VEHICLE electronics

The monthly magazine for automotive electronics engineers

Continental fined €100m for role in diesel scandal



Continental has been fined €100m for a negligent breach of supervisory duties connected with the supply of ECUs and software by its former Vitesco powertrain business.

The fine relates to the use of illegal defeat devices in diesel engines to cheat emissions tests.

The public prosecutor's office in Hannover issued the fine, which consists of a €5m penalty portion and a €95m levy of economic benefits.

This is about the activities of Continental's former powertrain division, which was spun off to form Vitesco Technologies in 2021.

Continental will not be appealing the decision, saying it is in the company's interests the fine proceedings have been brought to an end.

Continental has been cooperating with the public prosecutor, including sharing the results of its own investigation with the authorities.

The company has strengthened compliance, created an independent executive board function for integrity and law, and expanded its technical compliance system.

This was taken into account in Continental's favour when calculating the fine.

Olaf Schick holds the executive board position for integrity and law. He said: "It is important and in our own interests that we draw a line under the fine proceedings. We have made the topic of integrity our top priority, creating a new organisational structure and mandating intensive training for our employees. We are committed to this process and will continue to invest in the integrity of the company."

The fine will not lead to any significant additional impact on earnings in fiscal 2024 thanks to a provision set aside for this purpose in previous years.

Vitesco Technologies is generally obligated to indemnify Continental against the ensuing costs and liabilities.

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Etas and Blackberry ink SDV agreement

Etas and Blackberry QNX have agreed to sell and market jointly software for safety-critical functions on software-defined vehicles (SDVs).

This streamlined reselling deal extends the existing long-running technical partnership between the companies.

It will provide pre-integrated software leveraging Etas RTA-VRTE middleware, based on Autosar Adaptive, and the QNX operating system to provide a safe foundation for developing microprocessor-based vehicle computer and domain controller ECUs.

This includes Etas' automotive firewall and host-based intrusion detection technology so automakers and their suppliers can implement continuous security monitoring in compliance with UN-R 155 and ISO/SAE 21434.

The software from Etas and Blackberry provides a base for data management, communication, task execution, safety, security and flexibility.

"This collaboration continues the journey that we undertook five years ago to create the leading microprocessor-based automotive software integration supporting the Autosar Adaptive standard," said Mariella Mintolo, executive vice president at Etas. "Partnerships like ours with Blackberry QNX are pivotal, reshaping the industry's economic framework, and facilitating the adoption of emerging technologies."

Grant Courville, Blackberry vice president, added: "Optimised software and technology integration backed by trusted and established ecosystem suppliers is critical to the long-term success of connected vehicles."

Car flies with Oxygène



Electronic music pioneer Jean-Michel Jarre became the world's first passenger to take off in KleinVision's flying AirCar in preparation for the Starmus Earth concert running from 12 to 15 May in Bratislava.

AirCar, which received its certificate of airworthiness in 2022, has already logged 130 flight hours and over 520 takeoffs.

"It is like being in a Jules Verne book, but for real," said Jarre after completing two flights in the AirCar at Piestany international airport in Slovakia. "One second you speak to the driver, and next, you are up there in the air – an amazing experience."

Garik Israelian, astrophysicist at the Institute of Astrophysics of the Canary Islands, was co-founder of Starmus with Queen's Brian May, who will also be performing.

"AirCar's addition to Starmus is a fantastic complement to our festival experience," said Israelian. "It mirrors the exhilarating journey we embark on, starting with Jean-Michel and Brian's monumental concert that propels us to new heights, soaring alongside artists and inspiring thinkers like Jane Goodall, and coming back to Earth with the wisdom of astronaut Chris Hadfield once the festival concludes."

AirCar will not only be part of the Starmus opening concert, it will also be showcased at Starmus Camp, which, together with the Stephen Hawking Medal Ceremony and nine Nobelists giving lectures, could turn Bratislava into the world capital of science.

Microchip completes VSI takeover

Microchip has completed the acquisition of South Korea-based VSI, a pioneer in providing high-speed, asymmetric, camera, sensor and display connectivity technologies and products based on the Automotive Serdes Alliance (ASA) open standard for in-vehicle networking (IVN).

The terms of the transaction have not been disclosed.

The market size of automotive radar, camera and lidar modules is expected to more than double between 2022 and 2028 to $27bn in revenue, according to Yole Group. This anticipated growth is driven by the increased adoption of adas, in-cabin monitoring, safety and convenience features, and multi-screen digital cockpits for software-defined vehicles (SDVs).



Acquisition brings products based on ASA

These applications will require more highly asymmetric raw data and video links and higher bandwidths, making current, proprietary serdes-based options no longer adequate, both commercially and technically.

In response to this, the ASA was formed in 2019 and released the first open-standard ASA Motion Link (ASA-ML) specifications.

"This acquisition brings VSI's knowledgeable team, their market traction and ASA-ML technologies and products to Microchip's expansive automotive networking portfolio to better serve the adas megatrend we are focused on," said Mitch Obolsky, senior vice president at Microchip. "As the industry converges around three primary IVN pillars – Ethernet, PCIe and ASA-ML – camera and display connectivity is one of the fastest growing and largest IVN markets. With VSI, Microchip can now offer products that span all three pillars and provide automotive security, microcontrollers, motor control, touch and power management to our customers to enable their SDV architectures."

In addition to being an open standard, ASA-ML brings link layer security and scalability to support 2 to 16Gbit/s line rates. Furthermore, the upcoming specification update will enable ASA-ML to support Ethernet-based architectures.

"Our standards-compliant chipsets are being evaluated by car manufacturers worldwide," said Steve Kang, CEO of VSI. "We recently collaborated with BMW in a proof of concept to showcase ASA-ML and our product readiness. This acquisition brings together two organisations with a shared commitment to advancing technology through innovation."

In March this year, BMW announced it would shift to using standard ASA-ML for upcoming start of productions.

Betamek acquires Sanshin

Automotive electronics manufacturing services (EMS) company Betamek has acquired fellow Malaysian company Sanshin, an established player in the automotive electronics manufacturing sector, for RM13.4m.

Sanshin is known for making car audios and other electronics components, serving markets in Malaysia, Japan, Hong Kong and Thailand.

"This acquisition is a testament to Betamek's strategic vision to lead and innovate within the automotive electronics industry," said Encik Muhammad Fauzi Bin Abd Ghani, executive director of Betamek. "By integrating Sanshin's expertise and market presence with our own, we are setting a new benchmark for excellence and driving forward the evolution of automotive electronics amidst a thriving market. We are enthusiastic about the synergies this milestone will unlock for both companies, and are committed to leveraging these opportunities to deliver enhanced value."

Betamek signed a joint venture with Shenzen Zhonghong Technology in March aimed at advancing adas and smart cockpit products.

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STM extends SiC supply deal with SiCrystal

ST Microelectronics has expanded its existing multi-year, long-term 150mm silicon carbide (SiC) substrate wafers supply agreement with Rohm's SiCrystal subsidiary.

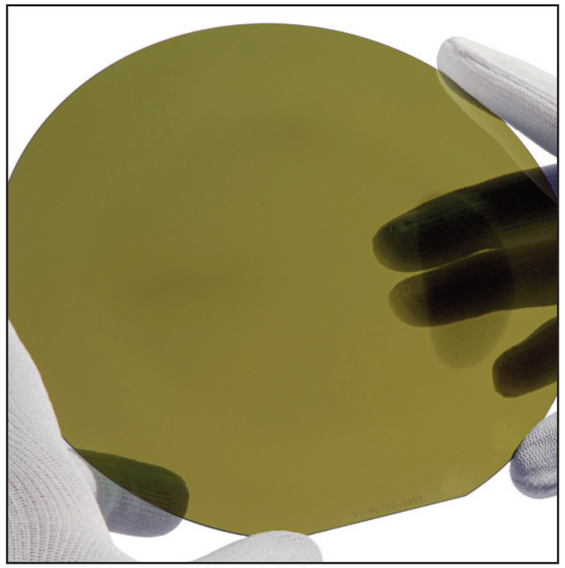
The new multi-year agreement governs the supply of larger volumes of SiC substrate wafers manufactured in Nuremberg, Germany, for a minimum expected value of $230m.

"This expanded agreement with SiCrystal will bring additional volumes of 150mm SiC substrate wafers to support our devices manufacturing capacity ramp-up for automotive and industrial customers worldwide," said Geoff West, chief procurement officer at STM. "It helps strengthen our supply chain resilience for future growth, with a balanced mix of in-house and commercial supply across regions."

Energy-efficient SiC power semiconductors enable electrification in the automotive and industrial sectors in a more sustainable way.

By facilitating more efficient energy generation, distribution and storage, SiC supports the transition to cleaner mobility, lower emissions and greener energy.

"We are very pleased to extend this supply agreement with our longstanding customer STM," said Robert Eckstein, chief executive officer of SiCrystal. "We will continue to support our partner to expand SiC business by ramping up 150mm SiC substrate wafer quantities continuously and by always providing reliable quality.



STM signs 150mm SiC wafer deal with SiCrystal

Renesas restarts power semi production in Kai

Renesas has restarted operations at its Kofu Factory in Kai City, Yamanashi, Japan.

The aim is to boost production capacity of power semiconductors in anticipation of the growing demand for EVs.

The factory previously operated 150 and 200mm wafer fabrication lines, but ceased operations in 2014.

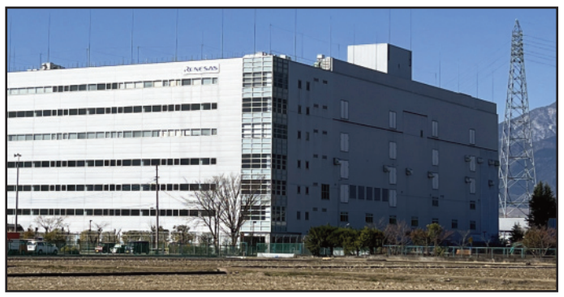
Renesas made the decision to re-open the factory as a 300mm wafer fab to support the growing demand for power semiconductors.

The company invested ¥90bn in 2022 and started operations in April this year.

The factory will start mass production of IGBTs and other products in 2025, doubling Renesas' current production capacity for power semiconductors.

