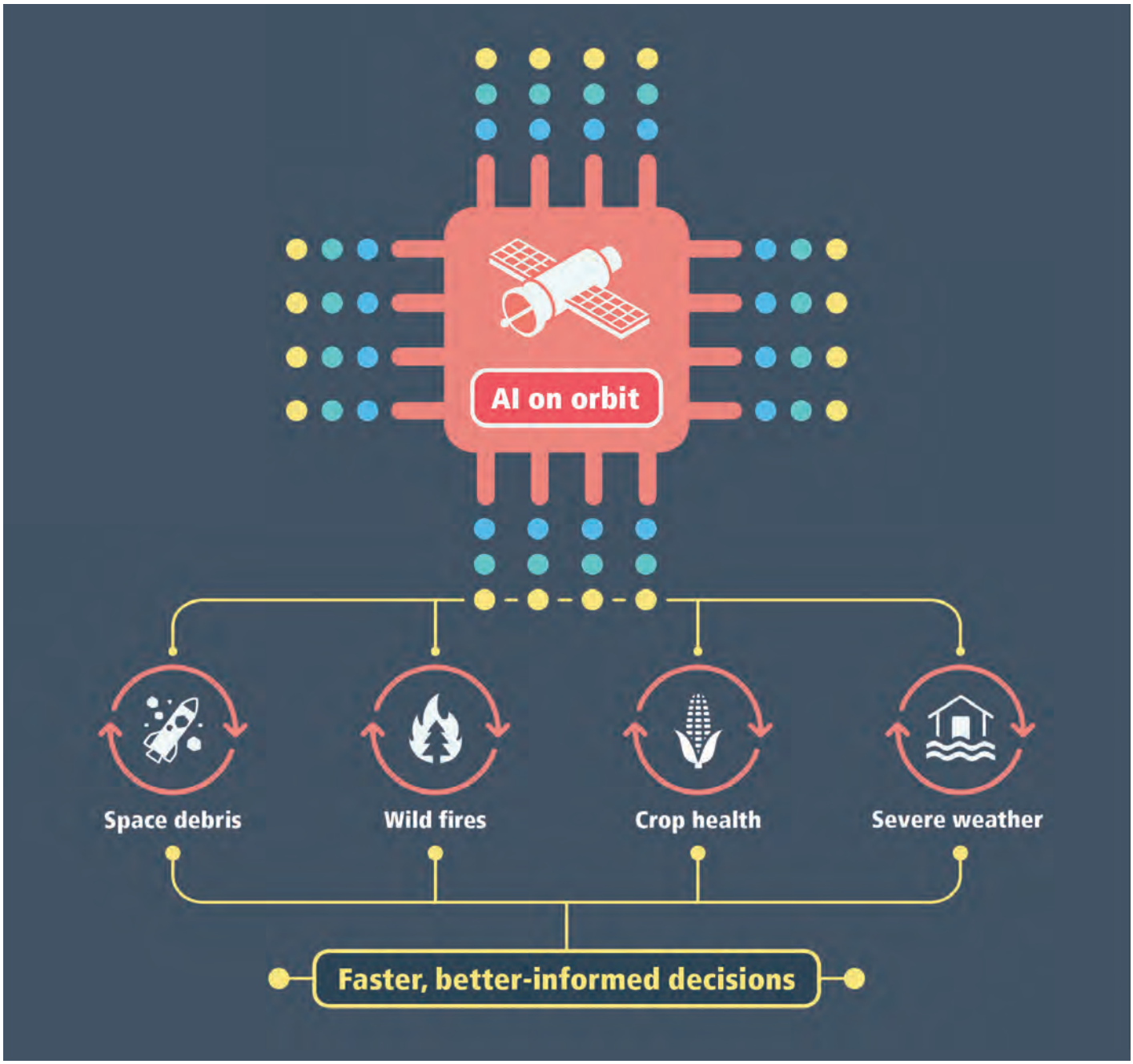
POWER ELECTRONICS EUROPE

ISSUE 1 – Feb/March 2026 www.power-mag.com

AI-ENABLED COMPUTING DRIVES FAST ACTION TO URGENT EVENTS

Powered by high-density, rad-tolerant power modules



THE EUROPEAN JOURNAL FOR POWER ELECTRONICS AND TECHNOLOGY

Also inside this issue

pcim

mesago
Messe Frankfurt Group

Ready for departure?

Your direct flight to the future of power electronics starts right here, right now.

PCIM Expo & Conference
9 – 11.6.2026 I Nuremberg, Germany
Get your ticket now!

Find out more: pcim.mesago.com/visitors

Join the leading event for power electronics

pcim.mesago.com/tickets

News & Features Editor Leslah Garland
Tel: +44 (0)1732 370340
Email: leslah.garland@dfamedia.co.uk

Publisher Damien Oxlee
Tel: +44 (0)1732 370342
Email: damien.oxlee@dfamedia.co.uk
www.power-mag.com

Production Editor Chris Davis
Tel: +44 (0)1732 370340
Email: chris@dfamedia.co.uk

Financial Manager Joanne Morgan
Tel: +44 (0)1732 370340
Email: accounts@dfamedia.co.uk

Reader/Circulation Enquiries
Perception
Tel: +44 (0) 1825 701520
Email: cs@perception-sas.com

INTERNATIONAL SALES OFFICES
Mainland Europe:
Victoria Hufmann
Norbert Hufmann
Tel: +49 911 9397 643
Fax: +49 911 9397 6459
Email: pee@hufmann.info

Eastern US
Damien Oxlee
Tel: +44 (0)1732 370342
Email: damien.oxlee@dfamedia.co.uk

Western US and Canada
Damien Oxlee
Tel: +44 (0)1732 370342
Email: damien.oxlee@dfamedia.co.uk

Japan:
Yoshinori Ikeda,
Pacific Business Inc
Tel: 81-(0)3-3661-6138
Fax: 81-(0)3-3661-6139
Email: pbi2010@gol.com

Taiwan
Prisco Ind. Service Corp.
Tel: 886 2 2322 5266 Fax: 886 2 2322 2205

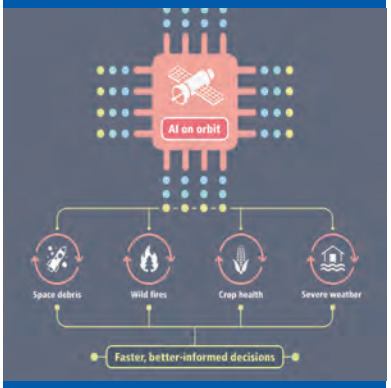
Circulation and subscription: **Power Electronics Europe** is available for the following subscription charges. **Power Electronics Europe**: annual charge UK/NI £95, overseas $160, EUR 150.
Contact: DFA Manufacturing Media, 192 High Street, Tonbridge, Kent TN9 1BE Great Britain.
Tel: +44 (0)1732 370340.
Refunds on cancelled subscriptions will only be provided at the Publisher's discretion, unless specifically guaranteed within the terms of subscription offer.

Editorial information should be sent to The Editor, **Power Electronics Europe**, 192 High Street, Tonbridge TN9 1BE U.K.

Printed by: Warners.

ISSN 1748-3530

FEATURE STORY



Harnessing AI in space to enable faster communication and a new era of innovation

Rad-tolerant DC-DC converter modules power AI1 Transponder for in-orbit computation

By Salah Ben Doua, Sr. Principal Field Application Engineer EMEA Aerospace and Defense & Satellite Solutions, Vicor

More details on page 10.

71st International Electron Devices Meeting

The 71st IEEE International Electron Devices Meeting (IEDM 2025) took place on 6-10 December 2025 in San Francisco

The IEEE IEDM is the flagship conference for breakthrough technologies in electronic devices. It attracts leading researchers, technologists, and industry experts from around the world to present the latest developments in device physics, process technology, and applications.

The event focused on "100 Years of FETs" and the shift from individual device optimisation to full circuit-level integration to address "Moore's Wall".

it is 100 years since Julius Edgar Lilienfeld filed a patent for a FET. Such devices remain central to modern electronics and inevitably to the work reported at IEDM 2025.

Key highlights

Beginning with transistors made from two-dimensional (2D) materials, Quentin Smets and colleagues at Imec, KU Leuven and Intel reported approaches to integrate 2D FETs into back-end-of-line processes. The researchers introduced three distinct device integration schemes: damascene-type top contacts; replacement oxide technology; and interlayer removal.

Elsewhere - advances with oxide-semiconductor channel transistors - where Mutsumi Okajima and colleagues at Kioxia Corporation reported a 3D dynamic random-access memory (DRAM) architecture using such transistors.

Using polycrystalline silicon thin-film transistors (TFTs), Sanghun Jeon and colleagues at the Korea Advanced Institute of Science and Technology (KAIST) reported the development of a neuromorphic silicon retina that can perceive and process light as spikes. The approach involves the integration of the polycrystalline silicon TFTs, which function as spike generators, and amorphous silicon photodiodes.

Work from Jiandong Ye, Guoquan Lu, Yuhao Zhang and colleagues at the University of Hong Kong, Virginia Tech, the City University of Hong Kong and Nanjing University concentrated on the development of an ultrawide-bandgap (UWBG) power module that is capable of 1,000 V and 200 A switching.

Other highlights included breakthroughs in Complementary FET (CFET) technology by TSMC and imec, advancements in 3D DRAM and AI acceleration, new heterogeneous integration techniques like Intel's "DrGaN," and progress in beyond-silicon materials such as 2D materials and silicon photonics.

Technical challenges addressed included thermal management in 3D architectures and reassessing reliability standards for oxide semiconductors.

Save the Date for 2026 - December 12-16, 2026 - Hilton Union Square San Francisco

https://www.ieee-iedm.org/

Navitas Unveils Breakthrough 10 kW DC-DC Platform Delivering 98.5% Efficiency for 800 VDC Next-Gen AI Data Centres

Navitas Semiconductor, a leader in GaNFast gallium nitride (GaN) and GeneSiC silicon carbide (SiC) power semiconductors, has announced it has unveiled a breakthrough 10 kW DC-DC power platform delivering up to 98.5% peak efficiency and 1 MHz switching frequency, enabling unprecedented power density to support the rapid, large-scale expansion of next-generation AI data centres.

The company says the all-GaN 10 kW 800 V–to–50 V DC-DC platform employs advanced 650 V and 100 V GaNFast FETs in a three-level half-bridge architecture with synchronous rectification to deliver 98.5% peak efficiency and 98.1% full load efficiency in a full-brick (61 ? 116 ? 11 mm) package, achieving 2.1 kW/in? power density.

The resulting production-oriented platform supports 800 V–to–50 V and +/ - 400 V–to–50 V architectures at 10 kW, integrating auxiliary power and control to simplify adoption and enable high–power-density module designs for next-generation HVDC AI data centres. Read more on Navitas' Whitepaper on "Redefining Data Center Power: GaN and SiC Technologies for Next-Gen 800 VDC Infrastructure".

"The design platform enables the transition to HVDC data centre power infrastructure, supporting the future power requirements of AI workloads that will demand between 100- and even 1,000-times more compute per query," said Chris Allexandre, President and CEO of Navitas Semiconductor. "Navitas continues to redefine what's possible in AI data centre power, with the 10 kW DC-DC solution giving breakthrough efficiency, power density, and scalability to allow faster and cooler operation while making them more sustainable."

The 10 kW DC-DC platform is being evaluated by key data centre customers through collaborative development and will make its debut at the Navitas booth (#2027) at APEC, March 22–26 in San Antonio, TX.

https://navitassemi.com/

Infineon's Silicon Carbide Power Semiconductors Selected for TOYOTA's New "bZ4X"

Infineon Technologies has announced that CoolSiC MOSFETs (silicon carbide (SiC) power MOSFETs) have been adopted in the new bZ4X model from Toyota, one of the world's largest automakers.

The company says iIntegrated into the on-board charger (OBC) and DC/DC converter, the SiC MOSFETs leverage the material's advantages of low losses, high thermal resistance, and high voltage capability to help extend driving range and reduce charging time.

"We are very proud that Toyota, one of the world's largest automakers, has chosen Infineon's CoolSiC technology. Silicon carbide enhances the range, efficiency and performance of electric vehicles and is therefore a very important part of the future of mobility." said Peter Schaefer, Executive Vice President and Chief Sales Officer Automotive at Infineon. "With our dedication and our commitment to innovation and zero-defect quality, we are well positioned to meet the growing demand for power electronics in electromobility."

Infineon says its CoolSiC MOSFETs feature a unique trench gate structure that reduces normalised on-resistance and chip size, enabling reductions in both conduction and switching losses to contribute to higher efficiency in automotive power systems. In addition, optimised parasitic capacitance and gate threshold voltage enable unipolar gate drive, contributing to simplification of drive circuits for automotive electric drive train and supporting high-density, high-reliability design for OBC and DC/DC converters.

https://www.infineon.com/

Reliable Transient Voltage Protection for Automotive, Industrial and Energy Applications: Comprehensive TVS Diode Portfolio from YAGEO is Available at Rutronik

With a broad portfolio of transient voltage suppression (TVS) diodes by YAGEO, Rutronik says it is strengthening its circuit protection solutions for high-reliability electronic systems. Covering standoff voltages from 5 V to 600 V and surge power ratings from 400 W up to 5,000 W, the portfolio is ideally suited for demanding applications in automotive, industrial and energy markets.

