VEHICLE electronics

The monthly magazine for automotive electronics engineers

Amazon will not save Argo AI

Hopes have faded that Amazon will come to the rescue of Argo AI, the now-defunct Ford and Volkswagen backed start-up producing self-driving technology.

According to reports, Amazon wanted to use the technology in delivery vehicles, but found it too expensive.

Argo AI was founded in 2017. Ford and VW each hold 39% of Argo, with ride-hail company Lyft owning two per cent and the rest held by Argo's founders and employees.

Ford said the large-scale profitable commercialisation of level-four adas would be further out than anticipated, but development and enthusiasm for L2+ and L3 adas meant it was going to focus on those areas.

Ford says it has decided to shift its capital spending from the L4 adas being developed by Argo to internally developed L2+ and L3 technology.

In 2017, when Ford invested in Argo AI and autonomous vehicles, the company anticipated being able to bring L4 adas to market by 2021.



Lyft uses Argo AI technology for robotaxi service

"But things have changed, and there's a huge opportunity right now for Ford to give time back to millions of customers while they're in their vehicles," said Ford CEO Jim Farley. "It's mission-critical for Ford to develop great and differentiated L2+ and L3 applications that at the same time make transportation even safer. We're optimistic about a future for L4 adas, but profitable, fully autonomous vehicles at scale are a long way off and we won't necessarily have to create that technology ourselves."

Argo AI has 2000 workers and a statement said some would be redeployed by Ford and VW.

A VW statement said: "Volkswagen is working with Argo AI to provide continued employment for employees and to develop the most promising projects in the field of autonomous driving."

VW is going to focus on its Cariad subsidiary, which will continue to develop automated driving for individual mobility in an alliance with Bosch.

Issue 108
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IN THIS ISSUE

2: AUO adopts ADI matrix LED drivers

3: Mazda chooses Rohm SiC modules

5: Autoliv and Geely safety partnership

7: Xilinx SoC allows automated parking

9: Stellantis acquires AIMotive start-up

12: AVL and R&S speed EMC testing

13: Electronica show report

18: Renesas about to move to SiC

21: Reducing power loss in SiC inverters

23: Can self-driving cars be trusted?

29: How resistors support e-mobility

33: Product news

38: Contact details

AUO adopts ADI matrix LED drivers

Taiwanese firm AUO will use Analog Devices' matrix LED display driver technology in its automotive widescreen displays.

This technology enables local dimming, reducing power consumption by at least half and supporting functional safety requirements.

To deliver a more immersive experience, vehicles are incorporating widescreen displays throughout the cabin. Increased automation and autonomy are pushing the requirements of these displays from a typical infotainment hub to a safety centre with visuals surrounding the vehicle.

Furthermore, the automotive industry is accelerating the transition to electric vehicles, where power consumption is increasingly important.

ADI has developed an approach called local dimming that drives LEDs behind the screen in the car display unit. Developed through a proprietary power process technology, the driver integrates all external switching positive channel fets, enables high resolution and high contrast ratio for large automotive displays, provides improved diagnostics of LEDs, and reduces ghost images.

The power portfolio is Asil B to D rated.

ADI aims to enhance the in-cabin experience by enabling energy-efficient widescreens capable of local dimming through proprietary power management and processing, as well as high resolution displays through its GMSL gigabit multimedia serial link serdes connectivity.

"AUO AmLED displays feature power savings, excellent sunlight readability and high contrast ratio, which greatly upgrade driving safety and in-cabin entertainment experience," said Simon Hsu, head of AUO's automotive business unit.

Close encounters of the snow kind



This is not an alien spacecraft but a Kässbohrer Pistenbully, an off-road vehicle using sim cards from Deutsche Telekom.

Kässbohrer all-terrain vehicles are for use in the most impassable, difficult and hard-to-reach areas of the world.

The transmission of telemetry data from the vehicles was the first argument for networking. In ski resorts, for example, snow groomers are on the road all winter. The number of groomers is designed for the size of the ski area. So if one groomer breaks down, part of the ski area would not be prepared and tourists would be left disappointed.

Evaluating transmitted telemetry data provides an overview of whether all vehicles are in working order to avoid such failures.

To ensure an even snow cover, it measures the snow depth in the entire ski area. With the data visualised in real time, the driver can directly implement instructions for the corresponding areas. Data volumes of up to 40Gbyte per machine per month are accumulated.

Location and deployment data are transmitted in real time. This requires network availability even in extreme weather conditions at an altitude of over 3.5km.

Rohm develops SiC modules for Mazda e-axles



Ichiro Hirose (left) and Katsumi Azuma

Rohm has signed a joint development agreement with Mazda and Imasen Electric for inverters and SiC power modules to be used in the electric drive units of electric vehicles, including e-axles.

As the heart of the EV, an e-axle integrates a motor, reduction gearbox and inverter into one unit that plays a large part in determining the driving performance and power conversion efficiency of electric vehicles.

SiC mosfets in particular are expected to improve efficiency.

Rohm will carry out joint inverter development for e-axle by participating in a cooperative framework for the electric drive units development and production with companies such as Imasen and led by Mazda.

At the same time, Rohm will develop and supply SiC power modules to improve performance.

Through this collaboration, Rohm aims to develop more competitive SiC mosfets and modules by working backwards from the finished vehicle to understand the performance and optimal drive method required of power semiconductors.

Besides creating value through mutual understanding between car and device manufacturers, the three companies also support technical innovation in the automotive field and contribute to a sustainable society by leveraging knowledge, technologies and products garnered on a global basis.

"By partnering with like-minded companies, Mazda is committed to injecting driving pleasure into every product, including electric vehicles," said Ichiro Hirose, director of R&D at Mazda.

Katsumi Azuma, who is COO at Rohm, added: "Through this partnership, we hope that by reflecting the true demands and requests in our products we can develop automotive systems that contribute to decarbonisation while allowing us to gain a deeper understanding of Mazda's goal of creating cars that are sustainable with the earth and society."

Renault chooses KPit for software-defined vehicles

KPit Technologies is helping Renault develop software-defined vehicles (SDVs).

Renault is investing and forming partnerships to develop an SDV platform to drive its growth by improving the experience for consumers and unlocking monetisation over the length of vehicle ownership.

KPit has experience in automotive and mobility software, cross-domain competencies, global scale, and an ecosystem of alliance partners, along with the expertise in developing SDV roadmaps for several companies.

Renault expects the SDV technology programmes to drive value to its roadmap of vehicle production from 2026.

"Our vision is to reimagine mobility with industry leaders like Renault," said Kishor Patil, CEO of KPit Technologies. "The power of software from KPit will unlock electrification, autonomous driving and connected vehicle experiences that will delight Renault consumers."

Thierry Cammal, Renault VP, added: "Software is the force behind the transformation of the automotive industry. KPit is recognised as a leading software integration partner globally with multi-domain software competencies, making them a strategic scaling partner to us. Together, we will develop SDV technology platforms that will help us maintain market leadership and help the industry accelerate SDV transformation."

IPG and TraceTronic combine adas testing

IPG Automotive and TraceTronic have intensified their partnership for testing adas and autonomous driving functions.

TraceTronic provides automated testing of vehicle software, and IPG Automotive specialises in vehicle simulation for adas and automated driving.

They are optimising their systems for a seamless test process at every stage of vehicle software development from MIL, SIL and HIL to VIL.

The aim of the collaboration is to link two software offerings closer together: CarMaker for virtual test driving, and the Automotive DevOps platform for test automation and analysis.

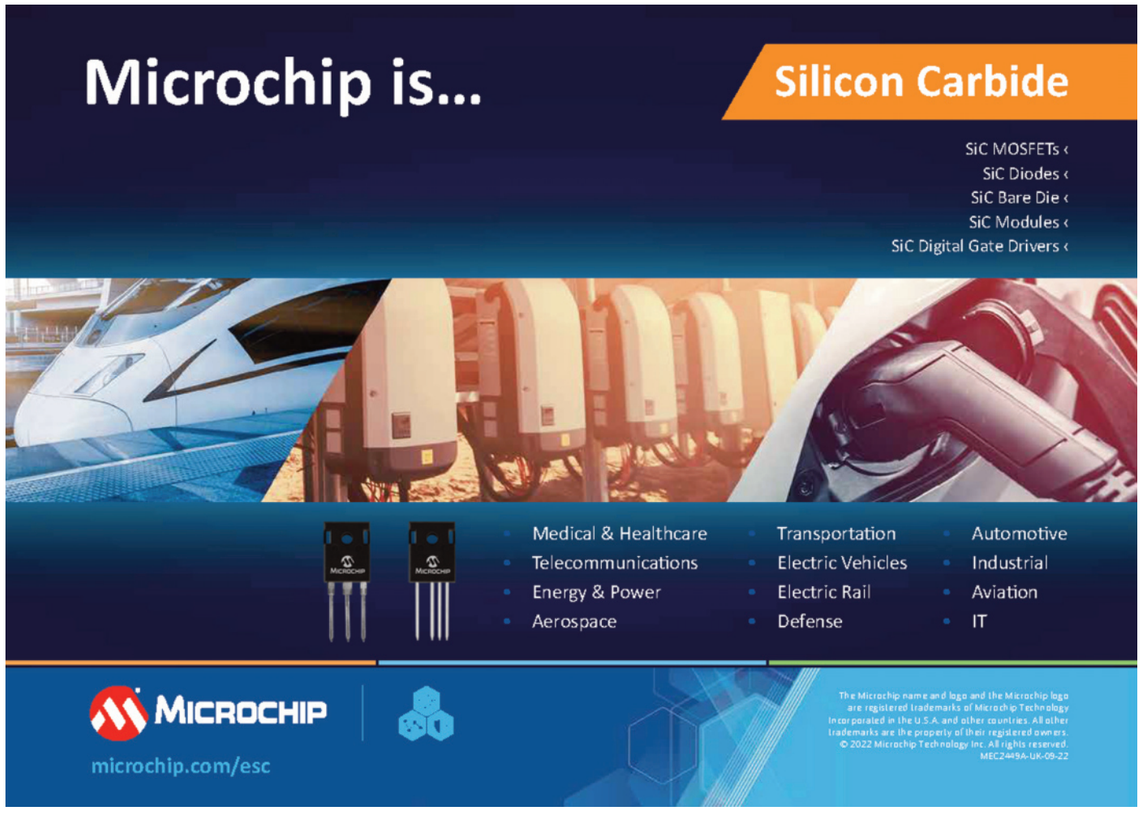
Both systems are being developed further as a joint platform to meet the growing requirements in test processes of software-defined vehicles.

With the seamless integration of the CarMaker product family into the automation tools from TraceTronic, extensive functionality tests for safety-relevant adas and AD systems can largely already be performed in the virtual environment. The applied test process is automated, from planning and execution to the evaluation of test cases.