"We are proud to announce a remarkable achievement of the Kofu Factory," said Hidetoshi Shibata, CEO of Renesas. "After its closure in 2014, the Kofu Factory has gone through a transformation and emerged as a dedicated 300mm wafer fab for power semiconductors, exactly a decade later. The power semiconductors produced at the Kofu Factory will help maximise the effective use of electricity, which will be in significant demand as EVs and AI continue to proliferate and advance."

The clean room size is up to 18,000m^2.



Kofu Factory in Kai City



Open-source accelerates transition to software-defined mobility

Elektrobit open-source OS meets functional safety rules

Said to be the world's first open-source operating system (OS) compliant with automotive functional safety standards, EB Corbos Linux for Safety Applications has been announced by Continental subsidiary Elektrobit.

It has received a positive technical assessment for the safety element out of context (SEooC) based on ISO 26262 Asil B and IEC 61508 Sil 2.

Long the norm in other high-tech industries, free open-source software (FOSS) in automotive has until now been limited by strict safety requirements. With EB Corbos Linux for Safety Applications, automotive manufacturers and suppliers can use Linux in safety-related high-performance computing (HPC) functional domains such as applications for adas and autonomous vehicles.

"This is a revolutionary step forward for automotive software," said Mike Robertson, managing director at Elektrobit. "Many in the industry have been striving towards this goal. We are proud to be the first to succeed in elevating software development and maintenance for safety-critical functions to a globally recognised standard."

Technology companies, including Arm and Canonical, are collaborating with Elektrobit to accelerate the transformation towards software-defined mobility.

"The automotive industry is undergoing a massive shift with advanced driver experiences, electrification and autonomy driving a need for more compute, software and AI," said Dipti Vachani, senior VP at Arm.

EB Corbos Linux for Safety Applications is available for project integration worldwide.

Pateo financed to develop domain controllers

Chinese smart car firm Pateo has secured 1.5bn yuan financing, which will be invested in developing intelligent integrated domain controllers and accelerating its full-stack intelligent driving domain controller.

At the same time, it plans to dive deeper into cockpit-driving fusion and a central computing platform (CCP), build an integrated smart manufacturing and supply chain system in the Yangtze River Delta, and make overall planning and arrangements for a future factory.

While completing this equity financing, Pateo also signed a 19bn yuan credit agreement with seven state-owned banks.

Since its establishment, Pateo has invested nearly 2bn yuan in R&D, ranking first in China's intelligent automotive connectivity patents.

The funds raised this time will be mainly used to create automotive intelligent integrated domain control products, including for smart cockpits, autonomous driving, automotive-grade chips, process modules and display screens, as well as conduct full-stack development of intelligent driving domain controllers, and make efforts in cabin-driving fusion and CCP.

"In the second half of the electric vehicle race, intelligence is the core for automakers to create product differentiation, hence the accelerated iteration of automotive product architecture and form," said Shao Jiang, chief analyst at TF Research Institute. "As an intelligence supplier with self-owned core technologies, Pateo is in a period of leapfrog growth."

R&S partners IPG for HiL radar testing



IPG and R&S combined test set-up

Rohde & Schwarz has teamed up with virtual test driving specialist IPG to redefine automotive radar hardware-in-the-loop (HiL) integration testing.

The aim is to reduce the cost by bringing autonomous driving (AD) testing from the proving ground to the development lab.

Combining the CarMaker simulation software from IPG with the R&S AREG800A radar object simulator and QAT100 antenna array provides vehicle manufacturers with the ability to simulate adas and AD scenarios such as those defined by Euro NCap in a controlled, safe, time-efficient and cost-reducing way.

This combination provides automotive OEMs and radar sensor suppliers with a comprehensive radar sensor testing platform. It is applicable for validation and real-time, closed-loop characterisation of radar sensors and enables compliance with Association for ASAM standards.

IPG's CarMaker simulation software is for the development and end-to-end testing of cars and light commercial vehicles at all development stages from MiL and SiL to HiL and ViL.

The open integration and test platform allows vehicle manufacturers, engineering services companies and tier-one suppliers to implement virtual test scenarios in the application areas of powertrain, vehicle dynamic chassis functions, and adas and AD.

Thanks to a high-resolution 3D engine, the simulation of the complete sensor stack is possible in high detail. Seamless integration into existing tool landscapes is also possible with various supported standards and interfaces such as the ASAM open standards.

The AREG800A and QAT100 generate multiple artificial objects, each with independent range, radar cross section (RCS), angle (azimuth and elevation) and radial velocity. The ASAM open simulation interface (OSI) links AREG800A with the CarMaker HiL test automation for realistic driving scenario assessment within radar HiL testing.

Moreover, it includes a scenario editor designed for non-simulation experts. This simplifies the process of testing manoeuvre-based driving scenarios and their associated complex traffic-related configurations, and makes it accessible to a wider range of professionals.

CarMaker features a test manager capable of building and running automated test sequences. It can run tests individually or simultaneously, locally or in the cloud, providing flexibility and scalability. Additionally, it automates the calculation and evaluation of key performance indicators and generates reports automatically, saving time and effort.

CarMaker helps define the configuration of virtual vehicle prototypes. This enhances the realism and accuracy of simulations, making them more useful for testing and development.

Andreas Höfer, chief technology officer at IPG Automotive, said: "With the collaboration between Rohde & Schwarz and IPG, we intend to provide the automotive industry with a comprehensive HiL integration test offering, bringing tests from the proving ground into the lab, resulting in significant time and cost savings in the development process."

• Rohde & Schwarz has inaugurated a facility centre in Bengaluru's Manyata Tech Park in India, housing R&D, system integration, calibration and repair services.

This increases its presence in the third-largest city in India.

"We are proud to expand our presence in Bengaluru," said Andreas Pauly, president of Rohde & Schwarz. "India is not merely a growth market but a vital component of our global strategy. The new facility marks a significant milestone in our journey towards strengthening our position as a trusted partner in India's evolving technological landscape."

KDPOF and Hinge tackle optical communications

Fibre-optic connectivity firm KDPOF is working with Chinese vehicle electronics architecture company Hinge Technology to solve technical problems in the application of optical communications in vehicles.

Hinge is using ICs from KDPOF to design integrated optical modules combined with automotive-grade connectors and optical fibre harnesses to design the electrical and electronic architecture.

"The widespread application of optical communications in automotive production faces challenges, including harsh environmental conditions and tough requirements for low cost and high reliability," said Yang Jun, CTO of Hinge Technology. "Our collaboration with KDPOF, accelerates the industrialisation of vehicle communications system products based on 1 to 50Gbit/s optical communications."

Using KDPOF components, Hinge has developed an optical fibre camera. It can be paired with an optical fibre surround-view host, resulting in a high-speed optical communications 360-degree surround view system or a reverse image system.

The camera uses a 2MP image sensor for data collection, which is processed and transmitted via plastic optical fibre to the controller for image display or processing.

Optical fibre cameras can achieve a stable transmission distance up to 40m and deliver high-definition, real-time images. By comparison, LVDS coaxial cameras have no relay transmission and are limited to 15m.

"At the recent Automotive Ethernet Summit in Shanghai, China, we showed our first joint project: a plastic optical fibre camera by Hinge Technology based on our well-proven KD1053 IC and integrated KD9351 fibre optic transceiver," said Carlos Pardo, CEO of KDPOF.

The EVB9351AUT evaluation board provides a platform for testing the transceivers, designed for the 1000baseRHC phy implementation in automotive optical networks.

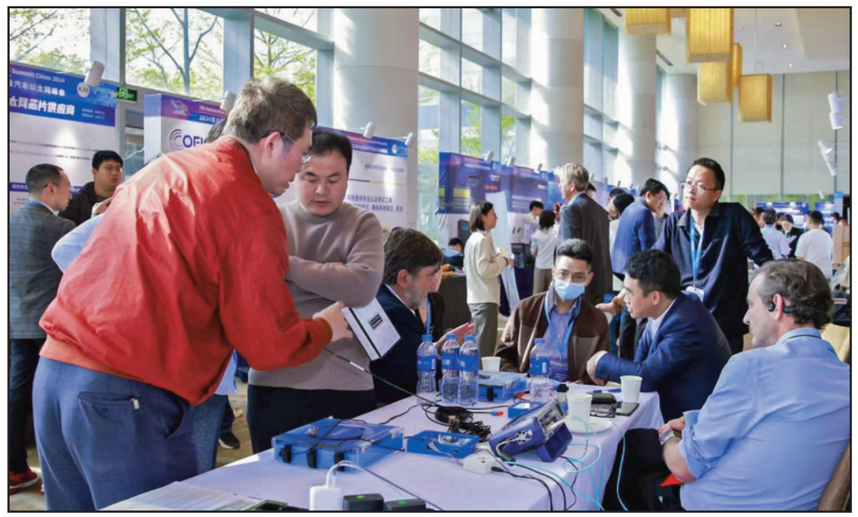
The KD9351, with dimensions of 7 by 8mm in an LGA-36 package, handles the PMD sublayer of the physical layer. The KD1053, at 7 by 7mm in a QFN-56 package, manages the PCS and PMA sublayers as specified by IEEE 802.3bvTM-2017. This supports data rates of 1000 and 100Mbit/s.

Additionally, the board has an SFP slot, letting it serve as a media converter between the optical 1000baseRHC port and various SFP modules.

KDPOF and Hinge plan to extend their partnership to the application of optical communications in battery management systems for EVs. The companies are collaborating on the development and manufacturing of optical modules and SoCs.

They intend to introduce optical-electronic integrated chip packaging technology in regions of China, establishing FAB facilities capable of packaging chips with bandwidths from 1 to 10Gbits.

Hinge conducts functional verification on mass-produced vehicles, including for packet loss rates, signal transmission losses, optical module heat dissipation, optical module and connector path coupling, and connection reliability in various road environments.


Joint demo of high-speed camera at Automotive Ethernet Summit

Polyn monitor for checking vibration data right on tyres

Fabless semiconductor company Polyn Technology has developed VibroSense for tyre monitoring, a neuromorphic front-end (NFE) for pre-processing vibration data locally, right on the tyre.

The application-specific neuromorphic analogue signal processing (NASP) technology and NFE chips are for always-on sensors.

