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SEPTEMBER 2021

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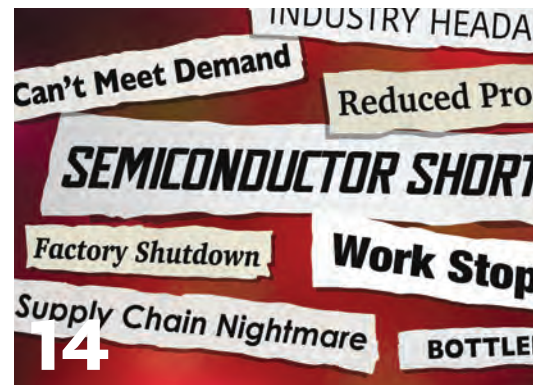
COMING UP SHORT

Timeline illustrates how a culmination of negative variables caused the global component shortage.

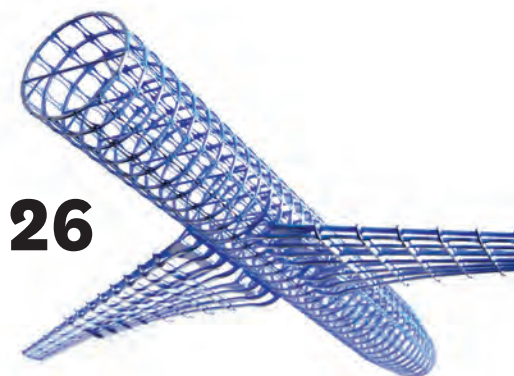
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Arris delivers design & manufacturing technology that employs composite material methods.



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Pandemic reveals global supply chain house of cards



As the world attempts to recover from a pandemic, another threat looms for electronic OEMs – a global shortage of components. In particular, the global semiconductor shortage didn't come without its warnings, which many industry leaders failed to heed. Projections say that the global chip shortage will last at least another 12 to 24 months, but there are ways in which businesses can mitigate the problem to manage the crisis better.

In many cases component supply chains have been simultaneously squeezed on both ends – supply and demand. While unscheduled closures of manufacturing and distribution facilities, bottlenecks at borders and sick workers have caused choke points in supply lines, people being cooped up in their homes for months on end have driven up demand for a host of products – from home office electronics to gaming devices.

The pandemic, however, has shown us that global supply chains are a huge house of cards: fragile enough on a good day, but prone to come tumbling down when there's an unexpected breeze. This has been particularly apparent with the manufacturing of computer chips.

The demand for microchips

Even before the COVID-19 pandemic, supply chains were beginning to show signs of shortages, there was already great pressure on the production of microprocessors, microcontrollers, motherboards due to limited global production capacity and greater calls for product.

Before long, the far-reaching effects of Covid-19 starting in 2020 slowed or shuttered production of these essential components for days, weeks or even months at a

time. Not so long ago, disruptions in the production of microchips tended to impact only the manufacture of consumer electronic devices.

Today, these interruptions have also managed to wreak havoc on the manufacture of automobiles, as chips are increasingly being used in power steering and braking systems, car infotainment systems and other elements. Major car makers in North America idled a number of their manufacturing facilities due to the global semiconductor shortage. Automakers are relative newcomers to the microprocessor market, as a result, they simply don't have the clout that other buyers have, leaving them out in the cold when supplies dry up.

It is clear that the global semiconductor chip shortage has been and will be more impactful to 2021 than most in the industry anticipated earlier this year. Average lead times for semi orders are between 25 and beyond 52 weeks, extending shortages into the first quarter of 2023.

The growing list of items that require microchips is disconcerting, as these components are almost solely manufactured in some of the riskiest places in the world from a natural disaster perspective. This has to change. We need more manufacturing facilities for microchips and these must be located in places with low risk to natural and other hazards.

Diversification of chipmaking

Geographical diversification of chipmaking is one solution companies are opting for in a strategic move to secure the supply chain and provide a long-term fix amid the turbulence the semiconductor industry has experienced. A handful of US-based firms have urged the Biden administration to invest in domestic semiconductor

manufacturing to buffer supply chain shocks and shortages, as well as reduce dependency on Asia, which is where 75% of chips are produced.

Here at home, a select group of globally recognized Canadian founders, business leaders, chip manufacturers, and investors formed Canada's Semiconductor Council, with a mandate to build and lead Canada's national semiconductor strategy and action plan. The coalition is working towards advancing Canadian competitiveness, strengthening trade partnerships, bolstering supply chain resilience, and propelling Canada to the forefront of the US\$7 trillion global semiconductor industry.

In addition, CMC Microsystems (CMC), a non-profit national organization that accelerates technology research and commercialization, has a plan to accelerate high tech manufacturing in Canada, including specialty semiconductors, by helping existing and new companies achieve high volume manufacturing success.

More recently, 5N Plus Inc., a producer of specialty semiconductors and performance materials, announced that it is investing \$8.5-million in its Montreal campus to expand the development and manufacturing of critical and strategic materials, including those containing tellurium, for advanced II-VI semiconductor compounds and engineered powders.

Buckle up, as this roller coaster stands to continue. For a deeper dive into how supply chain realities are impacting electronic distribution channels and design cycles, be sure to read the related articles in this issue as contributed by Digi-Key, NeuronicWorks and Fusion Worldwide. **EP&T**

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WIRE & CABLE

DATA CABLE ANNOUNCES NEW OWNERSHIP

Leading custom cable assembly manufacturer The Data Cable Co. Inc. recently announced that the firm has been purchased by Canadian Financial Counsel Inc., a Canadian private equity firm, following the retirement of founders and long-standing owners Dick and Lita Fearon, after 41 years.

While the change in ownership promises that Data Cable will continue to operate ‘business as usual’, company president, Paul Nelson, was keen to elaborate that Data Cable will continue to operate fully with their existing management team and staff from their current facility in Orangeville, Ontario.

“The new ownership brings significant new resources to the company which we’re confident will help us continue to strategically grow, diversify, and further strengthen our position and offerings in the markets we serve, which all directly benefit our customers,” says Nelson. “Our customers will continue to receive the same high-quality products & services, competitive pricing, and exceptional customer service from Data Cable that they expect.”

Founded in 1980 in Orangeville, Ontario, Data Cable’s initial roots were in manufacturing custom cabling that connected mainframe computers and minicomputers. The company grew significantly over the past four decades.

Today, the firm specializes as speed-to-market experts in the manufacture of high-quality OEM cabling assemblies and custom connectivity solutions, such as cable assemblies, wire harnesses, electro-mechanical assemblies, box builds, sub-assemblies & more.

The firm has served a widely diverse customer base and group of industries including medical, military, industrial automation & satellite ground technology. They operate with 50+ employees working in their 35,000 square-foot manufacturing facility in Orangeville.

QUANTUM TECH

FEDS FUND QUANTUM TECHNOLOGY SECTOR

The Canadian government is providing \$2.2M to support the establishment of the Quantum Algorithms Institute (QAI) to accelerate the innovation and commercialization of quantum technologies.

The Quantum Algorithms Institute, hosted at Simon Fraser University’s campus in Surrey BC, will be a



The Quantum Algorithms Institute, hosted at Simon Fraser University’s Surrey BC campus.

collaborative centre aimed at attracting unique industry partnerships, growing a world leading talent pool and developing commercial applications and adoption of quantum technologies. The Institute will use the funds to renovate a state-of-the-art physical hub to facilitate engagement, host collaborative events between industry and academia, organize quantum technology conferences for local and international players, and promote collaboration between existing quantum companies and potential new customers.

A new generation of optical and electronic devices use quantum effects to significantly enhance the performance over that of existing technologies. For example, quantum computers will be able to solve problems that the largest classical supercomputers would take thousands of years to solve, but in a fraction of the time.

This technology will have significant impacts across many sectors including manufacturing, natural resources, finance, engineering, healthcare, defense, transport, telecommunications and life sciences.

IIOT

DIGI-KEY LAUNCHES ‘FACTORY TOMORROW’ VIDEO SERIES

Digi-Key Electronics recently launched ‘Factory Tomorrow,’ a new video series focused on advancements in industrial automation. Sponsored by Banner Engineering and Weidmüller, the three-part video series showcases the latest innovations in robotics, automation and connectivity, as well as cutting-edge manufacturing technologies.

“As machines get smarter, manufacturers must continually evolve to meet the increasingly complex environment in which they operate,” said Robbie Paul, director of IoT business solutions at Digi-Key. “Growth and investment in industrial automation and



Digi-Key launched a three-part video series on innovations in industrial automation.

digitized systems are the new normal and Digi-Key is committed to helping our customers keep pace with today’s ever-changing business landscape.”

Andrew Barco, Weidmüller’s director of automation products & solutions, stresses the importance of not only making these connections but also of controlling and optimizing them. “Edge computing, which brings computation and data storage closer to where it is needed, is perfect for small, stand-alone applications where our AI/ML can help improve decision-making, add value, increase efficiency and boost production.”

WEARABLES

UOFT RESEARCHERS DEVELOP STRETCHABLE SENSOR MATERIAL



Binbin Ying, a former visiting PhD student in U of T professor Xinyu Liu’s lab, demonstrates a cold-tolerant, stretchable and sticky sensor material called iSkin that converts physical movement into electrical signals (Source: Runze Zuo)

A new material designed by researchers at the University of Toronto’s Faculty of Applied Science & Engineering combines the flexibility of human skin with improved conductivity and tolerance of temperatures as low as -93C.

Known as ionic skin, or iSkin, the substance could enhance a wide range of technologies – from wearable electronics to soft robotics.

The substance, which belongs to a family of materials called hydrogels, are cross-linked polymers that are able to hold a lot of water within their chemical structures, according to Binbin Ying, who is now completing post-doctoral work at MIT but led the design of the material while pursuing graduate studies at McGill University. Ying is simultaneously working as a visiting PhD student in the lab of U of T Engineering Professor Xinyu Liu.

“Many of the tissues in our own bodies are hydrogels, so they are often used in applications where biocompatibility is important such as cosmetics or tissue engineering. But,

if we want to use them in soft, flexible or wearable electronics, we need to add in new functionalities such as mechanical stretchability and electrical conductivity,” says Ying.

Last year, Ying and Liu unveiled an earlier iteration of iSkin that showed off some of its capabilities: it is self-powered, nontoxic and can stretch to 400% of its original size. Most importantly, bending the material creates a proportional change in its conductivity. This enables it to convert physical movement into an analogous electrical signal.

“A physiotherapist could stick it on your knee or your elbow to measure when and by how much your joint is moving,” says Liu. “We’ve also coated it on a glove, enabling us to measure and track hand movements, which, in turn, can be used to control a robot. It’s a very versatile way to facilitate all kinds of human-machine interactions.”

CONSUMER TECH

PANDEMIC DRIVES TECH SPENDING IN CANADA

The excitement for technology continues to rise among Canadians, as 35% of households say they are more likely to buy tech products due to the pandemic, according to new research from the Consumer Technology Association (CTA).

CTA’s 6th annual Canadian Consumer Technology Ownership & Market Potential Study also shows that consumer intent to buy tech products in the next 12 months is 5% higher than this time last year – with televisions, smartphones, and home video game consoles helping drive the growth.

“More Canadians now see tech as essential – not only for working, learning, and staying connected during the pandemic, but also for our post-pandemic lives,” said Steve Koenig, VP, research, CTA.

Home entertainment systems are surging in popularity. TVs (90%), DVD/Blu-ray players (54%), and digital streaming devices (43%) are the most-frequently owned products in the category. For the first time, half of Canadian homes (50%) have a 4K Ultra HD TV – a 14-point increase from 2020, the largest growth for any product surveyed.

2021 brought a milestone for the videogame industry with approximately half of Canadian homes (49%, up 10.7% from last year) now owning a videogame console. And 18% of households plan to buy one in the next 12 months, a 25% jump from 2020, illustrating a strong desire for home-based entertainment.



400%

The amount electronic material iSkin can stretch beyond its original size.

