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FEATURE STORY

The Case for 48V Centric Power Modules Has Never Been Stronger

By Maury Wood, VP Strategic Marketing & BU Operations, Vicor

More details on page 8.

Navitas' GaN & SiC Devices Power Dell's Family of AI Notebooks

GaNFast and GeneSiC power technologies deliver portability, efficiency, and sustainability for Dell AI notebook computer adapters from 60 W to 360 W

Navitas Semiconductor (Nasdaq: NVTS), an industry leader in next-generation GaNFast gallium nitride (GaN) and GeneSiC silicon carbide (SiC) power semiconductors, has announced its adoption of both technologies into Dell's family of notebook adapters, from 60 W to 360 W.

Enabled by over 20 years of SiC technology leadership, GeneSiC leads on performance of SiC MOSFETs with patented 'trench-assisted planar' technology and 5th-gen GeneSiC silicon carbide (SiC) diodes to deliver high-speed, high-efficiency performance with proprietary 'low-knee' technology for cool operation.

Navitas' GaNFast power ICs enable high-frequency, high-efficiency power conversion, achieving 3x more power and 3x faster charging in half the size and weight compared to prior designs with legacy silicon power devices.

Navitas GaN & SiC technology together enables Dell to provide high-speed charging, with highest efficiency, coolest temperature, smallest size, and lowest material count. Dell's latest line-up of AI notebooks includes Neural Processor Units (NPUs), which are dedicated AI engines, to manage sustained AI and AI offload. This builds on Dell's portfolio as the broadest GaN adapter offering for notebooks in the industry.

The new adapters will also help Dell achieve its advanced sustainability goals, with a focus on CO_2 reduction and energy reduction. The adapter cases require up to 50% less plastic and are made with post-recycled materials, significantly reducing energy waste, and improving resource utilization. Navitas' GaNFast and GeneSiC technologies increase the level of system integration and switching frequency, which reduces the number of components, as well as the size, resulting in a 'dematerialization' that lowers carbon footprint throughout the production, packaging, and logistics processes. Each GaNFast power IC shipped saves 4 kg CO_2 and every SiC MOSFET shipped saves 25 kg CO_2 vs. legacy silicon power chips.

"Since Dell's first GaN adapter was enabled by Navitas back in 2020, we've worked closely with Dell engineering to further improve charging speed, efficiency, size, weight, and now environmental footprint", said Gene Sheridan, CEO and co-founder of Navitas. "Dell's new adapters are an optimal solution for speed, portability, and sustainability. Our clients achieve a win-win for both the market and environment by deploying Navitas GaNFast power ICs and GeneSiC power devices."

For more information on our GaNFast portfolio and charging system solutions, please contact info@navitassemi.com or visit

www.navitassemi.com.

Data Challenges amidst the EU's upcoming DPP mandate

The European Commission's latest effort to facilitate a more circular economy - the Ecodesign for Sustainable Products Regulation (ESPR) - came into force last year and set in motion a series of eco-conscious actions for electronics manufacturers to follow who place products in the EU marketplace. Since this announcement, some have started their compliance journeys to prepare for the regulation's Digital Product Passport (DPP) mandate but others simply don't know where to start. To address the initial action needed by the electronics industry, the first stage will be identifying and validating data to support compliance - a step likely to be challenging.

As a quick recap, DPPs act as a digital record of a physical product, securely keeping track of information across a product's lifecycle, including event or transactional data, or even data concerning its sustainability credentials. For example, the carbon footprint of its production. While specific DPP requirements for each product group impacted - via the delegated acts - are yet to be published, the first crucial step of gathering and validating data can be actioned now.

To start this data validation journey, collaborating with all stakeholders will prove pivotal in identifying existing environmental data. Such transparent discussions are likely to uncover hidden insights and highlight opportunities to improve data transparency. Similarly, conducting a data gap analysis early on will ensure missing information is pinpointed and enable businesses to consider the information likely to be required in the DPPs - i.e. data on production waste or carbon footprints. This will enable firms to develop strategies for closing gaps, adopt new tools, or partner with specialists. Additionally, considering a Life Cycle Assessment (LCA) to measure a product's environmental impact across its lifecycle, from raw material extraction to disposal, will provide a comprehensive view to address identified gaps.

Throughout these first steps, validating data sources to build an accurate, verifiable picture of each product is crucial - this includes assessing the credibility of third-party data suppliers and ensuring relevant standards are maintained.

Due to the complexity, building a DPP solution won't be possible for most businesses, so seeking out specialist partners will prove invaluable. Such partners should consider the creation and implementation of DPPs in a bespoke manner and focus on factors such as ease of use, scalability, and resource requirements for seamless adoption.

By following these steps, alongside ensuring a pilot is conducted to refine processes, capture insights, and estimate the scale and timeline for full deployment, businesses can efficiently prepare for DPP integration and ensure long-term sustainability compliance. To learn more about this and get a head start on DPP integration, reach out to DPP provider Protokol here:

https://www.protokol.com/services/digital-product-passport-consulting/.

Infineon announces the next milestone in semiconductor manufacturing technology

Infineon technologies says after announcing the world's first 300-millimeter gallium nitride (GaN) power wafer and opening the world's largest 200-millimeter silicon carbide (SiC) power fab in Kulim, Malaysia, it has unveiled the next milestone in semiconductor manufacturing technology.

The company says it has reached a breakthrough in handling and processing the thinnest silicon power wafers ever manufactured, with a thickness of only 20 micrometres and a diameter of 300 millimetres, in a high-scale semiconductor fab. The ultra-thin silicon wafers are only a quarter as thick as a human hair and half as thick as current state-of-the-art wafers of 40-60 micrometres.

"The world's thinnest silicon wafer is proof of our dedication to deliver outstanding customer value by pushing the technical boundaries of power semiconductor technology," said Jochen Hanebeck, CEO at Infineon Technologies.

"Infineon's breakthrough in ultra-thin wafer technology marks a significant step forward in energy-efficient power solutions and helps us leverage the full potential of the global trends decarbonisation and digitalisation. With this technological masterpiece, we are solidifying our position as the industry's innovation leader by mastering all three relevant semiconductor materials: Si, SiC and GaN."

The company says this innovation will significantly help increase energy efficiency, power density and reliability in power conversion solutions for applications in AI data centres as well as consumer, motor control and computing applications.

For more information visit https://www.infineon.com/cms/en/about-infineon/press/press-releases/2024/INFXX202410-013.html

NECTO Studio V7.1 IDE from MIKROE now includes full programmer and debug support for Microchip tools

Also adds support for Microchip's SAM MCU and STMicroelectronics' STM32L4 series of ultra-low-power MCUs

MIKROE, an embedded solutions company that dramatically cuts development time by providing innovative hardware and software products based on proven standards, has announced that the latest 7.1 release of the company's NECTO Studio IDE (integrated development environment) is even easier for users of Microchip MCUs to work within, benefitting from the time-to-market advantages that the NECTO ecosystem delivers.

Following close collaboration between Microchip and MIKROE, NECTO 7.1 now includes full programmer and debugger support for the following tools: MPLAB ICD 5, MPLAB ICD 4, MPLAB ICE 4, Atmel-ICE, PICkit On-Board 4 (PKOB4), EDBG, Power Debugger, MPLAB PICkit 5, MPLAB PICkit 4, MPLAB Snap, JTAGICE3, PKOB nano, mEDBG and Simulator.

More, the mikroSDK 2.0 software development kit which runs natively within NECTO Studio, making application code portable and reusable on many different platforms and architectures, with virtually no code changes, has been further enhanced with support for 66 new MCUs from the SAM E70/S70/V70/V71 series, a robust Arm® Cortex®-M7 lineup running at up to 300 MHz. In addition, full mikroSDK support is now available for the STM32L4x family.

Comments Nebojsa Matic, CEO of MIKROE: "Getting started with NECTO and Microchip is simple: create a new NECTO setup with one of Microchip compilers XC8, XC16, or XC32; select your preferred Microchip programmer from the supported list; and apply new NECTO setup to an existing project or start a brand-new one. We remain committed to expanding our MCU offerings on a daily basis, so stay tuned for even more additions!"

APEC 2025 Marks the Applied Power Electronics Conference's 40th Anniversary

The upcoming 40th Annual Applied Power Electronics Conference (APEC 2025), running March 16-20 at the Georgia World Congress Center in Atlanta, is shaping up to be an exceptional celebration of its 40th anniversary. Since 1986, the APEC conference and exposition has continued the long-standing tradition of addressing issues of immediate and long-term interest to the practicing power electronics engineer. This year's APEC 2025 will offer the most extensive programme in the event's history, including Technical Sessions (Papers), Industry Sessions and Professional Education Seminars—plus a Plenary Session, a vibrant Exposition, as well as several Special Events and Social Activities.

APEC 2025 General Chair, Aung Thet Tu, noted APEC's exponential growth since its inception: "Forty years ago, we had 250 attendees and 20 exhibitors. The 1986 conference program included seven sessions, 34 technical papers and six professional education seminars. In comparison, APEC 2025 is projected to have over 6,000 attendees and over 300 exhibitors—and a conference program of 750 technical presentations and 18 professional education seminars"

Power electronics technologies are a key element in many of today's high-visibility, high-growth global markets, which makes this year's APEC especially relevant to industry professionals. Vehicle electrification, alternative energy sources, battery technologies, data center high-efficiency power conversion, wearable electronics, and energy harvesting are among the many topics being addressed. Accordingly, press representatives are expected to cover the event in record numbers, with over 20 technical journals registered, to date.

APEC is sponsored by the IEEE Power Electronics Society (PELS), the IEEE Industry Applications Society (IAS) and the Power Sources Manufacturers Association (PSMA). PSMA is also celebrating its 40th anniversary in 2025. APEC 2025 Publicity Co-chair, Kathy Naraghi, acknowledged the many Supporting Publications for their role in the remarkable interest in the 2025 conference and exposition. "We are so appreciative of all the journals providing promotional support. Thanks to these publications and their editorial staff, our 40th anniversary APEC promises to be one of our best-attended yet."

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The Case for 48V Centric Power Modules Has Never Been Stronger

By Maury Wood, VP Strategic Marketing & BU Operations, Vicor

Advancing semiconductor technology and global competitive forces have resulted in a stunning increase in the power density of numerous equipment types in the industrial, automotive, aerospace and high-performance computing markets over the last ten years. The vast energy required to power generative AI computing data centers is at the forefront of this megatrend.