VibroSense uses NASP technology for reliable tyre vibration analysis provided by deep neural networks capable of confidently identifying vibration patterns.

It can be applied to many types of tyres in various monitoring applications.

As tyres are the only parts of the car that directly contact the road, the analysis of in-tyre vibration sensor data determines the road condition for better grip control. VibroSense can inform the car's adas and other systems – such as electronically controlled suspension and anti-lock braking – about ice on the road or a pavement change in a few microseconds, enhancing driving safety.

"The tyre monitoring application of VibroSense has shown high performance, around 95% accuracy, in detecting road conditions," said Eugene Zetserov, Polyn vice president. "VibroSense can be used in many ways, for example, to obtain tyre wear data or indicate wheel imbalance issues, to avoid fuel inefficiency. VibroSense demonstrates how NASP can be applied locally to signal data to efficiently provide real-time critical information to various systems and services."

VibroSense extracts vibration patterns from the sensor's raw signal and passes the data only for classification at the next compute point, saving power consumption for a tyre monitoring system (TMS).

Polyn has built a facility for tyre data collection and is developing a library of vibration data patterns of various tyre types, road surface conditions, pavements, levels of tyre wear, and more.

"Polyn is working with several tyre makers on proofs of concept and with sensor node manufacturers to incorporate VibroSense in new-generation TMS nodes," Zetserov said.



Opening of Heilind distribution centre in Hanau

Heilind opens distribution centre near Frankfurt

Distributor Heilind Electronics has opened a distribution centre in Hanau near Frankfurt, Germany.

Opened in April, the centre aims to support European innovation while expanding its presence in Western Europe, supporting growth in the Dach region, Benelux, Italy and France.

Hanau is a major logistics hub in Europe. The distribution centre spans 8000m^2, including a value-add centre and offices.

This surface area allows for increased storage capacity, accommodating more inventory to meet demand fluctuations.

The facility offers value-added distribution services including kitting, re-reeling, special packaging and connector assembly.

"We always aim to be close to our customers so we can provide an even higher level of service," said Grzegorz Łyszczarz, managing director of Heilind Electronics in Europe. "Germany has always been a pivotal market for us, and in the past five years we started expanding our presence in the country by opening additional local offices. Despite geopolitical uncertainties affecting the market, our growth has led us to establish a new distribution centre here in Hanau."

Stefan Barrig, sales director of Heilind, added: "Since establishing our presence in Poland in 2019 and expanding into central and south-east Europe with the launch of our distribution centre in Mysłowice in 2022, we have seen tremendous growth."

Applied Intuition helps create automated parking

Applied Intuition is helping engineers develop, test and deploy machine-learning-based or classical automated parking systems (APSs) up to 12 times faster with improved safety and reliability.

APS lets vehicles self-park, increasing safety and comfort for drivers, but they are traditionally difficult to develop. Automotive OEMs and tier-one suppliers face numerous difficulties when developing APS, including diverse operational design domains (ODDs), unpredictable vehicle and pedestrian movement in parking lots, and nonlinear vehicle dynamics.



Applied Intuition speeds automated parking development

Furthermore, the need for highly accurate 360-degree sensor and perception coverage often demands machine learning (ML) techniques such as birds-eye-view perception or occupancy networks.

Applied Intuition's automated parking development offering addresses the key problems of engineering an APS, enabling adas and AD development teams to enhance safety and reliability while reducing time to market.

Pre-constructed ODD taxonomies, test suites and maps let development teams customise simulations to their programme needs.

The 360-degree sensing and perception testing with multi-sensor software- and hardware-in-the-loop simulation models APS sensors such as ultrasonics and fisheye cameras.

Data mining and curation optimises data-driven AI and ML development by rapidly assembling training datasets that target specific model weaknesses.

Synthetic parking datasets train ML-based perception, targeting specific edge cases and data gaps identified in model testing and dataset curation.

Realistic simulated vehicle dynamics and behaviour accurately model low-velocity and high-steering-angle vehicle behaviour in unstructured parking lots, enabling the testing of all planners and training of ML-based planners.

Cloud orchestration ensures simulation tests can be executed at scale across an ODD.

These capabilities enable adas and AD development teams to develop safe and efficient APS up to twelve times faster, reduce cloud simulation costs by up to 70%, and improve the performance of ML-based perception on target edge cases by up to three times.

"Safe and reliable APS can have a huge impact on driving comfort and convenience," said Peter Ludwig, CTO of Applied Intuition. "Automated parking should be a smooth everyday experience, but it's hard to get right and most existing systems don't work well outside the dealer lot demo. Applied Intuition is empowering OEMs and tier-one suppliers to develop next-generation APSs that work outstandingly well anywhere a vehicle can park and offer the best possible experience for drivers and passengers."

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Marelli lights up China with domain controller

Marelli has developed in China an automotive lighting domain control unit platform that can control vehicles' front lights, rear lights and 360° lighting features.

In the future, even more lighting algorithms could be integrated.

Whether it is internal combustion engine or electric vehicles, the automotive lighting control system remains key for enhancing vehicle safety and improving the driving experience.

To meet the evolution of electronic and electrical architectures, Marelli is advancing vehicle lighting control system architecture with this approach.

The mass production of Marelli's light domain controller has been introduced and proved in China's electric vehicles market.

On the end node side, Marelli has introduced the MCU Less intelligent driver concept, enabling the opportunity to centralise the whole lighting software into domain ECUs, supporting the automotive industry's trend towards software-defined vehicles (SDVs).

As lighting functions become increasingly independent from dedicated ECUs, the software-as-a-product (SaaP) concept has reinforced the core role of software in the entire lighting system.

Marelli's approach supports OTA (over-the-air) updates and continuous deployment of features for automotive lighting software, after the vehicle is in production.

Marelli's portfolio includes control units for automotive lighting, ranging from basic lighting controllers that meet distributed power supply systems, to centralised Can communication controllers that support adaptive matrix headlamps, to high-definition rendering controllers represented by micro-LED and digital micromirror device technologies.



Marelli automotive lighting domain control unit

In China, Marelli has built a complete R&D, design and production system. On the production side, it has devoted production facilities for ECUs for lighting in Guangzhou and Wuhu.

On the R&D side, the company has centres in Shanghai and Wuhu to support the development of lighting control units for Chinese and global markets, while collaborating and sharing design resources with design centres in Europe.

Apollo acquires Panasonic Automotive

Asset management company Apollo has bought a majority stake in Panasonic Automotive for ¥311bn. Panasonic will retain a minority stake.

Panasonic Automotive is a tier-one automotive supplier that designs and manufactures infotainment systems and other in-vehicle products for car makers. The company has a long track record of technological and manufacturing innovation and benefits from strong market positions across its core segments.

"We are excited to partner with Panasonic Automotive to position the business for accelerated growth," said Tetsuji Okamoto, lead partner in Japan for Apollo. "This transaction builds on our proven track record of being a strategic partner to Japan's leading conglomerates and leverages our strong sector and operational expertise. We have enormous respect for Panasonic Automotive's reputation for quality and innovation and look forward to working with the company's talented team to unlock its full potential."

Masashi Nagayasu, CEO of Panasonic Automotive, added: "Panasonic Automotive has automotive knowledge and insight, strong customer relationships and great talent. Panasonic Automotive has the potential to win through this once-in-a-century transformational period. We aim to become a top global player in the automotive electronics industry by providing added value to cars and the mobility experience with our customers."

The transaction is expected to be completed early next year

embeddedworld
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WORLD VIEW

Steve Rogerson reports from Embedded World in Nuremberg, Germany

NXP puts boxes into processors

Rather than putting processors into boxes, NXP is putting boxes into processors. That was how automotive marketing director Brian Carlson summed up the S32N55 processor, the first in the S32N family of what NXP calls vehicle super-integration processors.

As the heart of the recently announced S32 CoreRide central compute offering (see p33), it provides scalable combinations of safe, real-time and applications processing for automakers' central compute needs.

The processor can handle safe, centralised, real-time vehicle control that demands high-performance, deterministic compute supporting high levels of functional safety. Through software-defined hardware-enforced isolation, it can host dozens of vehicle functions with different levels of criticality, while providing freedom from interference between them.

"We are putting lots of different functions into the processor," said Carlson. "We give each vehicle process its own resources, and these are totally isolated in that they can't interfere with anything else."

Vehicle propulsion, vehicle dynamics, chassis control, body and other core vehicle functions have been implemented as discrete ECUs, each with their own microcontroller and wiring. Vehicle functions can now be consolidated into an S32N55 processor with multiple isolation execution environments to break through software-defined vehicle (SDV) integration barriers.



Brian Carlson: "It can keep reconfiguring itself."

This super-integration capability allows automakers to reduce ECU hardware costs significantly. Decreased material and reduced weight also contribute to sustainability and extended driving range. Ultimately, fewer ECUs and significantly less wiring result in lower manufacturing complexity and time for car makers.

"It is very flexible," said Carlson. "Each OEM does things differently. You can dynamically change it every boot time to do different functions. It can keep reconfiguring itself. And it is about partitioning."

With the core-to-pin hardware isolation and virtualisation technologies, its resources can be dynamically partitioned to adapt over time to be used optimally to meet evolving vehicle function needs.

Vehicle functions can be independently managed, including fault handling and reset. They can receive independent software updates with safe, granular over-the-air upgradeability, which is a crucial capability for SDVs to enhance their functionality over time.

The processor integrates 16 split-lock Arm Cortex-R52 cores running at 1.2GHz for real-time compute. The cores can operate in split or lockstep mode to support different functional safety levels up to ISO 26262 Asil D. Two auxiliary pairs of lockstep Cortex-M7 cores support system and communication management.

Tightly-coupled integrated memory and 48Mbyte of sram speed execution with low latency. A firewalled hardware security engine provides a root of trust for secure boot, security services and key management.

Memory can be expanded with dram, flash and NAND or NOR flash interfaces. Functional safety and security are supported with memory error correction and inline cryptography.

An integrated time-sensitive networking (TSN) 2.5Gbit/s Ethernet switch, a Can hub for internal routing of 24 Can-FD buses, four Can XL interfaces and a PCI Express generation-four interface help reduce wiring costs.