With Canadians at home more than ever over the past year, purchases were focused on enhancing their experience indoors. For the second year in a row, smart speakers lead the smart home category – 36% of homes now own a smart speaker, and 17% plan to buy one in the next year. Smart light bulbs and smart appliances, at 19% and 18% respectively, are the second-most frequently owned smart home tech.

Additionally, 15% of Canadian households own a robotic vacuum, with 10% indicating they plan to purchase one in the next 12 months.

Twelve per cent of Canadian households now own pet technology—a 50% increase from 2020—likely due to the surge in pet adoptions during the pandemic.

The pandemic sped the adoption of health and wellness technologies and services. Nineteen percent of Canadian homes now own air purifiers, 16% have smart or connected health monitoring devices and 11% have connected sports or fitness equipment (up four points from 2020).

Both smartwatches (25% ownership) and wearable activity fitness trackers (28%) showed year-over-year growth. Looking forward, first-time buyers slightly prefer smartwatches over activity trackers (47% vs. 44%, respectively), indicating new buyers seek functions beyond the capabilities of a wearable fitness tracker, such as enhanced health monitoring apps and productivity tools

START-UPS

INNOVATION HUB COMES TO OWEN SOUND

FedDev Ontario announced an \$845,000-non-repayable FedDev Ontario contribution for Grey County, in partnership with Catapult Grey Bruce, to enhance service offering and business programming at the Sydenham Campus Regional Skills Training, Trades and Innovation Centre in Owen Sound. This

investment will support 75 businesses, produce 10 new products and services, create 50 new jobs and will leverage an additional \$1.8 million in private investment for the region.

Through this project, Grey County will establish a maker space and device lab at the Sydenham Campus Regional Skills Training, Trades and Innovation Centre, with 3D printers and prototyping equipment to support SMEs to develop STEM skills, integrate new technologies, and commercialize their products.

The investment will also support two new programming streams: acceleration programming for established companies; and incubation programming for newer businesses, benefitting from access to the maker space.

ALBERTA GROUP SEEKS TO SUPPORT START-UPS

Alberta Enterprise has invested \$10-million in Yaletown Partners second Innovation Growth Fund to help Alberta’s industry-focused software, data and device technology companies grow beyond early stage. Alberta Enterprise first invested in Yaletown Ventures II fund in 2010, followed by Innovation Growth Fund I in 2017. Yaletown manages a large portfolio of Canadian technology companies, and has been a successful investment partner for Alberta Enterprise for more than a decade.

“Our investment in Yaletown’s new fund ensures better access to capital for Alberta tech companies so they can propel their initial growth and qualify for funding past Series A,” commented Kristina Williams, CEO Alberta Enterprise Corp. “Ensuring Alberta startups can grow beyond early stage is core to our mandate and we’re glad to continue our successful partnership with Yaletown to create opportunities for Alberta startups at all stages of funding.”

Yaletown has a \$200-million target for its Innovation Growth Fund II which is focused on helping to close the scale-up capital gap for Canadian technology businesses driving digital transformation and modernizing traditional industries. The fund’s aim is to advance technologies supporting “Intelligent Industry” by drawing on machine learning, artificial intelligence and the Industrial Internet of Things (IIoT).

The fund will also back companies creating substantial operational efficiencies in industry, which reduce climate impact while driving financial returns for customers.

Visit ept.ca for the latest new products, news and industry events.

EyeQ provides clear vision on AI video enhancement

Perfectly Clear technology autocorrects more than 51-billion photos per year

BY SOHAIL KAMAL, WEST COAST CORRESPONDENT



EyeQ Imaging Inc. is helping its clients exhibit a clearer focus by developing innovative digital imaging technology that evolves the way businesses correct and enhance imagery and videos. The Calgary-based firm's technology, Perfectly Clear, autocorrects more than 51 billion photos per year, helping their clients improve workflow by auto-correcting photos efficiently and effectively.

West Coast Report recently had the opportunity to meet with Brad Malcolm, CEO and co-founder of EyeQ, about what led them to start EyeQ, their development of new artificial intelligence technology for video processing, and how they have blossomed from Calgary, Alberta.

"We started EyeQ out of frustration. We would capture an amazing image, only to have the photo not look so good," explains Malcolm. "The team has grown over our 20 years, with the biggest growth being between 2018 and 2021. We did a large licensing deal to a cell phone company, OPPO," explains Malcolm. They met with printers, producers, and began supporting the manufacturing pipeline for various print deliverables. They work with HP Indigo, as well as companies like Qualcomm, Nvidia, and other vendors.

Running on the GPU

The firm's previous technology ran on the central processing unit (CPU), but



Brad Malcolm, CEO and co-founder of EyeQ Imaging Inc.

they are expanding into the video correcting and optimization space which is leading them to run on the graphics processing unit (GPU). "Today, we are a team of leading scientists, physicists, AI experts, and photographers who are driven to make every photo and video as brilliant, vibrant, and clear as possible all while maintaining color integrity." By using artificial intelligence to automatically enhance videos in real-time, they can now offer professional retouchers editing sliders to make video editing and enhancement easier than ever. "Much like what we are used to with auto-correct for photos, we now offer the same for videos. All of this, while enhancing videos by harnessing the power of AI, which is really exciting."

"When you are going 50-million miles an hour, it is not possible to wait two months to find out if there is talent or the time to train them to be up to speed"

International approach

To some, it may seem surprising that a world-class tech company in this space would be from Calgary. Their customers are global, and they power some of the largest printers in the world.

"We have different time zones to support, and revenues come from around the world. Germany, France, China, the States, Korea. In places like China, language is a big deal. So in countries like that, you need a presence. Calgary [has historically been] oil and gas-based and finding knowledge in the photography space is specific and tough to find locally. So, we have learned to hire where there is talent," says Malcolm.

"I hired an experienced CTO out of Texas, someone who understands the image pipeline. When you are going 50 million miles an hour, it is not possible to wait two months to find out if there is talent available - or to find the time to train them to be up to speed." Now, Calgary is positioning itself as a mini tech hub for start-ups, which EyeQ is proud to be a big part of.

Malcolm finished by sharing advice for other aspiring entrepreneurs: "Always hire the best people possible. Without good people and the right team, one can't execute and grow. And don't be afraid to think outside the box - that's how great ideas happen." **EP&T**

To learn more about EyeQ, go to eyeq.photos.



Previous technology from EyeQ ran on the CPU, but the firm has expanded into the video correcting and optimization space - leading them to run on the GPU.



Sohail Kamal is EP&T's West Coast correspondent.
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Component traceability and transparency

BY TERI IVANISZYN, VICE-PRESIDENT, OPERATIONAL EXCELLENCE, DIGI-KEY ELECTRONICS



The electronic components supply chain has evolved immensely over the past few years. That's a good thing, but it also comes with challenges that are driving the need for greater accountability and transparency. These challenges include increased outsourcing to global counterparts and a rise in counterfeit activity.

Many companies are understandably desperate to find the chips they badly need, and as a result are turning to new – and sometimes untrustworthy – sources to find them. With the supply chain under immense strain due to shortages of all kinds, including semiconductors, there has unfortunately been a flood of counterfeit products entering the market.

These parts may appear very similar to the authentic version, or even be refurbished

components that are sold as new. It can sometimes be difficult to tell the difference, with little details such as packaging or a 'not-quite-right' appearance giving away the inauthenticity. Other times, the differences are undetectable without sophisticated technology.

These black-market schemes can be widespread, and can generate millions of dollars in revenue. A bad actor in the U.S. was recently sentenced to two years in prison and a \$250,000 fine for conspiring to sell counterfeit smart phone components.

So how can you protect your company from falling victim to these costly and frustrating counterfeits? The key lies with traceability.

Traceability is key

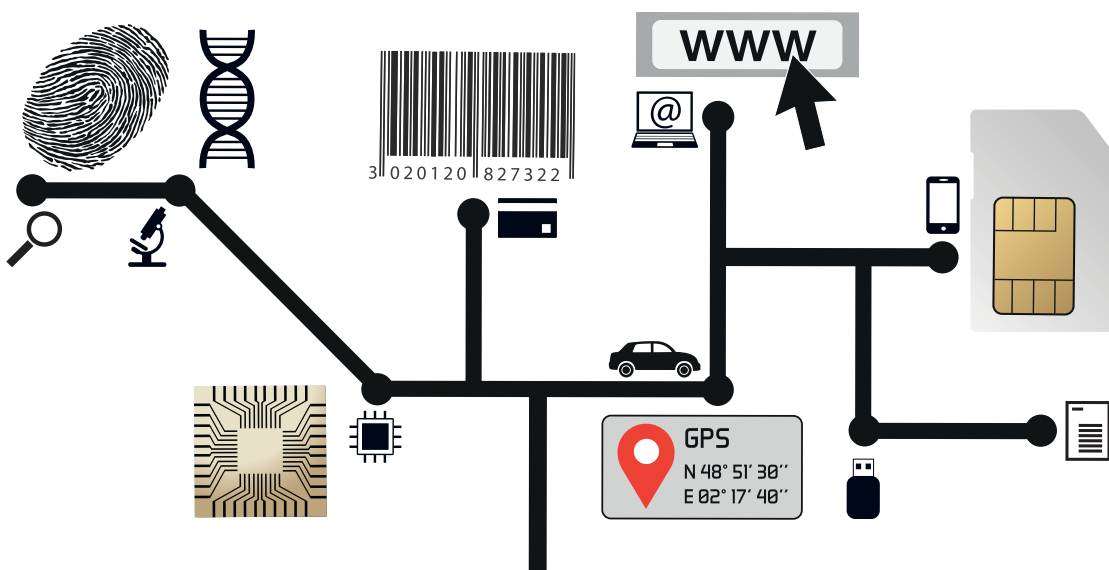
Reputable distributors are addressing counterfeit challenges while working to retain existing

customers and attract new ones by providing traceability information, including date codes, and lot and serial numbers. Given the rise in counterfeit inventory, customers want to know where their products are manufactured and what they're made of.

Traceability technologies enable manufacturers to track production information back to the exact date, time, supplier components, operator and machines used.

This and other such information enables anyone throughout the supply chain to trace components back to the original equipment manufacturer (OEM) should anything go wrong. Within the electronic components industry, specifically, traceability is quickly becoming a priority.

Companies slow to provide traceability for their components are likely to fall behind, quickly losing credibility and even market share.



Advantages of traceability

1 | Combats counterfeit activity. In the last few years and especially with shortages hamstringing the supply chain, the electronic components industry has seen an uptick in counterfeit components flooding the market. The industry is responding by developing new processes to increase transparency and traceability for authentic parts within the supply chain.

2 | Helps mitigate product recalls. Product recalls are common—and expensive—so protecting your company against such recalls and the associated liability is critical. In the event that a recall does become necessary, having robust traceability data helps you manage the recall more quickly and cost-effectively. What's more, traceability makes it possible for you to recall only the products that involve specific serial numbers, saving both time and money.



3 | Increases customer satisfaction. Another advantage of adopting traceability is stronger customer relationships. That's certainly been the case for us, as our customers often use the information traceability provides to improve their processes, resolve issues related to defects, and help manage regulation and compliance.

4 | Improves brand management and brand integrity. Traceability is important to companies that want to protect their reputations and the reputations of their brands.

5 | Meets government and compliance mandates. Traceability helps ease the burden of and lessen the chances for fines and penalties associated with noncompliance, something that is particularly helpful in highly regulated industries such as aerospace, automotive and medical device industries.

6 | Offers a competitive advantage. Proving that products meet certain standards and/or comply with industry regulations is a competitive differentiator that traceability can deliver.

7 | Creates operational efficiencies. Implementing traceability processes helps organizations make products that are safer and of higher quality. Traceability also creates processes that can be optimized for continuous improvement. Sourcing traceable products can also save companies money --if any faults arise with a product, the OEM or subcontractor can quickly send out a recall, mitigating losses and reducing legal costs. Defects of genuine products can also be quarantined much easier than recalls of counterfeit parts.

