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MARCH 2023

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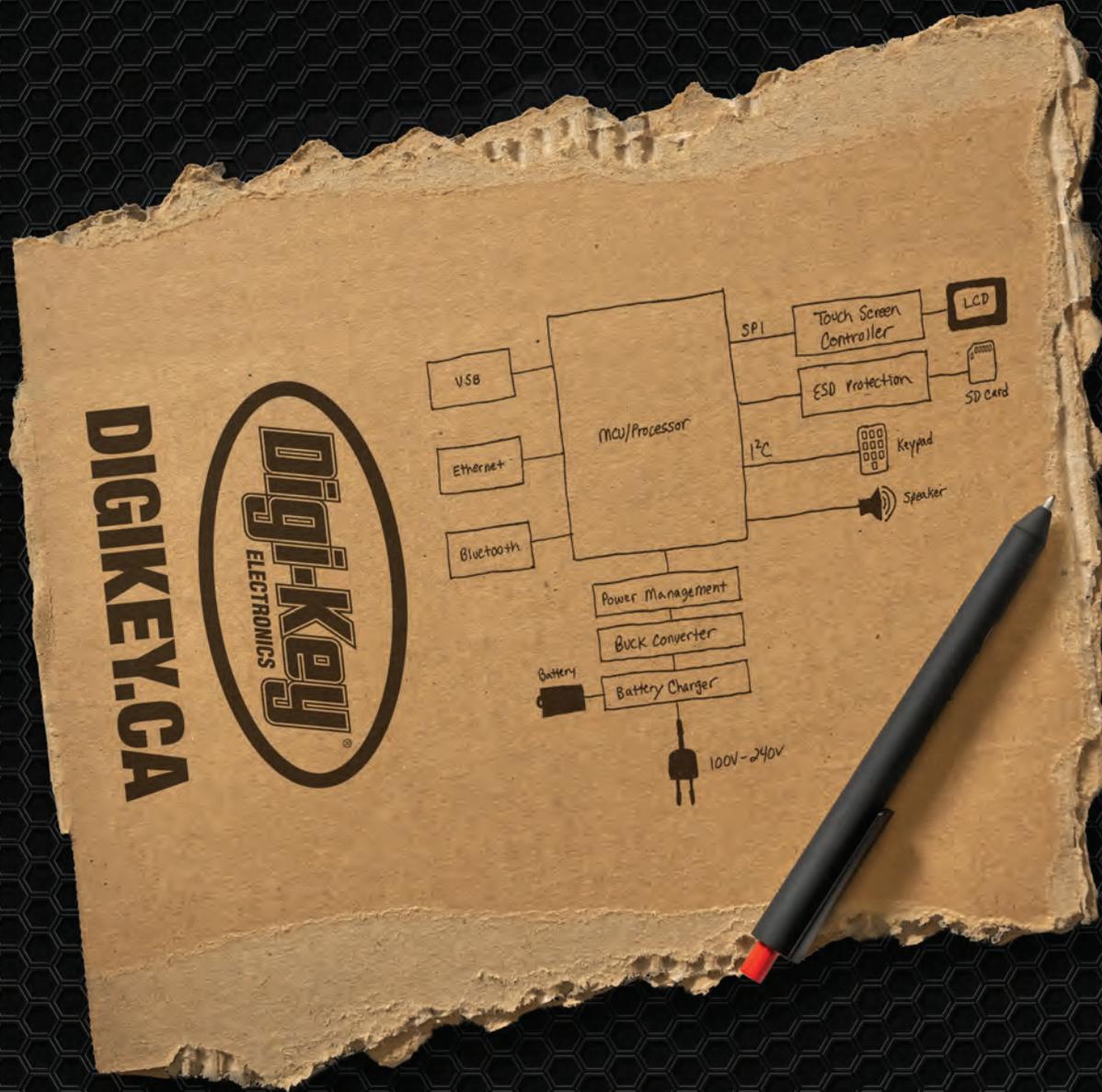
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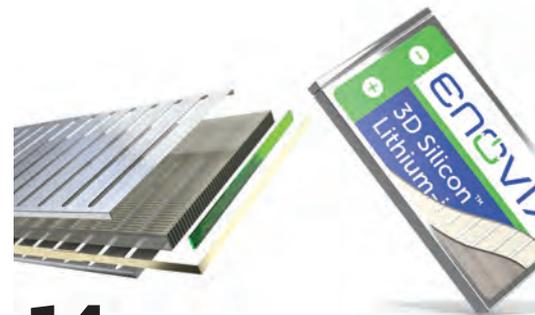
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Advanced silicon-anode lithium-ion battery is safer and more energy dense than any on the market.

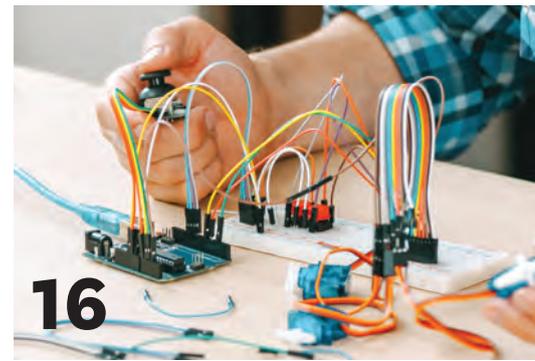
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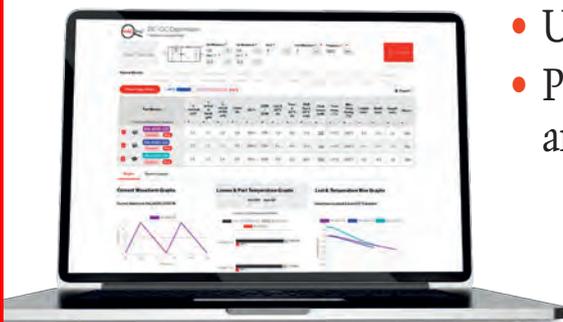
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How to build an electronic design?

Let's ask AI language sensation ChatGPT



If you're not familiar with ChatGPT - it is the new AI-driven language tool that is 'breaking' the Internet. It can generate human-like text with high accuracy and coherence when you ask it a question. It quickly summarizes an answer into what should be a grammatically correct and punctuated paragraph.

Within two weeks of its late November launch, millions of users were trying out the large language-model app. Developed by OpenAI, the chatbot is built on top of the research firm's GPT-3 family of large language models and has been fine-tuned using both supervised and reinforcement learning techniques.

It is also poised to introduce AI to anyone who has managed to avoid it so far. It has put the power of AI systems on full display for everyone in an entertaining and immediately graspable way.

ChatGPT has its critics as well. Noting that like humans, it has an ideology and bias of its own. Some users have found it is not as objective and nonpartisan as one would expect from a machine. But, that may be conversation for another time.

The platform accesses massive amounts of text data from books, websites and other sources to generate responses. So, being as intrigued as the next person, I took a free trial with ChatGPT and asked it a question relevant to my readership.

What are some of the most important factors in creating an electronic design.

The ChatGPT response was as follows:

There are several important factors to consider when creating an

electronic design. Here are some of the most crucial ones:

- **Functionality:** The design must fulfill its intended purpose and meet the necessary requirements. This includes things like performance, accuracy, speed, and reliability.

"It is also poised to introduce AI to anyone who has managed to avoid it so far. It has put the power of AI systems on full display for everyone in an entertaining and immediately graspable way"

- **Safety:** Electronic designs must be safe for both the end user and any other parties involved. Safety considerations can include things like electrical hazards, fire risks, and electromagnetic interference.

- **Power:** Power consumption is an important factor to consider in electronic designs. You must ensure that the design is optimized to minimize power usage while still meeting performance requirements.

- **Size and form factor:** The size and form factor of the electronic design must be appropriate for its intended use. This includes considerations such as the physical size of components, the layout of the circuit board, and the overall packaging of the device.

- **Cost:** The cost of the electronic design is an important factor that must be taken into account during the design process. The design should be cost-effective while still meeting all the necessary requirements.

- **Manufacturability:** The electronic design must be able to

be manufactured at scale. This includes things like design for manufacturability, the availability of components, and the ability to test and troubleshoot the device during production.

- **Environmental factors:** The electronic design must be able to operate in the intended environmental conditions, such as temperature, humidity, and electromagnetic interference.

Overall, creating an electronic design is a complex process that requires careful consideration of many different factors. By paying attention to these critical factors, you can help ensure that your design is successful and meets all necessary requirements.

In conclusion

In the coming years, advances in machine learning and natural language processing will keep enhancing the capabilities of language models like ChatGPT. The ability of language models to comprehend and produce human-like language, as well as to do increasingly difficult tasks like producing code or writing extensive articles, should continue to accelerate through the next few years. As would be expected, more companies are targeting the release of their own chatbots.