If power systems engineers do not consider new approaches to address these exponential increases, power supplies will become an ever-greater contributor to increased system size (specifically volume), weight and cost.

Furthermore, all other things being equal, the rise in equipment power demands will see an equivalent rise in thermal management requirements, contributing to the expansion of power system form factors and recurring costs. Clearly, new approaches (including architectures, topologies and packaging methods) and innovative solutions are urgently needed.

48V-centric power modules with high conversion efficiency and power density have arrived to meet these intertwined and complex challenges.

Evolution from 12V to 48V Power Delivery Networks

The transition across numerous markets from 12V toward 48V power delivery networks (PDN's) is accelerating. For example, the first 48V PDN electric vehicles are on the road today with many in development, and 48V distribution within data center racks among Hyperscalers is now commonplace. Power system design engineers should weigh the relative merits of 48V PDNs as a logical starting point for the power delivery architecture of their electrical power subsystem.

The transition to 48V-centric power distribution is not without challenges. The 12V centric power component ecosystem offers maturity and know-how accumulated over about 75 years. There is a multiplicity of 12V optimized power component and power supply options available on the market, and power system designers are typically comfortable with this technology in all its facets. By comparison, the 48V-centric power components and subsystems are less established, with wide 48V adoption in data center server racks first appearing in 2021.

Power system engineers are less familiar with power components and subsystems needed to support a 48V-centric PDN design, and have relatively less development experience with 48V distribution hub architectures. However, by sourcing 48V DC-DC converter power modules, with integrated magnetics can eliminate areas of technical and commercial risk and uncertainty, as the module manufacturer assumes all design, sourcing, testing, quality and reliability responsibilities, shielding the end system designer from this ecosystem immaturity (Figure 1).

Additionally, many existing 12V subsystem loads are fully cost-optimized and are not financially or functionally sensible to replace in the short to medium term, so bridging between a 48V and 12V centric PDN can achieve the optimal system design. Importantly, both 12V and 48V are considered SELV (Safety Extra Low Voltage) levels, so moving to 48V power distribution hubs does not compromise human safety.

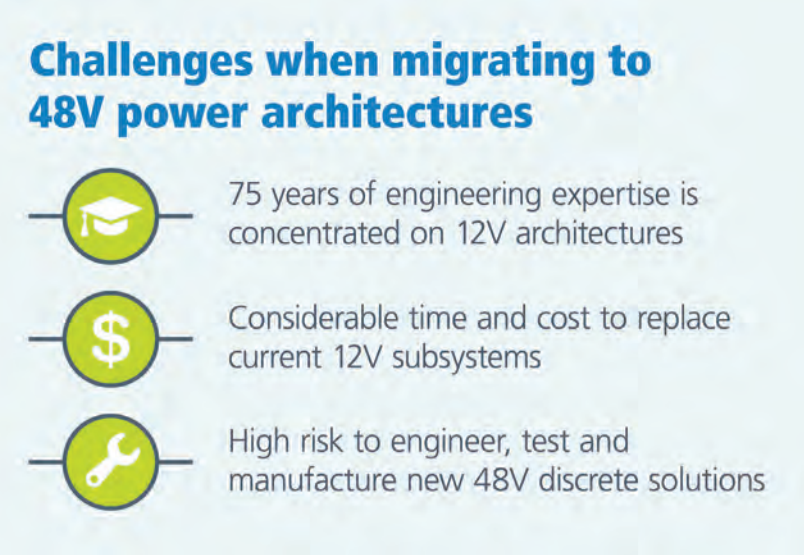

Figure 1: The 12V ecosystem is well established and in many cases is fully cost-optimized. So bridging between a 48V and 12V-centric power delivery network using DC-DC converter modules is the optimal solution to ease the path to 48V power designs.

Types of 48V-Centric Power Modules

There are many types of power modules that offer a full DC-DC converter function, with high power density and some that incorporate integrated magnetics. High voltage (up to 920VDC) BCM's (fixed-ratio DC-DC bus converter modules), are typically galvanically isolated (4,242V is typical and a conversion ratio of K = 1/8 yields 50VOUT from 400VIN for example and a K = 1/16 yields 50VOUT from 800VIN).

NBM's (low-voltage non-isolated fixed-ratio bus converters) are also available (K = 1/4 yields 12V from 48VIN) and enable the bridging function between the 48V and 12V centric PDN's. Regulated DC-DC converters are also available. A good example of a regulated fixed-ratio converter is the DCM3735, a 2kW, 160A, 48V to 12V converter (Figure 2).

Power system engineers can take advantage of these power modules by utilizing higher system bus distribution voltages requiring lower current to deliver

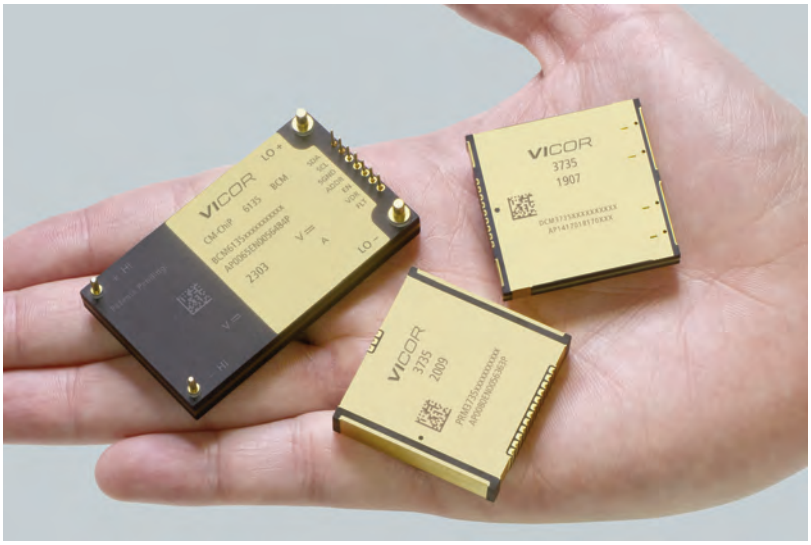

Figure 2: Vicor automotive grade BCM6135, DCM3735 and PRM3735 power modules have set a new standard for power density in the automotive industry. Collectively they solve complex conversion challenges with 800V, 400V, 48V and 12V systems for xEVs power systems.

the same power. For OEMs, this consequence of Ohm's Law can yield superior electrical, mechanical and thermal performance, higher overall system efficiency and significant economic benefits.

Important Attributes to Look for in a Power Module

A top-level attribute of best-in-class 48V-centric power modules is high volumetric power density (continuous output power per cubic inch or W/in3), achieved through innovative circuit structures and topologies, as well as state-of-the-art thermal and mechanical packaging. A related distinguishing characteristic of power modules is package thickness, which can be as thin as 7mm in advanced products. Thin packages enable lower thermal resistance, and three-dimensional electroplating (i.e., bottom, top and sides) provides a coplanar thermal conduction interface perfectly suited for heat sinks and coldplates (Figure 3).

Due to increasing equipment electrification across broad sectors of the global economy and the rising power demands across numerous end-market equipment types, liquid cooling solutions are increasingly more popular. This trend is synergistic with overmolded, high power density, thin power modules, which are exceptionally thermally adept (i.e., high thermal conductivity as measured in watts per meter per Kelvins). Designers should also consider overmolded 48V-centric power modules with integrated magnetics, as an easier way to present a planar thermal interface of all power dissipative components to heat sinks, heat pipes or coldplates.

Power conversion efficiency is a critically important performance parameter. At high output power levels, the power loss heat load is substantial, even when continuous conversion efficiency is relatively high. For example, at 2.4kW (50AOUT at 48VOUT) at 98% efficiency is still 48W of power loss that must be continuously thermally managed. Therefore modules should offer very high DC-DC conversion efficiency across operating temperature to simplify thermal management solutions.

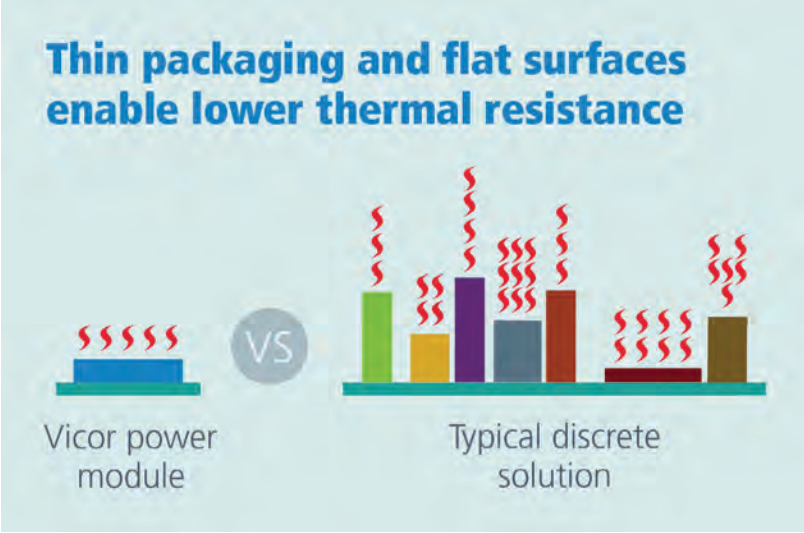

Figure 3: The thermal engineering of modern electronic systems has become a key design consideration. Discrete power designs are typically more complicated arrangements and are more challenging to cool compared to modular solutions that are thinner, more uniform designs. Thin packages enable lower thermal resistance, and three-dimensional electroplating (i.e., bottom, top and sides) provides a coplanar thermal conduction interface perfectly suited for heat sinks and coldplates.

Robust and Simplified System Designs

Overmolded power modules are also mechanically robust and more thermally adept easing the thermal management design challenge. Modules that offer full DC-DC converter solutions with integrated magnetics also minimize external circuitry, easing the system design process. For systems requiring industrial grade, military grade or automotive grade, modules are qualified by their manufacturer to rigorous electrical, mechanical and environmental standards, including temperature cycling, humidity exposure and shock/vibration testing, and are automatically production tested (i.e., using ATE) as a complete system to well-specified performance limits. This eliminates the need for the OEM to conduct separate qualification and performance characterization tests.

