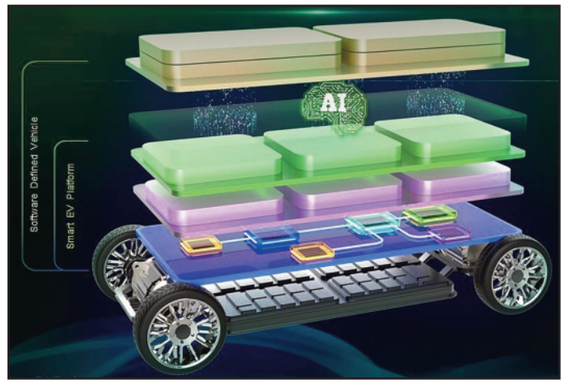
VEHICLE electronics

The monthly magazine for automotive electronics engineers

Foxconn and Elektrobit partner on AI for SDVs

Electronics manufacturer Foxconn has signed a development agreement with Continental subsidiary Elektrobit to produce flexible and AI-centric software to support the rapid transformation to software-defined vehicles (SDVs).



Elektrobit and Foxconn plan smart EV platform

Elektrobit and Foxconn (Hon Hai Technology) intend to create a smart EV platform called EV.OS, including hardware and software, to develop smart automotive systems that reduce complexity and cost, and scale production.

The smart EV platform will include the EV.EEA reference EE architecture, a non-differentiating EV operating system and an EV application.

When completed, EV.OS and EV.EEA will form the backbone of a future-ready SDV platform, enabled by Elektrobit's software platform integration capabilities. It will support multiple high-performance and real-time ECUs and enable service-oriented architectures across all functional domains, including a semantic vehicle API for third-party applications.

Development will be supported by an efficient CI, CT and CD toolchain and a level-three virtualised environment.

"Elektrobit has a unique value proposition in automotive embedded software development with regards to both development of our own software products, and integration and homologation of large-scale automotive series projects," said Maria Anhalt, CEO of Elektrobit. "Our collaboration with Foxconn is another milestone in the evolution of software-defined vehicles.

"By combining Elektrobit's automotive software expertise with Foxconn's manufacturing and hardware innovation, we are creating a scalable platform that reduces complexity, shortens development cycles and supports future mobility business models."

Issue 139
July 2025

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Cyient partners Mips to optimise asics and ASSPs

Custom silicon company Cyient Semiconductors is working with Mips, a specialist in Risc-V processor IP, to develop domain-optimised asic and ASSP products for automotive, industrial and data centre markets.

These will leverage the Mips Atlas portfolio of processor IP. The partnership will focus on enabling real-time, safety-critical applications, power delivery and compute efficiency.

Motor control and data centre power delivery are focal platforms to leverage Cyient's analogue mixed signal capabilities and Mips Atlas CPU IP.

"As compute systems scale from cloud to the edge, intelligent power delivery is emerging as a key enabler of performance and efficiency," said Suman Narayan, CEO of Cyient Semiconductors. "Our collaboration with Mips allows us to bring together embedded intelligence and advanced power architectures in custom silicon platforms built on a scalable, open foundation. Together, we are designing tomorrow's semiconductors, purpose-built for a more connected and power-efficient world."

Demand for software-defined vehicles, data centre infrastructure and industrial automation is driving growth for custom silicon. Users can build differentiated products that are easy to programme using Mips processor IP, based on the open Risc-V instruction set architecture, combined with Cyient intelligent power and mixed-signal design expertise.

"The problem of power efficiency and motor control are both real-time compute workloads for which Mips M8500 microcontrollers are the optimal choice," said Sameer Wasson, CEO of Mips. "Building around our best-in-class real-time and control-loop performance and efficiency, Cyient can bring their unique capability in intelligent power delivery into custom asic and ASSP designs to build differentiated products that meet our customers' needs."

Targeted applications include motor drive control, intelligent power management, power delivery management and safety-critical applications, offered as ASSP or asic platforms. OEMs and system integrators should benefit from faster time to market, avoiding proprietary lock-ins, and optimised platform cost.

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QNX and Vector MoU provides SDV foundation

QNX and Vector have signed a memorandum of understanding to launch a foundational vehicle software platform to streamline software-defined vehicle (SDV) development.

The platform combines Vector's safe middleware technology with QNX's safety-certified operating system.

As part of an existing integration between QNX and TTTech Auto, the platform can also be extended to include MotionWise Schedule, TTTech Auto's deterministic, time-triggered scheduling algorithm, providing more flexibility and choice in the scheduling of platform components and applications.

The platform is built to serve as a lightweight, reliable and optimised core for application development and deployment across electronic control units (ECUs) in modern vehicles.

Designed with performance, safety and ease of use at its core, the platform should help OEMs reduce duplicative software development and rework, enabling them to focus on delivering differentiated in-vehicle experiences while accelerating the journey from research to production and onto roads.

At the same time, this initiative embodies a transformation from the traditional automotive value chain to a dynamic value network, fostering open collaboration models and aligning with industry standards to ensure long-term ecosystem compatibility.



Matthias Traub (left) and John Wall

"The automotive industry is at a tipping point, where software complexity threatens to outpace innovation," said John Wall, chief operating officer at QNX. "By joining forces with Vector, we're delivering a foundational platform that seeks to remove significant friction from the development process and empower OEMs to focus on what truly matters – creating transformative driving experiences for their customers. This is about building smarter, safer vehicles, faster."

An early-access version of the platform will be made available to selected partners later this year, enabling early prototyping, integration and feedback. A certified release is planned for the end of 2026, meeting ISO 26262 Asil-D and ISO 21434 cyber-security standards.

"This collaboration marks a significant milestone in our mission to advance the frontier of automotive software engineering," said Matthias Traub, managing director at Vector. "With QNX, we are co-developing a foundational platform that delivers best-in-class performance, combining openness, safety and scalability. It empowers the entire ecosystem from OEMs to developers to build the next generation of intelligent vehicles."

An early demo was seen at June's Automobil-Elektronik Kongress in Ludwigsburg.

Quintauris and Segger collaborate on Risc-V

Segger and Quintauris are collaborating to develop products and technology for the open-source Risc-V ecosystem.

The partnership focuses on developing hardware and enabling mass deployment of Risc-V products and technology in the automotive, health, IoT and high-performance computer markets.

Quintauris is working to bridge Risc-V innovations and commercial products and specify reference architectures.

Segger is providing debug and tracing support and tools, such as its J-Link and J-Trace debug probes, SystemView real-time recording and visualisation tool, and Embedded Studio IDE. It will also contribute to the technical aspects of setting up a reference Risc-V platform for the automotive industry.

Quintauris was founded in 2023 by Bosch, Infineon, Nordic Semi, NXP, ST Microelectronics and Qualcomm.

OpenGMSL Association to transform high-speed links

OEMs, tier-one suppliers, semiconductor manufacturers and others have formed the OpenGMSL Association to transform serdes transmission of video or high-speed data as an open, worldwide standard across the automotive ecosystem.

Initial members include Analog Devices, Aptiv, Coilcraft, Core Microelectronics, Denso, Ethernovia, Geely, GlobalFoundries, Granite River Labs, Indie Semiconductor, Keysight Technologies, Hyundai Mobis, Murata, Noffz Technologies, Omnivision, Qualcomm, Rohde & Schwarz, Rosenberger, Teledyne LeCroy, TDK, TZ Electronic Systems and Würth Elektronik.

With an open standard for video and high-speed data transmission based on GMSL (gigabit multimedia serial link) technology, adoption could reshape autonomous driving, adas and infotainment applications

Adas vision systems rely heavily on quality video data to make critical, real-time decisions that improve driver safety and reduce accidents.

Meanwhile, touchscreen infotainment systems demand high-speed, low-latency connectivity to deliver seamless, immersive user experiences.

These factors are driving up development costs for new vehicles, complicating integration, stifling innovation and slowing advancements in safety.

Participation in a worldwide standard allows for innovation in autonomous driving, adas and infotainment, among other applications. OEMs and suppliers can thereby accelerate time to market using technologies that operate efficiently together, thus lowering operational costs.

The OpenGMSL standard is based on Analog Devices' GMSL tech.

"With over a billion GMSL ICs shipped and adoption by more than 25 global OEMs and 50 tier-one suppliers, GMSL is one of the most mature and road-proven high-speed video link technologies in the automotive industry," said Paul Fernando, president of the association.



Harman display brings consumer quality to Tata

The new Tata Harrier EV will be the first vehicle to integrate Samsung's proprietary Neo QLED technology in a display that is said to bring true consumer-tech level viewing experiences to the car.

Made by Samsung-subsidiary Harman, the display has vivid colours and striking contrast that bring home-theatre quality visuals into the vehicle with enhanced brightness, intelligent algorithms and sleek design.

"We've brought together Samsung's cutting-edge consumer display innovation and Harman's deep automotive expertise to create something truly unique: a first-of-its-kind, in-vehicle visual experience that brings living room TV-level brilliance to the road," said Shilpa Dely, vice president at Harman. "We have finally closed the gap between consumer and automotive display technology, and we're proud to debut this global breakthrough with our trusted partners at Tata Motors."

The 37cm floating display is engineered to deliver home-theatre-level visual brilliance under all lighting conditions.

The cadmium-free quantum dot display with intelligent blue mini-LED control delivers 1200-nit peak brightness, perfect black levels and a wide 95% NTSC colour gamut for lifelike images.

Proprietary real-time visual control algorithms dynamically manage image output to reduce power consumption.

A slim design with bezels under 5mm offers a refined, immersive viewing experience built to automotive durability and safety standards.

There is a long relationship between Harman and Tata, which began with the JBL-branded audio systems in Tata vehicles across India. With the Harrier EV, the partnership expands to include branded displays



Harman Neo QLED in Tata Harrier EV



Anritsu demonstrates NTN technology

Anritsu demonstrates 3GPP tech with BMW

Anritsu was a test and measurement partner in two demos of 3GPP Rel-17 compliant non-terrestrial network (NTN) technology at the 5GAA's meetings in Paris.

These demos provided the first of their kind measurements showing the readiness of the technology and ecosystem to improve automotive safety.

In one of the collaborations with BMW, Deutsche Telekom, Viasat and Skylo, Anritsu contributed to measurements of end-to-end NTN key performance indicators (KPI). The joint effort focused on measuring NTN KPIs to demonstrate the feasibility and effectiveness of use cases such as local hazard warning and emergency messaging.

In separate collaborations with LG Electronics, Cubic3, Viasat and Skylo, the joint effort focused on measuring NTN KPIs to demonstrate the capability to support use cases such as voice over NTN and switching between terrestrial and non-terrestrial networks.

During the use case testing, Anritsu and partners showed that end-to-end latency and reliability over NTN were proven with independent measurement systems. This was achieved through measurements using the physical Network Master Pro MT1000A and virtual testers from Anritsu, integrated into the live demos to connect and measure between car and application server.

These use cases highlight the critical role NTN can play in support of improving road safety.

By leveraging NTN technology, telecom networks can deliver timely and targeted alerts to drivers, pedestrians and others even when out of cellular range, helping reduce accidents and improving response times in emergency situations.

Singtel partnership scales vehicle IoT connectivity

A partnership between Singapore telco Singtel, FloLive and Lenovo is helping automotive OEMs build connected vehicles equipped with built-in internet access for navigation, safety updates, entertainment and autonomous driving.

The partners are providing reliable, secure and scalable IoT connectivity.

This integration combines Singtel's global IoT network, Lenovo's device connectivity expertise, and FloLive's global network and multi-IMSI SIM technology, streamlining enterprise operations, reducing time to market and ensuring consistent service delivery across borders.

It also helps automotive OEMs enhance or build features to improve the driving experience of their customers.

The global connected car market is projected to exceed $250bn by 2030, with Asia-Pacific among the fastest-growing regions. China is poised to remain the global leader in EV adoption, according to the International Energy Agency.

Singtel is already a driver of connected car innovation in the region, being the only operator to have powered connected vehicle programmes for automotive OEMs from the USA, Europe, China and Asia Pacific.