Will this AI app bring about the dawn of a new age of communication and how will it change our lives? Some people worry technologies demonstrated by ChatGPT could disrupt industries, potentially putting artists, tutors, coders, writers and journalists out of work. I guess we will have to wait and see? Hopefully not too soon - I've got another magazine issue to put out. **EP&T**

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EP&T

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AUTOMOTIVE

MAGNA'S CLEARVIEW VISION SYSTEM COMES TO MARKET

Magna International Inc. has begun production its ClearView vision technology on the Ram 2500 and 3500 Heavy Duty trucks, designed to make the vehicles smarter and safer. The unique system, which bundles camera and mirror technology, has the potential to reduce blind-spot accidents and promote safety by enhancing visibility around the vehicle. ClearView also provides other benefits including making it easier to park and maneuver the vehicle.

The ClearView system includes an interior rear-view video mirror, exterior mirrors with integrated cameras and a center high-mounted stop lamp camera. An additional trailer camera is available as an option to provide an unobstructed view while towing. All camera data is processed through Magna's software in a central electronic control unit. The interior mirror display also includes several other customizable features including the ability to zoom in and out, adjust brightness, rotate or move the images to the left, right, up or down.

PROJECT ARROW DEBUTS ZERO EMISSION VEHICLE

Project Arrow - the first Canadian zero-emission vehicle was unveiled at CES in January. The sleek, silver concept vehicle was completely designed, engineered and built in Canada, involving 58 partners and led by the Automotive Parts Manufacturers' Association.



The ClearView system includes an interior rear-view video mirror, exterior mirrors with integrated cameras and a centre high-mounted stop lamp camera.

The vehicle's design comes from Carleton University in Ottawa and the Ontario Tech University in Oshawa teamed up with the manufacturers' association to build the prototype.

The manufacturers' association says Canada has not launched a global automaker in 100 years, but Project Arrow is meant to prove the country can offer mobility technology to the world.

META MATERIALS FEATURED IN APMA CAR

Meta Materials Inc. a Halifax NS-based developer of high-performance functional materials and nanocomposites, announced that its NANOWEB automotive product applications is featured in Project Arrow.

Meta Materials has developed several technologies that uniquely benefit the automotive industry and its customers, with a clear focus on high performance, sustainable solutions.



Meta Materials' NANOWEB product offers multiple applications such de-icing and defogging in automobiles.

"We're proud to be working together with Canada's automotive supply sector and post-secondary institutions to deliver this game-changing vehicle designed from the bottom up specifically for the Canadian environment and its harsh winter conditions," said George Palikaras, president and CEO. "We're poised to turn powerful concepts into practical applications, utilizing invisible nanocomposite technologies."

According to Palikaras, Meta Materials' automotive solutions "do more with less" by addressing the need for more efficient and sustainable material use, with an added benefit of improved functionality. The firm's NANOWEB product offers multiple applications such de-icing and defogging, EMI shielding, electrochromic glass to reduce heat buildup in summertime and act as a vehicle antenna, while remaining completely transparent.

DIRAC JOINS FORCES WITH BLACKBERRY QNX

BlackBerry QNX has partnered with Swedish digital audio pioneer Dirac to integrate the firm's award-winning Opteo professional solution into the QNX Acoustics Management Platform. The aim will be to make it easier and more affordable for automakers to digitally upgrade the performance of sound systems in high-end vehicles.



The two companies have already begun work on the first implementation in a high-end electric vehicle for a leading European manufacturer.

According to Lars Carlsson, Dirac's vice-president and head of business development automotive audio, the partnership enables automakers to optimize the sound experience across entire vehicle lineups while also demonstrating Dirac and BlackBerry QNX's shared commitment to supporting the growing trend of software-defined vehicles that can offer subscription-based upgrades capable of receiving over-the-air software updates.

ELEVEN-X'S PARKING SOLUTION WINS IOT AWARD



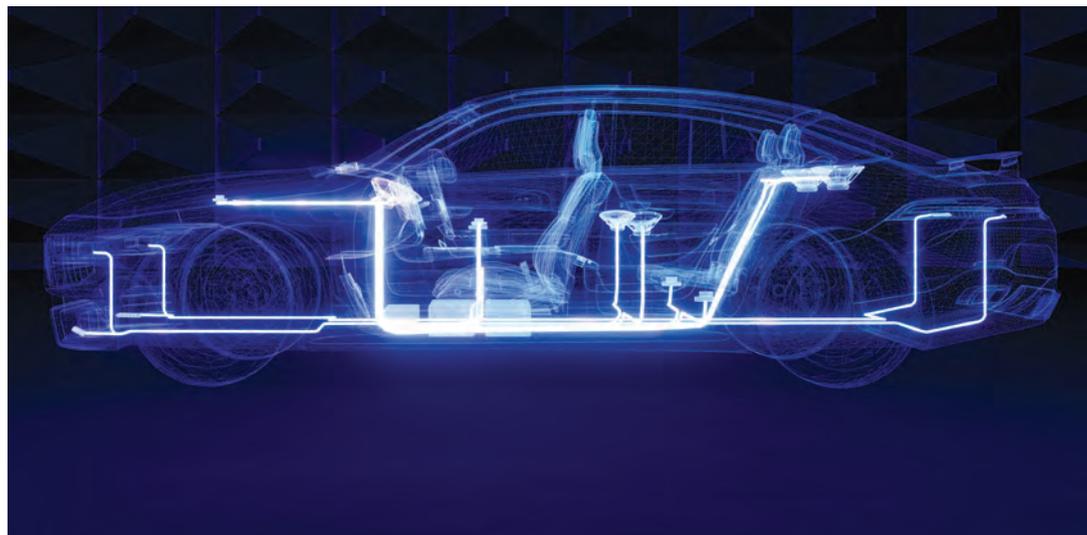
Waterloo-based eleven-x, a global leader providing wireless IoT and smart city solutions, announced that its eXactpark solution has been named 'Overall Smart City Solution Of The Year' – recognized by market intelligence organization IoT Breakthrough.

The innovative smart parking monitoring solution, which is already being utilized by cities and institutions across North America, enables a stress-free parking experience for drivers and improved oversight for parking managers. The comprehensive solution combines a sensor-based real-time occupancy monitoring technology and a complete software platform that provides insight on parking availability for wayfinding as well as more efficient parking management.

WIRELESS

UWATERLOO LEADS 5G TECH CONSORTIUM

The University of Waterloo recently announced a 5G and beyond mobile network technology consortium to develop secure 5G mobile networks and improve Canada's security and defence. The group is funded by the Department of National Defence (DND) through its Innovation for Defence



Dirac will integrate its Opteo digital audio solution into the QNX Acoustics Management Platform.

Excellence and Security (IDEaS) program. A team of computer scientists at Waterloo is leading the \$1.5 million multi-partner consortium.

The three-year project brings together academic and industry partners from École de technologie supérieure in Montréal, University of Regina, BlackBerry, NoviFlow, and Rockport Networks, with support from Rogers Communications Canada to create new solutions to secure 5G mobile networks.

This latest global wireless standard delivers reliable, high-speed data transfers with very little delay — advanced communications technology that is transforming businesses, industries, and nations.

Among the technologies the consortium will develop are artificial intelligence systems to detect a range of cyberattacks on 5G network slices as they happen, then respond quickly and automatically with countermeasures to keep the network secure. Additionally, security requirements will be built into the 5G network slices themselves using end-to-end network slice orchestration that responds dynamically to an application's security requirements and the severity of threats.

UWINDSOR LAUNCHES 5G CONNECTED CAMPUS

The University of Windsor (UWindsor) and TELUS have launched a 5G connected campus and commercial lab to support advanced research with 5G technology and establish the university as a go-to centre for innovation. TELUS is investing \$5 million as part of a multi-year agreement that began in 2020 to fuel the development of new applications for 5G technology.

The collaboration will not only support multidisciplinary research

in the agriculture, advanced manufacturing, and connected and autonomous vehicles (CAVs) sectors, but will transform UWindsor campuses to enhance teaching, innovation and collaboration.

WEARABLES

ESIGHT UNVEILS NEXT GEN ASSISTIVE DESIGN



Toronto-based vision-enhancement platform, eSight, recently launched its latest innovation in assistive technology. eSight Go is a wearable device that sets a new standard for enhanced vision technology through its heightened visual clarity, lightweight design and expansive field of view, helping those with central vision loss gain independence in their everyday life.

"We've spent the past year vastly improving the capacity and design of our digital eyewear, not only to help enhance vision for our visually impaired users, but so they can enjoy an enriched and fulfilling livelihood in the most seamless way possible," said eSight director of product marketing Roland Mattern.