From the OEM perspective, power modules are a single bill of materials (BOM) item (Figure 4). The fact that there are dozens of components within the module is opaque to the end customer. By contrast, a discretely implemented power supply has a multiplicity of components that must be purchased, kitted, assembled, tested and managed (due to potential product obsolescence) over the lifetime of the equipment that utilizes the power supply. The use of a system-level DC-DC converter power module therefore effectively eliminates numerous points of failure, increasing end-product quality. The purchasing effort and inventory management costs of power modules are significantly lower than discrete component power systems. This allows power systems engineers to leverage their trusted supplier's cutting-edge materials science, circuit design and conversion topological innovation with little to no learning curve overhead.

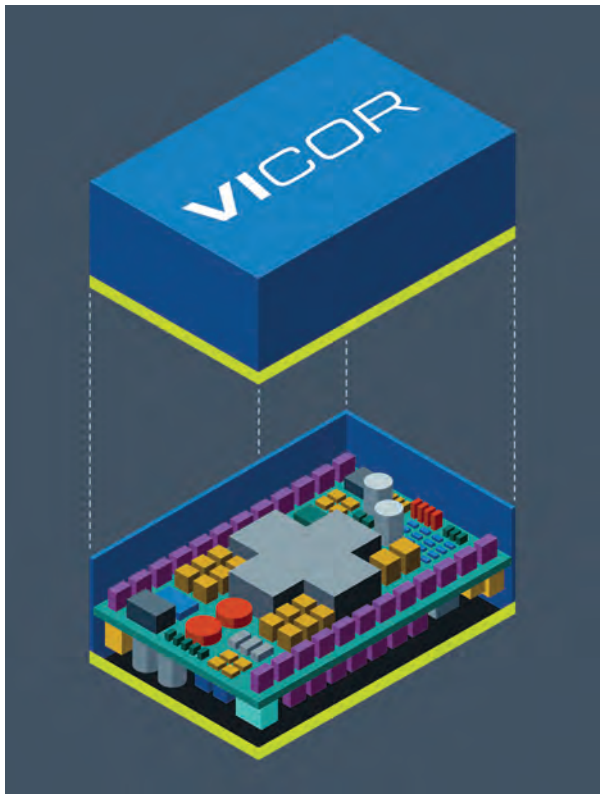

Figure 4: Pre-qualified miniaturized power modules offer a number of benefits over discrete designs. Power modules are a single bill of material (BOM) item and eliminate numerous points of failure. The fact that there are dozens of components internal to the module is opaque to the end customer. By contrast, a discretely implemented power supply has many components that must be purchased, kitted, assembled, tested and managed over the lifetime of the equipment.

Ease of Use and Power Scaling Considerations

For power scaling needs and achieving a faster design time, power modules should be capable of operating in current-shared parallel arrays. As the power system demands increase, it is possible to double or quadruple the output power through a relatively easy subsystem redesign.

An important characteristic of modern PDNs is reverse (or bidirectional) operation. The classic example is electric vehicle regenerative braking, where energy is returned to the battery pack from the traction motor inverters during braking. Bidirectional operation appears in many electrification use cases, and best-in-class power modules will offer either instantaneous reverse power conversion or reverse power conversion under digital control. Fixed-ratio BCMs and NBMs are inherently bidirectional and enable new depths of innovation.

In some specific cases, modules are designed to comply with a variety of standards, including FCC/EU EMI (conducted and radiated), as well as safety and environmental standards administered by CE, ECHA RoHS, CSA, UKCA, TUV and UL/IEC. High voltage isolated power modules should have also undergone high potential (HIPOT) safety testing. This is a significant reduction in engineering operating expense (otherwise frequently outsourced) and the capital expense of related test equipment, as well as a valuable project schedule risk reduction mitigation. Additionally, module-level product safety certifications are vital for gaining power-subsystem-level regulatory approvals.

A trusted supplier should provide comprehensive technical support and collateral, including complete data sheets, application notes, electrical, 3D mechanical and thermal simulation models, design guides and evaluation board systems. These are essential tools for design engineering success.

Electric Vehicles Save Weight and Capitalize on Transient Response with Power Modules

Automotive BEV and recreational light electric vehicle (LEV) OEMs need to show continuous performance improvement aspects beyond those of their gasoline-powered progenitors to continue to win new customers. Vehicle acceleration and battery life (i.e., vehicle range) are critical performance elements that often influence the buying decisions of EV consumers.

Small size and weight, high volumetric power density and simple, inexpensive, robust passive cooling solutions are of vital consumer marketing value to OEMs. Additionally, the use of a module-level PDN solutions frees the vehicle system designers to focus on other product development tasks because modules with high power density can solve the size and weight problems of a design.

Superior load transient response of topologies such as the Vicor SAC™ (Sine Amplitude Converter) enables numerous innovative applications in electric vehicles, including active suspension, drive-by-wire, steer-by-wire, 12V and 48V battery and supercapacitor elimination. Best-in-class modules offer industry-leading efficiency and power density, delivering outstanding electrical performance even when de-rated for use with passive heat sinks (or in some chassis or body mount applications). The robust mechanical construction of overmolded modules is well suited to the harsh environments of rugged electric recreational vehicles.

The use of a 48V zonal architecture results in much thinner cabling throughout the vehicle, which is a substantial weight and cost savings (Figure 5). Furthermore, thinner distribution power bus wires are easier to route, giving vehicle chassis and body designers more freedom from three dimensional design constraints. The reduced cable power dissipation at 48V also yields improved vehicle range.

The automotive EV designs are migrating rapidly to 48V distribution hubs with 12V zones for legacy subsystems. The global auto industry supply chain will drive rapid cost reduction of the components of this "zonal architecture" to the benefit of LEV developers.

Consider choosing a 48V module supplier that can offer automotive-grade modules with APQP process and AECQ-100 qualification attributes. These automotive grade modules are also available to LEV platform developers in the event they require AECQ-100 level reliability.

Factory Automation Equipment Benefits from Thinner Wiring and "massimetric power density"

Industrial robots are evolving to include autonomous (untethered and battery-powered) capabilities and integrated genAI inferencing processors.

Importantly, 48V cabling saves robot weight and cost versus 12V cabling, and is far easier to route mechanically, which is helpful for anthropogenic (humanoid) robots designs that are relatively trim.

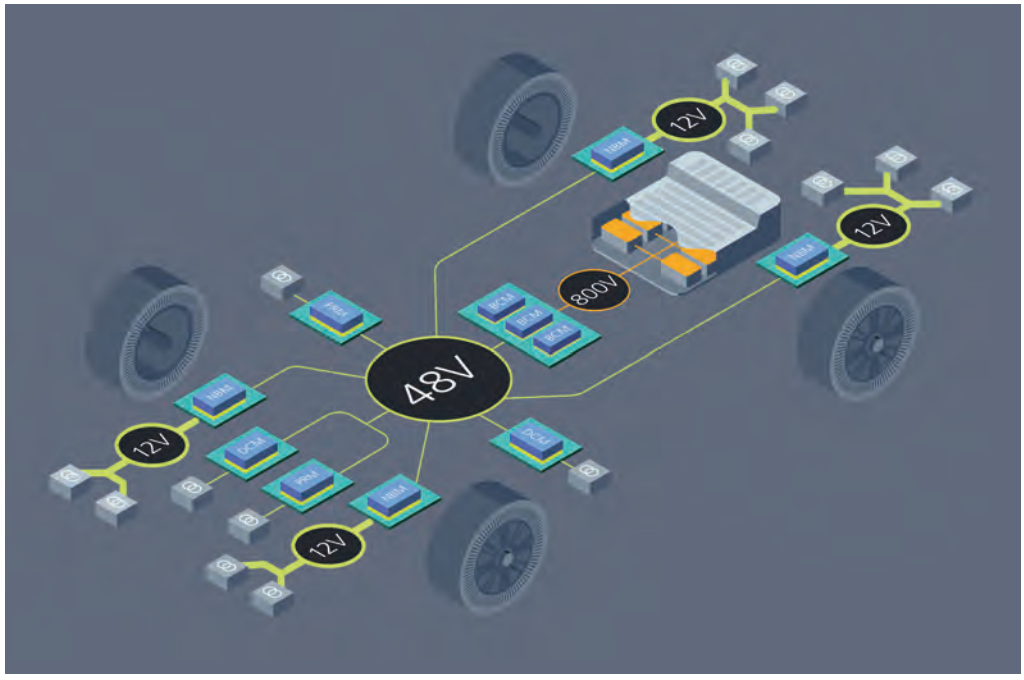

Figure 5: EVs are migrating toward 48V power delivery networks with 12V zones to accommodate legacy subsystems. Vicor compact, lightweight DC-DC converters make point of load conversion easy and highly efficient.

Some industrial mobile robots are quite small, so small 48V power modules and thinner wire harnesses are clearly advantageous for these designs (Figure 6).

Higher volumetric power density means lower robot weight for the same level of power delivery as alternative lower power density solutions, which extends operating time between battery recharges; this is a critical end-customer purchasing consideration.

For autonomous vehicular robots, including limbed humanoid robots, an important power delivery criterion is "massimetric power density." This is measured in continuous output watts per gram (W/g). Robot weight defines many performance aspects given the physical constraints of battery size, cost and chemical power density. Every opportunity to reduce weight is valuable, including the weight of the power delivery 48V DC-DC converters. 48V DC-DC converters appropriate for robot designs are capable of delivering more than 60W per gram (2kW at 29 grams) – a solid benchmark for regulated output converters.

Power Modules Accelerate the Adoption of 48V

These two real-world market segment examples illustrate and underscore the tremendous advantages that 48V-centric (HVDC to 48V and 48V to 12V) high-power-density modules bring to a broad spectrum of industrial, high-performance computing, aerospace and defense and automotive power system designs. In aggregate, the multiplicity of technical, economic and performance-based advantages that 48V power delivery networks enable for next-generation equipment hardware designs are extremely compelling.

Vicor power modules offer industry-leading high voltage (800V/400V to 48V to 12V) zonal bridging, and low-voltage, high-current point-of-load solutions that address all modern hardware design requirements. With the world's first ChiP™ (Converter housed in Package) high volume fabrication process, and a fully vertically integrated and automated factory, Vicor is ready and able to meet today's advanced 48V power module demands.

