VEHICLE electronics

The monthly magazine for automotive electronics engineers

SiC market for EVs set for 12% CAGR

The global silicon carbide (SiC) market for electric vehicles is set to jump from $879m in 2023 to hit $3bn in 2034, according to Transparency Market Research.

This represents a CAGR of 11.9% between 2024 and 2034.

As the automotive industry shifts towards greener technologies, the demand for advanced power electronics has surged. SiC is known for its electrical properties, and is a key material for developing high-efficiency components for electric powertrains.

A primary advantage of SiC over traditional silicon is its ability to operate at higher voltages, temperatures and frequencies. These characteristics enable SiC components to deliver better performance and efficiency, which are critical for the power management systems in EVs.

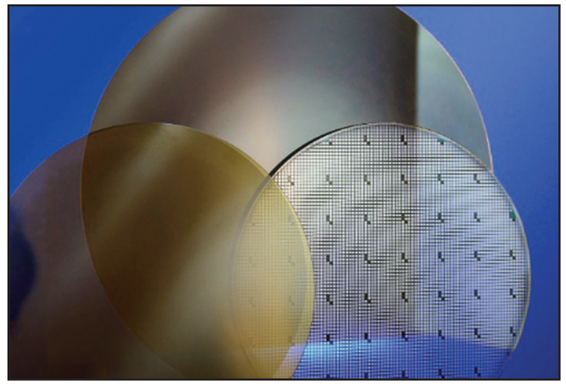
For instance, SiC-based inverters can convert DC to AC power more efficiently, leading to improved battery use and extended driving range.

Major players are investing heavily in research and development to enhance the performance and reliability of SiC-equipped components. Companies are focusing on innovations that can reduce energy losses, lower heat generation and improve the overall durability of power electronic systems.

This is not only crucial for the efficiency of electric powertrains but also for the reduction of the overall size and weight, which can positively impact vehicle design and manufacturing costs.

As the market for EVs continues to expand, the role of SiC will become increasingly significant, driving advancements in power electronics and contributing to the global efforts in reducing carbon emissions and promoting sustainable transportation.

Asia Pacific holds a significant share. This region includes some of the world's largest and fastest-growing EV markets, such as China, Japan and South Korea.



SiC market to soar (picture: Nexperia)

Issue 128
August 2024

IN THIS ISSUE

2: VW and OnSemi sign supply deal

4: BMW joins Eclipse SDV group

8: Harman and Cariad extend apps

10: Arm and Tata MoU for SDVs

11: CCC certifies NXP digital car key

13: Report from Aesin conference

19: How V2X can improve safety

24: Connectors from e-bikes to planes

25: How shippers implement AI

29: Maintaining bias in electrical systems

33: Focus on Indian automotive future

37: Product news

42: Contact details

VW and OnSemi sign multi-year supply deal

OnSemi has signed a multi-year deal with Volkswagen to be the primary supplier of a complete power box as part of the traction inverter for its SSP scalable systems platform.

This uses silicon carbide (SiC) technologies in an integrated module that can scale across all power levels, from high power to low power traction inverters to be compatible with all vehicle categories.

"By offering a complete power system that encompasses the entire power subassembly, we provide Volkswagen with a single, simplified modular and scalable platform that maximises efficiency and performance for their vehicle line," said Hassane El-Khoury, CEO of OnSemi. "This new approach allows for the customisation of power needs and the addition of features for different vehicles without compromising on performance, all while reducing cost."

Based on the EliteSiC M3e mosfets, the power box can handle more power in a smaller package, which reduces energy losses. The inclusion of three integrated half-bridge modules mounted on a cooling channel should further improve efficiency by ensuring heat is effectively managed from the semiconductor to the coolant encasement.

This leads to better performance, improved heat control and increased efficiency, so EVs can drive further on a single charge.

By using this, Volkswagen should be able to transition easily to future EliteSiC-based platforms.

"We are very pleased to have OnSemi as a strategic supplier for the power box of the traction inverter for our first tranche in the SSP platform," said Dirk Große-Loheide, VW board member.

Volkswagen should also benefit from OnSemi's planned investment to expand its SiC manufacturing in the Czech Republic.

Who wants to have a car crash?



In-car gaming platform AirConsole, in collaboration with Sony Pictures Television, has launched the "Who Wants to Be a Millionaire?" game for BMW vehicles.

Raising safety concerns, the picture accompanying the announcement shows the driver and front passenger playing the game on the front console and the release says it offers "an unmatched entertainment experience for drivers and passengers alike".

The text-to-speech technology reads out questions and personalises gameplay by recognising and using players' names, providing an engaging sonic experience. Players can use lifelines like removing incorrect answers, asking the audience or swapping questions, all accessible through their smartphones.

"We are thrilled to see Who Wants to Be a Millionaire? come to life in BMW cars through AirConsole," said Michael Fuller, vice president at AirConsole.

Vehicle Electronics has asked AirConsole to comment on the safety aspects.

Baidu chooses Hesai lidar for robotaxi use



Baidu robotaxi undergoes road testing in Wuhan

Baidu has selected Hesai Technology to be the exclusive long-range lidar supplier for its Yichi 06 robotaxi platform.

This lidar deal is worth an estimated $200m to $300m based on Baidu's plans to deploy 100,000 robotaxis in China. It is expected to be the first widespread application in the Chinese market.

The Chinese robotaxi market is expected to exceed $162bn in 2025 and $404bn in 2030, making it one of the largest markets for the autonomous driving landscape.

As a result, lidar demand will grow as more autonomous vehicle firms seek better sensor performance, safety and perception.

Baidu's fifth-generation Apollo Go robotaxis, which are in operation in Wuhan and other cities in China, already use Hesai's Pandar as the main lidar. This year, the sixth-generation Apollo Go autonomous vehicles will also be deployed, the cost of which has dropped 60% compared with the previous generation, to a price around $28,500.

Hesai dominated the global robotaxi lidar market in 2023 with a 74% share of the $124m market. Among the top ten L4 autonomous driving companies globally, nine of them, including Zoox, Nvidia and Nuro, use Hesai's lidar.

Hesai's total lidar shipment volume exceeded 380,000 units in the first quarter of this year.

"The autonomous driving industry has rapidly evolved in recent years and today's surge of autonomous driving in China is a testament to the breakthroughs we've made in smart driving," said David Li, CEO of Hesai. "Advanced sensors like lidar are accelerating the adoption of autonomous driving."

Hesai has a presence in the USA, Europe and Asia with customers spanning over 40 countries.

Automotive electronics to see rapid growth till 2032

The automotive electronics market is expected to hit $503.5bn by 2032 and see a CAGR of 8.6% from 2024 to 2032, according to SNS Insider. It was valued at $260.25bn in 2023.

The rising demand for electric vehicles is driving the growth of this market as they are more dependent on electronic components for various basic functions. They control power delivery and are monitored to optimise efficiency and smooth operation. EVs also require battery management systems.

And EVs tend to be some of the first adopters of adas such as lane departure warning, automatic emergency braking and adaptive cruise control.

While established tech giants such as Apple reportedly shelved their EV projects in February 2024, others are forging ahead. In March, Xiaomi declared the upcoming delivery of its first electric vehicle.

Hyundai and LG Electronics are forming an alliance to become major players in the market.

On the basis of components, current-carrying devices were dominant in 2023 with a revenue share of more than 40%.

In 2023, the safety systems segment emerged as the leading application with more than 35% revenue share. This included adas, airbags and electronic stability control.

People are increasingly prioritising safety features in their vehicles, and governments are making these features mandatory through regulations.

Automakers and suppliers are investing heavily in developing more advanced safety features. These include active safety measures, providing a 360˚ perception of the surroundings, and incorporating redundancy in perception, processing and software to increase reliability.

According to the research, by the end of this decade, 68.5% of all new passenger vehicles will have some level of automation at SAE level 2+ or higher.

BMW joins Eclipse SDV working group

BMW has joined the Eclipse Foundation's software defined vehicle (SDV) working group.

The group facilitates global collaboration on open-source software technologies for use in modern vehicles.

"BMW has mastered software from chip to cloud and has done so for generations," said Frank Weber, board member at BMW. "The number of digital functions in cars is growing rapidly. All players in our industry can benefit significantly from more cooperation in developing and securing software that does not differentiate from the competition."

In the automotive industry, there is a great deal of potential overlap for basic software functionality.

"We see open-source as an active collaboration model for software development and expect a lot from the joint activities in the Eclipse SDV working group," said Christian Salzmann, BMW vice president. "As an active contributor in open-source projects such as Zuul, we already bring a lot of relevant experience to the table."

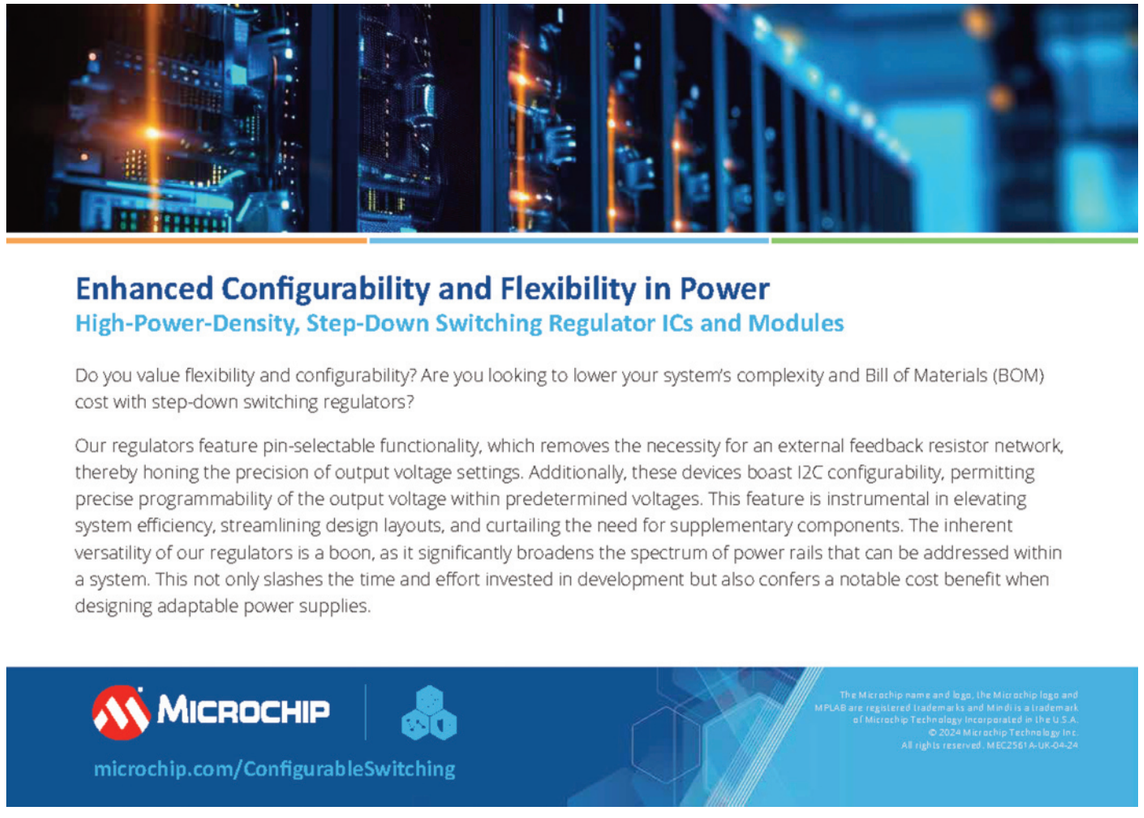
As a member of the Eclipse Foundation for more than a decade, BMW will continue to support and drive innovation within the Open-MDM and OpenPass working groups. BMW will also continue to contribute to Autosar.