Used by thousands of people across the globe with over 20 different eye conditions, eSight devices use a combination of hardware and software to enhance vision through a nimble, wearable design that does not restrict a wearer's full periphery. eSight Go is designed for 100 percent mobility retention, allowing people to use the technology while at school, work, home and enjoying time with friends and family. **EP&T**

5G

Consortium will develop AI systems to detect a range of cyberattacks on 5G network slices as they happen.

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

BC analytics firm scores with amateur hockey

Drive Hockey's sensor-based system made affordable, accessible

BY SOHAIL KAMAL, WEST COAST CORRESPONDENT

 Hockey. Canada's favorite sport. With North Vancouver's phenom Connor Beard and Canada's recent junior hockey gold medal, there has been a renewed interest in junior hockey. Young players are arriving at the NHL level stronger and more skillful seemingly every year.

To keep up, coaches and scouts are relying increasingly on data-driven analytics. Drive Hockey Analytics is helping to fill this void. West Coast Report recently had the opportunity to connect with Adam Nathwani, COO of Drive Hockey, about Drive Hockey's growth and development in amateur hockey.

"Drive Hockey has matured from testing and developing the concept to actually building and selling our player and puck tracking system. In 2019, it was working mainly with prototypes in a controlled lab-type environment. Today, the system is in use in live events by actual teams and leagues," says Nathwani.

Expand across Canada

They recently tracked the British Columbia Hockey League (BCHL) Top Prospect Game and have been asked by other notable leagues and organizations to introduce their technology into their operations. The company has also grown the team, adding skills and experience in operations, sales, data engineering, and pro-level hockey training.

"We were accepted into the Future of Sport Lab, a sports technology venture accelerator program run by Maple Leaf Sport and Entertainment (MLSE) and Toronto Met University," says Nathwani. "We have also expanded from Vancouver to Calgary, Ottawa, and Hamilton through our Service Partner program with other key hockey cities in the pipeline across North America and parts of Europe."

Drive Hockey's mission is to bring pro-level analytics to amateur hockey by providing



Drive Hockey's analytics system involves a suite of sensors using ultra-wideband technology to capture data.



Adam Nathwani, COO of Drive Hockey Analytics

athlete and game intelligence to fast-track player development in a simple and affordable way. The NHL is investing heavily in data capture and analytics but few other leagues have those resources.

"We are able to give [amateur hockey] that top-quality data and fill a gap in the market. Working with the BCHL brings credibility. They are a major development league that sees the benefits of bringing data into the player development process as well as new opportunities it enables in scouting, media, broadcasting, and fan engagement," explains Nathwani. "The BCHL is known as a forward-thinking,

innovative league so there is significant alignment with our organizations."

Deeper dive stats

The richness of their data capture, at 3K data points per second, allows for a considerable depth of analytics at the amateur levels and is more consistent with what is available at the NHL level.

"Our data allows us to provide insight beyond box score or superficial stats but rather dive deeper into hockey events, what led to them, what their outcomes were, and all the situational context around them," says Nathwani.

"Players have a better understanding of their game, can track progress, can benchmark against peers and competitors, and can see their deficiencies and strengths. A coach can do the same at the team level but can also understand the differences in their players for more targeted, specific player development."

Drive Hockey's offering also allows fans to engage with the sport in new ways leveraging data through the integration of data into the broadcast feeds, in-arena experience, and gaming, among others. GMs can use data as an additional tool for scouting, trade consideration, recruitment, and

roster management just like an NHL GM would.

Sensors on the players

The system involves a suite of sensors using ultra-wideband technology to capture rich player and team performance data automatically, objectively, and in real-time.

The data is fed through their data system and AI models identify hockey-specific events and skills which are then visualized on their online platform where coaches, players, and other stakeholders can review a variety of athletics, gameplay, tactical, and skill-based metrics shortly after their ice time.

"We use portable sensors around the ice rink that can be taken from rink to rink and set up in under 15 minutes, sensors on the players as a wearable, sensors in our custom pucks, and sensors in the stick through a stick insert that all work together to capture 3K data points per second," says Nathwani. **EP&T**

To learn more, go to drivehockey.com



Sohail Kamal is EP&T's West Coast correspondent. sohail@nextgear.ca

EU updates REACH chemicals

BY RANA SADEGHI, M.ENG IN ENVIRONMENTAL ENGINEERING AT ENVIROPASS



REACH is one of the major European environmental laws regulating hazardous substances. This legislation affects importers and manufacturers. Every six months, the European Union updates the REACH chemicals on the Candidate List of Substances of Very High Concern (SVHC). Here is the most recent addition.

233 SVHC

The EU REACH list of SVHC is an essential inventory of hazardous substances that businesses must monitor regularly. These substances have negative impacts on human health and the environment. Therefore, producers must notify downstream users if a component of an electronic assembly contains an SVHC at a concentration of 0.1% or more (weight by weight). On January 17, 2023, the European Chemicals Agency (ECHA) added nine high-risk substances to the SVHC list. Therefore, there are now 233 SVHC on the Candidate List of REACH.

Latest REACH Chemicals

Some of the latest SVHCs may impact applications in the electrical and electronic industry. The table below provides examples of these substances, their hazard, and their applications in Electrical and Electronic Equipment (EEE).

What is EU REACH regulation?

The Registration, Evaluation, Authorization, and Restriction of Chemicals regulation (1907/2006/EC), also known as EU REACH, is a legal requirement that producers, importers, and distributors putting products into the European market must comply with. According to ECHA, this legislation aims to strengthen the protection of human health and the environment from the risks that hazardous chemicals can cause while increasing the competitiveness of the EU chemicals sector. Accordingly, substances restricted under Annex XVII of the regulation and declarable chemicals in the Candidate List defined as SVHC pose certain legal obligations for the manufacturers, importers, and suppliers of an article, including EEE. EEE may indeed contain REACH regulated chemicals. For instance, Bis (2-ethyl (hexyl) phthalate (DEHP) is an SVHC found as a plasticizer in polymers (e.g., PVC and vinyl chloride resins). Notably, DEHP is also one of the four phthalates restricted under directive 2015/863/EU, known as RoHS.

Annex XVII: Restricted List

Annex XVII of the REACH regulation contains a list of restricted chemicals in various

Table 1

Substance Name	CAS #	Hazards	Example of Applications (Where used)
1,1'-[ethane-1,2-diyl(bisoxo)] bis[2,4,6-tribromobenzene] (BTBPE)	37853-59-1	Very Persistent and very Bioaccumulative (vPvB)	Acrylonitrile butadiene-polystyrene (ABS) and high-impact polystyrene (HIPS) resins in EEE products
2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol (TBBPA)	79-94-7	Carcinogenic	Brominated flame-retardant used in printed circuit boards and printed wiring boards (PWB)
Barium diboron tetraoxide	13701-59-2	Toxic for reproduction	PVC truck foil and electrical wires coatings
bis(2-ethylhexyl) tetrabromophthalate covering any of the individual isomers and/or combinations thereof		Very Persistent and very Bioaccumulative (vPvB)	Adhesives and sealants, plastic, and rubber

Table 2

Substance Name	CAS #	Conditions for the restriction (Simplified)
Nickel	7440-02-0	Restricted in articles intended to come into direct and prolonged contact with the skin (e.g., nickel finishes in a handle or button)
C9-C14 linear and/or branched perfluorocarboxylic acids (C9-C14 PFCAs), their salts and C9-C14 PFCAs-related substances, perfluorononanoic acid (PFNA); nonadecafluorodecanoic acid (PFDA); heneicosfluoroundecanoic acid (PFUnDA); tricosfluorododecanoic acid (PFDoDA); pentacosfluorotridecanoic acid (PFTTrDA); heptacosfluorotetradecanoic acid (PFTDA); including their salts and precursors	2058-94-8, 307-55-1, 335-76-2, 375-95-1, 376-06-7, 72629-94-8	Shall not be manufactured, or placed on the market as substances on their own from 25 February 2023. Shall not, from 25 February 2023, be used in, or placed on the market in: (a) another substance, as a constituent (b) a mixture (c) an article. Exemptions apply.

substances, mixtures, or articles. It is important to note that the EU regularly amends restrictions to Annex XVII. Examples of these restricted substances and their conditions, particularly applicable to EEE products, are:

SCIP: REACH SVHC notification database

The SCIP database provides information on Substances of Concern in articles as such or in complex objects (Products). As of 5 January 2021, suppliers putting articles containing SVHC on the Candidate List in concentration more than 0.1% w/w into the EU market must submit information on these articles to ECHA. SCIP is an effective tool to improve data sharing and provide greater transparency. Consequently, it guarantees that information on SVHC-containing articles is available to end-users throughout the entire lifetime of products, including at the disposal stage.