The TVS diode series from YAGEO are designed to protect sensitive electronic circuits against ESD events, lightning-induced surges, load dump transients, and other voltage spikes. Thanks to their fast-clamping response, high peak pulse current capability, and stable electrical characteristics, the devices can reliably limit transient over voltages to safe levels, protecting downstream components.

Depending on the series, the TVS diodes are specified for an operating temperature range from –55 °C to 150 °C, making them suitable for harsh environmental conditions. For automotive applications, selected series are

AEC-Q101 qualified, ensuring long-term reliability under temperature cycling, electrical stress, and repetitive surge exposure.

YAGEO's portfolio offers high flexibility for system designers. Multiple SMD and axial package options are available, including SMA, SMBJ, SMCJ, SOD123, low-profile DFN leadless packages, and high-power axial devices. This variety allows easy integration into space-constrained PCB layouts without compromising protection performance.

Additional reliability is ensured through tight parameter control, advanced wafer-level chip processing, and YAGEO's global quality and supply network, supporting mission-critical applications in automotive, industrial, and energy systems.

www.rutronik24.com

Farnell Unveils Nexperia's NEVB-MTR1-KIT1 Motor Control Evaluation Kit Featuring Würth Elektronik Components

Farnell has announced it has released a new unboxing video showcasing the NEVB-MTR1-KIT1 motor control evaluation kit. The kit is built by Nexperia, a leading semiconductor manufacturer and developed in partnership with Würth Elektronik.

Bringing together Nexperia's advanced semiconductor technology with Würth Elektronik's high-performance passive components provides engineers with a ready-made platform to accelerate motor controller development. The video gives engineers and developers insights into the kit's design, features, and real-world benefits.

"We're proud to showcase the result of a powerful collaboration between trusted partners," said Jose Lok, Global Product Category Director – Onboard Components & SBC, Farnell. "This unboxing represents more than just a product. It reflects the strength of our supplier network, a shared commitment to excellence, and the seamless integration of expertise across every stage of development. From packaging to presentation, what you'll see here is the outcome of aligned values, rigorous standards, and a partnership built on trust."

The comprehensive kit includes a 3-phase inverter board, a motor controller board, a Leonardo R3 microcontroller development board, pre-wired motor connections, and a brushless DC (BLDC) motor. Each board has been designed

with precision and reliability in mind, and the unboxing video highlights its high build quality, robust technical performance, and extensive design support for developers.

"Partnering with Würth Elektronik allows us to combine the best of both worlds, high-quality passive components and advanced power semiconductors, on a single board," said Kinga Czutro, Senior Corporate Account Manager Distribution at Nexperia. "The board is not just a development tool. It's a practical platform for enabling engineers and innovators to accelerate innovation at the core of their designs and move from prototype to production with confidence."

The NEVB-MTR1-KIT1 motor driver evaluation kit offers a modular, developer-friendly platform that adapts to diverse motors, control algorithms, and test environments. Its flexibility accelerates motor controller development and enables rapid iteration, testing, and optimisation, helping developers speed up time to market. The kit can be configured for use in under two minutes and is conveniently powered via USB-C.

Würth Elektronik says it supplied a broad range of passive components for the kit — including inductors, ferrite beads, capacitors, and connectors — all selected for their reliability and performance in demanding motor control applications. A standout feature is the integration of high-current connectors, enabling evaluations up to 1 kW at 48 V.

"We're not just building components together, we're building ecosystems that enable the development and operational excellence of smarter, faster, and more efficient solutions for every industry," said Nicola Wieland, Export |Distribution Marketing Specialist for Würth Elektronik.

Key applications for the kit include use with 12–48V power tools and cordless equipment plus electric forklift trucks. The unboxing video is available via Farnell's YouTube channel.

http://www.farnell.com

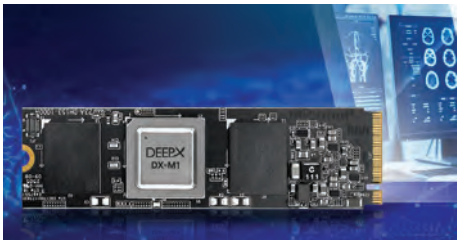
Advantech Expands Global Edge AI Partner Ecosystem

Advantech, a global leader in IoT intelligent systems and embedded platforms, has announced its partnership with DEEPX, a leading Korean AI semiconductor innovator specialising in NPU (Neural Processing Unit) technology.

Advantech says this collaboration expands its AI chipset ecosystem and introduces the company's first AI acceleration solution powered by DEEPX technology, the EAI-1961 series Edge AI Acceleration Module.

"Advantech evaluates a broad range of AI chip technologies to address diverse industrial needs," said Joey Hsu, Director of Advantech's Embedded Sector. "DEEPX demonstrates commendable efficiency in power and thermal performance, which is essential for reliable edge AI deployment. By integrating DEEPX's energy-efficient NPU with Advantech's industrial hardware expertise, we aim to offer more optimised AI solutions for next-generation edge systems."

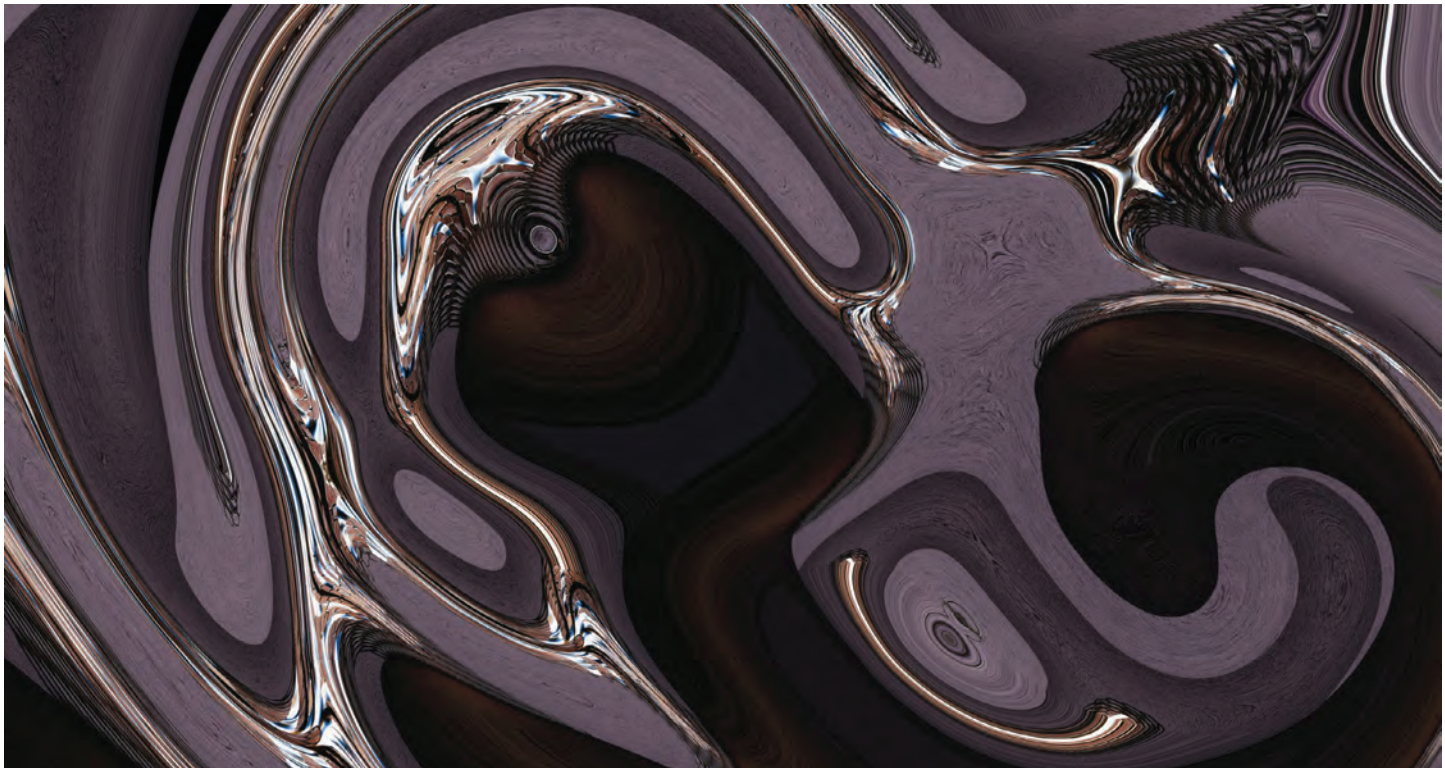
The newly launched EAI-1961 series is Advantech's first product featuring DEEPX's DX-M1 NPU technology. Designed in the industry-standard M.2 form factor, the module delivers up to 25 TOPS of AI inference while supporting up to 4GB of LPDDR5 memory. Its highly energy-efficient



architecture ensures stable thermal behaviour even during heavy workloads, making it well suited for vision-centric applications such as robotic vision, intelligent surveillance, in-vehicle computing, and precision medical diagnostics.

http://www.advantech.com

New project to cut e-waste by designing recyclable power electronics



A new EPSRC funded UK research project is exploring how liquid metals could transform the way power electronics are built – making them more reliable and recyclable at end of life and helping tackle one of the fastest-growing waste challenges facing the global technology sector.

The project, being co-run by Compound Semiconductor Applications (CSA) Catapult and the University of Cambridge, focuses on developing a novel "floating" internal structure within power electronic devices using liquid metals. This approach reduces mechanical stress during operation, improves long-term reliability, and crucially allows components to be separated more easily when systems reach the end of their working life. The result is power electronics designed to live multiple lives, rather than being discarded after just one.

This innovation comes at a critical time. Around 74 million tonnes of electronic waste are discarded globally every year – the equivalent of every person on the planet throwing away around 50 smartphones annually. That waste contains more than £40 billion worth of recoverable materials, most of which is never reclaimed.

As electrification accelerates across sectors such as energy, transport and industry, the volume of power electronics in use is rising sharply – yet these systems are not always designed with repair, reuse or recycling in mind.

When components fail or performance drops, entire units are often scrapped, turning valuable materials into waste and driving unnecessary environmental impact. By rethinking how power electronics are packaged and assembled, the project aims to change that trajectory.

Alongside the liquid metal innovation, the team is developing a modular "standard cell" approach to power electronics design. This would allow common building blocks to be deployed across multiple applications, extending product lifetimes, simplifying repair, and reducing waste at scale.

The project brings together the University of Cambridge and Compound Semiconductor Applications (CSA) Catapult, combining academic research with practical engineering and manufacturing expertise. Working closely with industry partners, the collaboration is focused on translating new ideas into scalable, real-world technology that can be adopted by UK businesses.

By embedding reuse, repair and recyclability into the design process from the outset, the project is directly supporting the UK's transition to a circular economy, helping to keep valuable materials in circulation and reduce the growing e-waste burden. For sectors rolling out electrification at scale, this approach could lower environmental impact while also improving resilience and long-term cost efficiency.

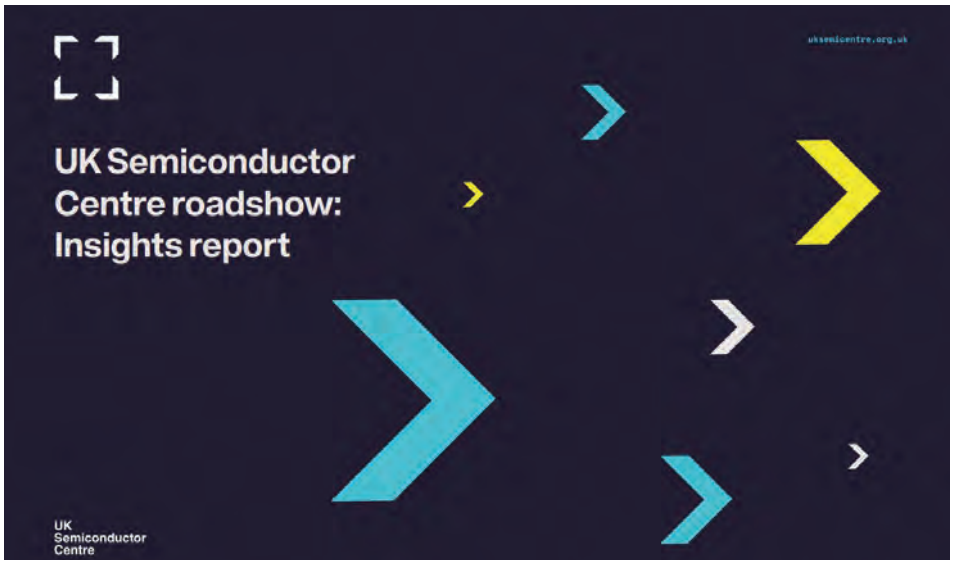
Professor Teng Long, Principal Investigator on the project from the University of Cambridge, said: "Our vision is to create power electronics that are not only efficient and powerful but also designed to live multiple lives. This EPSRC support enables us to explore a truly circular approach – one that integrates high performance with environmental responsibility."

Dr Jayakrishnan Chandrappan, Co-Investigator on the project and Head of Packaging at CSA Catapult, said: "Power electronics underpin almost every piece of low-carbon technology. Yet they're rarely designed with end-of-life in mind. Our hope with this project is that we can support and inspire UK businesses in our industry to adopt circular design principles, without compromising on performance.