"Autosar is a success story that does a lot for the automotive industry," said Salzmann. "We see the activities in Eclipse as a supplement, not as a substitute."

The working group supports the open-source development of automotive software. With over 50 members, the initiative has garnered significant industry support.

Qorix, a new company for middleware in the mobility industry, has also joined the group.

"We are thrilled to join and collaborate with industry leaders," said Markus Schupfner, CEO of Qorix. "Our participation will leverage open-source innovation and drive industry transformation."



Hyundai and Bell extend infotainment partnership

Hyundai and Bell Canada have announced a multi-year extension of their partnership to provide Canadian customers with in-car connected infotainment services.

Through Bell's IoT connectivity, Hyundai, Kia and Genesis users in Canada should benefit from fast and reliable access to infotainment features, with the partnership also exploring services such as over-the-air software updates, music and video streaming, casual gaming and, eventually, wifi hotspots, providing seamless connectivity on the go.

"Bell has been a trusted partner of Hyundai for the past seven years, providing superior services and innovation leadership," said Haeyoung Kwon, vice president at Hyundai. "We are thrilled to take this relationship into the future to bring even more exciting in-car capabilities to the Canadian consumer."

The partnership also focuses on the continued development of capabilities such as eUICC for a more stable future mobile environment, navigation, feature on-demand service, expanded voice recognition capabilities and more EV functions.

"Bell is proud to partner with Hyundai to transform the car ownership, driving and passenger experience for Canadians with cutting-edge offerings, powered through our network," said Costa Pantazopoulos, Bell vice president. "Our mutual commitment to service excellence and technology innovation creates a powerful partnership that has been shaping the future of vehicle mobility since 2017, and we're excited to continue on this road in years to come."



Haeyoung Kwon (left) and Costa Pantazopoulos



Geely cars use STM SiC technology

STM signs long-term SiC supply deal with Geely

ST Microelectronics and Geely Auto Group have signed a long-term silicon carbide (SiC) supply agreement to extend their existing cooperation.

Under this multi-year contract, STM will provide Geely brands with SiC power devices for mid-to-high-end battery electric vehicles.

In addition, building on their longstanding cooperation across multiple automotive applications, Geely and STM have established a joint lab to exchange information and explore innovations related to automotive electronics and electrical architectures, such as in in-vehicle infotainment, smart cockpit systems and adas.

Geely has adopted STM's third-generation SiC mosfets in electric traction inverters. The traction inverter is the core of electric powertrains and SiC mosfets increase their efficiency.

"I believe that through the form of innovation joint lab, Geely and STM can deepen our cooperation, achieve mutual benefit, and accelerate the development and implementation of innovative technologies in Geely Auto," said Li Chuanhai from Geely's automotive central research institute.

Henry Cao, STM executive VP, added: "Geely Auto, is a shining example of automotive innovation in China, making rapid progress in car electrification and digitalisation, while expanding its presence in the global market."

As China's top automotive brand, Geely Auto sold 1.68 million vehicles in 2023, with new-energy EV sales reaching 480,000 units, accounting for 28% of the company's sales for the year.

Last year, STM and Sanan Optoelectronics created a 200mm SiC device manufacturing joint venture in Chongqing, China.

Researchers create autonomous vehicle guide

Researchers at Coventry University are helping create a guide for operating autonomous vehicles.

They have contributed their expertise acting as technical authors.

The guide, titled BSI Flex 1887: Human Factors for Remote Operation of Vehicles Guide v1.0, was developed by the British Standards Institution (BSI) and supported by the UK government's CCAV centre for connected and autonomous vehicles. It aims to establish good practices for the remote monitoring, assistance and operation of self-driving vehicles.

Stewart Birrell, Kevin Vincent and Adam Bogg from the university's Research Centre for Future Transport & Cities (FTC) have gathered feedback from industry leaders and applied their human factors research expertise to create this guide.

"It will provide essential guidance to the forthcoming early-stage CAV deployment projects," said Vincent.

BSI Flex 1887 provides practical information to help businesses address challenges in operating autonomous vehicles. It emphasises the selection and training of remote operating staff, the organisation's end-to-end responsibilities and fundamental workstation design principles.

Considerations include: ensuring qualified personnel are chosen and adequately trained for remote operation; implementing effective strategies for assessing and maintaining operator performance; following specific guidelines to enhance efficiency and comfort in the operators' working environments; and optimising the performance and co-ordination of remote operators through effective management.

While the BSI Flex primarily focuses on road applications, it also serves as guidance for controlled environments lacking specific standards. It is now open for public consultation. Stakeholders and interested parties are encouraged to help feedback to ensure it meet the highest standards.



Infineon and Swoboda develop current sensors

Infineon and Swoboda are jointly developing and marketing current sensor modules for automotive applications.

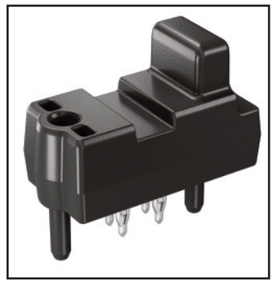
The partnership combines the current sensor ICs from Infineon with Swoboda's expertise in the development and industrialisation of sensor modules to address the fast-growing market of sensing for hybrid and electric vehicles.

The collaborative high-performance current measurement products could accelerate time-to-market for high-volume applications such as traction inverters and battery management systems, but also for other key automotive applications.

Swoboda is a family-owned company that supplies OEMs and tier-one suppliers. It has more than 4000 employees at twelve locations and generated a turnover of more than €500m in the last financial year. It manufactures in China, Czech Republic, Germany, Mexico, Romania and the USA.

A product from the collaboration, the Swoboda CSM510HP2, contains a fully encapsulated current sensor module with reduced footprint without compromising performance. It is based on the Infineon TLE4973 coreless current sensor IC and allows precision sensing with a total error below two per cent.

The module is designed for seamless integration with the HybridPack Drive G2, Infineon's automotive power module for traction inverters in electric vehicles. This eliminates the need for separate external current sensors to make the traction inverters more compact.



Infineon and Swoboda current sensor module

"This new generation of current sensors sets standards to simplify system integration," said Klaus Lebherz, head of business development at Swoboda. "Infineon's latest sensor technology and our injection moulding knowhow turned out to be a perfect match."

Infineon and Swoboda are developing additional current sensing products to serve any kind of power devices. Other target applications include inverter DC links and high-voltage battery management.

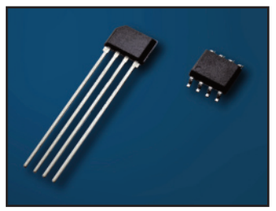
"The market demands high performance, compact and easy to integrate current sensing," said Andrea Monterastelli from Infineon. "The seamless fit into Infineon`s HybridPack Drive G2 offers the most compact option for hybrid and electric vehicles, enabled by our best-in-class current sensor ICs and Swoboda's expertise."

Nio picks Melexis to monitor traction inverter

Chinese electric vehicle maker Nio has selected Melexis' current sensor chips for its traction inverter systems.

The chips will power all of Nio's battery electric vehicles (BEVs).

Melexis will provide local support with engineers to ensure seamless integration and optimisation.



Melexis current sensor chips

The traction inverter converts the battery's DC into the AC that powers the electric motor. The current sensor is essential for precisely monitoring the current to ensure the vehicle's safety and performance.

"We are very pleased to have entered into this collaboration with Melexis," said Bi Lu, vice president of Nio. "This collaboration will further strengthen our position in the EV market and bring a better driving experience to our customers."

Dieter Verstreken, vice president at Melexis, added: "Our current sensor ICs, coupled with the expertise of our dedicated local engineers, will provide Nio with the support they need to achieve success in the electric vehicle market. We look forward to collaborating with Nio on future projects to advance electric vehicle technology."

• Melexis has opened its largest wafer testing site worldwide in Kuching, Sarawak, Malaysia.

The four-storey building hosts 90 pieces of semiconductor wafer test equipment and is next to X-Fab's wafer foundry, one of Melexis' key suppliers.

Harman and Cariad extend app range for VW

Harman and Volkswagen software group Cariad are collaborating to extend the range of apps available in VW's app store to more than 70.

The app store integrates with Harman's Ignite store for infotainment systems that let OEMs maintain control of third-party content and relationship with the end user.

Audi has already implemented the store in select models and regions from model year 2024 and will integrate it in the Q6 e-Tron that will start coming to customers this August, with additional VW brands to follow.

Apps soon available include the Livil in-car messenger that uses gen AI to streamline the driver's typical communication processes.

"The Livil team is happy to collaborate and innovate with both Cariad and Harman," said Nils Frers, CEO of Livil. "With Livil's in-car messenger, drivers of Volkswagen vehicles will receive first access to the platform, which has been purpose-built around the opportunities and requirements unique to driving."

Harman is collaborating with others to offer more apps, including Bloomberg and Microsoft. The latter will involve bringing Microsoft Teams to automotive through a web conferencing app that directly connects users to Teams meetings through the in-vehicle calendar.

"We're pleased to collaborate with Harman Ignite and Cariad to address the needs of hybrid workers," said Raj Paul, senior director at Microsoft. "A new integration between the companies allows Harman to provide safe use of Microsoft Teams meeting functionality while on the road."

The Ignite store is a safe and secure automotive platform, compliant with the Android Automotive OS that connects OEMs with developers to provide consumers in-vehicle digital experiences.

"As a fully compliant Android Automotive OS app store, the Harman Ignite store continues to bring new app experiences into the vehicle," said Jens Beckmann, senior director at Harman.

Solid Sands
SuperGuard Library Safety Qualification Suite

How to qualify a C or C++ standard library implementation?

The C and C++ standard libraries are treated the same as any automotive software component, so the libraries should be tested and qualified for use in safety-critical applications with the same care and quality assurance. Especially for the C++ standard library, this is a challenge.

SuperGuard has the answers to this question.

SuperGuard Features:
- Requirements-based testing for the C and C++ standard library
- High structural code coverage and MC/DC
- CSV report linking requirements, test specifications and test results
- Compliant with the requirements of functional safety standards

Test Platform Features:
- Multi-processing speedup
- Supports bare metal targets
- Requirements traceability
- Windows and Linux hosts
- Full control over test sets
- Python configuration plugin
- Reporting tools

Compliant With:
- ISO 26262
- IEC 61508
- EN 50128 / EN 50716
- IEC 62304
- And many more

Learn more on www.solidsands.nl
Amsterdam | The Netherlands

Autotalks and Rolling reveal production start for V2X module

Rolling Wireless' RX-135x, the first V2X module based on Autotalks' Secton3 chipset, is available for user programmes with start of production scheduled for 2026.

The V2X module will let manufacturers offer day 2+ safety applications. It is now available for sampling.