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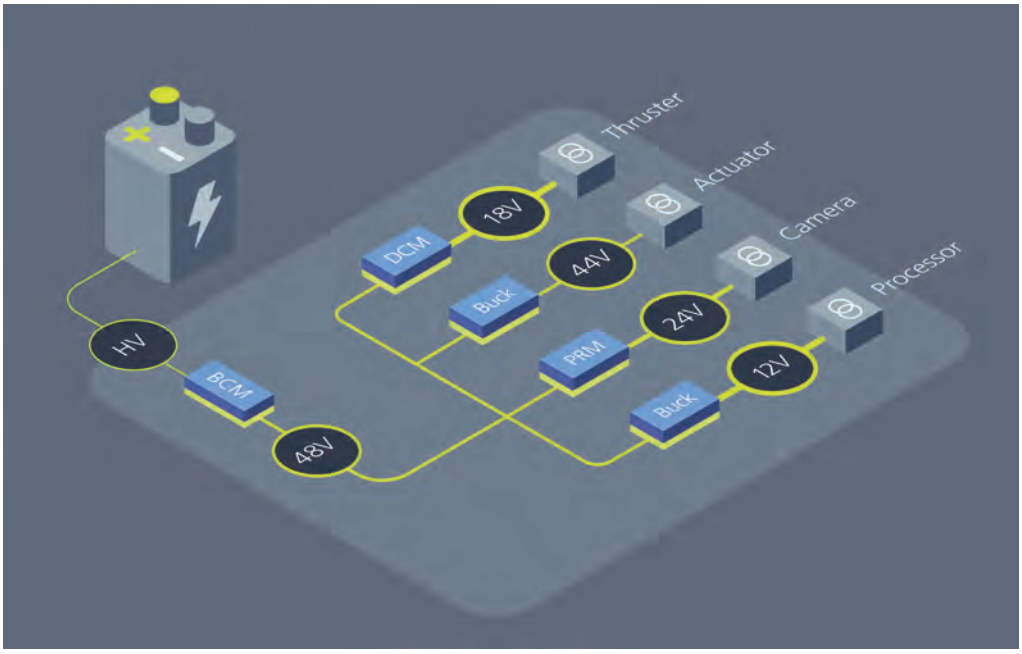

Figure 6: Humanoid robots have numerous power domains with diverse loads. Vicor's broad family of 48-centric power modules adds flexibility to the design process and can accommodate many loads with high efficiency.

Power Semiconductor Industry

Cambridge GaN Devices secures $32M to drive global growth in power semiconductor industry.

- Cambridge University spinout secures Series C funding to expand its operations in Cambridge, North America, Taiwan and Europe
- Cambridge GaN Devices (CGD) develops energy-efficient semiconductors using gallium nitride (GaN), reshaping the future of power electronics
- CGD's technology will help electric vehicles and data centres be more energy efficient, presenting major opportunities in the global power semiconductor industry

Cambridge GaN Devices (CGD), a leading innovator in gallium nitride (GaN) power devices, has successfully closed a $32 million Series C funding round. The investment was led by a strategic investor with participation from British Patient Capital and supported by existing investors Parkwalk, BGF, Cambridge Innovation Capital (CIC), Foresight Group, and IQ Capital.

Transforming Power Electronics with GaN

Gallium nitride-based devices represent a breakthrough in power electronics, offering faster switching speeds, lower energy consumption, and more compact designs than traditional silicon-based solutions. CGD's proprietary monolithic ICeGaN® technology, which simplifies the implementation of GaN into existing and progressive designs, delivers efficiency levels exceeding 99%, enabling energy savings of up to 50% in a wide range of high-power applications including electric vehicles and data centre power supplies. These innovations have the potential to save millions of tons of CO2 emissions annually, accelerating the global transition to more sustainable energy systems due to the inherent ease-of-use that ICeGaN® technology provides to its customers.

Dr. Giorgia Longobardi, CEO and Founder of CGD: "This funding round marks a pivotal moment for CGD. It validates our technology and vision to revolutionize the power electronics industry with our efficient GaN solutions and make sustainable power electronics possible. We're now poised to accelerate our growth and make a significant impact in reducing energy consumption across multiple sectors. We look forward to collaborating with our strategic investor to penetrate the automotive market".

Market Opportunity and Proven Success

The global GaN power device market is

CGD Team

projected to grow at a remarkable CAGR of 41%, reaching $2 billion by 20291. At the same time, ICeGaN® is being seen as a viable alternative to existing solutions using Silicon Carbide (SiC), combining high energy-efficiency, miniaturization, and monolithically integrated smart functionalities. This will enable Cambridge GaN Devices to have access to a high power market estimated to be in excess of $10 billion by 20291. With its cutting-edge technology and market leadership position, CGD is well positioned to capitalize on this rapid market expansion. Having successfully secured industry-leading customers in their pipeline, CGD has consistently demonstrated its ability to deliver reliable and impactful solutions, enabling innovation in the sector.

Henryk Dabrowski, SVP of Sales CGD:" I'm thrilled to see this funding helping to deliver on customer deals we've already closed for CGD's latest-generation P2 products. This investment will significantly boost our ability to meet the growing demand for our reliable and easy-to-use GaN solutions."

Global Expansion and Vision for the Future

With a global team of experts, decades of research, and a commitment to pushing the boundaries of GaN technology, CGD continues to deliver solutions that enhance everyday electronics. As the world advances toward electrification and sustainability, CGD's leadership in GaN technology offers a pathway to reduce energy consumption, lower costs, and mitigate environmental impact. By enabling efficient, compact, and high-performance power devices, CGD is setting a new standard for sustainable power electronics.

The funding will enable the company to expand its operations in Cambridge, North America, Taiwan and Europe, and deliver CGD's unique value proposition to its growing customer base.

This significant investment will fuel CGD's growth strategy, focusing on the continued delivery of highly efficient GaN products to high-power industrial, data centre, and automotive markets.

John Pearson, Chief Investment Officer Parkwalk Advisors: "CGD is at the forefront of technology that can reduce the energy demands of booming industries, like Artificial Intelligence and Electric Mobility. It has enormous global potential and widespread applications which will see CGD continue to innovate and grow. We are proud to have backed CGD since 2019 and are excited to be working with an exceptional team and cohort of other investors to accelerate its global expansion."

George Mills, Director, Deeptech - Direct & Co-Investments, British Patent Captal: "Following years of research, Cambridge GaN Devices have proven the impact of their semiconductor technology. Their GaN devices consume less energy than their silicon-based counterparts, which both reduces costs and has a positive environmental impact. It's valuable technology that now needs long-term capital to scale."

https://camgandevices.com/

Microgate helps penetrate deep space to unlock secrets of the Universe

Adaptive optics using precision power conversion technologies enable world-changing discoveries

Established in 1989 by brothers Vinicio and Roberto Biasi, Microgate built its early reputation providing highly accurate timing devices for professional sports and racing events. Driven by a focus on extreme precision, the company soon expanded its technology to space exploration, emanating from Roberto's advanced training in adaptive optics, which inspired the design of a linear motor-driven control system for massive earth-based telescope installations.

Enabling deep space exploration with colossal telescopes

The European Southern Observatory (ESO) is an intergovernmental, ground-based astronomy research organization comprising 16 member states and is working with Microgate to build the adaptive mirror for the next and largest generation of Extremely Large Telescopes (ELTs).

ELTs use primary mirrors with diameters in the 30-meter range – or in the case of the ESO-ELT an even more impressive 39-meter diameter. The objective of these telescopes is to capture light from the distant past to learn more about the early Universe. This requires a large primary mirror to collect the very few photons that can be captured from distant stars and galaxies. Unlike the Hubble or James Webb space telescopes, this Earth-based method of exploring the deep space has several advantages. According to *The Astronomy Enthusiast,* ground telescopes have an advantage of size – noting that the largest Earth-based telescope is 23 times larger than the Hubble. Ground telescopes can also be located anywhere on the planet and are easily upgradeable using the latest technology, while their counterparts in space are far more difficult to maintain and upgrade once launched.

Figure 2: ESO's telescopes helped Andrea Ghez and Reinhard Genzel win the Nobel prize in Physics in 2020 for the discovery of the supermassive black hole in the Milky Way's galactic centre.

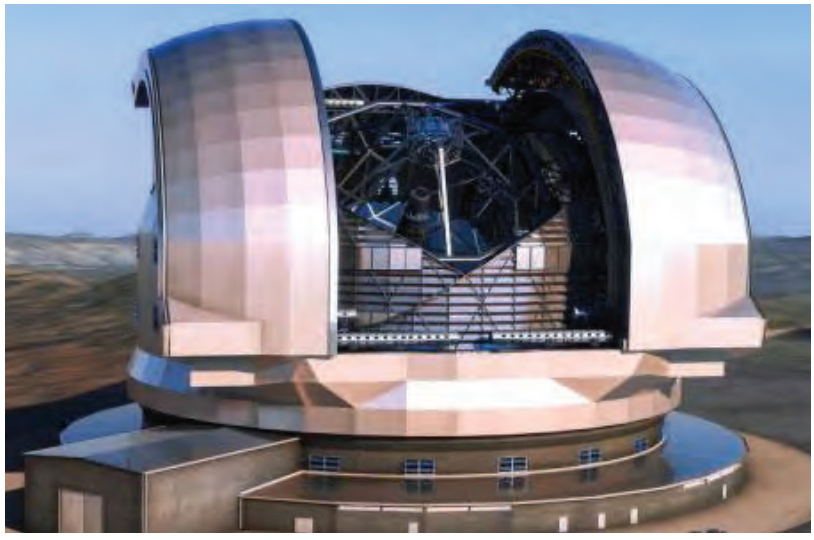

Figure 1: Microgate builds the highly sophisticated adaptive-optics mirror for the ESO Extremely Large Telescope. The optics, powered by high-density DC-DC converter modules, correct for atmospheric disturbances to extract more light, achieving higher resolution imaging.

ESO's existing telescopes have made possible several ground-breaking discoveries. For example, using the organization's facilities, astronomers tracked the movement of stars in the extreme gravitational field at the center of our galaxy, delivering convincing evidence that a supermassive black hole exists there. This discovery was recognized with the 2020 Nobel Prize in Physics.