"By designing electronics with foundations that are built to last, be repaired and reused, we can demonstrate ways to meaningfully cut waste at scale, with huge benefits to the environment, while at the same time strengthening the UK's power electronics supply chain."

https://csa.catapult.org.uk/

UK semiconductor industry highlights scale-up as primary barrier to growth



UK semiconductor companies say a lack of access to finance and infrastructure is restricting their ability to scale, preventing the industry from fulfilling its potential and competing globally.

This is the finding of a new report published recently by the UK Semiconductor Centre (UKSC).

Industry representatives from across the UK consistently highlighted shortages of patient capital, a lack of specialist investor knowledge in semiconductors, and complex public and private funding pathways that are often poorly aligned.

Access to infrastructure — including open-access facilities and pilot lines — was also identified as a significant barrier to growth.

These insights echo findings from a recent House of Lords committee report, which warned that a failure to scale science and technology companies is causing the UK economy to "bleed to death".

The new report draws on insights gathered during a series of UKSC-led workshops held over a three-month period at the end of 2025.

Across 10 locations, the UKSC brought together more than 450 representatives from businesses, universities, local and national government, non-profits, learned societies and trade bodies.

The workshops were designed to gather feedback on the five missions the UKSC is working towards: business scale-up; international partnerships; a national strategic roadmap; ecosystem advocacy and promotion; and workforce and skills development.

At each workshop, participants were asked to vote on the mission they believed was the most important national and regional priority.

In response to the scale-up challenge, the UKSC intends to mobilise a combination of public and private capital at each stage of growth and grow a network of investors who are confident in semiconductor business models, whether they have invested in semiconductors before or not.

The UKSC will also undertake an extensive ecosystem mapping exercise so UK organisations can find partners, facilities, infrastructure and support quickly that will enable them to scale.

Workforce and skills development was also highlighted as a significant national challenge, with participants describing a fragile talent pipeline that is not keeping pace with the rapid growth of the semiconductor industry.

It is estimated that nearly 40% of the UK semiconductor workforce will reach retirement age within the next 15 years, potentially leaving a shortfall of more than 10,000 roles.

Participants highlighted limited exposure to electronics and semiconductor careers among schoolchildren, gaps in apprenticeship and technician pathways, and the need for greater diversity across the sector. Stronger links between education and industry were also identified as essential to ensure students and graduates are equipped with work-ready skills.

The UKSC is a strategic hub established to connect, represent and promote the UK semiconductor industry in the UK and internationally. Its goal is to unlock the full potential of the UK semiconductor sector by maximising opportunities, growth and reach.

The UKSC will use the findings of the report to inform future activity, workstreams, analysis and engagement across the ecosystem.

Semiconductors underpin almost all modern technology — from AI and data centres to electrification, connectivity, healthcare and defence. As the global market enters a major growth cycle driven by AI compute and electrification, there is a significant opportunity for the UK to seize.

The UK has globally respected capability across research, advanced materials, compound semiconductors, power electronics, photonics and semiconductor design.

Raj Gawera, Chief Operating Officer of the UK Semiconductor Centre, said: "This report provides invaluable insight into the key challenges facing our industry, alongside a wealth of constructive ideas on how the UK Semiconductor Centre can help address them. Participants consistently viewed the UKSC as coordinating effort, advocating on behalf of the sector, and providing a unified voice.

"Across the ten workshops, it was extremely encouraging to see the passion and commitment of people working across the sector, and a shared determination to see the UK succeed as a globally recognised semiconductor nation.

"With the rapid growth of AI, electrification and quantum technologies, we are facing a once-in-a-generation opportunity that the UK can absolutely capitalise on and place itself at the centre of these revolutionary technologies.

"This report will inform UKSC's action plan and act as a springboard to help build a stronger, more connected ecosystem that is ready to compete on the world stage."

https://uksemicentre.org.uk/

What rising raw material prices mean for electronics

If you feel like you're paying more for your electronic components, you're not imagining it. Thanks to upstream pressures, rising prices for key commodities used across electronics and manufacturing are filtering down into everything from copper-heavy printed circuit boards (PCBs) to metal-backed passives. Here, Chris Withers, Sales Director at Zel Components, an alternative electronic parts supplier, explains how engineers can respond more quickly to market volatility.

On the London Metal Exchange (LME), copper reached record territory in early January 2026, pushing above $13,300 per tonne. That's more than 20% higher than the late 2025 average as stock tightness and strong industrial demand combined.

That matters because copper isn't just a metal you read about in commodity news. It's used extensively in printed circuit boards, internal connectors and wiring, as well as across many power and signal paths in electronics. As a result, movements in copper pricing directly influence the cost of the boards and assemblies engineers design and build.

Precious metals are also impacting pricing dynamics. Gold recently surged above $5,000 per ounce, reaching a series of record highs in the first few weeks of 2026 amid market volatility and safe-haven demand. While gold isn't in every bill of materials, it's used in contact plating and specialist components where performance meets reliability.

Likewise, aluminium has traded firmly above $3,000 per tonne on global benchmarks and is forecast to remain well supported given current market dynamics. Even when commodity analysts suggest prices might ease later in the year, the near-term story is volatility, which introduces risk.

When inputs move

Engineers regularly buy copper foil, laminates and boards priced off copper's movement. Over 2025 and into 2026, manufacturers of copper-clad laminate — the base material for almost all FR-4 boards — began issuing public price adjustments directly linked to rising raw materials.

Some supplier notices describe increases of up to 30% across all thicknesses of copper-clad laminate and prepreg, driven by higher copper prices, glass cloth costs and processing expenses.

This is the kind of upstream movement that doesn't stay upstream. It filters through every layer of a PCB quotation, especially in multi-layer designs where copper and prepreg content is higher.

The wider passive component landscape tells a similar story. Industry analysis shows price increases across capacitors, inductors, ferrite beads and related passives. These range from single digit to double-digit percentages for early 2026 deliveries, often citing metals and process cost inflation among the drivers.

This doesn't mean you should panic buy every part in your current bill of materials (BOM). However, it does mean that the old "wait-and-see" strategy is getting riskier, particularly if you're dependent on a single branded source for key sections of your design.

Alternative sourcing

Second sourcing is moving back into focus, not as a cost-cutting exercise but as a form of risk management. Pin-for-pin alternatives, for instance, allow engineering teams to maintain electrical and mechanical compatibility while reducing dependence on individual manufacturers, whose pricing or lead times may be more exposed to raw material volatility.

This approach is particularly effective for widely used regulators, discretes, interface devices and passives, where functional equivalence is well understood and validation cycles are manageable. As volatility increases, having approved alternatives already mapped can significantly reduce disruption when prices shift or allocations appear.

When suppliers combine local stock with extended inventory and effective cross-reference tools, response times improve. During a time of uncertain input costs, that flexibility is as valuable as unit price, provided performance remains consistent.

Prices might ease at some point, but it's difficult to predict when. Volatility isn't going away, and when raw material costs feed into electronics pricing, it's the teams that design and source with flexibility in mind that are better positioned to respond when conditions change.

For more information on pin-for-pin alternatives and ways to reduce sourcing risk across current designs, visit the Zel Components website - **https://zelcomponents.co.uk/**

Harnessing AI in space to enable faster communication and a new era of innovation

Rad-tolerant DC-DC converter modules power AI1 Transponder for in-orbit computation

By Salah Ben Doua, Sr. Principal Field Application Engineer EMEA Aerospace and Defense & Satellite Solutions, Vicor

Since 2010 the number of satellites orbiting earth has increased by 25 times. Satellites cost millions of dollars to deploy and are designed to remain in orbit 5 to 10 years, requiring reliable and robust onboard processor systems to support the duration of a mission.

The demand for smaller satellites with increasingly sophisticated computational capabilities is pushing the limits of the latest ultra-deep-submicron FPGAs and ASICs and their power delivery networks. These high-performance processors have demanding, low-voltage, high-current power requirements and their system design is further compounded by the complexities of managing thermal and radiation conditions in space.

Embracing these challenges, Spacechips has introduced its Spacechips AI1 Transponder product, a small, onboard processor card containing an Adaptive Compute Acceleration Platform (ACAP) AI accelerator. The system delivers up to 133 tera operations per second (TOPS) of performance to support new real-time autonomous computing applications, while ensuring the reliability and longevity to complete longer missions.

"Many spacecraft operators simply don't have sufficient bandwidth in the RF spectrum to download all of the data they've acquired for real-time processing," said Dr. Rajan Bedi, CEO of Spacechips. "An alternative solution is accomplishing the processing in-orbit and simply downlink the intelligent insights."

The impact of in-orbit computing for applications in space and on Earth

Spacechips is harnessing powerful artificial intelligence compute engines capable of enabling in-orbit AI to address a variety challenges including monitoring mission critical spacecraft system health. AI algorithms can continuously assess the health of onboard subsystems—power, thermal, altitude control and communications—by learning normal operational patterns and detecting anomalies early. Beyond satellite operations, innovative applications address a variety of space-related and Earth-bound problems that benefit from faster communications that enable proactive responses.

1. Tracking space debris to avoid costly collisions

AI-equipped satellites can autonomously detect, classify and track space debris when direct line-of-sight communication with Earth is not possible using real-time data captured from onboard imaging sensors. Traditional ground-based monitoring often struggles with smaller, fast-moving fragments, but AI can process sensor input in real-time to predict trajectories and identify collision risks. Neural networks trained in orbital mechanics help refine debris catalogs and update avoidance maneuvers autonomously.

2. Identifying severe weather patterns

AI on satellites observing the Earth's atmosphere can enhance the identification and prediction of severe weather events. Instead of simply collecting imagery, an onboard neural network can segment cloud types, estimate storm intensity and flag rapidly forming systems for higher-priority downlink. This allows faster response to severe weather events and improves localized forecasting accuracy, especially over oceans and remote regions where ground sensors are sparse.

3. Detecting surface hotspots and predicting flashpoints

Infrared sensors paired with AI can detect temperature anomalies such as wildfires, volcanic activity or industrial accidents. Machine learning models trained on historical patterns can distinguish between benign heat sources and emerging "flashpoints," enabling near-real-time alerts to disaster response agencies. Predictive modeling also helps identify regions at elevated risk before ignition occurs, allowing for preemptive action.

4. Reporting critical crop production rainfall data

AI can combine multispectral imaging, GPS-tagged agricultural zones and rainfall data to assess crop health, yield potential and water stress. Models can distinguish between soil moisture variations, nutrient deficiencies and disease indicators. When fused with climate and precipitation inputs, onboard AI can deliver rapid, localized agricultural intelligence to governments and farmers, supporting sustainable food production and resource allocation.

Today's low-Earth-orbit (LEO) observation spacecraft can establish direct line of sight over a specific region only about once every 10 minutes. If satellites were trained to fill those blind spots using AI algorithms, emergency management teams could make faster, better-informed decisions regarding which potential flashpoint areas are the most vulnerable. The goal is to design intelligent, autonomous real-time decision-making when direct line-of-sight communication with Earth is not possible.

"In the case of disaster management, whether it's a wildfire or a devastating flood, the difference between seconds and minutes is huge in terms of protecting people and wildlife, and reducing the destruction to infrastructure and property," Bedi said. "If we can make these decisions quicker, we can minimize damage and loss of life."

Figure 1 In-orbit AI can detect temperature anomalies such as wildfires, volcanic activity or industrial accidents using Spacechips AI1 processor. Emergency management teams can also make faster, better-informed decisions about which fire prone areas are the most vulnerable.

Bedi cited breakthroughs like the AMD Versal adaptive compute acceleration platforms, a family of advanced FPGAs that deliver up to 133 TOPS using 8-bit integer inference models to reduce memory and computational overhead. This level of on-chip processing can enable in-orbit AI where spacecraft and payloads make intelligent, in-situ decisions autonomously and in real-time – without downlinking gigabytes of data for ground-based post-processing in the cloud. This incurs a latency and a financial cost.

Spacechips AI1 processor board designed for in-orbit AI and machine-learning communication

Spacechips serves a spectrum of space applications each with differing orbital, reliability and longevity requirements. Some payloads remain in low-Earth orbit for weeks or months, while others operate in geostationary orbit for a decade or more. Bedi vets the diverse needs of new space companies to help them determine if their requirements are better met by a $100,000 space-qualified FPGA or a $200 industrial-grade processor. By understanding the design tradeoffs, Spacechips steers its customers toward mission-optimized solutions.

Spacechips AI1 Transponder Board is a smart, reconfigurable receiver and transmitter offering up to 133 TOPS of in-orbit AI and machine-learning performance. This capability will enable many new Earth-observation, in-space servicing, assembly and manufacturing (ISAM), signals intelligence (SIGINT), and intelligence, surveillance and reconnaissance (ISR) and telecommunication applications for satellites.

Given the constrained operating environment of space, AI-enabled computing has an acute need for precision power management. The need is compounded by the significantly expanding number, scope and variety of missions that require different kinds of spacecraft and a growing reliance on some form of solar power to deliver adequate power.

These crafts range from geosynchronous satellites the size of a city bus to CubeSats and FemtoSats, which can be smaller than a shoebox with a mass of less than 100 grams.

