a supply chain program

Start small, think big

Transitioning to a supply chain program with a component distributor can lower total cost of ownership, reduce inventory requirements and realize component cost advantages through longer, larger volume contracts. Some purchasers are hesitant to utilize these programs, however, due to misunderstandings about how difficult they are to set up and manage, the volumes required, or the integration of inventory and ordering systems.

Cynthia Bova said: "At TTI, we offer many different value added supply chain solutions to help customers manage inventory, reduce costs, mitigate risk and save time and effort. These services can be extensive with a high degree of integration between TTI and the customer's supply chain processes. Advanced inventory management services include, for example: material requirements planning, forecast management, vendor managed inventory, auto-replenishment and stockroom management."

Scalable solutions

Not every company, however, is ready — or truly needs — these robust supply chain solutions. Maybe a smaller company has experienced rapid growth and its processes are still trying to catch up, or maybe an established company may simply not yet capture enough data for reliable forecasting solutions.

Bova added: "The great news is that you don't have to have a complex supply chain solution to take advantage of TTI's expertise and value added services. Even for smaller accounts, TTI can provide actionable insight and supply chain data that will help customers create efficiencies and reduce costs."

Given that pricing in the industry is currently very tight, there isn't much any distributor can do from a component-pricing standpoint, but that doesn't mean a customer can't lower its total cost of ownership. Opportunities where costs can be reduced, such as purchase order consolidation, shipping lot sizing, optimizing inventory spacing and turns, or amalgamating payables, can be identified during the assessment phase of developing a supply chain program and can uncover significant savings.

Flexible tools

Fortunately, TTI offers customers the flexibility to test supply chain solutions by starting out small. They can implement forecasting and inventory management on just a few components on their bill of materials to test the effectiveness of the tools. This facilitates an ongoing evaluation of the program, refining individual areas where efficiencies, savings and improvements can be made.

In order to achieve these savings, a good supply chain program needs to have qualified personnel evaluating the system on a consistent basis. Fortunately, certification programs do exist and it is worth looking for them when evaluating supply chain partners.

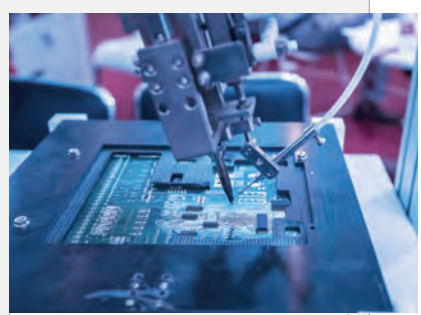
Bova explained: "Our supply chain specialists are happy to work with customers to share what we've learned through decades of building effective supply chain solutions and in fact, many customers go on to extend that knowledge to other vendors."

She concluded: "Regardless of size, ability to generate forecast data and purchasing process, customers can look to TTI to offer solutions right-sized and built just for them."

www.ttiinc.com

Supply chain optimization brings well-known benefits such as lower total cost of ownership, but can these savings be realized on a small scale? TTI's Cynthia Bova believes so

Regional supply chain manager – Great Lakes and Northeast, Cynthia Bova



Despite tight pricing, customers can lower total cost of ownership

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It is essential to understand the life expectation of a part before it is incorporated into a design

Insider tips for successful sourcing

Sourcing is easy, isn't it? Products are always available, deliveries never slip and models are available for years — unfortunately not. Linear Technology offers some golden rules to help purchasers survive

In this age of instant access, purchasers could be under the illusion that product availability is a constant. Unfortunately, in the semiconductor world, this simply isn't true. There are many things to bear in mind if you don't want manufacturing colleagues shouting at you when production lines shut down.

Rule 1: Not all manufacturers are the same
Semiconductor manufacturers focus on different market segments. Some concentrate on high volume consumer products, while others, such as Linear Technology, focus on markets that need decades of product availability, like industrial, transportation, military and even telecoms.

With this in mind, it is essential to understand the life expectation of a part before it is incorporated into a design. Purchasers need to research the market focus of a manufacturer, looking behind the distributor if necessary, and advise design engineers accordingly.

Rule 2: Industry is cyclical
Semiconductor boom-bust cycles are the result of a combination of events encompassing capital spending changes, process migration issues and demand slowdowns. It is impossible to predict when they will occur, their impact and the speed of recovery. For the purchaser, it comes as a shock when lead-times suddenly go from six to 36 weeks. All you can do is be aware of what's going on in the industry and build in buffer stocks.

Rule 3: Price is not the only cost
If a price sounds too good to be true, it probably is. Many purchasers are wary of counterfeit products and have procedures in place to catch obviously fake devices before they make it to manufacturing. Unfortunately, it's not so obvious when products are salvaged or reclaimed from PCB assemblies and refurbished. Solvents used to extract the IC can eat into the plastic package months later when product is in the field, leading to product recalls and damage to your company reputation, which is hugely expensive.

For standard products, purchasing outside the franchised or direct from manufacturer route exposes buyers to unnecessary risks.

Rule 4: Fab or fabless?
This is one aspect of the supply chain that perhaps only the most experienced purchaser understands. Many semiconductor manufacturers are vertically integrated, operating their own wafer fabs, test and assembly operations. As a general rule, this gives the manufacturer good control over the whole manufacturing cycle and is good for low to medium volume, high mix customers. It means short, and more importantly, stable lead times.

Going to outside fabs, which might process up to 12 inch wafers, is generally good for high volume products, where economies of scale come into play. If your product is not high volume, however, choosing a manufacturer that has full control of its own manufacturing will help purchasers sleep better at night.

Rule 5: Ethical supply
It's important that purchasers know whether their suppliers have procedures to support compliant use of 'conflict minerals,' potentially even knowing which mine the minerals were extracted from. Ask your supplier whether it has appropriate systems in place.

www.linear.com

Many semiconductor manufacturers operate their own wafer fabs, test and assembly operations

Choosing a manufacturer that has full control of its own manufacturing provides peace of mind


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Distributors see opportunity for growth in 2017

James Carbone
contributing editor

Despite forecasts of slow growth for the semiconductor industry, some distributors are confident they will be able to outperform the overall components market

By James Carbone

North American-based distributors are cautiously optimistic that solid sales growth that they posted in 2016 because of healthy demand by automotive, medical and industrial equipment OEMs and electronics manufacturing services (EMS) providers will carry over into 2017.

Many distributors say they are expecting robust mid to upper single-digit growth in 2017, while some expect double-digit increases. Many say they expect sales growth will be strongest in Asia followed by Europe and the Americas.

Distributors were able to grow sales in 2016 despite a weak semiconductor market. Some researchers had forecast global semiconductor sales would decline 2-4 per cent.

"That has not been the case for us," said Karim Yasmine, executive vice president at Future Electronics, based in Montréal. "It's been a really solid year."

He said Future had a "great first half growth" which was sustained in the second half of 2016. "The overall market is irrelevant to us." He said Future's growth was two or three times higher than the overall market this year and "we will do that again next year. We always aim to grow 2X the market," said Yasmine.

He said it was not just semiconductor sales that were strong. "We often tend to talk about semiconductors only, but the passives business is phenomenal," said Yasmine. "About 3.5 trillion units ship every year and on every board you have so many passive components," Yasmine said.

He noted that passives growth rates in the industry are actually much more consistent than semiconductors. "Passives sales go up or down one or 2 per cent every year. But we have seen a boom on the passive side of the business. We've seen significant growth," he said.

Yasmine said strong component growth will continue into 2017. He said automotive, the industrial market, medical, Internet of Things (IoT) and connectivity, and solid-state lighting will be growth drivers in 2017.

Mouser Electronics, based in Mansfield, Texas, also posted strong growth in 2016 as its sales hit $1 billion for the first time. Kevin Hess, senior vice president of marketing, said Mouser's sales would close 2016 growing about 10 per cent and similar growth was likely in 2017.

He noted that there was strong growth in the second half of 2016. "If you look at the past couple months, we've had double-digit growth over last year for September and October and we had record weeks," said Hess.

Strong growth in Europe and Asia

Mouser's growth has been strongest in Europe and Asia. The distributor's sales in Asia grew 18 per cent, while its European sales increased 16 per cent. Mouser is poised for strong growth in 2017 and has been making investments in inventory.

"We just completed an expansion of our warehouse, adding another 250,000 square feet to have more room for inventory," said Kevin Hess, senior vice president of marketing for Mouser Electronics

"We just completed an expansion of our warehouse, adding another 250,000 square feet to have more room for inventory," said Hess.

Mouser also added 35 new suppliers in 2016. Some of them are board manufacturers to give engineers a "head start in design," he said. "But we are also bringing in component manufacturers that were missing from our line card," including sensor lines which, along with microcontrollers, are important for IoT applications, he said.

Hess said that in the future Mouser may add fewer lines because there are fewer "key suppliers that are missing from our line card." The distributor will add suppliers in the future for technology reasons.

Hess said he expected growth to continue in 2017. "If we continue to grow in some of the markets where we are not strong today, I think we will achieve double-digit growth next year," he said.

Mouser often outperforms the market because of its business model. It sells semiconductors and other components to engineers designing new products. While the business model is not immune to downturns, design activity at OEMs is more consistent even if manufacturing electronic systems slows down.

"There've been years when semiconductors were down or been flat, but overall our semiconductor sales growth continue to grow," said Hess. Mouser's semiconductor sales are expected to be healthy next year, he said. Semiconductors are the number one product "that we ship into both Europe and Asia. It is a very high percentage of our business in Europe and Asia and is still the highest percent of business for the Americas. That trend will continue," said Hess.

However, it's not just about semiconductors. "The thing that we need to focus on is once we get the semiconductor order, how can

"In Asia, we're seeing strong growth in the transportation, industrial power and wireless verticals year over year," said Andy King, president global components for Arrow Electronics

we sell the passive components, the connectors and the sensors" that are also needed in a new design, he said.

Investing in growth

Arrow Electronics, based in Englewood, Colo., is another distributor that posted strong sales in 2016. "Our global components sales, advanced 6 per cent year-over-year in the third quarter, with Asia sales growing a robust 16 per cent year-over-year," said Andy King, president global components for Arrow Electronics.

He said strong growth was due to investments that Arrow made in key segments such as IoT and cloud computing. King said Arrow will continue to grow sales in 2017 and beyond by continuing to "invest in sales and engineering support for small and medium-size businesses across all regions. Investing in customer engineering support is helping Arrow reach customers earlier in their product lifecycles, which has resulted in an increase in "global design activity and other early-stage, value-added support services," King said.

He added that transportation and solid-state lighting were strong segments for Arrow in the Americas in 2016 and "we expect that momentum to continue into 2017." Transportation, aerospace and defense are key segments for Arrow in Europe, said King. "In Asia, we're seeing strong growth in the transportation, industrial power and wireless verticals year over year," he said.

Dave Doherty, president and chief operating officer for Digi-Key, based in Thief River Falls, Minn., said he expected sales in 2017 will be similar to 2016. He noted that 2016 was unique in that sales were strong through the year. In many years sales drop after the first quarter then pick up later in the year, or sometimes sales may be strong in the first half and then drop off in the last two quarters.

Handling supply disruptions

He said North America will have mid-single-digit growth next year. "All the signals that we are seeing, the activity on the web sites, the shipments, the browsing, search engine tells us that next year should be more of the same, nothing too crazy explosive," he said. However, if there is an increase in demand, Digi-Key will be able to handle it.

"We are stocked with inventory pretty well and certainly can handle unexpected upsides," he said. Unexpected upsides can occur if there's a catastrophic event that disrupts electronics component production. Other events such as strikes, port or airport closures or civil unrest in the region, can delay the shipment of needed components resulting in buyers scrambling to find parts from distributors and other sources.

He said Digi-Key has the inventory to "not only support new product introduction, but if there is a disruption," said Doherty. "We are the place customers know they can come getting authorized authentic material," he said.

Doherty added it doesn't take much to disrupt supply because companies "have gotten so efficient and so lean that one minor hiccup has a bullwhip effect," resulting in a delay in shipment of parts, said Doherty.

Gerry Fay, senior vice president and president Avnet Electronics Marketing, global, said automotive and industrial have been "bright spots" for semiconductors sales for Avnet.

"Avnet is spending a lot of time focusing" on those segments which "will grow mid-to high single digits, whereas the rest of the semiconductor total available market will grow low single digits," he said.