Industry regulations and compliance

The desire for traceability information has led to the creation of independent organizations

and governing bodies that have established standards and certifications that ensure traceability back to the source. The industry is responding by creating new processes for increased transparency and traceability throughout the supply chain.

Two of the top industry associations working to address and mitigate this issue are the Counterfeit Avoidance Accreditation Program (CAAP) and International Organization for Standardization (ISO).

Digi-Key is CAAP-certified, meaning that our counterfeit controls have been verified by an external auditing company and that our components are compliant to aerospace standard AS6496. Digi-Key also has controls for disposition, inventory, receiving and customer returns. These controls adhere to AS6496 as well.

Additionally, in March 2021, Digi-Key launched an industry-first traceability feature called Part Tracing that prints information directly on select cut tape products. This development, which is available on

thousands of parts, enables engineers to better organize their components, improve traceability and reduce confusion.

In the event that suspect or confirmed counterfeit products are identified in the supply chain, Digi-Key has processes in place to quarantine the products and report the findings to suppliers, customers and the appropriate authorities.

Vertical industries also have industry groups that encourage and advocate for traceability for its members. One such group, the Automotive Industry Action Group (AIAG), was started by North America's three largest automotive OEMs. This group requires automotive manufacturers to meet traceability standards set by the group.

Not only do these groups help prevent counterfeit activity, their standards help advance safety, quality and sustainability throughout the supply chain.

Traceability is the future

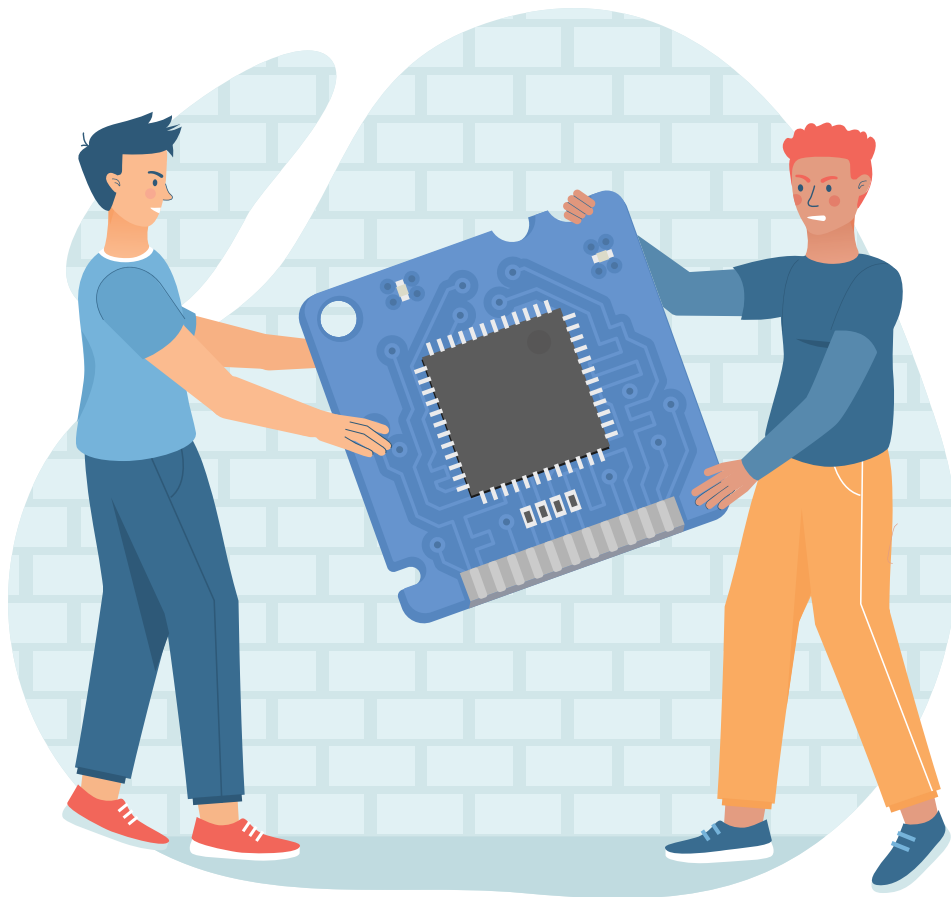
With the supply chain more digitized and connected than ever, traceability will continue to help manufacturers offer safe, authentic products. Gone are the days of listing components for sale on websites, no questions asked. Customers now demand the ability to track and trace critical components back to the OEM in case of a faulty product or a product recall.

The result is improved customer satisfaction, reduced manufacturing liabilities and, ultimately, increased revenues. While adopting traceability requires time, effort and resources, the returns companies realize far outweigh the investment. Bottom line: Complete and accurate traceability is no longer optional in electronics manufacturing; it is now a must-have. **EP&T**



Teri Ivaniszyn is vice-president, operational excellence, at Digi-Key Electronics, a high service distributor of electronic components

and automation products worldwide.



Components shortages: What it means for the product design house?

BY TITU BOTOS, CEO & CO-FOUNDER, NEURONICWORKS INC.



News on the global chips and components shortage has been doing the rounds for the last couple of months and the consequence of the shortage is now being felt in every link of the supply chain. Though the effects of the shortage were felt from as early as 2018, the COVID-19 pandemic has exacerbated the situation with supply chain disruptions and production issues.

The pre-pandemic shortage was created by the sharp increase in components demand by the automotive industry and the growth of IoT applications in general. The automotive industry has been including smarter electronic systems in vehicles including infotainment systems, navigation and steering support, advanced driver assistance systems (ADAS) and autonomous vehicle software. IoT applications

spanning industries continues to grow adding sensors and wireless communication to diverse, innovative applications, increasing the demand for an entire slew of electronic components.

What started with a blow to the automotive industry is now affecting the consumer electronics industry. When the pandemic first hit and movement became restricted, the demand for automobiles went down and the demand for personal devices rose dramatically with offices, schools and universities going into a virtual mode.

Component suppliers pivoted to supplying surging demand of consumer electronics like laptops, personal devices, gaming devices, etc. This also holds true for the healthcare industry with critical demand for ventilators, X-ray machines, and medical diagnostic tools.

Now component manufacturers are starting to shift back to pre-COVID operations but are still plagued with an increasingly fragile and long supply chain. And, this presents a challenge for product development and manufacturing of most devices that use semiconductors.

What is causing shortage?

The disruption in semiconductor availability is the result of a confluence of factors from across the globe. This includes unfavorable weather conditions in Texas, severe drought in Taiwan, a factory blaze in Japan, in addition to extreme changes in customer buying behavior brought about by the pandemic.

Add to this, global wide shutdowns of facilities due to the pandemic, which further exacerbated production bottlenecks.

Global effects of shrinking

According to World Semiconductor Trade Statistics Organization figures, after a decline in 2018 and 2019, the global semiconductor sales revenue grew by 6.5% in 2020, to \$439 bn. This trend is a testament to increasing pressures on component supply chains driven by COVID-19 demand.

The increasing demand has led to the global industry's reliance on a small group of foundries in Taiwan and South Korea for leading-edge chips. As well, the trade wars tension between US and China and the sanctions imposed on Chinese foundries have led to additional stress on Taiwan and South Korean foundries' capacities.

A recent report from Goldman Sachs states that the shortage of semiconductor chips has impacted 169 industries across the board, which could last well into 2022. According to the report, the worst hit industries are consumer focused like automobiles and consumer electronics.

Though it is interesting to note that the demand for consumer electronic devices like smartphones, laptops and tablets bolstered by the pandemic have been met over the last couple of months, which can help balance supply and demand to a certain extent.

Hoarding

Shortage of components leads to another concerning behavior of hoarding and stockpiling through inventory accumulation, safety stock building and double ordering. Foundries can find it extremely difficult to differentiate demand from hoarded product and hoarding can distort the demand signals currently impacting the supply chain, giving out wrong signals and making demand inflated.

Allocation

Allocation is a special situation when demand for components exceeds manufacturing capacity. As suppliers do not receive sufficient components from manufacturers to fulfil customer needs, suppliers are forced to allocate partial quantities and schedule deliveries over a period of time. Allocation also means that lead times are much longer and uncertain. Broadcom, for example, is one such chip manufacturer that

is now assigning allotments to their customers regardless of demand to try and balance the situation. Leading component manufacturers are asking for forecasted usage and advance Purchase Orders projected till the end of 2022.

Fake components

As with most other high demand commodities, there is a fear of fake or counterfeit chips that are making their way into the market. While not necessarily affecting tech giants who have robust supply chains and who typically will only purchase directly from reputable chip manufacturers, the low-volume manufacturers with less established supply chains are more at risk. These smaller companies usually use the services of third-party distributors who could be buying and selling components from different places including online open markets which opens the risk to counterfeit components. Many of these smaller distributors service the healthcare, automotive and defense industries.

Components cost

As the demand is higher than supply, component prices are soaring. We have experienced situations where components were charged six to ten times their 'regular' price. Manufacturers with deeper pockets can afford to pay a premium to ensure their lead times are maintained, but this is not the case for everyone.

The inflated price that is being paid for the components may ultimately spill over to the end user which is currently being reported.

More domestic chip making

Diversifying the manufacturing base is a crucial step to overcoming disruptive supply chains. Developing regional manufacturing and distribution hubs can help close the large supply gap and can minimize the risk of expensive delays in production and reduced lead times. Today, the vast majority of the world's electronic components are made in China, while the U.S. is the second biggest producer.

Reshoring or onshoring sentiment is growing in popularity across industries as manufacturers face lesser risk by spreading manufacturing capacity over a broader geographic region and enjoying reduced tariffs. There is also a decreased risk of cybersecurity threats, and considerably lower transportation costs.

Product developers help

While developing a product, there are typically two scenarios that can play out:

1. **New Product Development:** building and planning for a completely new product.
2. **Product Update/Maintenance:** updating a product with new technology or replacing legacy technology.

Both of these scenarios have their own challenges, but the former is the one under the most pressure. The issue here is the length of time between the design stage (where ideal components are selected) and the start of manufacturing. The longer the time between these two stages, the greater is the risk of being affected by components availability and cost variation.

For any product that requires hardware components, we advise our clients to prepare for a component shortage challenge given the fact that larger companies and manufacturers have bigger purchasing power and are currently resorting to stockpiling. To be better prepared, here is what we advise:

- **Plan in advance:** Work with your design firm to understand the components required for both prototyping and the various stages of production. Design houses usually have longstanding partnerships with key component manufacturers, vendors and distributors and can help to quickly identify and source the right components needed to meet the project goals.
- **Drop-in replacements:** Ask your design house to look for alternate options for components that are not too critical. Having a list of vendors that offer drop-in replacements prepared in advance, can help

reduce the risk of component shortage while moving into production build.

- **Purchase in advance, blanket orders:** As soon as the product design is finalized, tested and validated, place purchase orders for mass production. Even if it will be a couple of months before production at scale starts, it will be smart to have the necessary stock in place.

- **Redesign and Development:** Another alternative to replacing components is redesigning and redeveloping the product to optimize for available components.

Work closely with your design house to navigate the challenges of global component shortages and find the right solution (both for design and obsolescence management) to keep your product plan on schedule.

With the domino effect of the shortage, the future seems uncertain, and most industry analysts are adopting a wait and watch policy to see how this trend will unfold. But one thing is certain, diversifying the semiconductor manufacturing base is imperative to building a reliable global supply chain. **EP&T**



Titu Botos, co-founder and CEO of NeuronicWorks Inc., a product design and custom engineering company based in Ontario.

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The global chip shortage

A timeline of unfortunate events leads us to where we are now

BY FUSION WORLDWIDE



COVID-19 has sent traumatic ripples through supply chains around the globe, but the semiconductor supply chain was fragile long before governments shut down and catastrophe struck. In a culmination of negative variables, the chip shortage has amassed over the years from a series of unfortunate events.