By integrating capabilities from FloLive and partnering with Lenovo – whose technologies span secure payment, device management, data collection and computing – Singtel can offer OEMs a frictionless path to international expansion, with compliant and secure in-vehicle connectivity and device orchestration.

Call to bring back buttons



UK breakdown provider Start Rescue is backing vehicle makers opting to bring back physical buttons to the dashboards of their latest models.

Scrolling through on-screen menus, sometimes to perform the simplest functions, concerns many safety experts who believe this may be distracting drivers. Euro NCap plans stricter testing protocols for 2026, mandating physical controls for key functions to reduce eyes-off-road time and promote safer driving.

In fact, the issue has grown to the extent that drivers are even calling their breakdown provider for support after touchscreen problems bring their journey to a premature halt. Start Rescue has seen an increase in touchscreen related call-outs.

"Our support centre is receiving calls from customers facing touchscreen issues," said Lee Puffett, managing director of Start Rescue. "We're receiving reports of screens freezing and individual operations not responding with customers thinking there's a much wider problem."

Start Rescue is also receiving customer enquiries concerning juddering steering wheels that are activated by lane assist systems or driver drowsiness and awareness alerts.

"We're backing manufacturers re-introducing more buttons, switches and rotary controls," said Puffett. "It's welcome from a safety perspective with key equipment like screen demisting always being available with a quick click and not being wholly reliant on a touchscreen."

Intel closes automotive unit in Munich

Intel is closing its automotive chip business in Munich as part of plans that could see it lay off a fifth of its workforce.

More than 100 staff will be sacked in California starting this month. These will include engineers and senior managers.

The goal is to reduce operating costs by $500m this year and $1bn next.

The automotive unit in Munich was led by Jack Weast and was developing software-defined vehicle (SDV) platforms. This is part of a move to focus on its client and data centre products.

Intel is also outsourcing part of its marketing operations to Accenture.

The closures are not expected to affect its Israeli autonomous vehicle subsidiary Mobileye, of which Intel holds 88%.

The Munich unit design chips for infotainment and vehicle controls, as well as SDVs.

These cuts follow the appointment earlier this year of Lip-Bu Tan as CEO. He said then there would be major cuts.

If a fifth of the workforce are to be cut, that could see 20,000 people losing their jobs.



Last month, Intel appointed Greg Ernst as chief revenue officer as well as adding Srinivasan Iyengar, Jean-Didier Allegrucci and Shailendra Desai in key engineering leadership roles.

Eclipse announces open-source stack for SDVs

Open-source software group the Eclipse Foundation has announced the upcoming 0.5 release of the Safety Open Vehicle Core (S-Core) project.

This is the first open-source core software stack specifically designed for software-defined vehicles (SDVs).

Targeting embedded high-performance ECUs, S-Core is said to represent a milestone in the automotive industry's transition towards open, community-driven software platforms.

With support from a growing group of major industry companies, including BMW, Mercedes-Benz, Bosch, Etas, QNX, Qorix and Accenture, the project is building an open-source foundation that allows automakers and suppliers to accelerate the development of automotive software, while letting them concentrate on building their own differentiated features and applications.

"Open collaboration is key to managing complexity in modern vehicle software architectures," said Mike Milinkovich, executive director of the Eclipse Foundation. "With S-Core, we're providing developers with a reliable, safety-grade runtime environment that lets the industry focus on innovation while reducing duplication of effort."

Often described as middleware, S-Core sits between the operating system and application layer, delivering core, non-differentiating services that all SDVs require. By providing a common set of baseline functions, such as application orchestration, inter-process communication, logging and data persistence, S-Core aims to streamline development, lower costs and accelerate time to market for companies building SDVs.

The 0.5 release, targeted for availability in October 2025, will mark the project's first public milestone, providing an initial set of functional building blocks for industry adoption and feedback.

The reference platform for this release will run on QNX SDP 8.0, which is available for non-commercial prototyping and experimentation via the recently launched QNX Everywhere programme.

Additional operating system support, including Linux, is planned for future releases.

In parallel, the S-Core development process, currently under audit by a certification agency, aims to define a method for producing open-source software suitable for safety-critical automotive standards such as ISO 26262.

As software increasingly defines vehicle functionality, S-Core's open approach helps address one of the automotive industry's most pressing challenges: developing complex, high-performance vehicle software that is safe, cost-effective and scalable, while still allowing room for innovation.

By letting automakers, suppliers and technology companies collaborate on shared core components, S-Core allows development teams to focus their efforts on areas that create the most value, such as differentiated features, enhanced customer experiences and brand-defining innovations.

Typhoon provides HIL simulation for Infineon

Infineon is collaborating with Typhoon HIL, a provider of hardware-in-the-loop (HIL) simulation, to provide automotive engineering teams with an integrated, real-time development and test environment for key elements of xEV powertrains.

Those working with Infineon's Aurix TC3x and TC4x automotive microcontrollers (MCUs) can now use complete HIL simulation and test using Typhoon's HIL simulator for high fidelity motor drive, on-board charger, BMS and power electronics emulation.

This provides a plug-and-play interface via the Infineon TriBoard interface card.

"Developers of xEV components including motor drives, battery management systems, on-board chargers and DC-DC converters increasingly rely on controller hardware-in-the-loop, on top of software-in-the-loop and simulation-based approaches, to quickly achieve results and more rapidly iterate in both prototyping and test cycles," said Christopher Thibeault, director at Infineon. "With Typhoon's proven real-time HIL platform, our Aurix customers can access a design and test environment that will help bring their automotive products based on dependable electronics to market faster."

The offering includes any of several Typhoon simulators for real-time digital testing, a suite of testbed hardware and software tools, and the TriBoard interface card, which supports TC3xx and TC4xx evaluation boards and plugs directly into a single row of Din 41612 connectors on the front panel of the HIL simulator.

This streamlines validation workflows, expedites design and testing processes, and reduces development costs and complexity for customers.

Typhoon also offers an automotive communication extender for its HIL simulator based on an Aurix TC3xx processor, which will provide an enhanced communication interface that allows designers to connect to a larger number of heterogenous ECUs under test via Can, Can-FD, Lin and SPI protocols.

"We are excited to partner with a leader in the automotive integrated circuits market, to provide MCU developers with a platform for development and testing of Aurix-based controllers before hardware design is completed," said Petar Gartner, director at Typhoon HIL. "Our joint customers gain a competitive edge by accelerating their design and test operations while reducing costs, which ultimately translates to market advantage. We look forward to this ongoing collaboration with Infineon."

Toyota picks Rohm SiC mosfet

A power module equipped with Rohm's fourth generation SiC mosfet bare chip has been adopted in the traction inverter of Toyota's latest BZ5 crossover BEV for the Chinese market.

The battery EV was jointly developed by Toyota, BYD and FAW and was launched last month.

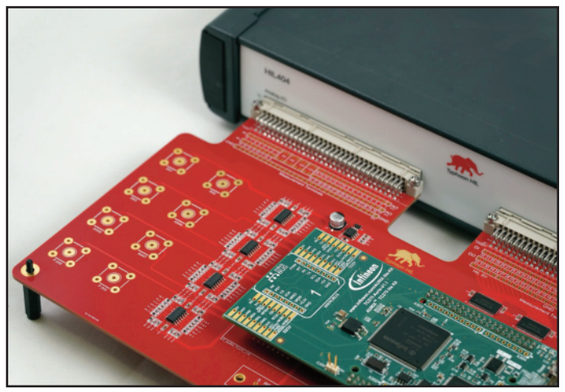
The power module has started mass production shipments from Haimosic in Shanghai, a joint venture between Rohm and Zhenghai.

Rohm's power products are centred on SiC mosfets and contribute to the extended range and performance of the BEV.

Rohm aims to complete the construction of the production line for the fifth-generation SiC mosfet this year, and is accelerating introduction plans for the sixth and seventh generations, focusing on the development of SiC power devices.

The aim is to improve device performance and production efficiency, and strengthen the system to provide SiC in various forms such as bare chips, discrete components and modules, promoting the spread of SiC and contributing to sustainable mobility.

The BZ5 driving range is 550km for the lower grade and 630km for the higher grade.



Those working with Aurix microcontrollers can use a Typhoons HIL simulator

Samsung supports digital key for Mercedes-Benz

Starting this month, Samsung Wallet will support digital key compatibility for Mercedes-Benz cars.

Galaxy users will get a more seamless way to lock, unlock and start their vehicle from their smartphone.

"We're excited to bring Mercedes-Benz drivers the incredible convenience that comes with Samsung digital key access," said Woncheol Chai, executive vice president at Samsung Electronics. "Our collaboration with Mercedes-Benz advances our vision of providing effortless access to tech-enabled experiences across the Galaxy ecosystem."

Launched in 2022, Samsung Wallet helps Galaxy users organise digital keys, payment methods, identification cards and more in one secure application. It is protected by government-grade security from Samsung Knox.

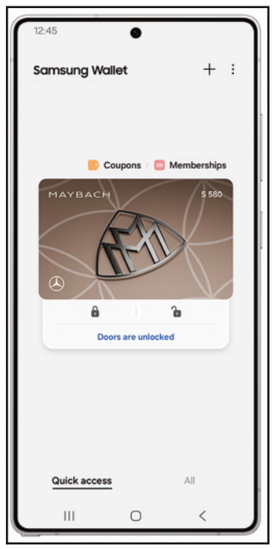
"Bringing convenience and luxury to our customers is our top priority as we strive to bring them the best vehicle experience possible," said Stefan Blossey, director at Mercedes-Benz. "Samsung digital key allows Mercedes-Benz to continue offering our customers convenient access and connectivity to their vehicles."

Once inside the vehicle, the digital key allows drivers to start their vehicles without using their physical keys or even removing their smartphone from their pockets. They can also securely share the digital key with friends or family through an easy-to-use interface that lets them grant or restrict access as needed.

Digital keys are securely embedded within the device, meeting EAL6+ security standards and providing protection against unauthorised access.

By using UWB technologies set by the Car Connectivity Consortium, the digital key ensures precise functionality, reducing the risk of unwanted attempts to access the vehicle.

If a device containing the digital key is misplaced or stolen, users can remotely lock or delete their digital keys via the Samsung Find service. With biometric or pin-based user authentication requirements, Samsung Wallet protects vehicles, ensuring interactions remain private and secure.



Interface for Mercedes digital key on Samsung Wallet

Hyundai sensors avoid rear-end collisions

Hyundai Mobis has unveiled technology to prevent rear-end collisions.

The active control technology, which uses sensors to detect approaching vehicles from behind and manoeuvre the vehicle out of danger, is expected to hit the market soon.

Hyundai Mobis has developed rear safety control technology that warns drivers and automatically maintains a safe distance when a rear vehicle approaches too closely. This integrates sensors such as rear-side radars and front cameras with driving control technology.

This technology operates when the driver uses the smart cruise control function on the highway. If the vehicle detects a rear vehicle is driving at a distance of about ten metres or less, it first emits a beep sound or displays a visual warning.

If the situation persists after a certain time, the vehicle will automatically increase its speed to maintain a safe distance. During this time, the rear side radars, which are mounted on both sides of the rear bumper, detect the movement of the vehicle behind. Meanwhile, the front camera recognises the lane and the vehicle ahead on the driving path to assist in safe acceleration.

Some global automakers are already applying safety technology to prevent rear-end collisions in mass production. When a rear-end collision is imminent, the system issues a warning and adjusts the seatbelts tension in preparation for the impact. However, these functions are not yet advanced enough for the vehicle to control itself autonomously.

Hyundai has enhanced its technology to enable the vehicles to adjust independently the distance between the front and rear vehicles and avoid dangerous situations.



Continental provides smart access to Audi

Continental is providing smartphone-based intelligent access for the new premium Audi Q6 E-Tron SUV.

In addition to a conventional car key, the system comprises the digital, smartphone-based Cosma intelligent access system, based on secure UWB technology.