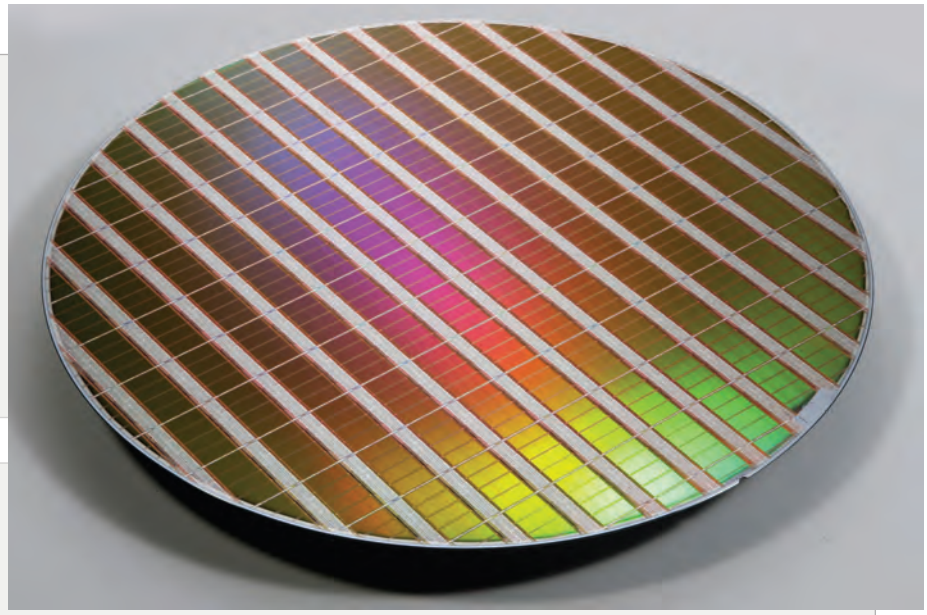
Fay said business in 2017 has the potential to be better than 2016. "We've done a good job of staking out and taking share in the military/aerospace segment particularly in the Americas," said Fay.

He said moving forward, Avnet has "differentiating factors" over its competitors. "The thing is our scale and scope. We are in more markets than any other distributor in the world," he said. "We are the only western distributor with our own footprint in Japan. We are a western distributor with the largest percentage of our business in Asia."

He said Avnet will concentrate more on components as it was selling its Technology Solutions IT business unit to Tech Data Corporation in a deal valued at $2.6 billion. "We are going to be totally focused on selling components and solutions around those components going forth," said Fay.

He added that Avnet is in a "very good position to take advantage of whatever market opportunities present themselves."

"We often tend to talk about semiconductors only, but the passives business is phenomenal," said Karim Yasmine, executive vice president at Future Electronics



Example of NAND flash

Managing NAND shortages

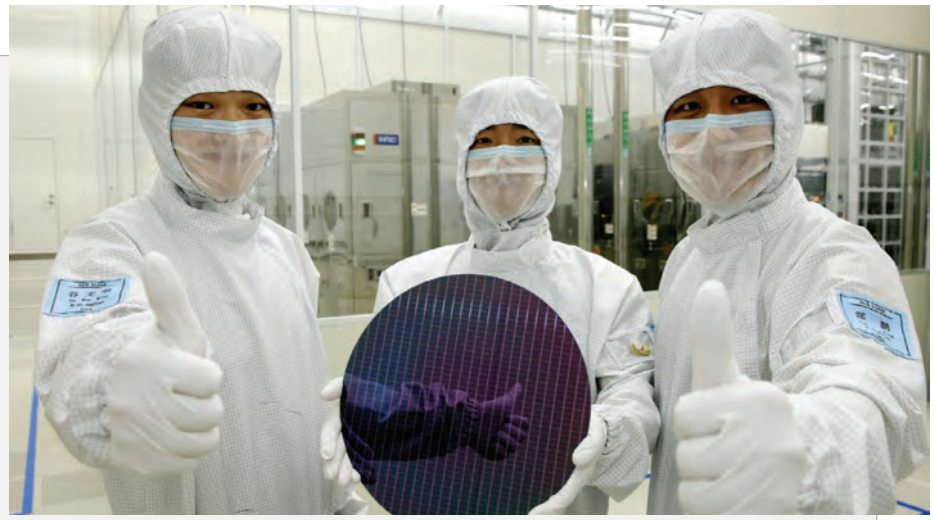
A report from DRAMeXchange predicted a shortage of NAND flash in the third quarter 2016 would be exacerbated in the fourth quarter due to higher demand in the smartphone and solid-state drive (SSD) industries. The short supply, coupled with strong demand, also will contribute to rising prices of NAND flash wafers and memory cards. DRAMeXchange also expects prices to rise for eMMC, eMCP and SSD products.

Demand from SSD manufacturers continues to increase as SSDs approach price parity with HDDs. DRAMeXchange expects the SSD adoption rate for notebook computers worldwide will exceed 30 percent for the first time, reaching nearly 33 percent, in 2016. Demand is also growing significantly for enterprise-grade SSDs. Demand has been mainly driven by server manufacturers and data centres in the US and China. The NAND flash shortage is predicated to last well into Q1 2017.

Production capabilities are limited for NAND flash and as a result lead times are getting longer. With shortage of supply comes obsolescence issues. With limited production capabilities inevitably NAND manufacturers are forced to concentrate on supply for the most popular and profitable technologies. Over the longer term this can have a devastating effect on critical applications as new replacements need to be sought when less popular technologies are no longer supported.

To overcome potential obsolescence issues, Simms suggests users: investigate and understand their short and medium term demand for NAND based products (0 to 12-months); highlight cost sensitive requirements and remove the volatility aspect by forward ordering; take stock provisions or work with a supplier who can manage this on their behalf; ensure JIT and call-off facilities are in place with suppliers.

Simms explains the driving forces behind NAND flash shortages and offers advice on how to manage



The NAND flash market is experiencing its biggest technology transition (to 3D NAND) in an effort to continue cost reductions, increase performance and satisfy demand.

Today's NAND is mainly 2D so production levels have been significantly reduced as 3D NAND development takes priority. This has led to periods of under supply and created shortages which are unprecedented. The release of mobile phone technologies for the Tier 1 manufacturers has also added to over demand. As Tier 1 customers, these manufacturers are allocated vast amounts of 2D NAND wafer which restricts availability for other partners.

Driving forces

NAND flash is created in wafer form and sliced to produce individual chips. However, not all NAND is created equally and characteristics vary across the wafer. Raw NAND is cut from wafers to provide die. Due to the production process, each die is different, with slightly different properties. On a wafer there are known positions for die of differing specifications and tolerances.

Die in locations with specifications in the middle of the tolerance range can be used in industrial applications, as they have the best endurance, wide temperature suitability and power efficiency. Others may be better suited to consumer applications, where tolerances and endurance are less critical. After sorting, die outside published specifications are sold for non-critical and low cost applications.

The test process is either performed by the manufacturer or another company which performs its own sorting by testing prior to packaging. In this case the wafer vendor will normally provide a map of the expected best die.

In summary as all types of NAND come from the same wafers, a shortage of NAND wafer impacts all markets.

www.simms.com

AEL Crystals has partnered with a developer of MEMs timing technology

IOT: shaping the future of frequency control

The internet of things is rapidly expanding. In fact, this concept of universally linked systems communicating together via the internet has been branded the third industrial revolution after mechanisation and computing.

Its implications have already seen a massive increase in home automation, with smart thermostats and connected lighting being early adopters, driven by the convergence of people, devices and data across the web. New products are using Bluetooth, Zigbee, Z-Wave, 6LowPAN and more recently the CSR Mesh / Bluetooth low energy (BTLE), Sigfox and Thread protocols for data handling.

Driving miniaturisation

For frequency control product manufacturers, the challenge lies in meeting the demand for reliable wireless frequency generation while also increasing miniaturisation, reducing power, for long battery life, and providing consistent performance over a broad operating specification.

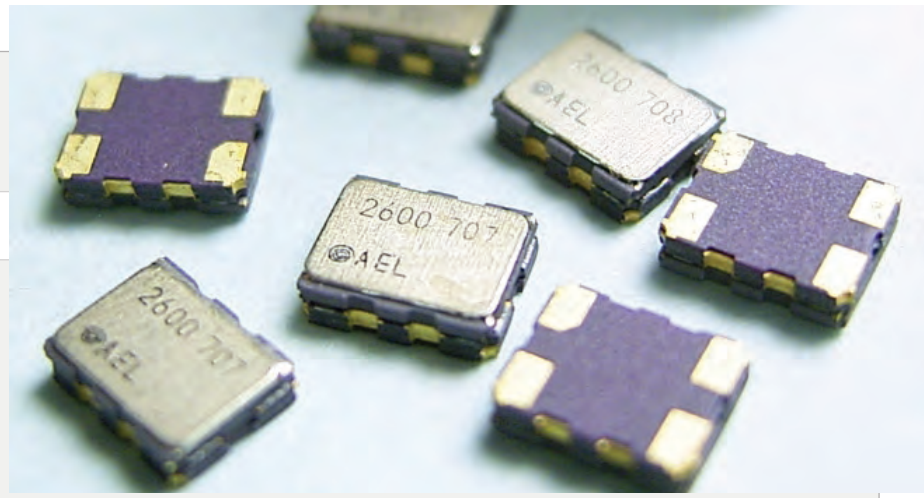
As more mainstream applications look to adopt this technology, FCP vendor, AEL Crystals, has released a range of products in response to these challenges. Options include, for example, a 1.6 by 1.0mm watch crystal with equivalent series resistance of 60kohm and 1.6 by a 1.2mm 32.768Hz oscillator.

MEMs advantages

In order to enhance this range further, AEL Crystals has partnered with developer and manufacturer of microelectromechanical timing technology, SiTime, to add MEMs oscillators to its portfolio.

Silicon based MEMS oscillators employ modern packaging technologies. They consist of a MEMS resonator die mounted on top of a programmable analogue oscillator integrated circuit. This is moulded into a standard plastic surface mount package with footprints compatible with quartz devices. To support

As the internet of things finds its way into mainstream applications, the hunt is on for ever smaller frequency control products. FCP manufacturers are keen to oblige, as AEL Crystals explains



Ultra-miniature crystals address space constraints

the space requirements of ultra-small applications, SiTime MEMS oscillators are available in ultra-small chip-scale packages. Finally, their programmable architecture allows customisation of features such as frequency and supply voltage.

RTC benefits

One particular area where SiTime MEMs devices can offer significant advantages is in the clocking for monitoring circuitry, in which the real-time clock is always on. This is a major factor in battery life for many IOT applications.

Designed for mobile, IoT and wearable applications where space and power are critical, SiT15xx 32.768kHz MEMS timing devices are available in a 2.0 by 1.2mm surface mount package for designs that require crystal resonator compatibility. For even greater space savings, the same device is available in a CSP, said to reduce the footprint by up to 80 per cent compared to existing 2012 SMD crystal packages.

Battery savings

In addition to its real time clock products, SiTime offers MHz oscillators in a 1.5 by 0.8mm chip scale package. This µpower oscillator boasts both low power in operation at 270µA maximum and a draw in standby mode of less than 0.7µA, again making them ideal for battery driven applications.

Thanks to their programmable nature, MEMS devices offer sample availability from stock in all frequencies, which allows buyers and developers to test and implement new designs quickly.

With a view to helping those in this sector complete their designs, AEL Crystals also supplies ultra-miniature temperature compensated crystal oscillators, antenna and filter devices. As an experienced vendor of frequency control products, it carries many wireless chipset product approvals and boasts millions of crystals already in use in wireless technology products.

www.aelcrystals.com

Crafting an anti-counterfeit strategy

Counterfeiting risks are magnified when dealing with end-of-life or obsolete components, so buyers need a clear strategy to avoid them, explains 4 Star Electronics

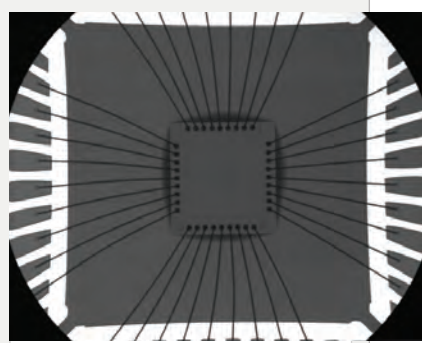
Organizations throughout the electronic component supply chain continue to struggle with counterfeiting; a struggle which becomes even greater when dealing with end-of-life or obsolete components. As counterfeiting has become more sophisticated, so the processes and tools required to combat it have gotten more complex. Buyers and procurements specialists therefore need to be aware of the risks and develop programs to reduce the probability of receiving counterfeit components.

Follow standards

Thankfully, there are some standards that can help reduce the risk of counterfeit material. For example, revision B of SAE's AS5553 standard covers counterfeit electrical, electronic and electromechanical parts; avoidance, detection, mitigation and disposition. This standard was recently updated, with the latest edition better addressing the risk-based nature of counterfeit mitigation. It can be effectively used by any organization in the supply chain and is a good starting point to developing a mitigation program by highlighting best practices.

The long awaited AS6171 standard covering test methods; general requirements, suspect or counterfeit, electrical, electronic and electromechanical parts could also be a game changer in the fight against counterfeit components. This standard was primarily developed for use by test labs to ensure consistency of inspection and test procedures, workmanship and training, but it can be used wherever these functions are performed in the procurement process. It is of particular importance when procuring open market components that do not have an unbroken chain of traceability back to the original component manufacturer.

To reduce the risk of procuring counterfeits in this situation, AS6171 fills in the details that are outlined in AS5553. For the test labs and independent distributors who work most closely with obsolete and end-of-life



Radiological inspection

product, accreditation to ISO 17025 shows that the various test methods in AS6171 can be performed with consistency and competence.