"These smaller spacecraft need to generate and harvest a lower amount of energy from their solar panels. We cannot simply design space electronics where all of the microchips consume 20 watts," Bedi said. "We have to be much more intelligent when optimizing our design to ensure it meets the power budget that is supplied by the relevant spacecraft platform."

Vicor Factorized Power Architecture with current multipliers reduce size and weight— delivers top processor performance in space

Spacechips has partnered with Vicor to provide the critical power architecture for in-orbit AI processing.

"These microchips have an approximate core voltage of 0.8 volts with a TDC of 130 amps. How do you actually generate such a power rail?" Bedi asked. "That's a huge problem to solve. We could take a conventional multiphase buck and connect ten of them in parallel, but then what you get is physically large and very complicated due to voltage averaging as a means of deriving the 0.8V"

The value of the Vicor solution, according to Bedi, is that it is very small and power dense, which allows for smaller designs and greater system flexibility. Vicor Factorized Power Architecture (FPA™) is a power delivery system design that separates the functions of DC-DC conversion into independent modules. In radiation-tolerant Vicor modules, the BCM® bus converter provides the isolation and step-down transformation to 28V, the PRM™ regulator provides regulation to a VTM™ current multiplier that performs the 28V DC transformation to 0.8V. This allows for better efficiency, flexibility and higher power density, especially in high-performance computing applications.

"Vicor FPA delivers a much more elegant, efficient solution in a very small form factor," Bedi said. "I recently taught a course on power microelectronics for space applications, in which we showed the relative package size, current density and power density of Vicor DC-DC converters against all competing space-grid power products. The benefits of Vicor FPA are simply an order of magnitude superior to everything else on the market."

Bedi has incorporated Vicor FPA power

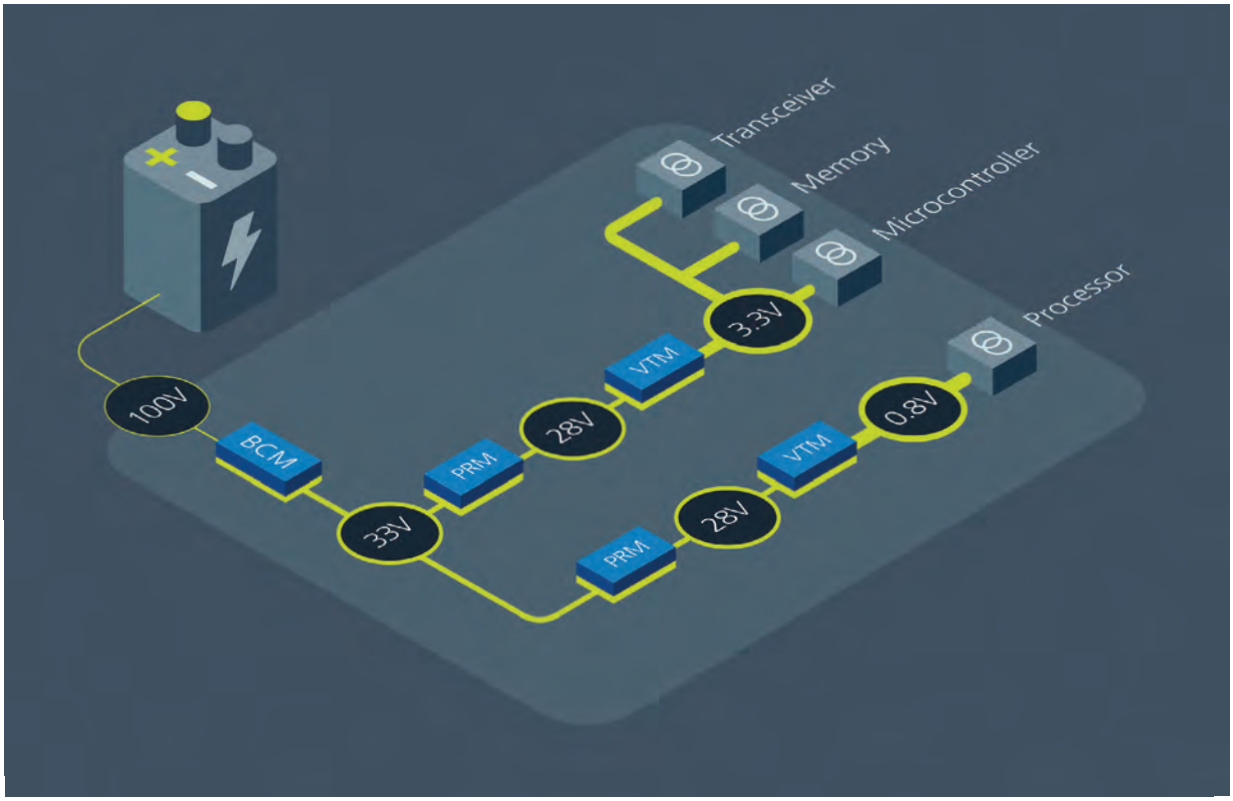


Figure 2 Vicor Factorized Power Architecture (FPA™) separates the functions of DC-DC conversion into independent modules. Using radiation-tolerant modules, the BCM® bus converter provides the isolation, the PRM™ regulator provides the regulation and the VTM™ current multiplier performs the DC transformation. This allows for better efficiency, flexibility and higher power density, especially in high-performance computing applications.

modules into the Spacechips AI1 board. The Versal FPGA-based, reconfigurable, AI-enabled transponder allows telecommunications and SIGINT operators to perform real-time, on-board processing by autonomously changing RF frequency plans, channelization, modulation and communication standards based on live traffic needs. Vicor power converter modules also feature a dual powertrain, which for fault-intolerant space applications provides built-in redundancy that allows loads to be driven at 100 percent on each side of the powertrain.

"These advantages justified our decision to baseline Vicor FPA for Spacechips AI1," Bedi said. "And because we've already derisked and designed-in a scalable power solution, we can move to even higher levels of power consumption without reinventing the wheel."

A lofty vision for making our world a better place

Bedi said Spacechips will continue striving to increase processing power and flexibility to support the next generation of satellite missions. Bedi is driven by the opportunity, not only to solve emerging technical space problems, but to identify new applications that can better serve our world.

"Spacechips is still the world's only dedicated space electronics company," Bedi shared. "We're part of a New Space Economy that is growing rapidly and poised to offer a lot of great value to a wide variety of markets. Many non-space companies are now capitalizing on space data to enhance the delivery of their products and services. It's a new industrial revolution, and our products and services align with that opportunity."

Together Spacechips and Vicor have partnered to design the most power dense processer board on orbit. The AI1 board is rad-tolerant, rugged and compact, setting a new standard for power processing and enabling the untold impact of computing for New Space. The innovative spirit and drive of Spacechips is changing our world from outer space to Earth.

SAME GREAT CONTENT

ALL NEW WEBSITE

www.drivesncontrols.com

FastLane

By Dirk Brauer, Research & Innovation Director at Valeo eAutomotive Germany GmbH;
Dr. Sebastian Fritzsche, Manager Technology Scouting at Heraeus Electronics GmbH & Co. KG

Left Source: Adobe Stocks, modified by Heraeus Electronics

As the global electronics industry undergoes a seismic shift toward sustainability, efficiency, and sovereignty, Silicon Carbide (SiC) is emerging as the cornerstone of next-generation power electronics. At the heart of this transformation is FastLane—a three-year European funded project launched in 2024, uniting 29 partners across seven countries to redefine the SiC value chain from raw materials to system-level demonstrators.

Led by Valeo and supported by the EU, FastLane is more than a research project—it's a strategic blueprint for Europe's technological resilience. Its mission: to boost energy efficiency, reduce CO_2 emissions, and strengthen EU sovereignty. This article focusses on the key packaging material innovations such as metal ceramic substrates (silver free AMB), bonding wires, die top system and sinter paste. This project enables highly reliable, cost-effective and high performance SiC power modules.

FastLane - Boosting EU material value chain for SiC power electronics

Dirk Brauer, Research & Innovation Director at Valeo eAutomotive Germany GmbH;
Dr. Sebastian Fritzsche, Manager Technology Scouting at Heraeus Electronics GmbH & Co. KG

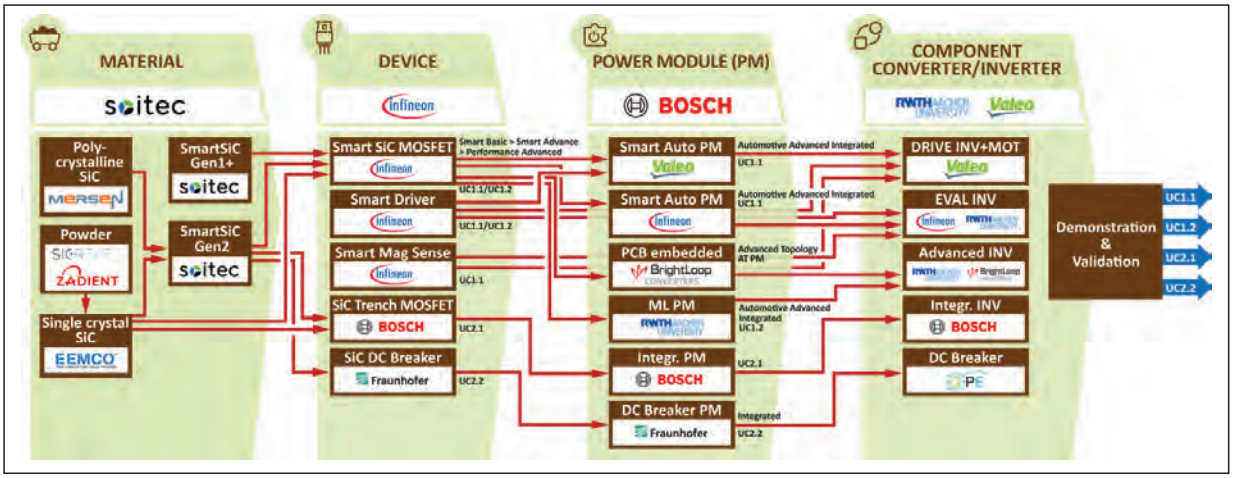
The global electronics industry is undergoing a profound transformation, driven by the demand for higher efficiency, environmental sustainability, and strategic autonomy. In this evolving landscape, **Silicon Carbide (SiC)** has emerged as a key enabler of next-generation power applications. To harness its full potential, the **European FastLane project**, launched in 2024, supports EU independence in critical raw materials while developing an independent SiC raw material and device supply chain and broadening SiC functionalities to overcome current limitations.

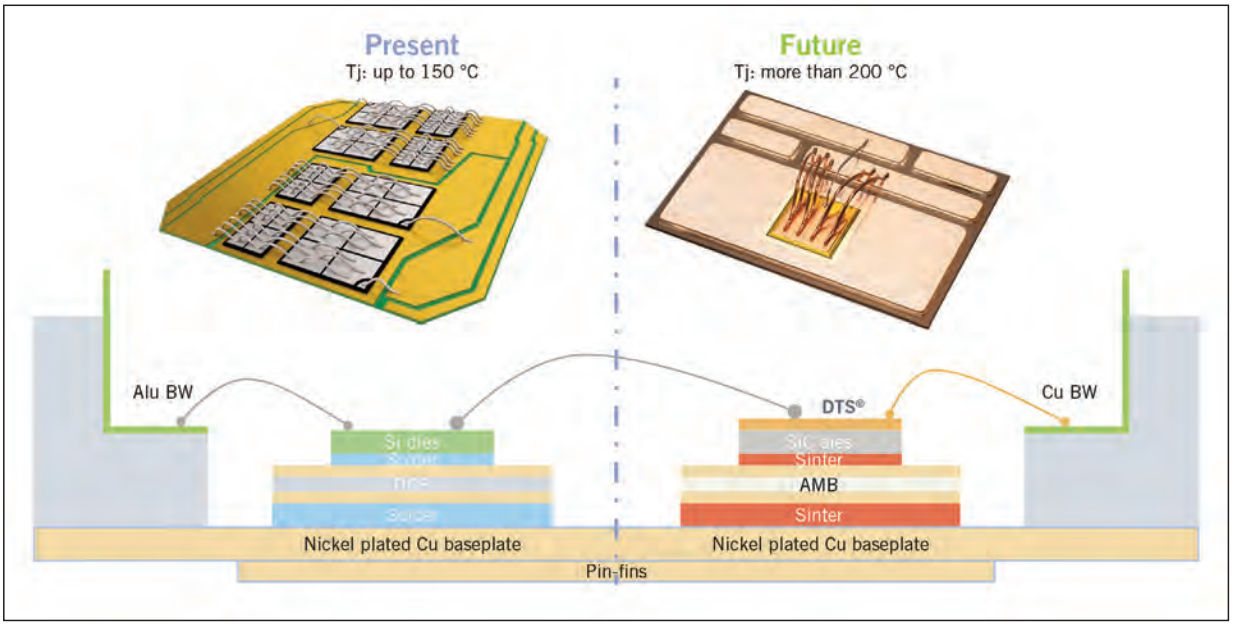
A Pan-European Effort to Reshape Power Electronics

FastLane is a three-year initiative co-funded by the European Union, bringing together **29 partners from seven countries**, including leading research institutions, specialized SMEs, and major industrial players. Under the coordination of **Valeo**, the consortium aims to enhance energy efficiency and reduce the carbon footprint of power electronics by developing a robust, independent SiC supply chain—from raw materials to system-level demonstrators. By leveraging economies of scale, FastLane drives cost-efficient energy conversion applications, strengthening Europe's technological and economic resilience in power electronics.

