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Encouraging Young Minds

Kids are awesome. They might not seem so when they're screaming in a restaurant or kicking the back of your seat on a six-hour ride to Las Vegas (or, God forbid, screaming and kicking your seat while you try to eat on a flight to Vegas), but they have incredible ways of solving problems.

I'm not even referring to kids building prosthetics out of Lego blocks or finding better ways to grow food — though those kids are incredible — but consider the projects that middle school robotics teams are developing, or even the creative solutions coming from engineering kits. They often don't receive the recognition — parents should hang this stuff on the fridge — but the way a child's mind works is pretty incredible.

So, how do we honor the minds of unsung geniuses? We create the Young Mind Awards!

The Awards are designed to showcase the work of middle, high school, and collegiate-level students in the areas of electronics, wireless, medical, electromechanical, and R&D. This project can be anything from FIRST robotics to science fair projects to lab hacks. Either in teams or individually, students must present their designs to a panel of industry judges.

The winners will receive a reward for themselves as well as for the teacher and school they represent.

All finalists will be invited to a ceremony as a part of the R&D 100 Awards in Las Vegas in November. It's an opportunity to mix and mingle with industry experts from across the country and showcase the design.

If you know a stellar student or school program that would qualify, send them over to www.youngmindawards.com. It's a small fee to register, but it's also an opportunity to showcase the design to the world. All applications must be received by May 31, 2015.

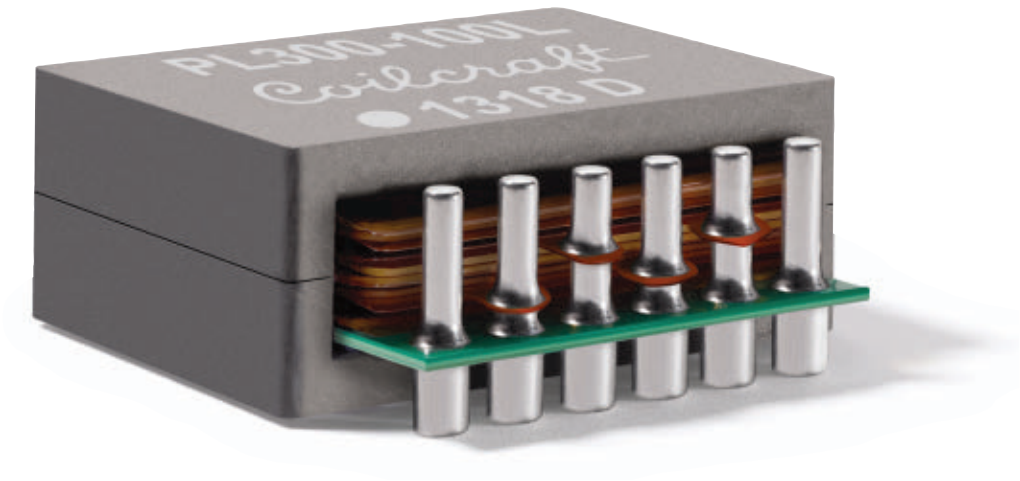
On a personal note, I'm quite excited that ECN is involved in something that could really make a difference for some kids and, hopefully, inspire them to have a little faith in their own creativity and explore what they can do.

Kids are capable of incredible things if we just let them try, and the Young Mind Awards might just turn into a showcase for the future engineers of the world.

Until next issue,

Kasey Panetta

300 Watts. Zero Wait.



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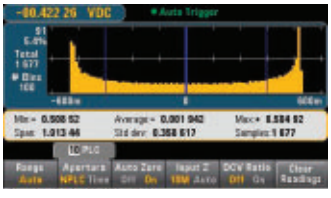
As the industry leader in bench digital multimeters (DMMs), Keysight delivers more than numbers. We empower insights. Now we're raising the standard again with two new Keysight Truevolt DMMs, the 6½ digit 34465A and 7½ digit 34470A. Both models build on Truevolt's graphical capabilities such as trend and histogram charts offering more insights quickly. They provide a data logging mode for easier trend analysis and a digitizing mode for capturing transients. Also, both offer auto calibration that allows you to maintain measurement accuracy throughout your workday. Our new 7½ digit DMM offers greater resolution and accuracy for your most challenging devices.


Trend chart


Histogram

Truevolt DMMs	34461A	34465A *NEW*	34470A *NEW*
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Linearity	2 ppm	1 ppm	0.5 ppm
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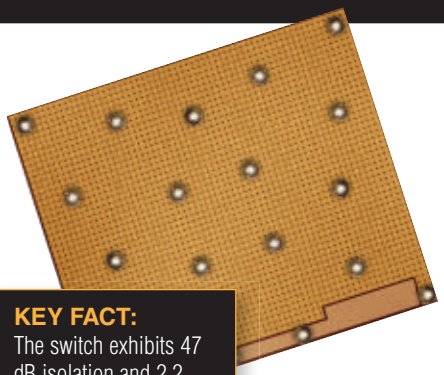


KEY FACT:
The switch exhibits 47 dB isolation and 2.2 dB insertion loss at 30 GHz, as well as 50 dBm IIP3 at 13.5 GHz.

RF switch delivers high port-to-port isolation

Peregrine's PE42524 is a single-pole double-throw RF switch die that supports a frequency range from 10 MHz to 40 GHz. It delivers high port-to-port isolation, insertion loss, and linearity. The component has a switching time of 225 nanoseconds, a settling time of 840 nanoseconds, and a ESD rating of 2,000 V HBM on all pins. Unlike GaAs solutions, no blocking capacitors are required if DC voltage is not present on the RF ports. The device is available as a flip-chip die with 500 microns bump pitch, which eliminates high-frequency performance variations due to bond wire length variances.

For more information, visit www.psemi.com.

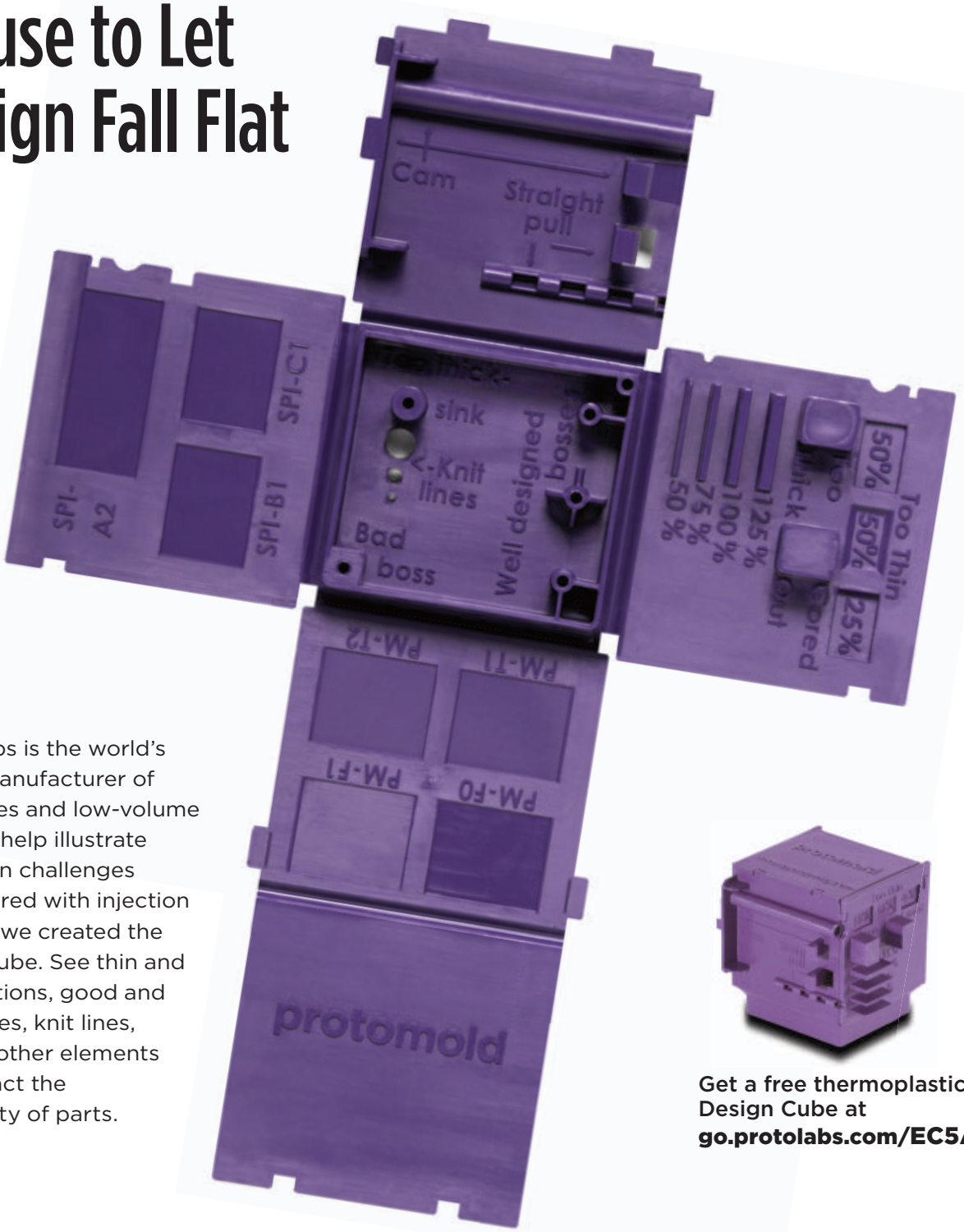
Class D audio demo board uses eGaN FETs

Efficient Power Conversion Corporation (EPC) introduces the EPC9106, a reference design for a 150 W, 8 ohm Class-D audio amplifier. This demonstration board uses a Bridge-Tied-Load design, composed of four ground-referenced half-bridge output stages, which allows scalability and expandability of the design. All elements that can impact the sonic performance of Class-D Audio systems are minimized or eliminated in an eGaN FET-based system. This board demonstrates that high quality sound can be achieved in a small size due to the performance capabilities of high frequency switching eGaN FETs.