Director of operations at independent distributor, 4 Star Electronics, Scott McKee, said: "AS6171 will allow independent distributors and their sub-contracted test labs to provide the risk-based tests that our customers need. Those who choose to be accredited will all be on the same page, making it easier to choose which suppliers to work with."

Research options

An effective counterfeit avoidance program includes a preference to source material from authorized sources, including original component manufacturers, their authorized or franchised distributors and authorized aftermarket manufacturers. When these sources are unable to help, buyers can turn to other trusted suppliers that their organization has fully qualified, as well as undertaking risk-based inspection and tests that are appropriate for the end-use of the parts.

For end of life material, it's important to research and understand the lifecycle and market conditions of any components used. Staying current with product change and end-of-life notices through forecasting and communication with vendors makes it possible to execute last time buys and minimize higher risk purchases.

Analyze risks

Although the AS standards are targeted to the high-reliability world of military and aerospace electronics, the principles apply just as well to the commercial and industrial sectors of the industry. OEMs and contract manufacturers all need obsolete and hard-to-find parts, so it's important they choose vendors wisely. Limit open market sources to those trusted independent distributors who utilize the latest inspection and test techniques, and who understand the risks inherent in the supply chain.

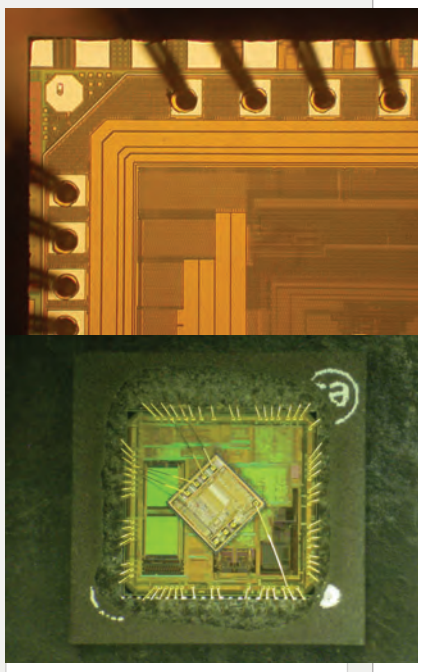
As a minimum, there are some inspections and tests that should be performed whenever the pedigree of a part is unknown. These are typically performed by independent distributors or their labs and include a review of packaging and documentation, followed by external visual inspections, including surface analysis and marking tests. Tests should also encompass digital photographs and microscopy of components as well as x-ray and XRF analysis.

If the end-use application is particularly high risk, or if any anomalies are found, additional testing may be required such as decapsulation and die examination, functional electrical testing, electron microscopy, acoustic microscopy and others, on a case-by-case basis. AS6171 offers detailed slash sheets that outline the requirements of all of these test methods.

Minimize dangers

In summary, there are a few steps that can be taken to reduce the risk of receiving counterfeit parts. Most importantly, develop a risk-based counterfeit mitigation plan based on AS5553 and/or other industry standards.
Buy parts from authorized sources whenever possible and develop relationships with quality independent distributors that can supply critical parts such as end-of-life or obsolete components. For non-traceable parts, specify testing that can be performed by a qualified independent distributor or laboratory. Following these steps can lower risk and lead to a trouble-free procurement experience.

www.4starelectronics.com



Destructive internal analysis can reveal counterfeits

Semiconductor market will recover in 2017

Improving economic growth, healthy chip demand and stabilizing prices will result in 5 per cent growth for the semiconductor market in 2017

By James Carbone

The good news for electronics purchasers is that it will not be a seller's market for semiconductors in 2017 as supply will be ample and lead times for most chips won't stretch.

The bad news is it won't be a buyer's market either as chip prices, which had fallen in recent years, will firm and tags for some semiconductors will increase.

"It will be a recovery year in 2017," said Jim Feldhan, president of Semico Research. Semiconductor sales will increase 5.3 per cent to $354.2 billion, he said. That is a significant improvement from 2016 when sales were expected to end the year declining 2.5 per cent to $336 billion from $345 billion in 2015 because of sluggish demand from computer, smart phone and communications equipment manufacturers.

However, end equipment demand is expect to pick up in 2017, resulting in stronger semiconductor demand. In fact, it appears the recovery of the semiconductor industry actually began in the second half of 2016, according to Feldhan.

"The third quarter of 2016 was up 11 per cent from the second quarter and September was actually up 22 per cent over August and that was a record-breaking month," he said. "The quarter ended up $83 billion. We were forecasting $88 billion for the fourth quarter," Feldhan said.

While semiconductor business improved in the second half, it was not enough to overcome declining revenue caused by falling prices, especially for memory ICs. "The biggest problem in the first half of the year was memory prices were declining," said Feldhan. "There were really steep declines for DRAM." However, in July prices started to increase for both DRAM and NAND flash.

Another reason revenue fell in 2016 was falling prices for ICs used in wireless equipment. Shipments of smart phones did not grow as much as in previous years. Smart phone sales often increase 10-20 per cent per year, but in 2016 shipments increased only 6 per cent, said Feldhan.

Mobile communications infrastructure is another area that has struggled as more software is used to upgrade systems rather than semiconductors, according to Myson Robles-Bruce, principal analyst with IHS Markit Technology. He said 5G networks "will be more based on software and there's not a whole lot of hardware development around 5G."

Demand to rise

However, the good news for chipmakers supplying semiconductors for computers, smart phones and other equipment is demand should increase next year. Businesses are replacing their older computers. "Although it's not dramatic, it will stop the big single-digit declines" of computer shipments, said Feldhan. More consumers will also replace their older computers, he said. "The overall PC market will be stable," said Feldhan. While sales of desktop computers will decline, notebooks and tablets will have positive growth. "The net result is basically a flat market and that's a marked improvement from being down 6 per cent in 2016 and 9 per cent the year before," said Feldhan.

Other end markets will also help drive semiconductor demand in 2017. "We're seeing good growth in the medical market. The Internet of Things (IoT) still needs to prove itself in terms of volume, but there's a lot of design activity," he said.

IoT is often talked about as having the potential to be a major demand driver for all electronic components including semiconductors. However, many suppliers and analysts say it so far has had limited impact on the semiconductor market. However, that is not the case with the automotive segment. Automotive represents about 12 per cent of the overall semiconductor market and it is growing at near a double-digit rate, said Feldhan.

One reason for that growth is continuing development of Advanced Driver Assistance Systems (ADAS), which require DRAM, NAND flash memory, general-purpose microprocessors, application specific standard products and analog chips among other semiconductors, said Robles-Bruce.

Strong auto IC growth in U.S.

Matas said the auto industry is having a huge impact on chip sales in North America. The compound annual growth rate for the automotive IC market is 10.4 per cent, compared to 9.4 per cent in Europe, he said. "There is a surge

Computers, communications use most semiconductors

Semiconductor Revenue by Electronic Equipment Category, 2014-2018
(Millions of Dollars) Source: Gartner Inc.

	2014 YR	2015 YR	2016 YR	2017 YR	2018 YR
Automotive Electronics	29,985.4	30,298.1	31,634.6	33,382.5	35,846.6
Communication Electronics	102,671.7	107,528.2	113,215.2	121,563.8	123,884.3
Consumer Electronics	38,523.6	36,708.6	35,398.3	36,745.9	37,999.3
Data Processing Electronics	134,796.5	124,320.6	114,364.5	117,652.9	122,490.5
Industrial Electronics	32,719.0	31,935.5	33,300.7	36,688.5	40,721.8
Military/Civil Aerospace Electronics	3,931.4	3,977.0	3,888.1	4,040.1	4,162.8

going on in the United States with implementation of more automotive electronics," said Matas.

Some of the electronics systems are government mandated such as backup cameras in vehicles which will be required in 2018. Other features are not yet mandated, but automakers are designing them in anyway. One example is emergency braking systems.

"Automobile manufacturers are working together to make sure each car has emergency braking systems," said Matas. "It is not a government-issued mandate, but they are working ahead of the government."

The autonomous vehicle or self driving car is a major focus in North America and will drive chip sales for years. "Google and Uber are test driving their autonomous vehicles and other cars are also being tested," said Matas. Once such cars go into volume production, it will have an impact on semiconductor sales especially for sensors, microcontrollers and analog chips among others

Other segments that will drive semiconductor demand in 2017 other than automotive include defense, civil aerospace and consumer electronics, according to Robles-Bruce. "In consumer electronics, equipment such as HD televisions, home appliances and possibly smart watches will drive demand next year," he said. As a result, semiconductor revenue should grow 5 per cent in 2017 and stronger growth is likely in 2018, said Robles-Bruce.

Feldhan added that the overall economy should improve in 2017 and that will help drive demand for electronics equipment and components. In fact, GDP in the United States in the third quarter increased to 3.2 percent and some economists said decent economic growth should continue into 2017.

"We're expecting a little bit better economic growth next year and that will help the industrial market as well," said Feldhan. The combination of slightly improved economics, better supply and demand, better handset sales and stable computing market, tends to lead to stable average selling prices for semiconductors, said Feldhan. He said the average selling price for an integrated circuit was $1.01 in 2016 and that will decline slightly to about $1.00 in 2017.

However, prices for some chips are expected to increase. For instance, IC Insights is forecasting a 5 per cent increase in DRAM prices in 2017. In 2016 there was a 16 per cent decline in the average DRAM price and a 4 per cent drop in 2015, the researcher said.

For other chips. prices may fall, but at a slower rate than in recent years. For example, in 2014 there was an 11 per cent decline in ASPs for NAND flash, said Matas. In 2015 and 2016 prices decline 6 per cent in each year. In 2017, the average price for NAND will drop only 2 per cent.

Enough capacity?
While analysts are forecasting an increase in semiconductor demand for 2017 and beyond, there should be enough capacity in place so there are no serious shortages or huge price increases as foundries are making the needed investments in capacity. "Most of the industry is using foundries now so they are aggregating all of that demand and they will be able to build the capacity that the industry needs," said Feldhan.

"We've seen significantly less boom/bust cycles with capacity because of shared capacity as a result of the foundry market." He noted that TSMC—the largest foundry—is making the necessary investments and is pushing ahead on developing 10 and 5nm processes.

"TSMC has a lion's share of the market and will be able to invest enough dollars to supply the industry with capacity," said Feldhan. Globalfoundries, another major foundry, has also increased capacity.

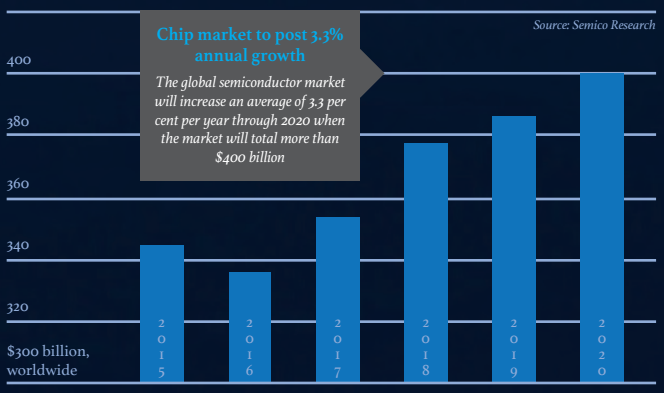
Intel, which builds its own chips, has excess capacity and has "a lot of floor space that they could put equipment in" if the company needs to, said Feldhan.

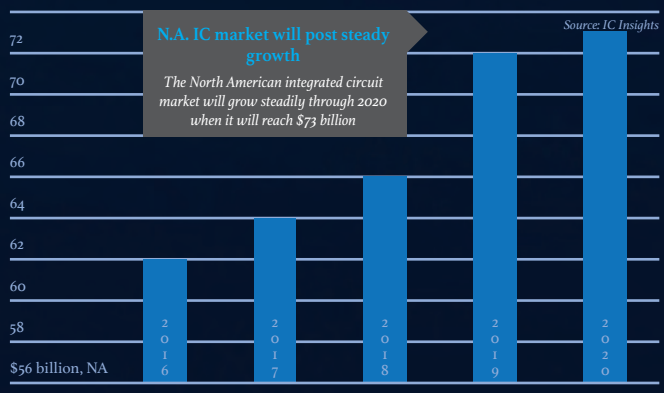
Analysts noted that the semiconductor industry has matured and growth in the future won't be spectacular so there should be fewer capacity issues than in the past. However, while the industry has matured there will still be growth, but it will steady because of continuing demand for servers, televisions and other consumer electronics, smart phones, computers and cloud computing.

Because of slower, but steadier semiconductor demand, Semico forecasts 3.3 per cent compound annual growth for the industry through 2020. Such a growth rate is likely to continue for years "until we have another Steve Jobs who comes along and invents the next must-have type product," said Feldhan.