Rolling Wireless is also developing a V2X module based on Autotalks' Tekton3 chipsets, more suitable for e-bike market needs, in addition to vehicle needs.

"We are thrilled to collaborate with Autotalks to bring the first complete 5G-V2X option to market," said Andreas Kohn, COO at Rolling Wireless. "Our combined strengths position us as the ideal partners for automotive, e-bike and road infrastructure manufacturers seeking robust and future-proof V2X."



Partnership suits automotive, e-bike and road infrastructure

The Secton3 and Tekton3 chipsets support all four V2X sidelink communication standards: LTE-V2X, IEEE 802.11p (DSRC), 5G-V2X and 802.11bd. In addition to 5G-V2X operation, they enable the concurrent use of two radio technologies such as DSRC plus 5G-V2X. This allows the integration of 5G-V2X while preserving compatibility with legacy technologies in existing installed bases.

"Our joint efforts with Rolling Wireless help bring the next generation of V2X technology to the entire ecosystem," said Yuval Lachman, Autotalks vice president. "The RX135x module brilliantly demonstrates the capabilities of our Secton3 chipset, and its availability represents a significant milestone on the path to safer and more efficient road transportation for everyone."

The RX135x is a dual-mode V2X module supporting legacy (LTE-V2X and DSRC 802.11p) and next-generation (NR-V2X and DSRC 802.11bd) technologies. It allows single-channel as well as concurrent dual-channel operation.

The module can be connected either to a Rolling Wireless 5G network access device (NAD), using the NAD's application processor, or to any external host processor to run the V2X stack and applications.

Suzuki and Tier IV partner on autonomous driving

Tier IV and Suzuki have entered a capital and business alliance to accelerate the development and commercialisation of autonomous driving technology.

By combining Tier IV's scalable software with Suzuki's manufacturing expertise, the partnership aims to create innovative mobility services enabled by autonomous driving technology.

These services are intended to address the increasing need for more accessible and efficient regional mobility.

Tier IV is spearheading Autoware open-source software to foster the development of autonomous driving technology across the industry. Leveraging Autoware, it also provides scalable software platforms with a global network of partners, fuelling the rollout of intelligent vehicles.

In Hamamatsu in Japan, Suzuki is pioneering smart mobility services using autonomous driving technology, targeting regions where traditional public transportation services are diminishing.

• Tier IV has extended its series B funding round, securing an additional ¥8.5bn. This brings the total series B funding to ¥20.7bn and the company's overall funding to ¥38.1bn.

Arm and Tata sign MoU for software-defined vehicles

Tata Technologies has signed a memorandum of understanding (MoU) with Arm to develop automotive software and systems for software-defined vehicles (SDVs).

Tata will work with Arm to enable its software on the Arm Automotive Enhanced (AE) portfolio, including compute subsystems (CSS) for automotive, to accelerate the development timelines of high-performance vehicle computing.

Both companies will work together to develop software leveraging Soafee reference architecture virtual platforms and demonstrating a chip-to-cloud software stack for SDVs.

The aim is to combine Tata's automotive domain expertise and software capabilities with Arm technologies to reduce the development time of SDVs for automotive OEMs.

Tata will develop a Soafee reference architecture stack using the Arm AE portfolio and CSS, along with enabling a cloud-native development framework integrating various dev-sec-ops and virtual platforms to shift-left the development of SDVs, accelerating time to market for automakers.

At this year's CES and Mobile World Congress, Tata and Arm jointly demonstrated a cloud-native reference software architecture for SDVs on Arm SoCs. These were presented at Embedded World on the Cortex-A720AE in a virtualised environment, realising a shift-left strategy for safety-critical vehicle software running on heterogeneous computing systems.

"We are excited about this collaboration with Arm, which underscores Tata's commitment to engineering a better world by enabling the automotive industry to realise connected, autonomous and sustainable products that deliver great customer experience," said Warren Harris, CEO of Tata Technologies.

Dipti Vachani, senior vice president at Arm, added: "Vehicle electronics are becoming increasingly complex with the need for more AI and software to improve user experiences and advance autonomy. This partnership combines the high-performance, power-efficient and functional safety leadership of the Arm AE technology platform and the time-to-market advantages of our CSS for automotive with the automotive software expertise from Tata to empower our mutual customers to accelerate the development of AI-enabled vehicles."

With 25 years of expertise in product engineering and digital services, along with a track record in delivering engineering to the automotive industry, Tata says it is well-positioned to meet the needs of SDVs.

Moreover, it hopes to enable rapid prototyping, testing and deployment of SDV technologies, unlocking opportunities for developers and accelerating the time to market for OEMs.

Hutchinson reduces EV noises

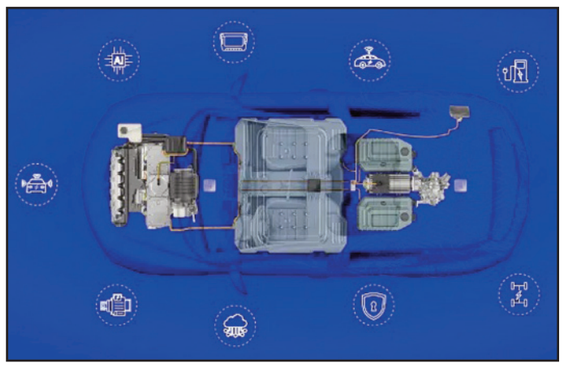
Hutchinson has developed NVH (noise, vibration and harshness) encapsulation with acoustic and thermal properties to reduce the noise of cooling compressors and e-motors on EVs.

It has been designed to equip several thousand electric and hybrid vehicles for OEMs.

With EVs, cabin noises can arise from multiple sources and occur while the vehicle is on the move, stopped or parked, especially during the fast charge.

Noises from powertrains and compressors were previously masked by combustion engines, but they are becoming increasingly obvious.

This encapsulation combines vibration attenuation and absorption, especially at frequencies above 1kHz.


Tata and Arm partner on SDVs

CCC certifies NXP digital car key

The Car Connectivity Consortium (CCC) has certified NXP's SN220 single-chip NFC and embedded secure element under its CCC Digital Key programme launched last year.

This marks NXP as the first digital car key provider to receive a certification for its NFC chips.

This is part of NXP's complete system encompassing the full digital car key ecosystem across UWB, NFC chips and Bluetooth Low Energy for both mobile device manufacturers and car OEMs.

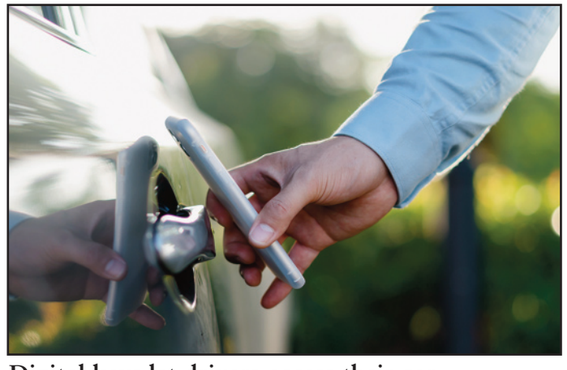
Digital car keys do more than let drivers access their car seamlessly and securely. They allow drivers to control access to their car, from family members to valets. As this feature grows in popularity, interoperability, security and safety are crucial components.

The CCC recently introduced a certification programme aligned with the CCC Digital Key specification. This defines digital car keys to ensure seamless interoperability and security across the full ecosystem of cars, mobile phones and other hands-free secure car access devices.

"As a charter member of the CCC, NXP has long been at the heart of the secure car access ecosystem," said Michael Leitner, general manager at NXP. "This certification validates the specification that will enable the future of digital keys in the automotive market. As the first certified provider, NXP's fully integrated systems will set the standard for quality and security in this rapidly growing market."

The SN220 combines an NFC controller with an embedded secure element in a single chip. NXP's digital key includes not only a secure element and NFC, but also leverages UWB and Bluetooth LE to ensure a consistent and seamless user experience.

"Certification is a crucial step towards building trust among consumers and the industry," said Alysia Johnson, CCC president. "It enables auto and device manufacturers to deliver secure, user-friendly experiences for digital key access. Our goal is to establish global compatibility for a seamless and secure digital key experience, regardless of what car or mobile device is involved."



Digital keys let drivers access their car

Exida certifies Vector software up to Asil D

Exida has again certified Vector's Microsar Classic Safe basic software up to Asil D.

In addition to the regular recertification, the focus was on proving that Microsar Classic Safe basic software meets the safety requirements for availability in redundant systems. This means ECU developers at automotive manufacturers and their suppliers can now use the basic software for autonomous driving functions.

The assessors from Exida evaluated modules from various domains of the basic software. They determined their freedom from interference regarding memory and the correct implementation of the dedicated safety requirements that ensure the availability of redundant systems.

For the first time, the assessors evaluated the analysis method introduced in the development of Microsar, which ensures upper limits for the execution time of the modules.

The limitation of the execution time ensures the permanent availability of control commands for steering and braking in autonomous vehicles.

In addition to the scope of the previous assessment, Exida evaluated modules for communication via Ethernet and J1939, as well as modules for the safe separation of software on different microprocessor cores.

As a result, ECU developers can receive all relevant modules of Vector's Autosar basic software with Asil D for their safety-relevant projects.

Vector also offers a safety-relevant option for high-performance ECUs based on Autosar Adaptive to Asil D. An independent certificate is planned for year end.



Dynisma DMG motion generator

Dynisma helps meet Euro adas regulations

Motion simulator company Dynisma says it will play a crucial role in helping small series automotive OEMs meet upcoming adas legislation.

From 2025, European small series type approval regulations require, by law, specialist vehicle manufacturers, such as lower volume sports and supercar makers, to equip vehicles with adas technology, such as lane-keep assist (LKA) and autonomous emergency braking (AEB).

Engineering adas features can be a time consuming and expensive process, but driver-in-the-loop simulators can accelerate development rapidly, allowing safe and repeatable virtual testing in multiple road conditions, cutting costs by reducing the number of physical prototypes required.

However, effectiveness is determined by how closely the simulator can correlate to a real vehicle, which is where the Dynisma DMG motion generator comes in.

The DMG has a latency below 4ms, as demanded by F1, eliminating motion sickness and allowing for realistic, prolonged occupant testing. Many other commercially available simulators have latencies between 15 and 40ms, and require even experienced test drivers to take regular breaks.

It can be used to develop systems such as LKA, lane departure warning and emergency lane keeping adas technology, and, with realistic braking performance, AEB too.

Coupled with Dynisma's engineers, DMGs can help all car makers, not just small manufacturers, get the most out of simulator technology and develop every part of their adas armoury.

Some models also offer infinite yaw for simulating low speed driving on roundabouts, with no mis-cues.

Driver handover and interaction is another element for autonomous vehicles beyond SAE level two; driving simulators can assess this safely and reliably. DMGs can also be applied to other dangerous test scenarios, such as a tyre blowout or fault while in autonomous mode.

It is possible to test driver monitoring systems accurately and gather data faster and safer than would be possible on test tracks or public roads.

As adas evolves towards SAE levels two and three, where features such as adaptive cruise control and LKA take greater control, passenger comfort also becomes a priority. Car makers have to balance responsive and safe control systems with maintaining passenger comfort, in terms of the accelerations felt by the occupants as well as their perceived safety.

