VEHICLE electronics

The monthly magazine for automotive electronics engineers

Self-driving fault forces Tesla recall

Tesla is recalling more then 360,00 vehicles because of a problem with its full self-driving (FSD) feature that can be a safety risk at intersections.

The fault has caused 18 incidents since May 2019, though none have resulted in injuries or death.

Tesla is recalling certain 2016 to 2023 Models S and X, 2017 to 2023 Model 3, and 2020 to 2023 Model Y vehicles equipped with FSD beta software or pending installation.

According to the US National Highway Traffic Safety Administration (NHTSA), the FSD beta system may allow the vehicle to act unsafe around intersections, such as traveling straight through an intersection while in a turn-only lane, entering a stop sign-controlled intersection without coming to a complete stop, or proceeding into an intersection during a steady yellow traffic signal without due caution.

In addition, the system may respond insufficiently to changes in posted speed limits or not adequately account for the driver's adjustment of the vehicle's speed to exceed posted speed limits.

An NHTSA statement said the software allowed a vehicle to exceed speed limits or travel through intersections in an unlawful or unpredictable manner, increasing the risk of a crash.

Tesla will release an over-the-air (OTA) software update, free of charge. Owner notification letters are expected to be mailed by 15 April 2023.

The NHSTA says this could potentially affect 362,758 vehicles.

Tesla CEO Elon Musk said in a Tweet: "The word 'recall' for an over-the-air software update is anachronistic and just flat wrong."

FSD beta is an SAE level-two feature that can provide steering, braking and acceleration support to the driver under certain operating limitations.

The driver is responsible for operating the vehicle when the feature is engaged, but it could potentially infringe local traffic laws or customs during some manoeuvres before drivers intervene.



Tesla 2017 Models S and X

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OnSemi provides SiC modules for VW traction inverters

OnSemi is providing modules and semiconductors to Volkswagen to enable a complete EV traction inverter.

The semiconductors support the front and rear inverters in VW vehicles.

In a first step, OnSemi will deliver its EliteSiC 1.2kV traction inverter power modules. The modules are pin-to-pin compatible to scale to different power levels and types of motors.

Teams from the two companies have been collaborating for more than a year on the optimisation of the power modules, with pre-production samples under development and evaluation.

"The superior performance and quality of OnSemi's traction inverter modules together with our joint efforts to create the best system enable us to deliver the outstanding driving experience and quality customers expect from a VW group vehicle," said Karsten Schnake, head of the Compass operative and strategic semiconductor taskforce at Volkswagen. "OnSemi's broad portfolio of intelligent power and sensing further allows us to offer cutting-edge technologies and features in our EVs, from the traction inverter and beyond. Beside this milestone, OnSemi with its balanced production facility layout in the USA, Asia and Europe, including the plant in the Czech Republic, is the perfect match to support our strategic markets."

With 19 wafer fab and packaging manufacturing sites, OnSemi provides VW with more than 500 devices including IGBTs, mosfets, image sensors and PMICs.

The company has a silicon carbide (SiC) production chain that includes volume boule growth, wafering, substrate, epitaxy, device fabrication, integrated modules and discrete packages.

"Our broad manufacturing footprint – including a resilient end-to-end SiC supply chain – empowers OnSemi to deliver the supply assurance OEMs demand," said Simon Keeton, EVP at OnSemi.

ZF and Beep L4 shuttle for USA



ZF and mobility provider Beep are bringing this autonomous level-four shuttle to the US market. The two companies have agreed potentially to supply several thousand vehicles. It combines ZF's autonomous transport system (ATS) with Beep's mobility service management platform.

The shuttle is equipped with lidar, radar, camera and audio that provide precise environmental detection. This is complemented by ZF's ProConnect connectivity platform, which enables communication with the infrastructure and the cloud, and the ZF ProAI computer.

ZF's automated driving software processes the information, derives safe driving strategies using artificial intelligence, and passes them on as input to the on-board actuators.

The emission-free shuttles can operate on defined routes 24 hours a day, seven days a week. Public transport operators can provide passengers with a mobility service even when demand is low and expand routes to meet increased demand.

Headquartered in Florida, Beep delivers shared mobility services.

"ZF's full suite of shuttle services, its US partner network and its automotive-grade vehicle complement our turnkey mobility networks and autonomous services technology platform," said Joe Moye, CEO for Beep, which is evaluating a number of possible sites and routes.

Continental display recognises drivers

Continental and its partner Trinamix have developed a display with an integrated camera for biometric driver identification.

It will be on show at Mobile World Congress from 27 February to 2 March in Barcelona on the Trinamix stand.

Using a function that many users are familiar with from face recognition on their smartphones, the technology protects against car theft since the vehicle can only be started after authentication of the person in the driver's seat.

This can also be used for digital payment via the car display when refuelling, parking or paying tolls, as well as car rental. In addition, the technology can be used for payments in app stores or for access to digital services.