Sophisticated adaptive optics compensate for wavefront aberrations enhancing visibility

The ESO-ELT is situated atop Cerro Armazones in Chile's Atacama Desert at an altitude of about 3,000 meters. The site

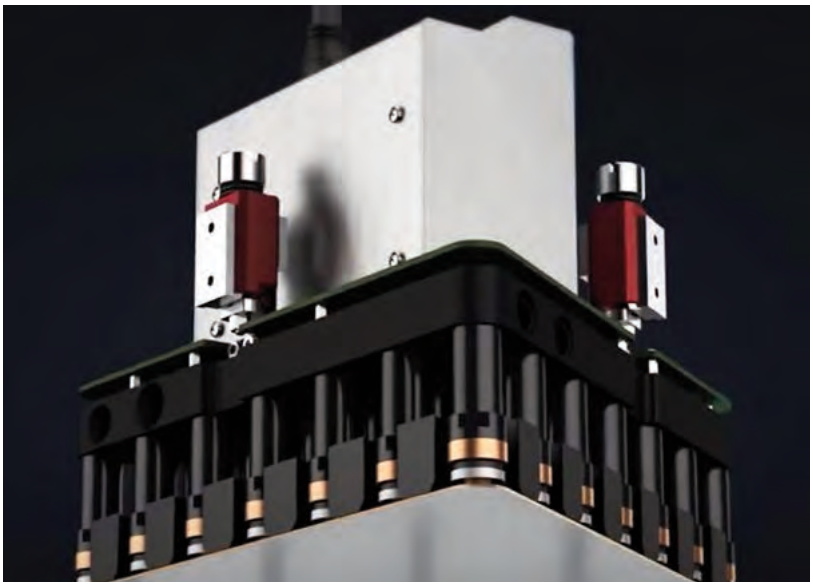

Figure 3: The mirror physically floats on the magnetic field generated by the voice-coil motors. Each coil allows a dedicated control current to locally deform the mirror and correct the shape. Using electronics operating at a frequency of about 100 kHz, the shape of the mirror can be completely redefine in one millisecond.

selection for these installations was strongly dependent on the quality of visible light.

This is because, as light passes through the atmosphere, it is subject to a disturbance known as a wavefront aberration. Using Microgate technology, the captured light is reflected from the primary to a secondary, adaptive mirror, which is physically deformed to re-establish what is known as a "plane" wavefront. In the case of the ESO-ELT project, Microgate delivers all of the real-time control hardware and software to mechanically deform the mirror and physically manipulate the incoming wavefront to correct for these atmospheric disturbances and improve the image quality.

The ability to control the mirror's geometric shape requires the use of contactless, linear voice-coil motors that conceptually are similar to a loudspeaker.

The adaptive mirror is 2.4 meters in diameter and is made of highly specialized glass with a thickness of 1.9 millimeters. The voice-coil motors are driven by a precise current driver and a series of co-located permanent magnets. These are glued to the back of the mirror and provide the force to deform the glass. This process is performed across the entire surface of the adaptive lens using 5,316 motors, each with an inter-axis distance, or pitch, of about 30 millimeters.

The adaptive mirror physically floats on the magnetic field generated by the voice-coil motors. Each coil allows a dedicated control current to locally deform the mirror and correct the shape. This is achieved by using an equivalent number of highly-sensitive capacitive, or position, sensors with an accuracy in the nanometer (millionth of a millimeter) range. Using electronics operating at a frequency of about 100 kHz, Microgate engineers can completely redefine the shape of the mirror in one millisecond.

Once the gap has been measured, FPGA-based processors apply the correct commands to the mirror in real time and bring the control error to zero. The result is an extremely sharp and clean image that is rendered without having to launch a telescope into space.

"The process requires extreme precision to correct the wavefront aberrations," said Gerald Angerer, Microgate hardware development engineer. "As a result, we can improve the image resolution significantly."

High density power modules are mission critical to honing adaptive optics

The energy challenges to achieve such precision are considerable. For example, accurate thermal management of the adaptive optics system is critical and requires all exposed surfaces to be kept close to ambient temperature to avoid local turbulence. To compensate, Microgate uses a direct-expansion gas cooling system to thermally dissipate the motor-control electronics. Other cooling materials, such as water or glycol have been excluded, because even a small loss of coolant on the primary mirror could cause catastrophic damage to the entire telescope.

The power challenge is made even more difficult by the limited space available for any power delivery solution, given the constraints imposed by housing thousands of motors in a confined space. A previous option required remote DC-DC converters to bring power to the motors with relatively long and complex wiring.

To streamline the approach, Microgate chose the Vicor DCM3623 series DC-DC power module. The power-system board is now mounted on the underside of the gas-cooled cold plate, and each DCM3623 powers up to 36 motor channels, eliminating complicated wiring.

"Vicor's high-efficiency and high-power density modules are very compact and reliable and take up very little space on the circuit board," said Angerer. "These miniaturized power converters are the best

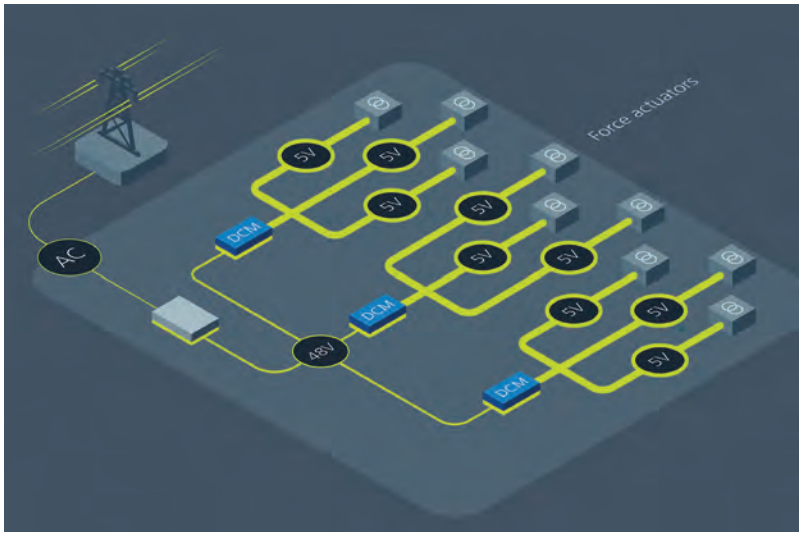

Figure 4: Microgate uses the Vicor DCM3623 series - DC-DC power module to mechanically deform the miror and physically manipulate the incoming wave-front to correct for these atmospheric disturbances. This process is mission critical to the telescopes optics to produce stronger light and ultimately higher image quality.

option for us. We have been using them for more than 10 years and there is currently no comparable substitute."

Vicor power modules deliver other benefits over alternative solutions:

- **Power density:** Vicor power modules are compact and extremely dense to meet the intense power demands of the ELT mirrors in a very confined space.
- **Efficiency:** The modules reduce energy losses created in the form of heat, helping to keep the temperature of the optical system stable. Too much heat could potentially degrade performance or distort optics.
- **Fast transient response:** The output voltage of Vicor modules remains stable within a wide frequency band, ensuring precise motor operation even under fast step-load variations.
- **Low electromagnetic noise:** EMI interference can disturb the focusing system, resulting in loss of image quality.

Together exploring new frontiers of deep space to enrich our world

Microgate is committed to deep space exploration through the instantaneous, precise manipulation of exceptionally complex mirrors. Vicor power modules are enhancing the optics of these next-generation telescopes with high power density and reliability. Through a process of continuous experimentation, Microgate is collaborating with Vicor and other world-class partners to deliver mission-critical power electronics to organizations like the European Southern Observatory.

"Unlocking the secrets of deep space is difficult," said Angerer. "These new discoveries are re-writing our history books and redefining the way we think about the human race and where we fit into the Universe. It's very challenging, and we are grateful to be working with some great partners to achieve our goals."

Brothers Roberto Biasi and Vinicio (RIGHT)

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5 Key Uses for Virtual and Augmented Reality in Electronics Manufacturing

In the rapidly evolving world of electronics, staying ahead of the curve is imperative. That's why many electronics and original equipment manufacturers (OEMs) are investing more and more in new technologies, particularly in virtual reality (VR) and augmented reality (AR).

Far from being merely futuristic concepts, these technologies are transforming the industry today, enhancing efficiency, accuracy and productivity across various stages of the manufacturing process.

In fact, the global AR and VR market in manufacturing is projected to reach $88.4 billion by 2026, growing at a compound annual growth rate (CAGR) of 31.5% from 2023. This surge in adoption is driven by the benefits these technologies bring to the table – from improving quality control and maintenance to enhancing training, design and prototyping.

Let's delve into five significant applications of VR and AR in manufacturing, exploring their benefits and considerations…

1. Better prototyping and design

AR and VR are transforming the design and prototyping stages by allowing engineers and designers to visualise products in 3D before they are built. VR can be used to create virtual prototypes that can be tested and modified in a virtual space, whereas AR can project design iterations onto physical objects – providing a hybrid view that combines the new designs with existing physical components.

Benefits:

- Augmented and virtual reality technologies significantly reduce the time required to develop and refine prototypes.
- Cost savings. Electronics manufacturers and OEMs can cut down on the material costs associated with physical prototypes.
- These technologies facilitate better communication and collaboration amongst design teams, regardless of their location.

Considerations:

- Technical skills. Before employees can start realising the full benefits of AR and VR for prototyping and design, they first need to be taught how to use these specialist design tools.
- Software integration. Ensuring compatibility with existing design and engineering software can be challenging.

2. Streamlined maintenance and repair

Both augmented and virtual reality technologies can provide real-time, hands-free guidance for maintenance and repair tasks. Technicians can wear AR glasses that overlay instructions and diagrams directly onto themachinery they are working on. This can include step-by-step guides, real-time data from sensors and remote assistance from experts.

Benefits:

- These technologies reduce human error by providing precise, real-time instructions.

- AR and VR speed up repair processes by providing instant access to information.
- Knowledge transfer. Less experienced workers can perform complex tasks with expert guidance from AR and VR rather than taking up the time of more experienced team members.

Considerations:

- Data security. Electronics manufacturers and OEMs need to be mindful of ensuring the security of sensitive data displayed via AR or VR.
- Dependence on technology. As with any tech, there is the potential for over-reliance on AR or VR systems, which can be problematic if the technology fails.

3. Improved quality control

AR and VR can enhance quality control processes by allowing inspectors to compare products against digital benchmarks in real time. For example, AR can highlight deviations from the standard directly on the product, whilst VR can simulate and analyse production processes to identify potential quality issues before they occur.

Benefits:

- AR and VR improve the accuracy of inspections.
- These technologies can identify issues before they lead to defects, reducing waste and rework.
- Electronics manufacturers and OEMs can simplify the documentation process by automatically recording inspection data through AR or VR.

Considerations:

- Implementation complexity. Integrating AR and VR with existing quality control systems can be complex.
- Inspectors need training to effectively use AR and VR tools.

4. Enhanced training programmes

Manufacturers are employing VR and AR to create immersive training modules for their employees. Instead of traditional methods, new hires can now engage in interactive simulations that mimic real-world scenarios.Both VR and AR enable trainees to practise operating machinery, performing complex tasks and responding to emergency situations in a risk-free environment.