Motion simulators can thus offer passenger-in-the-loop testing.

It can also help with vehicle dynamics and aerodynamics, propulsion systems, noise vibration and harshness, control systems and HMIs, user experience, and ergonomics.

"Developing adas technology cost-effectively and rapidly is vital for all OEMs, particularly for lower volume car makers, who need to comply with upcoming legislation, yet may not have the same resources as the largest OEMs," said Ash Warne, Dynisma CEO.

Vehicle Electronics August 2024, 14

The focus at this year's Aesin conference was collaboration; Steve Rogerson reports

WORKING TOGETHER



Will Drury: “No one company can do it all.”

Collaboration was the theme of July’s Aesin conference in the UK as contributors from industry to academia looked at how to tackle problems from simulation to software-defined vehicles and power electronics.

Aesin, established in 2012, is a member-based organisation set up in response to the explosion in car electronics and software.

“Collaboration is in our mission,” said Will Drury, CEO of energy research body PNDC, part of the University of Strathclyde. “If you want to work smarter, you have to do that in collaboration with each other.”

He said this was important in response to global megatrends such as fighting climate change, energy transition, rapid urbanisation and an ageing population.

“These all affect the automotive industry,” said Drury. “We work with those who want to work with us and share a common goal. No one company can do it all. This is about partnerships, this is about collaboration. Collaboration makes us more innovative, it brings wider cognitive diversity.”

SDVs

However, according to Peter Virk, executive director at Lotus, the



Peter Virk: “Where are all the software developers?”



Steve Waldron: “Software engineers do exist.”

automotive industry is facing a skills shortage that is doubling every five years. This, he said, put even more pressure on the industry to work together and collaborate.

This, he said, was a key difficulty when it came to software-defined vehicles (SDVs).

“Everyone is talking about SDVs, but where are all the software developers?” Virk said. But Steve Waldron, product line manager at Vector, said: “Software engineers do exist and are keen to deliver the features to the customer.”

This, said Julian Day, senior field applications engineer at Green Hills Software, was important because it was the software that enabled differentiation and different features.

“For an SDV, the software defines the value of the vehicle,” said Day. “It will generate revenue over the lifetime of the car.”

However, it can also provide a negative experience for the user.

“Building safe software in the first place is crucial,” said Day. “And if you understand your software properly, it helps you to make changes.”

Paul Darnell, technical director at 3SK, said he disliked the term SDV because it “constrained our thinking” whereas what engineers should be looking at was the customer experience.

“Software is part of that, but only a part,” he said. “We should be improving the customer experience and creating revenue streams. This will be enabled by software-intensive systems, but not all the software will be on the vehicle.”

So, he said, rather than talking about SDVs, people should be looking at software-enabled experiences, and that meant including car charging services, restaurants and so on.

He also said there was a danger of creating a negative experience and pointed out that the number of software-related recalls was increasing.

“That is customers having negative experiences,” he said. “We need to rectify that. We have to tread carefully with SDVs to make sure we don’t create a disaster.”

Simulation

Some examples of collaboration were given from the simulation world, one being the Certus project set up last year in the UK to provide a toolset that can identify and define the test requirements for automated driving systems; it has received £1.5m in grant funding. Leading the project is Horiba Mira and its senior engineer Alejandro Trueba said: “We have to decide what to test and how much simulation we use. We start from the customer features.”

Matt Daley, technical director at RFPro, focussed on the



Alejandro Trueba: “We start from the customer features.”

Sim4CamSens project, a UK government-funded initiative to quantify and simulate camera, radar and lidar sensor performance under varying conditions.

“Our goal is to reduce the reliance on real-world testing,” he said. “Simulation is essential but



Julian Day: “Software defines value of vehicles.”



Paul Darnell: “Not all software is on vehicles.”



Matt Daley: "Driving around until you find something interesting is just too slow."

there is a massive task involved to show simulation can be done for automated vehicles. We have to prove that to the industry."

This involves quantifying and simulating how the vehicle perceives the world.

"The biggest challenge is perception," he said. "We have pulled together a collaboration of companies covering systems engineering, modelling, simulation, and sensor development, measurement and characterisation. We are actively trying to get other players in the sensor market to come in with us as well. Simulation is the way to build confidence in these systems. Driving around until you find something interesting is just too slow."

Also, the researchers are trying to find safety-critical situations that could kill somebody.

"We don't want to do that in reality," Daley said. "We have to do that in simulation."

He said they had built up a "wonderful array" of data in all different weather conditions, but said the goal was not to eliminate physical testing but to get the highest value from it.

"Simulation lets us do that," he said.

Tim Edwards, senior research manager at Jaguar Land Rover, said it was a "hugely complex task" to deal with a vehicle's interaction with the rest of the world.

"There is a huge explosion in variables," he said, but he warned that while simulation-based testing was needed, it wasn't free.

"You still need to use it effectively," he said. "We are trying to assess the safety and the functionality of the vehicles we are putting on the market."

Power

The transition to electric vehicles has brought wide bandgap semiconductors to the fore in automotive electronics design with silicon carbide (SiC) and gallium nitride (GaN) being key technologies.

"SiC is widely deployed in inverter designs but GaN is taking over," said Andrew Patterson, business director at Silvaco. "People are now looking at gallium oxide and diamond."

This was important, he said, because every watt of energy that could be saved meant a car would go a little bit further.

"Younger people are less interested in the power of cars," he said. "They just want to get from A to B and they are interested in reducing emissions. How can we avoid destroying the planet?"



Tim Edwards: "There is a huge explosion in variables."



Simon Stacey: "GaN will make an impact in automotive."

Simon Stacey, COO at Cambridge GaN Devices, unsurprisingly agreed with Patterson's predictions on GaN.

"GaN will make an impact in automotive," he said. "It enables higher efficiencies and power densities, and has a lower carbon footprint than silicon and even SiC. SiC is the incumbent material today."

However, he admitted that GaN had a more complex design and there were questions about its robustness.

But if the move to electric vehicles is to succeed then many feel it has to have more to offer than a lower carbon footprint, however important that may be. Many want the look and feel of a premium vehicle.

This is something McLaren Applied is taking on board. The company was initially set up to take technologies developed for Formula One and move them into other industries.

Paolo Bargiacchi, head of automotive engineering at McLaren Applied, said: "Premium vehicles have always been an extension of people's lifestyle. We still think the powertrain can be part of differentiation today and can be an opportunity for innovation."

He talked about two collaborative projects that McLaren Applied is working on with Microchip and others. One is Escape for building a secure end-to-end supply chain for automotive power electronics from the epi-layer right up to tier-one manufacturers. The other is Scienze, a project to establish a supply chain capable of manufacturing power electronic components at higher volumes than the current capability.

"We are at a critical stage in the electric revolution," said Bargiacchi, "with the upcoming focus on product differentiation. Examples include noise, vibration, harshness and drivability. These can be achieved by honing various powertrain attributes."



Andrew Patterson: "How can we avoid destroying the planet?"

Conclusion

Working together has become a must for almost all parts of the automotive industry as technologies become too complex for one company to do it alone. Skills from different disciplines are needed to create a superior and sustainable whole.

Collaboration is necessary not just in SDVs, simulation and power electronics but everywhere. It is time to make friends.



Paolo Bargiacchi: "We are at a critical stage."

V2X

BREAKING barriers

Ross Turnbull explores how automotive OEMs can continue improving safety by supporting the V2X transition

What if drivers knew there was danger before they could see it? Vehicle-to-everything (V2X) technology, which lets cars communicate with a wide variety of surrounding objects, promises to deliver just that. But what is holding back V2X adoption, and what can automotive OEMs do to stay competitive in the meantime?

As connected systems show huge promise for convenience and efficiency – both in the workplace and at home – there has been some questions around adoption of a fully-connected approach in the automotive sector.

V2X describes a system where the vehicle is connected to virtually any entity that may affect or be affected by the car, including other vehicles, local infrastructure, pedestrians and cyclists.

The benefits of V2X technology are clear. V2X-enabled vehicles could alert their drivers to unseen hazards, such as the sudden braking of a car several vehicles ahead. Information about road conditions, such as upcoming bends or roadworks, can also be provided. And connectivity with road infrastructure means public transport and emergency services can be prioritised by traffic light systems.

In fact, European car safety assessor Euro NCap has already amended its car safety rating system to include V2X-based technologies, as the assessor recognises the positive impact V2X could have for safety.

Barriers

Despite the potential promised by V2X, it is unlikely to be seen on a mass scale anytime soon. A lack of standardisation in communication protocols across the market has proven to be a huge barrier to adoption so far.

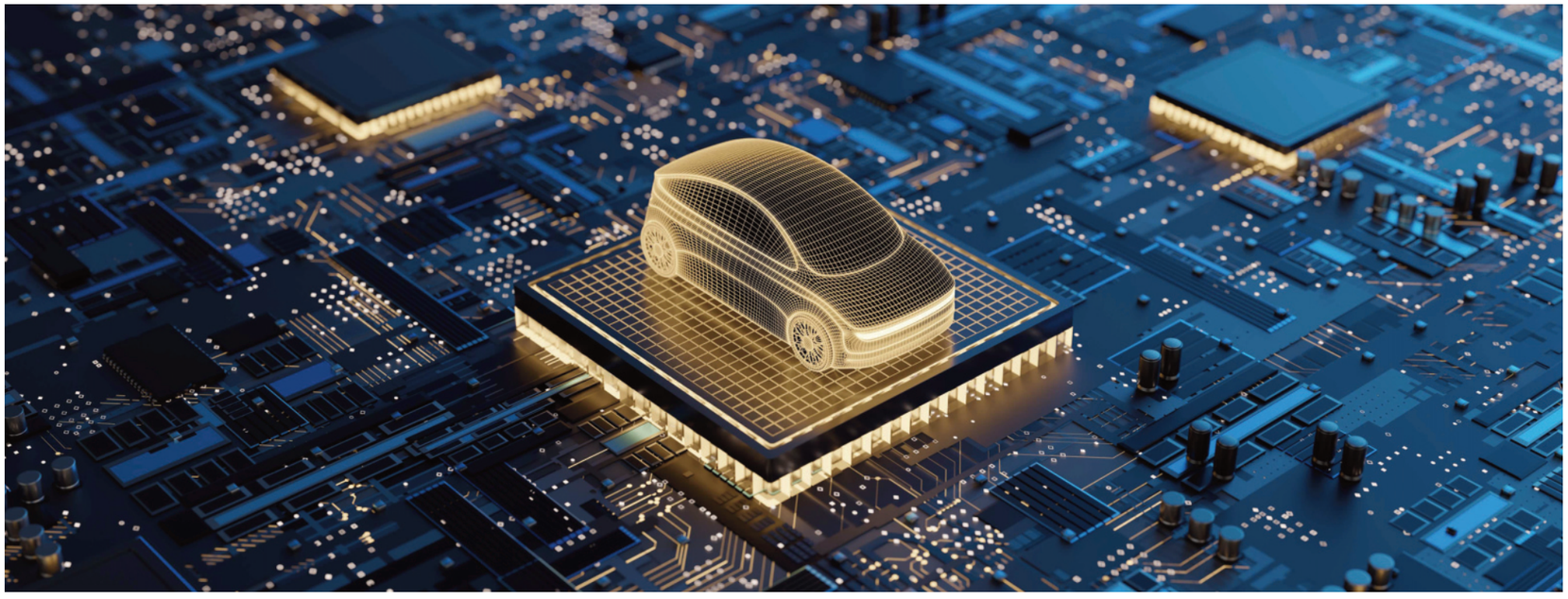
At present, there are two main options for V2X communications. The first is dedicated short-range communications, or DRSC, which works similarly to wifi. The other option is cellular V2X (C-V2X), which operates on the 4G and 5G cellular networks. Aaround half the global market is using DRSC, while the rest use C-V2X.