From trade wars between countries impacting commodity pricing, extreme weather damaging factories and a global pandemic causing manufacturers to reduce workforce capacity, the chipmaking sector has had little to no time to recover from blow after blow of supply chain disturbances.

These woes that chipmakers experience appear endless even among plans for major companies to expand to meet demand as countries vie to be crowned lead global chipmaker. Each phenomenon has contributed to the current market volatility and will continue to impact the outlook for companies as chipmakers expect the shortages to continue in the years to come.

2018 and 2019

Trade wars cause ripple effects in supply chain

The US – China trade war and the Japan – Korea trade war led to market turbulence for chipmakers and added to rising concern over the effects geopolitical conflicts had on manufacturing and distribution. Both trade wars caused increased lead times, raised pricing and contributed to constraints on raw materials.

US – China trade war:

In 2018, the US – China trade war began and unfolded in five phases between 2018 and 2021. “The trade war took direct aim at Beijing’s ambitions to become a leader in advanced manufacturing technologies such as semiconductors and electric vehicles,” reported *The Wall Street Journal*. The first wave of tariffs that had a direct impact on chipmaking hit Chinese imports in 2018 and targeted raw materials for chips, such as silicon and reactor tubes and holders designed for semiconductor wafer production.

In a ripple effect, the tariffs that hit these raw materials were

one of three main factors that led to the 8-inch (20mm) wafer shortage reported in Q3 2019, which persists today; the other factors were increased end-product demand and uneven supply of foundry equipment. The tension between the US and China further caused wafer supply hoarding when the US later blacklisted China’s biggest chipmaker SMIC in 2020. With many vital parts of the supply chain impacted, US industries reliant on semiconductors feared restrictions on Chinese imports would lead China to create their own semiconductor ecosystem, even if they’d have to play catch-up with US chip designs.

In August 2019, the trade war escalated as Beijing announced it would apply \$75 billion in tariffs on US goods. The last phase of US tariffs in September 2019 was aimed to hit \$120 billion worth of Chinese goods. An agreement between the US and China was made in 2019 that included structural reforms and changes to China’s economic and trade regime. The hope was that when this agreement later went into effect, it would reduce

the back-and-forth tariff increases on imports.

Japan – Korea trade war:

The Japan – Korea trade war that began in 2019 commenced with Japan implementing export restrictions on raw materials used to make chips. Major semiconductor manufacturers SK Hynix and Samsung, both headquartered in South Korea, were caught in the crosshairs trying to secure inventory to buffer production against disruption. The major chipmakers in South Korea were heavily dependent on chemicals produced by Japan vital in chipmaking. The already lingering concern of the semiconductor supply chain from tensions between the US and China heightened as a result of this additional disruption in the production of chips coming out of Asia.

2020

No reprieve in sight in wake of escalated shortages

In 2020, COVID-19 struck. Manufacturers in all industries scrambled to meet supply and demand in an unprecedented economic climate. For chipmakers, production for almost half of the year was halted due to government shutdowns and COVID-19 restrictions. By the time production did resume, semiconductor companies had to adjust to increased pressure in various sectors.

The automotive industry especially saw a rise in demand as purchasing behavior shifted in the second half of the year when consumers avoided public transportation due to the pandemic and developed an increased desire for customization in vehicles. Recovery for automakers was hindered as the supply chain experienced shortages in 8-inch wafers and ABF substrates necessary for

The pandemic, raw material shortages and demand demand all weighed on semiconductor manufacturers in 2020 with no reprieve in sight. For global chipmakers to adjust, supply chain resiliency became more crucial to remedy shortages

semiconductors manufactured in cars. In response, automakers like Volkswagen, Ford and Toyota cut production at a time when the industry was on the precipice of a boom.

Deterioration in raw materials continued to intensify because of capacity restraints, the unpredictability of the COVID-19 pandemic and the unforeseen events that struck chipmakers globally. The 8-inch wafer shortage snowballed from 2019 due to higher demand in the IC market, increased tension between the US and China and growth in 5G and automotive industries—which led wafer production capacity to reach 99% in 2020.

An ABF shortage was exacerbated after a fire impacted production from Japanese manufacturer Nittobo in July 2020. ABF suppliers tried to increase production for the months ahead, but with high demand for semiconductors, backlogs and lead times were predicted to extend into late 2021.

Another fire broke out at the Asahi Kasei Microdevices (AKM) semiconductor plant in Miyazaki, Japan, in October 2020, which left the factory severely damaged and out of operation. The semiconductor manufacturer communicated to customers that they should switch to alternative products, and they would work with a third-party manufacturer until the AKM plant could reopen. Panic ensued in the market, which led prices to skyrocket in the days following the fire. Customers stocked up on supplies to attempt to prevent further disruption in their supply chains.

The pandemic, raw material shortages and demand all weighed on semiconductor manufacturers in 2020 with no reprieve in sight. For global chipmakers to adjust, supply chain resiliency became more crucial to remedy shortages and

for companies to deescalate interruptions.

**2021
An opportunity for growth in global supply chains, but will industries persevere?**

After a tumultuous year in 2020, it appeared there might be some light at the end of a long, long tunnel for some industries in 2021. In the new year, companies were optimistic with the rollout of 5G, the rebound of the automotive sector, a heightened need for data centers and increasing reliance on AI and IoT, which would mean growth for businesses. However, shortages that were originally attributed to the pandemic continued to worsen with demand growth, raw material shortages and catastrophes.

In Q1 2021, distributor inventories were under allocation and end-customer supply was very tight for a variety of components. The numerous shortages caused stunted growth and led manufacturers to fight over resources. The first quarter led to another dark tunnel for global markets with the outlook for Q2 2021, which forecasted a continued struggle for chipmakers to fulfill orders across a variety of industries—a struggle that would force companies to decrease their production lines or stop them altogether.

Semiconductor production continued to take additional hits when Renesas's Naka factory in Japan experienced two detrimental blows in a brief time period, further impacting the wafer shortage that originally began in 2019. In February 2021, an earthquake caused a blackout that temporarily suspended production but had minimal repercussions. The second blow struck the same plant when a fire broke out in March. The fire affected a building where two-thirds of

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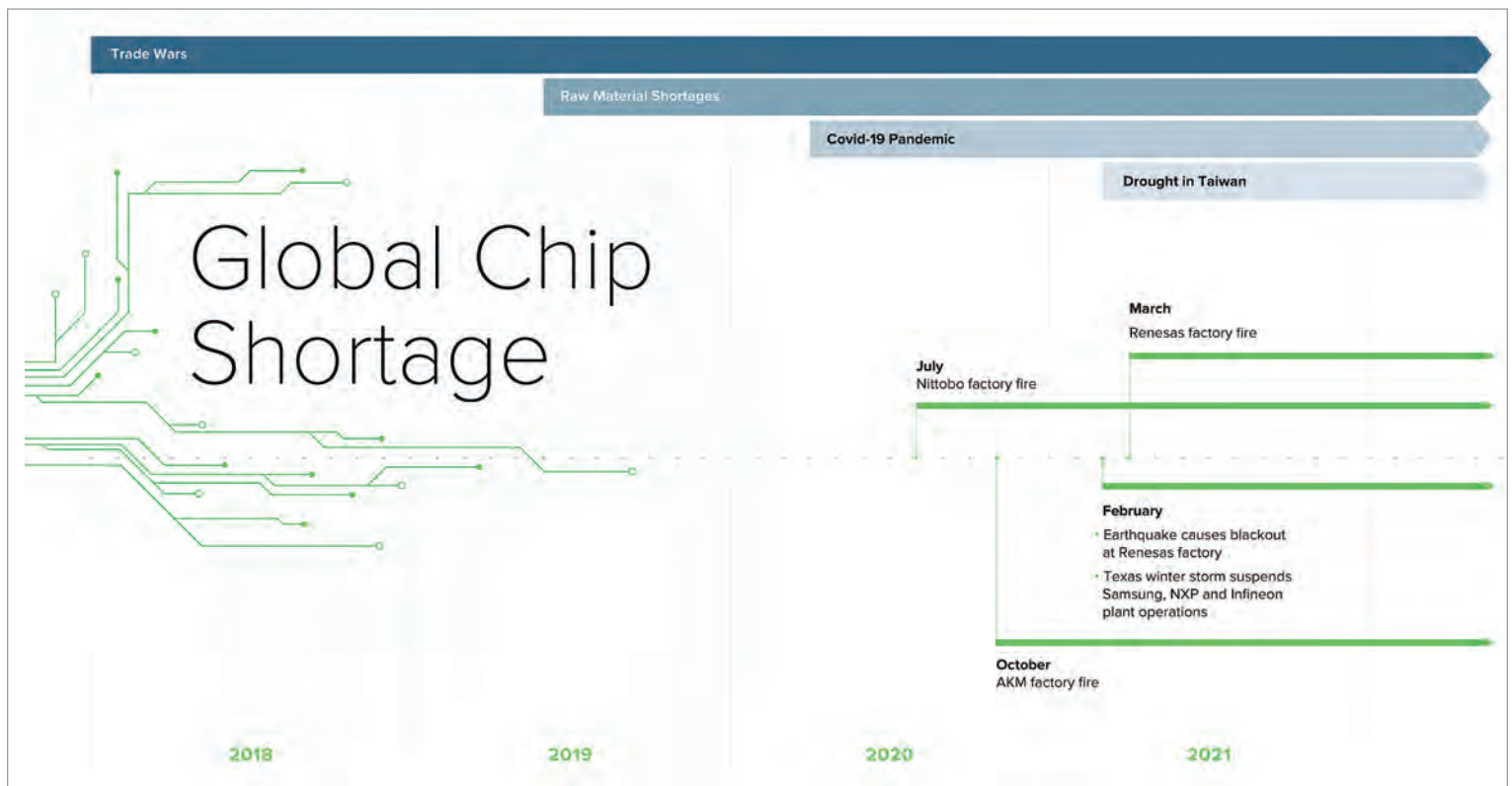


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the wafers produced were used in automobile production and created additional woes for automakers.

Concurrently in February, the commodity chip supply chain suffered another disruption when Texas reported widespread power outages and rolling blackouts caused by Winter Storm Uri. Major manufacturers Samsung, NXP and Infineon suspended plant operations as a result. Even as operations resumed for manufacturers in late February, the disruption added to mounted supply strain.

For many chipmakers, there was no pause for recovery for many chipmakers throughout Q2 as the outbreak of the COVID-19 Delta variant caused government lockdowns in Southeast Asia. Taiwanese plants and foundries alone produce roughly 53% of the global semiconductor market and four of the ten foundries have facilities in Taiwan. Countries like Taiwan were already navigating the effects of the exponentially worsened shortages in Q2 2021, which then carried over into Q3. Macronix temporarily closed one of its Taiwan factories due to COVID-19, which delayed all

So far, the events in 2021 have exemplified the downward trajectory global markets are expected to face from intensified shortages, disasters and lack of raw materials

June and July shipments. Lead times increased to 18-24 weeks and Q3 prices were expected to increase by 18-40% on Macronix ICs.

Similarly, Malaysia, Vietnam, the Philippines, and Singapore were among Southeast Asian countries hit with a wave of the Delta variant while simultaneously combating extreme weather conditions like typhoon season and major flooding. Manufacturing sites and trade ports were rattled by lockdowns, and companies had to re-evaluate supply chain strategies in attempt to meet production and fulfill orders.

So far, the events in 2021 have exemplified the downward trajectory global markets are expected to face from intensified shortages, disasters and lack of raw materials.

Looking to the future

Geographical diversification of chipmaking is one solution companies are opting for in a

strategic move to secure the supply chain and provide a long-term fix amid the turbulence the semiconductor industry has experienced. In their initiatives to do just this, US companies have urged the Biden administration to invest in domestic semiconductor manufacturing to buffer supply chain shocks and shortages, as well as reduce dependency on Asia, which is where 75% of chips are produced. The semiconductor industry could receive \$50 billion to expand US chip manufacturing if President Biden's infrastructure proposal is approved by Congress after review.