For more information, visit www.epc-co.com.

KEY FACT: The EPC9106 features the eGaN FET in conjunction with the LM5113 eGaN FET gate driver from Texas Instruments.

Refuse to Let Design Fall Flat



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This is the only advice for girls who want to be engineers

By Kasey Panetta, Editor, @kcpanetta

What we should do about the gender gap? The ongoing conversation ranges from, 'Should we be doing anything?' to 'What types of toys will teach my children the skills they'll need to succeed as an engineer?' to 'What gender gap? Quit complaining.' In fact, I've seen all of these discussions take place in the comment section of ECN.

Actress Emma Watson, who serves as a UN Women Goodwill Ambassador and works to further educational opportunities for women around the world, was on Twitter answering questions about the HeForShe campaign called 10X10X10 initiative. She was asked a very important question.

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5 smart careers for future engineers bit.ly/1ukhOIz #electronics

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Record-breaking speed of Audi's autonomous vehicle

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Why a future engineer picked @princeton http://ow.ly/HXMV7 @kcpanetta

Navy's electromagnetic railgun launches projectiles up to Mach 7

By Jason Lomberg, Digital Editor, @JasonECNMag

The Office of Naval Research unveiled its electromagnetic railgun for the first time at the Naval Future Force Science & Technology EXPO last week. With the ability to launch a hyper-velocity projectile up to Mach 7 in less than a second, it's a doozy.

Engineering Update: China's drone delivery service

➤ *China's drone delivery service*

While we struggle with domestic drone regulations, China's e-commerce giant, Alibaba, is moving forward with a similar service as Amazon's vaunted drone delivery system

➤ *An Internet-connected smart mattress cover*

Luna has created an internet-connected mattress cover that automatically sets the bed's temperature, tracks the quality of your rest, and can even kick your coffee machine into action when you wake up.

➤ *3D-printed, virtual reality food*

Project Nourished aims to accomplish a "gastronomical virtual reality experience," or simulating fine dining without the calories or other health-related issues. The project confidently urges you to "eat anything you want without regret."

Green Tea

The first (and only) item Alibaba delivered via drone

TWEET

@kcpanetta :

Hanging out at @students2scienc

0

Number of drones allowed at the 2015 Super bowl

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The next big thing in data centers

400 VDC data centers are the future.

By Brian Davie, Director of Global Sales & Marketing, Anderson Power Products

Data centers powered by 400 VDC distribution have been a topic of discussion and debate for many years. Much of the support comes from industry studies. In 2007, one of the earliest studies of 400 VDC distribution was presented at the International Telecommunications Energy Conference and concluded that DC power distribution can achieve efficiency gains of 7 percent versus AC distribution.

In 2010, Intel coauthored a case study of a 5.5 MW data center with EYP Mission Critical Facilities. This study concluded that energy savings of approximately 7 to 8 percent could be achieved over high-efficiency, best-practice 208 to 480 VAC with a 15 percent electrical facility capital cost savings, 33 percent space savings, and 200 percent reliability improvement.

The implementation challenges

As important as these papers were to the birth of 400 VDC power in the data center, implementation would require the development of many new products. One product that was a major roadblock to the 400 DVC deployment was a connector for connecting DC server power supplies to a DC power distribution strip. Traditional IEC320 AC power connectors cannot survive the breaking of a 400 VDC arc nor do they protect the user from the DC electric arc.

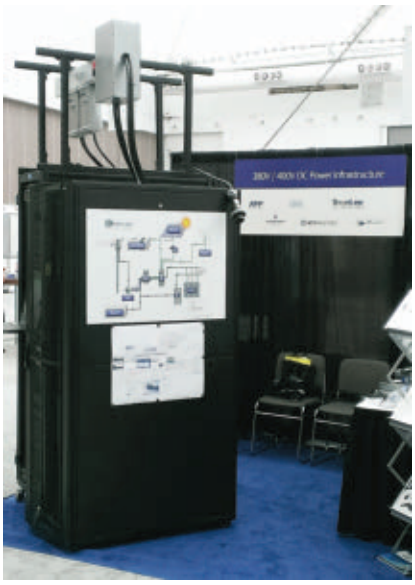
In the last few years, some companies have focused on products that greatly minimizes the DC arc so that arc breaking is possible for hundreds of cycles, while the deep, overlapping housings protect the user from any exposure to the electric arc. The products are designed to offer connectors that are touch-safe when mated or unmated and include an integral safety latch for further user safety.

In June 2013, Hewlett Packard released off the shelf 400 VDC power supplies for their Proliant family of servers. 400 VDC IT equipment is now available from a growing number of IT manufacturers, including Cisco Systems, HP, IBM, Juniper Systems, NEC, and SGI.

The new standards

The growing interest in potential benefits of 400 VDC data centers and the new availability of appropriate power products has led to new DC electrical standards. The European Telecommunications Standards Institute (ETSI) has developed standard EN 300 132-3-1, which describes the characteristics of a DC bus between 260 and 400 V, and EN 301 605, which describes the earthing and bonding of 400 VDC data and telecom (ICT) equipment. Additional standards have been published by the Emerge Alliance, the International Telecommunication Union (ITU-T), and the International Electrotechnical Commission (IEC).

At the 2014 Inletec symposium, a group of companies cooperated to demonstrate a complete 400 VDC power distribution scheme for data centers. The functional, plug-and-play system included 400 VDC power distribution products provided by Anderson Power Products, Emerson Network Power, Universal Electric Corporation, and Vicor Corporation as well as 400 VDC IT equipment provided by Intel Corporation, IBM, and Juniper Networks. The 400 VDC demonstration also featured a live data feed of power consumption and power efficiency measurements at a NTT Facilities 400 VDC data center thousands of miles away in Japan.



A 400 VDC demo at INTELEC 2014. (Image: Anderson Power Products)

Embracing the data center

Many 400 VDC data center demonstrations operating around the world and the first steps towards full commercialization of 400 VDC data centers have begun.

One of the first commercial scale 400 VDC data centers was implemented by Green CH in 2012. Green's Zurich West facility, which employs HP HVDC servers, is the largest implementation of DC in a data center to date.

ABB installed one megawatt of 400 VDC power distribution for 1,100 m^2 of the planned 3,300 m^2 Zurich-West data center. Performance tests have shown

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Saf-D-Grid® Connector Models" (Credit: APP)

that the Green 400 VDC power distribution system is 10 percent more efficient than comparable AC technology. In addition, the initial investment costs for the system were 15 percent lower than the comparable AC power distribution system in the same facility expansion.

Another 400 VDC data center is being built by Steel Orca in Princeton, NJ. The Steel Orca density-optimized data center is focused on web services, hosting, mainstream computing, and high-performance computing. To distribute power, the 300,000 sq-ft collocation facility, utilizes a 380 VDC distribution bus architecture design to an EMerge Alliance Standard.

EMerge Alliance members worked together and with IT industries leaders to create the 380 VDC solution now at Steel ORCA. DC powered HP ProLiant SL2500 Scalable servers are deployed in multi-node, high efficiency 4U chassis. The DC power system in Steel Orca's Digital Burst Environment provides a scalable and incrementally deployable power infrastructure of the highest system resiliency and reliability that saves the owner and tenants up to 50 percent of their initial capital investments.

The future is bright

In seven short years, the 400 VDC data center has grown from theory to reality. The basic building blocks like IT equipment, power systems, and distribution components are now commercially available and being used to build out full scale data centers that are more reliable, have lower cost of capital, and are less expensive to operate. With IT and power distribution industry leaders paving the way, there can be little doubt that the 400 VDC data center is here to stay. ECN

Electric vehicles make the connection

Making power connectors using precision cold forming

By Mark Jennings, Engineering Director of Dawson Shanahan

Sales of electric vehicles (EVs) are booming, with UK registrations in 2014 up to nearly 1.3 million, an increase of 10 percent from last year, according to the Society of Motor Manufacturers and Traders (SMMT).

Not to mention, Nissan sold its 100,000th LEAF, making it the best-selling EV in history.

The number of pure models in SMMT's registration database is now into double figures, and their introduction has completely changed the face of the lowest CO^2-emitting models. Because pure electric vehicles have zero tailpipe emissions, the top spot is shared between 11 all-electric vehicles, and these models continue to expand in numbers, meaning that no non-electric vehicle has any hope of ever re-entering the top ten.

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Agilent's Electronic Measurement Group is now **Keysight Technologies**.

Setting a challenge

Electric transport offers increased sustainability, but also creates engineering challenges. Each advance in a single stage of the power transmission chain requires others to match it. The best existing lithium-ion battery, which uses metal oxides in the positive electrode, provides around 100 miles of service, for example. This is not viable for widespread take-up. Then there are charging stations to consider. As plug-in electric vehicle ownership expands, so does the need for charging stations with fast-charging capabilities. On-street facilities provided by electric utility companies, mobile charging stations provide a range of special connectors to accommodate many different vehicles.

Richard Martin, editorial director for clean technology marketing and consultant firm Navigant Research, says, "Fast charging, however and whenever it gets built, is going to be key for the development of a mainstream market for plug-in electric vehicles."

Enhancements to even the smallest components will establish the electric car as a serious player. The pressure to improve sustainability, coupled with the potential rewards of making a breakthrough in EV technology, raises the odds that these engineering solutions will be found.

Optimizing powertrain efficiency will increase mileage and reduce energy consumption, while maintaining performance levels. EV motors run at a very high speed, in order to increase efficiency and power density. This means that components, such as bearings, must be engineered to minimize friction while operating for much longer periods. To this end, bearings have been designed with features, such as optimized internal geometry, making them very robust and energy efficient at sustained high speed. Innovations like this can boost electric vehicle mileage, and improve the robustness of the powertrain's key components.