The simulations are performed with accurate virtual prototypes and in realistic scenarios. Simulation artefacts are highly reusable across various test environments such as MIL, SIL, HIL and VIL. The optimised simulation core reduces the necessary resources for big scale simulation studies and, at the same time, increases the level of detail for tests with real-time systems.

The integrated execution distribution automatically distributes test orders for new driving functions to available test resources on HIL test benches as well as on scalable, distributed systems such as cloud and high-performance clusters.

In addition, freely configurable test reports provide sound feedback on changes in the software code and support detailed error analysis.



Aeris supplies IoT for M Auto e-bikes

M Auto is using Aeris' secure, intelligent IoT connectivity to help enable sustainable transportation across Africa.

M Auto is an electric vehicle start-up with 2000 e-bikes on the ground and 3000 bikes ready for market. It is also creating employment across Africa by investing in manufacturing and deploying e-bikes across the continent, with Togo and Benin being the first two countries to go live.

M Auto's vision is to replace all African motorcycles powered by an internal combustion engine with electric by 2030 while creating more than one million jobs.

Aeris helped M Auto through the initial launch of its EV products and services and enabled it to shorten time to market. M Auto uses the Aeris intelligent IoT network to deploy its devices faster and support services to scale more quickly into different markets.

The IoT network provides connectivity everywhere to help build and scale IoT programmes including sustainable mobility.

Aeris' global subscriber identity module (SIM), which is deployed at the point of manufacture, enabled M Auto to reduce its supply chain costs and deployment time.



M Auto is deploying e-bikes across Africa

"At M Auto, our credo is to offer high quality products at affordable prices everywhere in Africa and for everyone," said Shegun Adjadi Bakari, CEO of M Auto.

Mohsen Mohseninia, vice president at Aeris, added: "Aeris' ability to offer secure, intelligent IoT connectivity at the most optimised total cost of ownership ensures that M Auto's e-bikes are operational and reliable regardless of where they are deployed in Africa."

Autoliv and Geely partner on safety

Autoliv and Geely are jointly developing safety technology for vehicles.

The collaboration includes a system approach to automotive safety and will cover 16 technologies. The objective is to develop products that will meet the demand for safer vehicles and save more lives.



Sng Yih: Pleased

The cooperation is expected to accelerate the launch of safety technologies for high-level autonomous driving, intelligent steering wheels, 360° occupant safety and a sustainable leather replacement.

"The new cooperation between Autoliv and Geely shows our common intention to speed up the process of going to market with new safety technology that will save more lives," said Sng Yih, president of Autoliv in China. "Geely is a strong player in a very dynamic and transformative industry, and I am pleased that we have established this cooperation in China. Our shared commitment to sustainability underpins and supports our collaboration."

Autoliv and Geely first began working together in 2002 and have generated numerous technologies, including a pre-pretensioner seatbelt and a steering wheel with hands off detection technology. The new collaboration is non-exclusive.

"This strategic collaboration marks another milestone for Geely and Autoliv and gives us the opportunity to create cars with a new level of safety technology," said Guowang Kang, vice president at Geely. "Through our close cooperation, both Geely and Autoliv can increase our respective innovation capacity and technical competitiveness in the automotive market."

Videantis and AD Technology build adas SoC

Videantis is collaborating with asic design firm AD Technology to build automotive SoCs for adas and autonomous driving (AD) using Samsung Foundry's 5nm process.

Based on this technology node, each firm will contribute its expertise in implementing a scalable and customisable SoC targeting the full range of automotive processing requirements.

From smart edge sensor data processing in decentralised vehicle architectures up to high-performance compute systems in domain and central processing units, this SoC will target adas and AD applications up to SAE level four.

Videantis' v-MP6000-UDX unified processing platform renders separate specialised cores for AI, vision, signal processing, graphics or video coding obsolete. This cuts down overall SoC complexity and boosts flexibility to support diverse automotive use cases at high silicon utilisation.

The SoC combines this processing subsystem and automotive processors licensed from Arm and does not need companion chips.

With the efficiency of the platform already proven in safety-relevant single-box automotive smart cameras in high-volume automotive production, seamless reuse of existing software, development tools and expertise towards this upcoming SoC is said to be guaranteed.

Full stack development benefits from reduced software development complexity due to using a single unified tool-chain for all algorithm types.

"We are very pleased to team up with AD Technology, one of the world's leading design houses contributing a proven expertise in the implementation of high-end SoCs as well as securing premium access to Samsung Foundry's volume production capacities," said Hans-Joachim Stolberg, CEO of Videantis.

The firms are working closely with automotive OEMs and tier-one suppliers to develop SoCs for their vehicle architectures, enabling rapid customisation for a wide range of automotive devices.

"It is our duty to make our customers successful," said JK Park, CEO of AD Technology.

First products resulting out of this collaboration are targeting vehicles with start of production in 2025 and onwards.





Aisin bases automated parking on AMD Xilinx SoC

Toyota-owned tier-one supplier Aisin is working on an automatic parking system that is expected to hit the road in 2024.

At its heart will be AMD Xilinx Zynq UltraScale+ MPSoC. This helps the automated parking assist (APA) detect pedestrians, vehicles and free space at low latency.

The MPSoC will be deployed in the cameras within the APA and combines an Arm-based multicore, multiprocessing system with asic-class programmable logic containing custom co-processors including a deep learning processor unit for convolutional neural network processing.

This enables machine-learning-based scene segmentation and object detection for the APA.



AMD Xilinx Zynq UltraScale+ MPSoC

"This doesn't just help the driver, it is taking over the whole thing," said Wayne Lyons, senior director for automotive at AMD. "It is very smart as it makes the manoeuvre into the free space."

He said it could also operate the automatic emergency brake if a "dynamic event" happened during the manoeuvre.

The APA uses four cameras and 12 ultrasonic sensors to recognise the surrounding environment and calculate the driving route. The system then controls the vehicle according to the calculated route to park itself.

"It is as simple as pressing a button on the dashboard," said Lyons. "This will let it automatically detect the parking space using the combination of ultrasonic sensors and cameras. It will then just go ahead and reverse into the parking space."

The MPSoC can offload critical functions, such as graphics and video pipelining, to dedicated processing blocks to enable low-latency image processing.

"Aisin's APA system leverages complex AI and requires an SoC delivering high performance and low latency," said Morito Oshita, president of Aisin's chassis division. "Basic surround-view systems reduced some of the challenges of manual parking for consumers, whereas APA can now significantly ease the stress of parking in tight spots. We are pleased to start development and bring this to consumers."

Hanneke Krekels, AMD corporate VP, added: "As surround-view evolves from basic video stitching and graphic overlays that visually assist drivers, to cars now being able to use AI to park themselves, we see a huge opportunity to support the needs of this market with our adaptable Zynq platform. Aisin is leading the pack with its innovative approach, designing this APA with the flexibility to adapt the specifications depending on the specific requirements."

Lyons said an OEM would be launching this in an on-road vehicle in 2024. He wouldn't say which OEM. Though Aisin is owned by Toyota, it does make products for other car makers.

APA will be available as an option but Lyons stressed it would not be limited to the top tier. "It will be a popular option and be more mainstream," he said.

• AMD has completed the functional safety certification of the Zynq UltraScale+ full-power domain and programmable logic power domain. The devices become the first adaptive SoCs to be fully certified for use in functional safety applications based on ISO 26262, IEC 61508 and ISO 13849.

Continental wears Ambarella SoCs

Continental plans to offer adas technology based on the CV3 artificial intelligence (AI) SoC family from semiconductor company Ambarella.

The scalable SoC portfolio, which is built for adas applications, complements Continental's offerings for assisted driving and advances vehicle automation.

The more sensors installed in a vehicle, the greater the amount of data collected to detect the environment. The joint offering with a centralised single-chip processing based on 5nm technology lets vehicles process the environment through multiple sensors quicker.

Sensor options include high-resolution cameras, radars, lidars and ultrasonic sensors.

The integrated SoC enables early data fusion, in which the information from different sensors is superimposed simultaneously for various modalities such as emergency brake assist, parking or cruising.

"After exchanging on different use cases with Ambarella for two years, Continental is now integrating its high-performance, low latency and low-power processing chipset into our assisted driving," said Frank Petznick, head of Continental's autonomous mobility business. "This brings our adas to the next level and helps to serve the growing amount of sensor data in the vehicle. With this, we achieve a more comprehensive and accurate environment perception."

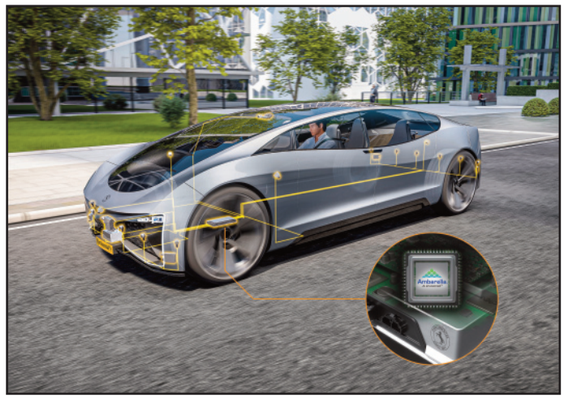
Continental's driver assistance systems enhanced with Ambarella's SoCs can process more collected data faster. In this way, they increase precision and enable a larger range of functions.

The scalability of the SoC family lets vehicle manufacturers choose the necessary performance level for their requirements on the same vehicle architecture.

Low power consumption leads to fewer cooling efforts, making sustainable energy savings possible, while reducing costs.

Ambarella's SoCs are said to provide significant AI performance per watt for neural network computation, with a performance increase of over 40 times compared with its former semiconductor chip family.

Additionally, Ambarella integrates its image signal processor technology into all SoCs. This results in robust adas with higher levels of environmental perception in difficult lighting, weather and driving conditions for machine and human vision.



Continental is using SoCs from Ambarella

Airbiquity aids over-the-air updates for two-wheel vehicle manufacturers

Connected vehicle firm Airbiquity is helping two-wheeler OEMs deliver vehicle-to-cloud connectivity for over-the-air (OTA) software updates.

Its OTAmatic mLink can eliminate the need for embedded telematic control units (TCUs), enabling the secure delivery and installation of OTA software updates for vehicle maintenance, feature upgrades and consumer personalisation.

It enables safe and secure delivery, installation, and management of OTA software updates to motorcycles, scooters and other two-wheel vehicles using consumer smartphones.

And it reduces OTA related hardware requirements for embedded TCUs and other devices when used in a hybrid brought-in built-in system architecture.