Compliance with EU REACH

Lacking accurate SVHC disclosures or not adhering to REACH Annex XVII may lead to fines and product withdrawal from the EU market. Particularly, keeping up with the periodic updates of the REACH chemicals can be challenging for businesses. Companies can prevent relevant legal issues and demonstrate due diligence by implementing an environmental product compliance management system. MACC (Monitor, Assess, Correct, Communicate) is one of the environmental compliance approaches used for this purpose. Furthermore, organizations can get help from consulting firms specialized in product compliance and providing various services, including lab testing, documentation, and registration. **EP&T**

EnviroPass Inc. is an independent consultant offering environmental compliance solutions. <https://www.getenviropass.com/>

RACK ‘EM UP

Addressing the circuit protection and power distribution requirements of data centre racks

BY CARLING TECHNOLOGIES INC.

➔ Data centres are quickly evolving thanks to initiatives driving the adoption of green technologies, reduced physical footprints, increased densities, and better environmental controls. In response, several OEMs now preconfigure equipment racks with computing and storage solutions, helping to increase efficiencies while incorporating management controls, monitoring systems, and expansion capabilities.

Integrated, well-designed equipment racks are now the foundation of a data centre. However, racks can (and do) fail, bringing operations to a halt and introducing downtime into operations that are expected to function 24/7. Because of the equipment rack's importance in a data centre, it is crucial for OEMs to incorporate more resiliency into their preconfigured offerings and adopt best practices that ensure their equipment functions as intended.

One important way to improve the quality and resiliency of preconfigured equipment racks is to use reliable power distribution units (PDUs) with circuit protection components designed for data and telecom centre applications. After all, an equipment rack is only as good as its PDU, and a PDU is only as good as its circuit protection.

Critical role of data centre PDUs

Data centres need to fit a lot of equipment into a small space, including PDUs that send power to servers. PDUs, in turn, need circuit breakers to protect sensitive electronics from short circuits and overcurrent conditions. In these confined spaces, the risk of fires and overheating are real concerns. Selecting inferior circuit breakers can lead to equipment damage, unreliability, and dangerous situations.

An equipment rack or enclosure must be designed to deal with the



physical equipment housed inside, and that means incorporating PDUs and circuitry protection that extends the life of the equipment.

As you would expect, PDUs are facing the same evolutionary demands placed upon the reengineering of data centres, which means PDUs themselves have to be more efficient and reliable and take up less space while generating less heat. As densities increase and component miniaturization becomes more necessary, PDUs also need to incorporate better circuit protection technologies.

What to look for in circuit protection components

Making sure data centre equipment is properly protected means using a PDU with circuit protection technology that can operate under the expected conditions. Important criteria to consider include:

Operational Environment: What temperature range is the PDU likely to encounter, and what levels of humidity are expected? Better components have the ability to work under greater variations in temperature and humidity.

24/7

Racks can fail, halting operations and causing downtime while businesses must function 24/7



Ease of Service: Can the PDU be reset? Does it support hot swaps of components? Does it provide a bypass capability? Are replacement parts readily available? How long is the product life cycle? What guarantees are in place to ensure long-term parts availability?

Reliability: Has MTBF been tested? What is the rated number of cycles on the components? How does the device deal with dirty power sources, load ramping, surges, and other power problems?

Safety: What type of circuit protection is in use? Are buttons and controls protected from accidental activation? Is there any method to prevent accidental disconnects? How are cables routed? Are there any sharp edges? Is there ground fault protection? How well is the PDU secured to the rack?

Efficiency: Are increased densities supported (1RU sizing)? What footprint reduction options are available? Are management and monitoring tools included? Are any types of power

PDU

Power distribution units (PDU) are facing the same evolutionary demands placed upon the re-engineering of data centres

alarms available? Are hydraulic-magnetic circuit breakers available?

With all of these criteria to consider, it is easy to see how complex choosing the right PDU for an equipment rack can be. Nevertheless, protecting connected devices comes down to one undeniable fact, and that is the quality and type of circuit breaker involved.

Circuit breaker solutions for data centres

Circuit breakers are the most critical component of any PDU. Much like any other technology, circuit breakers have evolved and offer many different ancillary features that mark design excellence. As IT equipment has become more sensitive to power variances, surges, and so forth, circuit breakers must be up to the task and properly integrated into a PDU.

In some cases, that may mean selecting circuit breakers that are compact in nature and designed to operate in confined spaces. Those breakers should use hydraulic-magnetic circuit protection technology, and when transformer-enabled, they should be

able to sense current down to a level of 1%. This enables precise current monitoring and reporting required for back billing of the actual power consumed by data centre storage and routing devices, while also facilitating load adjustments and maximum efficiency.

In other cases, circuit breakers that are designed for high power density situations may be required. Those breakers should come in low-profile form factors, use hydraulic-magnetic actuator mechanisms, and ensure rapid tripping and cooling to prevent serious equipment damage and fire. Check out our J-Series for these features as well as its wide range of delay options, including Instantaneous, ultra-short, short, medium, long, short hi-inrush, medium hi-inrush and long hi-inrush.

Depending on the intended application of a PDU, circuit breaker designs may have a dramatic impact on the suitability of that PDU. Take for example cases where it is critical to prevent manual override of a breaker in an overcurrent situation. That may mean using a tandem pole circuit breaker, which is designed with a common trip linkage ensuring that if one pole trips, the tandem pole simultaneously trips. It is also important that the breaker incorporates a trip-free mechanism, which is a safety feature making it impossible to manually hold the contacts closed during overcurrent or fault conditions.

Of course, PDUs designed for dc environments require adequate circuit protection as well. Dc-powered systems have different needs and normally incorporate high dc voltages (up to 600 Vdc), along with high amperages.

Better circuit breakers for those environments employ hydraulic-magnetic mechanisms, along with permanent magnets that can create strong magnetic fields that are used by arc runners to better react to spikes and help to cool the breaker as well. **EP&T**

Carling Technologies, a Littelfuse brand, provides a full line of hydraulic-magnetic circuit breakers that can be configured for specific data centre applications. The compact, low-profile circuit breakers are suitable for the rigors and confined spaces found in datacom and telecom rack systems and power distribution units.

<https://www.carlingtech.com/>

Through hole & surface mount technology for the reflow oven



Electrical and electronic components come in a wide variety of sizes and mounting technologies.

The classic is through hole technology (THT), while its modern counterpart is surface-mounting technology (SMT). Unfortunately, these two technologies, which are combined in almost every electronic device, require different soldering methods. A dilemma? Yes and no.

At the beginning of the 20th century, there were no printed circuit boards (pcb). All components available at that time were wired freely by hand. It was not until around 1920 that the first prototypes were created: stamped conductor tracks riveted to hard paper and held together with sheet metal springs. In 1943, the first patent was granted for a pcb.

Through Hole

It was not until the early 1950s that pcbs slowly gained acceptance. Through hole technology first emerged in Germany, as the connecting wires of components were inserted through drilled holes in the pcb, which were provided with copper conductor tracks on their underside. This approach simplified production and at the same time reduced the error rate during wiring. Today, this is called THT: Through Hole Technology.

Surface-mount

Surface-mount technology (SMT) is not that much younger, even though it is used for almost all modern electronic products. Its beginnings can be found in the 1960s, developed by IBM for the computers of the Saturn and Apollo missions. The reasons given for this development at the time were the cramped space conditions in the spaceships and a reduction in circuit impedance to increase switching frequencies. Miniaturization SMT and THT both have a fixed place on the production floor of every contract electronics manufacturer (CEM) today. The increasing customer demand for mobile electronic devices is shifting the focus more and more to surface mount technology. Usually SMT components are much smaller and thus allow more compact end-devices. In contrast to through-hole mounting, SMT components are 'glued' directly onto the copper-clad surface of the board and then soldered in a reflow oven. Often, an SMT pcb permits assembly on both sides, which doubles the possible, fully automated assembly density.



Schurter OGN is an open fuse holder for 5x20 fuses that can be soldered in the reflow oven. Device can also be converted into a closed fuse holder by means of a cover.

Hybrid consequences

However, not every component can be reduced in size at will. Stationary electronic devices almost always have a built-in power supply. Traditionally, this consists of a transformer, capacitors, resistors and a rectifier. However, even the switching power supplies used very frequently today cannot be 'shrunk' to miniature dimensions, depending on the power required. Power needs space.

If, for example, the power supply also has to be placed on the SMT circuit board, then it quickly becomes a tight squeeze for a transformer. Or let's consider the question of fuse protection: If a fuse blows in the event of an overcurrent, then it would be extremely useful if this fuse could be replaced without great effort. This need gave rise to hybrids: SMT circuit boards that contain additional drill holes for THT components.

The use of two technologies has consequences in the soldering process. For the CEM, this means that each board must undergo two soldering processes. One for the surface-mounted components (reflow method) and a second for the components in through-hole assembly (wave soldering). It goes without saying that two soldering processes are associated with significantly higher costs and a longer production time. In addition, two soldering systems must be available. But, there are other disadvantages as well.