Similarly, recent advances in power connector technology are enabling designers to boost power conversion from motors and powertrains. Power connectors are used, for example, in EV for charging units, and in the motors used to drive each wheel. Manufacturers are striving to improve the efficiency of power connectors to minimize power losses while reducing weight and cost. One option is to engineer connectors using precision cold forming, which enhances part quality and significantly cuts metal waste.

Cold precision

Precision cold forming can be used to make

engineered parts with up to 80 percent less scrap than traditional machining processes. The technique offers manufacturers a way to enhance component quality while reducing costs, through a combination of faster lead times, better surface finish, and improved mechanical characteristics.

Precision cold forming is carried out at ambient temperatures, and is much faster than many competing techniques. Components can quickly be made to order, which cuts lead times and removes the need to store high volumes of spare parts onsite. Cold forming makes superior quality products by plasticizing metals along — rather than across — their grain boundaries to produce parts with low stress deformation and high levels of mechanical integrity.

Furthermore, precision cold forming offers high levels of definition, even on parts with complex contours. Dimensional tolerances are typically within five microns, with the added benefit of extremely fine surface finishes. In many cases, no extra machining or polishing is required.

At the same time, parts undergo work-hardening during cold forming, which further improves their machinability and durability. Work hardening reforms the structure of the metal to prevent further dislocations, creating a stronger component. Because this strength increase is comparable to that of heat treatment, it can be more cost effective to cold work a weaker, less costly metal than it is to hot work a more expensive one – especially when a precision finish is required. ECN

Harnessing the Tides

Bringing tidal power to the forefront of the energy world.

By Kasey Panetta, Editor

Solar and wind often dominate the alternative energy conversation, but a rarely discussed, though increasingly popular, third option exists in gathering energy from the tides.

Among its many attributes, tidal power or marine and hydrokinetic power (MKP) is cyclical, which means that twice a day, this option will produce a predictable and consistent amount of energy. Just how much energy can tidal power offer? A lot. In fact, the U.S. Department of Energy (DOE) estimates up to 1,400 TWh of potential tidal energy per year.

Tidal power vs solar and wind

It's well-documented that solar and wind can provide a cleaner alternative to traditional energy sources, but both are dependent on unpredictable weather conditions. Locations for solar plants and wind farms are selected carefully in order to optimize energy collection, but it's not a foolproof system. Additionally, the randomness of the energy collection means a suitable storage system is essential. Solar and wind are able to collect large amounts of energy under specific conditions, but with limited storage options, they require backup systems.

How it works

Researchers have designed a few different types of tidal power generation methods including tidal stream, barrages, and lagoon, but they all work on the same general principle of gathering energy via hydrokinetic energy conversion through turbines and generators. For example, tidal stream power works by taking advantage of the tidal streams created by the flow of the tides. This works in essentially the same way as any wind turbine on land, but the tides cause the underwater turbine to rotate — quite slowly due to the high density of water — which drives the generators and creates electricity. The turbines are generally 180 to 240 feet below the surface of the water, which lowers the risk of having them damaged by waves or boats, but also allows them to take advantage of the best sources of tidal streams.

The devices currently available on the market convert hydrokinetic energy into electricity generating AC power in amounts anywhere from 200 Kw to 2 MW with the more advanced turbines averaging between 1.5 and 2 MW, says Mark Baker, sales manager in renewables focusing on global marine renewables and UK solar project opportunities for General Electric. This electricity is then exported to the grid via variable speed drive converter technology. For reference, current wind turbine technology can offer up to 8 MW output per turbine.

The history of the tide

People have been using water as a means of power for centuries. In fact, hydropower currently provides about seven percent of the U.S.'s electricity, according to the DOE.

As for using tidal energy, evidence of "tide mills" dates back to the Middle ages with the earliest known tide mill cropping up in London during Roman times on the — now subterranean — River Fleet. Given its availability, harnessing water — or in the case of tidal stations, harnessing the moon and tides — has long been sought after as a solution to a lack of energy options.

Even the modern idea of tidal energy isn't all that modern. The La Rance Tidal power plant in France was built between 1960 and 1966. This plant has 24 turbines and a peak rating of 240 MW. The La Rance is a barrage-style power plant, which means the water is captured by a dam as the tide flows in and released as it flows out. The turbines capture energy as tide ebbs and flows. Until recently, it was the largest tidal power plant, but was dethroned in 2011 by the Sihwa Lake Tidal power plant in South Korea, which has an output capacity of 254 MW. The other three largest plants include: Swansea Bay Tidal Lagoon with a maximum output of 240 MW (currently awaiting final planning consent); May Gen Tidal Energy project in Scotland with a maximum output of 86 MW, and the Annapolis Roral generating station in the Bay of Fundi with 20 MW.

The challenges

Tidal power generation can solve some of the problems presented by solar and wind, but it also faces similar challenges, including location, price, and maintenance.

Unfortunately, tidal power plants can be expensive to install — the Swansea Bay Tidal Lagoon is a $1.5 billion investment — and the underwater location can make operations and maintenance an issue. This has caused a lot of companies and governments to shy away from investing in the required infrastructure.

Planning requires a consorium of investors and a solid supply chain. Then developers and consortiums must carefully select their locations to ensure it offers high tidal race flow rates or significant tidal head differentials, like the ones found in lagoons, says Baker.

Aside from needing very specific locations, the systems can be quite expensive to build, install, and maintain. Though the price of the devices varies depending on the size and design, prices can climb up to an astronomical $30 million for a pre-commercial test device.

One of the biggest challenges with tidal stream turbines is maintenance and trouble-free operations. Given that the devices are located underwater, a big advantage regarding the aesthetics of the region, upkeep can be complicated and expensive.

While some devices still depend on support vessels, which can have a price tag of up to $150,000 per day, others can be towed to shore for a cheaper support option, according to Baker. Smaller support vessels, specifically for the deployment and maintenance retrieval of tidal stream devices, are being designed with dynamic positioning systems, which helps lower costs.

The solution to maintenance problems is designing systems that are built to last in a very harsh environment. The longer devices can go without requiring service and maintenance — excluding unexpected breakdowns — the cheaper they are to operate. For example, Tidal Lagoon power stations are designed for more than 100 years of operations and tidal stream generation devices have to be designed with the capability of operating for five years without maintenance, says Baker. The turbines, made of composite material similar to those used in the aircraft industry, must be anti-corrosive and high-quality to withstand harsh marine environments.

Unfortunately, current installation and maintenance costs are still too high, prohibitively so in some cases, which means any new projects require a lot of col-

laboration between governments, corporations, and locals.

The environmental effect

The environmental effects of solar and wind plants have been well-documented. For example, birds struggle to see the wind turbines and solar panels can magnify the sun's rays in a way that can be detrimental to local animals.

Tidal power plants have a few different concerns, including the fact that the turbines can slow the rate of the tides they're designed to capture. Even a slight change could be detrimental to local sea and plant life. In particular danger are migratory routes and breeding/nursery grounds for certain types of fish, as well as, mudflats and salt-marshes, which serve as habitats for birds, according to a study conducted by researchers at the Proudman Oceanographic Laboratory and the University of Liverpool based on a study of the Irish Sea. Additionally, the turbines may offer the same issues as their on-land counterparts, creating a hazard that animals can run into.

The devices could also cause modifications to the tidal and residual flows, and more alarmingly, a reduced flow could result in a buildup of contaminants and chemicals.

Because each location for this type of power plant must be carefully selected for the right tides, each area comes with a unique ecosystem and the impact on this area must be carefully considered. The environmental effect of underwater turbines are still being studied by the DOE, but projects in the UK and Europe have proceeded with careful considertion as to how they will affect the local fish and wildlife.

Future tidal power solutions

The future of tidal power solutions is a little murky. Regulations still need to be established and the process of planning a plant is complicated and time-consuming. All plans require effective consortiums, the right investors, and an open dialougue with local environmentalists and citizens.

Though these systems reduce the amount of CO2 in the air and have the potential to provide clean energy, it is a major undertaking the harness the power of the tides. ECN

A second life for **ammeter shunt resisters**

Finding renewed demand in renewable energy applications.

By Phil Ebbert, VP of Engineering, Riedon Inc.

The growth in energy supply from renewable sources like solar, wind, and wave (tidal power), is prompting an increased demand for more accurate high-current measurement solutions to ensure the warranted performance of the various elements of a distributed power system. A return to the principles of traditional ammeters that employ shunt resistors for high-current handling appears to be the answer.

The nature of the renewable power

While some forms of renewable energy, such as hydroelectricity have been around for many years, it is the more recent development of solar and wind generation that have been the focus of attention for governments around the globe as they seek to deliver on their green energy policies.

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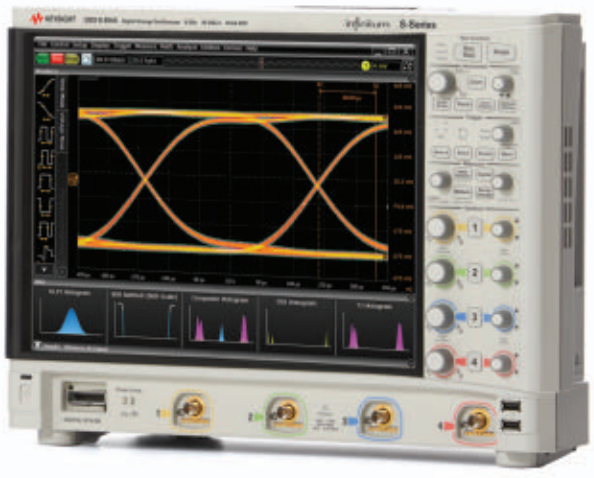

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Unlike established coal, gas, and nuclear generating plant, which use turbines to directly generate AC power that can be fed into the grid via substation transformers, the nature of solar and wind power either generates DC power or involves some conversion to and from DC. Solar power from photovoltaic panels is inherently DC generation and needs some form of inverter device to convert it to AC for connection to the grid. Many wind turbines, especially those deployed in generating electricity for domestic, agricultural, and industrial premises, also generate DC.