By the numbers

- **5.3%** — *The forecasted rate of growth of the semiconductor market in 2017* Source: Semico Research
- **$1.00** — *The expected average selling price for a semiconductor in 2017* Source: Semico Research
- **10.4%** — *The compound annual growth rate of the North American automotive integrated circuit market over the next four years* Source: IC Insights
- **$354.2 billion** — *The forecasted size of the global semiconductor market in 2017* Source: Semico Research
- **3.3%** — *The compound annual growth rate of the worldwide semiconductor market through 2020* Source: Semico Research
- **5%** — *The expected average price increase for DRAM in 2017* Source IC Insights
- **$63.8 billion** — *The forecasted size of the North American integrated circuit market in 2017* Source IC Insights





Buyers face impact of chip industry consolidation and higher prices in 2017

A shrinking semiconductor supply base could lead to higher prices for some components and mean changes in commodity strategies

By James Carbone

The impact of consolidation in the semiconductor industry, expected price increases for memory chips and other semiconductors, and rising manufacturing costs in China are some of the issues that electronics buyers will face in 2017.

Some buyers are also concerned about if semiconductor and other component manufacturers will have enough capacity to meet expected rising demand over the next several years. With the U.S. economy growing, some purchasers believe there could be an increase in new orders for computers, smart phones and other electronics equipment, but they are not sure that component makers have invested enough in new capacity because of declining or weak revenue growth.

Buyers are also concerned about supply continuity in the event there are trade issues with Mexico and China if presidential campaign rhetoric turns into reality and the new administration follows through on promises to renegotiate trade agreements and impose protective tariffs on imports.

But as the New Year begins, the shrinking semiconductor supply base appears to be the main issue with buyers. The number of mergers and acquisitions in the chip industry over the last two years has been unprecedented.

In 2015 there were 21 major mergers and acquisitions totaling $103.8 billion, according to researcher IC Insights. For the first three quarters of 2016, there've been seven major mergers and acquisitions totaling about $55.3 billion and more consolidation is likely.

The large amount of consolidation has resulted in a shifting semiconductor landscape, which has created a greater need to focus on supply chain risk management and price increases, according to Steve McEuen, vice president of global purchasing for EMS provider Creation Technologies, based in Burnaby, British Columbia. "Through consolidation these manufacturers are able to identify and eliminate duplication of product lines. Consolidation significantly reduces the number of options, or makes certain product lines cost-prohibitive," he said. "It also results in changes to operations including layoffs and other cost-cutting measures."

Not-so-sudden impact

The impact of recent consolidation could start to be felt over the next year. Some buyers believe consolidation will ultimately result in healthier supply base that will be in a better position to meet the needs of OEMs and EMS providers. However, other purchasers say the amount of consolidation that has occurred will shift the balance of negotiating power for many commodities to suppliers and make it's harder to get advantageous terms from suppliers and result in higher prices.

For instance, if two major suppliers with overlapping product lines merge, there is obviously less competition and it would be harder for OEM or EMS purchasers to negotiate price concessions and other favorable terms from the merged company or from another supplier that is a competitor of the merged company.

In some cases mergers of two companies that did not have overlapping product lines have occurred. If a buyer had been doing business with a company that was acquired, negotiations could still be challenging if the supplier that purchased the other component manufacturer has a different business strategy than the company it acquired. The company may want to grow its market share and increase profit margins and may refuse to cut prices, said Seth Choi, vice president, supply chain management for of SMTC Corp, based in Markham, Ont.

So far the impact of consolidation on prices is unclear. "At this point I can't say whether mergers and acquisitions have influenced prices one way or the other," said Brian Matas, vice president of market research for IC Insights.

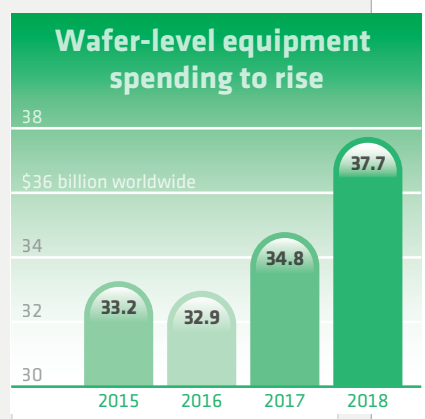
"It would seem logical that all the M&As would begin to drive prices upward a little bit more." However, he noted once a merger has taken place, it takes a while for the merged company to determine which products it wants to keep and how the company will be organized. "Once they have established that, maybe prices will be addressed," he said.

Impacting sourcing strategies

Besides impacting negotiation and prices, consolidation can also affect sourcing strategies for a commodity. Most OEMs and EMS providers don't like to have a single source for a commodity. Many have multiple suppliers for a semiconductor and apportion their spend among those suppliers based on the suppliers' score card performances from the previous year.

For instance, an OEM may have three suppliers for a semiconductor. The supplier that had the highest scorecard rating may be awarded 50 per cent of an OEM's spend for the commodity, while the second highest rated supplier may get 30 per cent and the third supplier 20 per cent of the OEM's business for the part.

John Caltabiano, vice president supply chain for EMS provider Jabil Circuit



Semiconductor manufacturers will increase spending on wafer-level manufacturing equiment from $33.2 billion in 2015 to $37.7 billion in 2018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If the scorecard performances of suppliers change, the percentage of business awarded to each supplier can also change. However, depending on the commodity, consolidation could make it more difficult to have a multisource strategy and have a competitive tension among suppliers because there are fewer suppliers.

"Consolidation means semiconductor manufacturers have greater power in the market place to assure that their investments in technology, markets and products yield the required returns," said John Caltabiano, vice president supply chain for EMS provider Jabil Circuit, based in St. Petersburg, Fla. "This will require purchasers to use longer term relationships to help in commercial discussions versus simple competitive bidding," he said.

In fact, many large global OEMs often forge strategic alliances with crucial semiconductor suppliers to get access to the latest technology, receive preferential treatment during shortages, and to get to world-class prices for critical components. However, as the supply base shrinks it may be harder for some OEMS and EMS providers to form partnerships with key suppliers.

More capacity wanted

While supplier consolidation is a concern for buyers, so is investment in capacity by component manufacturers. Because of sluggish sales and overall weak demand, capital spending by chip makers for new fabs and equipment has been soft over the past two years. Worldwide semiconductor capital spending was expected to end 2016 declining 0.3 percent to $64.6 billion, according to researcher Gartner, Inc. Spending was flat in 2015. While industry analysts say there should be enough capacity in 2017 for most semiconductors, supply will likely be tight for some chips such as memory ICs. With the lack of capacity investment growth, if semiconductor demand increases, which analysts say is likely, lead times are likely to stretch and prices for some ICs will rise.

So far sluggish capital spending by semiconductor manufacturers has not been a problem because demand for chips has been soft for most of the last two years. However, demand for many semiconductors picked up in the second half of 2016 and there was an undersupply of certain chips such as DRAM and NAND flash, said Gartner.

Demand may weaken in the first quarter of 2017, but will pick up after that. "At the start of 2017, a weaker demand environment will create a brief technical oversupply, but the industry will then move back into an undersupply for the remainder of 2017 and into 2018," said David Christensen, senior research analyst with Gartner.

He noted there was a shortage of NAND flash in the third quarter of 2016. As a result, memory IC makers likely will increase capacity for NAND and DRAM. Other chipmakers will also increase capacity in 2017 as well. Gartner forecasts that capital spending by semiconductor companies will rise 7 per cent in 2017, said Christensen.

"Logic manufacturers will focus their spending on ramping fabs for the introduction of high-volume 10-nanometer production in 2017," he said. "Memory IC manufacturers will move production to 3-D NAND flash." he said.

Certain end equipment segments such as 4G LTE smart phones are driving investment in advanced process technologies. The adoption of fingerprint sensors, touch display drivers and active-matrix dynamic light-emitting diodes (AMOLEDs) by Chinese smartphones has made full use of 200mm foundries' 0.18-micron capacity.

Even with expected increases in capital spending, prices for some semiconductors will rise in 2017 because of weak capital spending over the past two years. IC Insights says the average DRAM price will increase 5 per cent in 2017. In 2016, the price dropped 16%. The average price of NAND flash will fall, but only 2 per cent in 2017. The price had fallen 6 per cent in both 2015 and 2016, the researcher said. Prices for microcontrollers will also rise on average 2 per cent in 2017, the researcher said. Prices are expected to increase 2 per cent for 16-bit microcontrollers and 3 per cent for 32-bit MCUs.

Besides rising and firming prices another challenge memory IC buyers in the computer industry may face is the transition of more DRAM production from computing and graphics applications to mobile phones, solid-state drives and other storage devices. Chips for those devices have higher profit margins than memory ICs used for computing and graphics applications.

While increasing prices for semiconductors can be challenging for both OEM and EMS buyers, rising manufacturing costs in China will be primarily a challenge for OEM purchasers involved in outsourcing decisions. Many electronics OEMs decided to outsource production of their equipment to China years ago because of low labor rates.

But wages have been rising steadily in China and will continue in 2017 and beyond, said Dan Panzica, principal analyst with IHS Markit Technology. Labor rates in China will surpass labor rates in Mexico sometime next year or in 2018, he said. In fact in some regions of China labor rates are already higher than in Mexico.

By 2020, the labor rate in China will be $5.50 per hour compared to $5.18 in Mexico, the researcher said. It is unclear if rising labor rates in China will mean more OEMs will outsource manufacturing to Mexico rather than China. Many OEMs have been building their products in or near the markets where the products will be sold.

Most OEMs that have their systems built in China will likely stay in the country to service the Chinese market. They may also have manufacturing in Mexico for the North American market.

However, many buyers involved in outsourcing decisions and are looking for low labor rates are taking a close look at Vietnam. The country is increasingly becoming a manufacturing center, although it lacks the resources of China and Mexico. Vietnam's hourly labor rates are cheaper than China's or Mexico's. For instance the labor rate in Guangdong, China in 2016 was $4.00/hour and $4.14/hour in Mexico. In Vietnam the rate was $2.42/hour, according to IHS Market Technology.

Of course, electronics OEMs outsourcing to EMS providers in China or Mexico could potentially face a serious supply chain challenges in 2017 if the Trump administration imposes up 35 per cent tariff on products built in those countries or gets into a trade war with China over Taiwan.

During the presidential campaign, Donald Trump said he might impose tariffs on China. He also had a phone conversation with the president of Taiwan, which did not go over well with China, which claims sovereignty over Taiwan. Matas said a "wild card in what happens to the IC business next year could be a cat-and-mouse game between Trump and China." He noted that there is a lot of foundry IC production in Taiwan and many of those chips are shipped to China to be used in computers, smart phones and other electronics equipment built in the country.

"With so much of the IC industry's foundry capacity being in Taiwan, and a lot that goes to China's electronics assembly plants, the threat of new trade barriers between the island and the mainland seem to be significant," said Matas.

If trade issues between the U.S., China and Taiwan escalate it would be disruptive to the electronics supply chain and would seem to be as "much a risk as any of the other usual disruptors" to the supply chain such as earthquakes, North Korea tensions, challenges with economies in Europe and terrorism," said Matas.

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Master Appliance Corp.
Matrix Orbital
Maxim Integrated
Maxwell Technologies, Inc.
MCB Industrie / Vishay
Measurement Specialties / TE Connectivity
MEC switches
Mechatronics
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Memory Protection Devices
MEMSIC
Mentor Graphics
MG Chemicals
Micrel / Microchip
Micrium
Micro Commercial Components (MCC)
Micro/sys
Microchip Technology
microEngineering Labs Inc.
Micro-Measurements / Vishay Precision Group
Micron Technology
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Microsemi
Microwave Technology
Midcom / Wurth Electronics
Mide Technology
Midwest Microwave / Cinch Connectivity Solutions
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NXP Semiconductors / Freescale
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OEG Relays / TE Connectivity
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Precision Electronic Components Ltd.
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QT Brightek
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Tamura
Taoglas
TAOS / ams
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TDK-Lambda Americas, Inc.
TE Connectivity
TE Connectivity Aerospace Defense and Marine
TE Connectivity ALCOSWITCH Switches
TE Connectivity AMP Connectors
TE Connectivity Corcom Filters
TE Connectivity DEUTSCH Connectors
TE Connectivity Measurement Specialties
TE Connectivity Potter & Brumfield Relays
TE Connectivity Raychem Cable Protection
TE Connectivity Raychem Circuit Protection / Littelfuse
TE Connectivity's Agastat Relays
TE Connectivity's Axicom Relays
TE Connectivity's Buchanan Terminal Blocks
TE Connectivity's CGS Resistors
TE Connectivity's CII
TE Connectivity's Elcon Connectors
TE Connectivity's Holsworthy Resistors
TE Connectivity's Kilovac Relays
TE Connectivity's Neohm Resistors
TE Connectivity's OEG Relays
TE Connectivity's Products Unlimited Transformers & Relays
TE Connectivity's Q-Cee's
TE Connectivity's Schrack Relays
TE Connectivity's Sigma Inductors
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Vishay Precision Group / Micro-Measurements
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Voltronics (Knowles)
VPG / Micro-Measurements
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Weller
Welwyn / TT Electronics
Wickmann / Littelfuse
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Winbond Electronics Corporation
Winchester Electronics
Wintec Industries
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Buyers' Guide