It is complemented with NXP's power management and vehicle networking devices as the S32 CoreRide platform's central vehicle controller to accelerate user designs. The FS04 safe system power management IC, which was co-architected to support Asil-D functional safety, combined with PF53 scalable core supply for platform design, provides efficient power conversion, supports low power modes and handles power sequencing.

"There will be further processors with more capabilities for application as well as machine learning," said Carlson. "The first one is about real-time processing."



Gerard Vink: "We are pretty convinced that Risc-V will take off in automotive."

Tasking sees Risc-V nearly ready to challenge Arm

Tasking introduced a compiler toolset for Risc-V, which it believes will seriously challenge Arm architectures in automotive in the next five to ten years.

The VX-Toolset ISO 26262 and ISO/SAE 21434 compliant compiler facilitates the development of automotive embedded software that meets functional safety and cyber-security requirements.

"This is the first certified to ISO 26262," said Florian Süßmair, Tasking's product marketing director. "It is important for us to support the ecosystem for Risc-V. Risc-V will have a big effect on automotive for cost and performance."

However, he said it could take five to ten years before Risc-V started to replace Arm architectures in automotive.

"At the moment, it is in an evaluation phase," he said. "It is not in production for automotive."

Gerard Vink, an industry specialist at Tasking, added: "At the moment, there are a lot of IP suppliers for Risc-V, and most of them are small companies. Automotive OEMs want a stable supply chain, so until you get the big companies involved, it won't happen in automotive."

Tasking is working with Synopsys on a virtual development kit.

"Now we are seeing Synopsys supporting Risc-V, this means silicon vendors such as NXP, Infineon and Renesas can go to trusted partners for Risc-V. Infineon has announced it will go with Risc-V for automotive."

The automotive industry has witnessed a steady increase in the use of semiconductor technology. In response to the growing demand for resilience within the semiconductor ecosystem, the industry is increasingly turning to open standards such as Risc-V.

"We are pretty convinced that Risc-V will take off in automotive," said Vink. "First in the rather low-end devices we will see Arm cores replaced by Risc-V. In the long term, we will see the high-performance devices go to Risc-V. Renesas and NXP are both working with Risc-V, though NXP has not publicly announced it is supporting Risc-V in automotive."

He said Tasking was working with several SoC vendors on Risc-V.

With this shift comes the necessity for certified compiler toolsets for Risc-V that adhere to ISO 26262 for functional safety and ISO/SAE 21434 for cyber security.

Addressing this, the VX-Toolset for Risc-V is complemented by Tasking's BlueBox system-level analysis, verification and debug tools. This provides the functionality required to build the automotive software stack for Risc-V.

Green Hills demonstrates STM and Infineon collaborations

Green Hills Software, ST Microelectronics and Porsche software specialist Cetitec are working together to deliver an integrated and configurable communications platform for use in zonal controllers for the centralised EE vehicle architecture in software-defined vehicles (SDVs).

This consists of Green Hills' μ-Velosity real-time operating system, STM's Stellar integration MCU platform, and Cetitec's networking stacks, gateways and routing frameworks.

The zonal controllers demonstration at the show illustrated the adaptability of SDV architectures with μ-Velosity adding a layer of security on top of the hardware-optimised real-time traffic rerouting.

"We want to show how it can react to a dynamic situation," said Benjamin Mot, Green Hills technical business development engineer.

Green Hills is also collaborating with Infineon on an integrated microcontroller-based processing platform for safety-critical real-time automotive systems. The platform combines μ-Velosity with Infineon's Aurix TC4x safety controllers.



Benjamin Mot: "We offer full platform support."

The Embedded World demonstration showed how OEMs and tier-one suppliers can have a reliable, safe and secure processing platform to develop domain and zonal controllers as well as drivetrains for electric vehicles for their SDV architectures.

"We are offering full platform support," said Mot.

Featured technologies in the demonstration included the Multi integrated development environment, safety-certified optimising compilers, C/C++ run-time libraries, and μ-Velosity running on the Infineon TriCore Aurix TC4x.

In the demonstration, μ-Velosity integrates with Infineon's low-level driver library and the lightweight TCP/IP stack. This provides a prototype platform for zonal controllers that collects data from various sensors and forwards them to a central computer.

"Sensors detect changes and feed that back over Ethernet," said Mot. "We do the sensor fusion. So you get raw sensor data and the fused data."

This checks for input consistency using redundant sensor data in real time and provides uniform data to the central compute.

Eclipse seeks more members for SDV group

The Eclipse Foundation hopes one of the communication protocols it is developing for software-defined vehicles (SDVs) will be in a road car as early as next year.

But, according to its SDV programme manager Sara Gallian, it is too early to name a date for its open-source software; in the short-term it wants more car makers to join the more than forty members working on the project.



Sara Gallian

The SDV working group was set up around two years ago to provide a forum for individuals and organisations to build and promote open-source software to create a scalable, modular open-sourced vehicle software platform.

"We know that automotive is very competitive," said Gallian, "but we want to enable collaboration."

By creating an open-source base, the hope is this will save car makers and suppliers development time and cost, leaving them to focus on adding differentiating software.

"There is a lot of room for collaboration," she said.

The group is working on 27 projects, 17 of which have code. There are 43 members including car makers General Motors, Volkswagen and Mercedes-Benz.

"We expect in the short term other OEMs to join," said Gallian.

Gowin FPGAs target booming EV market

Decade old FPGA-maker Gowin believes its Chinese HQ positions it well to take advantage of the country's booming electric vehicle segment.

"We didn't want to be just another Silicon Valley company," said CEO Jason Zhu, who is based in Silicon Valley. "China is the biggest FPGA market, which is why we have our headquarters there."

The company, which hopes to launch an IPO next year, employs around 300 people worldwide.

The company uses TSMC as its manufacturing partner, which it chose because of its AEC qualification.

"Around five years ago, we started to look at what would be the next big market, and that is the smart car," said Zhu. "But as well as the smart car, we are seeing the growth in the electric car, and a lot of Chinese car makers are starting to do EVs."

He said traditional Chinese car makers were chasing those in Germany and Japan and knew they would never get to the Toyota and BMW level.

"'But now it is EVs, and Chinese companies have lowered the cost very aggressively," said Zhu. "With this has come adas and smart cockpits. We saw a big opportunity here. Gowin's automotive-qualified parts can really help this EV market. In most Chinese EVs there are Gowin semiconductors."

More than three million automotive devices shipped demonstrates the success of this move.

Gowin has collaborated with SoC makers such as MediaTek and Unisoc. It products are enabling advances in adas and autonomous vehicle technology, processing signals from automotive sensors such as cameras, radar and lidar.

Gowin is using this base to target European, North American, Japanese and Taiwanese markets.

"We can help car makers anywhere catch up," said Zhu. "Our current customer base is the Chinese car market, but we want to expand for car makers globally."

Gowin is already working with Toyota on developing an application and is now looking at Europe to work with tier-one suppliers and car makers.

Zhu said traditional car makers were very conservative but not with the new EV makers who started from nowhere.

"These were new companies that developed their EVs very aggressively," he said. "They were like smartphone makers with new models every year. This was a golden opportunity for FPGAs. We have FPGAs off the shelf that are already AEC qualified."

Arora V, Gowin's latest automotive FPGA, uses TSMC 22nm low-power technology.

Focused on supporting high-speed data transfer through serdes transceiver technology, Arora V, the company hopes, could challenge the dominance of traditional FPGA players.



Jason Zhu: "This was a golden opportunity for FPGAs."

LDRA makes software certification easier

LDRA introduced a way to simplify the analysis and management of software certification activities and artefacts.

Called LDRAVault, it can improve the management of certification efforts by automatically aggregating reports and results from the LDRA tool suite across a certification project team and throughout the lifecycle of the project, including code reviews, code coverage analysis and unit testing.



Jim McElroy: "The complexity of a vehicle is coming down to software."

LDRAVault generates visualisations of verification results and trends, and automatically maintains project snapshots and user-defined milestones. The visualisations help project and engineering management make informed decisions to optimise costs and time to market.

"Most of our customers need to prove they adhere to a particular standard," said Jim McElroy, LDRA vice president. "We help them demonstrate their compliance, saving time and money."

In the embedded market, there are increasing demands for transparency and visibility in software development and verification workflows, particularly in the evolving certification and regulatory landscape. Aggregating and analysing verification data from disparate teams has historically been difficult as developers aim to improve overall organisational software quality through process improvement.

LDRAVault's automatic aggregation of information supports these processes with instant, up-to-date access to all software quality analysis and verification results from multiple projects and team members.

"The complexity of a vehicle is coming down to software," said McElroy. "Whether infotainment or body electronics, the software is remaking the vehicle. So you need more effective methods to certify and validate the software development."

LDRAVault relies on the capabilities of the firm's tool suite, including static and dynamic analysis, unit and system testing, and reports, to generate visualisations such as heat maps and trend graphs that users can drill into to discover and address the root cause of potential critical software problems.

Trend graphs also convey how the organisation progresses in its verification and validation activities throughout the development lifecycle.

LDRA also launched domain-specific software productivity packages for its tool suite. These packages replace the cost and complexity of running different traceability, software analysis and compliance reporting points with a streamlined workflow for functional safety and security standards.

"What we have done is aggregate the capabilities in our tool suite to address key industries," said McElroy. "For example, we have a package for automotive, one for rail transport and so on."

The packages offer capabilities ranging from static and dynamic analysis with unit and integration testing to complete compliance reporting for specific industry standards and assurance levels.

Functional safety and security are fundamental to each of the productivity packages and include capabilities such as coding standards compliance, security assessments, automatic test case generation, execution, artefact generation and compliance reporting. These productivity packages also offer add-in products to address the unique demands of each of the industries, applications and required integrations.

"Each package is similar but has specific elements for that industry," said McElroy. "So the automotive one, for example, will have information on ISO 26262."



Tetsuo Higashi: "They can achieve brilliant high-grade graphics."

Nuvoton expands graphics use

Nuvoton is expanding the use of its Gerda graphics processors and announced a multi-sensing bridge IC that should be sampling next year.

The Gerda graphics processor was developed for HMI applications handling inputs from in-car cameras and is now being used for head-up displays and for large displays on two-wheelers.