The project's comprehensive structure spans multiple work packages and collaborative efforts, covering the entire SiC power electronics value chain. This includes material development, device fabrication, packaging innovations, and final system integration.

Below: Overview Project Partners in the Consortium
Source: FastLane Project





Material innovations in power electronic modules addressing key challenges in thermal management, electrical performance, and reliability.
Source: Heraeus Electronics

Materials Innovation for Scalable SiC Integration

Within the FastLane consortium, materials development plays a central role in enabling the assembly and performance of advanced SiC power modules. Among the contributors, Heraeus Electronics supports the integration of six distinct SiC module designs through three specialized packaging technologies. These innovations address key challenges in thermal management, electrical performance, and reliability—critical factors for next-generation power electronics.

The company's focus lies in developing environmentally responsible materials that facilitate miniaturization, forward integration, and high-efficiency energy conversion. In response to industry-wide shifts—such as the rise of e-mobility, AI, and next-generation communication technologies—collaborative innovation across the value chain has become essential. Heraeus Electronics engages in joint research efforts with academic institutions, start-ups, equipment providers, and end users, contributing to broader ecosystem development through EU funded initiatives and industry associations

.

Technical Innovations: Three Packaging Building Blocks

To achieve the FastLane project goal for higher efficiency of power modules SiC dies enable them to operate at >175°C, with higher switching frequencies and increased power densities. Their effective implementation requires advanced packaging materials. Heraeus contributes within FastLane with the following key innovations:

1. Ag sinter pastes enabling attachment of Active metal brazed (AMB) substrates without noble metal surfaces
2. Ag-free AMB substrates with designs reducing parasitic inductance and
3. Die-Top System (DTS©) enabling reliable Cu bonding to SiC dies.

1. Silver Sintering for AMB Substrate Attachment on Aluminum Baseplates

To reduce both cost and weight in SiC power module packaging, Heraeus has developed **the PE 360P silver sinter paste**, enabling the attachment of **Active Metal Brazed (AMB) substrates** to aluminum baseplates without the need for precious metal surfaces.

This innovation offers significant advantages:

- **Up to 70% weight reduction**
- **Cost savings of up to 91% compared to copper baseplates**

Initial results with PE 360P show robust AMB adhesion and minimal delamination (<5%) already with Cu-coated Al baseplates after 1500 temperature cycles (–55 °C/+150 °C), comparable to similar Ag-coated baseplates. In contrast, Ni-coated Al baseplates fail to ensure sufficient adhesion. Ongoing work focuses further on optimizing Ag sintering directly on non-precious metals coated Al.

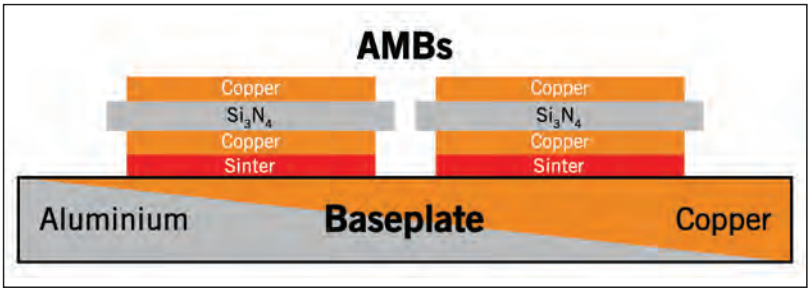
This approach supports scalable, cost-efficient packaging for high-performance SiC modules.

2. Silver-Free, Low-Inductance AMB Substrates

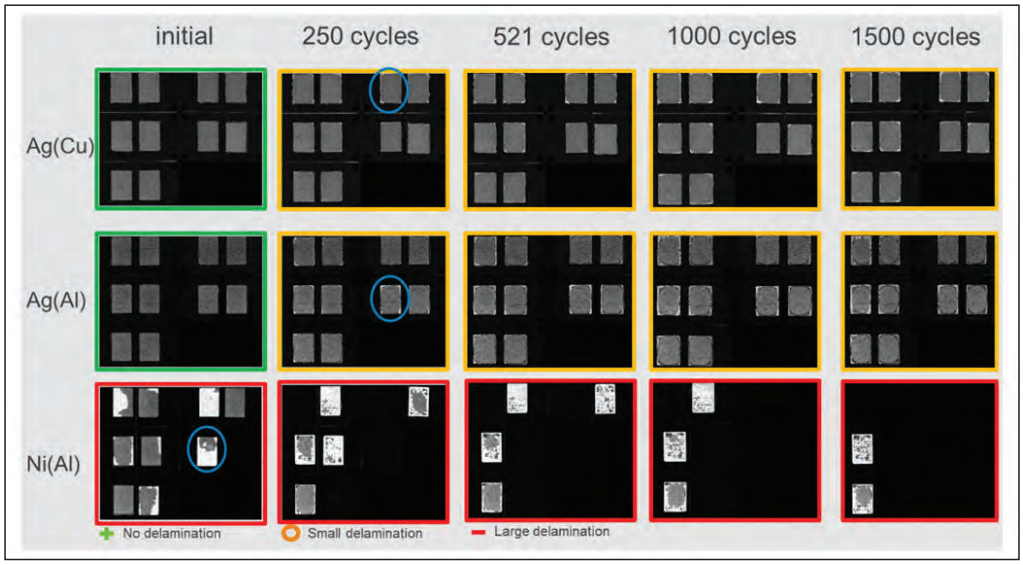
The second major innovation centers on the development of **silver-free, low-inductance AMB substrates** using **Si_3N_4 ceramics**, designed to reduce parasitic inductance and improve cost efficiency.

Key benefits include:

- Reduced cost through elimination of silver (Ag content >60wt% in conventional AMB pastes)
- Reduced Ag migration for enhanced reliability
- Superior performance compared to traditional Direct Copper Bonded (DCB) substrates

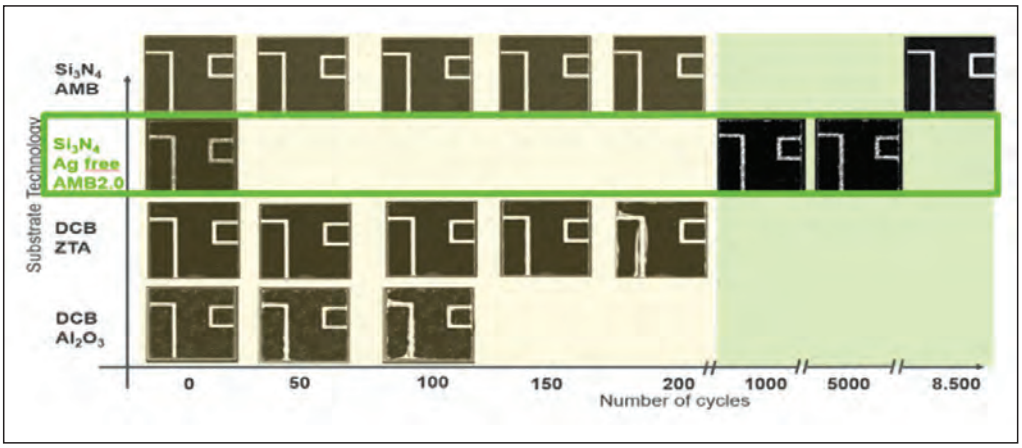


Schematic drawing of AMBs sintered to baseplates. **Source: Heraeus Electronics**



Scanning acoustic microscope results after thermal cycling of AMBs attached to three different baseplate types.

Source: Heraeus Electronics



Scanning acoustic microscope results after thermal cycling of AMB and DCB substrates.

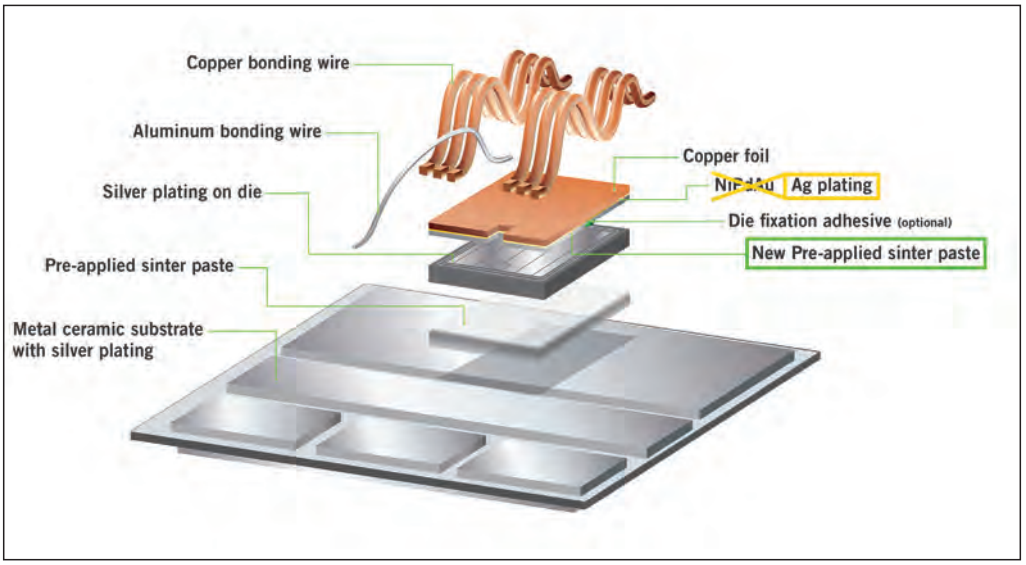
Source: Heraeus Electronics

Scanning acoustic microscopy confirmed the reliability of these AMB 2.0 substrates after thermal shock testing (–65°C to +150°C). Their performance rivals Ag-containing AMB, surpasses DCB substrates, and meets all customer specifications. Their integration into **Valeo's low-inductance power modules** is planned as the next step.

This innovation also strengthens the **European AMB supply chain**, with all key manufacturing partners—including metal and ceramic suppliers and Heraeus Electronics' technology and production site—located within Europe. This supports risk mitigation, improves supply chain stability, reduces CO_2 emissions, and enhances the EU's market position. To ensure secure global delivery capability, Heraeus Electronics also maintains a **dual-source strategy in Asia**.

3. Die Top System for Copper Wire Bonding

The third building block addresses **top-side interconnection**, a critical factor for achieving high reliability in SiC modules. Heraeus has developed the **Die Top System (DTS®)** in collaboration with European partners. This system features a **copper foil with pre-applied sinter material**, enabling copper wire bonding with over **10×**



Schematic drawing of die top system DTS®.

Source: Heraeus Electronics

reliability improvement compared to aluminum bonding.

The industrialized **DTS®** Silver replaces NiPdAu metallization with Ag plating, ensuring:

- Simplified sintering
- Reliable copper bonding to SiC dies

Future development includes laser-structured **DTS®** Silver for finer wire bonding geometries (down to 0.5 × 0.5 mm^2). These advanced interconnects will be evaluated in FastLane power modules for performance and reliability.

First-Year Deliverables and Ongoing Integration

In the first year of FastLane, Heraeus Electronics and its partners successfully delivered three core packaging innovations:

1. Development of an **Ag sinter paste** for AMB attachment on Ag-metallized aluminum baseplates, replacing conventional copper
2. Design of **silver-free AMB substrates** using Si_3N_4 ceramics for reduced cost and inductance
3. Development of **DTS® systems** enabling reliable and cost-efficient copper wire bonding to SiC dies

These technologies are now undergoing **integration and reliability testing** across multiple power module use cases. This work will continue through **June 2027**, with the goal of enhancing SiC performance, efficiency, and resilience throughout Europe's power electronics value chain.

Conclusion and Outlook: Tailored SiC Demonstrators for Strategic Applications

By integrating advanced SiC technologies into tailored demonstrators across mobility and energy domains, FastLane delivers on five major objectives:

It aims to reduce the environmental impact of power electronics by improving energy efficiency and lowering the carbon footprint of materials and processes. At the same time, it contributes to strengthening European sovereignty over critical raw materials by establishing a more independent and resilient SiC supply chain.

The project also focuses on unlocking new functionalities in SiC devices and packaging, enabling operation under higher temperatures, switching frequencies, and power densities. Cost optimization is pursued through innovations in materials and scalable manufacturing techniques.

Finally, FastLane supports accelerated innovation in next-generation power electronics by fostering collaboration across research institutions, industrial partners, and technology developers. Ultimately improving usability and affordability for end users.

The contributions from all FastLane partners are enabling the development of **SiC power module demonstrators** tailored to specific end-user applications.

E-mobility:

- Light commercial vehicles (UCs 1.1 & 1.2a) for high-volume applications
- Ultra-class haul trucks (UC 1.2b) for high-power, heavy-duty environments

Energy systems:

- Power inverters for electrolyzers (UC 2.1) to support green hydrogen production
- Solid-state circuit breakers (UC 2.2) for grid protection and advanced battery storage

These demonstrators will validate the technical feasibility and performance of SiC modules under real-world conditions. Together, these efforts aim to position Europe at the forefront of sustainable, high-performance power electronics—powered by Silicon Carbide.