Issue: Aging

If a hybrid pcb has to go through two soldering processes, many components are heated twice to temperatures well above 200°C. This is not beneficial to them. High temperatures will shorten the lifetime of any electronic component.

Issue: misplacement

The double soldering process poses an additional risk from its practical implementation: It is usually the case that the THT components are inserted after the reflow soldering process for SMT. In particular, manual placement of the components for the second soldering cycle in the wave bath involves a massively increased risk of incorrect placement.

Approach: no hybrids

To avoid these problems, there are several approaches. The simplest is to prevent them from occurring altogether. In other words, use only SMT or only THT components. Then a single soldering process is always sufficient. However, this is often not possible in practice due to the technical properties that the end product to be soldered should have.

Alternative: THR

'Through hole reflow' (THR) are equipped with through hole technology, and are specially designed for automated assembly and high thermal stress in the reflow oven. During the assembly process, a paste is first printed in the vias for the THT pins, and then the component is pushed through the solder paste. As the paste melts in the reflow oven, the liquid solder retracts into the via due to wetting and capillary forces, forming a clean solder joint. The two technologies provide one highly efficient soldering process.

Fuse protection

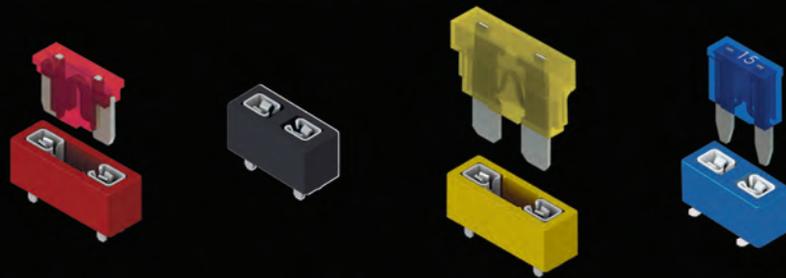
With this in mind, we should once again take a look at the circuit protection of a fully automatically assembled pcb. It would be highly advantageous to install a fuse holder on the SMT board, which can also be soldered right away in the reflow process.

It's nice to know that one soldering process is enough, isn't it? **EP&T**

This article was written and submitted by Schurter Group, a Swiss-based technology company and specialized producer of electronic components.

<https://www.schurter.com/en>

THERE'S A KEYSTONE IN EVERY GREAT INVENTION.



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For More Details
See our Blog

How 3D architecture experts created a new and improved battery

BY STEPHEN LAW, EDITOR - EP&T

Most cutting edge technologies, such as artificial intelligence, 5G, Edge computing, electric vehicles, augmented and virtual reality - all require greater battery energy density. Building and scaling a battery containing a 100% active silicon anode has long been a goal of the industry because it dramatically increases energy density and performance.

Enovix Corp., a Fremont CA-based developer of next generation silicon-anode lithium-ion battery production, has created a proprietary cell architecture that enables a 100% active silicon anode, which translates to a battery with high energy density, high cycle life and fast charging without compromising safety.

Enovix is building an advanced silicon-anode lithium-ion battery production facility in the U.S. for volume production.

For this article, EP&T Magazine spoke with Ashok Lahiri, Enovix co-founder and chief technology officer, who has served as a technical advisor to the firm since February 2023. Prior to that role, he had been chief technology officer since co-founding the company in 2007. Lahiri has been lead architect of the Enovix 3D silicon Lithium-ion rechargeable battery, responsible for design and implementation of the firm's patented 3D cell architecture and high-capacity silicon anode.



Ashok Lahiri,
Enovix co-founder
and chief
technology officer

Q Enovix believes it has the next great advancement in battery tech. Describe the company's proprietary cell architecture that increases energy density and maintains high cycle life.

A Enovix has reinvented the battery architecture by replacing the jelly roll design that is seen in many conventional batteries with an innovative stacked design. The jelly roll architecture is made up of sheets of anode, separator and cathode rolled together, which wastes volume due to the lack of precision and the fact that a round object is placed in a rectilinear package. The Enovix cell architecture instead stacks its cathodes, anodes and separators side by side, allowing a more efficient

use of the battery's volume, leading to improved overall energy density and the ability to use a 100% active silicon anode.

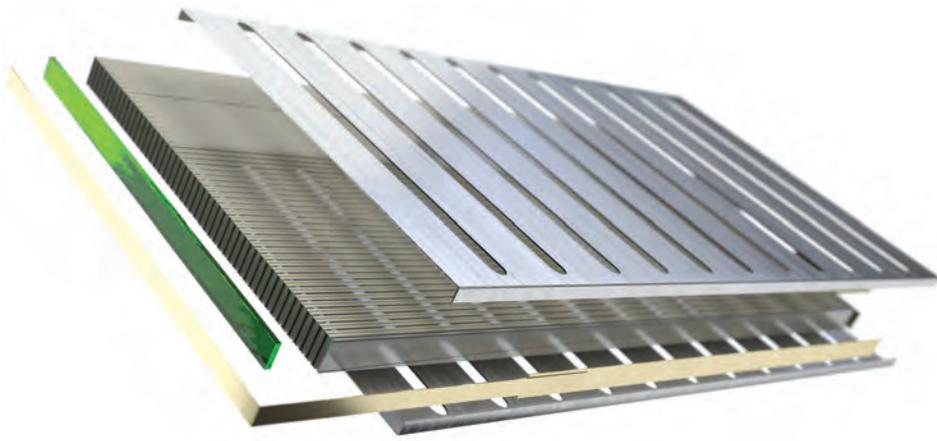
Most conventional Li-ion batteries often use graphite anodes. However, at Enovix we use 100% active silicon anodes. Silicon is a plentiful and sustainable ingredient that can theoretically store more than twice as many lithium ions as graphite. The use of silicon translates to a battery that has high energy density in an efficient form factor. Enovix also uses an integrated constraint system to keep the cell under constant pressure, which keeps the electrodes from disconnecting and cracking and improves the battery life cycle.

Q. What makes the Enovix battery so unique to what is currently available on the market today?

The architecture of Enovix batteries is something the industry has never seen before. For decades the industry has made batteries mostly the same way, working to improve the materials and chemistry inside the battery, until Enovix's 3D architecture strayed from the paradigm. Our background in 3D architectures, along with our passion for problem solving, convinced us we could produce the next generation Li-ion battery. By replacing the traditional jelly roll design with a precise laser cut design with stacked anodes, separators and cathodes, Enovix's cells allow for a more efficient use of the battery's volume.

The architecture also enables a breakthrough in Li-ion battery safety, called BrakeFlow. The Enovix 3D cell is divided into many sub-cell units, each holding a small fraction of the battery's energy and each having a discrete connection to a common anode or cathode busbar. Each sub-cell is connected to the common busbar through the BrakeFlow system that is engineered, based on the number of electrodes and the individual electrode's area, to limit the discharge

The Enovix cell architecture stacks its cathodes, anodes and separators side by side, allowing a more efficient use of the battery's volume, leading to improved overall energy density and the ability to use a 100% active silicon anode



current from the remainder of the cell, through the shorted subunit. If BrakeFlow is working properly, the power dissipated at the short should not raise the temperature around the short location enough to trigger thermal runaway. With BrakeFlow incorporated, instead of a sudden catastrophic release of energy, the battery is designed to discharge slowly and safely.

Q. Why has it been so difficult to manufacture, up until this point. Manufacturing is often one of the more difficult phases when developing a first-of-its-kind technology, especially if the tools don't already exist. Often several iterations of tooling are required before the needed efficiency is achieved. This is not unlike what many other industries like solar or semiconductor have gone through. With each successive iteration, the manufacturing process has become more and more efficient. This is why we're projecting, based on learning from our Gen1 toolset, that our Gen2 toolset is expected to perform significantly better.

Q. How does the architecture of this Li-ion battery technology make it smaller, more energy dense and better for the environment?

Our batteries have a 100% active silicon anode. Silicon is a plentiful and sustainable ingredient that can theoretically store more than twice as many lithium ions as a graphite anode, which is used in most conventional Li-ion batteries today. The use of silicon within our battery architecture translates to a higher energy dense battery in an efficient form factor.

If you need a battery with a given amount of energy, by packing more energy into the same form factor there is less waste of the inactive materials of the cell like the packaging.

Q. What design segments do you anticipate being the most common for this technology?

We're focused first on serving our customers that produce small, wearable consumer electronics, then moving to larger cells for devices such as mobile phones and laptops.

The Enovix 3D cell is divided into many sub-cell units, each holding a small fraction of the energy.