"There is a large unserved segment of two-wheeler OEMs that currently don't have embedded TCUs in their vehicle platforms to support remote software updates despite increasing consumer demand for this capability," said Keefe Leung, Airbiquity vice president. "OTAmatic mLink allows them to activate this functionality while providing a familiar user experience for consumers who are used to managing software updates with their smartphones."

Infineon adds TSMC RRAM to Aurix microcontrollers

Infineon plans to add TSMC's resistive RAM (RRAM) non-volatile memory (NVM) technology into its Aurix microcontrollers (MCU).

Embedded flash microcontrollers have been the main building blocks of automotive ECUs since the first engine management systems. They are essential for clean, safe and smart cars, used in propulsion systems, vehicle dynamics control, driver assistance and body applications.

Most MCUs are based on embedded flash memory technology. RRAM is a next step in embedded memories that allows scaling to 28nm and beyond.

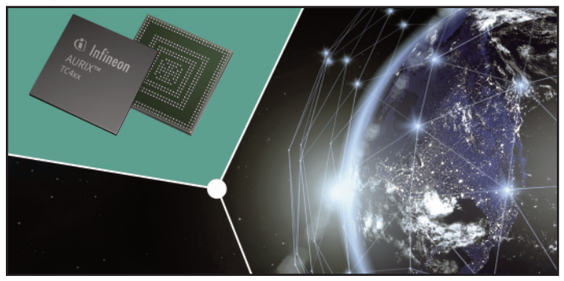
The Aurix TC4x MCUs combine trends in virtualisation, security and networking to enable software-defined vehicles and new EE architectures.

TSMC and Infineon created the basis for introducing RRAM in the automotive domain. This will put Aurix device on a broader technology and supply basis.

RRAM offers high disturb immunity and allows bit-wise write without the need of erase. Endurance and data retention performance has comparable performance with flash technology.

"TSMC and Infineon have a long track record of successful collaboration, including the first Aurix generation with TC2x products," said Kevin Zhang, senior vice president at TSMC. "We have also partnered on RRAM NVM technology for almost a decade in a range of different applications. Moving the TC4x to RRAM will open new opportunities in terms of shrinking MCUs into smaller nodes."

Infineon is already shipping samples of its Aurix TC4x family to lead customers that are based on TSMC's 28nm e-flash. The first samples based on 28nm RRAM technology will be available by the end of 2023.



Infineon prepares to add RRAM to Aurix



Stellantis gains access to AIMotive technology

Stellantis acquires AIMotive start-up

Stellantis hopes to accelerates its autonomous driving journey with the acquisition of artificial intelligence (AI) and autonomous driving start-up AIMotive.

This acquisition should enhance Stellantis' AI and autonomous driving core technology, expand its global talent pool, and boost the mid-term development of the STLA AutoDrive platform.

"Acquiring AIMotive's world-class artificial intelligence and autonomous driving technology is an important contribution to becoming a sustainable mobility tech company," said Yves Bonnefont, Stellantis chief software officer. "AIMotive's class-leading expertise and start-up spirit will accelerate our journey to deliver our goals."

AIMotive's product portfolio is focused on four key areas within artificial intelligence and autonomous driving: AIDrive embedded software stack for autonomous driving; AIData AI operations and data tooling; AIWare expertise and intellectual property for silicon ICs; and AISim software simulation for development of autonomous driving.

Stellantis' software teams are already developing three technology platforms that will be deployed at scale across four vehicle platforms, starting in 2024. The software strategy is expected to generate approximately €20bn in incremental annual revenues by the end of the decade, as part of the Dare Forward 2030 plan objectives, backed by more than a €30bn investment in electrification and software.

AIMotive is based in Budapest, with offices in Germany, USA and Japan, and 200 employees.

Wolfspeed supplies Jaguar with SiC

Wolfspeed is supplying silicon carbide (SiC) semiconductors to help Jaguar Land Rover increase powertrain efficiency and extend driving range for its electric vehicles.

The SiC technology will be used in the vehicles' inverter, managing the transfer of power from the battery to the electric motors.

The first Range Rover vehicles with this technology will be available from 2024, and the all-electric Jaguar brand the following year.

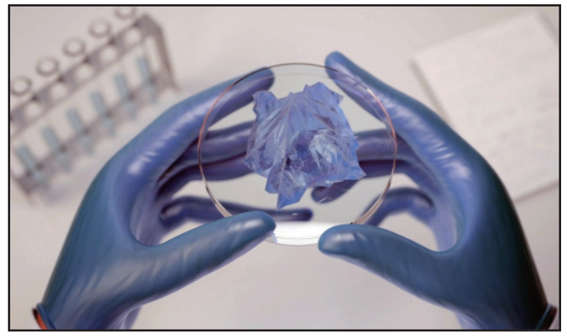
The partnership builds on Wolfspeed's relationship with the Jaguar TCS racing team competing in the ABB FIA Formula E world championship, where its SiC technology has been used to accelerate on-track efficiency and performance.

"We are not strangers having collaborated together with the Jaguar TCS Racing team for the last five seasons," said Thierry Bolloré, CEO of Jaguar Land Rove. "By developing that into a strategic partnership as part of our Reimagine strategy, we can integrate Wolfspeed's advanced silicon carbide technology into our next-generation electric vehicles, delivering extended range and performance capabilities for our clients."

Wolfspeed CEO Gregg Lowe added: "Wolfspeed is proud to partner with Jaguar Land Rover, supporting its bold commitment to electrify its iconic brands by using silicon carbide's superior performance, efficiency and range. The energy efficiency of silicon carbide will play an essential role as Jaguar Land Rover pursues its own zero carbon goals, and as the world transitions to an all-electric transportation future."

The partnership sees Jaguar Land Rover participate in the Wolfspeed assurance of supply programme to secure the supply of this technology for future electric vehicle production needs. This will enable more visibility and control over Jaguar's future supply chain.

• BorgWarner is to invest $500m in Wolfspeed, securing up to $650m in annual capacity for SiC devices.



Jaguar Land Rover will use Wolfspeed SiC

Veoneer and Arbe co-develop radars

Veoneer and 4D imaging radar company Arbe Robotics are co-developing radars for automotive-grade safety and rolling out autonomous functionality.

After five years research among technology start-ups, Veoneer has chosen to partner with Arbe for its 2K high resolution surround radar that can enhance the perception system and sensor fusion.

Veoneer will develop, market and integrate two surround 4D imaging radars extending on Arbe's reference designs: one long-range, high resolution, 360° sensing product with 48 x 48 RF channels (Tx and Rx) and one with 24 x 12 RF channels.

Veoneer's waveguide technology may enhance Arbe's performance metrics by improving antenna efficiency and reducing performance variability during manufacturing.

The 4D ultra high-resolution imaging radar can operate in difficult weather and lighting conditions and differentiates true threats from false alarms to ensure a safe road ahead for drivers, pedestrians and other vulnerable road users.

The radar sensor is modular in design, providing redundancy and the data diversity critical for automotive-grade safety and rolling out autonomous functionality.

The surround radar is expected to be in pre-production by mid-2023.

"Veoneer is committed to offering safe, robust, high-quality sensors to vehicle manufacturers globally," said Jacob Svanberg, CEO of Veoneer. "During the past five years, we have performed extensive research among 4D radar companies globally. By partnering with Arbe Robotics, Veoneer will be able to offer and integrate scalable automotive-grade 4D radar-sensors in future cars, at competitive prices."

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AVL and R&S speed up EMC testing

AVL and Rohde & Schwarz are collaborating to automate and speed up EMC tests under real driving conditions.

To ease and speed up the development process, the two providers of automotive test systems have produced a joint offering for automated EMC data analysis of an electric drivetrain under real driving conditions.

The electrification of vehicles leads to more EMC problems because of higher switching frequencies of semiconductors and higher emissions due to high voltages and currents.

EMS (electromagnetic susceptibility) and EMI (electromagnetic interference) testing of components and vehicles tackles these difficulties. To meet time-to-market requirements, test automation can be key.

Additionally, the tests must be as realistic as possible, so there is a trend from static EMC testing of vehicles to dynamic testing where the drivetrain is active, varying in speed as well as torque during the execution of the EMC test.

The real-time synchronisation of measurement data between the EMC testbed, measurement system and automation software is key to efficient and repeatable EMC-compliant component and vehicle development.



Collaboration: AVL and R&S speed up EMC testing

Therefore, AVL and Rohde & Schwarz have developed a way to support automated testing with simulation of real driving conditions while covering typical automotive standards.

The AVL Puna 2 automation controls the test cycle and stores the measured data in synchronisation with the R&S Elektra EMC test software to exchange information between the testbed and the EMC measurement equipment.

The Elektra software has been modified to enable automatic and seamless communication with AVL Concerto software, replacing a manual process. Concerto post-processes the measured data automatically and gives a full test report according to the pre-defined pass and fail criteria.

Elektra controls complete EMC systems and automates measurements of equipment under test being certified for emissions (EMI) and immunity (EMS). The software simplifies configuration of test systems and test descriptions in accordance with common standards. It speeds up test execution and paves the way to generating a comprehensive test report.

"Many customers have been wanting for years to see Rohde & Schwarz EMC analysers connected to the AVL EMC test automation system," said Alban Hemery, department manager at AVL. "Together, we have finally accomplished this."

Jürgen Meyer, vice president at Rohde & Schwarz, added: "Rohde & Schwarz has a long and productive history of collaboration with AVL to develop leading-edge test systems for the automotive industry.

The enhancement of Elektra to be compatible with Puma 2 is another significant step speeding up EMC test times under real driving conditions, particularly for electric drivetrains."

electronica 2022

BACK TO BUSINESS

Steve Rogerson reports from last month's Electronica in Munich

MCUs improve EV driving experience

NXP Semiconductors announced a series of automotive microcontrollers (MCUs) optimised for electric vehicle control applications.

The S32K39 MCUs include networking, security and functional safety capabilities beyond traditional automotive MCUs to address the needs of zonal vehicle EE architectures and software-defined vehicles.

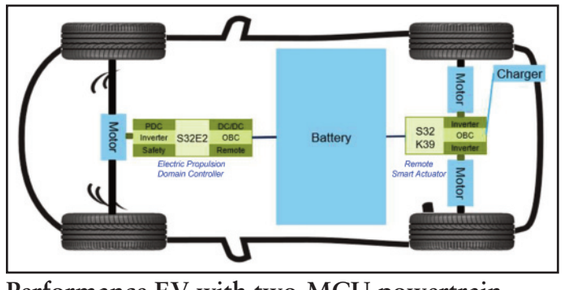
"OEMs are spending to electrify their fleets," said Brian Carlson, NXP's director of global product marketing. "They want all-electric vehicles and in a short time. And they want them to be more efficient, long range and at a low cost point."



Brian Carlson: "We are the brains that move the EV."