Proactively, two of the world's largest chipmakers, US-based Intel and Taiwan-based TSMC, plan to build new semiconductor factories in the US. In 2020, TSMC announced it would be spending \$12 billion to build a factory in Arizona with expected production to start in 2024. Intel then announced its plan to build two fabs in Arizona and

upgrade another in New Mexico (cumulatively spending \$23.5 billion) expected to be operational in 2023. Intel intends for these factories to be a US and Europe alternative to Asian chip factories, which frequently face natural disasters like typhoon season every year.

The continued trade war between the US and China is another reason chipmakers view geographical diversification as a solution to temper the semiconductor supply chain. Since 2018, the tariffs have caused a \$5.36 billion decline on Chinese imports of semiconductors.

The tariff increases over years, continued outbreaks of COVID-19 in areas like Southeast Asia and unpredictable circumstances have caused major blows to many companies in a variety of industries dependent on chips. Expansion and further investment in semiconductor factories will not be a one-off solution and is not an overnight fix by any means but does offer an optimistic outlook. **EP&T**

This article was written & submitted by Fusion Worldwide, a global open-market distributor of electronic components, based in Boston, MA. <https://www.fusionww.com>

EP&T

ELECTRONIC PRODUCTS & TECHNOLOGY

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SOURCING CEM PARTNERS **CONTRACT MANUFACTURING**

A coast to coast list of CEMs p. 20

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Powering up an ecosystem of efficiency

The power conversion market is exploding and the fastest way to manufacture these products quickly is to work with a curated ecosystem



Tony Ziccardi and Gueorgui Anguelov, SMPC Technologies Ltd.

➔ Throughout the world there is an ongoing transition from the internal combustion engine (ICE) to electric powertrains. We are moving towards a more electrified future through the continued expansion of charging networks and as electric powertrains continue to lengthen driving ranges. Demand for all sorts of Electric Vehicles (EV) is exploding.

To meet this demand, manufacturers of innovative power conversion products are having to create solutions that can be manufactured efficiently during ongoing supply chain shortages. The challenge is to successfully obtain competitive material costs and deliver best-in-class products.

Dorigo Systems saw an opportunity to offer power conversion companies a sophisticated manufacturing solution that has the right balance between design expertise and electronics manufacturing. Leveraging Dorigo's 33 years in contracting manufacturing, the team wanted to bring power conversion products to market as efficiently as possible with the lowest BOM costs.

Partner with best-in-class suppliers

"It was clear that we needed to work smarter during these challenging times," states Daniaal Arooj, Manufacturing Manager, Dorigo Systems. "Many choices existed to serve the needs of the growing power conversion



The EV-NRGY 12.5W dc Fast-Charger.

market and we determined that building a curated network of experts would best propel our customers' great ideas to market – faster."

Dorigo Systems partners with best-in-class suppliers using their curated ecosystem. These partners collaborate with their engineers in Design for Manufacturability (DFM) to ensure designs are built to be the best.

For power conversion customers, leveraging the expertise of SMPC Technologies has been critical to Dorigo's ongoing success. Both companies are located in the growing Power District of Burnaby, BC where industry-leading companies, such as Ballard Power Systems, are bringing the best power conversion products to market.

SMPC Technologies has been at the forefront of power conversion pioneering the commercialization of LLC technology used in high power conversion products. For over 20 years, SMPC has been designing power converters with very high power conversion efficiency and power density with low BOM costs.

"We are used to working with young, driven enthusiasts in this field," states Gueorgui Anguelov, President and CEO, SMPC Technologies Ltd. "What we often see is that these companies don't have the depth of knowledge in power conversion to increase design. Designing great products requires a multi-disciplinary effort using engineering expertise that few companies have in-house."

Working with Dorigo Systems, SMPC is changing how power conversion products are brought to market. Not only does SMPC offer design solutions, they also know how to efficiently manufacture high power conversion products for dc-dc converters (unidirectional or bidirectional), ac-dc rectifier, ac-ac converters and dc-ac inverters.

"We are designing solutions for companies that are experts in their field of understanding

For power conversion customers, leveraging the expertise of SMPC Technologies has been critical to Dorigo's on-going success. Both companies are located in the growing Power District of Burnaby BC, where industry leading companies, such as Ballard Power Systems, are bringing the best power conversion products to market.

but not as knowledgeable about actual chargers," says Gueorgui Anguelov, "We focus on providing solutions for Tier 2 and 3 level chargers to these organizations who are seeking a complete solution."

Level 3 chargers are the future for the EV market and will be similar to today's gas stations where EVs can charge up quickly along highways. Mr. Anguelov points to Tesla's Supercharger Stations which are currently driving this infrastructure throughout North America.

Often OEMs come to a point where they have to decide to design in-house or outsource. It's common to try and keep EV charger manufacturing in-house – is this really the best option?

A strong case for outsourcing

By trying to keep all aspects of EV charger manufacturing in-house, companies are quickly discovering that it's a struggle to innovate the product, scale production and keep costs low.

"The EV charging industry is currently a young, low-margin industry," comments Gueorgui Anguelov. "This is where an engineering and manufacturing partnership offered by Dorigo Systems and SMPC can make a dramatic difference in being competitive in power electric designs."

Partnering with Dorigo Systems ensures the power conversion designs can be prototyped and then scaled up for manufacture. As Dorigo is located nearby to SMPC, they stay within North America, avoiding 25% trade tariffs providing economies of scale to customers.

"We have built a nimble organization," Mr. Anguelov continues. "We are able to implement change in a matter of days versus weeks compared to larger firms which is a huge asset in this competitive marketplace. We also have good relationships with parts suppliers which is even more important today."

The power of a curated ecosystem

The curated ecosystem offered through Dorigo Systems ensures a complete solution for power conversion customers, including:

- Advanced computer simulation
- Optimization of electronic circuits and magnets
- Thermal management using advanced CFD codes

- Compliance with the strictest EMI safety standard
- Design for large scale and low cost manufacturing
- Design of analog and digital control systems
- Costing
- Prototyping
- Electronics manufacturing.

"Dorigo Systems is the best fit to manufacture the products we are building," states Tony Ziccardi, director of program management, SMPC. "The team is willing to learn

Lvl 2 charging stations



Danial Arooj, P.Eng., Dorigo

how to build the entire power conversion product from setting up dedicated lines, purchasing equipment, and training them to meet our specific requirements. Dorigo Systems can handle the most demanding and high complexity products and assemblies."

"Entry level prototypes are needed quickly and built by us once SMPC finalizes design," states Mr. Arooj. "From there, an SMT line is set up at Dorigo Systems for the efficient manufacture of designs."

"A great example of work completed through our ecosystem are the charging stations designed and manufactured for a leading charging solutions provider," says Tony Ziccardi. "Their electric vehicle charging stations can be used in a variety of parking lots making charging services easily accessible by EV drivers."

Dorigo Systems manufactures the charging station and electronic components for SMPC's EV-NGY 12.5W DC Fast-Charger is a high performance, low profile charger specifically designed to be incorporated into Level 3 EV charging stations. Dorigo assembles, packages and ships this industry-leading Level 3 charger.

The EV charging industry is at the forefront of a new battery fueled future powering cars, motorcycles, boats and so many other means of transportation. Being able to strategically power these vehicles will propel the adoption and growth of the EV industry as a whole. Dorigo and SMPC are ready to design the next generation of charging stations which will meet the needs of our electrified world. **EP&T**

This article was written and submitted by Dorigo Systems Ltd., a turnkey contract electronics manufacturer based in Burnaby BC.

Electronic Manufacturing Services Guide 2021

Playing an integral role in the eco system of the electronics industry in Canada, **Contract Electronics Manufacturers (CEMs)** or Electronic Manufacturing Services (EMS) providers represent one of the most important players in any design cycle.

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This guide is designed to serve our OEM readership base as a helpful source to locating a contract manufacturing partner in Canada.

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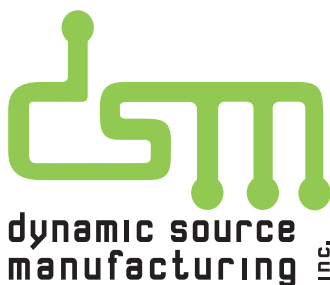
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Manufacturing the future of highly integrated electronic products

In the world of ubiquitous connectivity and widescale IoT, a design trend is playing a key role in moving electronics into the 'things' where digital intelligence unlocks value and opportunity.

BY ETHAN ESCOWITZ, CEO OF ARRIS COMPOSITES



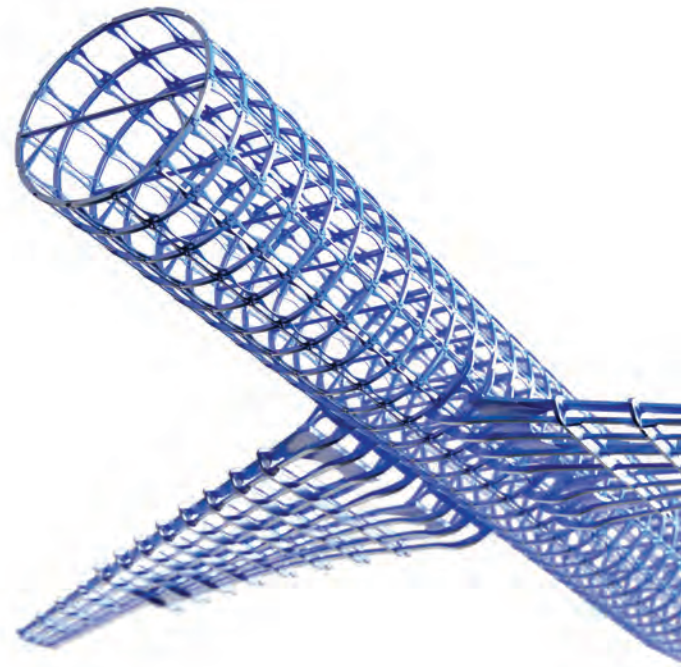
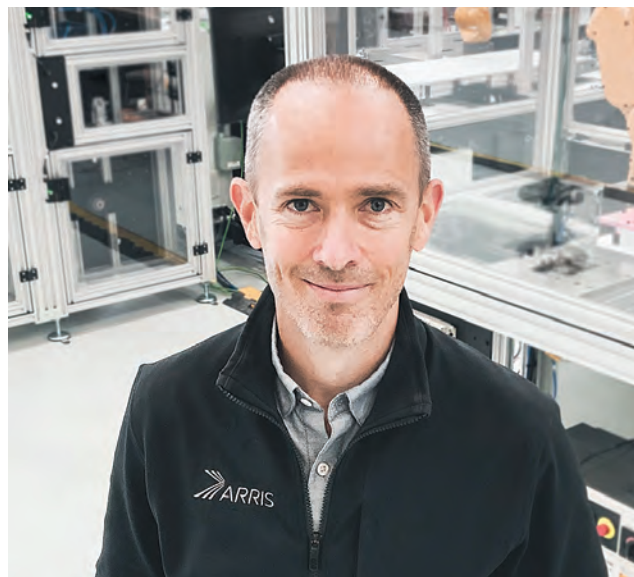
The existence of the Internet of Things is far more intuitive today as the digitally enabled "things" we interact with multiply in our everyday environments. Putting this into perspective, fifty billion web-connected devices on the planet equals 6+ connected devices for every human now living. That's a 100-fold increase since 2003. While one might think that any new IoT product would fall late on the adoption curve, the reality is far from that—there are many yet-to-be-digital "things" where new intelligence will unlock value for customers and opportunity for innovators. As IoT advances, we'll see more sophisticated digital tech in the objects and materials in our homes, products, transportation, built environment, manufacturing, and industries.

This IoT revolution is enabled by transformative breakthroughs in electrical engineering that are coming at a pace predicted by Moore's Law. But unlocking the full potential of ubiquitous digital intelligence also requires innovations beyond the circuit. Taking IoT to the next level depends on seamlessly integrating that intelligence into challenging physical environments—and that demands an entirely new approach to design for IoT products.