An advantage of the virtual digital car key is the vehicle can be locked and unlocked without having to hold physically a car key or smartphone. The option to operate the vehicle using a physical key remains available.

The system works with many mobile phone models from major smartphone providers. The Audi battery-electric powered SUV is in the premium mid-range class and produced in Ingolstadt.

Continental is supplying the complete digital Cosma system for the Q6 E-Tron, consisting of integration into a central control unit, transceivers with UWB radio technology and intelligent software.

In addition, Continental has helped develop the standard for contactless digital vehicle access.

"With the Audi Q6 E-Tron, we're equipping an important new electric model from Audi with particularly reliable and digital access," said Jean-François Tarabbia from Continental Automotive.

Access to the vehicle is controlled via Bluetooth Low Energy and UWB radio technology. The position of the smart device is determined using the UWB technology.

Additionally, the radio technology precisely detects the position of an authorised virtual key in the owner's pocket, near the vehicle or inside the vehicle itself.

Thanks to precise location detection, Cosma can effectively prevent so-called relay attacks, also known as the man-in-the-middle technique. Car thieves are thus no longer able to intercept and relay the key signal to gain unauthorised access to the vehicle.

AdaCore and Nvidia publish open-source reference

AdaCore is bringing its Ada and Spark programming languages into the automotive market in partnership with Nvidia.

The two companies are set to publish an off-the-shelf reference process, allowing others to follow their lead.

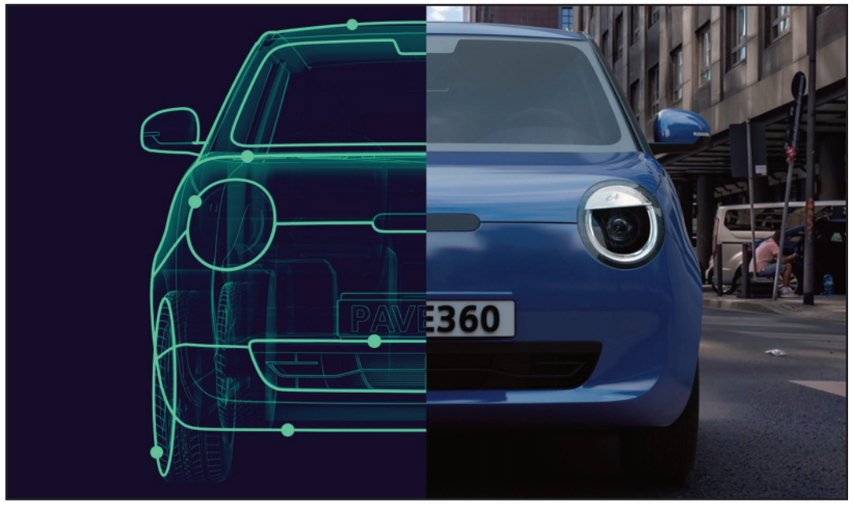
Nvidia developed Drive OS, the reference operating system and associated software stack for developing and deploying autonomous vehicle applications on Drive AGX-based hardware.

This includes software components that comply with ISO 26262. To achieve that, Nvidia selected these languages to develop some of the most critical components of its software stack.

This required establishing a development process that uses formal methods and other safety characteristics of Ada and Spark, thus leveraging their capabilities.

AdaCore and Nvidia decided to publish this reference process freely as an open-source and evolving document, so the industry at large can adopt Ada and Spark.

"As the added value of the automotive industry turns more from mechanical to software features, achieving software safety at the highest levels becomes one of the most critical challenges of modern car development," said Quentin Ochem from AdaCore.



This helps develop multi-domain digital twins for validation

Siemens supports Arm Zena CSS for SDV design

Siemens is adding support for the recently launched Arm Zena Compute Subsystems (CSS) in its Pave 360 software, designed for software-defined vehicles (SDVs).

Zena CSS, Arm's first CSS for automotive, is a pre-integrated and validated compute subsystem optimised for performance, power and area, and designed to accelerate development for AI-defined vehicles.

As the automotive industry enters a new phase of SDVs where intelligent, AI-defined functionality provides an opportunity for greater vehicle differentiation, a different development methodology and mindset are required.

"The era of AI-defined vehicles is an opportunity to bring new in-vehicle experiences to life, but it will require a much faster speed of development and deployment," said Suraj Gajendra, vice president at Arm. "With the help of virtual platforms like Pave 360 from Siemens, Arm is enabling our partners to begin software development on Zena CSS before physical silicon is available, significantly reducing software development time."

Engineers can use Pave 360 to develop software for Zena CSS before silicon is available and, within the Soafee community, the virtual prototyping environment becomes key to enable Soafee blueprints.

They can then functionally validate software in-system and accurately model SoC algorithms and hardware-software interaction, helping mitigate the challenges posed by software-defined and systems-aware vehicle development.

"Our work with Arm demonstrates that it's no longer enough that vehicle development is software defined," said David Fritz, vice president at Siemens. "The process now needs to be systems-aware with the full vehicle system developed in parallel to help ensure that the entire system meets requirements and will require continuous verification."

He said Siemens was in a position to support this approach as it helped its customers develop multi-domain – across electronics, hardware and application development – digital twins for validation and integration that encompasses the whole SoC, EE system and vehicle development flow.

Pave 360, as part of Siemens' SDV framework, brings together the Innexis software environment, Veloce hardware-assisted verification and validation system, Teamcenter software for product lifecycle, Polarion for application lifecycle management, and Simcenter Prescan and Amesim software for simulation to provide a more integrated approach to software-defined development.

The initial support for Zena CSS, based on Innexis architecture native acceleration, is available from Siemens as part of Pave 360.

Engineers can start developing software and, once silicon is available, continue through the Pave 360 digital twin flow seamlessly transitioning to accurate performance and power analysis using Innexis Developer Pro.

In parallel, Pave 360 enables requirements and verification to be linked together providing a digital twin that is systems-aware, mitigating the inevitable system integration storm experienced by vehicle developers today.

GlobalLogic picks Plaxidity X to secure SDV development

Automotive cyber security firm Plaxidity X is working with Hitachi subsidiary GlobalLogic to deliver an integrated and secure development environment for software-defined vehicles (SDVs).

The collaboration focuses on creating a coherent cloud framework for SDVs aimed at helping OEMs and tier-one suppliers accelerate the development lifecycle and reduce engineering costs, while ensuring all vehicle software meets high security standards.

To further its goals of reducing the time and costs of software development, GlobalLogic has selected PlaxidityX as its security partner for SDV development. Through this partnership, the companies are integrating the Plaxidity X dev-sec-ops platform into GlobalLogic's SDV cloud framework.

The framework is an infrastructure manager to streamline the deployment of all necessary software development resources for SDV projects. It enables a cloud-based engineering environment with seamless access to on-premise real hardware and, with this partnership, leverages dev-ops practices to shorten development cycles, automate testing and ensure continuous software updates to accelerate time to market for SDVs.

The Plaxidity X platform automates the integration of security practices at every phase of the software development lifecycle.

NXP lets Rimac consolidate SDV ECUs

NXP is collaborating with tier-one automotive supplier Rimac Technology to advance centralised architectures for software-defined vehicles (SDVs).

Using NXP's S32E2 processor, they have consolidated more than 20 ECUs into three centralised units. This helps automakers simplify the integration of different vehicle applications, reduce material costs, and support domain and zonal control.

ECU consolidation is a critical step in realising SDVs, allowing faster updates, lower power consumption and seamless integration of future features.

The S32E is part of NXP's multi-application processor range and integrates eight Arm Cortex-R52 processor cores running at up to 1GHz, high-resolution analogue-to-digital converters and the capability to support up to 64Mbyte of non-volatile memory.

"OEMs and tier-ones have faced the challenge of consolidating multiple applications within legacy microcontrollers or deploying excessive redundant computing to achieve application independence," said Ray Cornyn, senior vice president at NXP. "The NXP platform lets developers quickly implement SDV features for real-time applications. The S32E2 enables the efficient integration of numerous applications within an easy-to-debug environment, where task isolation and determinism are inherent to the design."

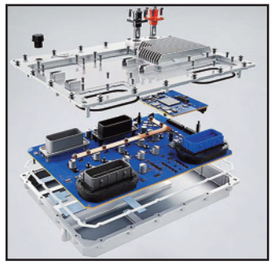
Rimac will primarily leverage the ECU platform in a hyper car programme, with plans to scale up in different vehicle segments and alternative mobility sectors.

"The growing complexity of vehicle systems with numerous ECUs requires a way to decrease weight, manage power consumption and simplify software integration," said Ana Martinčić Špoljarić, business unit director at Rimac Technology. "With NXP's S32E2 real-time processors, we found the ideal high-performance and automotive-grade option that allows us to integrate several units into a single domain controller, reducing complexity and material costs for automotive OEMs while significantly increasing computational power."

The S32E2 extends NXP's S32 automotive processing platform and fits between the recently introduced S32K5 microcontroller family and the 5nm S32N real-time super integration processors.

The ISO 26262 Asil-D compliant S32E2 series serves automotive OEMs by providing safe and secure processing that is essential for SDVs. Its safety offering with core-to-pin isolation mechanism ensures freedom from interference and task level fault recovery throughout the device.

The integrated, hardware security engine provides secure boot, key management and security services.



Rimac is using NXP for SDV architecture



GARAGE LAND

Steve Rogerson reports from Automechanika in Birmingham, UK

automechanika
BIRMINGHAM

How medical AI can help with car diagnostics

UK firm Technical Topics is just a few months away from the launch of AI software that takes lessons learned in medical diagnostics and applies them to vehicle repairs.

James Dillon, the firm's technical director, said this would be the culmination of a five-year project to apply AI to help technicians find the cause of problems easier.

Due to be launched on a cloud-based subscription model, the Diagnostics Assistance software aims to remove the bias that affects all of us when we tackle a new challenge.

"We as humans suffer from bias that is based on our belief structure," said Dillon. "Everything we do is biased."



James Dillon: "We kid ourselves."

This bias he said could be good or bad.

"When the thinking gets difficult, we make bad decisions," he said. "In car diagnostics, we make quick decision based on little data."

AI he said could look at the whole project and take the bias out of the decision-making process.

"If you see a car, you make a diagnosis based on the bias of previous problems," he said. "AI can give unbiased suggestions as to what is wrong. If you load all the answers into the machine, it will be able to pick the most likely ones."

He said the reason diagnostics went wrong was technicians measured the wrong things.

"We believe we have the answer when in fact we haven't," he said. "We kid ourselves. We have taken medical diagnostics and applied it to cars."

But he warned that humans were still the intelligent ones and it was up to them to interpret the decisions and suggestions made by the machine.

To help with this, he is looking at adding a way for the AI to explain its decision-making process so the technician can analyse the results more thoroughly.

automechanika BIRMINGHAM

Overcoming crazy complexity in modern vehicles

The complexity of modern vehicles is crazy. That was the view of Sean Brookes from Bosch Mobility Aftermarket as he explained the difficulties today's car repairers faced with ever more connected vehicles.

He said cars todays could contain hundreds of ECUs and multiple networks.

"Repairers need support," he said. "It is not enough just to put a scanner in. The modern garage needs access to support, wiring diagrams and so on. They need to have their hands held."

Being able to access the latest information, he said, was key.

On top of that, said his colleague Michael Purcell, security systems were making the car harder to access.

"They can stop repairers getting access to the systems," he said. "Full diagnostics are not possible without authorisation. Secure diagnostics access is no longer an option but a requirement."

Garages without secure diagnostic access have to go to each OEM and get access, and maybe pay a subscription fee.

The two men were plugging Bosch's adas equipment that provides access to multiple vehicles, with more due to be added, without ongoing costs and no matter how many technicians were in the workshop.

"Our diagnostics system will let you speak to all the different networks and get all the information you need," said Brookes. And it can provide original documents from the car maker.

After any repair on vehicles equipped with adas, which these days is every car released, some recalibration will be needed, and again Bosch believes its equipment can help.

"Adas uses sensors that monitor the environment and the vehicle," said Brookes. "This includes cameras, radar, lidar, rain and light sensors, AR cameras, ultrasonic parking sensors."