IEEE Study Proposes a Novel High-Efficiency Silicon Single-Photon Detector

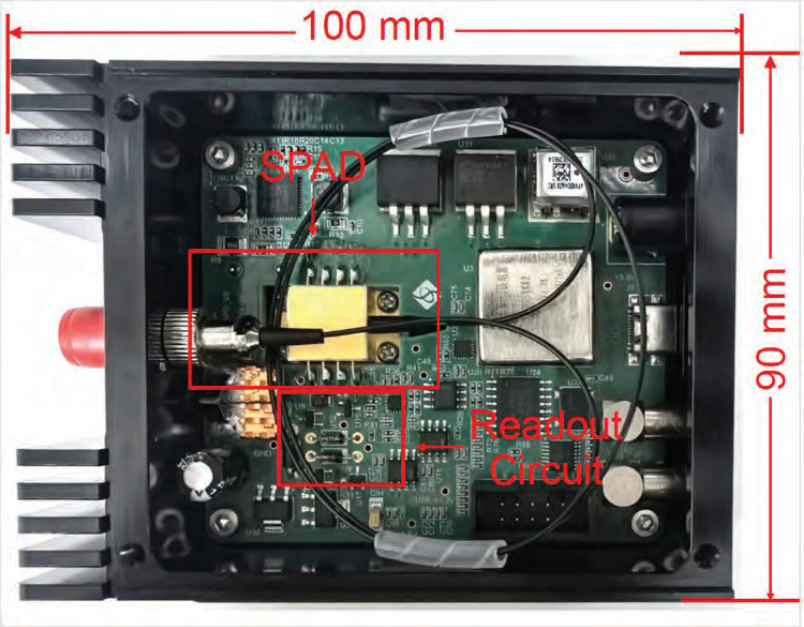
Researchers develop a new detector with over 84% photon detection efficiency and multiple operation modes

Silicon single-photon detectors (Si SPDs) with low cost and ease of operation are widely used for detecting single photons in the visible spectrum. However, photon detection efficiency (PDE) is important for effectively collecting photons, highlighting the need for high-efficiency detectors. Now, researchers have developed a novel Si SPD that reaches 84.4% PDE at 785 nm. It provides a practical solution for quantum communication and imaging applications that rely on detecting weak light signals.

Silicon single-photon detectors (Si SPDs) play a central role in quantum photonics and single-photon imaging for detecting single photons in the visible spectrum. Many of these applications demand high photon detection efficiency (PDE) for effectively collecting photons. While Si SPD have compact size and are easy to operate, boosting their efficiency above 80% has been a challenge.

To address this, Mr. Dong An from University of Science and Technology of China and his team developed a new Si SPD by optimizing both the device's semiconductor structure and its electronic readout. Their study was published in IEEE Journal of Selected Topics in Quantum Electronics, as part of its recently released Special Issue on Quantum Materials and Devices.

They designed a thick-junction silicon single-photon avalanche diode (SPAD) with a doping-compensated avalanche region to reduce noise and improve electric-field uniformity. A backside-illumination architecture increases the likelihood that each absorbed photon triggers an avalanche. To support this architecture, the researchers built a 50-volt active-quenching readout circuit that rapidly switches the detector between armed and idle states. This design maximizes avalanche probability and enables operation across multiple detection modes. The full SPD module comprising of SPAD, readout circuit, and affiliated circuits measures just 9 × 10 × 3 cm and integrates temperature stabilization and universal serial bus-based control.



Researchers have developed a new silicon single-photon detector with over 84% photon detection efficiency and multiple operation modes.

"Our new design with a remarkable PDE of up to 84.4% at 785 nm helps silicon detectors achieve their highest detection efficiency while preserving i7ts compact module, enable flexible operation in free-running, gating, and hybrid modes," says Mr. An.

At 268 K, the detector achieves a dark count rate of 260 counts per second, an afterpulse probability of 2.9%, and a timing jitter of 360 picoseconds. Cooling the device reduces dark counts further, while higher temperatures lower afterpulsing. The team notes that minimizing timing jitter remains an area for future improvement.

"Our study through the development of a high-efficiency Si SPD module provides a practical solution for quantum photonics and single-photon imaging applications demanding ultra-high-efficiency Si SPDs with flexible operation modes," says Mr. An.

Overall, the findings suggest that carefully engineered silicon structures, combined with advanced quenching electronics, can significantly raise detector performance and expand the capabilities of photon-based technologies.

Reference

Authors	Dong An et al.
Title of original paper:	Silicon Single-Photon Detector Achieving Over 84% Photon Detection Efficiency With Flexible Operation Modes
Journal:	IEEE Journal of Selected Topics in Quantum Electronics
DOI:	**10.1109/JSTQE.2025.3592992**
Affiliations	* Hefei National Research Center for Physical Sciences at the Microscale and School of Physical Sciences, University of Science and Technology of China, Hefei, Chin * Department of Solid State Image Sensor, CETC No. 44 Research Institute, China * Jinan Institute of Quantum Technology and CAS Center for Excellence in Quantum Information and Quantum Physics, University of Science and Technology of China, China


DfA
direct marketing
Grow your reach with connections
from our qualified global database
E-campaign I List Rental I Lease I Lead Generation
Drives&Controls
Hydraulics&Pneumatics
smartmachines&factories
Aftermarket
Talking Industry
POWER ELECTRONICS EUROPE
PWE Plant & Works Engineering
Offshore renewables · oil&gas · industry news
Engineering & Equipment
Damien Oxlee
T: +44 (0)1732 370342
E: damien.oxlee@dfamedia.co.uk
www.dfamedia.co.uk

Why scalable high-performance SoCs are the future of autonomous vehicles

By Alec Schott, Texas Instruments

Figure 1. Visualization of ADAS features for autonomous driving in a software-defined vehicle analyzing environmental data

The automotive industry is ascending to higher levels of vehicle autonomy with the help of central computing platforms. SoCs like the TDA5 family offer safe, efficient AI performance through an integrated C7™ NPU and chiplet-ready design. These SoCs enable automakers to more easily implement ADAS capabilities, bringing premium features to all types of vehicles, from base models to luxury cars.

Introduction

How long have advanced driver assistance systems (ADAS) and autonomous driving been trendy topics? For the last decade or so, automakers at trade shows have shown consumers visions of a future with roads full of intelligent, autonomous vehicles.

We are finally closer to that vision. You likely have driven in or may even own a vehicle with features that existed only conceptually 10 years ago.

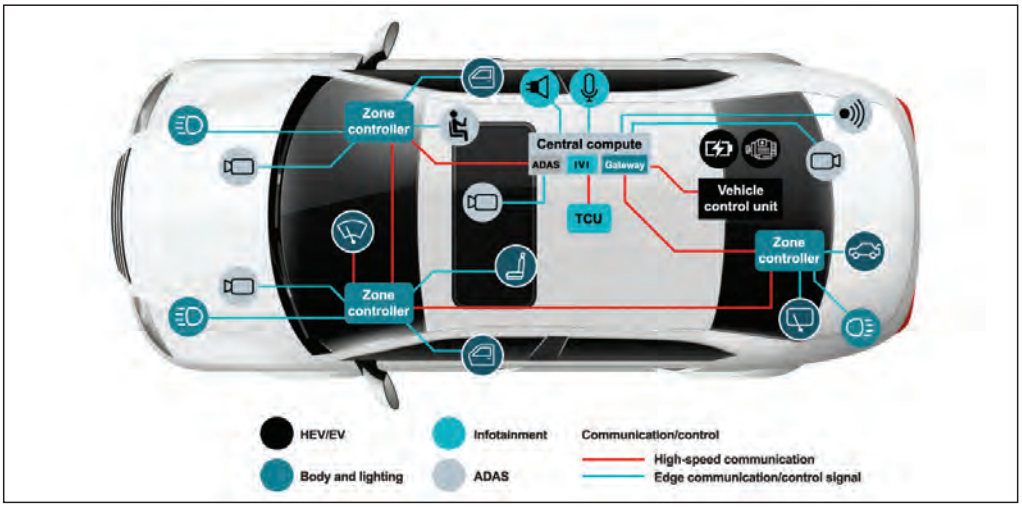
In terms of broad availability and the adoption of intelligent ADAS features and artificial intelligence (AI) capabilities, the industry is progressing through the Society of Automotive Engineers' levels of vehicle autonomy from Level 1 to Level 2 and Level 3. This proliferation of autonomous features is currently occurring in both domain-based and central computing vehicle architectures. The next, biggest steps toward vehicle autonomy will occur in the latter, with software-defined vehicles (SDVs), as visualized in Figure 1, poised to become the standard vehicle configuration.

This emerging vehicle architecture consolidates traditional distributed electronic control units (ECUs) into powerful central computing platforms, enabling over-the-air updates, feature additions and enhanced functionality throughout a vehicle's lifetime. SDVs use hardware as a platform and software for iterative updates, giving automakers the flexibility to continuously improve a vehicle's capabilities and deliver new autonomous driving features without hardware changes.

SoCs for the next generation of automotive designs

At the core of central computing architectures (Figure 2) are heterogeneous

Figure 2. Simplified overview of the central computing architecture and connected systems in a software-defined vehicle



SoCs that integrate a variety of IP blocks and support advanced software, such as the TDA54-Q1, the first device in the TDA5 family of SoCs.

While there are multiple types of high-performance SoCs on the market, SoCs that employ a variety of computing components are more power-efficient and able to increase performance in a central computing ECU when compared to SoCs primarily based on a single type of computing element (such as graphics processing units). SoCs with a variety of computing elements simplify development, deployment and execution of software for advanced autonomous driving features because they can offload specific tasks to their specialized IP blocks, including high-performance neural processing units (NPUs) and vision processors, supported by dedicated onboard memory.

Heterogeneous SoCs such as the TDA54-Q1 bring more autonomous driving capabilities and design flexibility to more vehicles through:

- Scalable AI performance. In terms of edge AI capabilities, TDA5 SoCs were designed using the latest automotive qualified 5nm process technology and feature integrated NPUs based on TI's proprietary C7™ digital signal processing architecture. These technologies help deliver an efficient power envelope and scalable AI performance from 10 to 1,200 trillion operations per second (TOPS). Engineers can leverage the AI resources of these SoCs to increase vehicle responsiveness through support for multibillion-parameter large language models, vision language models and advanced transformer networks. This level of AI performance is scalable over time to meet the evolving needs of different application requirements, from supporting Level 1 features such as adaptive cruise control all the way up to Level 3 autonomy, which covers conditional driving automation or self-driving under specified conditions.
- Safety-first architecture. TDA5 SoCs deliver a higher level of specialized performance and efficiency through a cross-domain hardware safety architecture that provides deterministic, real-time monitoring that software cannot achieve alone. Such performance enables OEMs to meet Automotive Safety Integrity Level D, the highest risk classification in the International Organization for Standardization 26262 standard. Using the latest Armv9 cores from Arm®, TDA5 SoCs feature lockstep capabilities in their application and microcontroller cores.
- Chiplet-ready architecture. The scalability of the TDA5 SoC family isn't limited to its processing performance; these devices also have a chiplet-ready architecture. Chiplets are an emerging semiconductor architectural design approach where individual integrated circuits serve a similar role as IP blocks in a heterogeneous SoC, allowing for the modular design of specialized chips. Built-in support for the Universal Chiplet Interconnect Express interface open technology standard enables greater scalability and adaptability of TDA5 SoCs through future chiplet extensions, offering developers a future-proof platform that can evolve with their needs.

Conclusion

Over the next decade, ADAS features will become standard and potentially even mandatory. Premium driving features will become mainstream and available for all vehicles, from entry-level base models to luxury cars. With devices like TDA5 SoCs, it's only a matter of time.

APEC 2026 will take place from March 22 to March 26, 2026, in San Antonio, Texas, at the Henry B. González Convention Centre

As "The Premier Event in Applied Power Electronics," APEC focuses on the practical and applied aspects of the power electronics business. This is not just a designer's conference. APEC has something of interest for anyone involved in power electronics:

- Equipment OEMs that use power supplies and dc-dc converters in their equipment
- Designers of power supplies, dc-dc converters, motor drives, uninterruptible power systems, inverters, and any other power electronic circuits, equipment, and systems
- Manufacturers and suppliers of components and assemblies used in power electronics
- Manufacturing, quality, and test engineers involved with power electronics equipment
- Marketing, sales, and anyone involved in the business of power electronics
- Compliance engineers testing and qualifying power electronics equipment or equipment that uses power electronics

After 41 years, APEC has grown into one of the largest technical conferences in North America, with more than 5,000 participants from over 50 countries each year. The scale of the conference reflects the energy and innovation of the power electronics community. Here, engineers, researchers, students, and business leaders come together to learn, share, and build the future of power electronics.

The technical programme at APEC spans the entire landscape of power electronics, from milliwatts to megawatts, and from low voltage to high voltage. Applications range from consumer electronics to data centres, electric vehicles, the modern power grid, electrified aircraft, space exploration, and many more.