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
ACOUSTIC COMPONENTS											
BeStar Electronics Ind. Co. Ltd.	BeStar Technologies Inc.	520-439-9204	www.bestartech.com	Y	N/A	$250,000	N/A	100.00%	50	900	Y
PUI Audio	PUI	1-800-551-4405	www.gopui.com	Y	1,256	N/A	£50	99.00%	5	33	Y
CABLE & WIRING											
Alpha Wire	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,106	N/A	$0	93.00%	50	1,000+	Y
Belden Wire & Cable	Mouser Electronics	800-346-6874	www.mouser.com	Y	5,863	N/A	$0	97%	50	1,000+	Y
Electri-Flex Company	Electri-Flex Company	1-800-323-6174	www.electriflex.com	M	40	N/A	$150	100%	6	110	Y
Molex	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CIRCUIT PROTECTION											
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,462	N/A	$0	68.00%	50	1,000+	Y
CBI Electric	Pridmore Corp	800 881 2072	www.pridmore.com	Y	35	$5,600	$0	100.00%	6	11	Y
Cooper Bussmann	Mouser Electronics	800-346-6873	www.mouser.com	Y	19,689	N/A	$0	42.00%	50	1,000+	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,487	N/A	$0	100%	50	1,000+	Y
Littelfuse	Mouser Electronics	800-346-6873	www.mouser.com	Y	28,790	N/A	$0	67%	50	1,000+	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	31,445	N/A	$0	68%	50	1,000+	Y
DISPLAYS & LEDs											
Avago Technologies	Mouser Electronics	800-346-6873	www.mouser.com	Y	403	N/A	$0	100.00%	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,390	N/A	$0	99.00%	50	1,000+	Y
Dialight	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,179	N/A	$0	84.00%	50	1,000+	Y
FEMA	Pridmore Corp	800 881 2072	www.pridmore.com	Y	6	N/A	$0	100.00%	6	11	Y
Kingbright Corp	Mouser Electronics	800-346-6873	www.mouser.com	Y	301	N/A	$0	100.00%	50	1,000+	Y
Kingbright Corp	Pridmore Corp	800 881 2072	www.pridmore.com	Y	179	$35,000	$0	100.00%	6	11	Y
LUMEX	Digi-Key	800-344-4539	digikey.com	Y	7,714	N/A	$0	96.42%	150	3,400	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,690	N/A	$0	100.00%	50	1,000+	Y
SunLED Company, LLC	PUI	1-800-551-4405	www.gopui.com	Y	1,351	N/A	£50	99%	5	33	Y
ELECTROMECHANICAL											
AAVID	Digi-Key	800-344-4539	digikey.com	Y	1,585	N/A	$0	60.44%	150	3,400	Y
ALPHA WIRE	Digi-Key	800-344-4539	digikey.com	Y	25,593	N/A	$0	99.46%	150	3,400	Y
APEM	Digi-Key	800-344-4539	digikey.com	Y	6,926	N/A	$0	99.99%	150	3,400	Y
APEX TOOL GROUP	Digi-Key	800-344-4539	digikey.com	Y	2,649	N/A	$0	99.36%	150	3,400	Y
ARTESYN EMBEDDED TECHNOLOGIES	Digi-Key	800-344-4539	digikey.com	Y	10,349	N/A	$0	89.32%	150	3,400	Y
B&K PRECISION	Digi-Key	800-344-4539	digikey.com	Y	3,214	N/A	$0	99.94%	150	3,400	Y
BEL FUSE	Digi-Key	800-344-4539	digikey.com	Y	4,207	N/A	$0	83.53%	150	3,400	Y
BERGQUIST	Digi-Key	800-344-4539	digikey.com	Y	523	N/A	$0	95.98%	150	3,400	Y
BUD INDUSTRIES INC	Digi-Key	800-344-4539	digikey.com	Y	4,161	N/A	$0	99.93%	150	3,400	Y
C&K COMPONENTS	Digi-Key	800-344-4539	digikey.com	Y	29,271	N/A	$0	95.29%	150	3,400	Y
CHERRY	Digi-Key	800-344-4539	digikey.com	Y	1,200	N/A	$0	92.25%	150	3,400	Y

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CNC TECH	Digi-Key	800-344-4539	digikey.com	Y	4,553	N/A	$0	100%	150	3,400	Y
COMAIR ROTRON	Digi-Key	800-344-4539	digikey.com	Y	616	N/A	$0	100%	150	3,400	Y
COPAL ELECTRONICS INC	Digi-Key	800-344-4539	digikey.com	Y	4,121	N/A	$0	99.93%	150	3,400	Y
COTO TECHNOLOGY	Digi-Key	800-344-4539	digikey.com	Y	1,071	N/A	$0	99.72%	150	3,400	Y
CRYDOM CO	Digi-Key	800-344-4539	digikey.com	Y	5,459	N/A	$0	100%	150	3,400	Y
CTS CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	31,504	N/A	$0	87.78%	150	3,400	Y
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DANAHER CORPORATION (Pomona, Fluke, Portescap, Amprobe)	Digi-Key	800-344-4539	digikey.com	Y	5,410	N/A	$0	96.65%	150	3,400	Y
DELTA PRODUCTS CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	2,063	N/A	$0	99.90%	150	3,400	Y
DESCO CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	3,500	N/A	$0	99.83%	150	3,400	Y
E-SWITCH	Digi-Key	800-344-4539	digikey.com	Y	8,625	N/A	$0	99.99%	150	3,400	Y
EBM-PAPST INC.	Digi-Key	800-344-4539	digikey.com	Y	1,779	N/A	$0	99.89%	150	3,400	Y
ESSENTRA COMPONENTS	Digi-Key	800-344-4539	digikey.com	Y	16,594	N/A	$0	100%	150	3,400	Y
EXCELSYS TECHNOLOGIES LTD	Digi-Key	800-344-4539	digikey.com	Y	616	N/A	$0	100%	150	3,400	Y
GENERAL CABLE CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	7,109	N/A	$0	98.51%	150	3,400	Y
GENERAL ELECTRIC CORPORATION (GE Critical Power)	Digi-Key	800-344-4539	digikey.com	Y	1,751	N/A	$0	68.30%	150	3,400	Y
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MEMORY PROTECTION DEVICES	Digi-Key	800-344-4539	digikey.com	Y	814	N/A	$0	99.63%	150	3,400	Y
MURATA CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	61,903	N/A	$0	99.72%	150	3,400	Y
NKK SWITCHES	Digi-Key	800-344-4539	digikey.com	Y	21,343	N/A	$0	97.59%	150	3,400	Y
NMB TECHNOLOGIES CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	3,003	N/A	$0	98.80%	150	3,400	Y
OMRON CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	70,119	N/A	$0	95.28%	150	3,400	Y
ORION FANS	Digi-Key	800-344-4539	digikey.com	Y	2,949	N/A	$0	100.00%	150	3,400	Y
PANASONIC CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	156,533	N/A	$0	93.83%	150	3,400	Y
PANDUIT CORP	Digi-Key	800-344-4539	digikey.com	Y	23,108	N/A	$0	99.92%	150	3,400	Y
PHIHONG USA CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	1,450	N/A	$0	100.00%	150	3,400	Y
QUALTEK	Digi-Key	800-344-4539	digikey.com	Y	209	N/A	$0	92.52%	150	3,400	Y
RECOM POWER CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	27,095	N/A	$0	100.00%	150	3,400	Y
SCHAFFNER EMC INC	Digi-Key	800-344-4539	digikey.com	Y	2,111	N/A	$0	100.00%	150	3,400	Y
SCHURTER INC	Digi-Key	800-344-4539	digikey.com	Y	9,910	N/A	$0	99.48%	150	3,400	Y
SL POWER ELECTRONICS MANUFACTURE OF CONDOR/AULT BRANDS	Digi-Key	800-344-4539	digikey.com	Y	3,159	N/A	$0	88.76%	150	3,400	Y
SUNON FANS	Digi-Key	800-344-4539	digikey.com	Y	1,850	N/A	$0	77.14%	150	3,400	Y
TDK CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	64,978	N/A	$0	99.30%	150	3,400	Y

Buyers' Guide

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ENCLOSURES (continued)											
TE CONNECTIVITY CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	437,107	N/A	$0	75.47%	150	3,400	Y
TECHFLEX	Digi-Key	800-344-4539	digikey.com	Y	2,136	N/A	$0	99.72%	150	3,400	Y
TELEDYNE LECROY	Digi-Key	800-344-4539	digikey.com	Y	628	N/A	$0	92.99%	150	3,400	Y
THOMAS RESEARCH PRODUCTS	Digi-Key	800-344-4539	digikey.com	Y	1,361	N/A	$0	82.15%	150	3,400	Y
VICOR CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	195,706	N/A	$0	52.15%	150	3,400	Y
XP POWER	Digi-Key	800-344-4539	digikey.com	Y	4,155	N/A	$0	100.00%	150	3,400	Y
ENCLOSURES											
Bud	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bud Industries	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,325	N/A	$0	80.00%	50	1,000+	Y
Hammond Manufacturing	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,839	N/A	$0	82%	50	1,000+	Y
New Age Enclosures	Mouser Electronics	805-595-1310	www.newageenclosures.com	M	1,000+	N/A	$0	100.00%	32	N/A	Y
FERRITE CORES											
Samwha	Pridmore Corp	800 881 2072	www.pridmore.com	Y	17	$20,000	$0	100.00%	6	11	Y
FREQUENCY MANAGEMENT											
Abracon Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,780	N/A	$0	100%	50	1,000+	Y
Citizen	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,723	N/A	$0	N/A	50	1,000+	Y
CTS Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,889	N/A	$0	100%	50	1,000+	Y
Ecliptek	PUI	1-800-551-4405	www.gopui.com	Y	2,589	N/A	£50	99.00%	5	33	Y
ECS Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,070	N/A	$0	100%	50	1,000+	Y
Epson Toyocom	Mouser Electronics	800-346-6873	www.mouser.com	Y	178	N/A	$0	100%	50	1,000+	Y
Fox Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	325	N/A	$0	100.00%	50	1,000+	Y
ILSI-MMD Corporation	PUI	1-800-551-4405	www.gopui.com	Y	1,683	N/A	£50	99%	5	33	Y
Susumu Co Ltd	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,500	N/A	N/A	N/A	N/A	N/A	Y
ICs & SEMICONDUCTORS											
ADAFRUIT INDUSTRIES	Digi-Key	800-344-4539	digikey.com	Y	1,153	N/A	$0	98.70%	150	3,400	Y
ADVANCED PHOTONIX (LUNA OPTOELECTRONICS)	Digi-Key	800-344-4539	digikey.com	Y	678	N/A	$0	29.94%	150	3,400	Y
ALLEGRO MICROSYSTEMS, LLC	Digi-Key	800-344-4539	digikey.com	Y	2,867	N/A	$0	86.22%	150	3,400	Y
ALPHA & OMEGA SEMICONDUCTOR INC	Digi-Key	800-344-4539	digikey.com	Y	2,830	N/A	$0	100.00%	150	3,400	Y
ALTERA	Digi-Key	800-344-4539	digikey.com	Y	10,502	N/A	$0	100.00%	150	3,400	Y
AMS	Digi-Key	800-344-4539	digikey.com	Y	2,911	N/A	$0	97.94%	150	3,400	Y
ANALOG DEVICES	Digi-Key	800-344-4539	digikey.com	Y	50,633	N/A	$0	73.33%	150	3,400	Y
Analog Devices, Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,749	N/A	$0	95%	50	1,000+	Y
APEX MICROTECHNOLOGY	Digi-Key	800-344-4539	digikey.com	Y	432	N/A	$0	75.23%	150	3,400	Y
Atmel Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,840	N/A	$0	74%	50	1,000+	Y
ATP ELECTRONICS, INC.	Digi-Key	800-344-4539	digikey.com	Y	191	N/A	$0	100.00%	150	3,400	Y
B&B SMARTWORX	Digi-Key	800-344-4539	digikey.com	Y	2,414	N/A	$0	100.00%	150	3,400	Y