Q. What types of consumer electronic devices are the most likely to adopt this battery type?

We believe the technologies of the future need a better battery, everything from wearables to EVs. We are working with some of the world's largest consumer electronic companies – including Samsung and others.

Q. Where is the production facility located and when can the electronic design community have access to this technology?

Enovix's first production facility is in Fremont, California (called Fab1). We announced in our November 2022 Letter to our Shareholders that we shipped qualification cells from Fab1 to accounts across many consumer electronics applications. In the future, our goal is to have devices with Enovix batteries in the marketplace. **EP&T**

Enovix Corp. is a leading developer in advanced silicon-anode lithium-ion battery development and production. The company's proprietary 3D cell architecture increases energy density and maintains high cycle life. <https://www.enovix.com>



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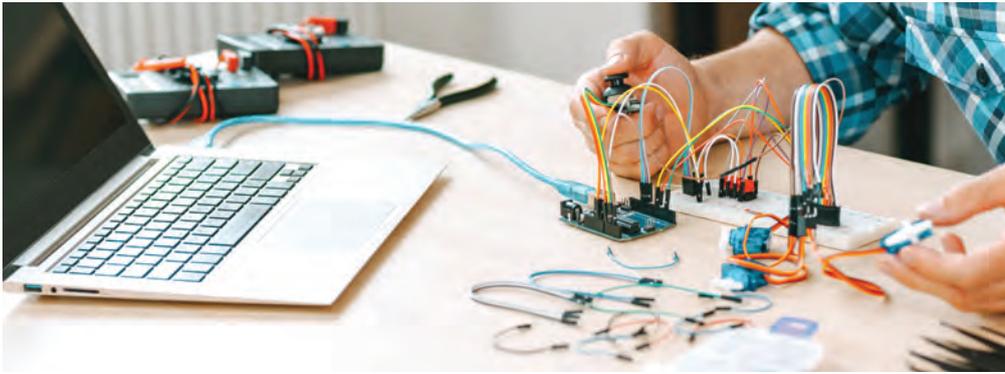
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Photo: Enovix



Do we really need to prototype?

A hardware vs software design perspective

BY PHILIP LING, EDITOR, SENIOR TECHNICAL WRITER, AVNET



We live in the age of over-the-air updates and constant upgrades. These can be used to fix bugs, but they are also used to deliver value-added or paid-for features. Products are now designed to change after shipping, so does that make the concept of prototyping redundant?

The word 'prototype' is widely understood to mean the first of its type. As such, it represents the form, fit and function of the final product. For all intents and purposes, it is the finished product in every way that matters. But, design teams must also accept that building a prototype could force design changes. Otherwise, is there really any value in building a prototype? And, with the widespread practice of using over-the-air (OTA) updates to change functionality, can a prototype really be referred to as the first of its type?

Here, we present both sides of the argument, from the perspectives of two engineers. One comes from a hardware background and the other from the software domain.

Hardware engineer says...

Practically anything can be prototyped. Sometimes, making a prototype is the only way to realize the vision. Importantly, it can uncover the unforeseen issues involved with both design and manufacturing. Because it uncovers valuable information, prototyping your design – particularly a complex part – becomes integral to the development process.

Software engineer says...

Physical prototyping was arguably more important when design was a human-centric process. A design would emerge organically, rather than be defined algorithmically. Early design required physical models by necessity. Modern computing may make physical modelling redundant. Aesthetically, a virtual

model can be rendered with enough detail that it appears real.

Hardware engineer says...

Of course, modeling is useful but the more we ask from our models the more data they produce. Processing that data becomes more difficult, requiring more processing power to do something useful with the data. Every design iteration, no matter how small, might require the entire design to be remodeled, again and again. That's a lot of data and a lot of processing power. A physical model is simpler to manipulate and refine.

Software engineer says...

We live in the age of hyperscale computing. Processing power is cheap and plentiful. Yes, modelling generates a lot of data that needs to be processed, and that can take a lot of effort. But, the next logical step is to use artificial intelligence to infer results from the data. This would remove the need to process all the actual data. Physical design is becoming increasingly intractable. At some point, using AI could be the only way to achieve meaningful results.

We can't ignore the fact that most things can now be modelled with enough accuracy to make a physical prototype unnecessary. Computer modelling is getting faster and less expensive. Add to this the features of virtual and augmented reality and things really come alive. Do we still need physical prototypes?

Hardware engineer says...

It's true that technology helps in many ways. Engineers are using additive manufacturing techniques such as 3D printing to make physical prototypes faster than ever, which blurs the line between real and virtual. The design files used for the model can also be used in production and conventional manufacturing

processes. So perhaps the real value of virtual prototyping is to get it into the real world.

Software engineer says...

Why bring a model into the real world at all? The crucial point is that a computer design is pure data. Anything done to a computer model will be captured as data. Compare this to building a physical prototype and then capturing the data when it is dropped, submerged, heated or cooled. Once, twice or 10 times might be easy, but what about 10,000 times or more?

From concept to production

Embedded systems are becoming more general purpose. They typically feature predictable building blocks, such as power, storage and processing. These common features don't need to be (re)designed for every product. The use of single-board computers supports this argument. Are they the only physical prototype we need?

Hardware engineer says...

Embedded systems are all similar, but they are also all different. Admittedly, developments in firmware over-the-air updates and partial reconfiguration of FPGAs could be used to accelerate product development. But it would be difficult and costly to standardize on a common, configurable hardware platform. It would also rely on being able to design a product after it goes into the production phase.

Software engineer says...

Agile processes have all but replaced the waterfall model for software development because it works better. The same could happen in embedded systems by using pre-designed blocks. There are only so many ways you can put hardware components together, the real design is in the software.

Hardware engineer says...

Tell that to car makers. Concept cars presented at shows rarely make it into production and the vehicle is unlikely to even function. They still go to the expense of creating the concept, physically, because they know the value in having something real to look at, to touch, to experience. An auto maker wouldn't dream of going direct from concept to production without many stages in between.

Software engineer says..

The automotive market is one of the biggest users of over-the-air updates. Many of the semi vendors provide sector-qualified integrated products support OTA for car OEMs. In the future, the real driver experience will come from software upgrades. **EP&T**



Philip Ling is editor-in-chief & senior technical writer at Avnet. He has more than 30 years of industry experience, including working as a design engineer on mixed-signal embedded systems.



IoT assists healthcare

Patient care becomes more data-driven

BY SHASH ANAND, SVP OF PRODUCT STRATEGY, SOTI INC.

➔ IoT devices can collect and share data on everything from body temperature to heart rate to blood pressure and more. In the past, healthcare organizations operated without this wealth of readily accessible data, but now they don't have to. Data gathered through IoT devices leads to better health decisions and overall healthier patients. Here's how.

Data preserves scarce resources

Doctors, nurses and hospital beds are in short supply these days and it's more crucial than ever to preserve scarce resources. With ER patients waiting an average of 33 hours before getting a hospital bed in Canada, the role data plays in enabling healthcare organizations to allocate resources and funds where they are needed most cannot be overlooked. For example, instead of sending a patient to a respiratory specialist for a routine appointment, a connected device can collect and transmit the necessary data to ensure the specialist is maximizing their time. This constant collection and transmission of patient data (sometimes called 'store-and-forward' technology) allows doctors to better evaluate their patients before selecting care or treatment options. Should a patient be referred to a specialist? Is hospital admittance required? Or is the solution as simple as modifying a prescription which does not require the time and costs associated with a specialist or hospital bed.

Additionally, a recent SOTI survey found that 75% of surveyed healthcare IT professionals state that medical services' quality will improve with more interconnected medical devices. It's obvious, then, that even

the experts are on the side of better and enhanced data management. The same study found that 94% of those surveyed agreed digital patient recordkeeping will save time and improve information recording. It's evident that healthcare workers themselves are also becoming cognizant of the benefits of optimized data management in healthcare.

Better healthcare through continuous monitoring

Using IoT to remotely monitor patients leads to deeper knowledge of historical trends and data. How many times has a doctor asked a patient whether they have experienced a particular symptom only to have the patient not accurately recall the date, time or details? By continuously capturing information in real-time, healthcare professionals can "go back in time" to see what occurred and when. This strengthens the level of care patients receive and eases the burden of data management for healthcare professionals.

With IoT, patient care can happen anywhere, anytime and strengthen overall patient health. Connected healthcare devices provide real-time monitoring and detection of issues. This means that doctors and healthcare experts receive more accurate and continuous data on key patient health metrics, allowing them to act instantaneously if needed.