While the pace of 5G development means it is likely C-V2X uptake will outweigh DSRC, it is not completely set in stone. In the meantime, some hybrid systems encompassing both wifi and cellular connectivity have been made available.

However, it is unlikely a hybrid approach will prove optimal in the long term.

Another issue is the sheer scale of the project. Building sensors into every traffic light, vehicle or crossing will require huge commitment from both local infrastructure providers and automotive OEMs. Though it is not entirely necessary for everything to be connected, the effectiveness of V2X is diminished somewhat by fewer connections.

So, where should manufacturers focus their efforts? It is clear that in Europe at least, the implementation of V2X technologies will be a requirement for cars aiming for a five-star safety rating. But continuing to develop the car's own sensor system, and not just the wider network, must also remain a priority. A car with smarter



onboard sensors can offer safety improvements right away, without the wait for surrounding devices to be brought online.

Capabilities

Many new car models now feature a wide variety of sensor types. Optical sensors may be used to identify lane markings, read traffic signs and categorise objects in the environment. Radio wave and laser-based technologies may also be used to provide more accurate positional information on the car and its surroundings.

Regardless of the sensor type, there is likely to be at least one integrated circuit (IC) within each. These ICs are primarily responsible for converting and processing the sensor data into meaningful electrical signals. The signals are then sent to the car's central electronic unit for further action.

As part of the interface between the sensor and driver, these ICs play a crucial role in the car's safety system. Without them, there is no useful information for the car to interpret. It is clear, then, that any problems with the IC will have knock-on effects.

Poor signal quality or strength could lead to inaccuracies in important safety features, potentially putting the car's occupants and other road users at risk. For automotive OEMs looking to build a more accurate or sophisticated sensor system, the IC is an ideal place to start.

Optimised

Commonly, these ICs are commercial off-the-shelf (cots) parts. While it is possible to find cots ICs designed for the automotive markets, the standardised nature of their design means they are unlikely to be better.

Instead, an asic can be used. An asic is a bespoke chip, where its design has been customised specifically to fit the needs of the application.

Thanks to its custom design, an asic offers a multitude of benefits over standard commercially available alternatives.

Circuitry tailored to the specific sensor type and sensitivity allows for better quality signals and a higher IC performance. Since the asic design will optimise for the most important functions, unnecessary components can be removed for a more compact size, ideal for implementation in space-limited areas.

And improvements in low power consumption electronics mean asics will often require a lot less power, useful for battery-powered sensors that are disconnected from the car's main electronics.

Once the asic design project has been completed, the user can retain full ownership of their IP. Retained ownership helps prevent designs from reaching the hands of the competition, keeping the market advantage in the user's product.

Conclusion

While V2X offers promising benefits, full-scale adoption seems further away than initially thought. But in the meantime, automotive OEMs should continue to seek ways to enhance their own vehicles' technology.

Fortunately, with the opportunity to develop custom ICs, there are viable options available for OEMs looking to differentiate themselves from their competition, securing the market advantage and the approval of safety-conscious consumers.

Ross Turnbull is director of product engineering at Swindon Silicon Systems



WORLD BATTERY INDUSTRY EXPO
世界电池产业博览会

WBE 2024 World Battery & Energy Storage Industry Expo

China's Biggest Trade Show for Battery and Energy Storage!



TEL:
+8618926213025

Visiting for free:
http://en.battery-expo.com

WBE is currently looking for reliable partners to represent our show in the worldwide markets!



From wheels to wings

Hans Wegendal discusses the difficulties of developing connectors for everything from electric bikes to planes

E-mobility is thriving in a new age of clean power. The concept is not limited to opulent cars of the super-rich. Instead, we now see scooters, bikes, planes and boats all powered by electricity.

In the past decade, EVs have gone from being the reserve of luxury sports cars to mainstream passenger cars. More recently, there has been an increase in single passenger EVs such as scooters or bikes in cities, with some companies even creating schemes to encourage the use of single passenger EVs due to their efficiency and accessibility.

According to transport charity Collaborative Mobility, there were around 34 million total rides on e-scooters in the UK from 2020 to the end of January 2023.

Scooters aren't the only thing being electrified. According to the International Air Transport Association, smaller electric aircraft of up to nine seats are already flying, electric aircraft up to 19 seats are planned for this decade and regional aircraft as soon as the 2030s.

Capable

This influx of new types of EVs comes with its own set of difficulties. Some of these vehicles may require connectors that are lightweight, corrosion resistant, electromagnetically shielded, use certain platings, be made from certain materials, or meet different industry standards.

Each end-product is different. An e-plane requires a higher power connecter compared with an e-bike; a connector used on a boat will need to have a high ingress protection rating.

Manufacturers must consider their application needs across their product ranges and choose the right connector to match.

Connectors are available designed for harsh environments across industries including aviation, military and energy. Many are assembled to order and can meet the burgeoning demand for e-mobility connectors.

As the e-mobility market continues to expand, it is vital that EV manufacturers of all kinds carefully consider their connector requirements, from the everyday to the extreme. In doing so, they can ensure that e-mobility thrives in the age of clean power.



Hans Wegendal is regional sales manager at PEI-Genesis

ARTIFICIAL INTELLIGENCE

TRANSFORMING LOGISTICS

Jonah McIntire looks at how shippers and carriers are implementing AI

Shippers, carriers and logistics service providers (LSPs) alike have been slowly adopting AI for almost a decade. So, in a sense, AI is nothing new. What is new, however, is the meteoric rise of generative AI.

The buzz around this reached a fever pitch in 2023, and this year we've seen shippers, carriers and LSPs transition from the thrill of its potential to the pragmatism of implementation. This requires a robust AI strategy with guardrails around data bias, transparency, compliance, ethics and more.

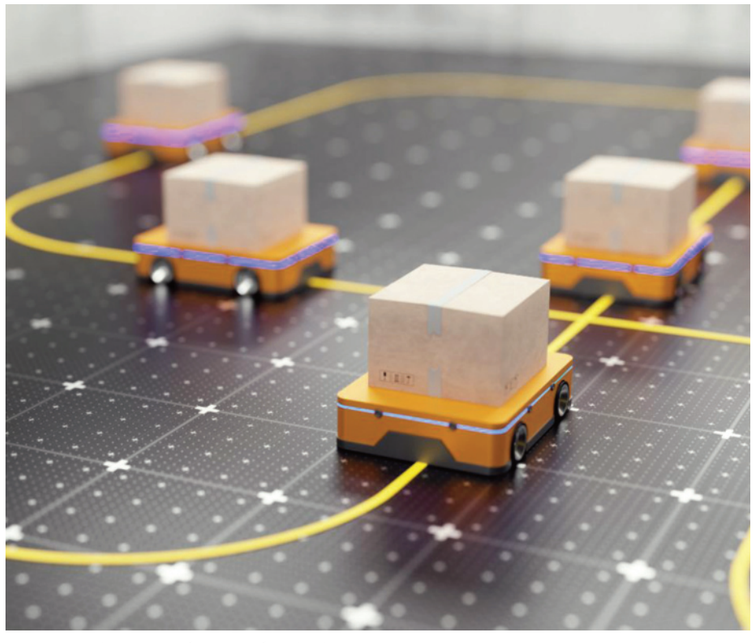
Value

AI's impact on logistics and transportation won't be a sudden revolution but a steady evolution. As a starting point, it can help to think of AI as additional talent. A good way to map out potential implementations is to identify which teams are being held back because of a lack of knowledge or high labour costs and use AI to help solve this problem.

So far, AI implementations in the logistics industry have focused on process automation and data-driven prediction. These generally don't involve newer generative AI models, but symbolic AI (which focuses on explicit knowledge representation and logical reasoning) and statistical AI, which uses data patterns and probabilities to learn and make predictions.

Classic procurement tools, many of which predate the current generative AI boom, are a great example. In particular, spot buying is an excellent AI use case. Why? First, it involves set budgets and carrier and lead time requirements, so the algorithm has explicit constraints within which to work. Secondly, negotiations follow a simple structure – participants can make an offer, wait for a response, make a counteroffer, accept an offer, or end a negotiation. AI can also help LSPs on the other side of spot procurement, allowing them to offer automatically instant, accurate quotes based on predicted market rates. This automation means they can quote for – and win – more opportunities.

Another AI use case is real-time ETA prediction. A decade ago, accurately predicting arrival times for loads seemed impossible, as strikes, traffic jams and adverse weather appeared utterly random to the human eye. However, today, AI models can uncover hidden patterns by analysing years of data. This enables shippers and carriers to predict ETAs accurately, ensuring they're always prepared to receive loads.



AI promises to change logistics

Interface

So, where does generative AI fit into this picture? Though it will undoubtedly unlock efficiencies and new capabilities across the logistics value chain, many changes will only be obvious within organisations. The transformation of logistics software user interfaces (UIs) is an obvious exception.

Most software currently uses a graphical user experience. Users engage by moving their mouse to an object, clicking it, and keying in data or re-clicking.

This means users must train themselves on each platform's symbolism, such as having navigation at the top versus on the side, and terminology where one platform might say 'orders' and another 'shipments'. People forget this form of interaction is unnatural because everyone grew up doing it.

However, it often creates friction between intention and action from users, who must constantly micro-plan how to get what they want from systems.

Generative AI promises to change this by working in natural language with zero friction. Currently, most generative AI models use text boxes, but there's no reason for progress to stop there. Humans talk faster than they write, so voice input could be a natural evolution, creating a perpetually available assistant who can do any action within a specific platform. This would unlock myriad possibilities. For instance, a freight forwarder might verbally describe a complex shipment scenario and have the software generate the necessary forms.



Shippers are adopting AI

What's next?

One thing is certain – AI is poised to drive a new era of intelligent transportation. However, shippers, carriers and LSPs can implement this technology in multiple ways. Some firms are choosing to invest in building their own AI tools in-house, which is demanding from a resource perspective.

On the other hand, many shippers, carriers and LSPs are opting to implement the best generative AI software from external providers. This strategy relies on the expertise of specialised firms and offers a faster time to implementation.

It's also worth noting that external providers (neutral third parties) typically work with multiple industry players. This collaborative platform approach means they can access a broader pool of data to train AI models, accelerating progress towards improving the industry's safety, efficiency and service levels.

Whichever approach companies take, the time is now to embrace AI strategically in a rapidly changing landscape.