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FREQUENCY MANAGEMENT (continued)											
BIVAR	Digi-Key	800-344-4539	digikey.com	Y	17,303	N/A	$0	100%	150	3,400	Y
BRIDGELUX	Digi-Key	800-344-4539	digikey.com	Y	1,177	N/A	$0	100%	150	3,400	Y
BROADCOM LIMITED (AVAGO)	Digi-Key	800-344-4539	digikey.com	Y	13,051	N/A	$0	89.20%	150	3,400	Y
CALIFORNIA EASTERN LABORATORIES (CEL)	Digi-Key	800-344-4539	digikey.com	Y	3,359	N/A	$0	85.23%	150	3,400	Y
CENTRAL SEMICONDUCTOR	Digi-Key	800-344-4539	digikey.com	Y	5,526	N/A	$0	92.45%	150	3,400	Y
Central Semiconductor Corp.	Future Electronics	(800) 675-1619	www.futureelectronics.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	Y
CIRRUS LOGIC	Digi-Key	800-344-4539	digikey.com	Y	2,759	N/A	$0	79.16%	150	3,400	Y
Cirrus Logic Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	325	N/A	N/A	N/A	N/A	N/A	Y
Comchip	Pridmore Corp	800 881 2072	www.pridmore.com	Y	5	$4,000	$0	100%	6	11	Y
COMCHIP CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	6,678	N/A	$0	100%	150	3,400	Y
CREE INC	Digi-Key	800-344-4539	digikey.com	Y	26,398	N/A	$0	100%	150	3,400	Y
CYPRESS SEMICONDUCTOR	Digi-Key	800-344-4539	digikey.com	Y	26,030	N/A	$0	89.02%	150	3,400	Y
Cypress Semiconductor Corp	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,325	N/A	$0	81.00%	50	1,000+	Y
DIALIGHT	Digi-Key	800-344-4539	digikey.com	Y	10,510	N/A	$0	74.29%	150	3,400	Y
DIGI INTERNATIONAL CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	4,015	N/A	$0	89.51%	150	3,400	Y
DIODES INC	Digi-Key	800-344-4539	digikey.com	Y	32,186	N/A	$0	89.01%	150	3,400	Y
Etron Technology Inc	PUI	1-800-551-4405	www.gopui.com	Y	1459	N/A	£50	99%	5	33	Y
EXAR CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	3,605	N/A	$0	99.97%	150	3,400	Y
FAIRCHILD	Digi-Key	800-344-4539	digikey.com	Y	39,473	N/A	$0	98.81%	150	3,400	Y
Fairchild Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,654	N/A	$0	98.00%	50	1,000+	Y
FINISAR CORP	Digi-Key	800-344-4539	digikey.com	Y	1,852	N/A	$0	98.38%	150	3,400	Y
Freescale Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	5,866	N/A	$0	70.00%	50	1,000+	Y
FTDI	Mouser Electronics	800-346-6873	www.mouser.com	Y	94	N/A	$0	100%	50	1,000+	Y
FTDI	Digi-Key	800-344-4539	digikey.com	Y	486	N/A	$0	100%	150	3,400	Y
IDT (Integrated Device Technology)	Digi-Key	800-344-4539	digikey.com	Y	49,881	N/A	$0	63.29%	150	3,400	Y
Infineon	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,580	N/A	$0	63%	50	1,000+	Y
INFINEON TECHNOLOGIES CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	24,610	N/A	$0	73.25%	150	3,400	Y
International Rectifier Corp	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,980	N/A	N/A	N/A	N/A	N/A	Y
Intersil Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,782	N/A	N/A	N/A	N/A	N/A	Y
INTERSIL CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	24,063	N/A	$0	74.18%	150	3,400	Y
INVENSENSE	Digi-Key	800-344-4539	digikey.com	Y	200	N/A	$0	100%	150	3,400	Y
IXYS CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	7,268	N/A	$0	99.55%	150	3,400	Y
KINGBRIGHT COMPANY LLC	Digi-Key	800-344-4539	digikey.com	Y	3,358	N/A	$0	99.85%	150	3,400	Y
LATTICE SEMICONDUCTOR CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	6,946	N/A	$0	64.44%	150	3,400	Y
LINEAR TECHNOLOGY CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	36,207	N/A	$0	76.91%	150	3,400	Y
LINX TECHNOLOGIES INC	Digi-Key	800-344-4539	digikey.com	Y	833	N/A	$0	91.72%	150	3,400	Y

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LITE-ON INC	Digi-Key	800-344-4539	digikey.com	Y	3,563	N/A	$0	99.49%	150	3,400	Y
LOGIC PD, INC.	Digi-Key	800-344-4539	digikey.com	Y	195	N/A	$0	62.56%	150	3,400	Y
MACOM TECHNOLOGY SOLUTIONS	Digi-Key	800-344-4539	digikey.com	Y	1,376	N/A	$0	97.53%	150	3,400	Y
MAXIM CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	65,795	N/A	$0	77.63%	150	3,400	Y
Maxim Integrated	Mouser Electronics	800-346-6873	www.mouser.com	Y	9,200	N/A	$0	89.00%	50	1,000+	Y
MELEXIS TECHNOLOGIES NV	Digi-Key	800-344-4539	digikey.com	Y	1,444	N/A	$0	94.94%	150	3,400	Y
MICRO COMMERCIAL COMPONENTS (MCC)	Digi-Key	800-344-4539	digikey.com	Y	11,183	N/A	$0	97.43%	150	3,400	Y
Microchip	Mouser Electronics	800-346-6873	www.mouser.com	Y	5,800	N/A	$0	100%	50	1,000+	Y
MICROCHIP CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	58,558	N/A	$0	90.13%	150	3,400	Y
MICRON CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	11,504	N/A	$0	88.34%	150	3,400	Y
Microsemi	Mouser Electronics	800-346-6673	Mouser.com	Y	6,099	N/A	$0	50%	50	930+	Y
MICROSEMI CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	27,580	N/A	$0	80.18%	150	3,400	Y
MULTI-TECH CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	922	N/A	$0	99.46%	150	3,400	Y
NEWHAVEN DISPLAY INTERNATIONAL CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	707	N/A	$0	100.00%	150	3,400	Y
NIMBELINK, LLC	Digi-Key	800-344-4539	digikey.com	Y	45	N/A	$0	100.00%	150	3,400	Y
NXP	Mouser Electronics	800-346-6873	www.mouser.com	Y	7,205	N/A	$0	100%	50	1,000+	Y
NXP SEMICONDUCTOR CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	38,701	N/A	$0	99.27%	150	3,400	Y
ON Semiconductor	Mouser Electronics	800-346-6873	www.mouser.com	Y	7,486	N/A	$0	96%	50	1,000+	Y
ON SEMICONDUCTOR CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	57,566	N/A	$0	79.85%	150	3,400	Y
OSRAM OPTO SEMICONDUCTORS INC	Digi-Key	800-344-4539	digikey.com	Y	6,045	N/A	$0	96.33%	150	3,400	Y
PEREGRINE SEMICONDUCTOR	Digi-Key	800-344-4539	digikey.com	Y	463	N/A	$0	99.57%	150	3,400	Y
POWER INTEGRATIONS	Digi-Key	800-344-4539	digikey.com	Y	1,447	N/A	$0	87.49%	150	3,400	Y
POWEREX INC	Digi-Key	800-344-4539	digikey.com	Y	3,395	N/A	$0	92.72%	150	3,400	Y
QUALCOMM TECHNOLOGIES INTERNATIONAL, LTD.	Digi-Key	800-344-4539	digikey.com	Y	4,984	N/A	$0	100.00%	150	3,400	Y
RENESAS ELECTRONICS AMERICA	Digi-Key	800-344-4539	digikey.com	Y	12,614	N/A	$0	84.65%	150	3,400	Y
RFMD CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	912	N/A	$0	87.17%	150	3,400	Y
SEGGER MICROCONTROLLER SYSTEMS	Digi-Key	800-344-4539	digikey.com	Y	45	N/A	$0	100.00%	150	3,400	Y
SEMTECH CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	3,694	N/A	$0	87.63%	150	3,400	Y
SEOUL SEMICONDUCTOR INC	Digi-Key	800-344-4539	digikey.com	Y	892	N/A	$0	88.98%	150	3,400	Y
SHARP CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	505	N/A	$0	62.18%	150	3,400	Y
SILICON LABORATORIES CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	17,747	N/A	$0	96.09%	150	3,400	Y
Silicon Laboratories Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,141	N/A	$0	100.00%	50	1,000+	Y
SKYWORKS CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	2,311	N/A	$0	99.61%	150	3,400	Y
SMC Diode Solutions	Future Electronics	1-800-675-1619	www.futureelectronics.com	Y	155	N/A	$100.00	75%	4	60	Y
ST Microelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	8,145	N/A	$0	96.00%	50	1,000+	Y
STMICROELECTRONICS CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	43,448	N/A	$0	97.47%	150	3,400	Y

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ICs & SEMICONDUCTORS (continued)											
SWISSBIT NA INC	Digi-Key	800-344-4539	digikey.com	Y	865	N/A	$0	100.00%	150	3,400	Y
Taiwan Semiconductor	Pridmore Corp	800 881 2072	www.pridmore.com	Y	426	$18,000	$0	100.00%	6	11	Y
TAOGLAS LIMITED	Digi-Key	800-344-4539	digikey.com	Y	537	N/A	$0	100.00%	150	3,400	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	29,676	N/A	$0	94%	50	1,000+	Y
TEXAS INSTRUMENTS CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	210,905	N/A	$0	89.60%	150	3,400	Y
Toshiba	Mouser Electronics	800-346-6873	www.mouser.com	Y	800	N/A	N/A	N/A	N/A	N/A	Y
TOSHIBA CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	12,097	N/A	$0	88.81%	150	3,400	Y
VERSALOGIC CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	444	N/A	$0	95.50%	150	3,400	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	53,781	N/A	$0	77%	50	1,000+	Y
VISUAL COMMUNICATIONS COMPANY (CML)	Digi-Key	800-344-4539	digikey.com	Y	5,698	N/A	$0	96.12%	150	3,400	Y
XILINX INC	Digi-Key	800-344-4539	digikey.com	Y	7,354	N/A	$0	51.78%	150	3,400	Y
INTERCONNECTION											
3M	Mouser Electronics	800-346-6873	www.mouser.com	Y	23,235	N/A	$0	46.00%	50	1,000+	Y
3M	Digi-Key	800-344-4539	digikey.com	Y	54,086	N/A	$0	93.83%	150	3,400	Y
Aero Conesys	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AMERICAN ELECTRICAL INC	Digi-Key	800-344-4539	digikey.com	Y	1,140	N/A	$0	100.00%	150	3,400	Y
Amphenol	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AMPHENOL	Digi-Key	800-344-4539	digikey.com	Y	426,945	N/A	$0	82.42%	150	3,400	Y
Amphenol	Mouser Electronics	800-346-6873	www.mouser.com	Y	165,853	N/A	$0	31%	50	1,000+	Y
ASSMANN WSW COMPONENTS	Digi-Key	800-344-4539	digikey.com	Y	10,433	N/A	$0	91.47%	150	3,400	Y
Cinch	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CONEC	Digi-Key	800-344-4539	digikey.com	Y	7,793	N/A	$0	99.99%	150	3,400	Y
CW INDUSTRIES	Digi-Key	800-344-4539	digikey.com	Y	8,384	N/A	$0	73.71%	150	3,400	Y
EDAC CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	9,720	N/A	$0	99.87%	150	3,400	Y
ELEKTRON TECHNOLOGY CORPORATION (Bulgin, ArcoLectric)	Digi-Key	800-344-4539	digikey.com	Y	3,936	N/A	$0	100%	150	3,400	Y
FCI	Mouser Electronics	800-346-6873	www.mouser.com	Y	3,394	N/A	$0	73.00%	50	1,000+	Y
Fischer Connectors Inc.	Kensington Electronics, Inc.	512-339-3300	www.keiconn.com	Y	N/A	N/A	$50	N/A	4	30	N
Harting	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,160	N/A	$0	51.00%	50	1,000+	Y
HARTING	Digi-Key	800-344-4539	digikey.com	Y	16,347	N/A	$0	99.96%	150	3,400	Y
HARWIN INC	Digi-Key	800-344-4539	digikey.com	Y	10,186	N/A	$0	89.51%	150	3,400	Y
Hirose Electric	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,322	N/A	$0	86%	50	1,000+	Y
HIROSE ELECTRIC CO LTD	Digi-Key	800-344-4539	digikey.com	Y	39,499	N/A	$0	91.53%	150	3,400	Y
Hypertac	Smiths Connectors	913 342 5544	www.smithsconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ITT Cannon	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ITT CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	141,017	N/A	$0	27.97%	150	3,400	Y
JAE Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,02	N/A	$0	100%	N/A	N/A	Y