These need to be recalibrated.

"If you take a bumper off, you will disturb these sensors and need to realign them," he said. "When a windscreen is replaced, the sensors will need to be recalibrated."



Sean Brookes (left) and Michael Purcell

There are two types of recalibration – dynamic and static – and diagnostic tools are needed for both. With dynamic testing, the equipment will be plugged into a vehicle and taken on a test drive to check that the sensors are picking up pedestrians, cyclists, traffic signals, lane markings and so on.

Static testing takes place in the workshop where a target is placed at a set distance from the vehicle. The workshop must have good quality lighting and a stable, flat floor. It is also important to make sure other equipment in the workshop does not interfere with the calibration equipment.

"Our equipment pulls together all the manufacturer equipment and puts it in one place," said Brookes.

The move to more electric vehicles is bringing more problems for repairers, with Purcell estimating that three-quarters of UK garages are not qualified to diagnose EVs.

"Tesla vehicles have proven a little bit tricky for garages," said Brookes. "For diagnostics, they are very difficult to connect into. They are always connected to the cloud. To put a diagnostic tool into this environment is very difficult. We have launched a tool that connects into this environment."



Nick Halliwell: "Do the calibration correctly."

Not recalibrating causes accidents

Bad calibration can lead to adas applying the brakes, apparently randomly.

That was the warning from Nick Halliwell, special projects manager at Car-o-Liner.

Garages need to remember that sorting out the fallout from an accident caused by a badly calibrated or misaligned sensor could be a nightmare for a garage.

"You need to follow the OEM service recommendations," he said. "I keep repeating that but it is a lesson the industry has to learn. If it goes wrong, it can be a lengthy process. Do the calibration correctly."

He said adas was moving from front cameras to rear collision warning systems. And while adas might not stop someone having an accident, it could make the vehicle safer, but only if calibrated correctly.

"Adas can slow a vehicle down more quickly that a human driver," he said. "Adas can also stop the vehicle if it detects the driver is not paying attention. And it can detect risks outside the driver's field of vision."

He said that repairers had to consider adas sensors all the time.

"If you change a windscreen with a camera behind it, you need to recalibrate," he said. "Even if you don't touch the adas but do something that changes the way a vehicle reacts, you need to recalibrate the adas."

And he warned garages not to start a repair unless they were sure they could complete the process regarding any adas recalibration.

"Follow OEM service information," he said.

DISPLAYS

SCREEN TIME

Yujie Bai explains the basics of TFT LCD, OLED and micro-LED displays for automotive

BMW 3 Series with curved touchscreen

The demand for larger, brighter, curved, higher resolution and higher contrast-ratio displays in automotive applications is stronger than ever.

New types of in-vehicle displays are becoming increasingly popular.

Currently, TFT LCDs dominate flat panel display technology in the automotive industry.

However, OLED and micro-LED displays are gaining more attention from car manufacturers due to their excellent display effects, low energy consumption, high flexibility and thinness.

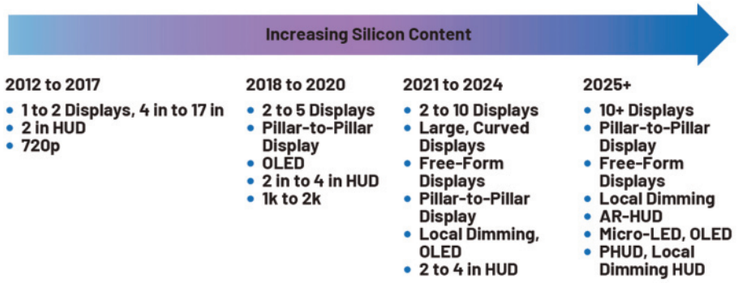


Fig. 1: Trends in cabin displays

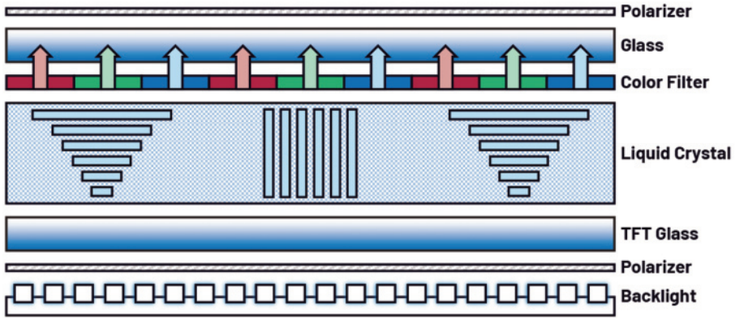


Fig. 2: TFT LCD structure

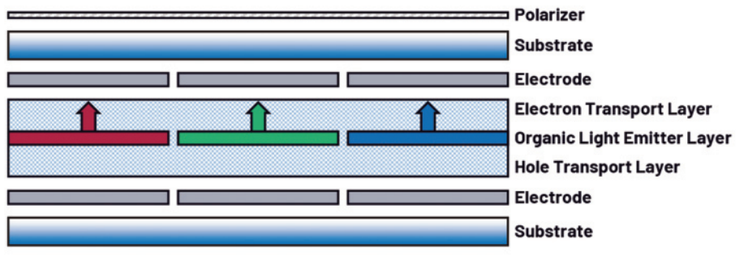


Fig. 3: OLED display structure

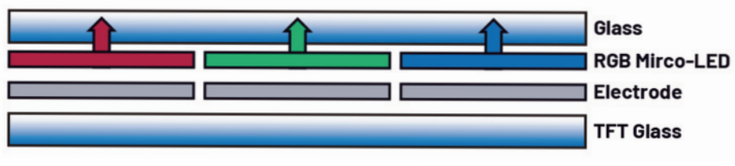


Fig. 4: Micro-LED display structure

Cabin trends

In recent years, the automotive industry has rapidly evolved in areas such as connectivity, electrification, autonomous driving and shared mobility. This evolution has reshaped cockpit design to enhance the user experience. According to IHS Markit, 161.5 million automotive display panels were shipped in 2018, and shipments are expected to exceed 200 million units this year.

To enhance the cabin experience, modern vehicles feature multiple types of displays: the instrument cluster, the centre information display (CID), heads-up display (HUD), passenger display, smart e-mirror, side mirror and rear entertainment display.

The instrument cluster provides the driver with key information such as speed and fuel gauge status. The HUD projects crucial information onto the windshield. The rear-seat entertainment displays and passenger displays are part of the infotainment system, allowing passengers to watch movies or engage in other entertainment.

The digital camera monitor system (CMS) is replacing exterior rear-view mirrors with two to three cameras, and the side mirror displays and e-mirror displays enhance the driver's visual perception of the surroundings.

According to IHS Markit, 10% of automotive display panel shipments were 25.4cm panels in 2018, and this is expected to grow to 18.4% this year. In recent years, 31.2cm and larger display panels have become the mainstream size for instrument clusters.

Since the Tesla Model 3 introduced a 38cm touchscreen in 2017, automotive display panels have trended towards being larger, with higher resolution, higher contrast ratios and free-form designs.

In 2019, the Li Xiang One featured a pillar-to-pillar display that included two 31.2 and 41.2cm screens. In 2023, the BMW 3 Series introduced a 37.8cm curved touchscreen with local dimming technology, stretching from the driver's side to the centre console.

The concept car Vision EQXX is equipped with a 120cm pillar-to-pillar screen that uses local dimming technology. The trend of automotive displays can be summarised as shown in Fig. 1.

The full-windshield HUD on BMW's Neue Klasse concept car will enter production this year. This innovative HUD technology allows visible displays across the entire width of the windshield for all passengers. The lower edge of the windshield, with higher light intensity and contrast, shows relevant information to the driver and passengers. Additionally, there is a free-form central display.

Architecture

The TFT LCDs in Fig. 2, OLEDs in Fig. 3 and micro-LEDs in Fig. 4 represent three distinct technologies that revolutionise visual display capabilities.

TFT LCDs use liquid crystals sandwiched between two glass substrates. The bottom substrate is embedded with TFTs, while the upper substrate serves as a colour filter. These liquid crystals align to modulate the rotation of light passing through them by controlling the current flow through the transistors, which causes changes in the electric field. Each pixel with a different colour is generated by illuminating the colour filter in varying proportions.

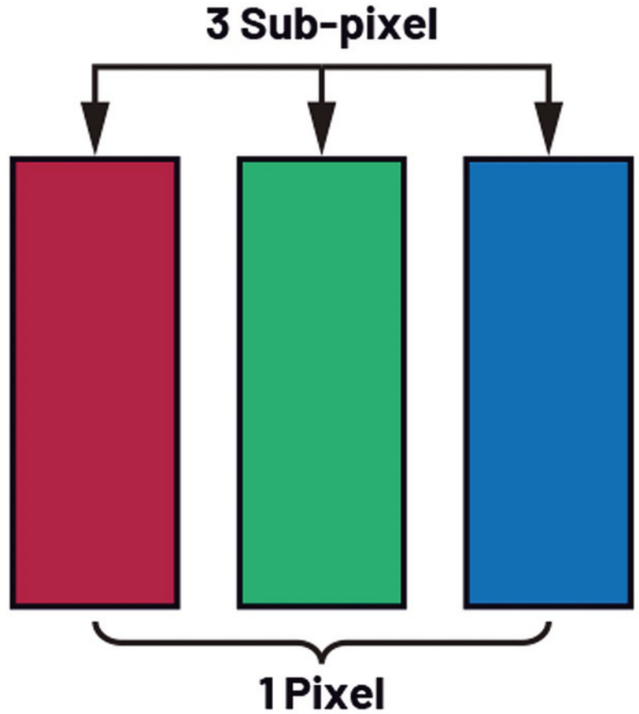


Fig. 5: Pixel

In contrast, OLED displays do not require a backlight due to their self-emissive capability. The basic structure of OLEDs consists of an organic light-emitting layer on indium tin oxide (ITO) glass. This organic light-emitting layer is sandwiched between two low work function metal electrodes: the upper cathode and the bottom anode.

When an external voltage is applied to the cathode and anode, the electron transport layer (ETL) and hole transport layer (HTL) inject electrons and holes into the organic light-emitting layer with controlled volume and speed. This process causes the OLEDs to emit light. Red, green and blue light can be produced by using different chemical materials in the OLEDs. Consequently, OLED displays are thinner, more energy efficient, and offer better colour reproduction and contrast.

Micro-LED displays are a recent advancement that use arrays of microscopic LEDs as individual pixels. Typically, the chip size of micro-LEDs is within 50μm,

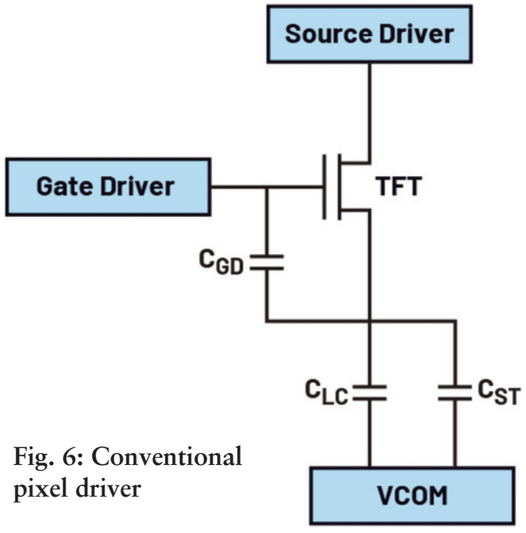


Fig. 6: Conventional pixel driver

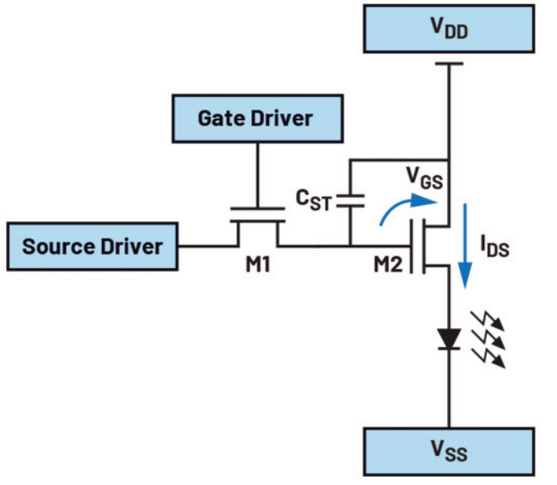


Fig. 7: 2T1C pixel driver of OLED or micro-LED

making them hardly visible to the human eye.