"We initially started supplying this for electric rear-view mirrors and side mirrors," said Tetsuo Higashi, assistant chief of Nuvoton's marketing department. "Japanese OEMs are using this as well as some Korean and Chinese OEMs. It has a compact design with embedded ram."

There are three ICs in the range, all in a QFP package to make them easier to use in PCB designs. The main difference is in the size of ram from 3.5 to 10Mbyte. They are based on either an Arm Cortex M7 or M33 processor.

"They can achieve brilliant high-grade graphics," said Higashi. "There is a strong demand for security, so we have cybersecurity and functional-safety support."

As well as head-up displays on cars, they are now also finding applications in larger displays for two-wheel vehicles.

"Electric motorbikes have bigger batteries than ever," said Higashi. "These types of displays are mostly attracting younger customers."

Under development is the multi-sensing bridge IC, which should be sampling in 2025.

"This is a unique IC," said Higashi. "It can aggregate image sensors and a microphone."

Automotive applications include in-cabin sensing and surround-view.

Adlink shows edge AI for autonomous driving

Adlink was showing its edge AI computing products for autonomous driving and adas applications.

Youssef Azizi, Adlink's product sales manager, said the company was using these for design and manufacturing projects for some customers looking at levels three to five autonomous driving.

One such product is the ADM-SR70 heterogenous computing platform that uses an Intel Sapphire Rapids CPU and Infineon TC397 safety MCU. It supports eight Can-FD channels.

"This intelligent box performs AI computing and carries out sensor fusion," said Azizi. "It is really powerful and needs liquid cooling. We are selling to system integrators working on autonomous shuttle buses."

The box is already in shuttle buses for testing but has not yet been deployed.

"We have some start-ups that are using it, and they are working with tier-one suppliers," said Azizi.

For those that only need the AI computing element, the ADM-AL30 uses an Intel 12th-generation Core i9 or i7 CPU and a Nvidia RTX 4000 SFF.

"It has all the automotive connections and is for those who don't need sensor fusion," said Azizi.

For commercial cars, Adlink has also developed controllers for smart cockpits, such as the ADM-Q95. This contains a Qualcomm SA8295P SoC.

"This started as a customer project and is now a standard product," said Azizi.



Youssef Azizi: "It is really powerful."

embeddedworld Exhibition&Conference

Direct Insight pushes Microsys SoM for vehicle developers

Systems integrator Direct Insight hopes automotive developers can benefit from the modules it has available following a partnership it signed earlier this year with German system-on-module (SoM) maker Microsys.

While Direct Insight managing director David Pashley acknowledges that the NXP S32G-based module will not go directly in a vehicle, it can be valuable in the development process.

"It turns out that a lot want to start with a module," said Pashley. "They may have a small project or they want to work with safety-certified products based on the processor."

The Miriac MPX-S32G399A was developed for the control of smart vehicle networks and comes with up to eight Arm Cortex-A53 and up to four Cortex-M7 dual-core lockstep complexes for real-time applications.

It has functional safety hardware and software for Asil-D systems.

"People can find developing with a processor too complex, so they will use a SoM," said Pashley. "There is a huge amount of lower tier vendors around automotive. A lot are providing middleware. They want to test their products and use this SoM."

As well as automotive, there is interest from those developing safety-critical railway systems and other transportation applications.

Stefan Brendjes, account manager at Microsys, said the S32G399A was initially used by BMW to provide the safety-relevant parts in its autonomous vehicle development. The dual-core lockstep adds a safety layer to ensure the car is safe to drive.

"The S32G399A has built-in lockstep," said Brendjes. "The target is level-four vehicles without a driver. That is why you need such safety features."

He said NXP asked Microsys to find other uses for the platform, including in industrial markets.

"So we put it on a SoM," he said.



Stefan Brendjes (left) and David Pashley



SENSORS



MAIN ATTRACTION

Stephen Bradshaw, Christian Nau and Enda Nicholl explore the magnet design for giant magnetoresistance multi-turn position sensors

True power-on multi-turn sensors based on giant magnetoresistance (GMR) sensing technology are set to revolutionise the position sensing market in both industrial and automotive use cases due to reduced system complexity and maintenance requirements.

There are though factors that must be considered when designing a magnetic system to ensure reliable operation even in the most demanding applications. Magnetic reference designs are available for early adoption of the technology.

Multi-turn sensing technology has applications in robotics, encoders and steer-by-wire systems.

The multi-turn sensor is essentially a magnetic write and electronic read memory combined with a conventional magnetic angle sensor to provide a highly accurate absolute position. The magnetic write process requires the incident magnetic field to be maintained with a specific operating window.

Magnetic write errors may occur if the magnetic field is either too high or too low.

It is essential to design the system magnet carefully and to consider any stray magnetic fields that might interfere with the sensor as well as mechanical tolerances over the life of the product.

Small stray magnetic fields could cause an error in the measured angle while larger stray magnetic fields could cause a magnetic write error leading to a gross turn count error.

Goals

A careful understanding of the system requirements is necessary to design the optimum magnet and shielding. Generally, the looser the system requirements, the larger and more expensive the magnet option required to achieve the target specifications.

Magnetic reference designs address various mechanical, stray field and temperature requirements that can be adopted by users of a true power-on multi-turn sensor.

The first design developed covers systems with relatively loose tolerances: sensor to magnet placement of 2.45mm ±1mm, total displacement of the sensor to the axis of rotation of ±0.6mm, operating temperature of -40 to +150˚C, and stray magnetic field shield attenuation of greater than 90%.

Considerations

When designing the magnet, there are some considerations to take into account and the following provides a high-level view of the main aspects to consider when designing for the GMR sensor.

Material

The GMR sensor operates in a defined magnetic window of 16 to 31mT; in addition, the maximum and minimum operating range has a thermal coefficient (TC) as can be seen by the red traces in Fig. 1.

Selecting a magnet material with a TC that matches that of the GMR sensor will increase the allowed variation of the operating magnetic field. This allows for greater variation in the strength of the magnet and/or the placement tolerance of the magnet with respect to the sensor.

Low-cost magnetic materials such as ferrites have a much higher TC than the GMR sensor, which would limit the operating temperature range compared with materials such as samarium-cobalt (SmCo) or neodymium-iron-boron (NeFeB).

Understanding the TC of the chosen magnetic material as well as the variation in the magnetic field strength due to manufacturing variations allows the required magnetic field strength at room temperature (25˚C) to be determined. Design simulations may then be carried out at room temperature with a high degree of confidence that the system will operate as expected over the full temperature range.

In Fig. 1, the solid green traces represent a window of the magnetic field strength that the magnet should be designed to

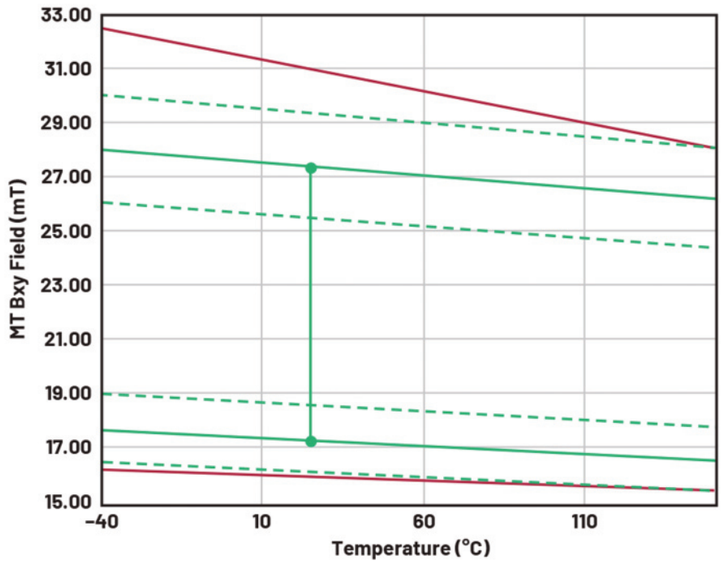


Fig. 1: Thermal coefficient comparison of the operating window versus a typical SmCo magnet

produce over the active area of the GMR sensor. This window is reduced from the maximum and minimum operating window of the GMR sensor due to variations in the manufacturing process of the magnetic material.

The green dotted lines show the maximum and minimum expected magnetic field due to a typical manufacturing variation of more than five per cent.

Simulation

The simulation of the magnet within the mechanical operating environment can take different forms. There are two types of simulation commonly used to design the magnet: an analytic simulation or finite element analysis (FEA).

The analytic simulation solves the magnetic field using the bulk parameters of the magnet being simulated (size, material) without considering the surroundings other than the assumption it is operating in air. This is a quick calculation and useful when there are no adjacent ferromagnetic materials.

FEA can model the effects of ferrous material in a larger magnetic system, which is essential when combining the magnet with a stray magnetic field shield or ferromagnetic materials close to the magnet or sensor. FEA is a time-consuming process, so usually a starting point for this would be a basic magnet design from an analytical analysis.

FEA was used in the simulation of the reference design for the magnet and stray field shield.

Design

The reference design magnet resulting from the simulation consists of a SmCo magnet with an integrated steel stray field shield, as shown in Fig. 2.

The magnet is designed to be injection moulded so it is capable of being mass produced. Injection moulding of SmCo magnets is common due to the ability for it to produce complex shapes and it is used widely in automotive and industrial applications.

The assembly is designed to be an interference fit with a 9mm diameter shaft; however, modifications to the bushing are possible to allow attachment to shafts of different sizes.

Characterisation

Careful characterisation of the magnet assemblies has been carried out to demonstrate the robust magnetic option for the GMR sensor. The key to characterisation is the ability to perform detailed maps of the magnetic field strength across an extended magnet to sensor placement window in a control environment.

Key to the success of characterisation is a good understanding and calibration of the magnetic field probes used.

Fig. 3 shows an example of the measured field strength at different air gaps. Repeating these measurements across the full operating temperature range and air gap range is time consuming but is essential to understanding the performance of the magnet to ensure it operates under the required conditions.



Fig. 2: Reference design magnet

Conclusion

In summary, the reference design magnet has been shown to meet the requirement for operation with a temperature of -40 to +150˚C, with an air gap of 2.45mm ±1mm, and an axial to sensor placement tolerance ±0.6mm.

An integrated true power-on multi-turn position sensor can reduce system design complexity and effort significantly, ultimately resulting in smaller, lighter and lower cost products.