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INTERCONNECTION (continued)											
JAE ELECTRONICS	Digi-Key	800-344-4539	digikey.com	Y	6,844	N/A	$0	100.00%	150	3,400	Y
JST	PUI	1-800-551-4405	www.gopui.com	Y	1,225	N/A	£50	99.00%	5	33	Y
JST SALES AMERICA INC	Digi-Key	800-344-4539	digikey.com	Y	4,320	N/A	$0	81.46%	150	3,400	Y
Kycon	PUI	1-800-551-4405	www.gopui.com	Y	1150	N/A	£50	99%	5	33	Y
LEMO	Digi-Key	800-344-4539	digikey.com	Y	27,601	N/A	$0	100.00%	150	3,400	Y
MILL-MAX MANUFACTURING CORP	Digi-Key	800-344-4539	digikey.com	Y	16,704	N/A	$0	61.28%	150	3,400	Y
Molex	Mouser Electronics	800-346-6873	www.mouser.com	Y	85,634	N/A	$0	89%	50	1,000+	Y
MOLEX CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	123,772	N/A	$0	95.41%	150	3,400	Y
Neutrik	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,563	N/A	$0	100%	50	1,000+	Y
ON SHORE TECHNOLOGY INC	Digi-Key	800-344-4539	digikey.com	Y	12,793	N/A	$0	99.99%	150	3,400	Y
Panduit	North Shore Components Inc.	631-504-6038	www.nscomponents.com	Y	1,000+	N/A	$100	N/A	3	20	Y
PARLEX USA LLC	Digi-Key	800-344-4539	digikey.com	Y	785	N/A	$0	98.34%	150	3,400	Y
PHOENIX CONTACT	Digi-Key	800-344-4539	digikey.com	Y	49,643	N/A	$0	99.99%	150	3,400	Y
Phoenix Contact	Mouser Electronics	800-346-6873	www.mouser.com	Y	30,044	N/A	$0	77.00%	50	1,000+	Y
SAMTEC INC	Digi-Key	800-344-4539	digikey.com	Y	20,270	N/A	$0	99.91%	150	3,400	Y
Souriau	Mouser Electronics	800-346-6873	www.mouser.com	Y	10,744	N/A	$0	27%	50	1,000+	Y
SOURIAU CONNECTION TECHNOLOGY CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	19,134	N/A	$0	89.06%	150	3,400	Y
SULLINS CONNECTOR SOLUTIONS	Digi-Key	800-344-4539	digikey.com	Y	204,896	N/A	$0	97.59%	150	3,400	Y
Switchcraft Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	300	N/A	$0	55%	50	1,000+	Y
SWITCHCRAFT CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	4,228	N/A	$0	80.39%	150	3,400	Y
TE Connectivity	Mouser Electronics	800-346-6873	www.mouser.com	Y	123,613	N/A	$0	69%	50	1,000+	Y
TENSILITY INTERNATIONAL CORP	Digi-Key	800-344-4539	digikey.com	Y	1,209	N/A	$0	100.00%	150	3,400	Y
WEIDMULLER	Digi-Key	800-344-4539	digikey.com	Y	42,770	N/A	$0	96.54%	150	3,400	Y
OBSOLESCENCE / HARD TO FIND											
	America II Electronics	800-767-2637	www.americaii.com	M	1,900	$1B	$0	75.00%	59	550+	Y
OPTO ELECTRONICS											
Avago Technologies	Mouser Electronics	800-346-6873	www.mouser.com	Y	7,165	N/A	$0	87.00%	50	1,000+	Y
Cree	Mouser Electronics	800-346-6873	www.mouser.com	Y	582	N/A	$0	99.00%	50	1,000+	Y
LedEngin, Inc	Mouser Electronics	800-346-6873	www.mouser.com	Y	437	N/A	$0	100.00%	50	1,000+	Y
Osram Opto Semiconductors	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,927	N/A	$0	99%	50	1,000+	Y
Sharp Microelectronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,415	N/A	$0	97%	50	1,000+	Y
PASSIVES											
ABRACON CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	28,548	N/A	$0	98.89%	150	3,400	Y
AMERICAN TECHNICAL CERAMICS	Digi-Key	800-344-4539	digikey.com	Y	2,021	N/A	$0	84.02%	150	3,400	Y
API DELEVAN	Digi-Key	800-344-4539	digikey.com	Y	28,483	N/A	$0	46.93%	150	3,400	Y
AVX	Mouser Electronics	800-346-6873	www.mouser.com	Y	42,454	N/A	$0	72%	50	1,000+	Y

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
PASSIVES (continued)											
AVX CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	65,718	N/A	$0	83.48%	150	3,400	Y
BOURNS	Digi-Key	800-344-4539	digikey.com	Y	59,314	N/A	$0	82.47%	150	3,400	Y
Bourns	Mouser Electronics	800-346-6873	www.mouser.com	Y	38	N/A	$0	78%	50	1,000+	Y
CADDOCK ELECTRONICS INC	Digi-Key	800-344-4539	digikey.com	Y	492	N/A	$0	98.78%	150	3,400	Y
CANTHERM	Digi-Key	800-344-4539	digikey.com	Y	823	N/A	$0	100%	150	3,400	Y
CITIZEN SYSTEMS AMERICA CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	4,309	N/A	$0	87.42%	150	3,400	Y
CONNOR-WINFIELD	Digi-Key	800-344-4539	digikey.com	Y	1,375	N/A	$0	98.62%	150	3,400	Y
Cornell Dubilier	Mouser Electronics	800-346-6873	www.mouser.com	Y	24,145	N/A	$0	71%	50	1,000+	Y
Cornell Dubilier	PUI	1-800-551-4405	www.gopui.com	Y	1420	N/A	£50	99%	5	33	Y
CORNELL DUBILIER ELECTRONICS	Digi-Key	800-344-4539	digikey.com	Y	25,597	N/A	$0	75.97%	150	3,400	Y
CRYSTEK CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	1,721	N/A	$0	100%	150	3,400	Y
EATON CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	28,434	N/A	$0	86.49%	150	3,400	Y
ECS INC	Digi-Key	800-344-4539	digikey.com	Y	8,236	N/A	$0	85.07%	150	3,400	Y
EFC Wesco	Pridmore Corp	800 881 2072	www.pridmore.com	Y	6	$37,000	$0	100%	6	11	Y
ENERGIZER BATTERY COMPANY	Digi-Key	800-344-4539	digikey.com	Y	453	N/A	$0	63.13%	150	3,400	Y
EPCOS	Mouser Electronics	800-346-6873	www.mouser.com	Y	26,533	N/A	$0	98.00%	50	1,000+	Y
EPSON CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	2,202	N/A	$0	82.60%	150	3,400	Y
FOX ELECTRONICS	Digi-Key	800-344-4539	digikey.com	Y	617	N/A	$0	100%	150	3,400	Y
HEICO CORPORATION (Ohmite)	Digi-Key	800-344-4539	digikey.com	Y	17,385	N/A	$0	64.94%	150	3,400	Y
HONEYWELL CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	26,319	N/A	$0	86.01%	150	3,400	Y
JOHANSON CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	5,039	N/A	$0	97.60%	150	3,400	Y
Kemet	Mouser Electronics	800-346-6873	www.mouser.com	Y	77,568	N/A	$0	66%	50	1,000+	Y
Kemet	Pridmore Corp	800 881 2072	www.pridmore.com	Y	476	$83,000	$0	95.00%	6	11	Y
KEMET CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	48,025	N/A	$0	90.12%	150	3,400	Y
KNOWLES CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	2,987	N/A	$0	91.16%	150	3,400	Y
KOA Speer	Mouser Electronics	800-346-6873	www.mouser.com	Y	34,078	N/A	$0	58%	50	1,000+	Y
LAIRD CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	14,568	N/A	$0	97.21%	150	3,400	Y
LEM USA INC	Digi-Key	800-344-4539	digikey.com	Y	377	N/A	$0	98.41%	150	3,400	Y
LITTELFUSE CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	86,652	N/A	$0	82.87%	150	3,400	Y
MALLORY SONALERT PRODUCTS INC	Digi-Key	800-344-4539	digikey.com	Y	1,893	N/A	$0	92.92%	150	3,400	Y
Murata	Mouser Electronics	800-346-6873	www.mouser.com	Y	33,780	N/A	$0	99%	50	1,000+	Y
NDK	Digi-Key	800-344-4539	digikey.com	Y	936	N/A	$0	100.00%	150	3,400	Y
NESSCAP CO LTD	Digi-Key	800-344-4539	digikey.com	Y	24	N/A	$0	100.00%	150	3,400	Y
Nichicon	Mouser Electronics	800-346-6873	www.mouser.com	Y	20,389	N/A	$0	84.00%	50	1,000+	Y
NICHICON	Digi-Key	800-344-4539	digikey.com	Y	35,421	N/A	$0	96.30%	150	3,400	Y
NVE CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	617	N/A	$0	60.25%	150	3,400	Y

Manufacturer	Distributor	Telephone	Website	Franchised Distributor (Y/N/M)	No. of Lines for Principle	Stock Value for Principle	Minimum Order Value	% Lead Free for Principle Range	No. of Technical Support Staff	Total No. of Staff	Pack and Hold
PASSIVES (continued)											
Ohmite	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,293	N/A	$0	55.00%	50	1,000+	Y
Panasonic Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	14,948	N/A	$0	100.00%	50	1,000+	Y
PUI AUDIO, INC.	Digi-Key	800-344-4539	digikey.com	Y	1,285	N/A	$0	75.55%	150	3,400	Y
PULSE CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	11,098	N/A	$0	93.56%	150	3,400	Y
RIEDON	Digi-Key	800-344-4539	digikey.com	Y	3,411	N/A	$0	99.82%	150	3,400	Y
ROHM SEMICONDUCTOR CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	63,003	N/A	$0	99.85%	150	3,400	Y
Samsung Electro-Mechanics	PUI	1-800-551-4405	www.gopui.com	Y	3852	N/A	50	99.00%	5	33	Y
Samsung Electro-Mechanics	Digi-Key	800-344-4539	digikey.com	Y	21,522	N/A	$0	100.00%	150	3,400	Y
STACKPOLE CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	55,938	N/A	$0	99.49%	150	3,400	Y
STANDEX-MEDER ELECTRONICS	Digi-Key	800-344-4539	digikey.com	Y	648	N/A	$0	99.69%	150	3,400	Y
SUMIDA AMERICA COMPONENTS INC	Digi-Key	800-344-4539	digikey.com	Y	7,157	N/A	$0	86.24%	150	3,400	Y
SUSUMU	Digi-Key	800-344-4539	digikey.com	Y	43,474	N/A	$0	99.98%	150	3,400	Y
TADIRAN BATTERIES	Digi-Key	800-344-4539	digikey.com	Y	65	N/A	$0	100.00%	150	3,400	Y
Taiyo Yuden	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,620	N/A	$0	98.00%	50	1,000+	Y
TAIYO YUDEN	Digi-Key	800-344-4539	digikey.com	Y	16,677	N/A	$0	99.96%	150	3,400	Y
TAMURA	Digi-Key	800-344-4539	digikey.com	Y	1,355	N/A	$0	92.25%	150	3,400	Y
TDK	Mouser Electronics	800-346-6873	www.mouser.com	Y	6,663	N/A	$0	100.00%	50	1,000+	Y
TRIAD MAGNETICS	Digi-Key	800-344-4539	digikey.com	Y	1,608	N/A	$0	98.82%	150	3,400	Y
TRIPP LITE	Digi-Key	800-344-4539	digikey.com	Y	3,646	N/A	$0	88.65%	150	3,400	Y
TT ELECTRONICS CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	8,975	N/A	$0	80.34%	150	3,400	Y
TXC CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	9,066	N/A	$0	100.00%	150	3,400	Y
United Chemi-Con	Pridmore Corp	800 881 2072	www.pridmore.com	Y	92	$25,000	$0	100.00%	6	11	Y
United Chemi-Con	PUI	1-800-551-4405	www.gopui.com	Y	1145	N/A	50	99.00%	5	33	Y
UNITED CHEMI-CON	Digi-Key	800-344-4539	digikey.com	Y	16,160	N/A	$0	87.44%	150	3,400	Y
Vishay	Mouser Electronics	800-346-6873	www.mouser.com	Y	102,917	N/A	$0	64.00%	50	1,000+	Y
VISHAY CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	275,942	N/A	$0	88.52%	150	3,400	Y
VISHAY PRECISION GROUP CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	28,238	N/A	$0	52.21%	150	3,400	Y
Wurth	Mouser Electronics	800-346-6873	www.mouser.com	Y	934	N/A	$0	99.00%	50	1,000+	Y
WURTH CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	22,245	N/A	$0	100.00%	150	3,400	Y
Yageo Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	18,246	N/A	$0	100.00%	50	1,000+	Y
YAGEO CORPORATION	Digi-Key	800-344-4539	digikey.com	Y	141,986	N/A	$0	83.67%	150	3,400	Y
POWER & BATTERIES											
APC	North Shore Components Inc.	631-504-6038	www.nscomponents.com	Y	1,000+	N/A	$100	N/A	3	20	Y
Emerson	Mouser Electronics	800-346-6873	www.mouser.com	Y	358	N/A	$1	85.00%	N/A	N/A	Y
Lineage Power	Mouser Electronics	800-346-6873	www.mouser.com	Y	301	N/A	$0	100.00%	N/A	N/A	Y
N2Power	PUI	1-800-551-4405	www.gopui.com	Y	1241	N/A	50	99.00%	5	33	Y