Due to their tiny size and assembly technology, the illumination sources for red, green and blue light can be integrated into a single pixel point, eliminating the need for colour filters and liquid crystals in micro-LED displays.

Each micro-LED in the pixel emits its own light, offering high brightness, deep blacks and excellent energy efficiency. These technologies represent significant strides in display innovation, each offering unique advantages in terms of structure and performance. Micro-LED displays are suitable for applications ranging from smartphones and televisions to augmented reality, wearables and automotive displays.

As TFT LCDs are a relatively mature technology with outstanding cost advantages, LCDs are currently the dominant flat panel display technology in the automotive industry. However, OLED and micro-LED displays are drawing more attention from car manufacturers.

OLED displays offer excellent effects, low energy consumption, high flexibility and thinness. Micro-LED displays are emerging as the next display technology, enabling curved display designs with enhanced brightness and contrast, thereby adding flexibility to in-cabin screen designs.

However, OLED displays suffer from image retention, causing pixel degradation after displaying static images for a long time, and their lifespan is shorter than that of LCDs. Micro-LED displays are

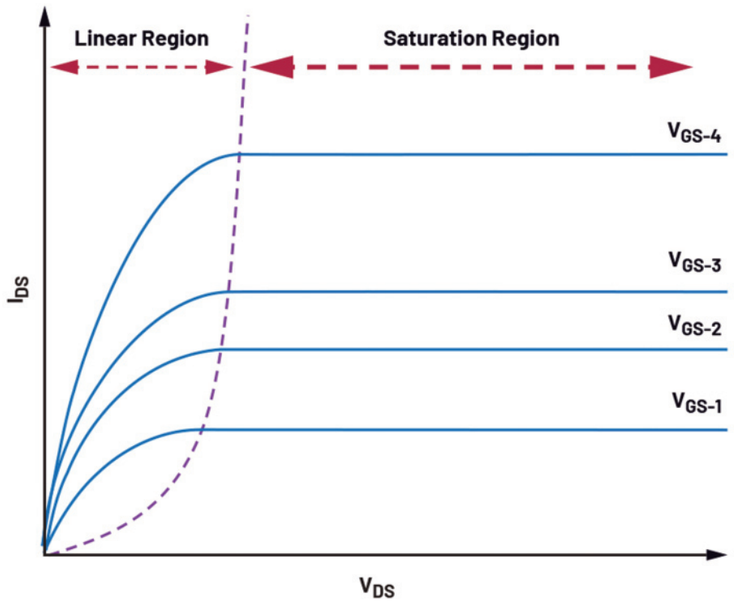


Fig. 8: Mos transistor output characteristics

expensive due to the problems in commercialising mass production.

The existing TFT LCDs can be upgraded with a mini-LED (submillimetre light-emitting diode) backlight source and local dimming technology. Mini-LEDs are scaled-down conventional LEDs and serve as a bridge to micro-LEDs. LEDs with dimensions smaller than 200μm are categorised as mini-LEDs, while LEDs under 100μm are categorised as micro-LEDs.

Although mini-LEDs can primarily serve as a backlight source in LCDs, they improve the thickness and contrast performance of LCDs, while being cost-effective.

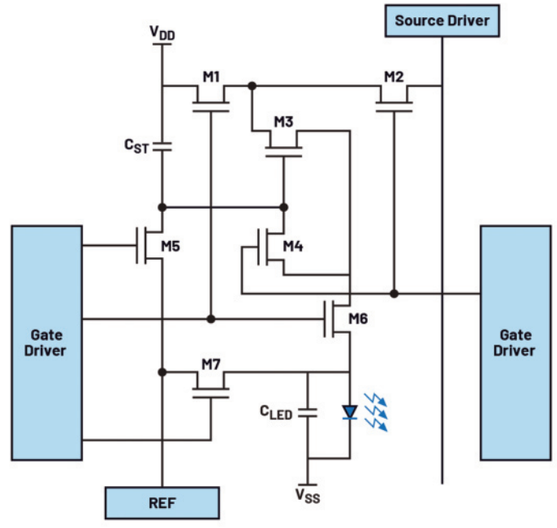


Fig. 9: Schematic of 7T1C pixel driver

Pixel drivers

Various colours are synthesised by mixing the three primary colours (red, green and blue). The mixture of these three colours forms a pixel, as shown in Fig. 5. Each pixel consists of three sub-pixels, which are managed and combined in one pixel.

TFT LCD, micro-LED and OLED displays use different methods to drive these sub-pixels due to their distinct display technologies and manufacturing processes. For example, the Tesla Model 3 has a 39.1cm TFT LCD with a resolution of 1920 by 1200 pixels, resulting in a total of 6.91 million sub-pixels.

In a TFT LCD, the equivalent circuit of a sub-pixel, which controls the electric field across the liquid crystal, is shown in Fig. 6. It comprises 1T2C (one transistor, one liquid crystal capacitor and one storage capacitor). The gate driver provides a positive voltage, called voltage gate high (V_{GH}), to turn on the TFT, and a negative voltage, called voltage gate low (V_{GL}), to turn off the TFT.

The picture information is transmitted to the source driver, which charges the liquid crystal capacitor (C_{LC}). The storage capacitor (C_{ST}) acts as a buffer to prevent leakage current from the C_{LC}.

Image retention or flicker in TFT LCDs is caused by parasitic capacitance (C_{GD}) existing between the gate node and drain node of the TFT. When the picture content changes and the TFT turns off from the on state, a voltage drop on the C_{LC} is caused by a capacitive voltage divider between C_{GD} and $C_{LC}||C_{ST}$. To improve panel performance consistency, the common backplane voltage (V_{COM}) is introduced and tuned to the centre of the pixel voltage during the pixel transition time.

The topology of popular pixel drivers in micro-LED and OLED displays is similar but more complex than in TFT LCDs due to the fabrication process and integration of TFT circuits with LEDs on a glass or polyimide substrate. Consequently, LEDs in each pixel are driven individually with their own brightness.

As shown in Fig. 7, a simple pixel driver called 2T1C (two transistors and one storage capacitor) has the analogue signal of LED emission sent to TFT M1. The threshold voltage (V_{GS}) is then stored in (C_{ST}), which is used to drive TFT M2 in the saturation region, as shown in Fig. 8.

The driving TFT M2 maintains the LEDs at a constant current with the positive voltage (V_{DD}) and cathode voltage (V_{SS}). The saturation operation driving method of this 2T1C pixel driver has the advantage of extending the LED's lifetime compared with the linear region operation of the driving TFT.

There are, however, disadvantages to the 2T1C pixel

driver, which include the Mura problem and threshold voltage shift under electric bias. The Mura problem is the uneven brightness in a display's uniformity, which is mainly caused by variations in the manufacturing process, such as the density of the TFT layer, uniformity of LED forward voltage and threshold voltage, and so on.

These effects cause image quality issues. Although the best fabrication process cannot overcome the threshold voltage shift, pixel circuits with voltage feedback methods and threshold voltage shift overcompensation methods have been proposed to improve image quality.

The 7T1C driving method is shown in Fig. 9. This 7T1C pixel circuit has three operation stages, as shown in Fig. 10: initialisation, compensation and emission. The TFT M4 is used for the diode connection of driving TFT M3. During compensation, the voltage stored in C_{ST} from the source driver maintains the LED emission. The TFTs M1, M6 and M7 are used to prevent the LED from turning on.

Currently, the display backplane technology has been developed from hydrogenated amorphous silicon (a-Si:H) TFT to low temperature polycrystalline silicon (LTPS) TFF, and low temperature polycrystalline silicon and oxide (LTPO) TFT constitute the next backplane

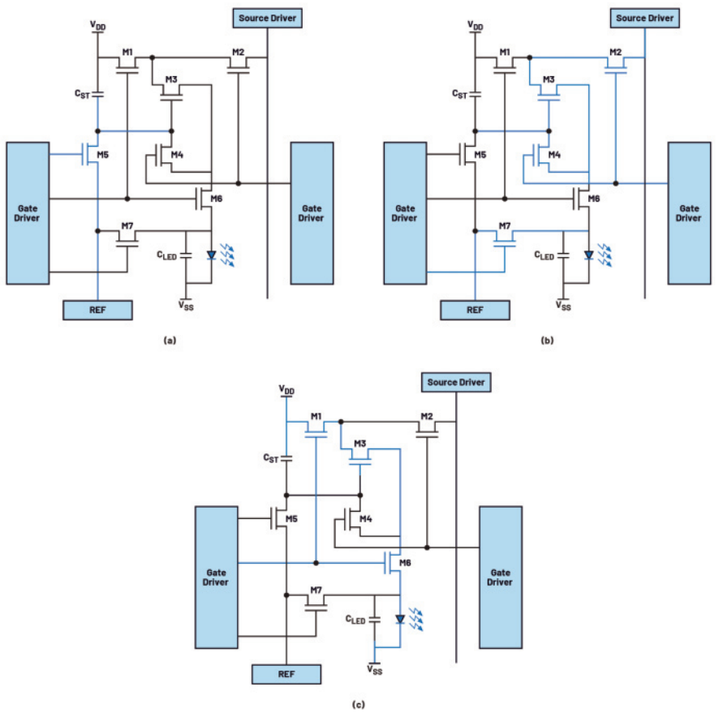


Fig. 10: Driving sequence of 7T1C compensation pixels: (a) initialisation, (b) compensation and (c) emission



Mercedes-Benz concept car Vision EQXX equipped with 120cm pillar-to-pillar screen

technology for consumer electronics.

The a-Si:H TFT has a low carrier mobility (1cm²/Vs), which results in the large size of the backplane and leads to more power consumption. The LTPS TFT has superior carrier mobility (>50cm²/Vs) so it is applied in the OLED display. The LTPS TFT usually has a high off-current. However, the LTPO TFT has a low off-current. Thus, the hybrid pixel scheme combining the LTPS and LTPO TFTs is considered for use in OLED and micro-LED display backplanes.