Examples of IoT healthcare tracking include:

- Blood pressure or blood sugar exceeding a specified level
- Blood oxygen levels dropping below normal
- Heart rate and body temperature
- Heart rates for babies in utero

IoT upholds Hippocratic oath

The fact is better data leads to better care. The ability of data to reinforce key aspects of the Hippocratic oath is another reason that data strengthens the quality-of-care patients receive. The SOTI study also showed that 86% of healthcare IT professionals are actively concerned with safeguarding private patient information. Clearly the need to prevent breaches is on the top of their minds. When IoT devices are configured with enhanced security measures, the Hippocratic tenant of respecting patient privacy is upheld by preventing data breaches. As such, when secure networks, updated firewall settings and updates to patch vulnerabilities are continually installed, it enforces the practice of the Hippocratic oath.

Additionally, IoT data allows for real-time alerting and tracking, so when a patient's vital signs exceed or fall below established thresholds, the information is relayed to a senior physician who can provide expert guidance. This enables physicians to call in colleagues when the skills of others are needed, once again in line with the principals of the Hippocratic Oath. The more data IoT healthcare devices collect, the better decisions doctors and patients can make regarding care. This, in turn, helps patients lead healthier, happier and longer lives. Data driven healthcare whether in the form of apps or smart hospitals is here - and patients are better for it. **EP&T**

Shash Anand is senior VP of Product strategy at SOTI Inc., overseeing the firm's evolution from a single product centered around Mobile Device Management (MDM) to an integrated platform that solves many of the challenges around Enterprise Mobility Management (EMM) and IoT management. <https://soti.net/>



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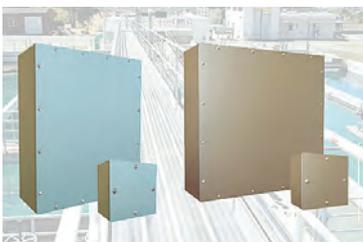
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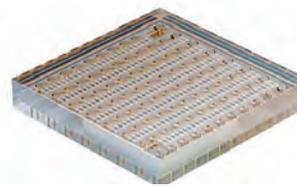


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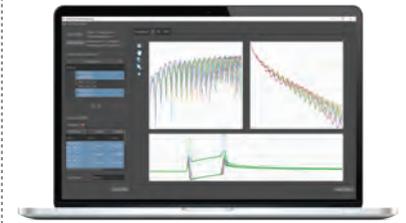


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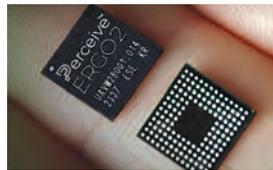
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AI PROCESSOR COMBINES PERFORMANCE, EFFICIENCY

PERCEIVE

Ergo 2 AI processor enables larger, more complex neural networks inside edge devices, including transformer networks for language and imaging, while drawing less than 100 milliwatts of compute power. Device provides performance required for more complex use cases, including those requiring transformer models,



larger neural networks, multiple networks operating simultaneously, and multimodal inputs, while maintaining industry-leading power efficiency. Processor expands user ability to build more ambitious designs and products.

🔗 <https://perceive.io/>

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Strip Series B300



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The B300 opens up new possibilities for fast and reliable stripping of wires with cross-sections from 0.03 to 8 mm². Repeat accuracy, mechanical precision and short process cycles ensure high productivity in common strip applications. And the new ergonomic machine design and reimagined user interface offers unrivaled ease of use.

- Compact modular design
- High-resolution 5" color touch screen
- LED lighting for clear view of work area
- Highly sensitive trigger mechanism
- High process reliability

Wire Solutions for a Connected World

To Be Precise.



DISTRIBUTION

TTI EXPANDS OSRAM SENSOR RANGE

TTI Inc. reached an agreement to become an authorized distributor of ams Osram's sensing solutions.

With the recent merger of both ams (global sensor leaders) and Osram (global light emitter leaders), the new concern has been lighting up the optoelectronics world offering industry-leading reliability and performance with the highest level of miniaturization, integration, accuracy and sensitivity for the automotive, eMobility, lighting, industrial and medical markets.

"Launching ams Osram's extensive sensor portfolio perfectly complements their high power visible and infrared LED products already on the TTI line card. ams Osram's broad product portfolio provides leading edge LED lighting and sensor solutions for TTI to offer our customers," says John Drabik, president TTI Americas.

DIGI-KEY INVENTS PART STORAGE TRAY



Digi-Key Electronics has been awarded a US patent on a tray product used for transporting and storing electronic components. The tray was invented by Digi-Key engineers Shane Heinle and Reid Landsrud, who set out to create a safer and more

efficient way of transporting broken pack integrated circuits. The trays are a quarter of a size of the industry standard JEDEC trays allowing for a smaller packaging and shipping footprint for smaller quantity items, as well as a reduced environmental impact.

After inventing the tray, Digi-Key worked with fellow Minnesota companies Holland Molds of Wadena, RTP Co. of Winona, and CCI of New Hope, to assist in commercial production of the tray.

SAGER ADDS VARTA

Sager Electronics has signed a distribution agreement with VARTA, a globally recognized provider of batteries used in a variety of applications.

"As a leader in lithium-ion technology and micro-batteries, VARTA is an outstanding addition to the Sager line card," remarked Kristin Bryant, supplier marketing and product manager for Sager. "Their rechargeable batteries, chargers and portable power products enable us to offer customers a broader selection of battery products."

APPOINTMENTS

PEMTRON ADDS DIRECT FIELD SUPPORT

Pemtron Technology, an inspection equipment developer and supplier, has added direct support in Canada. In addition to its local manufacturers' representative, Brock Electronics, the company has hired a specialized printed circuit board assembly (pcba) technician with extensive hands-on experience based in Toronto.

Pemtron's new field service engineer has proven experience with SMT & PTH machine programming, setup and operation, preventive maintenance, troubleshooting and problem solving. In addition to providing maintenance and support, the new FSE will help Pemtron customers improve production efficiency and production quality.

AIM APPOINTS NATIONAL SALES MGR

AIM Solder has announced the appointment of Mehak Sharma to the position of Canadian national sales manager. Sharma holds a bachelor's degree in electronics and a master's degree in microelectronics, and brings more than 10 years of sales and support experience to her new post. In this position, she will be responsible for sales growth with new and existing clients in Canada.



"Mehak's knowledge, expertise and motivation will undoubtedly bring success to the growing electronic market in this region," said David Suraski, AIM's executive vice president, AMD. Sharma is based in the greater Toronto area.

ACQUISITIONS

INFINITE ACQUIRES BULGIN

Bulgin Ltd, a UK-based developer and manufacturer of connectors for harsh-environments, has been acquired by Infinite Electronics Inc., a global interconnect firm. Bulgin was previously owned by Equistone Partners Europe, a leading European mid-market private equity firm.

"Both firms share much in common, such as ambitious global growth plans and customer-centric values," says Bulgin CEO John Wilson.

Infinite's product brand portfolio brands include: Pasternack, Fairview Microwave, L-com, MilesTek, ShowMeCables, NavePoint, INC Installs, Integra Optics, PolyPhaser, Transtector, KP Performance Antennas, RadioWaves and Aiconics.

ABB SELLS POWER CONVERSION DIVISION

ABB has reached an agreement to sell its Power Conversion division to AcBel Polytech Inc., formerly Lineage Power. It was acquired by ABB as part of the GE Industrial Solutions acquisition in 2018 and is not core to ABB.

The division is based in Plano, Texas, and employs 1,500 employees worldwide, predominantly at three major sites and the US headquarters. It is a global provider of end-to-end power conversion solutions for mission-critical applications in the telecommunications, data center and industrial sectors. The business is well positioned and currently capitalizing on key technology mega trends such as the rollout of 5G networks, the increased use of cloud computing and manufacturing automation.

EXPANSION

STENTECH OPENS PA FACILITY



StenTech Inc., a leading multinational SMT printing solutions company, has opened its newest facility in Huntingdon Valley of Philadelphia PA, which aims to provide local support, manufacturing of laser cut stencils and laser welded steps. The facility also features an advanced nano-coating, proven to be among the best in North America.