Even the larger wind turbines found on commercial wind farms, using generators that produce AC, can't necessarily be directly connected to the grid. This is because the voltage needs to be compatible, and so does the frequency, which is determined by the rotational speed of the turbine that in turn is dependent on wind speed. Gearboxes have been used to increase the rotational speed to overcome this problem, but they are heavy and expensive. The trend is towards direct-drive generators even though this requires AC outputs to first be converted to DC and then back to AC via an inverter that ensures the correct frequency and voltage for the grid.

Consequently, the DC nature of renewable sources, particularly in distributed systems, demands the means to measure DC as well as AC power. Unfortunately, this rules out current transformers, which are extensively used for AC power measurement and also provide the benefit of galvanic isolation from the circuit being measured. Instruments based on Hall-effect current transducers can measure DC as well as AC, and provide galvanic isolation, but don't typically provide the required measurement accuracy down to 0.1 percent or less. This is where ammeters using precision shunt resistors come into play, even if they require a separate means of isolation.

Ammeter shunts basics

Ammeter shunt resistors enable higher currents to be measured than are possible with a normal ammeter because they shunt the majority of the current around the meter. The principle involves the insertion of a very low resistance in series with the load, resulting in a small voltage drop across this shunt resistor, which can then be measured with a suitable voltmeter. This allows the current reading to be determined by the simple application of Ohm's Law so that the meter's scale can be directly calibrated in Amps.

Shunt resistors are designed to work with voltmeters to provide a full-scale deflection at the shunt's maximum rated current, usually with standardized voltage drops of 50, 75, or 100 mV. This means that a shunt designed for 100 A operation and a 100 mV drop will have a resistance of just 1 mΩ, with even lower values for higher currents and lower voltage drops. To achieve the necessary accuracy, the resistance need to be precisely defined, and potential measurement errors need to be eliminated. This is why a four-terminal construction is the norm for high-current shunt resistors, separating the load-current connections from the measurement terminals.

Temperature is a key factor in determining the performance of

shunt-based ammeter systems that aim to achieve 0.5, 0.25, and even 0.1 percent accuracy. Resistance elements made from Manganin alloy combine precision with a very low temperature coefficient of resistance (TCR) allowing operation over a typical temperature range from -40ºC to +60ºC.

Despite their low resistance, because shunt resistors carry the full load current the resulting power dissipation can be significant. A suitable construction is required to aid heat dissipation (by conduction and convection) and, for continuous operation current, the device may require derating to comply with IEEE standards for DC instrument shunts.

Selecting a shunt resistor

A number of important considerations come into play when selecting an off-the-shelf shunt or specifying a custom-designed one for a shunt-based resistance measuring system. It is essential that resistance is constant with the variations in temperature experienced in the system. Designs usually aim to ensure that the maximum temperature of the resistance element is 80˚C, with a normal operating range of 40˚C to 60˚C. Temperatures above 80˚C will cause the resistance of the element to drift, with a resulting loss of current-measuring accuracy. The temperature of the element must not exceed 140˚C, as this will cause an annealing process, which results in a permanent change in its resistance. The positioning and orientation of shunts must ensure these conditions are met. For example, resistance elements should always be mounted vertically, to ensure the maximum free air convection.

If the current being measured is at a high voltage, this voltage will be present in the connecting leads and the reading instrument. When possible, the shunt should be located in the grounded leg. This is essential in systems operating at 750 V and above.

Usually, shunts are selected or designed to operate at a maximum continuous current of 2/3 rated current. However, a system for measuring intermittent or surge currents can tolerate a higher current without exceeding the above temperature constraints, so the duty cycle of the shunt will be very important factor in the selection process. Taken in combination with the ambient temperature in which the shunt will be operating and the maximum temperature to be tolerated to determine cooling techniques.

Finally, depending on the precision and repeatability needed in the application, ammeter shunt resistors may need to be traceable to standards and require an annual schedule of recalibration and recertification. ECN

DISTRIBUTION

A special section

Mil/Aero cable assembly challenges require out-of-the-box options

A fresh approach to cable assembly and wire harness demands keeps military and aerospace manufacturers on budget and on time.

Steve Jones, Vice President, BTC Electronic Components

As avionics and military vehicle control systems become increasingly complex, many mil/aero manufacturers and customers have faced the challenge of having to create increasingly sophisticated cable assemblies, wiring harnesses, and test cables to satisfy the specific interconnect and testing needs of various aircraft, military vehicles, and ground-based control systems. In many cases, these cable assemblies involve hundreds of feet of wiring, dozens of different styles and types of connectors from multiple manufacturers, and the use of specialized tooling and equipment. In addition, the finished cables must be tested to ensure compliance with all current specifications and standards. Consequently, overcoming these design challenges costs manufacturers time, money, and productivity, as it requires additional production steps and materials, as well as the reallocation of a portion of the available labor force.

The current manufacturing environment has become increasingly geared toward automated processes and mass production with lean inventory. As such, the typical military/aerospace systems manufacturer is not set up for the efficient, economical production of low volume, high complexity, and labor-intensive cable assemblies that require multiple connector types, as these assemblies typically equate to higher procurement, inventory, and production costs. Consequently, when manufacturers must produce complex cable assemblies in-house, it is often at the expense of delivery schedules and inefficiencies to the manufacturer's core business.

Fortunately, a proven alternative to sourcing and producing such complex cable assemblies in-house can be an experienced connector distributor with specialized manufacturing skills, dedicated production space, access to extensive qualified parts inventories from a wide range of vendors, and testing and quality assurance facilities can serve as a strategic partner to such manufacturers. This delivers a wide range of value-added services — including virtually any level of cable assemblies, wire harnesses, and test cables — that also typically provide significant savings with regard to cost and delivery times.

The rise of the connector distributor as a source for complex mil/aero cable assemblies and test cables is a natural evolution for those distributors who have chosen to specialize in sourcing MIL-spec connectors, as it builds upon the value-added services they already provide, such as attaching cabling to individual connectors, assembling kits of related connectors and accessories, and final testing and quality assurance services. Plus, their ready access to extensive inventories of qualified connectors from multiple manufacturers dramatically shortens the lead times for delivery of the finished assemblies.

By selecting a distributor to provide completed cable assemblies, mil/aero manufacturers are able to order a single part number and receive a tested, packaged cable assembly that is ready for use, saving significant inventory and procurement costs.

For example, a specialized mil/aero connector distri-

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View from the Top

Steve Newland, Senior Vice President of Americas Sales and Global Sales Operations

MOUSER ELECTRONICS

Q. What is your primary focus when serving the design engineer?

At every level, Mouser puts the needs of our customers first. We specialize in answering the component needs of the design engineer and buyer by providing them with the newest semiconductors and electronic products from more than 500 manufacturers. Mouser is the industry NPI leader. We make it a priority to stock and distribute the newest products to give our customers a speed-to-market advantage.

Having the newest, most advanced technologies to develop prototypes avoids costly redesigns, manufacturing delays or even the termination of a project. It also leads to a design edge in delivering more product features, capabilities and longer lifecycles. That's why we work in close partnership with all our manufacturer partners to provide the fastest, easiest access to the industry's newest technologies.

Q. What value-added services do you provide beyond component supply?

To us it's not really an "added" service. Every customer gets full and complete service every time. Our goal is to provide excellent customer service along with technical support for buyers and engineers worldwide.

In addition to being the new product leader, we provide our customers with the latest life cycle status on components. By clearly identifying Obsolete and Not Recommended for New Design (NRND) components, Mouser helps its customers select the right product for their designs. This benefits buyers and also allows engineers to design with the latest components and avoid costly rebuilds. Engineers also can buy in the quantity needed. At Mouser we have no minimum order quantity.

We have several services and tools online that help customers through their buying process. Our advanced BOM tool allows customers to upload their bill of materials and receive real time pricing and delivery. Our Project Manager, Cart/Project Share make it simple for engineers and buyers to save projects and share instantly.

One major new resource to further help our customers is MultiSIM BLUE, introduced last year in partnership with National Instruments. Available via free download at Mouser.com, MultiSIM BLUE is a circuit design tool that enables engineers to design and simulate printed board circuits, using Mouser's distributed components, including the newest in analog and mixed signal ICs, passive components, discrete semiconductors, power management ICs, connectors and electromechanical components. The tool is fully integrated with BOM and cart purchasing capabilities.

Q. What can you offer customers to protect them from counterfeit and other marginal components?

At Mouser we take great pride in providing our customers with the newest, genuine authorized parts. We are an authorized distributor for every component stocked from more than 500 manufacturers. All of our components are obtained directly from the original manufacturer or through authorized channels.

Mouser is an AS9100C certified distributor, earning the industry's top standard for quality and control, providing design engineers and buyers the assurance that their orders are traceable and genuine. As an ECIA (Electronic Components Industry Association) and CEDA (China Electronics Distributor Alliance) authorized distributor, we are also a contributing member of the SAE G-19 Counterfeit Electronic Parts Committee that works to set standards for our industry.

Q. How do you help your customers meet their time-to-market demands?

At Mouser we really do believe in the adage that "time is money." We stock the widest selection of products and all are ready to ship that same day. At our state-of-the-art warehouse, many orders are processed within minutes of receiving them. We provide same-day shipping on most orders with delivery in one to three days.

For convenience, we offer easy online ordering and product documentation on the web, plus we have 20 Customer Support Centers worldwide, staffed with local representatives. For customers who prefer to call, we offer personal technical and sales support in local time zones, local language and local currency. This localized approach is a key part of our Best-in-Class service model for our customers.

Q. How do you help engineers in how they research a product/technology?

Online, Mouser has several places that engineers can quickly go and research new products and applications & technologies – www.mouser.com/new or www.mouser.com/applications. The Mouser Newest Products site provides detailed, technical information that can be viewed by category, manufacturer or by week.

We provide access to the latest essential technical data and industry applications through our Application and Technologies sites. These easy-to-navigate sites are an essential resource for reference designs to give engineers a quick start on their latest project. Product data sheets, application design notes, white papers, and other solution-based content are all designed to give our customers a technological edge.