Jonah McIntire is chief platform officer at Trimble subsidiary Transporeon

POWER TECHNOLOGIES

STABILITY IN EXTREMES

Victor Khasiev describes how to maintain bias voltages in electrical systems over source voltages from 5 to 140V



Image by Pexels from Pixabay

Modern automotive and industrial systems require a stable voltage source even as the system input voltage sweeps from one extreme to another. In automotive systems, significant rail voltage variations can result from cold cranking start-up, cylinder deactivation and activation in dynamic fuel management systems, or significant engine load changes.

Likewise, in industrial applications, line brownouts are a problem, and the switching on of motors in power equipment can lead to serious drops of input voltage.

Even when power conversion systems cannot provide full power to the loads at low voltage inputs, many of these systems must remain operational, regardless of the input voltage level. For example, widely used high voltage boost and buck converters employ high-voltage mosfets with a standard gate level.

At input dropout, the bias voltage should stay above 10V to keep the gate drivers operational. Critical digital control and information systems should be biased and functional regardless of the input conditions as well.

Circuit

If the input voltage is not expected to fall below the desirable bias level and the goal of the design is to have an external bias power supply to reduce the power dissipation of the switching controllers, then a straightforward buck converter can be employed.

This approach, illustrated in Fig. 1, is centred around a high-

Vehicle Electronics August 2024, 30

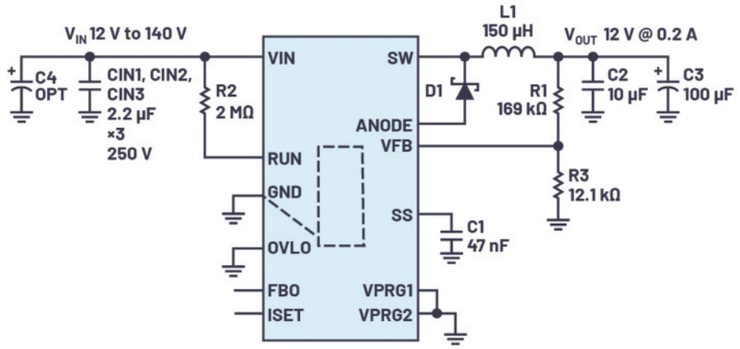


Fig. 1: High-voltage buck-based bias circuit electrical schematic where V_{IN} is 12.5 to 140V and V_{OUT} is 12V at 0.2A

voltage buck-controller with internal switching transistors. The powertrain also includes inductor L1, diode D1 and output capacitors C2 and C3. To reduce the profile to below 3mm, only ceramic capacitors were used in the input. An optional polarised capacitor can be used as well, but it considerably increases the height of the bias power supply.

This circuit was verified and tested, with the waveforms illustrating the functionality of the circuit presented in Fig. 2. The initial input voltage level of 100V

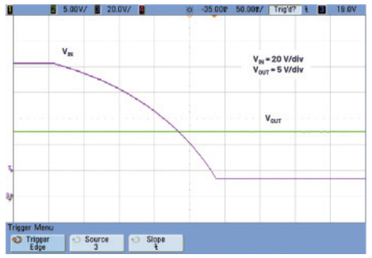


Fig. 2: High-voltage buck-based bias circuit waveforms where V_{IN} is 20V/div, V_{OUT} is 5V/div, and the time scale is 50ms/div

drops to 12V, but the output provides 0.2A of the stable 12V voltage to the load.

The performance outlook of this design significantly changes if the input voltage drops below the desired bias level. In this case, using just the buck converter is not enough, because the output voltage follows the input when it falls below the desired output.

Fig. 3 illustrates a solution to this problem using a dual-stage bias power supply.

The first, main stage is a high-voltage step-down converter similar to what is shown in Fig. 1. It is output connected to a boost converter and based on a converter IC with integrated power transistor.

The powertrain includes inductor L2, diode D2 and an output filter. The voltage stress on the components in the boost converter circuit is much lower than the buck front end, which permits selection of relatively inexpensive parts and reduces the overall cost.

The output of the buck converter in this circuit is set to 12.5V. However, the output of the boost converter is set to a lower voltage of 10.5V, enough for the load to

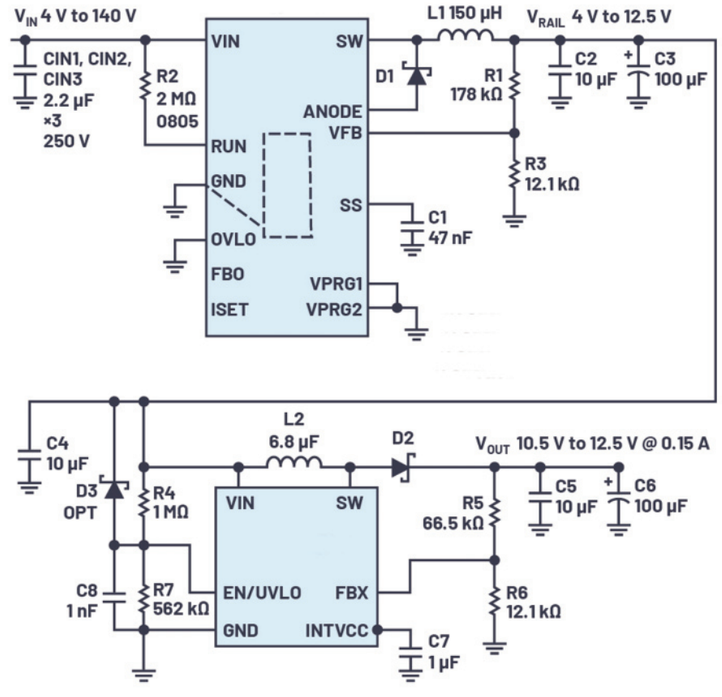


Fig. 3: High-voltage dual stage-based circuit electrical schematic where V_{IN} is 5 to 140V and the V_{OUT} is 10.5V at 0.1 to 0.15A

function properly. The converters are never operational at the same time. If one is switching, the second is not.

In normal operating conditions (V_{IN} >12.5V), when the input voltage changes from 12.5 to 100V, only the buck converter is active, providing 12.5V to the load.

The current flows to the load terminal V_{OUT} through the inductor and diode of the boost converter. Due to relatively low current levels, the losses in this current path are minimal.

As long as V_{IN} >12.5V, the voltage on the output of the boost converter is 12.5V and far exceeds the pre-set value of 10.5V, so there is no switching action in the boost section and only the buck is active.

As the input voltage reduces to 12.5V or below, the buck converter stops switching, but it keeps the internal p-channel mosfet in the on state, allowing 100% duty cycle operation.

If the input voltage falls below 12.5V, then both voltages, V_{RAIL} (intermediate rail) and V_{OUT}, fall to the V_{IN} level. In the 10.5V <V_{RAIL} <12.5V range of the intermediate rail, both the converter's buck and boost do not switch.

If the input voltage continues to fall and the V_{RAIL} level drops below 10.5V, the boost converter becomes operational, keeping V_{OUT} at 10.5V.

The waveforms illustrating the functionality of this converter are presented in Fig. 4. The minimum input voltage of 5.5V at the load current is 0.15A. Reducing the load to 0.1A corresponds to a minimum input voltage of 5.0V,

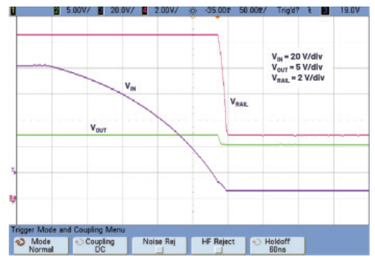


Fig. 4: High-voltage dual stage-based bias circuit waveforms; the load current is 0.15A and the time scale is 50ms/div

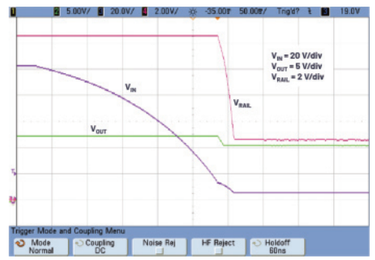


Fig. 5: High-voltage dual stage-based bias circuit waveforms; the load current is 0.1A and the time scale is 50ms/div



Fig. 6: Input voltage rises waveforms; the load current is 0.1A and the time scale is 50ms/div

as shown in Fig. 5. The rise of the input voltage from 5 to 100V is illustrated in Fig. 6.

Considerations

The maximum input voltage and load currents define the minimum operating input voltage of the boost and correspondingly the minimum input voltage of the entire power supply.

$$D = \frac{V_O - V_{IN}}{V_O}$$ Boost converter duty cycle (1)

$$I_{IN} = \frac{I_O}{(1-D)\times\eta}$$ Boost converter input current (2)

Assuming V_O, I_{MAX} and I_O as given, then the boost minimum voltage can be described as

$$VIN_{MIN} = \frac{I_O \times V_O}{I_{MAX} \times \eta}$$ (3)

However, if V_O, V_{INMIN}, and I_{MAX} are given, the maximum output current I_O is

$$I_O = \frac{I_{MAX} \times VIN_{MIN} \times \eta}{V_O}$$ (4)

Conclusion

It is important to keep major power systems operational over a wide input voltage range.

This article discusses ways to reach this goal.

The circuits presented here generate the stable bias level at input voltages up to 140V and down to 5V during the input voltage droops.

A secure bias level guarantees normal functionality of high-voltage mosfets and control blocks.

The proposed schemes using highly integrated converters reduce component count and overall cost. Adjustments can be made to reduce height if required by the application.



Victor Khasiev is senior applications engineer at Analog Devices

FOCUS ON INDIA

REACH FOR THE SKY

Sockalingam Muthiah shows how India is navigating its automotive future with connectivity and location intelligence



Vehicle Electronics



India's automotive landscape is changing rapidly

India's automotive industry is marked by significant shifts driven by technology and evolving consumer preferences. Just a few months ago, it was revealed that India held on to the world's third largest auto market ahead of Japan for the second consecutive year.

The growing automotive market, along with the rise in population in India presents an opportunity to leverage connectivity and location intelligence to redefine mobility and enhance the driving experience across the country.

Connected vehicles are gaining traction in India. Major players within the Indian automotive market are collaborating with technology firms to create innovations designed for India.

According to India's Automotive Component Manufacturers Association (ACMA), almost 90% of new passenger vehicles will have connectivity capabilities and by 2030, 15% of these connected cars will be autonomous. In India, it's expected that over 60% of vehicles rolling off Indian assembly lines will be connected by 2030.

This trend towards connected mobility is not unique to India; it's a global shift that is reshaping the automotive landscape across vehicle classes. However, connectivity remains a hurdle in diverse terrains such as India, where network coverage can be unreliable. Infrastructure gaps and legacy systems pose barriers to deploying advanced technologies.

Bridging these divides demands concerted efforts from stakeholders, underscoring the multifaceted nature of India's automotive industry.

Infrastructure

The rapid rise of electric mobility is also contributing to the changing Indian automotive landscape, aligning with ambitious sustainability goals. As part of India's decarbonisation target for 2030, the country's EV30@30 campaign has a goal of ensuring that electric vehicles (EVs) account for at least 30% of new vehicle sales by 2030. This approach holds tremendous promise for reducing emissions and mitigating the environmental impact of transportation.

At the same time, safety is paramount in the automotive industry, driven by both regulatory demands and consumer expectations.