We can think of three levels of design integration. For level one design, think of building a custom PC. Pick your boards, pick your memory, pick your thermal management, then select an enclosure that fits everything. For level two design, think of the

first mobile phone you looked inside of; most things from level one are there, but it was impressively packed together. For level three design, think of modern cell phones where you can see subtle interfaces between different materials on the enclosure, eliminating the need for old-fashioned antennas. That enclosure is an engineering marvel—resisting a long list of mechanical load scenarios and serving as an antenna, heat sink, user interface, environmental encapsulation, and doing so with extreme pressure to occupy as little volume as possible. This exemplifies the state-of-the-art, highly integrated product designs for portable electronics that have paved the way for IoT designs. And in this space, the design and manufacturing ideal is locating the minimum amount

↓ **Arris CEO**
Ethan Escowitz
describes his
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Introducing additive molding

ARRIS has developed a design and manufacturing technology called Additive Molding that employs optimized composite materials methods within topology optimized geometries to achieve maximum mechanical performance. This manufacturing technology is scalable and, as a result, addressing the needs of a wide range of industry leaders, though we focus here on portable electronics, IoT devices, and everywhere structures and electronics are being integrated. The new design latitudes that come from employing the highest performance structural materials within previously impossible shapes and sum millimeter feature sizes are important for almost anything that moves. Particularly in the pursuit of smaller, lighter, more rugged, better-encapsulated devices with demanding thermal and antenna requirements.

The preceding structural capabilities can be attributed to the unique ability of Additive Molding to align continuous composite fibers along the stress vectors within complex parts. This approach to composite materials is quite similar to the phenomenon of a tree's wood grain developing to resist the loads on its branches. While these structural latitudes deserve a deeper dive, an additional set of functional latitudes require attention here. While a single material can be multi-functional, it is often the case that a different material would perform a secondary function substantially better. And in these cases, Additive

➔ **Additive molding enables design teams to put different materials adjacent to one another within the same part.**



Molding opens all-new possibilities by enabling design teams to put different materials adjacent to one another within the same part. The right material, in the right place, in a single part. By doing so, electronics, signal circuits, structural health monitoring, metallic components, damping, thermal requirement, cosmetics, and numerous other product requirements can be solved better than with today's existing manufacturing methods. One of the most common benefits these "better" products realize is part count reduction through part consolidation and the associated product volume reduction. The easiest way to visualize this product design ideal is to compare George Jetson's car to Luke Skywalker's X-Wing fighter. While we can wonder what all those features and materials throughout Luke's X-Wing do, you have to admit, George Jetson had a lot of functionality packed into one simple, elegant vehicle! (I bet it cost less to manufacture, too.)

Additive Molding not only enables this kind of breakthrough product differentiation, but it's also a low-energy, near zero-waste manufacturing process that creates recyclable, thermoplastic composite products. That's a sharp contrast to the more traditional unrecyclable thermoset composite materials—the old-fashioned kind that most people, those who know a bit about the material class, are familiar with using. Sustainability is a must today. It's the right thing to do, and most top brands demand it because their customers, employees, and shareholders demand it. This is an extremely important and encouraging trend since mass production can have such an impact on our planet.

When a moment like this comes, a time when an important new mass



⬆ **The low-energy, near zero-waste manufacturing process creates recyclable, thermoplastic composite products.**

⬇ **Additive molding is also used in critical industrial applications, where enhanced performance is required.**

production capability comes online, the product design space has an opportunity to harness new design latitudes and innovate at the largest scale. These are exciting times, but they can be challenging—as change often can be. Additive Molding will be used to transform products in all kinds of ways; however, it will be the forward-thinking design teams that bring about that change. These individuals are the champions who dig in and investigate how they can level up the output of their product design team with new design and manufacturing latitude. It's sometimes hard when the devices they work on have legacy materials and engineering methods that make deviations from the status quo difficult. Especially when all those components are packed so closely together that changes require buy-in from a number of different engineering disciplines. At ARRIS, working in partnership with these thought leaders is what inspires us every day. The second line of our purpose statement is, "We partner with the world's most innovative companies to imagine, design, and manufacture the future." The first line is, "To advance humanity by creating the highest performance products for everyone." We can't do #1 without #2.

Rethinking consumer electronics

The impact of materials and manufacturing innovations will be felt first in the consumer electronics space, where competition and shorter product life-cycles create rapid innovation.

Moore's Law has brought incredible advances in computational power, but while today's laptops and smartphones are far smarter than those of a decade ago, they are still housed in essentially the same boxes and casings. The next step is fitting all that functionality into a pair of glasses and

a variety of other new value-creating devices. These challenges represent opportunities for new approaches and product architectures, especially as designers address smaller form-factors for wearables.

Additive Molding meets that demand in several key ways:

- **Lighter, stronger multi-materials.** Do more with less. Improve drop and impact resistance with lighter weight, stronger composite material options with a process that allows for thinner, more compact form factors.
- **Ultra-thin capabilities.** Achieve thinner enclosures, down to 0.2mm, without compromising strength or functionality. That's transformative: devices can be made smaller and lighter than with traditional methods or gain additional volume for bigger batteries and other functionality.
- **Embedded electronics.** Incorporating antennae, sensors, wireless charging systems, and other electronic components directly into composite structures makes it possible to create sophisticated functional parts that require no additional assembly and a reduced chance of failure due to vibration, impact, or other stresses.
- **Multi-functionality.** Combine different materials seamlessly to deliver multifunctional zones such as RF-transparent windows or location-optimized strength, stiffness, thermal, and electrical properties.
- **Part consolidation.** Embedded electronics and multi-functionality reduce the need for clips, brackets, fasteners, and other parts. That means greater resilience and also a more streamlined and cost-effective manufacturing and assembly process.
- These capabilities transform the way we think about consumer electronics, and enclosures are no longer an afterthought.

Leveling up industrial electronics, too

Consumer devices aren't the only area where manufacturing innovations are having an impact. Additive Molding is used in critical industrial applications, where high-performance is required.

The award-winning Skydio X2 drone, for instance, used Additive Molding to enable the consolidation of a 17-part assembly into a single, multi-functional structure. The airframe design has the strength and stiffness of titanium at a fraction of the weight while also leveraging a multi-material approach of carbon





Ultra Thin: 3D-Aligned Continuous Fiber Parts, Down To 0.2 mm



Confidential. All Rights Reserved © 2021 ARRIS Composites



and glass fiber to achieve functional requirements.

- RF-transparent, glass-fiber window was positioned above GPS electronics to serve as an enclosure that enabled unobstructed communication.
- The highest specific strength / specific stiffness carbon fiber composite material was aligned through structural arms that supported and protected the optical equipment.
- An impact-resistant aligned-fiber feature reinforced the ends of the arms.
- Resin-rich surfaces allowed the molding of both gloss and satin Class-A surfaces without the need for post-processing and with a distinctive pattern and graphic that gave the product a very compelling and award-winning look.

By bringing state-of-the-art materials and manufacturing methods into the drone space, ARRIS is expanding the boundaries of what is possible for aerospace designers. By bringing rapid innovation and fresh design and engineering thinking into a traditionally slow-moving industry, companies like Skydio are raising the bar.



↑ **Trusses can be built with continuous carbon or glass fibers for improved strength.**

As another example, Additive Molding allows trusses to be built with continuous carbon or glass fibers for the ultimate in strength and stiffness to weight beams. More versatile than I-beams and other extruded shapes, trusses can be optimized for load scenarios in applications such as wind, aerospace, and a variety of industrial applications where

corrosion-resistant composites are more cost-effective than continually painting metal structures. And by transitioning existing industrial users of thermoset composites over to more sustainable thermoplastics, ARRIS is also helping industry leaders to achieve sustainability objectives.

Highly-integrated automotive innovations

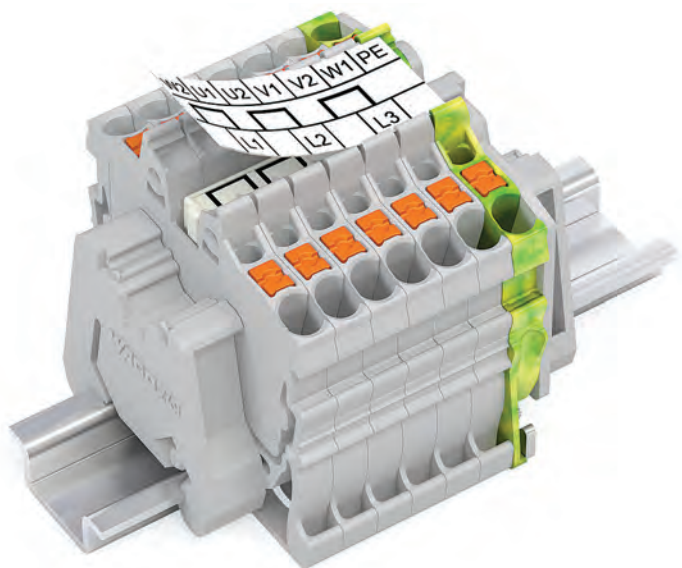
The automotive industry and human mobility are undergoing a massive transformation. Digital technologies, vehicle architectures, and even business models are suddenly shifting in a space that is usually characterized by slow incremental progress. Electronics are set to account for 50% of total vehicle cost by 2030, and similar to the economic pressure on aerospace OEMs to lightweight commercial aircraft, leaders in future mobility are reducing weight to improve the total cost of ownership of these smart, highly utilized vehicles.

For designers who want to reach beyond incremental improvement, the capabilities of Additive Molding enable teams to take a step back and look at the design and material ideals. By enabling functional materials to be embedded into a single optimized structure, teams can radically consolidate and streamline large, complex assemblies into more intelligent, optimal solutions for performance, functionality, and overall product desirability. And in a race to what's next in mobility, the prize for getting it right is extreme.

Ultimate performance meets ultimate scalability

Serving the needs of product design teams pursuing the ideals of engineering and design in materials, form, and function is at the core of ARRIS. While our design and manufacturing toolbox is the key to what's next, the individual champions that catalyze these design teams are the real change agents. Change is only possible when these individuals successfully address the engineering disciplines, product stakeholders, and organizational team dynamics to enable a more integrated outcome that is fundamentally better than what came before. **EP&T**

This article was written by Ethan Escowitz, CEO of Arris Composites, providers of next-gen composites for mass-market applications including aerospace, automotive, sports and consumer products.
<https://arriscomposites.com>



DIN-RAIL MOUNT TERMINAL BLOCKS ARE 60% SMALLER

WAGO

TOPJOB S Mini terminal block series reduces original footprint - at a size 60% smaller than firm's standard terminal blocks. Device provides the same industry-proven, Push-in CAGE CLAMP connection technology used throughout the product series, and is available with open tool slot or the easy-to-identify orange push buttons that can be easily actuated with any standard tool. Products can be mounted in various ways: miniature rail, snap-in mounting foot for chassis mount or direct mount with fixing flange.

➤ www.wago.com/us/discover-terminal-blocks/mini-rail-mount-terminal-blocks

2 & 4-PORT VNAs DELIVER RF ANALYSIS

SIGLENT



Siglent SNA5000A series 2- and 4-port Vector Network Analyzers provide a frequency analysis range of 9kHz up to 8.5GHz with a resolution of 1Hz, a dynamic range of 125dB, and a level resolution of 0.05dB. Product series consists of four models (2- or 4-port, 4.5GHz or 8.5GHz maximum frequency) that support measurements such as

scattering, differential, and time-domain parameters, Q-factor, and filter bandwidth and insertion loss. Units deliver impedance conversion, movement of measurement plane, limit testing, ripple test, fixture simulation, and adapter removal/insertion adjustments.