The devices support traditional IGBTs, as well as newer silicon carbide (SiC) and gallium nitride (GaN) technologies.

"SiC and GaN require higher switching and this can handle that," said Carlson. "We control 200kHz and two motors compared with some that are at 50kHz and one motor. It can support up to six-phase motors to give higher reliability and availability."



Performance EV with two-MCU powertrain

These dual 200kHz control loops improve power efficiency, and can enable smaller, lighter, more efficient inverters, letting motors deliver a longer driving range. They can control six-phase motors with higher power density and fault tolerance for better long-term reliability.

"We are the safe MCU that controls the motor," said Carlson. "We are the brains that move the EV."

A safe Asil-D software resolver, integrated sine-wave generation and sigma-delta converters eliminate external components to reduce cost. They also provide flexibility to control up to quad traction inverters when coupled with the NXP S32E real-time processor and can implement traction capabilities for four-wheel drive EVs in this configuration.

"It drives the motor and monitors the position of the motor at any time," said Carlson. "Lots of companies do motor control. What we do differently is control two motors, and very fast."

Because of its versatile architecture, the S32K39 can address EV applications beyond traction inverter control, including BMS, on-board charging and DC-DC conversion. With support for hardware isolation, time-sensitive networking and cryptography, it is well-positioned to support software-defined vehicles and zonal architectures.

The device has four Arm Cortex-M7 cores at 320MHz configured as a lockstep pair and two split-lock cores. There is up to 6Mbyte of flash and 800kbyte of sram.

Two motor control co-processors and NanoEdge high-resolution PWMs improve performance and precision control.

An integrated DSP is for flexible digital filtering and machine-learning algorithms.

Multi-channel analogue support provides SAR and sigma-delta A-D converters, comparators, and sine-wave generators for resolver excitation.

There are six Can-FD interfaces, TSN Ethernet and programmable IOs.

A hardware security engine is for trusted boot, security services, secure over-the-air updates using PKI and key management.

Versions without the two motor control processors are also available.

The product was developed with certified ISO and SAE 21434 cyber security and ISO 26262 functional safety processes.

"What we are doing is improving the driving experience for EVs," said Carlson, "with longer range, smoother responsiveness for acceleration and deceleration, and better handling."



David Lambe: "Enables significant cost savings."

Analog Devices showcases E²B technology

Analog Devices demonstrated its E²B automotive Ethernet 10baseT1S connectivity technology.

"It enables connecting sensors and actuators at the edge without needing an MCU over a single twisted-pair cable," said David Lambe, systems applications engineer at ADI. "It enables consolidation of software and significant system cost savings."

The technology is still in development and Lambe reckons it should be available in 2024.

Selecting a 10baseT1S multidrop link helps optimise the cable harness design. E²B, for Ethernet to the Edge Bus, produces a low complexity Ethernet implementation for 10baseT1S, simplifying the design process by removing the need for an MCU in the edge nodes.

E²B nodes are optimised yet flexible hardware-based 10baseT1S Ethernet edge nodes, suitable for Ethernet connection to edge sensors and actuators. It fits seamlessly into the overall larger Ethernet architecture and can be used on the same bus as other 10baseT1S compliant products.

"ADI's AD330x sits at the edge devices and can be configured to whatever is needed," said Lambe.

This includes SPI, I²C, PWM, GPIO, uart, ILaS, Lin and ADC.

Automotive Ethernet is seen as a key enabler of zonal architectures and supports trends such as personalisation, autonomy and electrification.

In existing automotive architectures, edge node connectivity is provided by non-Ethernet legacy networks. As systems transition to zonal architectures based on Ethernet connectivity and centralised processing, maintaining legacy network edge connectivity dictates the need for gateways to bridge from Ethernet to these legacy networks. However, bridging adds complexity, latency and inflexibility, making systems difficult to scale and reuse.

Maintaining Ethernet all the way to the edge nodes removes this bridging function, providing an optimised Ethernet architecture using time sensitive networking to deliver quality of service and flexible address-based routing for dynamic network creation.

BMS testing combination

By combining various products that it released over the years, Pickering this year produced a battery management system (BMS) simulator that allows manufacturers to verify that their BMS works properly before putting it into a car.

"Our battery simulator module can simulate six cells and be used to verify a BMS either in the R&D phase or for end-of-line testing," said Noman Hussain, Pickering's vice president for software business development. "You can plug in a real-life BMS and you don't need the battery itself. And you can stack them together to create a whole battery pack."

The simulator can then be used to simulate faults and other battery conditions to test that the BMS is working as it should.

"It can imitate different faults," said Hussain. "It tests to make sure the sensors and tests on the BMS are OK and how it will react if there is a fault."

He said the unit comprised products that had been released over the years and the complete system was put together this year.

"The tier-one supplier will get the BMS from the manufacturer and use our modules to verify it before they put it into a car," said Hussain. "We are pushing the limits with this."

The PXI multi-cell battery simulator module was shown along with other switch and simulation modules, including fault insertion switching and programmable resistors inside the BMS test demo developed with partner Austin Consultants.

Using modular, PXI-based switch and simulation modules offers advantages in testing a BMS, including flexibility to optimise the test system to meet exact requirements; simple modification to address evolving requirements; and a standard open architecture that promotes system longevity and mitigates obsolescence while providing seamless integration of multi-vendor instrumentation and communication modules.

The BMS test demo included Pickering's 41-752A PXI for simulating batteries in a stacked architecture, the 40-190B PXI fault insertion for simulating cell shorts and broken wires, the 40-253 PXI precision resistor for simulating battery load, the 42-297A PXIe programmable resistor for simulating battery temperature sensors, the 41-743 PXI programmable power supply for simulating battery chargers, the 43-920 PXI embedded controller and the 42-925 PXIe 18-slot chassis.



Noman Hussain: "We are pushing the limits."

Melexis claims pressure sensors most accurate ever

Melexis unveiled what it claims is the most accurate automotive pressure sensors ever made.They are for use in automotive engine management.

The MLX90824 determines the absolute pressure, then delivers a digital output using the Sent protocol whereas the MLX90822 provides an analogue output voltage.

These factory calibrated devices measures pressure spans from 1 to 4bar.

"An accuracy of ±0.5% full scale is maintained over the course of the sensor's working lifespan," said Laurent Otte from Melexis.

The two devices provide a sensor readout circuit, digital hardware, voltage regulators and Sent or analogue output drivers, plus essential passive components.

A pre-calibrated NTC thermistor input is available for the MLX90824. This lets users interface their NTC through the pressure sensor without end calibration.

Lorries can benefit from the +40V overvoltage and -40V reverse voltage protection mechanisms.

These pressure sensors have an operating temperature from -40 to +160˚C. They can even be exposed to +170˚C temperatures for a short period.

The mems sensing element is a micro-machined diaphragm bonded around a cavity etched in a silicon substrate.

Renesas prepares move into SiC

Renesas is about to move into silicon carbide (SiC) for automotive, probably though an acquisition, with an announcement due in the next quarter.

Though senior vice president Vivek Bhan would not confirm that an acquisition was pending, he said the company saw SiC as a key technology and that an announcement would be made in the next quarter.

"We recognise SiC is important and its role in the electric vehicle space and, in the future, we will make announcements about this," he said. "We are light in SiC compared with some of our key competitors. We see SiC as a very key technology. We see it in our future."

He said the firm had capabilities to offer a path towards SiC but would not be drawn on providing more information. When asked later, he said an announcement would come in the next quarter.

At the show, Renesas announced it was entering the automotive radar market with the introduction of a four-by-four-channel, 76 to 81GHz transceiver designed to meet the requirements of adas and level-three and higher autonomous driving.

The company said it would incorporate the RAA270205 high-definition radar transceiver into its sensor fusion portfolio, which combines radar, vision systems and other sensing modalities.

Designed with Steradian, which Renesas acquired earlier this year, the MMIC is suitable for imaging radar, long-range forward-looking radar and 4D radar, but can also be used for corner and central-processing radar architectures, the so-called satellite automotive radar systems.

"We acquired Steradian to move into the radar market," said Bhan. "Products will be shipping in Q1 2023. We will combine the radar technology with our existing adas SoCs."

With four transmit and four receive channels, it supports up to 16 mimo channels and can be cascaded to enable higher channel count and better radar resolution.

The company says it has best-in-class accuracy with up to 5GHz of bandwidth, and a 112.5MS/s ADC sampling rate that is nearly three times faster than competing devices. Power consumption of 1.2W is half that of comparable transceivers and it delivers a noise figure of 9dB, which is 3dB less than other radar transceivers. Its chirp rate of up to 300MHz/μs can improve radar resolution and object detection.

"Today's radar transceiver MMICs must achieve higher definition to support the high-accuracy requirements of adas and autonomous driving safety platforms," said Bhan. "Working in close collaboration with Steradian, which brings deep radar design expertise, we are expanding our sensor fusion offerings with a focus on functional safety and low power consumption to help our customers lower their development costs and improve time to market."


Vivek Bhan: "We see SiC as a very key technology."

OEMs demanding more sustainability

OEMs are increasingly talking directly with component makers and demanding more sustainability, according to Stephan Smit, business manager at Cyntec.

Part of Delta, Cyntec makes standard power chokes, DC-DC power modules and current-sensing resistors.

"Our focus is on the ECU and powertrain," said Smit. "We want to make things smaller, lighter and more efficient. We have products in infotainment, adas and lighting, and we are moving into the powertrain with battery management."

He said normally the company works closely with engineering departments in tier-one suppliers but for powertrains the OEMs are becoming more involved in the design stage.

"We see a strong change in the decision-making process," he said. "More OEMs are stepping into the supply chain due to the challenges the semiconductor industry has seen in the past two years. It is all about ensuring capacity and maximising flexibility. They all talk about control."



Stephan Smit

He said this made it easier for companies such as Cyntek.

"If we can liaise directly with OEMs, we get first-level information," he said. The car makers were also, he said, looking for sustainability in their suppliers.

"They want to know our carbon footprint and what we are doing to reduce it," said Smit. "They are looking at how we reuse materials. They want us to think about this."

He said major car makers were saying sustainability was becoming part of their decision-making process.

"They are putting the message out for their key partners to get used to it," he said.

Cyntec is based in Taiwan, with plants in Taiwan and China. It is also looking at setting up production plants elsewhere including in the Philippines and North America. This, said Smit, should help it reduce risk in the supply chain.



Peter Vaughan: "I love the innovation."

Exciting time for EV development

The amount of change happening in electric vehicle design is exciting Peter Vaughan, director at Power Integrations.

"We are driving a new way of thinking of how you can design the architecture," he said. "Today it is really still based on how 12V works. But with fully electric plug-in vehicles, you can look at doing the implementation completely differently."