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REED SWITCHES											
Power-One	Mouser Electronics	800-346-6873	www.mouser.com	Y	170	N/A	$0	60.00%	N/A	N/A	Y
TDK Lambda	Mouser Electronics	800-346-6873	www.mouser.com	Y	405	N/A	$0	80.00%	N/A	N/A	Y
HSI Sensing	HSI Sensing	405-224-4046	www.hsisensing.com	M	75	N/A	$200	100.00%	15	275	N
Standex-Meder Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	120	N/A	$0	82.00%	50	1,000+	Y
RESISTORS											
SRT Resistor Technology GmbH	BREL International	800-237-4564	www.brelintl.com	Y	550	NA	$0	100.00%	6	35	Y
SENSORS											
Freescale	Mouser Electronics	800-346-6873	www.mouser.com	Y	842	N/A	$0	97.00%	50	1,000+	Y
Honeywell Sensing and Control	Mouser Electronics	800-346-6873	www.mouser.com	Y	12,059	N/A	$0	64.00%	50	1,000+	Y
HSI Sensing	HSI Sensing	405-224-4046	www.hsisensing.com	M	75	N/A	$200	100.00%	15	275	N
Maxim Integrated	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,379	N/A	$0	45.00%	50	1,000+	Y
Omron	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,915	N/A	$0	59.00%	50	1,000+	Y
Standex-Meder Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	120	N/A	$0	82.00%	50	1,000+	Y
Texas Instruments	Mouser Electronics	800-346-6873	www.mouser.com	Y	914	N/A	$0	65.00%	50	1,000+	Y
SWITCHES & KEYBOARDS											
APEM	Mouser Electronics	800-346-6873	www.mouser.com	Y	4,326	N/A	$0	83.00%	50	1,000+	Y
APEM	PUI	1-800-551-4405	www.gopui.com	Y	988	N/A	50	99.00%	5	33	Y
C&K Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	27,230	N/A	$0	90.00%	50	1,000+	Y
Copal Electronics Inc	Pridmore Corp	800 881 2072	www.pridmore.com	Y	2	$450	$0	100.00%	6	11	Y
Honeywell Sensing and Control	Mouser Electronics	800-346-6873	www.mouser.com	Y	15,149	N/A	$0	73.00%	50	1,000+	Y
NKK Switches	Mouser Electronics	800-346-6873	www.mouser.com	Y	13,976	N/A	$0	86.00%	50	1,000+	Y
Omron	Mouser Electronics	800-346-6873	www.mouser.com	Y	10,669	N/A	$0	89.00%	50	1,000+	Y
OTTO	ECCO	773-767-2200	www.eccoconnectors.com	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OTTO	Mouser Electronics	800-346-6873	www.mouser.com	Y	500+	N/A	$0	100.00%	75	500	Y
Panasonic Electric Works	Mouser Electronics	800-346-6873	www.mouser.com	Y	2,748	N/A	$0	100.00%	50	1,000+	Y
Standex-Meder Electronics	Mouser Electronics	800-346-6873	www.mouser.com	Y	120	N/A	$0	82.00%	50	1,000+	Y
Switchcraft Corporation	Mouser Electronics	800-346-6873	www.mouser.com	Y	300	N/A	$0	55.00%	50	1,000+	Y
TEST & MEASUREMENT											
Fluke	Mouser Electronics	800-346-6873	www.mouser.com	Y	1,008	N/A	$0	94.00%	50	1,000+	Y
Sanyo Denki America, Inc.	PUI	1-800-551-4405	www.gopui.com	Y	2122	N/A	50	99.00%	5	33	Y
Teledyne LeCroy	Mouser Electronics	800-346-6873	www.mouser.com	Y	194	N/A	$0	96.00%	50	1,000+	Y
THERMAL MANAGEMENT											
Aavid Thermalloy	Mouser Electronics	800-346-6873	www.mouser.com	Y	826	N/A	$0	73.00%	50	1,000+	Y
WIRELESS SOLUTIONS											
Panasonic Electronic Components	Mouser Electronics	800-346-6873	www.mouser.com	Y	48	N/A	$0	100.00%	50	1,000+	Y
RFM	Mouser Electronics	800-346-6873	www.mouser.com	Y	312	N/A	$0	90.00%	50	1,000+	Y

MOUSER MANUFACTURERS

0 - 9

3M
3M Touch Systems
4D Systems NEW

A

Aavid Thermalloy
Abracon
Adaptive Interconnect Electronics
Adesto Technologies NEW
ADI Engineering NEW
ADLINK Technology NEW
Advanced Linear Devices
Advanced Thermal Solutions
Advantech NEW
AIM
Alliance Memory
All Sensors
Alorium Technology NEW
Alpha Wire
ALPS
Altech
Altera Corporation NEW
AME
American Technical Ceramics
Ametherm NEW
Amphenol
Amprobe
ams
AMSECO
Amulet Technologies
Analog Devices Inc. NEW
AnalogicTech
Anaren
Anderson Power
Antenna Factor
Antenova
Apacer Technology Inc.
APC by Schneider Electric
APEM
Apex Tool Group
API Delevan
APM HEXSEAL
Applied Motion
Arcol
Arduino NEW
Aries
Artesyn Embedded Technologies
Atmel
Atollic NEW
Ault / SL Power
Avago Technologies
Avery Dennison
AVX
Axiomtek NEW
Azoteq

B

B&K Precision
BeagleBoard by CircuitCo
BEI Sensors
Bel Power Solutions
Bel Signal Transformer
Belden
Bellin Dynamic Systems
Bergquist
Bias Power
BI Technologies
BIVAR
Blackhawk
Bluegiga / Silicon Labs
Bluetechnix NEW
Bomar Interconnect
Bosch Sensortec NEW
Bosch Connected Devices NEW
Boundary Devices NEW
Bourns
BPS
Broadcom NEW
Bud Industries
Bulgin

C

C&K Components
Caddock
Califia Lighting
California Eastern Labs / CEL
Carling Technologies
Carclo Technical Plastics
CCS
Central Semiconductor
Chemtronics
CHERRY
Cinch Connectivity Solutions
Cincon
Cirrus Logic
Citizen Finetech Miyota
Clare
CMOSIS NEW
Code Red Technologies
Comchip Technology
Condor / SL Power
CONEC
congatec
Connect One
Continental Industries
Conxall
Cornell Dubilier
Coto Technology
Cree
Crocus Technology NEW
Crouzet
Crydom
CRYSTEK CRYSTALS
CSB
CTS Electronic Components
CW Industries
Cypress Semiconductor

D

Davies Molding
DBM Optix
Dell NEW
Delphi
Deltron
Dialight
Dialog Semiconductor NEW
Dielectric Laboratories
Digi International
Digital View
Diode Laser Concepts
Diodes Incorporated
DIOO Microcircuits NEW
Displaytech Ltd.
DLP Design
DMC Tools (Daniels Manufacturing Corp) NEW

E

Eagle-Picher
EasySync
Eaton
ebm-papst
Ecliptek
ECS
EDAC
EE Tools
Electronic Assembly
Electroswitch
Elna
Elprotronic Inc.
Embedded Artists
Energy Micro
Enterpoint, Ltd. NEW
EPCOS
Epson
Ericsson Power Modules
ERP NEW
E-Switch
Esquilo NEW
ETA-USA
E-T-A Circuit Breakers NEW
ETI Systems
Eupec
Everspin Technologies
Everlight
EXAR
Extech

F

Fairchild Semiconductor
Fair-Rite
Fascomp
Fastron
FCT Electronics
Finisar NEW
Flamar NEW
FlexiPanel
Fluke
Fox
Freescale / NXP Semiconductor
FTDI
Fujitsu
Future Designs, Inc. (FDI)

G

GeneSiC Semiconductor
GE Critical Power
GHI Electronics
Glenair
Global Specialties
Gravitech
Greenlee
Greenliant
GSI Technology NEW
Guerrilla RF NEW

H

Hammond Enclosures
Hantronix
HARTING
Harwin
Heatron
Heyco
Hirose Electric
Honeywell

I

IAR Systems
ICE Components
IDI
iEi Technology NEW
IET Labs
Illumitex
Imagination Technologies NEW
Infineon
Inolux
Inspired LED
Intel NEW
Integrated Device Technology
International Power
Intersil NEW
Inventus Power
Ioxus
IQD Frequency Products NEW
IRC
ISSI
ITW Switches
IXYS Integrated Circuits

J

J.W. Miller
JAE Electronics
Jewell Modutec
JKL Components
Johanson NEW
Johnson / Cinch

K

Kamaya
Ka-Ro Electronics NEW
Kavlico NEW
Keil (ARM®)
Keithley
KEMET
KEMET NEC TOKIN NEW
Kester
Keterex
Keystone Electronics
Kionix
Kingbright
Knowles Acoustics
KOA Speer
Kostal NEW
Kycon
KYOCERA / AVX

L

Laird Technologies
Lantronix
Lattice Semiconductor
LedEngin
Ledil
LedLink
LEMO
Leopard Imaging
Leviton
LHV Power
Linx Technologies
Lite-On
Littelfuse
LMB/Heeger
Lorlin
LPRS NEW
LS Research
Lumex
Lumileds NEW
Luminus Devices
Luxo Corporation

M

MACOM
Macraigor Systems
Maestro Wireless
Magnecraft
Mallory
Mallory Sonalert
Marquardt Switches
Matrix Orbital
Maxim Integrated
Maxwell Technologies
MCC
Mean Well
Measurement Specialties
Meder
Melexis NEW
Menda
Merit Sensor NEW
Metcal
MG Chemicals
Micrel NEW
Microchip
Micronas NEW
MicroSemi SoC Group
Microtips
Mide Technology NEW
MikroElektronika
Mill-Max
Mitsubishi Electric
Molex
Monolithic Power Systems (MPS)
MSI Sensors
Mueller Electric
Murata
Murata Power Solutions
Murata Wireless Solutions NEW

N

NEC Relays
NetBurner
Netduino
Neutrik
New Age Enclosures
Newhaven Display
Nichicon
NJR
NKK Switches
NMB
NorComp
Nordic Semiconductor
Noritake
NOVACAP
NovaSensor / GE Sensing
NXP Semiconductors

O

Ohmite
OK Industries
Olimex Ltd.
Omron
ON Semiconductor
Oplink NEW
Optek Technologies
Optrex-Kyocera
Opulent NA NEW
Orion Fans
OSRAM Opto Semiconductors
OTTO NEW

P

Pacific Silicon Sensor
PacTec
Panasonic
PanaVise
PandaBoard
Panduit
Parallax
Particle NEW
Pericom
Phihong
Phoenix Contact
Piher
Plato
Plessey Semiconductors NEW
PLX Technology
Pomona
Powercast
Power Dynamics NEW
Power Integrations
Power-Sonic
Precision Technology NEW
Protek
Protektive Pak
PUI Audio
Pulse

Q, R

Q-Cee's / TE Connectivity
Qualtek
Quatech
Rabbit Semiconductor
Radiall NEW
RAF Electronic Hardware
Ramtron
RECOM
Rectron
Red Pitaya NEW
Redpine Signals
Renata
RF Digital
Ricoh Electronic Devices NEW
ROHM Semiconductor
Rosenberger NEW

S

Sagrad, Inc.
SanDisk NEW
Sanyo Denki
Sargent Tools
Schaffner
SchmartBoard
Schneider Electric NEW
Schurter
SEEED STUDIO NEW
SEGGER Microcontroller
Seiko Printers
Seoul Semiconductor
Semelab
Semflex / Cinch
Semitec USA
Semtech NEW
Serpac
Sharp Microelectronics
Shindengen
Silex Technology
Silicon Microstructures NEW
Silicon Labs
Simpson
SiTime
SkyeTek
Skyworks Solutions Inc. NEW
Smart Modular Technologies NEW
SMSC / Microchip
SolaHD
SolderCore
SOMNIUM Technologies NEW
Song Chuan
Souriau
SL Power
Spansion
SparkFun Electronics NEW
Spectra Symbol
Spectrum Control
Spectrum Digital
SPI Westek
Sprague Goodman
Staco
STMicroelectronics
Stratos / Cinch
Sumida
Susumu
Swissbit NEW
Switchcraft
Syfer

T

Tadiran
Taica NEW
Taiwan Semiconductor
Taiyo Yuden
Tamura
Taoglas
TDK
TDK-Lambda NEW
TE Connectivity
TechNexion NEW
Techspray
Tektronix
Teledyne LeCroy
Temp-Flex Cable
Terasic Technologies NEW
Texas Instruments
THAT Corporation
Thermometrics
Torex Semiconductor NEW
Toshiba
Triad Magnetics
Tripp Lite
TriQuint Semiconductor
Triune Systems
Trompeter / Cinch
TT Electronics
Tusonix
Twin Industries
TXC
Tyco Electronics

U

UDOO NEW
Ultralife
United Chemi-Con
US Sensor

V

Vacuumschmelze (VAC) NEW
Varitronix
VCC
Vector
Vectron International
VIA Embedded NEW
Vishay
Vitelec / Cinch
Volex
Voltronics
VORAGO Technologies NEW

W

W.L. Gore
Wahl
Wakefield-Vette
Walsin
Wandboard NEW
Welwyn
White-Rodgers
Wi2Wi
WIMA
Wiremold
WIZnet
Wolfson/Cirrus Logic
Wolfspeed
Wurth Electronics

X, Y, Z

Xeltek
Yageo
Yamaichi
ZiLOG

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