Conclusion

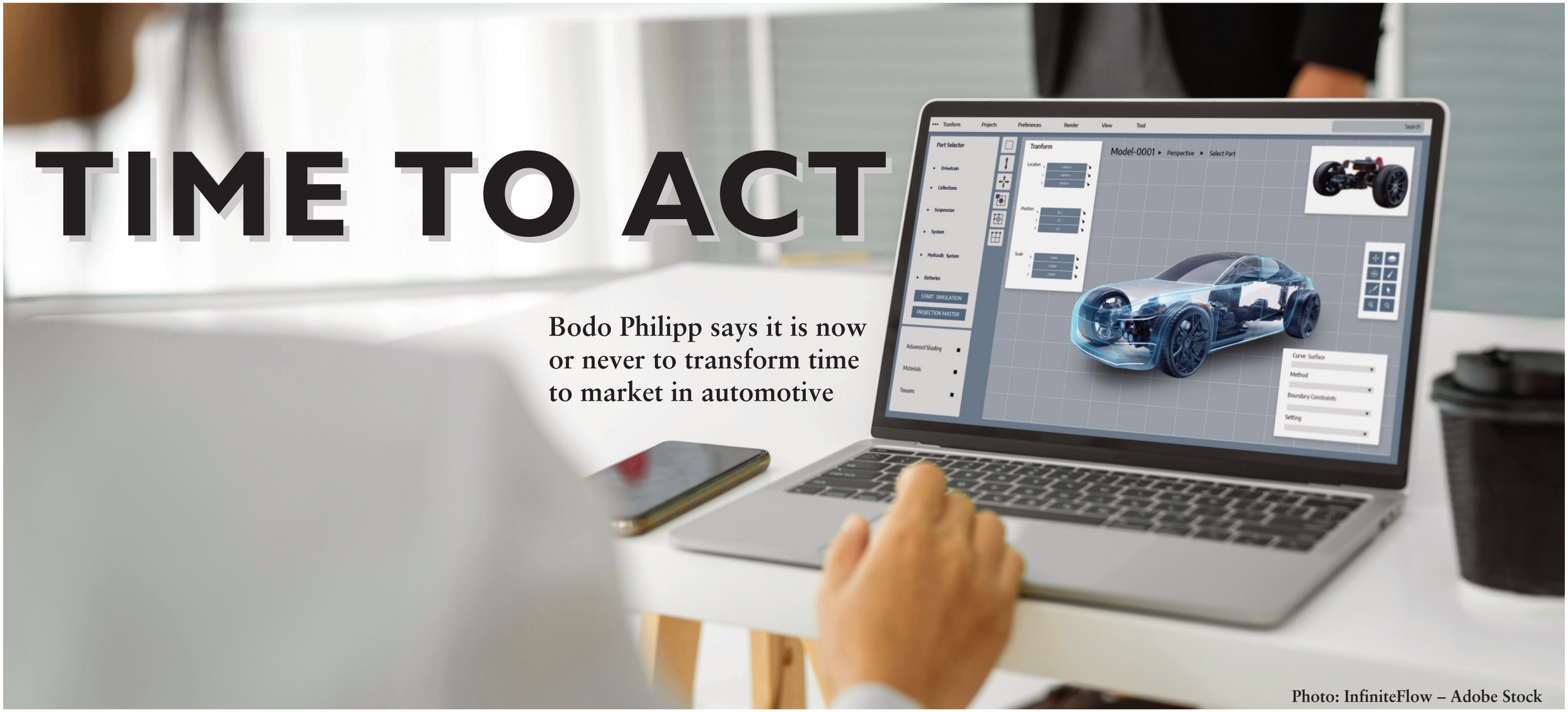
Displays in vehicles play an increasingly crucial role in the cabin experience, with growing expectations on enhancing visibility, safety, user experience and so on from the consumers. Automotive displays face significant problems in delivering outstanding image quality with high resolution and contrast ratio, free form, large size and cost-effective features.

To achieve better display performance, the pixel driver of OLED and micro-LED becomes more complicated than the TFT-LCD. Thus, OLED and micro-LED displays are expensive due to the problems in commercialising mass production. Mini-LED LCDs with local dimming technology serve as a bridge to micro-LED and OLED displays.

Yujie Bai is senior applications engineer at Analog Devices



TIME TO ACT



Bodo Philipp says it is now or never to transform time to market in automotive

Photo: InfiniteFlow – Adobe Stock

What does the future hold for the traditional automotive industry? From the potential failure of Nissan to the controversial closure of factories by VW, long established, familiar brands are struggling to compete with the new market dynamics.

The issue is not just the swathe of cheaper, government subsidised vehicles from China. Or even the radically changing driver expectations and fast diminishing customer loyalty. The industry has not failed to recognise the demands created by the new software led, function-oriented car design and build model. These challenges are accepted.

The problem is the industry remains mired in an endemic inability to truly change.

Car manufacturers may have seen the writing on the wall for a decade. They have looked to streamline processes and embrace technology innovation. Yet when Chinese cars have a 20-month time to market and their European competitors take nearly three times as long, something is still very wrong.

Technology is a vital enabler in change but the industry urgently needs to let go of traditional processes, culture and mindset. And that means moving away from cherry picking areas of change and the implementation of tactical digital options that address just one issue. Automotive companies must urgently overhaul the entire business, from process to mindset.

Last chance

How long can the automotive industry rely on brand value? It is no longer valid to argue that the new Chinese entrants are immature. Or that they lack customer appeal. For a digitally native generation, a car that greets the passengers, offers to take their picture and then posts it on Instagram is far more relatable than a brand relying on decade's old movie tie-ins.

The enormous gulf in time to market between old and new manufacturers is not just accelerating the innovation offered by new entrants. It is also allowing these companies to attract the instant gratification cohort that sees no reason a new car should not arrive as frequently as a new phone. In contrast, the time to market for legacy automotive companies continues to extend.

New market entrants, especially those from China, can introduce products based on an entirely different design, build and deliver model. In contrast to traditional automotive companies struggling

to retrofit new thinking onto a completely outdated operational model, they have been able to embed function-centric vehicle creation from day one.

And while new entrants may have sacrificed some build quality and reliability in the push for 20-month time to market and lacked the robust aftermarket infrastructure, these competitors are maturing fast.

Perhaps more significant is that new automotive companies have a completely different notion of compelling when it comes to cars and driving. While Lexus is emphasising its smooth luxury driving experience with a rerelease of its iconic Champagne Glass advert, in stark contrast BYD is promoting its self-driving hyper car with its ability to jump over road spikes and water.

There is an enormous gulf between the gaming and social media style of the new generation and the calm, comfortable focus of the traditional automotive landscape. Just how much longer will old brand values, even traditional vehicle concepts, sustain a legacy automotive industry that is struggling for money, sales and customer loyalty?

Digital opportunity

The shift towards function-oriented development has required new processes. It has pushed traditional vendors to invest heavily in dedicated software expertise and adapt tried and trusted supply chains to include sensors, radar, cameras and ECUs.

Automotive vendors are also in the vanguard of technology exploration, leveraging innovations in AI and virtual reality to reproduce sophisticated design models quickly, tweaking and innovating in real time.

Designers and engineers can collaborate from different countries, using Meta Quest and Apple Vision Pro to experience together the materials, haptics, even reflections of the concept car. Viewing insights in real time and effectively conceptualising changes allows the collaborative team to understand the impact and make decisions quickly.



Car manufacturers must streamline processes and embrace technology innovation (Photo: Gorodenkoff – Adobe Stock)

AI is enabling companies to run multiple design concepts simultaneously, combining financial evaluations, regulations and design ideas through rapid iterations in real time, shaving weeks, even months, off the process. The overall result is more confidence in decision making, leading to faster, more efficient outcomes.

Digitisation is without any doubt fundamental to transforming the time to market for automotive manufacturers. And yet, time to market is getting longer, not shorter due to the complexity and challenges associated with delivering function-oriented design within traditional automotive manufacturing processes.

Change

Digitisation is a foundation but technology alone will not be the answer. The issue is automotive companies' inability, to date, to change internal behaviour, culture and processes. The thinking is there but they have failed to activate and operationalise the new measures essential to achieving a new automotive paradigm.

This is where an independent third party can be a powerful enabler of change, not only by analysing what is required but actively overseeing and implementing new processes and embedding new culture and mindset.

End-to-end support leveraging process, methodology, tools, organisation and data can transform the speed and success of change programmes. An organisation with expertise in automotive and a background in software development can both help organisations define their direction and, critically, also work together to implement and execute the shifts required to achieve that goal by ensuring all employees are part of the process and have the support needed for long-term success.

The new automotive model, culture and thinking must be radically different.

Companies will have to step away from the traditional overspecification of every aspect of the process, from design through testing and accept a less rigorous, but still safe, 100% to achieve a faster time to market. They will have to achieve a new matrix that breaks down the familiar silos. They must do more than encourage collaboration between diverse teams by actively demanding that cooperation.

In the process, they will have to negotiate employee and union grievance and safeguard funding, all while accelerating innovation, hitting new targets for electric vehicle sales and meeting customer expectations. It is incredibly challenging but without this level of change, the current industry players will fail.

Conclusion

The automotive market is experiencing the most extraordinary pace of product innovation and technology, new market dynamics, business models and, as a result, customer expectation. Legacy manufacturers are squeezed from all directions and, with finances failing and customer loyalty dropping, fundamental, systemic change is urgent.

Chinese challengers cannot be countered by a tweak at the edges to encourage better collaboration through the design and development process. Piecemeal plans to build software expertise in one area or build in further efficiencies to the supply chain are not enough. The industry requires a radical, end-to-end overhaul of mindset, culture and process.

Automotive manufacturers need to change now. It currently takes four to five years to bring a new car to market, and if that new vehicle does not match up to cheaper, more innovative alternatives, the writing will be on the wall. Companies know this. They know they need to change. It is now urgent that automotive companies make a wholesale commitment to take actions today that truly embrace end-to-end transformation.



Bodo Philipp is CEO of MHP Consulting



AI is enabling companies to run multiple design concepts simultaneously, shaving weeks, even months off the process (Photo: Bussarin – Adobe Stock)

MOVE
MODELS • TECHNOLOGY • SUSTAINABILITY



Steve Rogerson reports from last month's Move show in London

Impact of AI on automotive innovation

AI is set to disrupt the automotive and mobility value chain and speed up innovation, according to Natalia Martin from Ernst & Young.

Though using AI to control autonomous vehicles is well known, Martin believes it will go beyond that as every part of the value chain becomes more intelligent.

However, she questioned whether stakeholders were investing in the right areas of the value chain.

“Nice, lucrative opportunities are likely to emerge across automotive, retail and aftermarket areas,” she said. “These are the areas that are still underinvested but are likely to grow quickly.”



Lilian Greenwood: “Fundamentally changing how people move.”



Dong-Su Kim: “Getting into a robot-taxi is very pleasant.”



Anne Laliron: “AI is a way to improve all our organisations.”

She said the speed at which AI was moving was unprecedented.

“This is causing a lot of unease around the world,” she said, “But we have a responsibility to help our clients prepare for the future.”



Natalia Martin: “People will either manage AI or AI will manage people.”

The difficulty is knowing how that future will pan out. Low public confidence could prevent AI delivering the dreams that are around now. On the other side, AI could redefine every aspect of life.

“Companies that reinvent themselves are the ones that are going to thrive,” she said, though there was still the possibility that AI could collapse into a handful of mega-players.

“AI’s progress will be defined by breakthroughs or breakdowns,” she said. “People will either manage AI or AI will manage people. Today, companies are still dealing with fundamental challenges when it comes to AI.”

In the UK, the government last year launched a transport AI action plan and MP Lilian Greenwood from the Department of Transport said the aim was to create a regulatory framework that would allow autonomous vehicles to thrive.

“We have plans for legislation for self-driving buses and taxis,” she said. “This government is fundamentally changing how people move.”

Dong-Su Kim, CEO of LG Technology Ventures, is pleased about that because he believes so-called robo-taxis offer a better experience than the likes of Uber or regular cabs, mainly because you don’t have to deal with a driver.

“In San Francisco, getting into a robo-taxi is very pleasant,” he said. “You don’t have to worry about the driver, you can set the air conditioning as you like, you can choose the music. It is a more pleasant experience.”

But he said local regulations were holding back the spread of robo-taxis. He also said they required very good mapping, and that took time. That, he said, was why Waymo was spreading city by city.

And he said for rural areas, autonomous shuttles could be life changing.

The problem, said Vivetha Natterjee from Zeekr Technology, was that different car makers and different regions of the world were approaching the deployment of robo-taxis differently. She said there had been pilots, trials and deployments around the world but there were signs that these were coming together.

“We now see the possibility of global deployment,” she said, but added there were still legal hurdles with which to deal.

“It is not a question of if something goes wrong,” she said. “Something definitely will go wrong, so it is a matter of what you do then. Someone will have to take the blame.”

AI said Dong-Su Kim had also impacted the manufacturing and R&D worlds, and that would lead to lower prices.

Anne Laliron, senior vice president at Stellantis, said the potential of AI could only be realised by sharing data, and then it could optimise traffic flow in cities and help reduce emissions.

“The data could be useful for cities to improve junctions that could be dangerous,” she said. “We have seen that in a city in France.”

Karl Deppen from Daimler Trucks agreed that AI could have a huge impact in improving road safety.

“We see a lot of AI apps entering the value chain,” he said. “We have to understand the benefits we can get from AI, and we also have to understand the risks.”

But Laliron added there was a lot more now that could be done with AI.