This, he said, could make things simpler and more reliable, and be done at a lower cost.

"It is a very collaborative environment right now," he said. "I love it. I love the innovation and challenging how things were done."

An EV has lots of functional blocks that can make things difficult for power technology engineers. These include safety features to make sure the high voltages do not electrocute occupants if there is a crash.

This is holding back the industry in bringing high voltages into the cabin for uses such as seat heating and entertainment.

"I don't know whether they will, but it is things like this that make it so exciting," said Vaughan. "I can't say this will never happen."

Another example is General Motors, which is charging 400V cells in series even though they are operated in parallel.

"We don't know yet whether that will be the best way," said Vaughan.

He said all car companies had their own opinions and were trying different strategies.

"They all have their own personalities and they are all quite different," he said. "I am not seeing convergence yet. Tons of different ideas are being implemented."

ISELED Alliance welcomes three members

Analog Devices, Renesas and Simoldes have joined the ISELED Alliance, bringing the total number of members in the open industry group to 46 companies.

Founded in 2016, the alliance aims to build an ecosystem based on ISELED technology for automotive lighting. Members include lighting tier-one suppliers, LED and semiconductor makers, and specialised lighting designers.

Analog Devices brings its E²B technology, which enables Ethernet connectivity to edge sensors and actuators. One of the first products in this family supports bridging from 10baseT1S to ISELED and ILaS without the need for a microcontroller on the edge node. This should make it easier to integrate ISELED and ILaS into future automotive Ethernet-based architectures.

"We see a transition from a domain architecture using Can, Lin and Flexray to a more zonal architecture driven by Ethernet," said Vlad Bulavsky, general manager of automotive connectivity at Analog Devices.

Renesas will be contributing its system expertise and developing future-oriented systems using ISELED technology based on its microcontrollers.

"The ISELED light and sensor network is an innovative concept to simplify integration of lights, sensors and actuators," said Satoshi Yoshida, senior director for automotive digital products at Renesas. "I am confident that the combination of easy-to-integrate LED lightning and Renesas' robust automotive product portfolio will allow us to deliver optimised automotive lighting for our customers."

Founded in 1959, Simoldes employs more than 6000 people producing tools for injecting thermoplastics. It started supplying plastic parts in 1981 and now supplies all relevant OEMs.

"The ISELED Alliance is delighted to welcome Analog Devices, Renesas and Simoldes as new members," said Robert Kraus, CEO of Inova Semiconductors and chair of the ISELED Alliance.

CSOT targets 2023 for in-vehicle displays



After only setting up its automotive division in 2018, China Star Optoelectronics Technology (CSOT) is hoping to see its displays appearing in on-road vehicles as early as next year.

TCL is well known in the TV industry and set up the CSOT flat-panel display subsidiary in 2009.

"We set up our automotive business in 2018," said Song Li (pictured), project manager at Wuhan-based CSOT. "We set up our own dedicated engineering team to look at automotive."

The company focuses on low-temperature polysilicon technology that provides advantages such as high contrast and touch technology without adding an extra layer.

"It is low cost and high performance," said Li.

The technology also allows a narrow viewing angle so the driver is not distracted by what the passenger may be watching. And there is a model with a built-in camera that can be used for facial recognition and driver monitoring.

"Our technology is not yet in an on-road vehicle but hopefully that will happen next year," said Li. "We are working with Chinese domestic car makers. We will eventually go global but our Chinese customers tend to move more quickly."



SiC LEAVE

George Lakkas shows how to reduce power loss and thermal dissipation in SiC traction inverters

With increasing competition between electric vehicle (EV) manufacturers to develop models with lower cost and longer drive range, power system engineers are under pressure to reduce power losses and improve traction inverter system efficiency, which can improve driving ranges and provide a competitive advantage.

Efficiency relates to lower power losses, which affect thermal performance and in turn system weight, size and cost.

Demand to reduce power losses will continue with the development of inverters that have higher power levels, especially as the number of motors per car increases, and trucks migrate to pure EVs.

Traction inverters have traditionally used insulated-gate bipolar transistors (IGBTs). But with the advancement of semiconductor technologies, silicon carbide (SiC) mosfets offer the ability to switch at higher frequencies than IGBTs, improving efficiency through resistive- and switching-loss reductions while increasing power and current density. Driving SiC mosfets in an EV traction inverter, especially at power levels above 100kW and with 800V buses, requires an isolated gate driver with reliable isolation technology, high drive strength, and fault monitoring and protection features.

Isolated gate drivers

The isolated gate-driver IC in Fig. 1 is an integral part of a traction inverter's power delivery. The gate driver provides low- to high-voltage (input to output) galvanic isolation, drives the high- and low-side power stages of the SiC or IGBT-based three-phase motor half bridges, and enables monitoring of and protection against various fault conditions.

Plateau

For SiC mosfets especially, the gate-driver IC has to reduce switching and conduction losses that include turn-on and turn-off energy.

Mosfet data sheets include a gate-charge characteristic, and on that curve you'll find a flat, horizontal section called a Miller plateau, shown in Fig. 2. The more time a mosfet spends between the on and off states, the more power is lost.

When the SiC mosfet switches, the gate-to-source voltage (V_{GS}) passes the gate-to-source threshold (V_{GSTH}), is clamped at the Miller plateau voltage (V_{plt}), and stays there because the charge and capacitance is fixed. Getting the mosfet to switch will require the addition or removal of a sufficient gate charge.

The isolated gate driver must drive the mosfet gate with high current to add or remove the gate charge to reduce power losses.

The equation below, which calculates the required SiC mosfet charge that the isolated gate driver will add or remove, shows that the mosfet gate current is proportional to the gate charge:

$$Q_{GATE} = I_{GATE} \times t_{SW}$$

where I_{GATE} is the isolated gate-driver IC current and t_{SW} is the turn-on time of the mosfet.

For 150kW or above traction inverter applications, the isolated gate driver should have more than 10A of drive strength to switch the SiC fet through the Miller plateau at high slew rates and take advantage of the higher switching frequencies.

SiC fets have a lower reverse recovery charge (Q_{rr}) and a more stable over temperature on-resistance ($R_{DS(on)}$) that enable higher switching speeds. The less time the mosfet stays in the Miller plateau, the lower the power losses and self-heating.

Power loss

The gate-driver Miller plateau also relates to switching losses in the gate drivers. The driver switching loss difference can be as much as 0.6W.

These losses contribute to overall power losses in the inverter, and reinforce the need for a high-current gate driver.

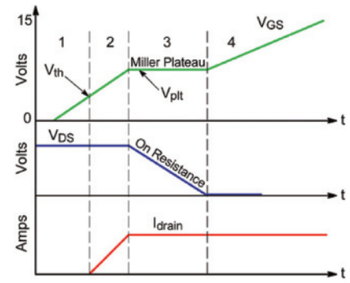


Fig. 2: Mosfet turn-on characteristics and the Miller plateau

Thermal dissipation

Power losses result in a temperature increase that can complicate thermal management by requiring heat sinks or thicker PCB copper layers. High drive strength helps lower the gate driver's case temperature, mitigating the need for more expensive heat sinks or additional PCB ground layers for heat sinking the gate driver's IC temperature.

Conclusion

With EV traction inverters increasing in power to over 150kW, choosing an isolated gate driver with maximum current strength through the Miller plateau can reduce SiC mosfet power losses and enable faster switching frequencies and therefore higher efficiency which would improve new EV model drive range.



George Lakkas is automotive marketing manager for high-power drivers at Texas Instruments

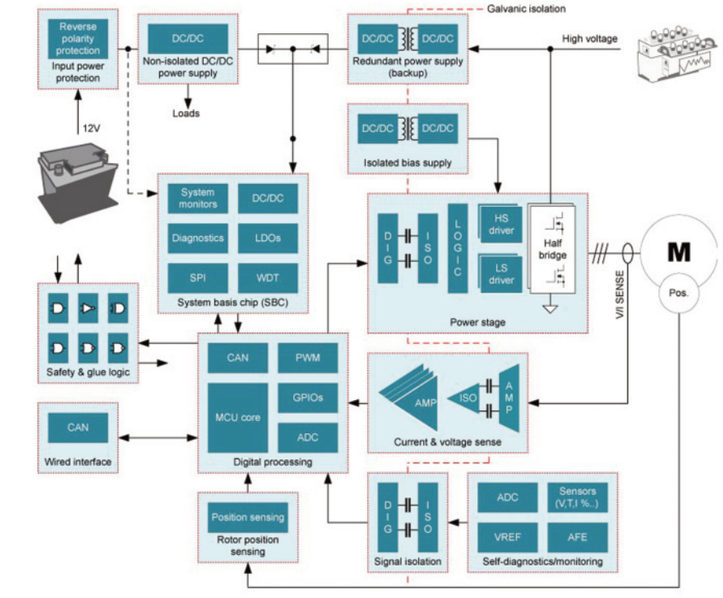


Fig. 1: EV traction inverter block diagram

AUTONOMOUS VEHICLES

SAFETY FIRST

Shahar Bin-Nun asks if autonomous vehicles can be trusted and how to keep drivers safe no matter the forecast

Image by Azerbaijan Stockers on Freepik

AUTONOMOUS VEHICLES

Recently, the magazine *Work Truck* spoke with industry experts on how to keep drivers safe in unpredictable weather. Mark Murrell, co-founder and president of CarriersEdge, a provider of online truck driver training, had the following advice: “Teach drivers how to assess the environment around them as they go about their day and react according to what they see and experience.”

This advice isn’t just suitable for trucks, it applies just as well to autonomous driving technology, which is exploding onto the private vehicle market at the moment.

Both human drivers and autonomous vehicle technology have to be ready to deal with a huge variety of conditions, particularly when it comes to weather. As climate change makes weather more unpredictable, this reactivity should become an even greater priority for autonomous vehicles.

A truck driver might face snow one day, high temperatures the next day, and flash floods the next, all on roads of variable age and quality. An autonomous vehicle has to do the same thing, while encountering thousands of different drivers in thousands of different sets of conditions. The same technology that encounters an 85-year-old grandpa doing his weekly grocery run in Florida will also encounter a busy taxi driver completing her 300th ride of the day in snowy New England.

Humans are remarkably good at this kind of adaptive learning. And yet the sheer number of kilometres travelled under tough working conditions means that truck drivers have one of the worst fatality rates in the USA. And these same problems that plague truck drivers have yet to be solved for autonomous cars.

Take black ice, for example. On poorly-built roads that aren’t maintained enough to allow for proper drainage, water can freeze solidly and transparently. It’s nearly impossible for humans to spot, and computers aren’t much better at it. Whether driven by humans or computers, most of today’s vehicles are not equipped to deal with black ice.