The Ministry of Road Transport & Highways (MoRTH) is looking to make certain adas features mandatory. Multiple car makers such as Honda, Hyundai, MG, Tata Motors and Mahindra have also added adas to their premium offerings.

This move is a commitment by the Indian government and automakers to enhance road safety.

From EV infrastructure planning to enhancing user experiences through smart, safe navigation and autonomous driving, location intelligence serves as the cornerstone of these automotive advancements.

For instance, the success of EVs hinges on robust infrastructure planning, particularly the optimal placement of charging stations. This is where location intelligence plays a crucial role to facilitate the development of convenient and accessible charging networks nationwide. Location intelligence also helps improve road safety efforts by providing real-time data insights that inform decision-making and optimise driving experiences.

At the end of the day, location intelligence is not just about making driving more convenient and safe; it's about building ecosystems where vehicles are intelligent, connected and responsive to user needs.

SDVs

The concept of software-defined vehicles (SDVs) further represents a paradigm shift. At the heart of SDVs lies the decoupling of hardware and software, reminiscent of the smartphone evolution.

This separation enables automakers to deliver new features and functionalities over the air, long after the vehicle has left the showroom floor. The vehicle's lifecycle transcends static hardware, evolving into a continuous engagement through software updates and personalised features.

SDVs are an opportunity for innovative business models, presenting myriad revenue streams where software becomes the core differentiation point for automakers. Beyond traditional vehicle sales, services such as subscription-based feature enhancements and data-driven insights into driver behaviour emerge as lucrative avenues.

As the automotive industry gravitates towards automation, SDVs will become a critical enabler. Vehicles equipped with intelligent software pave the way for autonomous driving functionalities. The integration of location technology spans the spectrum, from precise high-definition (HD) mapping for autonomous navigation to scenario-based simulation for robust testing.

This convergence of technologies and mobility will steer India towards a future where self-driving capabilities are not just a distant dream but an imminent reality.

Progress

As India's automotive industry evolves, it is expecting a future where vehicles are not just means of transportation but dynamic platforms for connectivity, safety and sustainability. For this to happen, collaborative innovation and concerted effort are needed across industries.

There are already partnerships with automotive giants such as BMW and Mercedes-Benz, where location-powered innovations are bringing tangible benefits, from immersive digital cockpits to automated driving.

Ultimately, the automotive landscape of tomorrow is not shaped by isolated advancements but by strong partnerships between automakers, technology giants, and location intelligence providers.

The potential for innovation is boundless, with location intelligence serving as the bedrock to usher in an era of smarter, safer and more enjoyable journeys on the road ahead.



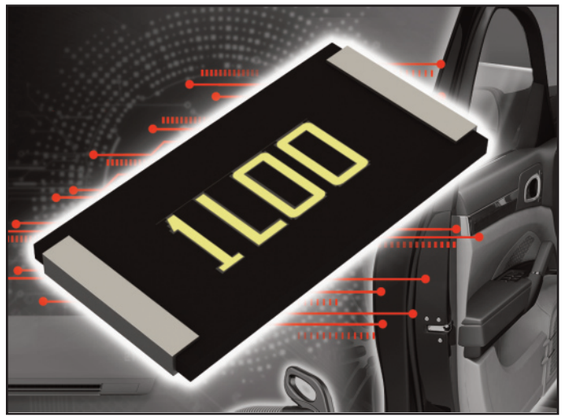
Sockalingam Muthiah is vice president at Here Technologies

Rated power 5W for shunt resistors

Three shunt resistors from Rohm have a rated power of 5W in resistance values of 0.5, 1.0 and 1.5mΩ.

The PMR100 standard type metal plate shunt resistors come in a 6.4 by 3.2mm package for motor control and power circuits in automotive, consumer and industrial applications.

To achieve power savings, precise circuit control using high accuracy high reliability shunt resistors is necessary.



These products achieve a rated power of 5W by using materials with good temperature characteristics and terminal temperature derating. This represents the best-in-class for 6432-size flat chip types with protective film.

Achieving about 2.5 times higher rated power than conventional PMR100 2W products and around 1.7 times higher than 3W models makes it possible to replace larger high-power types, contributing to greater miniaturisation.

Rated terminal temperature is +130°C for 0.5 and 1mΩ products and operating range is from -65 to +175°C.

Temperature coefficient of resistance (TCR) is ±75ppm/°C.

Adopting a proprietary trimless structure suppresses the rise in product temperature caused by localised current concentration. This allows a wider distance between electrodes, improving the ease of pattern design even with resistances as low as 0.5mΩ.

They are universally compatible for current sensing in automotive uses such as EPS, electric compressors, oil and water pumps, door motors, and adas controllers.

Multilayer inductors operate up to +165°C

Taiyo Yuden has commercialised four multilayer metal power inductors that meet AEC-Q200.

The MCoil passive automotive components use proprietary metal materials and multilayer construction methods to achieve an upper operating temperature limit of +165°C, said to be a world's first.

These products are used as choke coils in DC-DC converters in automotive ECUs, battery management systems, safety systems such as ABS, adas and instrument clusters.

By extending the upper operating temperature from +150°C to +165°C, these products can contribute to the miniaturisation and performance enhancement of power supply circuits by enabling high-density mounting in high-temperature environments.

Mass production has started and samples are available.

Advancements in electronic controls, as typified by adas, has led to more power supply circuits on vehicles, which has led to growth in the demand for power inductors.

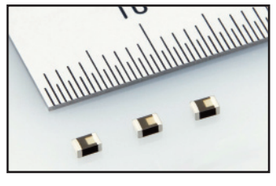
Furthermore, performance also continues to improve through functional integration, such as in integrated cockpits that combine instrument clusters and infotainment.

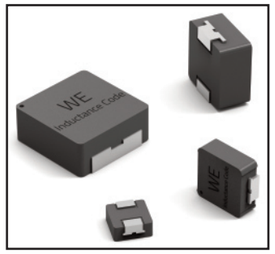
There is also a growing need to make on-board electronic components smaller to arrange devices in highly dense configurations and integrate them into single modules.

Components mounted at high densities become more susceptible to heat, as their reduced volumes makes it difficult for the heat generated by the components to dissipate. Furthermore, since ECUs are increasingly being installed in engine compartments, the components must be able to withstand high temperatures.

The MCoil LACN units have an operating range of -55 to +165°C and come in a 2.0 by 1.25 by 1.0mm package.

The four devices have nominal inductances of 0.24, 0.33, 0.47 and 1μH, with a tolerance of ±20%.





Inductors come in four sizes

A low-profile high-current automotive inductor from Würth Elektronik comes in four sizes with different inductance values.

The WE-LHCA flat and temperature-tough inductor is designed for an extended temperature range of -55 to +155°C and is constructed to avoid thermal degradation.

The AEC-Q200-certified inductor is for applications such as high-current power supplies, start-stop systems, power distribution modules, on-board chargers, infotainment or hvac systems.

The four sizes are 7030 (L=0.47-22μH), 1040 (1-68μH), 1365 (1-47μH) and 1770 (4.7-82μH).

These components have a low-profile shielded construction with a distributed air gap in iron alloy powder.

The high-current inductors are available from stock. The company provides developers with free samples.

Bluetooth SoC debuts at Electronica China

At July's Electronica in China, Goodix introduced an automotive-grade Bluetooth LE SoC.

The rapidly evolving Bluetooth technology is driving the adoption of emerging applications such as digital car keys, tyre pressure monitoring system (TPMS) and wireless battery management.

At the exhibition, Goodix introduced the GR5405, its automotive-grade Bluetooth LE SoC compliant with the AEC-Q100 grade-two standard.

Based on an Arm Cortex-M4F CPU core running at 64MHz, it integrates a 2.4GHz RF transceiver, Bluetooth LE 5.3 protocol stack, 512kbyte on-chip flash memory, 96kbyte system sram and peripherals.

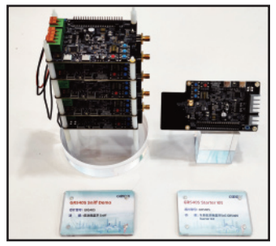
On RF performance, it has a maximum of +15dBm TX power, -99dBm RX sensitivity, and a maximum of 114dB link budget in Bluetooth LE 1Mbit/s mode.

With two main power supply schemes (DC-DC and SYS_LDO), it offers flexible options to achieve a balance between low power consumption and low BoM.

There are 24 multiplexed IO pins comprising nine GPIO pins with configurable pull-up and pull-down resistors, eight always-on IO pins, supporting wakeup from sleep mode, and seven mixed signal IO pins, configurable to be digital-analogue signal interfaces.

For digital key system applications, Goodix will soon launch a product series supporting the latest Bluetooth channel sounding standards.

This series focuses on higher integration and enhanced security, accelerating the development and market launch of customer products.



SoC improves battery performance

A system-on-chip, the result of a collaboration between Eatron Technologies and Syntiant, can improve battery performance and safety for light mobility uses.

The AI-BMS-on-chip can unlock 10% additional capacity and enhance battery lifespan by up to 25%, while reducing time to market, say the companies.



It combines Eatron's intelligent software layer with Syntiant's low-power neural decision processor.

Eatron's pre-trained models deliver accurate state-of-health, state-of-charge and remaining useful life assessments out of the box. Predictive diagnostics, meanwhile, can detect potential battery issues before they occur, enhancing safety.

By capitalising on the processing power of Syntiant's NDP120, the AI-BMS-on-chip can operate on the edge, where it can deliver real-time analysis and decision-making directly on the device without needing to rely on complex cloud infrastructure that would otherwise introduce cost, latency and power consumption issues.

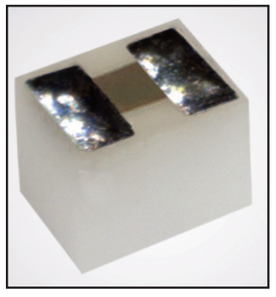
The jointly-developed plug-and-play offering could bring performance, safety and longevity enhancements to many battery-powered applications, from e-bikes to micro LCVs and forklifts.

Resistors maintain stability up to 70GHz

AEC-Q200 qualified thin-film chip resistors from Vishay provide high-frequency performance up to 70GHz for automotive, space, avionics, telecoms and military applications.

Offered in the 02016 case size, the Sfernice Cha series is available in resistance values from 10 to 500Ω.

The devices have a low internal reactance and exhibit behaviour close to a pure resistor over their large frequency range, with a nearly flat Z/R curve to 70GHz.



The microwave resistors maintain their high-frequency stability even after the most stressful AEC-Q200 tests – validated by their ΔR and Z/R measurements – guaranteeing performance under harsh environmental conditions.

The series is for automotive adas, lidar, connectivity and 4D radar systems; LEO satellites and space communication systems; military guidance and telemetry systems; drones; and RF antennas.

The devices provide limiting voltage of 30V, rated power of 30mW at +70°C, and a temperature coefficient of ±100ppm /°C, with ±50ppm/°C available on request.

To reduce development time and costs, the devices' S-parameter data are available for electronic simulation, in addition to 3D models for Ansys HFSS, Modelithics Microwave Global Models (PCB and pad-scalable), and design kits.

RoHS-compliant, halogen-free and Vishay Green, the resistors are offered in tape and reel packaging.