Finally, engineers can take part in our exciting new Empowering Innovation Together program with celebrity engineer Grant Imahara of Mythbusters fame. There are video spotlights, design challenges and many more ways for engineers to engage and share design ideas with Grant and one another. It's just one of the many ways we are serving our customers.

For more information, visit www.mouser.com

Steve Newland is Senior Vice President of Americas Sales and Global Sales Operations at Mouser Electronics, Inc. He has over 27 years of experience in manufacturing and distribution, and is currently responsible for leading Mouser's customer support teams including: customer service, training, technical support, quotations, service quality, and sales operations. Newland holds degrees in Industrial Distribution from Texas A&M University and an MBA in Business Management from The University of Dallas.

DISTRIBUTION

A special section

bution company was recently approached by an engineer from a large aerospace systems manufacturer that needed to source connectors and accessories to quickly manufacture test cable harnesses for their customer. For a number of reasons, their design and approval process had changed from the original plan and was threatening to delay their delivery schedule.

The customer had specified the overall test cable harness details, including the connector types, plating finish, overall cabling dimensions, and the requirement to provide EMI protection on the cable assemblies using shielded heat shrink. Since the customer required an accelerated timeframe for delivery, it became apparent to the manufacturer that it was more efficient to take advantage of the distributor's on-site stock and specialized capabilities and allow them to procure the connectors and other components, assemble them in their 24-hour assembly area, select suitable backshells and adapters, and assemble and deliver the test harnesses for the customer to complete the order.

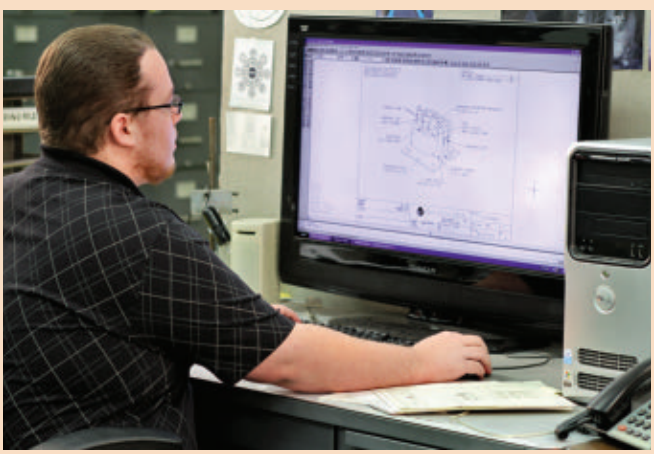
This partnership created an ideal situation for the end customer, who received their completed-to-specification order on time, and for the engineers and procurement staff at the aerospace systems manufacturer, who were able to focus on the project at hand rather than on specifying part numbers, searching for suppliers and identifying alternate components. Leveraging the connector distributor's specialized resources and capabilities allowed the OEM to deliver a completed cable assembly to their customer on time, at a significantly reduced cost, and with a shorter production time.

As illustrated, the most effective solution to the challenging requirements of supplying complex cable assemblies for increasingly intricate avionics and military vehicle control systems is a specialized connector distributor with a wide range of MIL-spec interconnect products and the capability to rapidly respond to orders using in-stock inventory and a specialized workforce of connector experts. ■

5 mistakes to avoid in power electronics design

Design Engineering, Project Management team, Electrocube, Inc.

Experience is key in the world of design, and with more than 50 years of experience in the electronics industry, we've seen all sorts of mistakes. This information comes from our observations and some of our own experiences, to assist you in better meeting your customers' expectations and design project requirements.



1. Verify assumptions.

In order for any design to get underway, assumptions must be made. Often, these assumptions are based upon accepted common knowledge or specific expertise and usually prove out to be correct. However, relying on assumptions made on partial knowledge or information is a common error.

Early in a project, the task of verifying the validity of the assumptions with specialists in that specific area of design must occur. As a group, engineers often think that others expect them to know it all and even pride themselves on their vast technical knowledge. But to avoid a common trap, acknowledge when a little assistance is needed to validate assumptions. Otherwise you may end up saying what other engineers want to hear, instead of discussing potential problems and needs.

2. Keep design options open

We all like to be creative, innovative, and recognized for our ideas. However, avoid getting so locked into a design that fulfillment of the original concept takes precedent over successfully meeting the customer requirements. If discoveries occur, be willing to change the design to adapt. Recognize the need for a change early and adapt quickly. The goal is

to produce the best product for the job and win the order – and more business. The key to fulfilling that goal is designing and creating the right product to meet the need.

3. Balance quality with lowest justifiable cost

Design engineers are under pressure to at least control, if not cut, costs. You need to strive for efficient and cost effective designs without giving in to temptation to cut beyond the point of good design practices.

Some of the great engineering disasters have occurred because of this mistake. It only takes one weak link in a design to cause a cascade system failure. The trick is to determine where costs can be cut without sacrificing the critical — plus safety margin — quality threshold. Careful examination and collaboration with available technical resources during the design, development, and testing phases will result in the most reliable product at the lowest justifiable cost. It is always more costly to rework or replace returned product than designing it right the first time.

4. Utilize consolidated project management

Today, design projects are fast-tracked, but that doesn't mean all project tasks are rushed. It means the same thoughtful, competent effort is applied to each task. However, multiple tasks take place simultaneously. The interdependence of tasks is rearranged and overlapped to shorten the project completion time. This requires proper fast-track project management and monitoring techniques. Under fast-track conditions, mistakes or errors, if not identified and corrected immediately, can spiral out of control in a matter of hours, jeopardizing the entire project. The usual protocol of reporting by exception during the next scheduled project meeting is often too little too late. Proper fast-track project management includes a system that mandates immediate and centralized reporting of all milestones reached and problems encountered. The window of opportunity to fix a problem before it creates other, more severe problems is very small. Only near instant awareness by the project manger can avoid disaster. This is the reason the project manager must have access to the current status of all tasks to keep all phases and aspects at a balanced rate.

5. Partner with suppliers

This is akin to verifying assumptions. Selecting a component, without consultation with the manufacturer's technical staff or moving foward with partial performance specifications just to discover a flaw, is an all-too- common mistake. A component's capability, size, temperature tolerance, and/or reliability may often be incomplete or overlooked. In addition, the component's assembly and operating conditions often changes more than originally assumed. If the component has no safety margin, it can fail. Working with the component suppliers early in the design process will assure awareness of the latest available specifications and technology, as well as the best component choice available for the application. The help is free. Why not use it early and often? ■

Do your capacitors have principles and performance?

By James C. Lewis, KEMET Corporation

Tantalum capacitors deliver important performance advantages, but ensuring a supply of ethically sound, high-purity tantalum demands coordinated commitment across continents.

Measuring tantalum purity

Tantalum capacitors are often the first choice for engineers where a high capacitance value is required within a small case size. The MnO2 type, with manganese dioxide cathode, can operate at temperatures up to 175°C or even 200°C and also benefit from good self healing properties and low leakage current. Tantalum capacitors with organic-polymer cathode deliver high volumetric efficiency with the advantages of low equivalent series resistance (ESR) and a benign failure mode.

High-purity tantalum powder holds the key to ensuring the best possible capacitor quality and reliability. Since 2012, however, capacitor manufacturers must go even further to provide the market with capacitors that are not only dependable but also uphold the best ethical standards.

In January 2012, the Dodd-Frank Wall Street Reform and Consumer Protection Act came into force. Section 1502 of the Act aims to help prevent conflict in parts of the world where precious natural resources — also called conflict minerals — are plundered by militias and sold to fund continued fighting, by requiring publicly listed companies to

View from the Top

Dan Stewart, Vice President of Marketing, Allied Electronics

Q. What is your primary focus when serving the design engineer?

Design engineers often work under tight deadlines and have to manage multiple projects at the same time. Our goal is to make their lives as easy as possible by stocking a wide range of products that we can get to the customer quickly, provide them with a broad set of tools to help them in the design process, and back that up with 47 local sales offices serving the US, Canada, and Mexico that can provide the support they need.

Q. What value-added services do you provide beyond component supply?

Allied has two great tools available free of charge to design engineers. The first is DesignSpark PCB, a downloadable software tool to help engineers design PCB boards. The second is DesignSpark Mechanical, a 3D direct modeling tool that can easily import and build 3D designs. Both of these programs are available free of charge to Allied customers to help ease the design process. For more information, and to download these exciting tools, please visit DesignSpark.com.

Q. What can you offer customers to protect them from counterfeit and other marginal components?

Allied just recently obtained one of the highest levels of certification to protect consumers from counterfeit parts. The AS9120A specification, geared specifically toward the defense and aviation markets, requires distributors to meet a stringent set of requirements to be able to trace the origin of the products they sell. Allied is fully committed to authorized distribution, and our customers can be confident knowing they are working with an authorized distributor when purchasing from Allied.

Q. How do you help your customers meet their time-to-market demands?

Allied is one of the largest in-stock distributors of electronics and automation products in the US. That means we can get products to our customers faster than most other distributors in the market. In addition to our large selection of in-stock products, Allied also has the latest order cut-off time in our industry. Customers can order as late as 10PM ET and still have their order ship that same day.

Q. Describe your company's e-procurement services.

Allied e-procurement services can support any major integration or 3rd party service. We've worked with many Fortune 500 companies to directly integrate with their supply chain solutions to reduce the overall cost of procurement. Some examples of our integrations include EDI, cXML, xCBL, OCI, and marketplaces such as Ariba, PerfectCommerce, SciQuest, and Hubwoo.

Q. How do you help customers keep procurement costs within budget and mitigate risks?

One of the biggest challenges in the procurement process is having to work with multiple suppliers to source products. Submitting requests for quotes and dealing with several suppliers to source the products can be time consuming and costly. Allied's broad range of products from over 300 authorized suppliers means that customers can use a single source for their project needs. In addition to our in-stock selection of products, Allied also partners closely with our manufacturers to provide an expanded portfolio of over 3,000,000 products that our customers can order online or through any of our 47 sales offices.