Even relatively commonplace occurrences such as the accumulation of dead leaves on roads or cold-weather tyres being used on non-wintry roads can lead to injury or death. So how, when even humans haven’t figured it out, can autonomous driving ever be truly safe?

Data

Humans such as truck drivers have one big advantage over self-driving vehicles: they remember and they communicate. A human might recall that a particular highway exit has a sharp curve combined with poor drainage, resulting in a dangerous puddle in a bad location.

If that driver doesn’t know about it, a fellow driver might create an alert. The next time the driver takes the exit, you can bet that truck will slow down in anticipation. Furthermore, a human driver will also know how to adapt to handle curves and slopes as the car ages and changes.

Autonomous cars use artificial neural networks to see their surroundings, but that technology can’t remember what happened in the past or learn from its mistakes. While an autonomous car might be able to use its vision to perceive a sharp curve, it can’t predict the puddle, at least, not yet – researchers are working on overcoming this.



Autonomous cars use artificial neural networks to see their surroundings, but that technology can’t remember what happened in the past or learn from its mistakes (Image by Wirestock on Freepik”

To make up for that, data should come in from two directions in addition to real-time weather information: the car itself, and, ideally, the cloud.

Real time

Weather can change on a dime. But even the most advanced sensors can’t fully anticipate how a vehicle will handle inclement weather unless that technology takes into account the vehicle’s current condition.

Each autonomous vehicle produces and records information about its own state – tyre pressure, speed, steering adjustments – but much of that information doesn’t get used. Even the autonomous driving technology that does apply those data rarely takes into account the crucial fact that cars change significantly over their lifetimes.

For example, a self-driving truck might predict that taking a curve at 90kmph is safe, at least under nominal or theoretical conditions. But a year of heavy use down the line, will that still be the case? The suspension will deteriorate over time. Tyres will slowly become more worn, then regain traction when they’re replaced. Braking might occur

AUTONOMOUS VEHICLES

less efficiently. All this changes the way a vehicle drives and reacts to road conditions.

Autonomous vehicles have enough data to aid in predicting how they might react to certain road conditions. Now it's a question of applying the insights from those data in real time.

Cloud

An increase in data can help the car make safer decisions, but it can't account for changes in roads, too. A hilly section of road may be totally safe during dry conditions but become especially dangerous in the snow.

The same road, year over year, will weather and age unpredictably just like vehicles. Road features such as grip levels change during different weather patterns. Plus, the location of road distresses – such as bumps, cracks and potholes – changes month over month too. The best way to make sure autonomous vehicles travel safely is by collecting not just individual data, but by providing crowdsourced data on a global scale.

Google Maps uses global data to help predict and anticipate traffic patterns. For example, drivers using Google Maps for directions will know to slow down on the highway due to an upcoming patch of red road that Google reports is just around the bend. Why couldn't the same technology be used to help autonomous driving technology account for road changes, both in real time and historically?

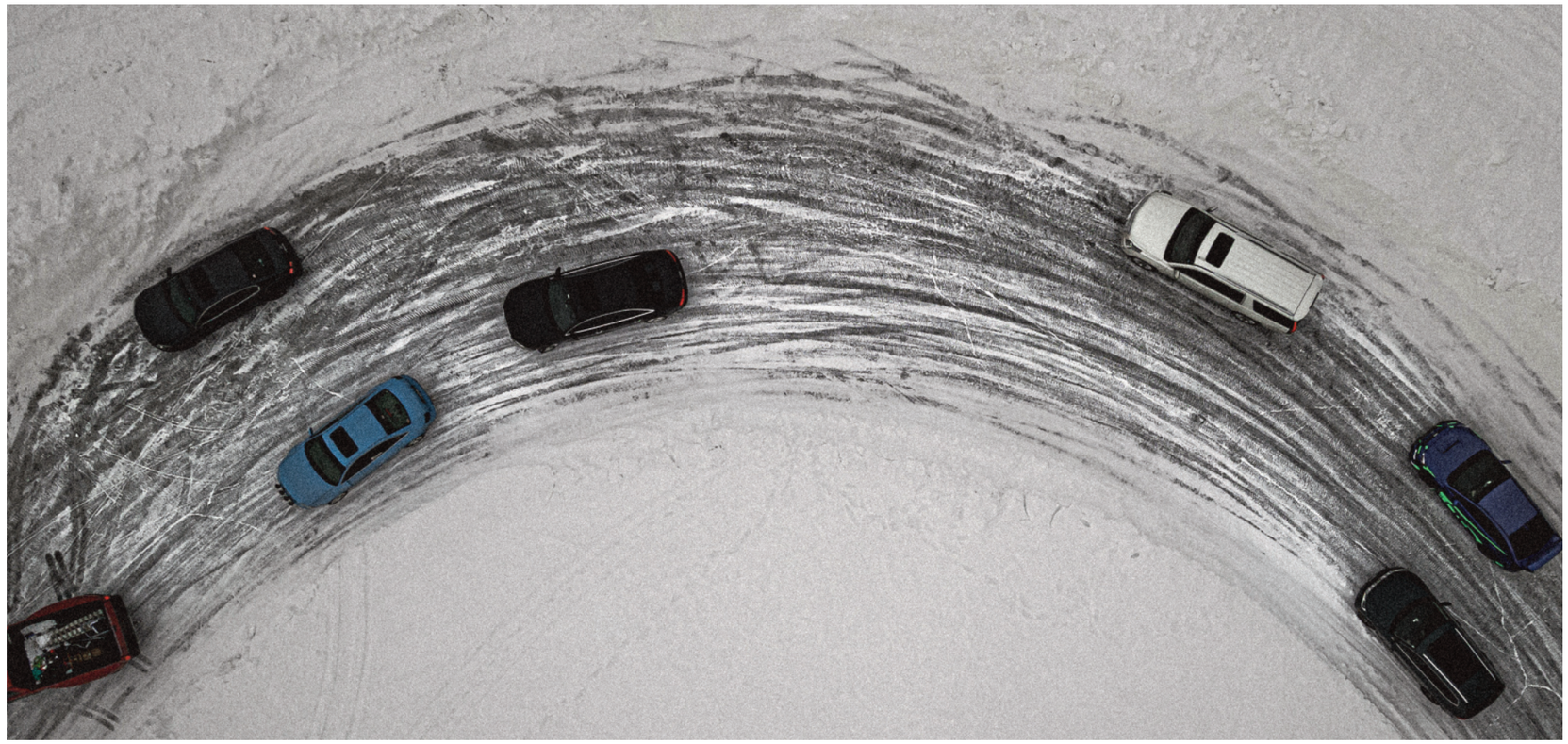


Autonomous vehicles will have to handle varying weather conditions

Safety

To become truly safe under unpredictable weather conditions, autonomous driving has to incorporate data from three angles.

First is the real-time vehicle condition. Knowing how a vehicle responds to inclement weather under factory conditions isn't enough. The vehicle must be able to analyse constantly how the vehicle itself has changed. Each vehicle already tracks the wheel speed, steering angle, engine RPMs and brake pedal position. Now, it should just be a matter of monitoring those changes over time.



As climate change makes weather more unpredictable, being able to react promptly to road conditions should become an even greater priority for autonomous vehicles (Image by Wirestock on Freepik)

Secondly is the real-time weather itself. Self-driving vehicles should be able to anticipate not only how dry road grip will be impacted by tyre wear, but also how those older tyres will be affected by extreme heat, accumulated leaf matter, high quantities of water and so on.

Finally, the whole is greater than the sum of its parts. Vehicles should share insights generated onboard in a central location, where advanced processing can generate accurate and highly refreshed global road condition maps, similar to how Google Maps work. Ideally, vehicles should collect and report data about how the road itself has changed over time, including potholes and new cracks, and how those changes will affect the vehicle's handling.

How could this look? Going back to the black ice example, the technology already exists to help drivers as well as autonomous vehicles deal with black ice. By using tactile sensing, a vehicle can continuously estimate road friction. Correlating crowd sourcing of such data to weather data can enable over time the prediction of black ice events from local weather data. Road conditions maps can estimate where this black ice could form.

Put that all together, and a vehicle could know it is approaching black ice risk and adjust speed accordingly based on the knowledge of the individual vehicle condition, keeping drivers safe.

Overall, tactile data are collected from those existing sensors in the vehicle and are affected by the dynamics between the road and the vehicle. This information enables a complete picture of the vehicle's condition, along with the surface condition in real time and produces insights that allow the driverless vehicle to make decisions based on tactile sensing, in any weather or visibility conditions.

So many of the pieces that will make autonomous vehicles navigate roads in various conditions already exist. The challenge now is to bring all of that information together with the goal of making the roads safe for the upcoming wave of autonomous vehicles.



Shahar Bin-Nun is CEO of Tactile Mobility

RESISTORS



REGENERATION GAME

Simone Bruckner explains the role of resistors in supporting e-mobility

Developments in the electric vehicle (EV) market are advancing at a rapid pace, with consumer uptake on the increase and the end of the road for newly-manufactured ICE vehicles fast approaching.

But concerns around EVs' viability for widespread usage remain.

A dynamic braking resistor (DBR) is a vital component in the EV power chain, responsible for safeguarding the electrical system by removing excess energy from a vehicle's braking system. This mechanism supports several applications in the EV space, such as regenerative braking, fuel cell power reliability and heavy goods vehicle emergency braking systems.

Regeneration

In EVs, a DBR's ability to absorb and redirect energy facilitates regenerative braking.

Regenerative braking uses the excess kinetic energy to recharge an EV's battery. It can do this because the electric motor in an EV can run in two directions: one, using the electrical energy to drive the wheels and move the car, and the other, using the excess kinetic energy to recharge the battery.

When the driver lifts their foot off the accelerator pedal and steps on the brake, the motor starts to resist the vehicle's motion, swapping direction, and begins putting energy back into the battery. As a result, regenerative braking uses the EV's motor as a generator to convert lost kinetic energy into stored energy in the battery.

On average, regenerative braking is between 60 and 70 per cent efficient, which means around two thirds of the kinetic energy lost during braking can be retained and stored in the EV battery and used later for acceleration, drastically improving the energy efficiency of the vehicle and extending battery life.

However, regenerative braking cannot act alone. A DBR is needed to make the process safe and effective.

If the car battery is already full or there is a failure in the system, there's nowhere for the excess energy to be dissipated, which risks the failure of the entire braking system. So, a DBR is installed to take this excess energy unsuitable for regenerative braking and dissipate it safely as heat.

In water-cooled resistors, this heats water, which can then be put to use elsewhere in the vehicle to provide heat to the cabin or preheat the battery itself, since a battery's efficiency is directly linked to its working temperature.

Heavier loads

It's not just in general EV braking systems that DBRs are important. There's also an added layer of their application when it comes to the braking systems of electric heavy goods vehicles (HGVs).