- The Technical Sessions at APEC feature more than 570 high-quality papers, making the APEC Proceedings the most valuable conference collection in power electronics, as reflected in the Scientific Journal Ranking (SJR).
- The Industry Sessions are a unique strength of APEC. With more than 170 presentations, they provide insights from industry researchers and

leading academic experts, bridging the gap between research and practice and highlighting the real-world impact of power electronics.

- APEC also offers 18 in-depth, 3.5-hour Professional Education Seminars, delivered by renowned speakers who are leading researchers in both academia and industry.
- The plenary keynotes at APEC deliver vision and inspiration from global leaders who are shaping the future of the field.

The Exposition at APEC is the largest power electronics showcase in North America, featuring around 300 companies as exhibitors. It offers an unmatched opportunity to explore the latest products, solutions, and technologies shaping the future of our field.

This year there has been significant investment in student activities. The Student Mentorship Programme, the Student Travel Award, the Student Job Fair, and the Student Session Assistance Programme will provide opportunities for students to grow and engage. Also the Student Demonstration Competition has been introduced for the first time at APEC, creating a new platform for students to showcase their talents and connect with industry.

APEC 2026, continues to support professional development for all. The Young Professionals programme and the Women in Engineering events provide valuable opportunities to learn, connect, and grow.

https://apec-conf.org/

APEC 2026 Plenary Session Features Renowned Power Electronics Experts

The APEC 2026 Conference Committee for the annual Applied Power Electronics Conference has announced that four distinguished plenary speakers are scheduled to keynote this year's conference and exhibition. The Plenary Session for APEC 2026 (March 22-26) will take place Monday afternoon, March 23rd, in the Hemisphere Ballroom, Henry B. González Convention Centre, from 1:45 to 4:45 PM. The session will also be live streamed on IEEE.tv.

Designed to engage a global audience across all sectors of the power electronics industry, the sessions will include interactive Q&A at the end of each presentation. The APEC 2026 Plenary Session speakers and presentations are:

- **HVDC Distribution for Future AI Data Centres**

Speaker: Brian Heber, Director of Engineering, Global Product Integrity, Vertiv, USA

- **Enabling Copernicus: Power Electronics at the Heart of Earth's Health Monitoring**

Speaker: Arturo Fernandez, Head of the Power Systems, EMC and Space Environments Division, European Space Agency, Europe

- **Why Now is the Time to Address Power Semiconductor Sustainability**

Speaker: Shiori Idaka, Head of European Research Cooperation Centre, Mitsubishi Electric Europe B.V.

- **MagNet Challenge: The Serendipity When Power Magnetics Meets AI**

Speaker: Minjie Chen, Associate Professor, Princeton University, USA

After the Plenary Session, all registered APEC attendees are invited to attend the Welcome Reception in the Exhibit Hall, being held from 4:45 to 7:45 PM.

Those interested in attending the APEC 2026 conference and exhibition can at https://apec-conf.org/attendees/registration/

https://apec-conf.org/

Shrinking the Footprint of High-Current Switching

By Takato Nabeshima, Product Marketing Manager - Relays, OMRON Electronic Components Europe

With electrification comes rising demand for compact, efficient, and resilient power control systems, from utility-grade installations and industrial drives to consumer EV charging units

Power control is a critical aspect of the electrification trend, expanding demand for improvements, upgrades, and modernisation throughout infrastructures from solar and wind generators to points of use. Equipment targeting residential applications faces intense cost pressure, with demands for miniaturisation to allow unobtrusive and fashionable styles. On the other hand, reliability and fault handling are dominant requirements in industrial electrification, while advancements that improve efficiency are wanted everywhere.

High-Current Switching

When it comes to handling high currents and voltages, electromechanical switches including contactors and relays are chosen for their high ratings and ability to safely isolate inactive loads. Contactors tend to have larger electromagnetic coils than relays as well as spring-loaded contacts for breaking the circuit and have been preferred in applications that involve controlling extremely high currents. Contactors have also tended to contain built-in weld detection that can protect the system if the main contacts become fused and fail to open when required. This is typically implemented with a set of auxiliary contacts that mirror the main contact structure.

With their auxiliary contact mechanism, higher coil rating, and spring loading, contactors tend to be physically larger than ordinary relays and can support lower maximum switching frequency. Interconnection typically relies on screw terminals, which require manual assembly. In today's electrifying world, new DC-switching applications include large inverters for utility-grade photovoltaic generators and battery-energy storage systems, high-speed electric vehicle chargers and domestic wallboxes, and uninterruptible power supplies (UPS). These are disrupting the old order,

demanding high current capability and safety features of contactors, smaller size, and lower power consumption, in a device compatible with high-volume production techniques. Similar pressures apply to more traditional AC loads such as lighting, HVAC and FA, where power density is increasing and demand for smaller and compact devices becomes a necessity.

Relays Step Up

New developments among relays allow current ratings in the 50A-300A range, which lets these devices offer an alternative to contactors in many domestic, industrial, and utility-grade applications.

The latest devices also feature weld detection with fault signalling thereby permitting comparable system protection. The auxiliary contact mechanism shown in figure 1 ensures safe insulation, with a withstand voltage of 2.5kV or minimum contact gap of 0.5mm, even after the coil is de-excited when the main contacts have a welding failure.

Among the inherent advantages of relays, smaller component dimensions permit more compact and lower-profile enclosure sizes. This can be important for consumer markets that desire fashionable and minimalist styles to industrial and utility applications challenged to install more and smarter infrastructure within existing space constraints. Contrasting the properties of a typical contactor with a comparable relay reveals more than 66% weight saving, as well as more than 60% less height and 85% lower volume.

The relays' smaller size and typically lower weight permit PCB mounting of high-power switches that can simplify and streamline equipment assembly. PCB-mounted components are compatible with automated production processes, allowing circuits to be assembled at high speed using inline insertion equipment. Subsequent automated soldering lets equipment vendors design-out traditional bulky and expensive components such as busbars and screw terminals that need to be manually fastened. In addition to permitting faster and more efficient assembly, soldered connections save human errors such as incomplete screw tightening or applying incorrect torque,

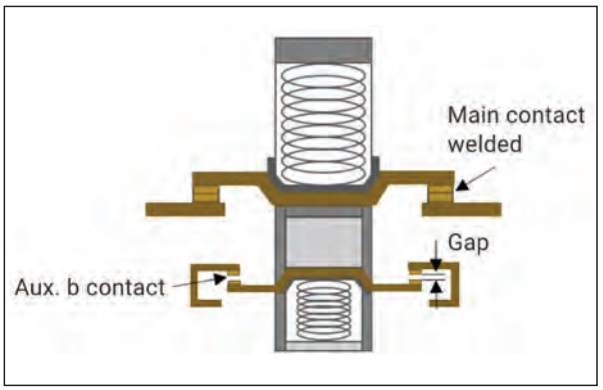
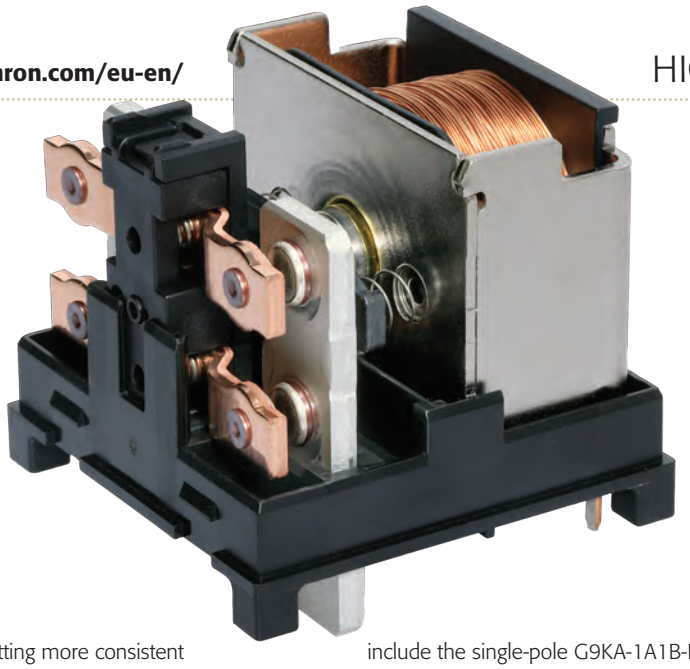


Figure 1. High-current relays now incorporate auxiliary contacts for fault detection.



permitting more consistent production quality.

On-Boarding

Moving established design practices and production flows away from traditional manually installed contactors to PCB-mount relay assemblies involves literally going back to the drawing package to create a new circuit-board design. PCB design guidelines include ensuring adequate copper thickness to carry the intended current, noting that enlarging the terminal surface area can help boost heat dissipation. A heatsink or insulated metal substrate can help protect the board in applications that demand extremely high current. In addition, for high-capacity PCB relays, implementing a holding-voltage circuit or PWM drive circuit to minimise power consumption can effectively ease thermal management and can potentially reduce the drive power to 25%. Equipment vendors can recoup the investment to redesign their PCBs through greater saleability, delivering smaller, lightweight PCB-based assemblies that fulfil market desires.

The production area may also need to be reorganised to reduce or remove manual workstations and migrate production onto automated machinery for through-hole assembly. A comparison of production techniques suggests that soldered terminals can reduce the bill of materials (BOM) including busbars and screws by up to 35%, while assembly-process costs can be reduced by as much as 50%. The benefits gained through automated assembly become more significant as production is scaled to larger volumes.

In addition, changing to PCB relays can enhance product performance and improve energy efficiency. The lower contact resistance of these relays leads to reduced I2R losses and heating thereby extending contact reliability. In addition, the coil power is lower, contributing further to increased efficiency.

OMRON's high-current PCB relays include the single-pole G9KA-1A1B-E, which can carry up to 300A and has main contact resistance less than 0.2mΩ. The design of the mechanism and the materials selected contribute to the low resistance and also permit a contact gap of 4.0 mm ensuring high performance with safety. There is also a 30V/1A mirror contact structure built-in to provide weld detection meeting IEC 60947-4-1, the international standard for electromechanical contactors and starters including motor protective switching devices.

Overall, while moving to PCB-mounted solutions requires upfront investment, vendors gain significant long-term payback in cost, efficiency, and reliability.

Conclusion

Electromechanical contactors are historically accepted as the kings of high-current switching, covering a wide range of ratings up to hundreds of Amps. While their strengths also include auxiliary fault-detection contacts, there are disadvantages. Devices tend to have a large and heavy coil and contact mechanism, which adds bulk and limits switching frequency, while manual assembly methods slow production and allow scope for human error.

New demands arising from electrification are driving innovations in PCB relays that elevate current-handling capability and provide built-in fault detection, presenting a new option in the 50-300A range that permit more compact, reliable, efficient, and cost-effective power control.

WHITEPAPER

Advancing Power Efficiency with SiC Merged-PiN Schottky (MPS) Diodes

Perry Schugart, CMO & Head of Business Development, RIR Power

Executive Summary

The rapid electrification of transportation, renewable energy systems, data centers, and industrial power infrastructure is driving unprecedented demand for power semiconductors that deliver higher efficiency, higher power density, and superior reliability. Silicon Carbide (SiC) technology has emerged as a cornerstone of this transformation, offering dramatic improvements over traditional silicon devices.

Within the SiC diode family, Merged-PiN Schottky (MPS) diodes represent a critical evolution beyond conventional SiC Schottky Barrier Diodes (SBDs). By intelligently combining Schottky and PiN diode structures in a single, monolithic device, SiC MPS diodes overcome the historical trade-offs between low conduction loss, high blocking capability, and ruggedness.

RIR Power Electronics Limited, leveraging over 55 years of high-power semiconductor expertise and its global Si and SiC development capabilities, is introducing SiC MPS diodes designed to meet the demanding requirements of next-generation EVs, renewable energy systems, industrial drives, aerospace, and green hydrogen infrastructure.

RIR's Leadership in SiC Power Devices

RIR is uniquely positioned as India's only company with existing high-power semiconductor fabrication capability, backed by proven experience in devices rated up to 20,000V and 12,000A. Through its U.S. development operations and its forthcoming first-of-its-kind SiC manufacturing facility in Odisha, RIR is building a vertically integrated SiC ecosystem spanning wafer processing, device design, packaging, and application support.

This foundation enables RIR to deliver high-voltage, high-reliability SiC MOSFETs and diodes, optimized not only for electrical performance, but also for manufacturability, long-term reliability, and system-level value.

Understanding SiC Schottky and Merged-PiN Schottky Diodes

Conventional SiC Schottky Barrier Diodes (SBDs)

SiC Schottky diodes are majority-carrier devices that offer:

- Near-zero reverse recovery charge (Qrr)
- Extremely fast switching
- Low switching losses

However, at higher voltages and temperatures, traditional SiC Schottky diodes face inherent limitations:

- Increased leakage current
- Reduced surge current capability
- Higher sensitivity to overload and short-term fault conditions

These factors can constrain their robustness in demanding applications such as traction inverters, grid-connected converters, and industrial power supplies.