Q. How does your company deal with international component issues like conflict minerals?

Where possible, we provide the environmental designation for each product so that a customer can easily obtain such information via our website. The classification of products for this purpose represents a significant task, but doing so provides for the most efficient and effective experience for our customers. Additionally, we provide links on our website which enable our customers to request information related to the conflict material, REACH, or RoHS status of a product or group of products.

Dan began his career at Allied in 2004 as a member of the eCommerce team. In 2007, he was promoted to director of eCommerce. Under his leadership, the company's online business has grown from $12 million to more than $150 million. Dan was promoted to vice president of marketing and the Allied executive management team in April 2013. In his new role, he is responsible for both the eCommerce and Marketing teams.

In 1998, Dan earned his Bachelor's degree from Colorado State University in Psychology, and while at Allied, he earned his MBA from the University of Texas at Arlington in 2011. Dan has more than 15 years in marketing/eCommerce and more than 15 years in the distribution industry. He has served on ECIA committees and advisory groups for Google and Endeca. Definitely an innovator, Dan wrote his first computer program when he was just seven years old. He is married with two

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report on the sources of any tin, tantalum, tungsten, or gold contained in their products.

This, of course, has direct relevance to companies producing tantalum capacitors. A significant percentage of the world's tantalum ore is located in the Democratic Republic of Congo (DRC), which, sadly, has also been an epicenter of the conflict minerals trade.

Whereas some companies have sought to ensure compliance simply by refusing to buy any minerals from the DRC, others found this to be detrimental for the country's economy and people.

KEMET's initiative in the DRC is just the first stage of what has become the industry's only closed-pipe, vertically integrated tantalum supply chain. By bringing all activities under control, from the mine through production of high-quality powder, to final assembly and screening of tantalum capacitors, this approach provides the highest possible assurances of ethical sourcing and product quality.

Positively conflict free

Rather than taking a negative approach by withdrawing from the DRC, the company researched mining companies in the region to identify a suitable partner. The organization that was selected, Mining Mineral Resources (MMR), has a successful history of working in the DRC, and has received concessions from the country's government to mine tantalum in the conflict-free Katanga Province. It was decided that developing the mine with MMR would not only ensure a secure source of conflict-free tantalum, but could positively impact the lives of the people of the village of Kisengo for the longer term.

The Kisengo facilities have been audited and are compliant with the Electronic Industry Citizenship Coalition (EICC)/Global e-Sustainability Initiative (GeSI) Conflict-Free Smelter Program (CFSP). The Kisengo mine is managed locally by the Coopérative des Artisanaux Miniers du Congo (CDMC), and all miners share in the proceeds on a daily basis. The involvement of the CDMC enables lean practices to maximise output while ensuring fairness for all workers.

Traveling the closed pipe

The tantalum ore mined at Kisengo is washed, weighed, and logged, and subsequently exported to a facility in Matamoros, Mexico dedicated to processing the ore into K-Salt, which is a necessary intermediate product for producing tantalum capacitors. From Matamoros, the K-Salt is shipped to the Carson City, Nevada, where it is converted to tantalum capacitor powder. This tantalum powder is then ready to be used by component manufacturing sites located worldwide, to produce tantalum capacitors.

This network represents a closed-pipe, vertically integrated supply chain capable of guaranteeing the supply of conflict-free tantalum for use in capacitors. The closed-pipe aspect to this supply chain is critical, preventing tantalum ore or processed products from unknown and possibly non-conflict-free sources from entering the supply chain undetected.

Ensuring chemical purity

The capacitor-grade tantalum powder is chemically pure, with concentrations of metallic and non-metallic impurities down to very low levels in the ppm range. However, impurities can be introduced during capacitor manufacturing, which can create imperfections in the dielectric that may cause the capacitor to fail.

The tantalum manufacturing capability features techniques for optimizing chemical purity to eliminate hidden dielectric defects that could continue to grow in the field, leading to capacitor failure.

Any defects present in the dielectric can introduce weaknesses in the capacitor, which may be manifested as a lower than usual breakdown voltage. Unfortunately, conventional end-of-line breakdown tests performed under accelerated conditions can induce stress-related faults in good capacitors. As an alternative, DC-keakage (DCL) testing can safely identify weak capacitors but often is unable to detect devices that have only small defects in the dielectric. The F-Tech process and SBDS can be applied together or individually, thereby giving customers the flexibility to select either as an option or to specify both for ultimate peace of mind.

Summary

By bringing control of all production processes, from mining the tantalum ore to producing high-quality tantalum powder and capacitor parts, and non-destructively screening devices at the end of line, this unique closed-pipe supply delivers perfect tantalum capacitors that can be trusted at every level from ethics to in-system performance. ■

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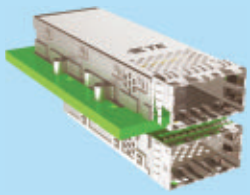

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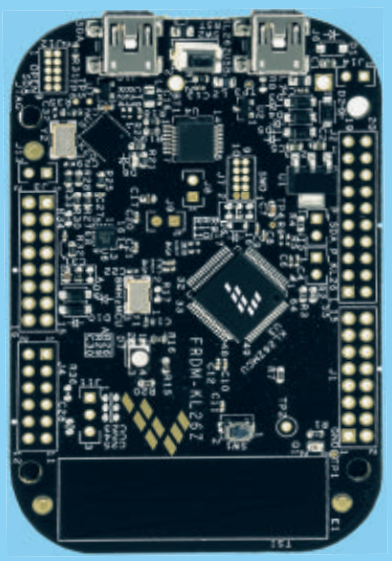

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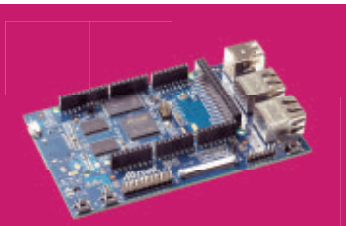

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Sensors and the IoT

On its current trajectory, global IP traffic is projected to grow at a CAGR of 21 percent from 107 to 247 exabytes per month between 2013 and 2018, according to the latest Cisco Visual Networking Index report. Consumer traffic dominates the trend, accounting for about 80 percent of the total. The largest segment of consumer traffic is video, set to cross the 50 percent mark for all consumer IP activity next year. Continued growth of connected video-capable devices, the ongoing shift from SD to HD content, and the adoption of 4k video virtually ensure these trends will continue past Cisco's five-year reporting interval.

Buried deep within the traffic statistics are the flows that derive from the rising use of sensors, particularly in the growing IoT segment. Though their contribution to data loading is tiny, the current and potential effects of sensor-based systems on their users can be profound.

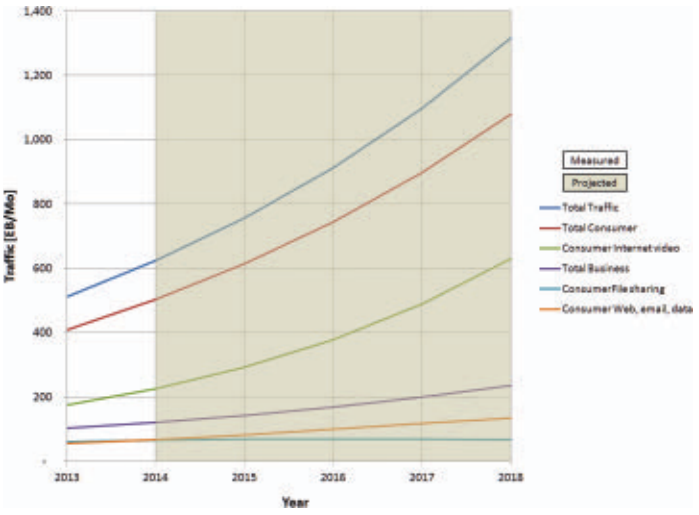
The power of the IoT is its ability to use miniature autonomous or semi-autonomous nodes to extract and deliver small amounts of data from which local or remote systems can glean actionable information. It may take gigabytes to convey the content (or lack thereof) that form a television program or feature film. However, it takes a miniscule fraction of that for sensor-based nodes to inform individuals or systems of environmental conditions, performance measures, or operating variances.

Sensor-based systems divide into two categories according to whether they detect or measure phenomena. Measurement systems typically require accuracy of their end-to-end transfer characteristics to at least the second order (offset [0^{th}], gain [1^{st}], and linearity [2^{nd}]), including the sensor, signal conditioner, and digitizer.

Detection systems, by contrast, assess a phenomenon's magnitude relative to a threshold. Detectors are comparatively insensitive to offset and gain drift terms when those errors are small compared to the signal amplitude, as they usually are. Most are unaffected by common sources and severities of nonlinearity. Because of this distinction, many consumer-grade applications focus on detectable phenomena.

For example, among the fastest growing segments for wearable sensor-based electronic devices is the fitness market. Wearable fitness monitors, exemplified by the now famous Fitbit product line, exploit micro accelerometers and altimeters to detect and count steps and stair climbs. Activity monitors can also track heartrates using detection rather than measurement methods. By contrast, medical applications must often measure heartbeat waveforms using high fidelity multi-channel signal processors — a far more complex and expensive approach, but one that produces more data than consumer-grade applications require.

Since the advent of low-power versions, inertial sensors have become increasingly popular in wearables. However, most implementations suffer a set of error terms that



Worldwide internet data traffic is dominated by consumer use, (Graphic courtesy JAS Technical Media. Data: Cisco).

are unique to these types of sensors: cross-axis sensitivity. Cross-axis errors in linear accelerometers cause a response to motion orthogonal to the primary axis, generating a non-zero output. Most gyroscope designs exhibit similar error terms through which linear acceleration produces a non-zero rotational signal. If sufficiently large, cross-axis sensitivity errors can adversely affect both inertial measurement and detection applications.