Electrifying HGVs is certainly more complex than standard vehicles, but it's no less pressing.

RESISTORS

While widespread targets haven't been set in the same way they have for the ban on fossil-fuelled cars and vans, some goals have begun to creep in.

In the UK, for example, all new HGVs sold must be zero emission by 2040, while in Austria, the target is 2035. But there's no denying that more of these targets will appear in the not-too-distant future.

HGVs brake differently to cars, as they do not purely rely on their service brakes to slow down. Instead, they also use auxiliary or endurance braking, which slows the vehicle in conjunction with the service brakes. They don't overheat as quickly on long declines and reduce the risk of brake fade or failure of the service brakes.

In electric HGVs, this braking is regenerative, which reduces wear on the service brakes and adds charge and range to the battery packs.

However, if there is a failure in the system, or the battery pack's state of charge is unable to accept the charge, this could become dangerous.

Using a DBR will dissipate the excess energy as heat to improve the safety of the braking system. To pass this test, the resistor must allow the HGV to travel 6km at 30km/hr on a seven per cent decline with the endurance braking system active and without the service brakes overheating and failing – the current standard set by the ECE R13 Type IIA endurance braking performance test.



Dynamic braking resistors allow for safer braking by removing excess energy from the braking system

Hydrogen

However, it's not just in braking where DBRs come into play. They can also positively impact the growing hydrogen fuel cell EV (FCEV) market.

While FCEVs aren't as viable for an imminent widespread rollout, the technology is there, and it certainly has more long-term promise.

FCEVs are powered by proton exchange membrane fuel cells.



Lorries and other large vehicles are switching to electric too

FCEVs turn hydrogen into electricity by combining the hydrogen fuel with air and pumping it into the fuel cell. Once inside the fuel cell, this triggers a chemical reaction, resulting in the extraction of electrons from the hydrogen. These electrons then create electricity, which is stored in a small battery used to power the vehicle.

If the hydrogen used to power them is produced using electricity from renewable sources, the result is a completely carbon-free transport system. The only end products of the fuel cell reaction are electricity, water and heat, and the sole exhaust emissions are water vapour and air, making them more aligned with the EV rollout. However, they do have some operational shortfalls.

Fuel cells are unable to work under heavy loads for a long time, which presents issues when rapidly accelerating or decelerating.

Studies into fuel cell function have shown that, when an FCEV begins accelerating, the fuel cell's power output increases gradually to a point, but then it begins to oscillate and drop despite velocity remaining consistent. This unreliable power output presents a challenge for automakers.

The answer is to install a fuel cell for a higher power requirement than necessary. For example, if an FCEV needs 100kW of power, installing a 120kW fuel cell would ensure there is always at least the required 100kW of power available, even if the fuel cell's power output drops. Opting for this requires a DBR to remove the excess energy when not required, by performing a load bank function.

By absorbing the excess energy, DBRs protect an FCEV's electrical system and let it be very reactive to high power demands and accelerate and decelerate rapidly without storing excess energy in a battery.



Simone Bruckner is managing director of Cressall

Magnetic sensor for safety and adas

A 3D Hall-effect position sensor from Allegro Microsystems comes in a 4 by 4mm PCB-less package.

The A31316 suits automotive safety and adas applications that require high levels of flexibility and performance in harsh conditions, such as powertrains and chassis.

Powertrain and chassis applications, passenger restraint systems, and shifter systems are subjected to environmental vibrations and contaminants that can degrade performance.

The sensor eliminates the need for a PCB or other external components. It integrates the die and capacitors in one package.

For vibration-robust designs, the pins can be welded or soldered directly to connector lead frames and can be overmoulded or potted for a tight seal. These options reduce the ability for contaminants and vibration to affect performance and can bring design flexibility to spaces where mechanical vibration and contamination are potential issues.

Designed for rotary and long-stroke linear applications, it maintains high angle accuracy from -40 to +150°C. Its flexible calibration table (33 fixed points or 22 freely placed points) enables options that can reduce the time and complexity of end-of-line calibration and reduce errors due to mechanical misalignment.

On-chip diagnostic features ensure reliable, safe operation.

The 3DMag family of rotary and linear magnetic position sensor ICs combine planar and vertical Hall-effect technologies to measure magnetic field components along three axes, enabling 3D sensing capabilities with a wide magnetic dynamic range without saturation.

The A31316 is the firm's first magnetic position sensor to provide multi-direction measurement in a PCB-less SIP package. It provides designers with a configurable signal path and flexible linearisation for end-of-line calibration to improve measurement accuracy.

The IC can compensate for nonlinear fields and static sensor-to-magnet misalignment errors, and its configurability makes it easier for designers to optimise for accuracy and calibration time. This helps reduce processing in the ECU and increases end-of-line yield for nonideal magnets and mechanical assembly tolerances.

Multi-level output using binning can integrate the functions of multiple magnetic switch ICs into a single A31316.

A Manchester interface allows for programming the eeprom through the output pin, which eliminates the need for a separate programming interface.

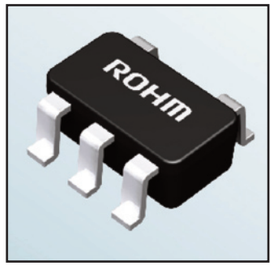
It stores factory and customer-programmed calibration settings, with dedicated registers for customer use.

A high-voltage supply is not required for eeprom programming, and it can be programmed directly with a 5V supply voltage enabling integration with microcontrollers or other low supply devices.

The IC includes the Sent protocol with 0.5 to 10μs tick times, and includes a PWM interface with 125Hz to 16kHz carrier for simple digital interface to microcontrollers.

Following SEooC functional safety guidelines, the sensor supports Asil-B system-level integration in accordance with ISO 26262 and is automotive qualified to AEC-Q100 Grade 0.





LDO regulators

Automotive-grade LDO regulators from Rohm are for use in adas sensors.

The BUxxJA3DG-C devices meets the basic requirements for LDOs in the secondary power supplies of automotive systems.

Package size is 2.9 by 2.8mm, and they support output currents up to 300mA while covering an input voltage range from 1.7 to 6V.

Such a low input supply voltage enables the use of the LDO in 1.8V power supply systems to provide low output voltages at a higher efficiency.

The output voltage noise is reduced to 55μV rms, which is about 40% lower than similar 3.3V low-noise LDO regulators. As a result, they can enable a quieter power supply and more miniaturisation.

They support +125°C operation and meet AEC-Q100.

Applications include adas, sensors, cameras and radar, as well as infotainment systems including clusters and head-up displays.

NFC reader chips suit digital-key applications

Automotive-qualified NFC reader ICs from ST Microelectronics are for Car Connectivity Consortium (CCC) digital-key applications, with features that increase performance and ease product certification.

The ST25R3920B can be used in car-door and centre-console locations for keyless entry and starting, as well as Qi wireless-charging control and smartphone pairing.

The chip comes with the firm's Heartbeat algorithm for NFC card protection on WPC applications, which can differentiate between an NFC card and a smartphone in card-emulation mode. This ensures phones can charge while cards stay protected.

Features include enhanced active wave shaping (AWS) to ease certification according to NFC Forum Certification Release 13 (CR13), which also promotes interoperability between CCC digital-key products and smartphones.

AWS helps remove undershoot and overshoot from the received signal by adjusting parameters and hence avoids repeatedly rematching the antenna during development.

The device also supports automatic antenna tuning and automatic low-power wake-up.

Output power is up to 1.6W combined with sensitivity to increase interaction distance when installed in a location such as a car door handle, where space constraints call for a small antenna.

The output power is dynamically adjustable to comply with upper and lower limits expressed in NFC Forum and EMV Co specifications.

By combining a noise-resistant input structure and noise-suppression receivers, it has immunity against external interference. It can also pass car manufacturers' proprietary injected-noise tests to ensure safe operation in worst-case conditions.

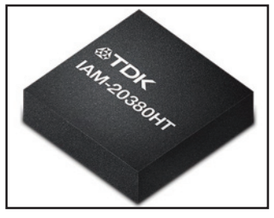
Samples are available now.



Stand-alone gyroscope for non-safety applications

TDK has announced the InvenSense IAM-20380-HT high-temperature automotive monolithic three-axis motion-tracking sensor for non-safety automotive applications.

The stand-alone gyroscope comes in a 3 by 3 by 0.75mm 16-pin LGA package that can operate over a wide temperature range, delivering reliable and accurate measurement data for non-safety applications including navigation and dead reckoning, vehicle tracking, telematics, door control, and vision systems.



It is a monolithic SoC device that eliminates the wire bonding connections between the sensing element (mems) and the electronic cmos front-end, improving performance and reliability.

Low noise performance with bias instability guarantees accurate vehicle location, onchip 16bit ADCs, and sensitivity tolerance.

It offers extended fifo depth up to 4096byte and two independent programmable interrupts.

GNSS module

An automotive-grade multi-band GNSS module from U-Blox can enable adas applications up to +105˚C.

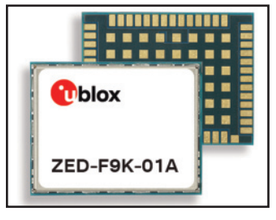
The Zed-F9K-01A AEC-Q104-qualified module has embedded hardware, software and inertial measurement unit to provide self-contained positioning.

The module supports L1, L2 and E5B, and L1 and L5 bands to increase flexibility, satellite availability and security. It combines multi-band and multi-constellation GNSS with dead reckoning high-precision real-time kinematic, which enables decimetre-level accuracy.

The module natively supports the firm's PointPerfect GNSS augmentation service.

It delivers multiple GNSS and IMU outputs in parallel to support all possible architectures, including a 50Hz sensor-fused option with low latency.

For real-time applications, the optimised multi-band and multi-constellation capability increases the number of visible satellites even in urban conditions.





C-V2X module enhances safety

A cellular V2X module from Quectel uses PC5 direct communications.

The AG18 module lets vehicles communicate with one another and with their surroundings to improve safety and traffic efficiency.

It supports vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and vehicle-to-pedestrian (V2P) communications on the unified 5.9GHz ITS band without the need of a (U)SIM, cellular subscription or network assistance.

The module has flexible positioning service options including L1+L5 dual frequency GNSS, Qualcomm QDR3 dead reckoning and high-precision PPE (RTK) technologies, ensuring that global automotive OEMs and tier-one suppliers can leverage location technology appropriate to their application.

Based upon the AEC-Q100-qualified Qualcomm SA415M chipset, the AG18 complies with the IATF 16949:2016 automotive quality management system. It can be used in harsh environments and provides ESD and EMI protection.

Being pin-to-pin compatible with the AG15 C-V2X module, it lets existing users migrate seamlessly and upgrade through a drop-in replacement.