➤ <https://siglentna.com/vector-network-analyzer/sna5000a/>

IP68 PUSH-PULL CONNECTORS REDUCE DIAMETER

SAGER ELECTRONICS

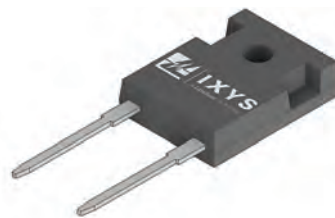


LEMO T Series IP68 water resistant push-pull Connectors are small in diameter, offering water resistant push-pull multi-pole connectors with IP68 protection. Lined with an inner sleeve that prevents penetration of solids and liquids, and a full 360° full EMC shielding, devices are specifically designed for outdoor applications. The device's outer shell comes in a standard matte chrome, used for MilAero equipment, and other applications where conditions call for ruggedized equipment. Available in solder, crimp, or print contacts.

➤ <https://www.sager.com/manufacturers/lemo-usa/lemo-t-series-ip68-water-resistant-push-pull-connectors/>

1700V SiC SCHOTTKY BARRIER DIODES SPEED SWITCHING

LITTELFUSE



LSIC2SD170Bxx Series SiC Schottky Diodes come in the TO-247-2L package with a choice of 10A, 25A, or 50A current ratings. Devices offer a variety of performance advantages, including close-to-zero reverse recovery current, high surge capability and a maximum operating junction temperature of 175°C. Devices are suitable for applications that require enhanced efficiency, reliability, and simplified thermal management.

➤ <https://www.littelfuse.com>

OSCILLOSCOPE SERVES AS LAB COMPANION

ROHDE & SCHWARZ



R&S RTO6 oscilloscope provides improved signals to insight for all applications. The large 15.6" touchscreen and a new GUI, combined with high waveform update rate, delivers improved signal fidelity, digital trigger and deep responsive memory serve as a fully integrated test solution for frequency, protocol and logic analysis. Product deliver rich measurement toolset combined with a streamlined user interface helps you quickly solve circuit issues from simple to complex. Unit comes with 6GHz maximum bandwidth and performs 1-million waveforms per second.

➤ <https://www.youtube.com/watch?v=Xz4gV6iKPt0>

EMC FILTERS SERVE 3-PHASE POWER SYSTEMS, MACHINERY

SCHURTER

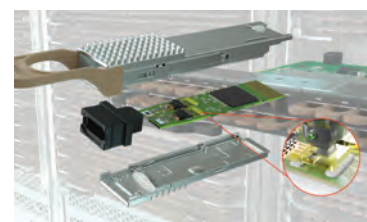


FMBD EP 3-phase + neutral line, double-stage EMC filter series delivers high attenuation capability, as well as high current and voltage ratings in a design that is more compact and lighter weight than previous generations. Product provides current ratings from 16 - 230A at an ambient temperature of 50°C. Devices are qualified for use over a wide temperature range from -40°C to 100°C with corresponding deratings applied. Devices are ENEC and cURus approved for applications up to 520Vac and ENEC and UR approved for applications up to 760Vac.

➤ www.schurter.com

OPTICAL ADHESIVE BOOSTS PERFORMANCE

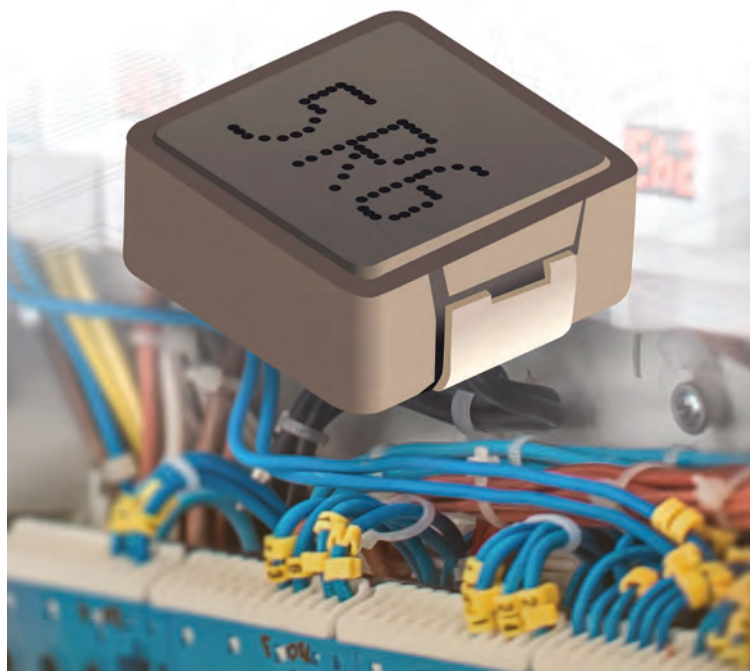
HENKEL



LOCTITE STYCAST OS 5101, a dual cure adhesive for optimal, precise optical lens and component alignment during the in-line assembly process. Material provide improved alignment accuracy for maximum light transmission in high-speed optical transport network solutions. After a first stage UV partial cure, product allows precise positioning of optical lenses within the transceiver optical sub-assembly and, once final thermal curing takes place, the material maintains its dimensional stability to ensure accurate lens position while in operation.

➤ www.henkel-northamerica.com

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SHIELDED POWER INDUCTOR IS AEC-Q200 COMPLIANT

BOURNS

Model SRP6530A Shielded Power Inductor Series meets the high current density and high temperature requirements in a variety of applications. The AEC-Q200 compliant devices provide shielded construction with a metal alloy powder core that offers low magnetic field radiation, low buzz noise, and a wide operating temperature range of -55°C to $+155^{\circ}\text{C}$. Devices are suitable for electromagnetic interference (EMI) filtering and power management solutions in consumer, industrial, and telecom electronics applications that require higher reliability. www.bourns.com/products/magnetic-products/power-inductors-aec-q200-compliant

CORD CLIPS ARE MADE IN U.S.A.

INTERPOWER

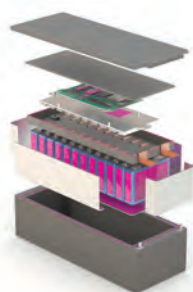


Optional cord clip serves all of firm's U.S.A.-made 3x18 AWG cords, and the 3x18 VCT-F Japanese cords.

Device is constructed of a glass-reinforced Polypropylene compounded resin for molding consistency and retention. Products are set at an optimal 4.75 inches behind the plug, and are molded in gray (P/N: 65910020) and black (P/N: 65910010). Cords are suitable for clipping excess cord to prevent tripping and injuries, and extend the life of the cord by keeping it away from tools and machinery. This Material is not Hazardous by OSHA Hazardous Communication Standard 29 CFR 1910.1200, and is not an RCRA hazardous waste compounded resin. www.interpower.com

THERMALLY CONDUCTIVE BATTERY ADHESIVE IS FLAME-RETARDANT

DELO



DELO-DUOPOX TC8686 structural adhesive for batteries used in hybrid vehicles is thermally conductive and flame-retardant. Product is suitable for low-voltage batteries found in mild hybrid and conventional hybrid vehicles, as well as in e-bikes and e-scooters. Adhesive allows battery cells to be bonded into a battery's housing while dissipating the heat

generated during operation. Instead of mechanically connecting the battery cells and then using gap fillers for heat dissipation, product combines connection of the thermal management system and structural bonding into one step.

<https://www.delo-adhesives.com/us>

BATTERY PACK TEST SYSTEM BOOSTS POWER IN LESS SPACE

KEYSIGHT TECHNOLOGIES



Scienlab SL1700A Series next gen battery pack test system for high voltage battery packs - up to 1500V for automotive and industrial applications. Product series utilizes high voltage silicon carbide (SiC) technology to improve efficiency and energy recovery capabilities, which is crucial to reduce overall lab costs. Unit provides high power in a small footprint and is modular and upgradable to address future power needs. <https://www.keysight.com/us/en/assets/3121-1291/data-sheets/SL1700A-Scienlab-Battery-Test-System-Pack-Level-Up-to-270-kW.pdf>

IP67 CABLE ASSEMBLIES ADD TAMPER RESISTANCE

AMPHENOL RF



TNC and RP-TNC configurations of waterproof IP-rated and tamper-resistant cable assemblies use 1.13mm micro coax cable and feature the ultraminiature AMC4 connector on one end. For use in applications where systems may be compromised through exposure to the elements or external tampering and offer strong protection against

either. Devices operate at 50 ohms and utilize the familiar threaded interface which ensures mating stability and reliable electrical performance. Front-mounted bulkhead jacks can be fastened on the inside of the panel.

<https://www.amphenolrf.com>

6900MHZ VCO OPERATES AT 6900MHZ

CRYSTEK

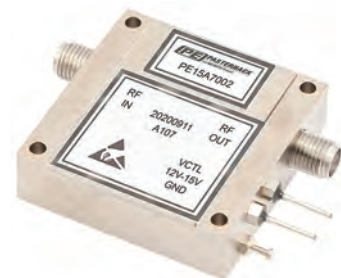


CVCO55CXT-6900-6900 VCO operates at 6900MHz with a control voltage range of 0.5V-4.5V, and features a typical phase noise of -100dBc/Hz @ 10kHz offset with improved linearity. Engineered and manufactured in the USA, device is packaged in the industry-standard 0.5 x 0.5-inch SMD package, with an output power of 2dBm. Input voltage is 8.0V, with a max current consumption of 35mA. Pulling and pushing are minimized to 0.5MHz pk-pk and 1.5MHz/V, respectively. Second harmonic suppression is -30dBc typical.

www.crystek.com

MIL-GRADE VARIABLE GAIN AMPLIFIERS BOOST PERFORMANCE

PASTERNAK



Series of 12 variable gain amplifiers address applications including instrumentation, sensors, radar, wireless communications, automatic gain control loops and more. Devices give designers the ability to vary the level of the broadband gain response using a dc voltage control and deliver unmatched performance for signal chains that require high dynamic range. Devices provide continuously variable gain control of 20dB typical over the entire

frequency band, which provides dynamic range and the ability to set signal levels.

➤ <https://www.pasternack.com>

LOW PHASE NOISE OSCILLATORS COME IN INDUSTRY STANDARD SIZES

WÜRTH ELEKTRONIK



IQD brand IQXO-408 & IQXO-455 low phase noise oscillators are available in industry standard packages of 2.5 x 2.0mm and 3.2 x 2mm. The CMOS clock oscillators can perform with a close in phase noise as low as -113dBc/Hz @ 10Hz and far out phase noise as low as -175dBc/Hz @ 100kHz (3.3V, 20MHz, IQXO-408). Devices are available at either 1.8 V, 2.5 V or 3.3 V with a phase jitter down to 40 fs RMS (over 12 kHz to 5 MHz).
➤ www.iqdfrequencyproducts.com

NASA LOW OUTGASSING SILVER FILLED EPOXY IS THERMALLY CONDUCTIVE MASTER BOND

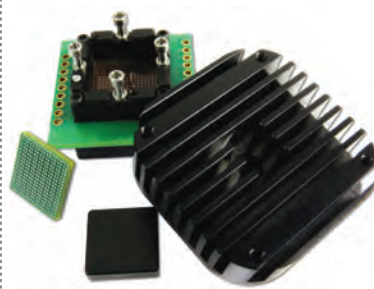


EP3HTS-TC one part NASA low outgassing rated epoxy delivers enhanced thermal conductivity of 16-17W/(m·K). Product cures rapidly at temperatures around 250-300°F [~ 125-150°C], and has an unlimited working life at room temperature. The material features a thixotropic paste consistency and is not pre-mixed and frozen. Product is suitable for automatic dispensing equipment or manual syringes and can be applied without any tailing. Product is highly electrically conductive, with a volume resistivity of less than 1x10⁻⁶ ohm-cm.
➤ <https://www.masterbond.com/certifications/nasa-low-outgassing>

BGA PACKAGE OPERATES UP TO 30GHZ BANDWIDTHS

IRONWOOD ELECTRONICS

SG-BGA-7335 high performance BGA socket for 0.65mm pitch BGA 266 pin IC's is designed for 12x12mm BGA package and operates at bandwidths up to 30GHz with less than 1dB of insertion loss. Sockets dissipate up to 4 watts with heat sinking compression screw. The contact



resistance is typically 20 milliohms per pin. The socket connects all pins with 30GHz bandwidth on all

connections. Device is mounted using supplied hardware on the target pcb with no soldering, and uses smallest footprint in the industry.