Benefits:

- Training via VR or AR reduces the risk of accidents during the learning phase.
- Cost-effective. These technologies lower costs associated with ongoing training materials and potential equipment damage due to mistakes.
- With AR and VR, electronics manufacturers and OEMs can accelerate the learning curve by providing hands-on experience without interrupting actual production.

Considerations:

- Initial setup cost. Developing VR and AR training modules can be expensive.
- Equipment needs. Training using VR and AR requires investment in headsets and compatible software.

5. Increased remote collaboration

Remote collaboration amongst teams is becoming increasingly important across a range of industries, including electronics manufacturing. AR and VR enable teams to work together on complex projects regardless ofphysical location. For instance, VR meetings can simulate face-to-face interactions, whilst AR can enable remote experts to provide real-time support and guidance.

Benefits:

- Global connectivity. AR and VR facilitate collaboration between teams across different locations.
- Time efficiency. A reduced need for travel helps electronics manufacturers and OEMs to save both time and costs.
- Enhanced communication. Improved understanding through visual and interactive elements helps bring teams up to speed quickly and ensures everyone is on the same page.

Considerations:

- Connectivity requirements. Reliable high-speed internet is crucial for seamless AR or VR
- Adoption barriers. Resistance to adopting new technologies can be a challenge.

Driving innovation and maintaining a competitive edge

The integration of virtual and augmented reality in electronics manufacturing offers numerous benefits, from enhanced training and efficient prototyping to improved maintenance, quality control and remote collaboration. However, these technologies also come with considerations that manufacturers must address, such as initial costs, technical requirements and the need for adequate training.

But as the electronics manufacturing industry continues to evolve, the strategic use of VR and AR will be pivotal in driving innovation and maintaining a competitive edge. Around 61% of manufacturing companies are already using or planning to implement AR within the next year, so if they want to remain competitive, it will be vital for other manufacturers to follow suit.

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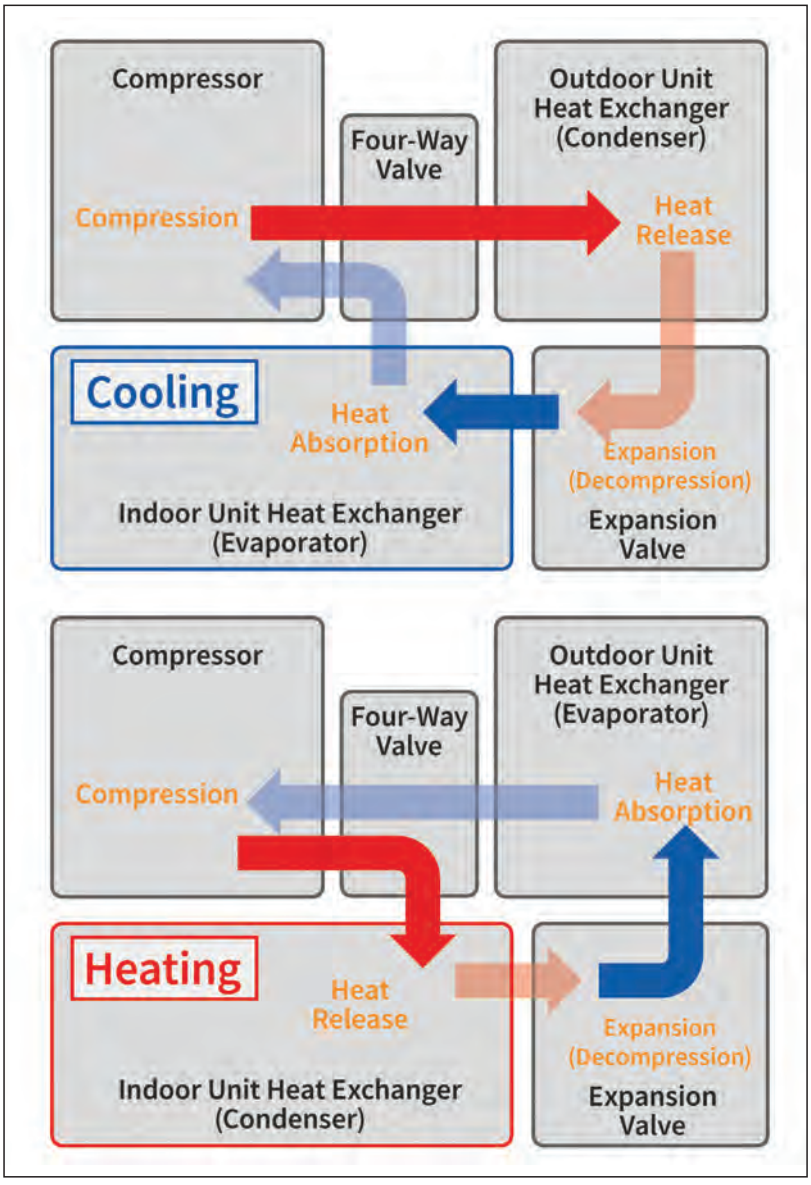
Heat pumps call for optimised solutions

Frank Malik, Radoslav Valchev, Toshiba Electronics Europe GmbH

The heat pump has become the leading choice for low-carbon heating and air-conditioning. Thanks to its high coefficient of performance (COP), it can deliver far more efficient temperature control to the home and office than conventional systems, such as gas boilers. To ensure the technology is used as widely as possible in the drive to net-zero, manufacturers will need to look carefully at the bill of materials and system cost. Reference designs provide valuable guidance to them as they illustrate how a variety of components can deliver more than the sum of their parts by taking into account how different technologies can support each other. The result is a design that both minimises the cost of the subsystem and reduces development time.

The concept behind the heat pump is powerful but simple, using an exchange of heat with the building surroundings by selectively compressing and expanding a refrigerant gas. Using this process, the heat pump achieves optimal energy utilisation, delivering more than 7kW of heat using just 1kW of electrical power under optimum conditions. Practical considerations and temperature variations over the year reduce the calculated efficiency. Even so, it is common to achieve figures ranging from 2.5 to 5. That compares well to a conventional water boiler. This will deliver only about 90% of the delivered power into useful heat, resulting in a COP of less than 1.



Motor control is key to effective thermal exchange, lowering losses and optimal use of energy. There are several important locations for motor controllers inside heat pumps, which are normally divided into two modules. One of these modules normally sits outdoors. This unit contains a tank that provides the refrigerant used throughout the heating and cooling system alongside a compressor, fan, and an evaporator/condenser unit.

In most cases, a smaller indoor unit contains motors that direct the flow of fluid through the heating system. It also contains a second evaporator/condenser unit and the user interface panel. The two units exchange heat between the indoor and outdoor environment using a refrigeration-type process that uses paired compression-condensation or expansion-evaporation cycles, depending on whether the indoor environment needs heating or cooling.

Toshiba developed the RD219 reference design to help support engineers deliver an efficient heat pump system. At its core is a single MCU combined with low-loss power components in an architecture that optimises the bill of materials.

Focus on power conversion

Power-conversion technology plays a vital role throughout the design. The compressor and fluid and air pumps represent key locations for motor controllers. Circulating pumps and valves, based on either motors or solenoids, help control the flow of refrigerant gas or liquid through the indoor heating system. Low-power permanent-magnet

synchronous motors (PMSM) or brushless DC (BLDC) motors can be used to drive additional fans to boost the rate of indoor air distribution.

Because heat pumps consume significant amounts of power, efficient rectification of the AC mains supply is an important requirement for the power-supply electronics. Designs will need to perform power factor correction (PFC) to prevent high levels of reactive power that are generated by simple rectification circuits, even with the help of capacitive smoothing. Active PFC circuits deliver better correction capabilities, using a boost-chopper configuration to control the flow of energy across multiple switching operations per AC cycle. This circuitry shapes the current waveform to follow the sine-wave profile of the input voltage. In doing so, it delivers a power factor close to unity.

Though designers can choose from several methods of PFC, continuous-conduction mode (CCM) will deliver the lowest current ripple. One consequence of this is the potential generation of a reverse-recovery current that is superimposed on the current that passes through the circuit's inductor when each power transistor is switched off. The addition of a Schottky diode such as Toshiba's TRS24N65FB helps minimise losses. Its silicon carbide technology leads to lower stored charge and with that low switching losses. A fast-switching insulated-gate bipolar transistor such as the GT30J65MRB further improves efficiency.

When optimising power-conversion efficiency in a heat pump, the critical motor is that in the compressor. This motor, typically based on an AC architecture, will encounter the biggest changes in operating conditions, resulted by the alternating gas pressure. This leads to large differences in torque requirements.

Field-oriented control

The key to efficiency in this motor is to use advanced field-oriented control (FOC) rather than simpler methods, such as volts-per-hertz. FOC continually tunes the current supplied to the three groups of stator winding inside a typical BLDC motor to force the rotor to move from one position to the next. In contrast, simple control methods suffer from different flaws such as high torque ripples, excessive losses and slow reaction to rapid load condition changes among others.

FOC considers torque as a central element in its strategy. The technique works by accurately modelling the magnetic field inside the motor. It uses that mathematical model to predict the motor's state, including rotor position, at any point in time. As load conditions change and alter sensor inputs, FOC reacts to adjust the current and voltage supply to each phase. This responsiveness ensures that the motor operates at its optimal efficiency under varying load and speed requirements.

A key benefit of FOC lies in its ability to reduce harmonic distortion in the electrical system. The method ensures the current waveform applied to the motor conforms to a smooth sinusoidal shape. This reduces the losses that are associated with harmonic currents. The motor generates less heat and overall system efficiency improves.