Interfaces include PCIe, USB 3.0 and 2.0, SPI, I²C, uart, GPIO, ADC and 1pps for applications such as telematics control units, telematics boxes, virtual boxes and roadside units.

Touch control



An automotive touch control single-chip from Goodix supports displays ranging from 31 to 69cm.

The GA687X has a report rate up to 250Hz to enable a minimum 10ms response time, and supports flexible amoled on-cell touchscreens. It also has a high signal-to-noise ratio to boost the display noise-resistant capability.

Using proprietary anti-interference technology improves EMC performance. It satisfies the Cispr 25 class-five EMI standard that international car makers require to ensure the stable operation against various in-vehicle electromagnetic interference.

The company claims it has the world's leading capacitive loading capability with an optimised chip design, and it supports the evolving trend of curved or special-shaped displays in cockpits by adapting to different screen stack-ups, including flexible amoled on-cell touchscreens.

It meets AEC-Q100 and IATF 16949.

LED driver adjusts brightness

An LED driver from Melexis has a wide dimming range allowing optimal brightness adjustment during night and day.

Part of its Melibu family, the MLX81143 includes 21 LED drivers and improves the power management of the full system. The Melibu interface makes it possible to drive up to 3000 LEDs in a car at the same time.

The system enables dynamic safety warnings and communication with the driver.

Car manufacturers continue to adopt animated lighting in the cabin to provide information such as driver assistance prompts and vehicle status updates. Changing colours and different blinking sequences enhance messages in need of driver attention.

However, this presents engineering difficulties, such as maintaining consistent colour across all the LEDs and implementing simultaneous light changes.

The MLX81143 addresses this by integrating the Can-over-uart Melibu communication interface to control individual LEDs that implement the lighting effects defined by the vehicle's systems.

The intelligent RGB-LED controller also provides real-time compensation of any colour drift caused by environmental changes, and colour-mixing accuracy of less than 1% to eliminate any distinguishable differences between LEDs.

The technology is already being used by multiple global car manufacturers.

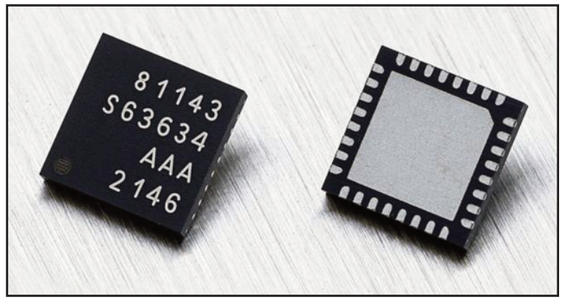
The interface uses a Can-FD physical layer to deliver performance at up to 2Mbit speeds.

Combining uart with the Melibu protocol guarantees an intelligent and high-resolution operation, with temperature-related colour drift being mitigated.

The device is AEC-Q100 qualified and meets ISO 26262 functional safety requirements, supporting Asil-B integration.

The architecture can help designers meet EMC requirements. It exhibits low EMI emissions and high levels of EMI immunity.

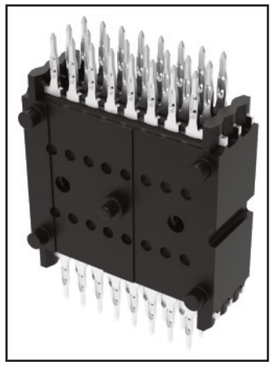
Samples are available.



Snap-in design to stack BTB connectors

A multi-row board-to-board (BTB) connector from Interplex has a proprietary snap-in biscuit design allowing multiple connector units to be stacked together.

This means interconnections can be appropriately sized while avoiding the need for them to be custom built.



This approach should enable different pin count requirements to be attended to via the same basic interconnect platform, without any extra expense or engineering effort.

The connectors have 0.4mm MiniPLX press-fit pins, so the need for soldering is eliminated. These pins are made from a copper alloy and exhibit contact resistance less than 1mΩ. Each pin has a 3A current carrying capability.

Optional coating of the pins with the company's patented IndiCoat technology mitigates tin whisker build-up to prevent the risk of short circuits and extend operational lifespan.

The multi-row connectors are available in board stacking heights from 7 to 30mm. They can have between one and six rows, with up to 30 contact terminals in each row.

Conforming with automotive performance requirements, they can withstand eight-hour cycling up to 10% RH, 35g shocks for 5 to 10ms across ten axes, and vibrations for eight hour per axis.

Working temperature is -40 to +150˚C.

They can be used in electric vehicles for power steering and ECU functions.

Precise current sensing reduces negative effects

Infineon has added the Xensiv TLE4971 family to its current sensor portfolio for automotive applications.

The 3.3V devices are available in a tison package with an integrated rail and available in four pre-programmed current ranges: 25, 50, 75 and 120A.

With a compact design and sensing, the device is suitable for automotive use cases including on-board chargers (OBCs), high-voltage auxiliary drives and charging applications.

Additionally, the current sensor is also suitable for industrial applications including DC chargers for electric vehicles, industrial drives, servo drives and PV inverters.

The devices offer a precise magnetic current sensing based on proprietary temperature and stress compensation, without the negative effects of magnetic cores caused by hysteresis or saturation effects.

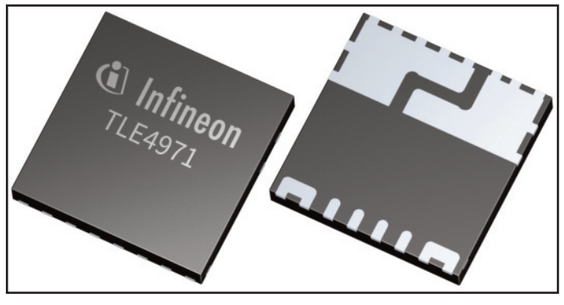
Due to the differential sensing principle, no core or shielding is required to protect against stray fields. In addition, the sensors suit applications using wide-bandgap technology such as gallium nitride (GaN) and silicon carbide (SiC).

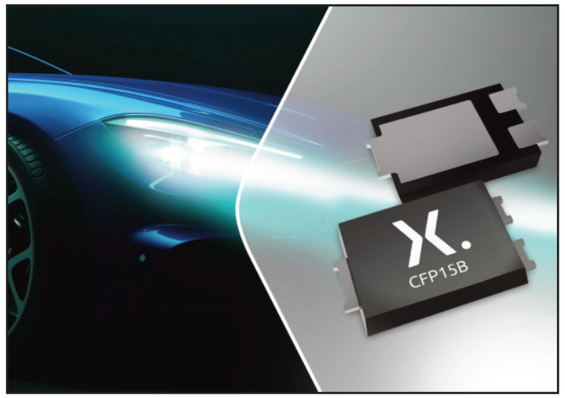
The integrated eeprom lets users customise the sensor's overcurrent detection values and deglitch filters for different use cases.

The small PG-tison-8-5 package allows a compact design. With the minimum insertion resistance of 220$\mu\Omega$ and inductance of less than 1nH, the system losses decrease to enable higher efficiency and accuracy.

Moreover, the package enables high dynamic range, high surge current and thermal performance.

The devices are qualified to AEC-Q100 grade one for applications up to +125˚C and offer improved output accuracy.





CFP diodes meet AEC-Q10

The latest additions to Nexperia's portfolio of clip-bonded flat-power (CFP) packaged diodes for industrial and automotive applications include 32 planar Schottky diodes and eight hyperfast recovery rectifiers housed in the CFP15B package.

They are available as standard and Q-types that meet AEC-Q101.

The operating range for the planar Schottky diodes is between 30 and 100V and 3 and 15A.

Versions optimised for low forward voltage, including the PMEG 100V 080ELPE/-Q, deliver low conduction losses and high efficiency for DC-DC converters and in reverse polarity protection applications.

These diodes are also available in low leakage variants with low reverse current and claimed best-in-class operating temperature capability, providing robustness against thermal runaway.

The eight 200V single-type recovery rectifier devices in the PNE 200xxEPE/-Q series have an average forward current between 4 and 10A and complement the firm's existing dual type recovery rectifiers.

Using the smaller, high-power density CFP15B instead of DPak or SMB/C packages can save up to 60% of board space, while maintaining the same level of electrical performance. This package design enables longer operating times and better board-level reliability.

Its optimised lead form ensures uniform solder joints for improved automated optical inspection. This can benefit adas, EV, LED lighting or ECU applications.

MLVs use soft terminations

Automotive-qualified multilayer varistors (MLVs) from Kyocera AVX are equipped with the company's patented Flexiterm soft termination technology, which has been employed on automotive-qualified multilayer ceramic capacitors (MLCCs) for more than 15 years.

The VCas MLVs are for under-the-bonnet applications such as engine sensors with a direct connection to the battery rail, as well as in automotive audio circuits.

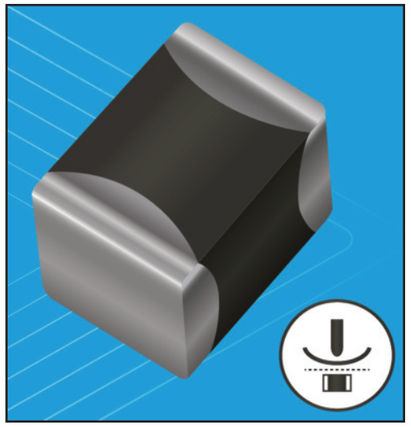
They exhibit high current and energy handling capabilities, fast response times, and multiple ESD strike capabilities, and provide bidirectional overvoltage protection.

They also provide EMI and RFI attenuation in their off state, which can reduce or even eliminate the need for additional EMC capacitors; exhibit lower insertion loss, lower leakage current, and reliability; and are qualified to AEC-Q200 and VW 80808 specifications.

Available in four surface-mount cases sizes from 0603 to 1210, they are rated for five working voltages from 5.6 to 30V DC, five clamping voltages from 18 to 67V, four energy transients spanning 0.1 to 1.5J, and operating temperatures from -55 to +150˚C.

They are also RoHS-compliant.

When subjected to the AEC-Q200 board bend and temperature cycling testing procedures, they withstood up to 5mm of flexure versus 2mm for MLVs with standard terminations over 3000 temperature cycles extending up to +150˚C with zero board flex failures and no significant changes to their electrical characteristics, which exceeds the 1000 cycles at up to +125˚C AEC-Q200 testing requirement.



This performance makes the series suitable for use in the signal and power lines of automotive, aerospace and IoT applications subject to hazards including significant temperature variations, vibration, wave soldering, forced cooling, improper handling, insertion and removal of PCBs from connectors, and high-density board configurations, all of which can result in board expansion, contraction, flexure and cracking, and the depanelisation of components mounted near the edges of the PCB, near flex zones, and near large, heavy components.

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