➤ <https://www.ironwoodelectronics.com/>

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World's first bridgeless totem pole PFC evaluation board - GaN Systems.

GaN Systems, Ottawa-based provider of GaN (gallium nitride) power semiconductors and ON Semiconductor, released a new 300W BTP-PFC Bridgeless Totem Pole Power Factor Correction (PFC) evaluation board. The board includes ON Semiconductor's NCP1680, the industry's first dedicated critical conduction mode (CrM) bridgeless totem pole PFC controller, and GaN Systems' 650V GS66508B GaN transistors. The devices combine to deliver an innovative cost-effective and high-performing solution in a small footprint.

The solution enables power engineers to evaluate GaN and capitalize on its benefits in improving power system performance. The evaluation board allows rapid development of advanced totem pole PFC designs and suitable in various power supply applications for the data center, telecom, industrial and consumer industries.

Altogether, the solution achieves near 99% efficiency, simplifies design and reduces BOM count cost.

CEMS

CELESTICA INVESTS IN NEW US FACILITY

Toronto-based contract electronics manufacturer Celestica Inc., recently marked the grand opening of its AbelConn Electronics facility in Maple Grove MN, a wholly-owned subsidiary of Celestica. The facility provides rapid prototyping, volume manufacturing, and engineering support for the defense and aerospace industries.

The 110,000 sq. ft. facility gives the firm the additional capacity in a key U.S. region to serve customers in defense, aerospace and other highly regulated markets such as health-tech, industrial and smart energy.

As part of its growth strategy, AbelConn is expanding its core capabilities around ITAR-certified volume production for chassis, circuit card assembly (CCA), backplanes, and connectors. Additionally, the firm is adding new capabilities, including engineering services, licensing, and repair and overhaul. The site is also obtaining ISO 13485 cert for the HealthTech market.

PCBS

BITTELE OFFERS FREE PASSIVES ON PCB ORDERS

Bittele Electronics Inc., a Toronto-based turn-key printed circuit board (pcb) manufacturer specializing in prototype and low-to-mid volume assembly, is offering its customers free passive parts via its online ordering system. Any passive part on a turnkey order's bill of materials (BOM) with a direct match to a part number in Bittele's inventory will be automatically provided to a customer, free of charge.

"Not only do you benefit from a lower BOM cost, our free passive parts offer also helps to reduce the lead time of your order since the parts are already at our production facility, says Bittele CEO Ben Yang.

Using Bittele's parts database when creating the BOM is the best way to ensure your order uses as many free parts as possible. However, even if that BOM doesn't contain part numbers from Bittele's parts library, customer's may still take advantage of the free passive parts offer using the *View Alternates* function of the online ordering system. "If a suitable substitution is found in Bittele's inventory, we will provide the part for free," Yang adds.

MOTION CONTROL

PI OPENS SILICON VALLEY TECH CENTER

German-based motion control, piezo tech and nanopositioning systems expert PI (Physik Instrumente) has opened a new tech centre in Silicon Valley as its most recent expansion in the US, to better support and meet the needs of new and existing customers.



The Tech Center houses the 'It's Possible' Lab as a secure environment to collaborate with customers on new innovations, as well as permanent product demos and conference and training space.

"Providing localized technical expertise in one of the most innovative regions in the world will further our collaborations with thought leaders in Photonics, Industrial Automation, Life Sciences, and Semiconductor markets, not to mention the numerous research institutions that know PI very well" said Dave Rego, President of PI Americas. "Our new Tech Center facility is a welcome addition enabling our current and future customers to push the boundaries of Nanopositioning, Performance Automation, and Piezo Technology within their cutting-edge applications. To say we are excited, is an understatement."

The Silicon Valley Tech Center joins PI's existing sales and applications office in the Los Angeles area, while the Americas headquarters is outside of Boston, MA, with additional engineering and manufacturing facilities in Hopkinton, MA and Nashua, NH.

DISTRIBUTION

MOUSER & ANALOG DEVICES DEBUT EBOOK



Mouser Electronics Inc. introduced an eBook in collaboration with Analog Devices Inc., exploring the technological innovations and wide-reaching applications of Industry 4.0. In

Industry 4.0 and Beyond, technical experts from Analog Devices offer insightful perspectives on topics such as industrial connectivity, condition monitoring, software-configurable hardware, factory security, and robotics and machine tool applications.

Industry 4.0 is being driven by advances in edge-to-cloud computing, software-configurable systems, analytics and other key areas, leading to new applications that are safer and more productive than those that came before.

The eBook offers seven detailed feature articles on applications for Industry 4.0, featuring product information for more than a dozen Analog Devices products, connecting designers directly to the tools required for Industry 4.0-ready solutions. The eBook also offers multiple embedded videos, providing an added layer of valuable instructional content.

BIZ GROWTH

SIEMENS SEES DOUBLE DIGIT GROWTH


Germany's Siemens AG raised its outlook for the year, joining other major European industrial companies in signaling that the economic recovery from the coronavirus pandemic is gathering pace despite parts shortages and concerns over the spread of the delta variant.

Rebounding global demand for infrastructure and manufacturing software led to a sharp increase in orders in the April-June quarter at Munich-based Siemens AG, with an order from U.S. rail company Amtrak a large contributor. Siemens said orders saw double-digit growth in all industrial businesses and reporting regions.

The engineering and manufacturing company raised its outlook for its fiscal year, joining Volkswagen and Airbus in raising their predictions for business performance amid a global recovery from the worst of the pandemic shutdowns in the April-June quarter a year ago.

Siemens cautioned that its business could be affected by the same shortage of semiconductors for electronic components that has forced production cutbacks among automakers. **EP&T**

PRODUCT SOURCE GUIDE



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TEARDOWN

Oura Ring 2 is jam-packed with tech

BY IFIXIT



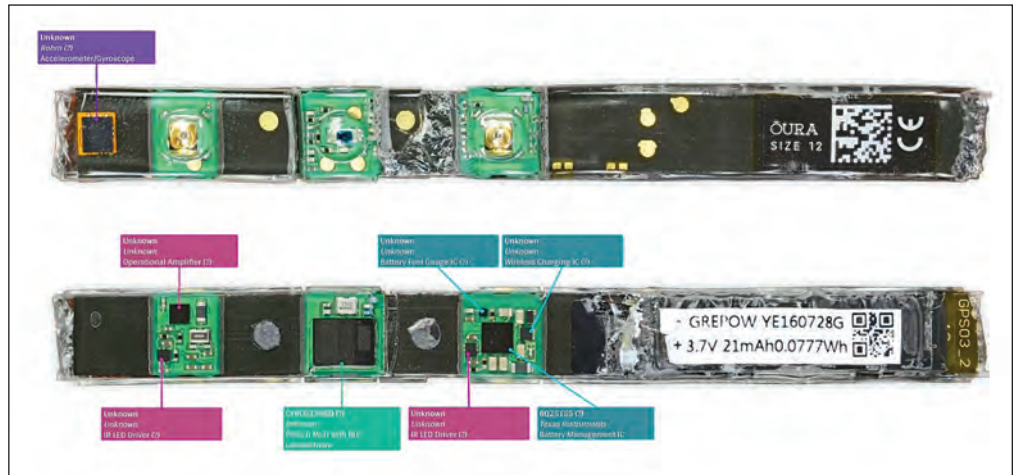
The Oura Ring has been around for a while now, but it didn't become mainstream news until the NBA got one for each player to try to detect early signs of COVID-19. There are a lot of questions about the effectiveness of the Oura Ring, but one thing's for sure: it's jam-packed with a lot of tech for such a small device.

The Oura Ring is interesting for a whole basket of reasons, but, especially because it monitors your vitals and analyzes your sleep. We've seen a lot of gimmicky devices over the years, but it's in our blood to understand how new tech works—so we took it apart to find out what tech is hiding underneath that .25 OZ of titanium.

This is primarily a video teardown, but intrepid iFixit community members have also submitted their own analyses.

One iFixit follower in particular spent hours attempting to reverse engineer the Oura Ring 2 through the video, datasheets, and X-rays, and shared the following:

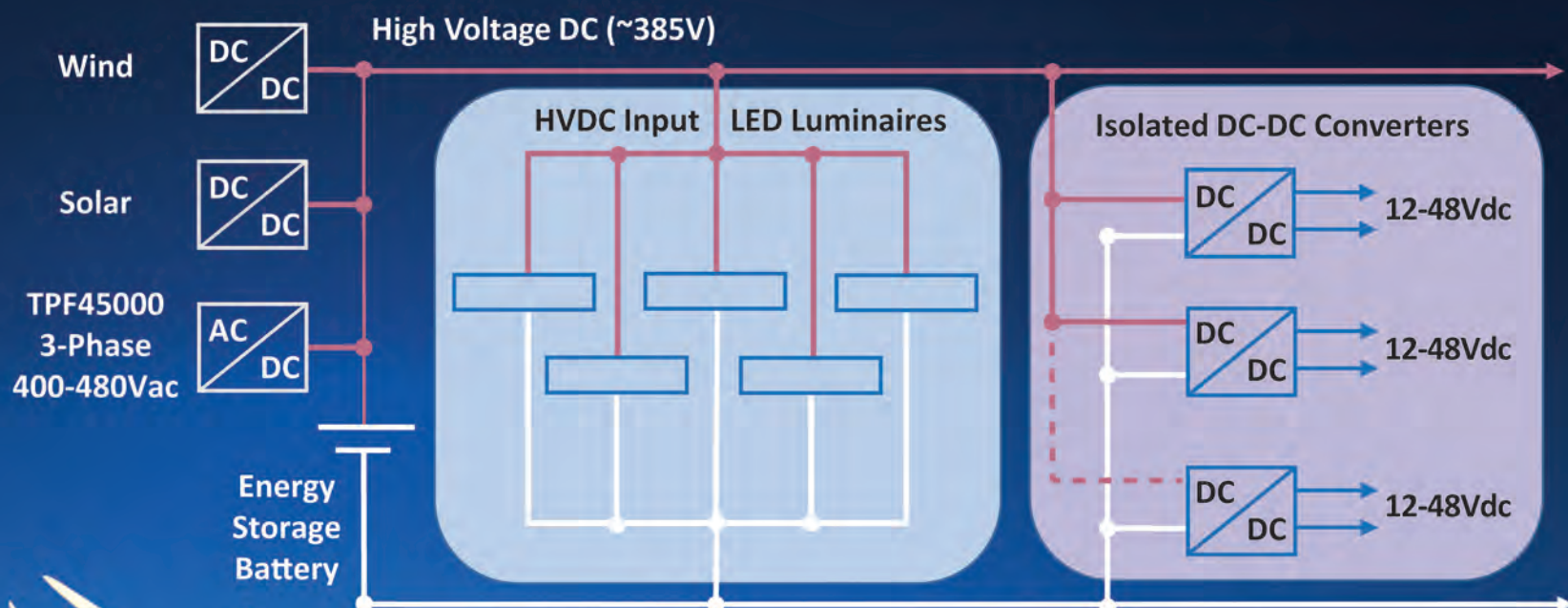
- The two IR LED drivers should be the same type, one for each IR LED.
- There's likely an operational amplifier for signal conditioning for the photo diode before the signal is sent to the microcontroller. (This is commonly done with these type of photo diode based health meters.)
- If this is not a microcontroller, it could be a temperature sensor (not a thermistor).
- A wireless charging IC, predicted based on its surrounding components and location.
- And finally, a battery fuel gauge IC for probably determining battery health.



These findings are from **iFixit**, the open source repair guide. The popular site teaches people how to fix just about any electronic device, and sells the parts and tools to make it possible. Anyone can create a repair manual for a device or edit the existing guides to improve them. iFixit empowers individuals to share their technical knowledge and teach the rest of the world how to fix their stuff. <https://canada.ifixit.com>



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