The reference design will let designers with and without magnetic design capability add new and improved functionality to current applications and open the door to many new applications.



Stephen Bradshaw is product applications engineer,



Christian Nau product applications manager and



Enda Nicholl strategic marketing manager, all with Analog Devices

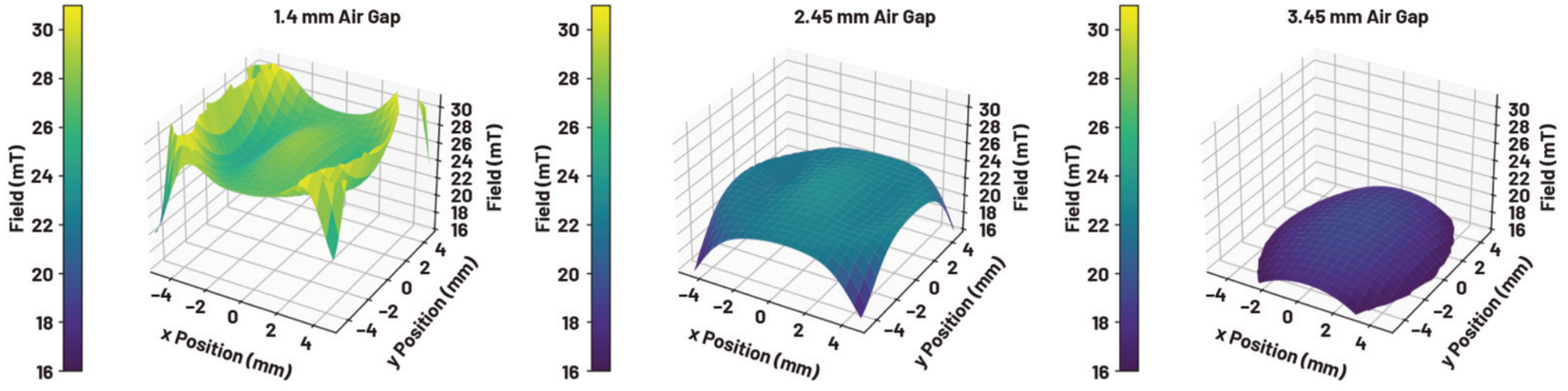
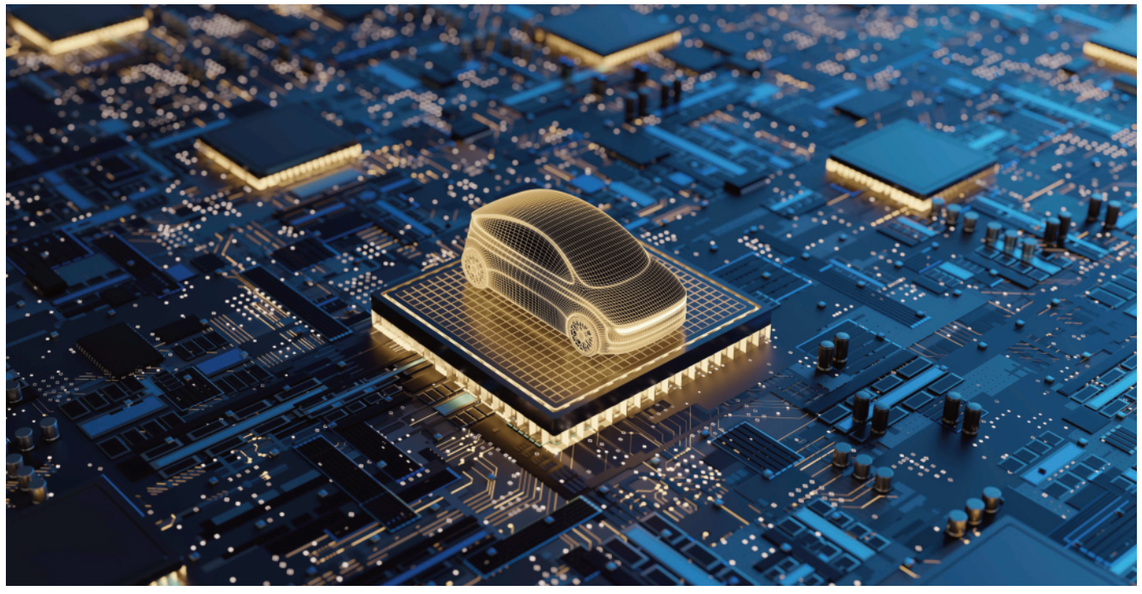


Fig. 3: Magnetic field distributions with air gaps of 1.4, 2.45 and 3.45mm



REDUCING OBSOLESCENCE

Ross Turnbull shows how asics can reduce obsolescence risks for automotive OEMs

With thousands of parts per car model expected to become obsolete each year, obsolescence presents a huge challenge for automotive manufacturers. But what makes obsolescence so threatening to the car manufacturing sector, and how can it be avoided?

For many purchasing and procurement professionals, obsolescence is a source of concern. Receiving notification of a product becoming obsolete will often raise multiple questions: What next? Is an alternative available? How will this affect the production line?

And it seems some sectors are more prone to obsolescence issues than others. The automotive industry, for example, is one that is increasingly struggling with the challenges of obsolescence. In fact, consultancy Oliver Wyman estimates that some 3000 parts per car model are expected to become obsolete every year. To understand why this is the case, dig deeper into the factors behind component obsolescence.

Understand

Obsolescence usually occurs as a result of the technology or functionality becoming out of date, a drop in market demand, lack of compliancy with new regulations, or a combination of these factors.

In automotive technology, the unprecedented rate of development is a huge driver for the former. Cars are smarter than ever. Where vehicles were once entirely mechanical, now there is increasing digitalisation throughout.

This includes lane and hazard detection systems, automatic parking and even completely autonomous driving, all a result of more advanced electronics. The caveat is the faster these developments occur, the quicker components become obsolete, potentially much earlier than initially forecast.

Consultancy Roland Berger estimates that some 62 per cent of the automotive market relies on older, more specialised chips. And as chip manufacturers are moving to more advanced technologies, there's less availability of these older components for OEMs. As a result, manufacturers are having to spend more time dealing with supply-chain problems and sourcing suitable chip replacements.

Another factor is the sheer number of components used in the automotive industry. Estimates put the number of chips per vehicle anywhere between 1000 and 3000. And with the continuing transition to electric vehicles, these figures are only set to grow. Evidently, manufacturers must seek strategies to manage obsolescence concerns if they're to keep up with a dynamic, evolving market. The question is how this can be done.

Manage

Often obsolescence is managed reactively, after the process or component has been deemed obsolete. But the problem with reactive management strategies is it leaves little room for error, and potentially a big hole in the manufacturer's pocket.

Finding an alternative source can be tricky. Any replacement chips must be verified before use in the application. And there's often significant redesign work required to ensure the product is compatible with the substitute device. Even if a suitable chip is found that doesn't require any product design changes, it's unlikely to have the same performance or functionality as the original IC.

Sourcing the right supplier can be just as difficult. There's always the concern that a third-party supplier can't deliver components to the quality demanded by the application. Their supply chain must also be questioned. It's no good to shift production to a new chip if the replacement is also expected to go obsolete.

Proactive

To reduce these issues, it's preferable to take a proactive approach to obsolescence. In part, this comes through enhanced supply chain management and transparency, as well as more accurate business forecasting.

It can also be achieved through the design of the chip itself. An asic is a bespoke chip that has been designed uniquely for custom requirements. As a result, the asic can be optimised down to the finest detail, offering improved performance, functionality and power consumption compared with off-the-shelf options.

Besides performance enhancements, the asic route offers benefits to those wishing to avoid obsolescence concerns. Commonly, chip obsolescence occurs due to two factors: either the silicon process or the packaging becoming obsolete.

An asic designer is always working proactively to avoid these. While sourcing packaging alternatives is relatively simple, silicon obsolescence requires a little more pre-planning. Typically, this is done at the earliest stage possible, where the asic supplier will select a silicon process and foundry with the required maturity and longevity to match the product's lifespan.

In the unlikely event the silicon process still becomes obsolete, the asic supplier should provide at least a years' notice, offering ample time for something suitable to be found. The ideal resolution is individual to the customer and its application.

For short-term production, for example, a one-off purchase of fully packaged parts may be suitable for the quickly changing demands of automotive electronics.

The IC design can also be ported onto a new silicon process, or the asic designer and user can embark on a completely new design altogether. Regardless of the route taken, this decision-making process must be taken collaboratively to ensure it works for the user and the product.

Expertise

For manufacturers in the automotive sector, there's a strong case to be made for working with IC designers with the same industry experience. Finding an asic designer already knowledgeable about an application means they can often provide additional insight, whether it's meeting industry regulations or keeping up to date with the latest trends.

Conclusion

As cars become more complex, the number of automotive electronic components increases. And, as a direct result, it seems obsolescence is set to become an even more pressing issue. But by taking a proactive management approach, developing custom electronics and working with suppliers, manufacturers can reduce the risk of obsolescence, even in the most demanding sectors.



Ross Turnbull is director of product engineering at Swindon Silicon Systems

EMISSIONS



GAS TASKS

Mike Torbitt asks if hydrogen can solve HGVs' emission problem and explains the role of resistors in making this shift

Heavy goods vehicles (HGVs) make up just one per cent of fleet vehicles, but produce a quarter of global road emissions, according to World Economic Forum data. While decarbonising HGVs poses challenges, it's a step that automakers must make to reduce emissions and meet global sustainability targets.

HGVs keep the world running, with DHL research showing that, globally, road freight is the second most common method of transporting goods. Usage continues to grow, with road freight volume forecast to exceed 30 billion tonne-kilometres (tkm) by 2050.

However, one of the world's most important industries is one of its least sustainable, as HGVs are the transport sector's worst polluter. Many nations are attempting to tackle this issue, with the EU aiming for a 90 per cent reduction in HGV emissions by 2040 and the USA recently announcing its first national goal for a zero-emission freight sector.

Despite this, around 96 per cent of new trucks being made in the EU are diesel powered. So why are HGVs so difficult to decarbonise?

A key problem is that, as the name suggests, HGVs are heavier than cars, and therefore require more power to carry loads. Additionally, HGV journeys are typically longer than those of other vehicles.