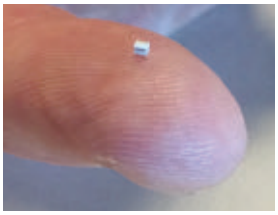
In particular, in-band mechanical vibration can develop sizable error signals relative to the inertial signals gyros produce. One class of gyroscope, based on bulk acoustic wave (BAW) technology, exhibits particularly low sensitivity to common shocks and vibration compared to other MEMS gyro designs.

Alas, it's not all joy in the land of sensors. Beyond the university laboratory, small companies pursue much of the advanced sensor development. In most cases, larger companies acquire those small sensor developers that succeed early in their technology's commercialization phase. Those that don't find market acceptance are never heard from again. A small number in a third category succeed commercially only to be overcome by market perturbations.

For example, Peratech Ltd had developed ultra-thin pressure-sensitive conductive polymers that successfully deployed on NASA missions. Peratech also created a quantum tunneling composite technology that could detect hazardous vapors. The company licensed its technologies worldwide, but when some licensees failed to renew, the company was unable continue operations and is now in liquidation.

Paratech's is a cautionary tale for system design engineers interested in exploiting new sensing technologies: Check who owns the technology you're considering. If it is the sensor manufacturer and they are a qualified vendor, then you're risk is limited to that of most any good supplied by that vendor. However, if the sensor maker is using licensed technology, you should learn what their contingency position is should the licensor fail or choose to sell the technology to a third party.

Magnetic reed sensor meets power constraints



Coto Technology Inc. has released the world's smallest MEMS-based magnetic reed sensor – now half the size of the original design, according to the company. Features include:

- Package measuring 1.11 mm^3.
- Suited to the demands of next generation medical, automotive, instrumentation, and industrial applications.
- The sensor offers directional magnetic sensitivity, ESD resistance, and a robust wafer level package and consumes zero power.
- The sensor meets the power constraints of battery-operating portable devices and electronics.

For more information, visit www.cotorelay.com.

Motor drive analyzers include high bandwidth

Teledyne LeCroy announces the MDA800 Series of motor drive analyzers that combine three-phase power analyzer static calculations, unique dynamic three-phase power and mechanical motor analysis capabilities, and high bandwidth (1 GHz) embedded control system debug in a single instrument.

- The components are based on the HDO8000 oscilloscope platform and are standard with 8 input channels with 12-bit resolution.
- The components are designed for motors, motor drives, variable frequency drives, variable speed drives, industrial automation, and motion control equipment manufacturers.

For more information, visit www.teledynelecroy.com.

MODERATED BY KASEY PANETTA
EDITOR

Q: What's the best defense against component counterfeiting?

Ed Smith, President, Avnet Electronics Marketing Americas

If we were to do a root cause analysis of the counterfeit component crisis in the electronics supply chain, I think we would find that while sourcing outside the authorized channel and the blatant disregard of criminals for intellectual property rights are significant, contributors to the problem, the root cause is actually part availability.

We know this from experience, and a recent ECN poll further supports this notion. Seventy percent of survey respondents cited some form of part availability issue as the reason for sourcing from unknown or unreliable parts brokers, from whom there is an extremely high probability of receiving counterfeit, remarked, or substandard parts.

Therefore, it stands to reason that the appropriate corrective action is to assure that your BOM is not compromised by part availability, which is easier said than done.

However, OEMs can significantly mitigate this risk through better/more proactive BOM management, particularly in the earliest phases of the design process. Time and again, we hear stories from purchasing and supply chain folks about the trials they face in trying to source hard-to-find components specified by engineers who considered only the part technology and not its lifecycle status, whether it is single-sourced, in high demand, or produced in a high-risk region.

It's time to break down the silos and actively engage supply chain/materials management professionals and/or your distribution partner in the new product development process in order to expand the product design criteria from basic form, fit, and function to include the plethora of supply chain considerations that can impact part availability.

This design for supply chain (DfSC) approach can not only mitigate counterfeit risk, but enable OEMs to reduce costs, increase revenue and achieve more consistent customer satisfaction.

Tom Grace, Brand Protection Manager, Eaton's Electrical Sector Americas

The best defense against component counterfeiting is to always buy authentic. Purchasing products directly from a manufacturer's authorized distributors and resellers ensures that the product being purchased is, in fact, genuine. A higher risk of counterfeits exists if you cannot trace the path of commerce to the original manufacturer.

As counterfeiters become more sophisticated, unsafe lookalike products are becoming more prevalent and harder to detect. To help electrical industry professionals detect counterfeit products, many manufacturers and certification organizations provide verification tools.

If a product is suspected to be counterfeit, it is vital to report it. By reporting a suspect product to the original manufacturer or brand owner, professionals can find out whether or not the product is authentic. If there is a discrepancy, this reporting process will help ensure the potentially dangerous device is removed from the marketplace.

In the event the original manufacturer's contact information is unavailable, professionals can always contact the IPR Center, which disseminates the information for appropriate response. Contact the IPR Center at IPRCenter@dhs.gov or 1-866-IPR-2060.

Programmable port controller allows 100 W power

Cypress Semiconductor Corp. announced a programmable USB Type-C port controller solution. The USB enables slim industrial designs, easy-to-use connectors and cables, the ability to transmit multiple protocols, and 100 W of power.

Features include:

- The Type-C standard's 2.4 mm connector plug is smaller than 4.5 mm USB Type-A standard connectors.
- It allows transport of USB signals and PCIe or DisplayPort signals on the same connector.
- Cypress's PSoC 4 architecture integrates a low-power ARM Cortex-M0 core with PSoC's unique programmable analog and digital peripherals.

For more information, visit www.cypress.com

ARM module includes free source code

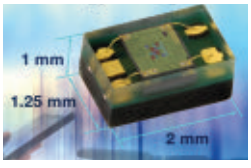
Data Translation announces an ARM-based vibration measurement module that provides an embedded solution for vibration applications using ARM and Linux. Features include:

- An accurate front-end design allows simultaneous measurement of four 24-bit IEPE sensor inputs at a sampling rate of 102.4 kS/s.
- The device is equipped to perform vibration tasks by including a 24-bit stimulus output, tachometer, general-purpose Digital I/O, external trigger functions, and counter/timers.

For more information, visit www.datatranslation.com.

RGBW sensor offers 16-bit resolution for each color channel

The Optoelectronics group of Vishay Intertechnology, Inc. introduced a digital RGBW sensor featuring Filtron technology for accurate RGBW spectral sensitivity while providing ambient light spectral sensitivity with responses close to that of the human eye. Features include:



- Senses red, green, blue, and white light, and it offers 16-bit resolution for each color channel.
- Designed for consumer devices, such as smartphones, digital cameras, and televisions.

For more information, visit www.vishay.com.

LEDs

Choosing the right Schottky diode for an LED backlight boost converter

By Steven Shackell, ON Semiconductor

LED backlight boost converters that are incorporated into modern wireless devices tend to consume large quantities of power. The Schottky diode selected is pivotal to ensure the boost converter's overall efficiency reaches its highest level. The resulting benefits are extremely desirable since wireless devices are becoming increasingly sophisticated, with a multitude of features and functionality now being designed in, and consumers are expecting longer battery lives.

Before any decision can be made on the Schottky diode, the boost converter's operation needs to be understood.

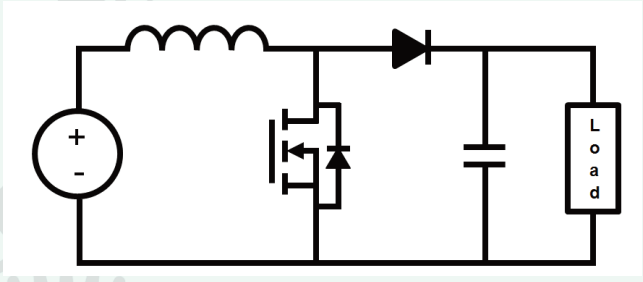


Figure 1. Schematic of boost converter (Credit: ON Semi)

Most wireless devices are powered by a single-cell Li-Ion battery with an operating range of 2.5 to 4.2 V. This battery voltage will be the input voltage of the boost converter. The output voltage is determined by the configuration of the LEDs and the forward voltage required to drive them. A common LED configuration for smartphones is one string of 10 LEDs. Other wireless devices may use two strings of six LEDs. The forward voltage of these LEDs is typically 3.3 V. This will result in an output voltage of 19.8 to 33 V.

The duty cycle of the boost converter will typically range from 80 to 90 percent. This means that the MOSFET will be switched on for 90 percent of the cycle so the inductor's magnetic field can be charged. While the MOSFET is on, the Schottky diode has the output voltage across its cathode to anode (reversed-biased). Once the MOSFET turns off, the built-up energy of the inductor is discharged through the Schottky diode and into the output capacitor and the LED string(s). The charge that the output capacitor receives is enough to supply a constant current to the LED load when the MOSFET turns back on for the next cycle. Additionally, a precision resistor is used with the LED string so that a very small voltage measurement can provide feedback to the controller.

It is critically important to be aware of the different currents in the boost converter when selecting the Schottky diode. Consider these three currents: average input

current, peak inductor current, and output current. The average input current is also the average current of the Schottky diode when it is forward-biased. The Schottky diode will experience peak inductor current when the MOSFET is switched off. This current will then linearly decay as the magnetic field of the inductor weakens until the MOSFET is switched back on at the next cycle.

The first parameter to consider when selecting a Schottky diode is the reverse voltage (VR). This is the maximum voltage that can be applied across the device from cathode to anode (reversed-biased). For boost converter applications, this voltage will be the output voltage of the converter. The controller of the boost converter should have integrated over-voltage protection (OVP) preventing the output voltage from exceeding a certain value. The VR of the Schottky diode should be as close to this value as possible. For example, if a boost driver has a maximum OVP of 39 V, then it is perfectly safe to choose a Schottky diode with a VR of 40 V. To obtain higher reverse voltages, a more resistive Epi-material must be used during the silicon wafer manufacturing.