Samples and production quantities are available now, with lead times of 20 weeks.

Quad-channel high-side switches

Quad-channel, high-side switches from HMI have an integrated nmos power fet and charge pump.

The HL8545 and HL8545G have protective features, including load current limitation, open or short-load power limitation during overload, and over-temperature shutdown with configurable latch-off or auto-retry.

Their high-accuracy current sensing capabilities and full diagnostics enable intelligent load control.

The HL8545 requires an external ground diode for reverse battery conditions to prevent reverse current from ground to battery, while the HL8545G does not.

The devices have active drain and source voltage clamps, which help manage the energy in inductive loads such as relays, solenoids, pumps and motors during the switching-off cycle.

They are available in a 16-pin DFN package.





SiC diode

Nexperia's 650V, 10A silicon carbide (SiC) Schottky diode has been automotive qualified to PSC1065H-Q and comes in real-two-pin (R2P) DPak (TO-252-2) packaging for electric vehicles and other automobiles.

The firm is also offering industrial-grade devices with current ratings of 6, 16 and 20A in TO-220-2, TO-247-2 and D2Pak-2 packaging.

The merged pin Schottky structure has advantages over similar SiC diodes including robustness against surges.

This eliminates the need for additional protection circuitry, reducing complexity and helping hardware designers achieve higher efficiency with smaller form factors in rugged high-power use.

The SiC technology delivers a thinner substrate at one-third of its original thickness, which reduces the thermal resistance from the junction to the back-side metal. This results in lower operating temperature, higher reliability and device lifetime, higher surge current capability, and lower forward voltage drop.

Power switches use smart fuse protection

High-side power switches from ST Microelectronics use proprietary intelligent fuse protection and a serial peripheral interface (SPI) for diagnostic data, permitting enhanced resilience and functional safety.

The quad-channel VNF9Q20F is the first in a family of monolithically integrated devices that combine the firm's VIPower M0-9 mosfet and proprietary STi2Fuse technology.

Based on patented I^2t (current squared through time-to-fuse) functionality, the STi2Fuse responds within 100μs to turn off the mosfet if excessive current is detected.

Performing as an intelligent circuit breaker, it enhances voltage stability and prevents PCB traces, connectors and wire harnesses from overheating.

While guarding against damaging overloads, the automotive power switch also has a capacitive charging mode that allows harmless inrush currents and so permits normal operation with highly capacitive loads.

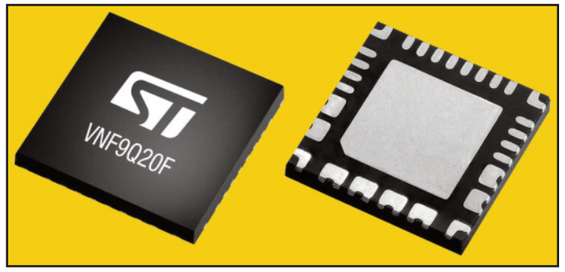
Ready for the latest zonal electrical and electronic architectures, it can also be used for fuse and relay replacement, ECU isolation, and managing systems that are active when the vehicle is parked.

With 64 programmable current-limit values, the STi2Fuse lets designers determine the overload response with precision.

Internal features include a 10bit ADC and fault registers allow diagnostic information and digital current sense feedback to support vehicle capabilities such as predictive maintenance.

By providing diagnostics through the SPI, and with built-in self-test, it helps systems meet specified safety integrity levels in ISO 26262. An embedded failsafe mode preserves operational status in the event of a failure or malfunction.

It is in production in a 6 by 6mm QFN package.



Mosfets gain robust lead-free packages

Infineon is expanding its portfolio of OptiMos 7 mosfets for automotive applications; the range of 40V products now includes devices in robust, lead-free packages.

In addition, 80 and 100V mosfets are available in the SSO8 package.

The mosfets are optimised for standard and future automotive 48V applications, including electric power steering, braking systems, power switches in new zone architectures, battery management, e-fuse boxes, DC-DC and BLDC drives in various 12 and 48V applications.

They are also suitable for other transportation applications such as light electric vehicles, e2-wheelers, e-scooters, e-motorcycles, and commercial and agricultural vehicles.

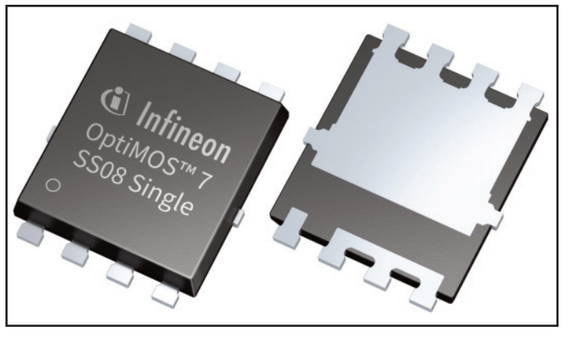
By combining 300mm thin-wafer technology and innovative packaging, the OptiMos 7 technology is said to enable performance advantages in all available voltage classes.

As a result, the components are available in a variety of rugged automotive power packages. These include single SSO8, dual SSO8, mTolg and sToll.

The family offers high power density and energy efficiency with an on-state resistance of 1.3mΩ maximum in a single SSO8 80V package in the smallest form factor.

The devices also have reduced switching losses, improved safe operating area (SOA) robustness and high avalanche current capability.

They are available in different automotive power packages in 40, 80 and 100V.



Vision processor suits adas and driver views

A vision processor from Indie Semiconductor was developed to address adas and driver viewing use cases, such as surround view systems and electronic mirrors.

The iND880xx system-on-chip (SoC) family sets benchmarks in image signal processing (ISP) performance and functionality for viewing and sensing applications.

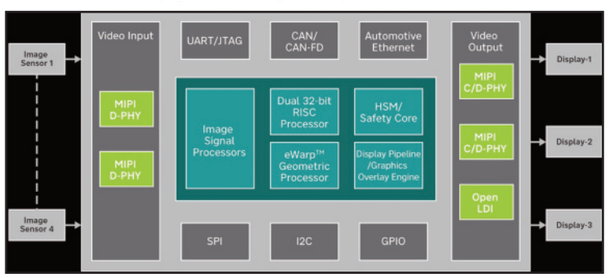
Balancing the competing needs of low light sensor performance (luminance) and the ability to differentiate colours (chrominance) for high-performance perception – for example, to differentiate red and amber traffic lights – has been an ongoing problem for legacy vision processors. High latency initialisation and pipeline processing has also limited legacy adas camera system real-time safety capabilities.

This family addresses these difficulties through a proprietary ISP pipeline that supports concurrent, low-latency processing of four independent sensor inputs, delivering a combined maximum throughput of 1400Mpixel/s.

Additionally, proprietary ISP features include a 24bit processing pipeline that enables high dynamic range processing up to 144dB, with dedicated support for a broad range of sensor colour filter arrays, including RGGB, RCCB, RYYCy and RGB-IR, facilitating high performance environmental perception even in low light.

Further, the ISP supports the eWarp proprietary high-performance geometric processing to dewarp image distortion from a wide field of view lens. These capabilities give automakers the scalability to deploy multiple instances of the SoC into various high-performance viewing and adas sensing use cases.

It is sampling with select users and will be in serial production next year.





PCB relay reduces heat for EV charging

A high-power PCB relay from Omron is for use in AC wallboxes for mode-three AC electric-vehicle charging stations.

The G9KC relay is said to provides the lowest contact resistance on the market and produces significantly less load terminal heat rise when in operation.

This opens opportunities for designers and manufacturers of EV chargers to create systems that can charge faster and more efficiently, with a higher reliability and expected lifetime.

The relay uses a mechanically coupled, double break contact for AC wallboxes and pedestal chargers for in home, workplace, commercial and industrial settings.

Its aim is to offer an improvement in energy efficiency while reducing heat dissipation. As a result, it contributes towards the overall reduction in operating temperature in a typical 22kW (maximum 32A/phase) wallbox.

This not only facilitates faster, more efficient charging, but also unlocks possibilities for wallbox designers to make them more compact and robust.

The relay's four-pole structure means a single device can replace larger multi-pole contactors and combinations of one and two pole, reducing the footprint required.

With a guaranteed initial contact resistance of less than 6mΩ, it has the potential to contribute less as a hotspot while improving charging efficiency and performance.

The lower operating temperature reduces the likelihood in the number of charge cycles reaching charging current throttling thresholds, while also contributing to improved reliability and longevity of the relays themselves, as well as surrounding components.

The relay can be mounted on a PCB to facilitate smaller and lighter designs.

Score of capacitors for EVs and adas

Twenty capacitors from Kyocera AVX are optimised for electric vehicles, adas and automated driving applications.

They are made using miniaturisation and high-capacity atomisation technologies developed for smartphones and materials proven to maintain high-reliability performance in automotive environments.

The Kam series of automotive MLCCs are available in a range of case sizes, capacitance values and voltage ratings for use in small, densely packed automotive circuits with fast processing speeds.

These surface-mount components are designed, manufactured and tested to ensure they meet the quality and reliability standards of automotive applications.

They are compliant with the AEC-Q200 stress test qualification for passive components, manufactured in IATF, QS9000 and VDA 6.4-approved facilities, and continuously tested in quality assurance laboratories including 100% visual inspection, increased sampling for accelerated wave soldering, and lot-by-lot reliability testing.

All are RoHS compliant and designed to be operated below the rated voltage.

The added components are available in 0201, 0402, 0603 and 0805 case sizes with thicknesses from 0.33 to 1.45mm, nickel-tin terminations, two dielectrics (X7R and X7T), four voltage ratings (4, 6.3, 10 and 16V), capacitance values from 0.1 to 22μF ±10%, and 17.8cm reels loaded with paper or embossed plastic tape.

Applications include ECUs, powertrains, central gateway communication nodes, cluster head-up displays, door control units, cameras, radar, lidar, memory, CPU and MPU decoupling, and other low-voltage safety systems with space constraints and high capacitance demands.

They are also suitable for use in high-reliability applications outside the automotive industry.

With this latest extension, the Kam MLCCs are available with nine case sizes, two termination styles, six dielectrics, 16 voltages from 4 to 3000V, capacitances from 0.5pF to 22μF, and eight capacitance tolerances spanning ±0.1pF ±20%.

As such, they are also for use in hybrid automotive battery control, inverter, converter, motor control and water pump applications, and on-engine applications.



Editor and Publisher:
Steve Rogerson
editor@vehicle-electronics.biz

Advertising Manager:
Diane Trotman
diane@vehicle-electronics.biz

Web Site Manager:
Martin Wilson
admin@vehicle-electronics.biz

Published by: Vehicle Electronics Magazine, 72 Westwood Road, Nottingham NG2 4FS, UK

Web site: vehicle-electronics.biz
Twitter: @velectronicsmag

© 2024 Vehicle Electronics
ISSN 2055-1177

Vehicle Electronics is available to readers worldwide. It will be published twelve times a year in a digital-only format. The magazine complies with GDPR. All rights reserved. No part of Vehicle Electronics may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying or recording on any information storage system, without the written consent of the publisher. The publisher cannot be held responsible for loss or damage to unsolicited press releases or photographs. Views of contributors and advertisers do not necessarily refelect the policy of Vehicle Electronics or those of the publisher.