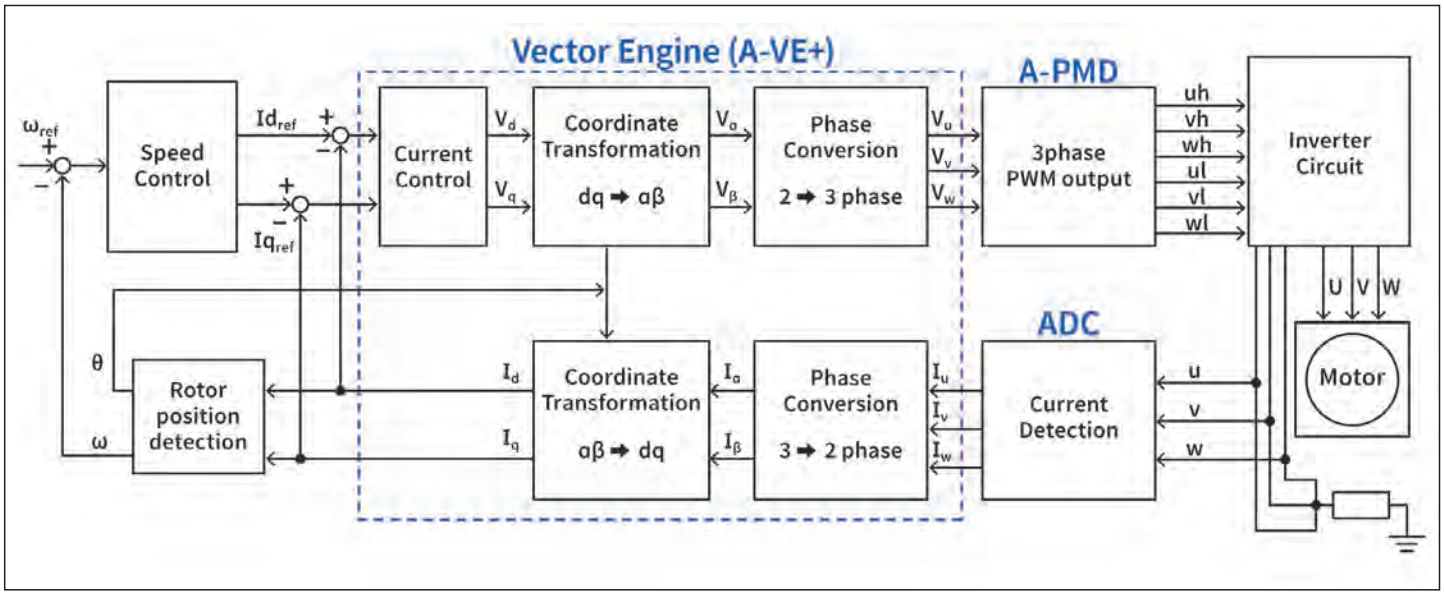
The use of a mathematical model to determine the rotor state avoids the need to include position or rotary motion sensors in the system design. The algorithm can estimate rotor angle using just current feedback provided by a simple shunt resistor.

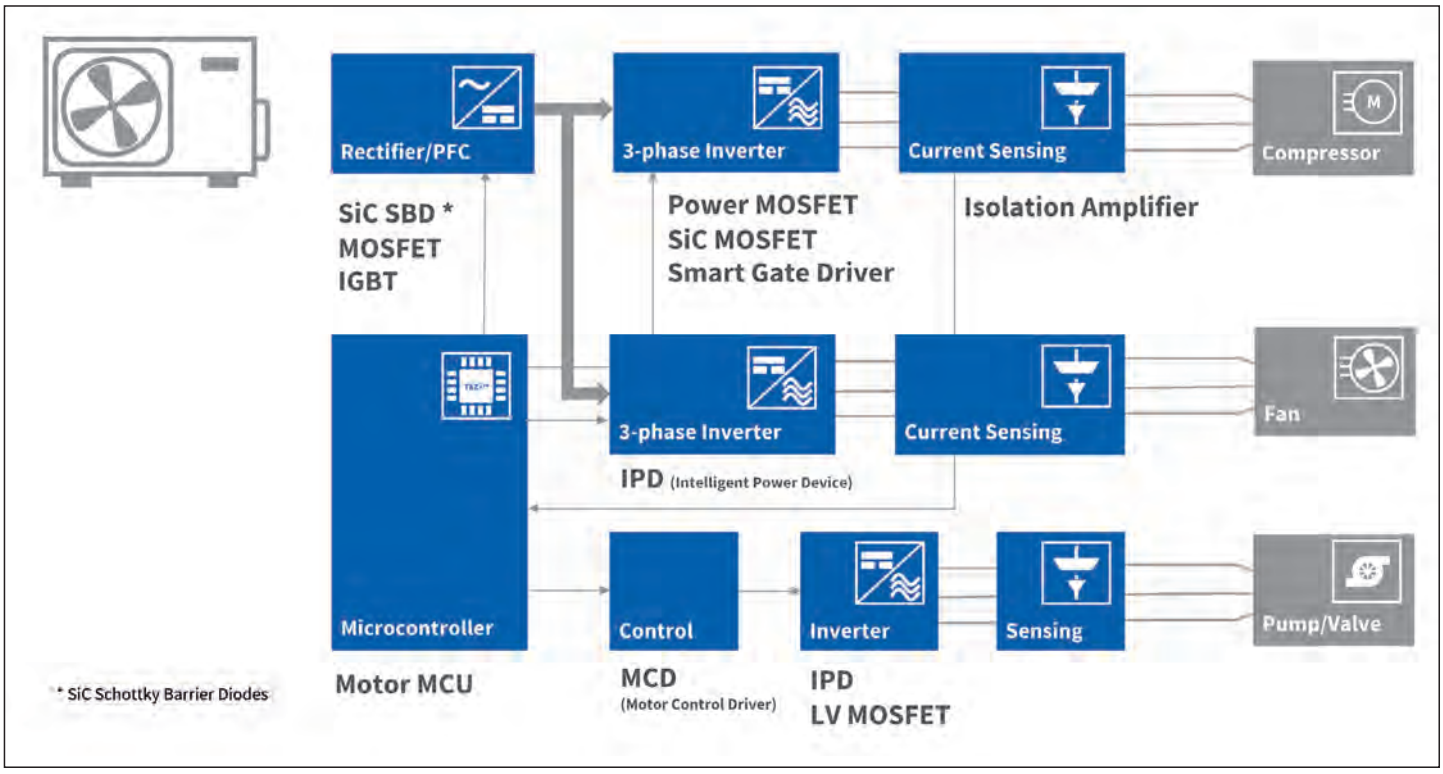
High-speed processing

The mathematical model demands complex arithmetic, which relies on repeated multiplications combined with sine and cosine trigonometric functions. This poses a problem for traditional MCUs. They rarely feature optimized instructions set for such specific tasks. To make use of these devices, developers need to implement software functions based on lookup tables for the trigonometric functions together with multi-instruction emulation of complex multiplications. The alternative is to employ a digital signal processor (DSP) that has required hardware support for these operations, though this may lack the infrastructure needed for interrupt-driven input/output control that is also necessary for motor control.

Though the pump motors can use relatively simple motor-control techniques, as they are not subject to the large torque changes of the compressor, there are user requirements that will complicate the design. The torque ripple of simple trapezoidal control signals often used to control BLDC motors results in unwanted noise and vibration. That is a problem in domestic environments where people may sleep close to the heat pump's external unit.

As a result, system designers may feel the need to employ multiple MCUs, possibly in combination with a digital signal processor (DSP), to implement the FOC calculations. However, careful attention to the needs of each of these subsystems leads to a solution where one system-on-chip (SoC) device can manage all the major functions of a heat pump.





Integrated design

For FOC and other algorithms that need advanced arithmetic and trigonometric functions, one solution is to employ a high-speed Arm® Cortex®-M processor and use that in combination with on-chip accelerators. Toshiba's TMPM4KL provides an example of this, employing the Arm® Cortex®-M4 RISC-based processor core running at speeds of up to 160MHz. A key addition to the core processor is the Advanced Vector Engine (A-VE). This provides the hardware support and instructions needed to perform the advanced DSP required by FOC.

PWM performance can be improved by the use of on-chip hardware units, such as Toshiba's A-PMD. This type of unit implements a wave-generation circuit coupled with a synchronous trigger-generation circuit. Across three phases, the wave-generation circuit creates appropriate PWM signals within each cycle. The module includes the ability to insert a dead-time period for each phase, which is a vital element of PWM algorithms to prevent shoot-through in the power stages. These functions can be scheduled automatically based on the data received from a single current shunt.

The RD219 reference design couples the TMPM4KL with other carefully chosen support components. For example, in the compressor section, the TK20A60W5 600V DT-MOS MOSFET ensures low conduction losses and delivers with low parasitic capacitances for fast and efficient switching. Motor-phase switching control is simplified by the TPD4204F, which integrates a level-shifting gate driver IC with superjunction MOSFETs.

Control over additional motors can be provided with sensorless sinusoidal control using the TC78B011FTG motor control driver. All can be managed by the TMPM4KL, which thanks to its accelerators, has the headroom to control two motors using FOC, handle PFC and manage pump-motor controllers solenoid-operated valves.

The resulting reference design provides the basis for building efficient heat pumps using the combination of advanced silicon for digital control and high-performance power devices that make the most of wide-bandgap and silicon technologies.

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Automated Test Equipment Revival

Repurposing and Extending the Life of Aging ATE Systems

Automated Test Equipment (ATE) and Automated Test Systems (ATS) serve the critical purpose of ensuring that electronic devices operate according to specifications in the field. As such, these systems are widely utilized for testing automotive electronics, batteries, telecom infrastructure, renewable energy systems, and consumer electronics. The aerospace and defense sectors also make substantial investments in ATE due to the criticality of electronics utilized in military equipment such as aircraft, naval vessels, and ground vehicles, as well as in various systems like weapons, radar, and wireless communication.

The dilemma, however, is that ATE stations are specifically engineered to validate the functionality of the units being tested. A substantial investment in testing equipment is necessary, and then… everything changes. Government contracts may not be renewed or could be entirely terminated. Hardware components become obsolete. Test specifications undergo modifications, sometimes necessitating a complete reconfiguration of the test.

At this point, the purpose-built ATE system that costs hundreds of thousands to millions is often left to gather dust, redistributed to another program, sold, salvaged for parts, or scrapped altogether.

"Some companies essentially have $300,000 paperweights sitting in their laboratory. At that point, they face a choice – they can find a way to get rid of it or have it refurbished or repurposed to meet the requirements of a new program or test," says Andrew Engler of Intepro Systems. Founded in 1981, Intepro has supplied Automated Test Equipment (ATE) systems that test power electronics used in various applications.

Engler emphasizes that many ATE equipment customers are not aware that updating or repurposing the equipment is even an option. However, experienced ATE system integrators like Intepro can upgrade any hardware component, replace the existing test program, and even reconfigure the entire test. There are significant benefits to this approach, including cost savings when compared to purchasing an

Photo: Intepro Systems refurbished

Experienced integrators can upgrade hardware components, replace test programs, and reconfigure tests, extending the equipment's life and functionality.

entirely new system.

ATE Revival

ATE encompasses apparatus designed to conduct tests on a device, referred to as the device under test (DUT), equipment under test (EUT), or unit under test (UUT). Through automation, these systems efficiently execute measurements and assess test outcomes.