“AI is a way to improve all our organisations,” she said. “It is helping optimise our work.”

But for that she said it was important the industry built trust, and to do that it needed experience.



Tony Han: “We don’t want to create problems.”



Karl Deppen: “AI could have a huge impact on safety.”

“We build trust with our customers by getting feedback from them,” she said. “We want safer mobility for all and we have to work in collaboration. By working with different players, we can maximise our work.”

Tony Han, CEO of WeRide, said though AI was a global market, it was important to tailor it for the needs of local society.

“We want to use AI to solve the problems of the local society,” he said. “We don’t want to create problems.”



Vivetha Natterjee: “Someone will have to take the blame.”

What will connected cars look like?

The way people view cars is changing fundamentally as the world progresses to more automated and autonomous vehicles. People are starting to see their vehicles as just an extension of an already connected lifestyle, and that will continue,

People want to do lots of other things in their cars," said Elena Boisseuil from Nissan. "In China, we are seeing a full integration of their lifestyles. In Europe, we are seeing the focus on navigation and safety."

On this she said China was showing the way it was going to go.

"It is a glimpse of the future," she said. "The younger generation in Europe and the USA will have the same digital expectations. The car becomes another device in their lives and they expect it to be connected to their lifestyles."



Elena Boisseuil: "We will see more interactions with the vehicle."



Mara Cole: "We are doing things for the first time."

And Mara Cole from Bayern Innovativ, added: "One of the fun things with connected cars is we are doing things for the first time. The users don't think of the background, they use the features."

Mohammad Horani, director of advanced engineering at Mitsubishi Electric, said an ideal connected vehicle would allow data to be consumed at the edge.

"We can reach a point where the whole in-cabin experience is streamed and customised," he said.

But Kyle Sabie from Enterprise Holdings is not sure people are ready for this. "Adas and AI require education," he said. "People are not used to this technology, so we need time to explain what this technology does and how it works."

Boisseuil thinks a lot of this will come naturally as users adopt the technology and provide feedback.

"They will talk with their friends and family," she said. "This all leads to trust. In Europe, they are more sceptical than they are in China where there is more trust to share more."

She said using AI agents would help build people's relationships with their cars.

"We will see more interactions with the vehicle because of AI. That will be for all occupants in the car. AI will play a big role in personalising the experience."

Sabie agreed consumers were putting trust in technology but said the industry still had a duty of care.

"We have to be transparent," he said. "We have to provide transparency about what we are doing to build and monitor that trust."

Horani said trust played a big role in increasing the use of these systems.

Asutosh Kumar from Tata Communications said security was a requirement for more features to be deployed at the edge.



Mohammad Horani: "An ideal connected vehicle would allow data to be consumed at the edge."



Kyle Sabie: "People are not used to this technology."

"We have to secure that environment," he said. "For the edge, the cloud and the car and the connections between these three environments, we have to make sure there are enough secure practices in place. We need to get the OEMs to think more about how they can master this."



Asutosh Kumar: "We have to secure that environment."

Reflecting on Formula E



Julia Pallé

After more than a decade of Formula E, the sport's sustainability vice president Julia Pallé reflected on what they set out to do and how far they have succeeded.

"We were founded with the goal of supporting the move to electric vehicles by showing it could be done in motorsport," she said. "We had to change the way mobility was seen."

EVs, she said, were more energy efficient than any other form of transport. But she said with Formula E it was more than that as these cars were designed and built using the principles of a circular economy.

As to the influence Formula E has had on other areas of motorsport, she said the industry was trying to be more sustainable.

"They will implement it strategically but it will never be as cultural as it is for us because they are there for a different purpose and their audience has different expectations," she said. "We created a sport from scratch."



SDVs change interactions with vehicles

Software-defined vehicles (SDVs) will not just create extra revenue streams for manufacturers but will also change the way drivers and passengers interact with their cars.



Marcus Welz

"The vehicle has a lot of information," said Marcus Welz from Hyundai. "It knows when I am driving to the office. It knows the traffic situation. It knows what I like to listen to. It can suggest what to play based on how long the journey will take. This is not the consumer adapting to the car but the vehicle adapting to the consumer."

Magnus Östberg from Mercedes-Benz agreed: "In the new era we are breaking through and creating a new user experience. It is possible to have an actual conversation with the vehicle. The vehicle will learn how to tailor features to the individual. This is the big breakthrough."

But he was keen to stress this was not just technology for technology's sake.

"The real value is what the customer actually uses," he said. "Understanding customer use cases is immensely important. And you have to look at other users of the vehicle; you can add on features for them. It gives us enormous possibilities."

There is also the possibility of having features on demand, said Welz. These could be features the customer pays for or they could just enhance the customer experience.

"These could help the customer use the car for longer and give it a higher resale value," said Welz. "AI is unlocking features that were not possible before."



Magnus Östberg



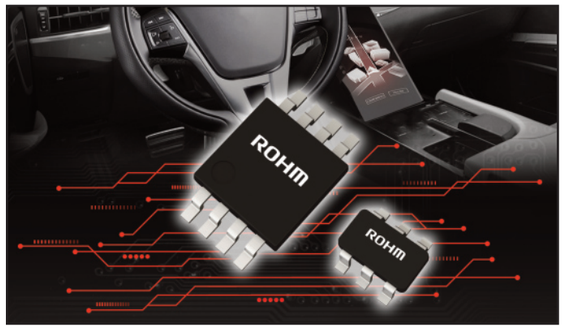
Current sense amps compatible with negative and high voltages

Current sense amps from Rohm meet AEC-Q100.

The BD1423xFVJ-C units in the tssop-B8J package support input voltages up to +80V, making them suitable for high-voltage environments such as 48V DC-DC converters, redundant power supplies, auxiliary batteries and electric compressors.

The series includes three models with different gain settings.

For lower voltage use, the BD1422xG-C, available in the ssop6 package, supports input voltages up to +40V. This makes it suitable for automotive applications requiring space-saving designs, such as current monitoring and overcurrent protection in 5 and 12V power supply networks used in body and drivetrain domains.



This series also has three gain options.

A current sense amp indirectly measures the current flowing through a circuit by amplifying the miniscule voltage drop across a shunt resistor. The amplified signal is then sent to an ADC or comparator for system control and monitoring.

These automotive-grade current sense amps leverage proven analogue expertise. This enables high-accuracy current sensing with compatibility for negative and high voltage environments, contributing to improved safety and reliability in automotive applications, particularly electric vehicles.

They integrate most current sensing circuitry, typically an operational amplifier and discrete components, into one package. As a result, current detection is possible by simply connecting a shunt resistor.

The devices also have a two-stage amplifier configuration, consisting of a chopper amplifier at the input and an auto-zero amplifier at the output. Internal resistor matching for gain setting ensures stable, accurate current sensing (±1%) while reducing the effects of temperature variations.

Furthermore, current detection accuracy is maintained even when an external RC filter circuit is added for noise suppression, reducing design complexity and development time.

Additional features include -14V negative voltage tolerance that supports back electromotive force, reverse connection and negative voltage input.

SiC mosfets step up from industrial to automotive

Automotive-qualified 1.2kV silicon carbide (SiC) mosfets from Nexperia have $R_{DS(on)}$ values of 30, 40 and 60mΩ.

They were previously offered in industrial grade and have now been AEC-Q101 certified.

This makes them suitable for automotive applications such as OBCs and traction inverters in electric vehicles as well as DC-DC converters and hvac systems.

They are housed in the D2Pak-7 package, which is more suitable for automated assembly operations than through-hole devices.

$R_{DS(on)}$ is a critical performance parameter for SiC mosfets as it impacts conduction losses. However, concentrating on the nominal value neglects that it can increase by more than 100% as device operating temperatures rise, resulting in a considerable increase in conduction losses.

The temperature stability is more critical when SMD package technologies are used compared with through-hole technology since devices are cooled through the PCB.

With these devices, the nominal value of $R_{DS(on)}$ increases by only 38% over an operating range from +25°C to +175°C.





Inductive sensor

An inductive sensor from Infineon can enhance performance in automotive chassis applications.

The Xensiv TLE4802-SC16-S0000 allows high-precision torque and angle measurements with stray field robustness, supporting digital output via Sent or SPC.

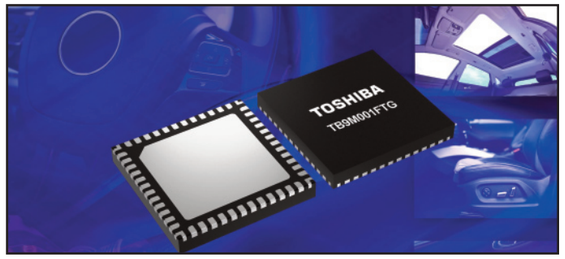
It achieves accurate sensing without additional shielding. For use in electric power steering systems, including torque and steering angle sensors, as well as pedal and suspension applications, the sensor offers flexibility and reliability.

It combines a coil driver, signal conditioning circuits and DSP.

The sensor includes overvoltage age and reverse polarity protection and comes in an RoHS-compliant and halogen-free surface-mounted tssop-16.

Qualified to AEC-Q100, grade 0, it operates from -40 to +150°C.

The sensor complies with ISO 26262.



Driver controls brushed motors

Toshiba has started sampling the TB9M001FTG, the second product in the SmartMCD motor control driver series.

This device delivers efficient and accurate control of brushed DC motors in automotive applications, including electric sunroofs, wipers, powered windows and adjustable seats.

The device integrates four low-side drivers that function as relay drivers, enabling forward and reverse control of two brushed DC motors when using single-pole double-throw (SPDT) relays.

In addition, the device has a built-in microcontroller with an Arm Cortex-M0 core, 192kbyte of flash memory and an additional 16kbyte of data flash. It also includes two high-side drivers for supporting 5 and 12V loads to external components, a Lin transceiver for in-vehicle communication, and an integrated power management system that generates all the required voltage levels from the car battery.

All these functions are integrated into a VQFN48 package, measuring typically 7 by 7mm.

It is AEC-Q100 grade-one qualified and meets Asil-A requirements.

Safety features include built-in error detections for overcurrent (low-side driver, high-side driver), overvoltage, undervoltage and thermal shutdown protection.

Sample shipments have started, with mass production due in December.

• Toshiba has also extended its line of isolation devices with four AEC-Q100 qualified, two-channel, high-speed digital isolators.

The DCM32xx00 series supports stable operation with high common-mode transient immunity (CMTI) of 100kV/μs typical at data transmission rates up to 50Mbit/s.



The devices ensure the safety and reliability of the OBC and BMS used in hybrid and full electric vehicles.

Leveraging proprietary magnetic coupling technology, the series delivers the high CMTI at supply voltages from 3 to 5V with a common-mode voltage of 1.5kV.

The devices are resistant to common-mode electrical noise at the input and output nodes, delivering stable equipment control signals for reliable operation.

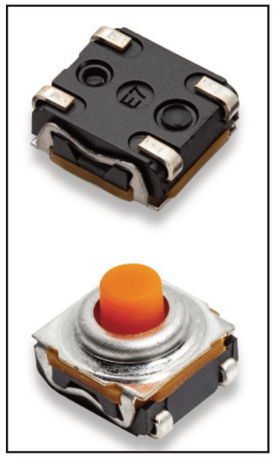
They provide pulse-width distortion of 0.8ns typical and are suitable high speed communication applications such as IO interfaces with Can communications.

The isolators are available in the eight-pin soic8-N package and have stable operation between -40 and +125°C.

Extended cage simplifies switch potting process

Sealed surface-mount tactile switches from Littelfuse support rugged applications across industrial, transportation, medical, aerospace and high-end consumer markets

The KSC PF compact, IP67-rated momentary action switches deliver environmental protection through an extended cage design that simplifies the potting process and improves long-term durability in harsh environments.



They have a 6.2 by 6.2 by 5.2mm footprint, soft actuator with positive tactile feedback, and protection against moisture, dust and vibration.

Its potting-friendly architecture offers engineers flexibility when designing electronics for outdoor and mission-critical environments.