In the past two decades, StenTech has built a reputation of quality, service, using high quality materials and the latest technologies, supported by its highly skilled and experienced technical team members. The firm has been a leading provider of stencil technology, being the first company to introduce fiberDiode lasers into North America. StenTech incorporates sub-brands, PhotoStencil and ADT, and offers an array of stencil technology, custom-tailored to suit most manufacturing requirements. **EP&T**

PRODUCT SOURCE GUIDE

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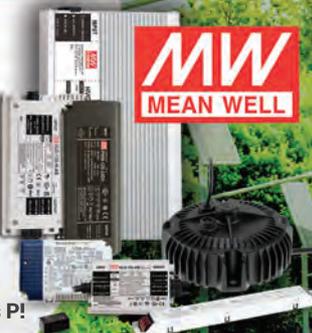
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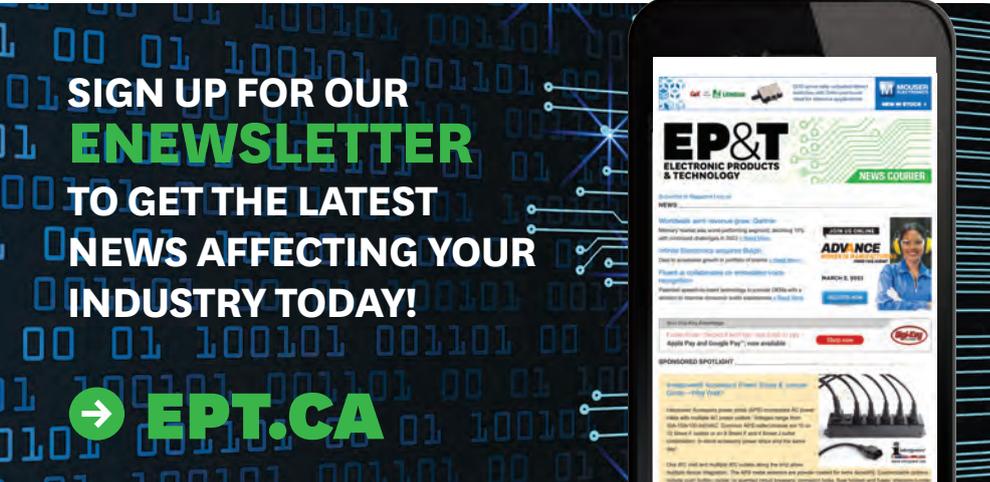
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Smart Robotics

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ROBOKIT1-DK DEVELOPMENT KIT



TDK_RoboKit1-DK is a comprehensive TDK showcase of different sensor technologies wrapped in a robust, open source, ROS compliant Software library, making it the perfect robotic development platform. (See Fig 1)

Full Robotic Package

The full TDK_RoboKit1 package includes everything found on the TDK_RoboKit1-DK as well as a 3D printed shell with ToF sockets, TDK's Industrial grade IMU module (IIM-42630), chassis with metal plates, standoffs, wheels and motors, and an ESP32 BLE module. (See Fig 2)



Product Categories

Multiple TDK sensors provided on a single platform.

- ICM-42688-P 6-Axis IMU
- ICP-10111 Barometric Pressure Sensor
- ICS-43434 Digital I²S MEMS Microphone
- CH101/201 Ultrasonic Time Of Flight
- B57861SO103AO39 Temperature sensor
- AK09918C AKM Magnetometer
- HVC4223F-D2 Embedded Motor Controller
- IIM-42630 Industrial Module (on Full robotic kit only)

Software Algorithms

Drivers and Algorithms available to support any robotic needs.

- Cliff Detection
- Floor Type Detection
- Obstacle Avoidance
- Voice Audio Commands
- Motor Control APIs
- Sensor Fusion

ROS1 & 2 Compliance & Open Sourced

Compliant with all the necessary robotic community standards.

- Ros 1/2 driver compatible
- Windows App for Dev Kit data collection
- Android App for Full Robotic kit BLE data collection
- MicroROS (COMING SOON!)

'Out Of The Box' experience

Supports any stage of robotic development from concept to production.

- Full Robotic package provides everything needed to build a fully functional robotic reference design
- Development Kit can be used for initial sensor evaluation, algorithm development, or software creation

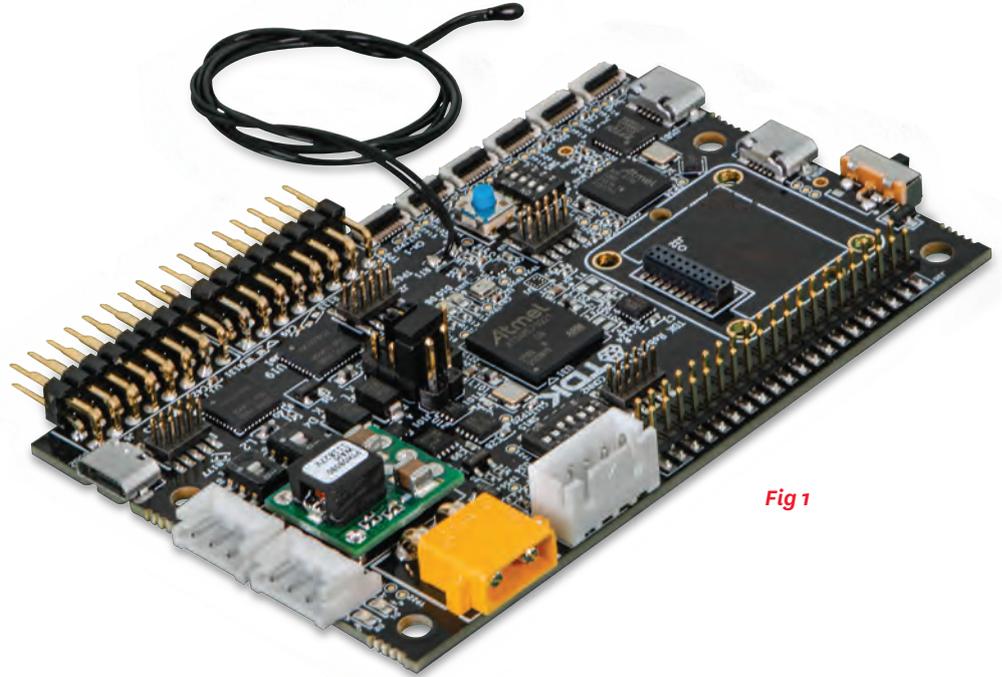


Fig 1

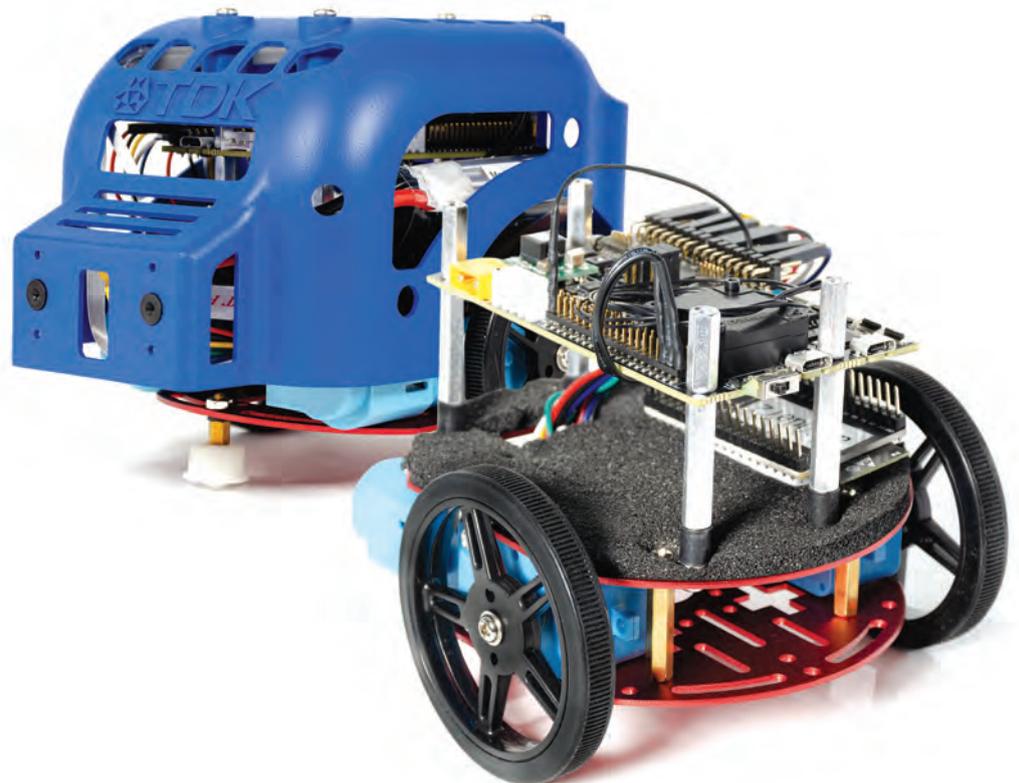


Fig 2



Scan here to view and download the full data sheet in pdf format.

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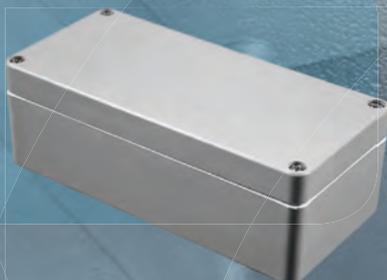
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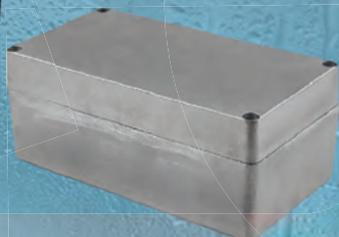
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