The ATE system typically consists of hardware, software, test instruments, signal sources, and test harnesses, probes or handlers. The hardware components are typically consolidated into all-in-one test stations, which vary in size and portability from compact test stations on wheels to large stationary test towers. Each system also includes test program software, which plays a critical role in test development and the management of data collection, storage, reporting, and analysis.

Engler says that these systems typically require long support paths since test requirements often extend 10-15 years. When this occurs, hardware components may fail or become obsolete.

Replacing hardware components is a relatively simple process. Although ATE systems can be used for different types of tests, Engler says Intepro specializes in power electronic testing, which includes testing power converters, inverters, chargers, batteries, adapters, and other power components. Although some of the test parameters may be different, there are many commonalities in the components of such systems.

Intepro's ATE test systems feature an open architecture for hardware and software that permits complete flexibility to configure and integrate off-the-shelf instrumentation with a wide range of Intepro and customer hardware. The systems are based on universal buses (VXI, PXI, LXI, CAN, Ethernet, GPIB, and Serial) that provide choice to the customer and are not limited to one brand of equipment.

Intepro offers many of the products used in test stations including AC and DC power sources, AC loads, and other standalone equipment. They offer service and repair work on all products, even on the equipment that they do not distribute. Intepro serves as a distributor for several well-known and established manufacturers.

The ATE test program software is a critical component and extensive reprogramming is required when changes need to be made, often at a substantial cost.

Intepro offers flexible test program software called PowerStar that streamlines and adapts to inevitable changes without extensive new programming. With more flexible software, ATE stations are 'future-proof' to ensure that as hardware requirements change and evolve, the test programs can adapt accordingly to ensure long-term usability.

PowerStar provides hundreds of fill-in-the-blank test routines that provide a range of control, from single instrument functional control to full test procedures with easy-to-use parameter entries. Engineers can customize their programs, without having to write code or assemble graphical components.

"[PowerStar] can be seamlessly integrated to operate across various hardware configurations and platforms. Even if there is already an incumbent software, our solution can be implemented and call on the other software when

Photo: System ready for refurbishment for online

Outdated ATE systems, often left unused, can be refurbished or repurposed, offering a cost-effective alternative to buying new systems.

Photo: Intepro_5 Bay System

Automated Test Equipment (ATE) is vital for ensuring electronic devices meet performance standards.

applicable" says Engler.

ATE systems are useful data acquisition and diagnostic tools for testing a variety of electronics in various industries for automatically testing and identifying faults in electronic packaged components.

However, as these systems age, integrators can modify or even repurpose as needed. Given the initial investment in these systems, squeezing more value out of existing automated test equipment is the best way to reduce costs and ensure an adequate return on investment.

For more information, visit www.inteprosystems.com, call (714) 953-2686 or email sales@inteproate.com

Freedom and flexibility for industrial communications with SICK's IO-Link Wireless Gateway

Sensor expert SICK has unveiled its new IO-Link Wireless Gateway, providing greater freedom and flexibility to industrial operations. The Industry 4.0 solution reduces installation costs, delivers real-time data streaming and supports advanced analytics for improved efficiency without the need for expensive cabling.

As demand for wireless connectivity and data communication grows, SICK is meeting evolving industry needs for intelligent, industrial communications and IIoT technology with a robust, easy-to-install wireless IO-Link solution that enables data capture and analysis from multiple sensors.

Working in harmony with SICK's world-class sensors and actuators, the IO-Link Wireless Gateway reduces installation and cuts downtime, while enhancing flexibility and safety. It features an intuitive design and enables real-time data streaming to enterprise and cloud platforms for advanced analytics, predictive maintenance and greater operational efficiency.

Preparing for the smart factories of the future with an advanced wireless solution

Ideally suited to applications where wired connections are impractical or impossible, SICK's IO-Link Wireless Gateway is the next evolution of the IO-Link global, bi-directional, smart, industrial communication standard. It enables innovative new machine designs that weren't previously possible and is also simple to retrofit to existing technology for unparalleled flexibility, future-proofed automation and greater scalability.

Comprising the IO-Link Bridge, IO-Link Hub and the IO-Link Master, the new suite of wireless IO-Link solutions available from SICK is the easiest way to make sensors and actuators wireless. Both the Bridge and the Hub can be used to feed data back to the master, with the IO-Link Hubs facilitating multi-sensor connectivity through their four IO-Link ports. The IO-Link Master can support up to 16 sensors at once, with the SICK Wireless IO-Link Gateway delivering smart connectivity at a distance of up to 20 m, with low latency of 5 ms.

Seamless integration of accurate, uninterrupted data collection into any operation

The SICK IO-Link Wireless Gateway offers simple, hassle-free installation with its 'plug-and-play' functionality, eliminating the need for programming or complex wiring. Sensors can be easily configured remotely via the IO-Link Wireless Gateway and the IO-Link Wireless network ensures uninterrupted data transmission and accurate data collection through dynamic frequency hopping and blacklisting. Localised power cabinets reduce interference, voltage drops and electrical noise, to further safeguard data accuracy.

The point-to-point wireless communication system adapts to any existing data infrastructure on the PLC, while ensuring accurate data transmission. Using the 'Connect X' platform, it provides access to various IIoT interfaces, such as REST API and MQTT, as well as multiple fieldbuses, including PROFINET, EtherNet/IP, and EtherCat.

Optimise production within harsh industrial settings

The exceptional flexibility offered by the SICK IO-Link Wireless Gateway is ideal for automation solutions where wired connections are impractical or unfeasible across a wide range of industry sectors, with applications including:

- Helping food & beverage manufacturers uphold strict hygiene standards by eliminating cabling, which can harbour bacteria and cause cross-contamination.
- Providing rapid cost-effective scalability to conveyors & cross belt sorters by supporting more sensors over longer distances, enabling additional sorting stations and extensions without costly hardware upgrades.
- Enabling real-time device-to-device communication among devices like AMRs, AGVs, and forklifts with low latency and data integrity, ensuring cohesive coordination and high flexibility with no cabling to minimise downtime.

Charlie Walker, SICK UK Data Solutions Consultant, says, "Now more than ever, wireless industrial communication systems, particularly IO-Link Wireless, are pivotal in realising smart factories. This technology provides all the benefits of SICK sensor intelligence with cable-free, simplified machine designs that enhance functionality and scalability. The SICK IO-Link Wireless Gateway also delivers versatility and mobility through remote control and configuration.

"IO-Link Wireless Gateways are part of fostering an advanced, adaptive manufacturing industry, bringing operations into the Industry 4.0 era and achieving unprecedented operational performance."

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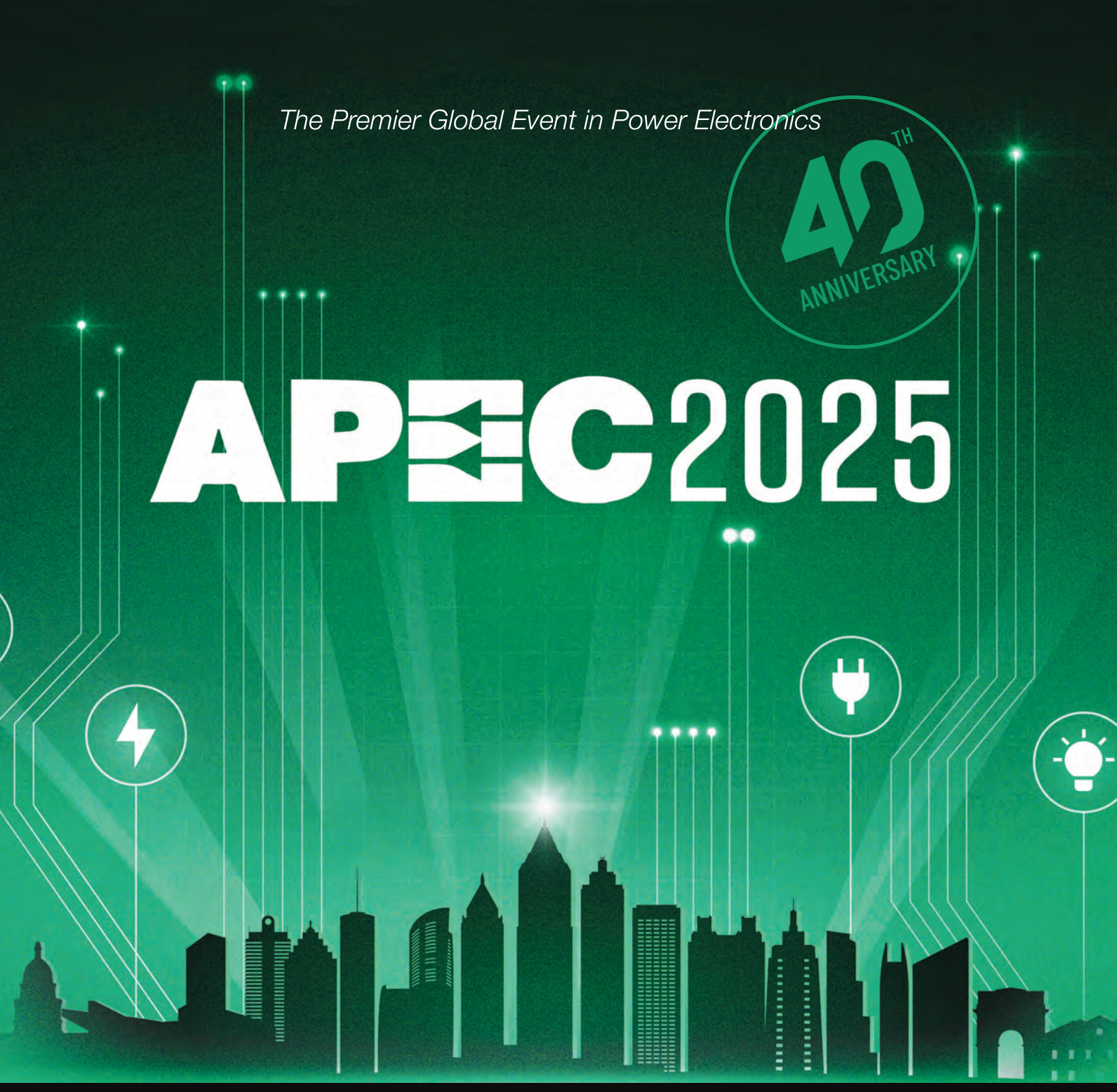

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