While sealed tactile switches are not new to the KSC portfolio, the PF is the first optimised explicitly for potting, a process that is rapidly gaining traction across multiple industries.

Potting involves fully encapsulating sensitive PCB-mounted components in resin, providing an extra layer of protection against corrosive agents, thermal shock and vibration.

Standard flat cage switch designs typically limit the depth of resin coverage, which can compromise protection. In contrast, the extended cage enables deeper potting, improves tolerance for resin surface levels, and protects adjacent PCB components, all while streamlining the production process and enhancing product reliability.

Potting is becoming standard in rugged applications such as e-mobility, industrial automation and outdoor electronics.

Compatible with SMT automated assembly for high-volume production, the switches are available with gullwing or J-bend termination options. They are rated up to one million cycles.

Maximum power handling is 1VA at 32V DC.

The switches are available in tape and reel format in quantities of 1400.

USB connector meets USCar standards

A shielded USB type-C connector from Hirose complies with USCar-2 and USCar-30 standards.

The AU1 has a reinforced shell and housing for vibration and heat resistance up to +105˚C.

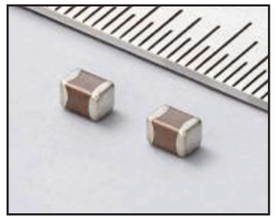
Supporting USB 3.2 Gen2, DisplayPort 1.4 and HDMI standards, the connector provides flexible connectivity across in-vehicle systems.

It is available in straight, right-angle horizontal and right-angle vertical versions.

Built-in connector position assurance delivers reliable signal transmission in harsh environments.

Cable length is 1000mm and transmission rate 10Gbit/s.





MLCC breaks size record

A multilayer ceramic capacitor (MLCC) from Murata has entered mass production and is said to be the world's first 0805 size (2.0 by 1.25mm) MLCC to offer a capacitance of 10μF with a 50V DC rating.

The GCM21BE71-H106KE02 is engineered for 12V automotive power lines.

The capacitor leverages Murata's proprietary ceramic material and thinning technologies to help engineers save PCB space and reduce the overall capacitor count, resulting in smaller, more efficient and reliable automotive systems.

It offers roughly 2.1 times the capacitance of the firm's previous 4.7μF, 50V DC product, despite sharing the same physical size.

Furthermore, compared with the previous 10μF, 50V DC MLCC in the larger 1206 size (3.2 by 1.6mm), this MLCC occupies approximately 53% less space.

Operating temperature is -55 to +125˚C. It weighs 17mg.

Eight-channel driver meets Asil B

An eight-channel automotive low-side driver from ST Microelectronics is ISO 26262 compliant and housed in a compact, leadless outline that saves space in body-control modules, hvac and climate controls, and power-domain controls.

The L9800 outputs can drive resistive, capacitive or inductive loads such as relays, solenoids and LEDs.

With continuous real-time diagnostics and open-circuit, short-circuit, overcurrent and overtemperature protection per channel, it enhances vehicle reliability and eases system-level ISO 26262 certification up to Asil B.

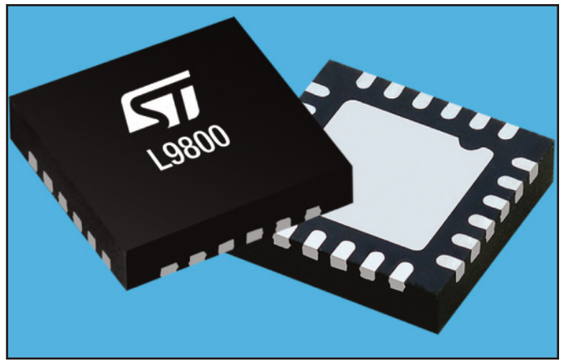
The diagnostic signals are available at the SPI port, which also provides access to the driver's internal configuration registers for device set-up.

The eight output channels can be driven via the SPI interface or alternatively using two dedicated parallel inputs that can be mapped to selected outputs.

These pins also allow emergency hardware control of two default channels even if the digital supply voltage is not available. This lets the device operate in limp-home mode, maintaining essential functions for safety and convenience in the event of a system failure such as a microcontroller fault or supply undervoltage.

It also provides a bulb-inrush mode that allows driving small lamps of about 2W or other electronic loads with high input capacitance, with protection against excessive current. In addition, the driver ensures safe operation during engine cranking with battery voltage as low as 3V.

It is available in a 4 by 4mm TFQFN24 package and is in production.



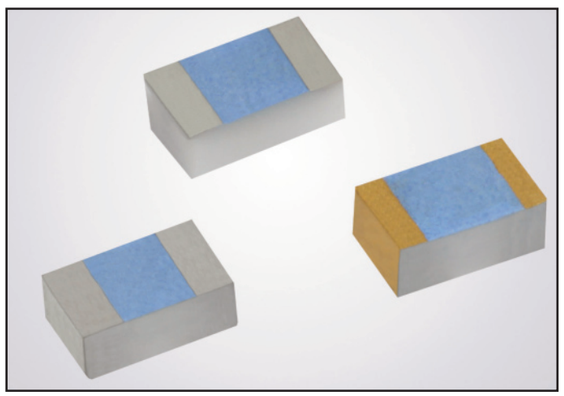
Thin-film chip resistors in 0402 case

Vishay has expanded its Cha series of AEC-Q200-qualified thin-film chip resistors with devices in the 0402 case size.

Available with resistance values from 10 to 500Ω, the Cha 0402 resistors provide frequency performance up to 50GHz for automotive, telecoms, medical, space, avionics and military applications.

Now available in the 02016 and 0402 case sizes, the devices offer low internal reactance and exhibit behaviour close to a pure resistor over their large frequency range, with nearly flat Z/R curve to 70 and 50GHz.

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



The series is suitable for automotive adas, lidar, connectivity and 4D radar systems. For these, the resistors provide limiting voltage of 37V, rated power of 300mW at +70˚C, and ±100ppm/˚C temperature coefficient with ±50ppm/˚C available on request.

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

The resistors are offered in waffle pack and tape and reel packaging.

Inverter brings GaN to medium-voltage drives

A 25A RMS, three-phase BLDC motor drive inverter reference design from EPC is for 96 to 150V battery-powered motor drive applications.

These include steering systems in automated guided vehicles and traction motors in compact autonomous vehicles.

Powered by the EPC2304 eGaN fet, the EPC9196 offers designers a compact, efficient and ready-to-deploy product to accelerate development and optimise system performance in the lower end of the 25 to 400A RMS application range.

The EPC2304 is a 200V-rated, 3.5mΩ typical fet in a thermally enhanced QFN package.

Chosen for its low $R_{DS(on)}$ and performance in compact form factors, it enables the EPC9196 to deliver up to 35A peak, 25A RMS, phase current at switching frequencies up to 100kHz.

This translates to low switching losses, reduced dead time and a smooth, low-noise motor drive profile even at high PWM speeds.

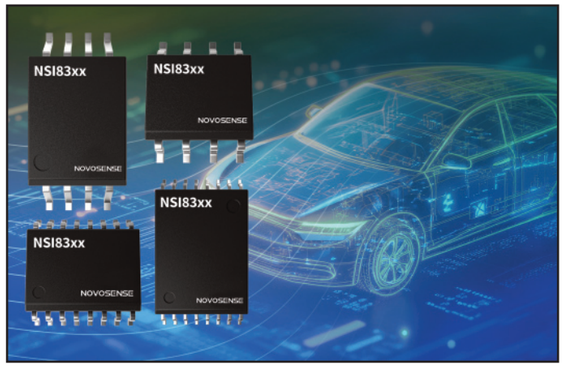
Input voltage is from 30 to 170V, and it has integrated gate drivers, housekeeping power, current and voltage sense, over-current protection, and thermal monitoring. The dv/dt control is optimised for motor drive applications below 10V/ns.

It is compatible with multiple motor drive controllers from Microchip, STM, TI and Renesas.

Ready for sensorless or encoder-based control configurations, it has been validated in real-world conditions, powering a 3kW servo motor at 150V DC and 60kHz switching frequency.

The design delivers clean waveforms with low ringing and good thermal behaviour with and without a heatsink.





Digital isolators ensure signal integrity for SiC

Automotive-grade digital isolators from Novosense suit simplified system-level EMI mitigation and ensure signal integrity in dense, high-frequency SiC-based switching environments.

The NSI83xx capacitive-based isolators are said to offer better EOS resilience and low power noise susceptibility.

The devices deliver reinforced insulation above 10kV RMS, a CMTI of 200kV/μs, and a lifespan exceeding 30 years.

Designed for applications such as BMS and traction inverters, the AEC-Q100-compliant series has an EMI performance achieving over 10dB margin in the Cispr 25 Class 5 test.

The firm is also introducing its NSI67x0 smart isolated gate driver series to the European market. Built to support the latest SiC and IGBT devices, these drivers offer precise control, robust CMTI and short propagation delays for managing the fast switching speeds and high voltages in modern traction inverters.

Their integration helps reduce design complexity while improving gate drive reliability under harsh electrical transients.

Also new to Europe is the NSM201x-P Hall-effect current sensor series. Tailored for new-energy vehicle (NEV) OBCs, DC-DC converters and solar system applications, these sensors can achieve sub-±1% sensitivity error and low zero offset error across wide temperature ranges, thanks to calibration and compensation technologies.

With 5kV EMS isolation, 1.5μs overcurrent detection and primary-side resistance down to 0.27mΩ, they offer accuracy and safety in space-constrained, high-current environments.

Depth sensor improves lidar performance

A stacked, direct time of flight (dToF) spad depth sensor from Sony is for automotive lidar systems, delivering high resolution and speed.

The IMX479 employs a dToF pixel unit composed of 3×3 single photon avalanche diode (spad) pixels as a minimum element to enhance measurement accuracy using line scan methods.

By integrating the distance measurement circuits and dToF pixels on one chip, the product has achieved a frame rate of up to 20fps while delivering a resolution of 520 dToF pixels with a pixel size of 10μm square.

Spad depth sensors use the dToF measurement method to measure the distance to an object by detecting the time of flight (time difference) of light emitted from a source until it returns to the sensor after being reflected by the object.

The sensor harnesses technologies acquired in the development of cmos image sensors, including the back-side illuminated, stacked structure and Cu-Cu connections.

This product consists of a pixel chip with back-illuminated dToF pixels and a logic chip with distance measurement circuits using a Cu-Cu connection on one chip.

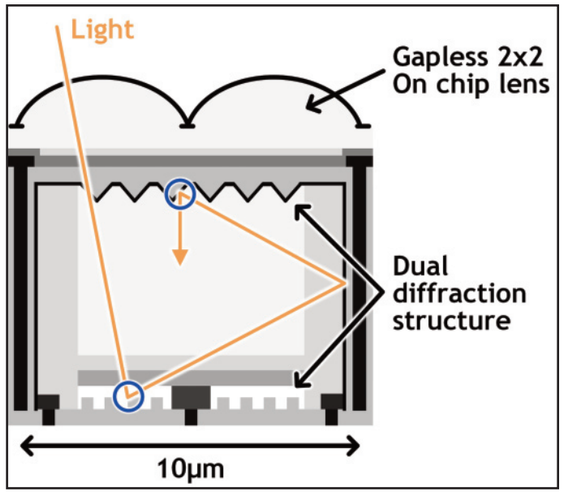
The distance measurement circuits handle multiple processes in parallel for higher speed processing.

These technologies deliver capabilities equivalent to 0.05˚ vertical angular resolution, improving the vertical detection accuracy by 2.7 times that of conventional products.

These elements allow detection of 3D objects that are vital to automotive lidar, including objects as high as 25cm such as a tyre or other objects in the road at a distance of 250m.

The proprietary circuits individually process each spad pixel data and calculate the distance. Doing so improved the lidar distance resolution to 5cm intervals.

Incident light is diffracted to enhance the absorption rate to achieve a 37% photon detection efficiency for the 940nm wavelength, which is commonly used on automotive lidar laser light sources.



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© 2025 Vehicle Electronics
ISSN 2055-1177

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