Standard electric vehicle (EV) battery capacity may be insufficient for HGVs, making regular charging crucial. At the same time, limited charging infrastructure further reduces the feasibility of battery-powered HGVs.

Hydrogen

An increasingly popular alternative is hydrogen-powered fuel cell electric vehicles (FCEVs). Much like battery electric vehicles (BEVs), FCEVs provide a cleaner alternative to diesel HGV engines.

However, rather than being equipped with rechargeable batteries, FCEVs generate power using proton exchange membrane fuel cells. As hydrogen and oxygen react to produce an electrical current, the only by-products of the process are heat and water, meaning FCEVs do not emit greenhouse gases.

The absence of a rechargeable battery solves the problem of limited charging infrastructure, as FCEVs are refuelled by filling the vehicle's tank with hydrogen. This means hydrogen fuel pumps can be added to pre-existing filling stations on common HGV routes, as is being rolled out across Germany.

Convenient refuelling that enables HGVs to undertake long journeys could make FCEVs a viable alternative to diesel engines.

Energy efficient

As hydrogen fuel cells become more common, the industry must look to increase their operating efficiency.

Fuel cell studies demonstrate that power output becomes unstable if FCEVs accelerate for prolonged amounts of time, as they cannot work under heavy loads for extended periods. Given the weight of HGVs, this fluctuation could reduce engine reliability.

Fortunately, automakers can combat instability by fitting cells with higher capacity than the vehicle requires. This means if power output decreases, HGVs still have the required amount of power available.

However, when excess energy is created, it is important to dissipate this energy safely to improve the HGV's lifespan. This can be done by fitting fuel cells with a dynamic braking resistor (DBR) to disperse the surplus as heat.

Such DBRs can be particularly suitable for fuel cell HGV applications. They can be water cooled, meaning they do not rely on heavy fans as is the case with air-cooled DBRs, and therefore are only 15 per cent of the standard DBR weight.

Consequently, the units are light enough that a number can be combined at once, allowing them to handle power of up to 125kW. This makes them useful for HGVs' high continuous power requirements.

In the aim to meet global sustainability targets, it is never too early to consider hydrogen-powered engines. The DBR-enabled use of hydrogen cells could safely and effectively fuel HGVs' net zero transition.



Mike Torbitt is managing director of Cressall

Switch detects conductive targets

Contactless, magnet-free and stray-field immune, a monolithic switch from Melexis directly detects conductive targets.

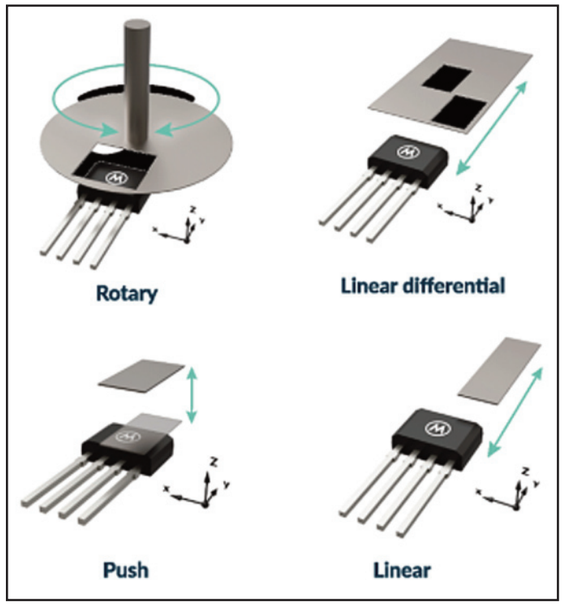
The Induxis MLX-92442 switch enables small module designs with reduced component count for improved safety and electrification in high voltage interlocks, charging flaps, seatbelt, bonnet and boot, gear tooth sensing, or brake-by-wire applications.

The technology actively senses the actual safety target, such as a seat belt buckle or door latch, directly without a magnet or button actuator, provided it is conductive.

With no moving mechanisms or additional parts, reliability and safety are enhanced with the direct sensing operation not tied to parts affixed to the safety element that could become damaged or displaced. It helps reduce costs and the inductive contactless operation is inherently more reliable than mechanical options that wear over time, as well as being immune to magnetic disturbance.

The design integrates the coils and interface within the chip, removing the need for engineers to develop bulky PCBs and coils for their application.

It is available in through-hole VK packaging or surface-mount soic packaging. In either case, the supporting BoM is reduced from three to two elements and this, combined with the foregoing magnets, helps produce a more sustainable and safer design.



Also included are reverse supply voltage, under-voltage and thermal protection, as well as an integrated self-diagnostic function with a dedicated safe mode.

Factory and end-of-line programming are supported, and the smart switch and latch operation is established by simply defining the applications' shape and motion. Magnetic simulation is not necessary, saving development time.

In terms of assembly design, the standard packaging and lack of magnets plus holder allows for simpler integration. It streamlines the supply chain, with fewer elements helping reduce prototyping and production assembly time. This also helps maintain mechanical tolerances in assemblies, as only the inductive sensor and conductive safety element need to be considered within air gaps up to 1.5mm.

Features include standard two- or three-wire interfaces, operating voltage of 3.5 to 18V, working temperature of -40 to +150°C and ISO 26262 Asil A compliance.

It is in pre-production with engineering B samples and evaluation kits available.



MLCCs for OBC

A CLLC-resonant MLCC (multi-layer ceramic capacitor) from Samsung provides 22nF at 1kV for on-board chargers (OBCs) in EVs.

Production is already underway, with samples available on request.

Due to the electrification and high functionality of modern cars, the number of MLCCs in a vehicle is climbing rapidly. Trends influencing specific characteristics include requirements for miniaturisation, high voltage, stability and higher capacitance.

It comes in a 1210 3.2 by 2.5mm form factor.

The OBC converts AC to DC, adjusting DC output accordingly to suit the battery, while providing power factor correction for shaping the input current to the power supply.

Ceramic MLCCs rather than plastic film capacitors are the preferred choice for distributed capacitance because of their ability to withstand high temperatures.

The Class 1 C0G MLCC operates from -55 to +125°C and meets the full requirements of EV charging systems.

Thermistors handle active charge and discharge

Inrush current limiting positive temperature coefficient (PTC) thermistors from Vishay are designed to increase performance in active charge and discharge circuits for automotive and industrial applications.

The PTCEL series devices combine 60Ω to 1kΩ resistances at +25°C (R25) with high voltage and energy handling capabilities.

They enable maximum voltages of 1kV DC at 500Ω and 1.2kV DC at 1kΩ, and maximum energy handling to 240J.

By combining multiple thermistors in parallel, energy absorption levels over 1kJ can be achieved. With their temperature operation to +105°C, they offer a heat capacity to 2.3J/K for all resistance values.

AEC-Q200 qualified and self-protecting, with no risk of over-heating, the thermistors provide overload protection in AC-DC and DC-DC converters; load dump, DC-link, battery management and emergency discharge circuits; on-board chargers; home energy storage systems; motor drives; and welding equipment.

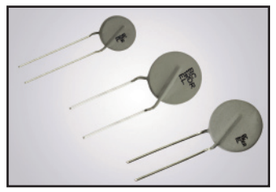
For these applications, the devices can withstand more than 100,000 inrush-power cycles and are resilient against non-switching peak power up to 25kW.

There are two sizes: the smaller PTCEL13R and larger PTCEL17 for low and high energy applications, respectively.

All devices are available in tape-on-reel packaging and offer a leadwire pitch of 5mm. In addition, the PTCEL17R is available with leadwire pitches of 7.5 and 10mm to accommodate higher voltages and can be automatically handled by pick-and-place equipment for lower placement costs.

The barium titanate thermistors consist of a ceramic pellet soldered between two tinned CCS wires and coated with a UL94 V-0 compliant high temperature silicone lacquer.

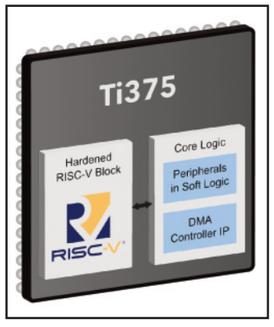
The RoHS-compliant devices are C-UL-US recognised under E148885 for AC and DC use, providing an increased and controlled safety level. Spice and 3D models for both sizes are available.



FPGAs drive vehicle applications

FPGAs from Efinix have been designed for the automotive industry to drive the long-term design and development of electronic applications inside and outside vehicles.

The line, now automotive qualified, and Efinix's Efinity tool suite that has achieved ISO 26262 certification extend the company's capabilities for automotive manufacturers.



The FPGAs include the Titanium Ti375.

Made in a 16nm process node, it delivers performance and efficiency through lower power and high compute in small packages ranging from 35,000 to one million logic elements. The devices are AEC-Q100 grade-one qualified.

Also included are the Trion T13 and T20, which provide 13,000 and 20,000 logic elements, respectively. These two FPGAs are AEC-Q100 grade-two qualified.

Target electronics in vehicles include sensors, cameras, including AI algorithms, in-cabin displays and infotainment. They are already being used by manufacturers of lidar units, camera monitoring systems that replace rear-view mirrors, and display controllers.

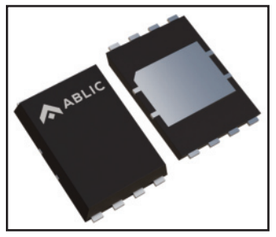
The architecture delivers critical security for automotive applications with encryption to protect configurations from theft and alterations, and authentication, which results in future proof designs through trusted configurations and over-the-air updates.

Supporting the FPGAs is the Efinity tool suite, which is ISO 26262 certified, and supports designs up to Asil D.

Step-up switching regulator controllers operate from 3V

Automotive step-up switching regulator controllers from Ablic have a 3V operation voltage.

The S-19990/9 devices are 36V step-up switching regulator controllers that can secure operating voltage from 3V, making these ICs suitable for constructing backup power supply step-up circuits.



Oscillation frequency is 400kHz or 2.2MHz.

A spread spectrum clock generation circuit enables reduction of the conduction noise and emission noise emitted by the step-up circuit.