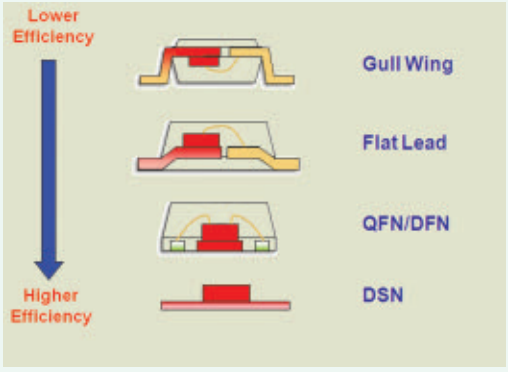


Figure 2. The evolution of discrete packaging technology (Credit: ON Semi)

The next parameter to consider is the Schottky diode's forward current rating (IF). This is the maximum DC current that the device is rated for. The two currents that will determine IF are the average input current and the peak inductor current. IF should be greater than the average input current of the boost converter. Schottky diodes will also commonly have a repetitive peak forward current (IFRM) and/or forward surge current (IFSM) rating. These define the maximum currents the device can withstand during surge or continuous pulses. The IFSM rating denotes the maximum current the Schottky diode can survive during a single pulse. The IFRM rating gives the maximum current it can survive over repetitive equivalent pulses, as seen in boost converters. These two ratings are often substituted for one another, but this is incorrect. The IFSM is a single pulse, so this current rating will be much larger than the IFRM rating, and the Schottky diode may not survive multiple pulses at the IFSM rating. Obviously, it is acceptable for the IFRM rating to be used in place of IFSM since it is a lower value and repetitive rather than a single pulse. Since the peak inductor current is repetitive in nature, IFRM is the correct rating to use, not the IFSM. The IFRM rating of the Schottky diode needs to be above the peak inductor current that occurs in the boost converter.

Now that the maximum ratings of the Schottky diode have been identified, the focus changes to the performance characteristics. The two major specifications are the forward voltage (VF) and reverse leakage current (IR). It is tempting to look at these specifications as individual parameters. However, this may lead to a Schottky diode being selected that consumes more power than one that was selected by looking at the parameters simultaneously. It is commonly believed that, in boost converters, the lower the VF, the better the Schottky diode performance. The industry is reaching a point in which lower VF devices are making large sacrifices in leakage currents. In applications where the output voltage to input voltage ratio is large, the Schottky diode is reversed-biased for the majority of the time. This means that the leakage current significantly contributes to the Schottky diode's power dissipation. It may also be tempting to compare both parameters, but how does one determine how much higher the IR can be for a particular decrease in VF? The best way to combine these specs in order to choose the correct Schottky diode is to calculate the power dissipation of the Schottky diode.

Once the Schottky diode's electrical characteristics are known, the next step is selecting the package. There are two decisions to make here: package style and size. To increase the longevity of the device, keeping the junction temperature as low as possible is advised — so a thermally efficient package style should be chosen. The chip-scale (DSN) is the most thermally efficient package style. Its high thermal efficiency stems from having the shortest thermal path between silicon and PCB. There is no leadframe present to add extra thermal resistivity. Regarding package size, as wireless devices squeeze in more features, available board space becomes increasingly limited. This is driving manufacturers to select ever-smaller packages, which in turn calls for smaller dies. The smaller the Schottky diode die, the higher the VF, since this is directly related to the Schottky contact area. However, as the die size becomes smaller, the leakage current decreases.

It is clear that the Schottky diode is an integral part of the LED backlight boost converter implementation and extending battery life of wireless devices. In order to heighten the efficiency of the boost converter as much as possible, it is important to carefully select the appropriate Schottky diode. When selecting such a device, there are three things to remember: ensuring that VR is as close to the OVP as possible, considering total power dissipation as opposed to forward voltage only, and ensuring that a thermally efficient package is chosen. With these circuit design tradeoffs considered, the best Schottky diode for optimal efficiency can be selected, which can support the operational effectiveness of the backlighting system for maximum results.

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Brushless DC servomotors address the medical and dental handpiece markets

The FAULHABER 2057 BHS Brushless DC Servo Motors are

cool to the touch with a high efficiency, slotless design that features smooth speed control with a continuous duty speed range up to 40,000 rpm. Low vibration, which reduces user fatigue, and low audible noise are ideal for long periods of use in sensitive medical and dental patient environments.

- The new motors come standard with digital hall sensors.
- Eliminates the need for an additional encoder for slower speed operation for dental implant or endoscopic positioning applications, which can also significantly reduce cabling complexity within the handpiece itself.
- Preloaded ball bearings insure that the motors are able to withstand the radial (22N) and axial loads (75N) in a hand piece. The long service life can be extended further through the replacement of the front bearing.
- A variety of high precision gearheads, high resolution magnetic and optical encoders and drive electronics are available to complete the drive system.

For more information, visit www.micromo.com

Power system meets IEC 61535 standards

TE Connectivity announces its newly enhanced NECTOR M power system. In addition to IEC 61535 standards, the power system solution is designed to meet the UL 1977 guidelines and just debuted a 5-position splitter that provides power, signal and control connection options for multiple lighting and electrical devices.

- The power system solution is a fully pluggable, modular wiring connector and cabling system for lighting and permanent indoor electrical installations.
- The round design reduces installation time especially compared to rectangular connector systems.
- The enhanced systems allow electrical contract manufacturers the ability to engineer, design, and build power distribution units, electrical devices and cable assemblies off-site that result in reduced on-site labor costs, increased efficiency, and improved reliability for permanent electrical installations.
- The multi-pole, keyed, modular wiring system is ideal for lighting designers, contractors and OEMs that require more flexibility in distributing power to various lighting systems and other common electrical devices within buildings.

For more information, visit www.te.com.

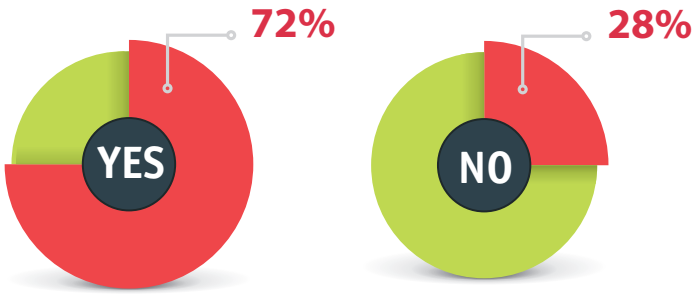
The White Board

Component Obsolescence

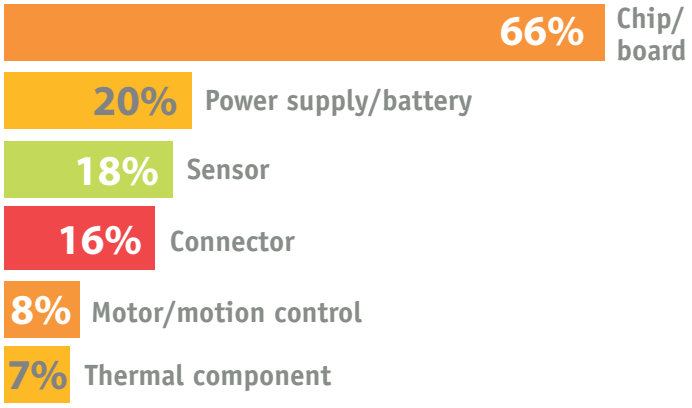
By Kasey Panetta, Editor

A team of engineers might spend weeks, months, or even years creating the perfect design solution for a difficult problem in their field. They might have just the right components for the budget and design needs, but looming over the project is the potential threat of component obsolescence. It's a struggle faced by all engineers at some point during their career, and the end result can be a blown budget, complete redesign, or a quick search for a replacement part. No matter the outcome, component obsolescence seems like an unavoidable problem in all applications.

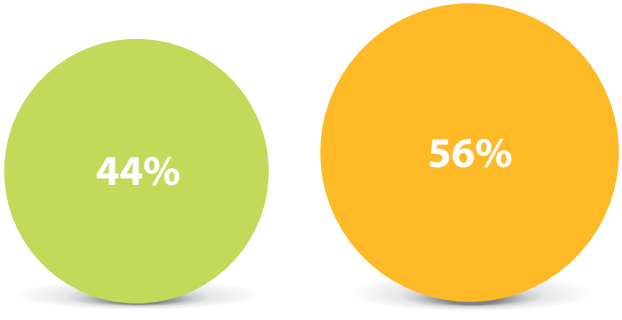
Have you ever had a project derailed due to component obsolescence?



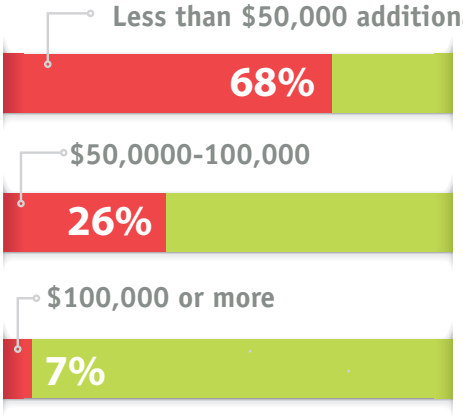
What type of components have the greatest incidence/risk of obsolescence?



What do you do when a component is being phased out?



How does the change or redesign affect final cost?



Do you maintain a relationship with a supplier that addresses obsolescence issues?

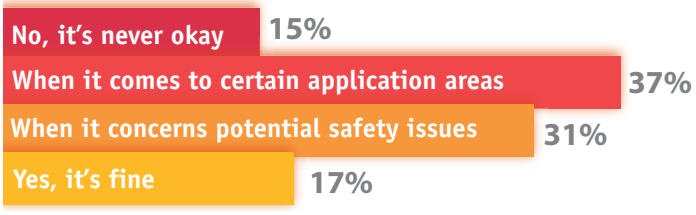
How do you handle cases of planned obsolescence?

73% It really depends on the situation

9% Nothing, it's just part of the deal

18% Find a new supplier

Is there ever a good case for planned obsolescence?



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