SiC Merged-PiN Schottky (MPS) Diodes

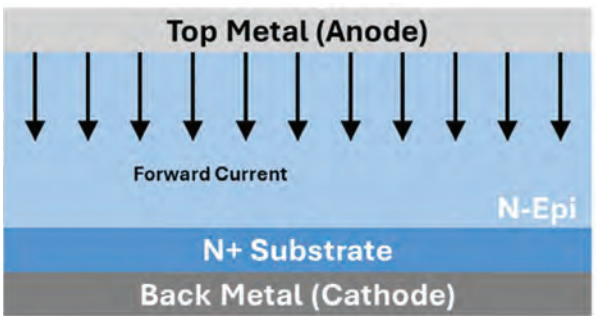
The Merged-PiN Schottky (MPS) structure integrates a PiN diode region within the Schottky architecture. Under normal forward operation, the device behaves like a Schottky diode, maintaining low forward voltage and fast switching. Under high current or high voltage stress (surge current), the PiN regions become active, dramatically enhancing device ruggedness.

This intelligent self-adapting behavior allows MPS diodes to deliver the best attributes of both Schottky and PiN devices—without their traditional drawbacks.

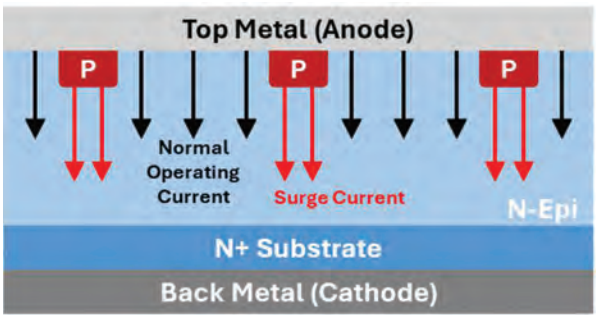
Key Performance Advantages of SiC MPS vs. SiC Schottky Diodes

One of the key advantages of SiC MPS diodes is in the forward conduction loss curve, RIR Power's SiC MPS diodes closely match SiC Schottky diodes at low to nominal current, maintaining low forward voltage and high efficiency during normal operation. At higher current and overload conditions, MPS diodes exhibit lower incremental conduction loss as the embedded PiN regions conduct, stabilizing forward voltage and reducing thermal stress compared to conventional SiC Schottky diodes.

Pure Schottky Diode (SBD)



Merged PiN Schottky Diode (MPS)

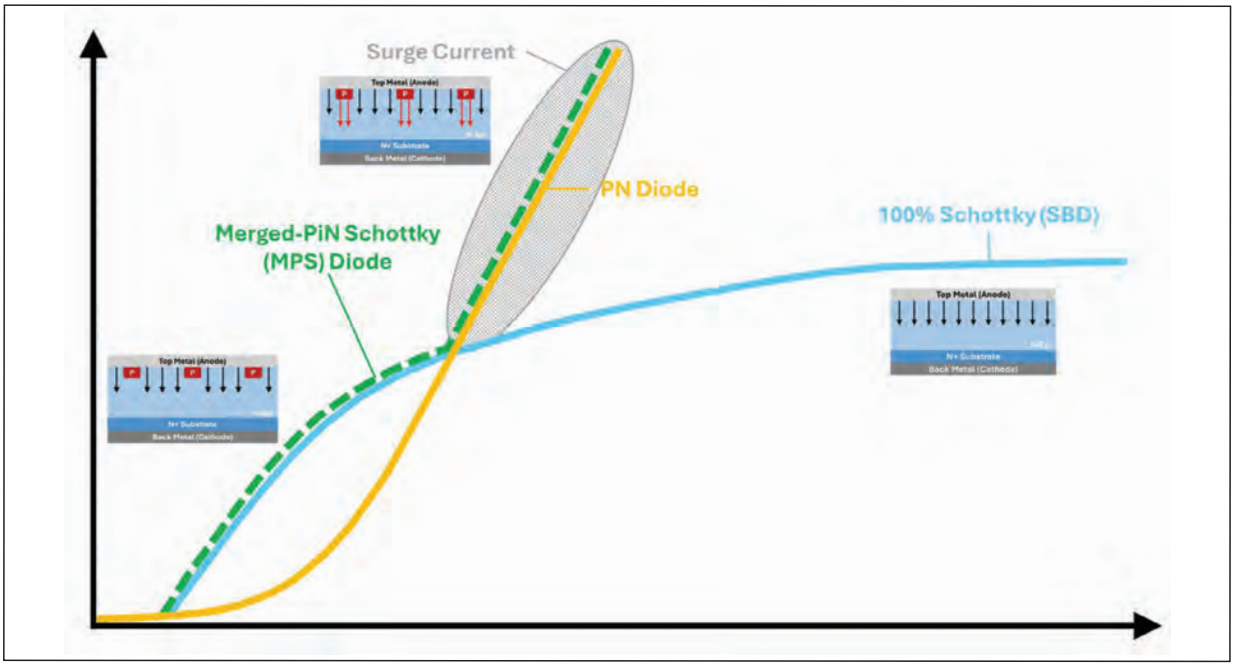


Comparison of SiC MPS vs. SiC Schottky Diodes

As depicted below, RIR Power's MPS diodes remove the need to choose between efficiency and ruggedness.

Parameter	SiC Schottky Diode (SBD)	SiC Merged-PiN Schottky (MPS) Diode	Customer Value
Conduction Mechanism	Majority carrier (Schottky)	Majority carrier with PiN assist	Best of both worlds
Reverse Recovery	Near-zero	Near-zero	High-frequency efficiency
Forward Voltage (Nominal Load)	Low	Low	Comparable efficiency
Forward Voltage (High Current / Surge)	Increases rapidly	Stabilized via PiN conduction	Improved overload handling
Leakage Current @ High Temperature	Higher	Significantly lower	Better high-temp reliability
Surge Current Capability	Limited	High	Robust against inrush & faults
Avalanche Capability	Limited	Enhanced	Grid and industrial resilience
Thermal Stability	Moderate	Superior	Extended operating range
System Derating Required	Higher	Lower	Smaller, lower-cost systems
Typical Use Case	Light to medium duty	Mission-critical, High stress	Broader applicability

Forward Surge Capability, IFSM



1. Superior Surge Current Capability
MPS diodes can safely conduct significantly higher surge currents due to the activation of PiN regions during overload events. This makes them far more robust in real-world systems exposed to inrush currents, short circuits, and grid disturbances.

2. Lower Leakage at High Temperature
While standard SiC Schottky diodes experience rapidly increasing leakage current as junction temperature rises, MPS structures suppress leakage through their PiN regions—enabling stable operation at elevated temperatures.

3. Improved Avalanche and Blocking Robustness
The merged structure enhances high-voltage blocking stability and avalanche capability, making MPS diodes better suited for high-voltage DC-link and grid-tied applications.

4. Near-Zero Reverse Recovery Performance
Like Schottky diodes, SiC MPS diodes remain majority-carrier devices during normal operation, preserving ultra-fast switching and negligible reverse recovery losses—critical for high-frequency power conversion.

5. Enhanced System Reliability
By combining efficiency with fault tolerance, MPS diodes reduce the need for over-design, snubber circuits, and excessive derating, improving overall system reliability and lowering total cost of ownership.

Application Impact

RIR's SiC MPS diodes enable higher system efficiency and reliability across

demanding applications by combining Schottky-like switching performance with enhanced surge, thermal, and high-voltage robustness. This makes them ideally suited for EV traction inverters, renewable energy systems, industrial drives, aerospace, and green hydrogen applications where high-power density, efficiency, ruggedness, and thermal performance are equally critical:

- **Electric Vehicles (EVs & HEVs)**
  Traction inverters, onboard chargers, and DC-DC converters benefit from reduced losses, higher efficiency, and improved fault tolerance.
- **Data Centers & AI Infrastructure**
  High-efficiency UPS, PDU, and server power systems benefit through reduced switching losses, higher power density, and enhanced reliability under continuous high-load operation—critical for hyperscale, edge, and AI-driven data centers with stringent uptime and energy-efficiency requirements.
- **Renewable Energy & Grid Infrastructure**
  Solar inverters, wind power converters, and energy storage systems gain higher power density and improved reliability under grid disturbances.
- **Industrial Power Supplies & Motor Drives**
  High-frequency switching, improved thermal margins, and surge robustness enable compact, high-performance industrial designs.
- **Aerospace & Defense Power Systems**
  Extreme environmental resilience, fast switching, and high voltage capability align with mission-critical reliability requirements.
- **Green Hydrogen & Electrolysis Systems**
  High-efficiency rectification and robust high-voltage performance support continuous operation and long service life.

Value Proposition

RIR's SiC MPS diode portfolio offers several decisive advantages:

1. **Higher System Efficiency** – Reduced switching and conduction losses across operating conditions.
2. **Greater Ruggedness** – Enhanced surge, avalanche, and thermal robustness.
3. **Design Flexibility** – Simplified protection and reduced derating requirements.
4. **Lower System Cost** – Smaller passives, reduced cooling needs, and fewer external protection components.

Conclusion

As power electronics systems push toward higher voltages, higher switching frequencies, and more demanding operating environments, RIR Power's SiC Merged-PiN Schottky diodes emerge as a clear advancement over conventional SiC Schottky devices. By combining efficiency with ruggedness, MPS technology enables designers to achieve higher performance without compromising reliability.

With the launch of its SiC MPS diodes, RIR Power Electronics Limited reinforces its leadership in high-power semiconductor innovation—delivering devices that are not only technologically advanced, but also engineered for real-world deployment across EVs, data centers, renewables, industrial systems, aerospace, and green hydrogen.

RIR is not merely supplying components, it is enabling the next generation of efficient and reliable power electronics solutions for the world. Powering Progress—Enabling Tomorrow.

Accelerated Life Test Instruments

www.accelrf.com
Accel-RF Instruments Corporation
Tel: 001 858 278 2074

Arbitrary 4-Quadrant Power Sources

www.rohrer-muenchen.de
Rohrer GmbH
Tel.: +49 (0)89 8970120

Busbars

www.auxel.com
Auxel FTG
Tel: + 33 3 20 62 95 20

Capacitors

www.cde.com
Cornell Dubilier
Tel: 001 508 996 8561

DC/DC Converters

www.protocol-power.com
Protocol Power Products
Tel: +44 (0)1582 477737

Diodes

www.neutronltd.co.uk
Neutron Ltd
Tel: +44 (0)1460 242200

Diodes

www.proton-electrotex.com/
Proton-Electrotex JSC/
Tel: +7 4862 440642;

Discrete Semiconductors

www.digikey.com/europe
Digi-Key
Tel: +31 (0)53 484 9584

Hall Current Sensors

www.dgseals.com
dgseals.com
Tel: 001 972 931 8463

High Voltage and High Power Electronics

Dean Technology, Inc.
www.deantechnology.com
+1 (972) 248-7691

IGBTs

www.microsemi.com
Microsemi Tel: 001 541 382 8028

Magnetic Materials/Products

www.dextermag.com
Dexter Magnetic Technologies, Inc.
Tel: 001 847 956 1140

Mosfets

www.aosmd.com
Alpha and Omega Semiconductor
Tel: 001 408 789 3233

www.neutronltd.co.uk
Neutron Ltd
Tel: +44 (0)1460 242200

Optoelectronic Devices

www.digikey.com/europe
Digi-Key
Tel: +31 (0)53 484 9584

Packaging & Packaging Materials

www.curamik.co.uk
curamik® electronics GmbH
Tel: +49 9645 9222 0

Power Amplifiers

www.rohrer-muenchen.de
Rohrer GmbH
Tel: +49 (0)89 8970120

Power ICs

www.digikey.com/europe
Digi-Key Tel: +31 (0)53 484 9584

Power Modules

www.picoelectronics.com
Pico Electronics
Tel: +44 1634 298900

www.fujielectric-europe.com
Fuji Electric Europe GmbH
Tel: +49 (0)69-66902920

www.proton-electrotex.com/
Proton-Electrotex JSC/
Tel: +7 4862 440642;

Power Semiconductors

www.proton-electrotex.com/
Proton-Electrotex JSC/
Tel: +7 4862 440642;

Power Substrates

www.universal-science.com
Universal Science Ltd
Tel: +44 (0)1908 222211

Resistors & Potentiometers

www.isabellenhuette.de
Isabellenhütte Heusler GmbH KG
Tel: +49/(27 71) 9 34 2 82

RF & Microwave Test Equipment.

www.ar-europe.ie
AR Europe
Tel: 353-61-504300

Simulation Software

www.power.ti.com
Texas Instruments
Tel: +44 (0)1604 663399

www.universal-science.com
Universal Science Ltd
Tel: +44 (0)1908 222211

Solder

www.indium.com
Indium Corporation
Tel: +44 (0) 1908-580400

Switched Mode Power Supplies

www.citapower.com
Bias Power, LLC
Tel: 001 847.419.9118

Thermal Management & Heatsinks

www.abl-heatsinks.co.uk
ABL Components Ltd
Tel: +44 (0) 121 789 8686

www.dau-at.com
Dau GmbH & Co KG
Tel: +43 3143 23510

Thyristors

www.proton-electrotex.com/
Proton-Electrotex JSC/
Tel: +7 4862 440642;

The Premier Global Event in Power Electronics

SAVE *the* DATE

March 7-11, 2027

New Orleans, LA

Ernest N. Morial Convention Center

APEC 2027

IAS IEEE INDUSTRY APPLICATIONS SOCIETY — Linking Research to Practice

IEEE — Advancing Technology for Humanity

pels IEEE POWER ELECTRONICS SOCIETY — Powering a Sustainable Future

PSMA