These IC can also continue operation at a typical current consumption of 60μA during switching off, while still maintaining response characteristics. These features let them support increasing safety requirements while continuing to decrease the voltage of backup capacitors and batteries, and achieving downsizing, lower costs, lower noise, lower standby current and high-speed response.

A built-in voltage feedback resistance circuit cuts off the voltage feedback resistance circuit current path during sleep mode.

This makes it possible to reduce standby current more than the S-19990 external voltage feedback resistance circuit.

The series is PPAP capable and planned for compliance with AEC-Q100 grade one.

Because this is a high withstand voltage product with an input voltage of 36V and a rating of 45V, it can be directly connected to 12V auxiliary batteries.

It comes in an HSNT-8(2030) package with leads outside the package to allow for easier mounting, higher strength and automatic visual inspection after mounting. It is also available in a gull-wing type HTMSOP-8 package.

Platform aids software-defined vehicle development

NXP has introduced the S32 CoreRide platform for developing software-defined vehicles (SDVs).

The software platform simplifies complex vehicle architecture development and can cuts costs for automakers and tier-one suppliers.

The platform brings together the firm's S32 compute, networking, system power management and ready-to-deploy software from its software partner ecosystem.

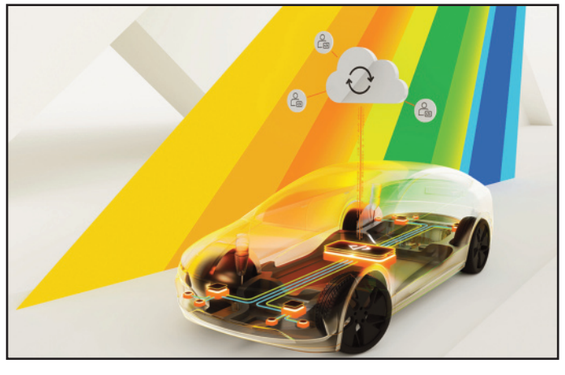
At Embedded World, the company also unveiled its first S32 CoreRide product for central compute based on the S32N family of vehicle super-integration processors (see p15).

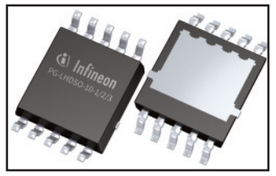
The platform can overcome the software and hardware integration problems blocking fast adoption of SDVs. Automakers have struggled to move functions from the traditional multi-ECU to zoned or centralised processing due to software and architectural inconsistencies.

This platform integrates NXP's hardware portfolio with software from automotive experts.

Leveraging the scalable S32 compute in S32 CoreRide, OEMs can consolidate ECUs and develop flexible architectures, from domain to zonal to centralised, that scale across vehicle classes and generations.

The platform provides the ability to isolate vehicle functions, helping ensure freedom from interference between each application and dynamically re-allocate resources so applications do not degrade in performance as they evolve over time.





Top-side cooling

The SSO10T TSC top-side cooling package from Infineon for power mosfets improves efficiency for automotive applications.

With its direct top-side cooling concept, the package eliminates heat transfer into or through the PCB of the ECU. The package enables a simple and compact double-sided PCB design and reduces cooling requirements and costs for power designs.

It suits applications such as electric power steering (EPS), EMB, power distribution, brushless DC drives (BLDC), safety switches, reverse battery and DC-DC converters.

The 5 by 7mm footprint is based on the standard SSO8, a 5 by 6mm housing. However, due to its top-side cooling, the SSO10 TSC offers 20 to 50 per cent higher performance than the standard SSO8, depending on the thermal interface material and thickness.

The package is Jedec listed and provides second-source compatibility.

Protocol decoder incorporates Can

The Tektronix Can XL protocol decoder helps engineers incorporate the latest generation of Can communications.

With the ability to decode signals representing data packets transmitted using Can XL frames, the decoder runs on 4, 5, 6 series MS scopes and offers error detection, analysis and debugging of timing and protocol headers.



Can XL allows mixed message types – Ethernet tunneling and traditional signal-based Can – at data rates of 20Mbit/s. These transmission types and rates are needed to handle increasing sensor data, enabling adas and paving the way for software-defined vehicles.

Support for the Can XL frame structure is included in the SRAuto automotive bus decode and analysis software package available for the 4, 5 and 6 series MSOs. Those who already have the SRAuto package can update it adding the ability to decode Can XL data packets, not only displaying normal data but indicating CRC errors, missing ACKs and XL form errors.

The package includes the ability to trigger on Can XL start and end of frame, as well as search through acquired signals to find specific Can XL packets.

The package also decodes Can and Can-FD decoding, supporting mixed mode networks. The presentation of decoded packets is possible in both a waveform view and in a formatted, time-stamped table.

In-vehicle computer relies on AI

An in-vehicle computer from Aaeon uses artificial intelligence (AI) and is powered by the Nvidia Jetson AGX Orin module.

The Boxer-8645AI is rugged for in-vehicle deployments, and harnesses image-processing tech.

It pairs with the NileCam25 full-HD global shutter GMSL2 colour camera from E-Con Systems, giving higher quality image acquisition with which to unleash the AI on the Jetson AGX Orin.

With eight GMSL2 interfaces via Fakra connectors, it suits high-speed video transmission over long distances.



Inferencing accuracy is increased thanks to the high frame rate, low-latency and synchronised multi-camera streaming from the NileCam25.

In-vehicle deployment suitability is bolstered by its E-Mark certification, nine-axis sensor and GNSS support.

The system has a 9 to 36V power input range with ignition delay on-off function.

LED driver controls brightness and colour

An automotive-compliant, three-channel, linear LED driver from Diodes provides independent controls for brightness and colour.

Human-centric automotive design is driving the demand for multi-channel LED drivers, which allow vehicle occupants to change interior lighting colours to match their mood. By simultaneously enabling animated turning-indicator signals and exterior grill lighting for different road conditions, these drivers can help increase safety levels.

The AL1783Q driver has LED current settings by an external ref pin, independent dimming controls for each channel, and PWM to perform LED dimming.

It is suitable for multiple interior and exterior lighting applications in electric and internal combustion engine vehicles.

The automotive industry is trending towards using higher voltage rails to power vehicle subsystems and this has seen battery voltages increasing from 12 and 24V to 48V. In response to this, the AL1783Q has been designed to operate from a 55V rail. This lets it support increasing LED chain voltages.

It delivers up to 66% more current per channel (250mA compared with a standard 150mA), enabling flexibility to support higher LED current ranges in a wider range of lighting applications. The current in each of the three channels can be set using individual resistors.

AEC-Q100 qualified, it comes in a thermally efficient tssop-16EP package (5.1 by 6.6mm) with an exposed cooling pad for heat dissipation.

Fault detection features include undervoltage lockout and overvoltage protection.





Transceiver enables light and sensor networks

A mixed-signal transceiver from Inova is for automotive Iseled light and sensor (ILaS) networks.

The INLT220Q IC establishes a daisy-chain connection with 2Mbit/s and low latency over several metres of simple UTP cable.

The device allows the building of centrally controlled automotive Iseled LED networks with sensors and actuators. A vehicle wide ILaS network can have up to 4079 individual addressable nodes.

It uses a packed, switched communication protocol. A node can be an INLT220Q configured as a branch or client device, for example Iseled smart LEDs or simple sensor subsystems connected via UTP cables.

By providing two cable interfaces (ISP and ESP) and an interface for Iseled components (chip to chip, CSP), the transceiver IC provides flexibility for the creation of branched networks.

Three additional GPIOs can be used to control buttons and switches as well as actuators such as vibration motors for haptic feedback.

The integrated buck controller allows a direct power supply from the battery.

A temperature sensor and A-D converter monitor the device's operating voltage and ambient temperature.

OTP memory is integrated so users can store product information and network addresses. Even if individual components fail, the remaining network devices can still be controlled without adjusting the addressing table in the software.

The device will be AEC-Q100 qualified and operates from -40 to +105°C. It comes in a 5 by 5 by 0.8mm wet QFN-20 package with a 0.65mm pitch.

DC motor pre-driver simplifies EMI optimisation

An automotive gate driver from ST Microelectronics provides an SPI port for programming and diagnostics, a charge pump, protective features, and two additional current-sense amplifiers for system monitoring.

Containing two high-side and two low-side drivers, the L99H92 can control a single H-bridge powering one bidirectional DC motor or two half bridges for two unidirectional motors.

Typical applications include electric sunroof, window lift, powered boot, sliding doors and seat-belt pre-tensioners.

The charge pump powers the high-side drivers to maintain correct operation as the vehicle battery voltage fluctuates, enabling the outputs to function with a supply as low as 5.4V. The charge-pump output is also available at an external pin to control a mosfet for reverse-battery protection.

The gate-driving current is programmed through the SPI port, allowing slew-rate control to reduce electromagnetic emissions and thermal dissipation. Programming the current saves up to four external discrete components per mosfet, typically needed for slew-rate setting with conventional drivers.

The maximum drive current of 170mA gives designers flexibility to use the driver with a wide variety of external mosfets, including high-power devices with large gate capacitance.

There is overcurrent protection with a programmable threshold, detected by monitoring the mosfet drain current. Cross-conduction protection with programmable dead time ensures safety and efficiency.

Additional protection includes overtemperature early warning and shutdown, overvoltage and undervoltage protection on analogue and digital power supply inputs, and open-load and output short-circuit detection in off-state diagnostic mode.

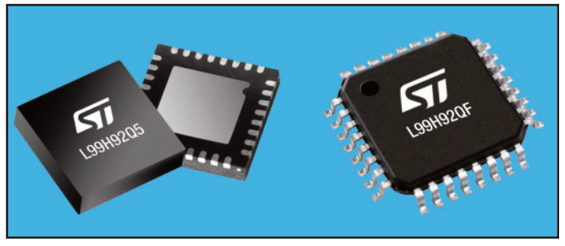
A fail-safe input can turn off all mosfets instantaneously and a dedicated diagnostic pin provides immediate fault warning without waiting for periodic SPI transfers.

Two current-sense amplifiers are integrated for system-status monitoring, helping reduce costs.

Suitable for high-side, low-side and inline sensing, the amplifiers have independently programmable gain, low offset and low thermal drift.

They can be independently disabled to reduce current consumption when unused.

It is in production now and packaged as a TQFP32 or QFN32 with wettable flanks to facilitate inspection.



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