The camera is also used to monitor the driver's attention looking for signs of fatigue at the wheel. It is seamlessly integrated into the display, making it invisible to the driver.



Vehicle only starts when driver is recognised

"The secure identification of vehicle users is an important function for future vehicles," said Philipp von Hirschheydt from Continental.

The integrated facial authentication is based on technology developed and patented by Trinamix. It combines facial recognition to verify the identity of the user with a new type of liveness detection. By recognising human skin, the system prevents spoofing, for example through photographs or realistic three-dimensional masks of the legitimate driver.

"Continental and Tinamix share the goal of improving security and comfort for consumers," said Wilfried Hermes, director of consumer electronics at Trinamix. "As an experienced automotive supplier and pioneer in connected mobility technologies, Continental enables us to develop new applications for Trinamix face authentication. Thanks to Continental's innovative display technology, all of this goes hand in hand with a perfect interior design."

ECar X plans digital cockpit for FAW

Mobility technology provider ECar X and semiconductor company SiEngine are working with Chinese car maker FAW to develop digital cockpits.

Based on the SE1000 SoC from SiEngine, the cockpits are planned for mass production by the end of this year for FAW vehicles.

SiEngine is a joint venture between ECar X and Arm in China.

Using ECar X's E04 digital cockpit computing platform, which is embedded with the SE1000 7nm SoC, the aim is to develop a digital cockpit for FAW models.

The platform will combine ECar X's self-developed hardware computing module, global vehicle operating system and software stack, with the SE1000 SoC. It also supports Android Automotive and GAS-based Google services and experiences from its ecosystem for the global market.

The SoC uses a 7nm AI processor combined with 8.8 billion transistors. It adopts a multi-core heterogeneous architecture and computing cluster, with eight-core CPU, 14-core GPU and independent NPU with 8Tops AI computing power, which can support the development of intelligent driving functions.

Its audio and video processing capabilities can support up to seven high-definition screen outputs and 12 video signal inputs, and it is equipped with dual Hifi 5 DSP processors.

There are built-in independent function safety islands and information safety islands. Different processor clusters independently serve different functional domains and integrate system safety functions at Asil-B, improving real-time, safety and data privacy.

The platform is also said to be the first in the digital cockpit field to adopt LPDDR5 high-speed memory modules.

Andes and LDRA collaborate on safety-critical software

Andes Technology, a supplier of 32 and 64bit Risc-V processor cores, has integrated its AndeSight IDE with the LDRA tool suite for automotive and other applications.

The integration with LDRA's software standards compliance, testing and verification tools helps developers manage applications in complex and safety-critical industries for safer, more secure, more efficient and more capable software.

As part of the integration, the LDRA tool suite, along with the Eclipse plugin, hooks into the AndeSight integrated development environment (IDE) to allow compilation, linking, programming and execution in the AndeSight environments.

The LDRA tool suite offers the built-in import capability to reduce the static analysis efforts of AndeSight project files via included paths, macros and other settings. In addition, the LDRA tool suite performs dynamic analysis on simulator targets within the AndeSight IDE or on evaluation boards.

This lets users perform system and unit tests using the already available Andes infrastructure.

The integration provides features such as source code static analysis, software dynamic analysis, software unit and integration testing on the host and target, improved code quality, and reduced testing time.

TÜV SÜD examined the quality and compliance of the software development processes and functional safety management of the LDRA tools.

The AndesCore N25F-SE is a safety-enhanced 32bit Risc-V CPU core and is certified to ISO 26262 Asil B functional safety standards.

"Designers are moving towards real implementations of their Risc-V designs within multiple safety-critical industries," said Ian Hennell, LDRA operations director. "As the focus shifts to a software-driven architecture supported by top-notch analysis tools, the Risc-V efforts require more than just enabling the existing architecture. With our integration with Andes, developers can meet these requirements while making sure their software is safe and security-driven."



Renesas unveils four SoC devices at ISSCC

Renesas announced four technologies for system-on-chip (SoC) devices for in-vehicle communication gateways at February's International Solid-State Circuits Conference (ISSCC) in San Francisco.

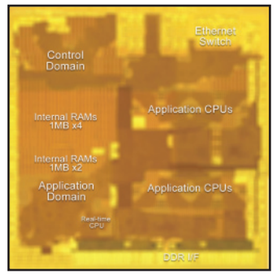
These SoCs are expected to help define electrical and electronic (EE) architectures in automotive systems.

The first is an architecture that dynamically changes the circuit operation timing to match the vehicle conditions with optimised performance and power consumption.

Second is fast start-up technology created by partitioning and powering essential programmes only.

The third is a network accelerator that achieves a power efficiency of 10Gbit/s/W. And fourth is security technology that prevents communication interference by recognising and protecting vital in-vehicle communications related to vehicle control.

For the first, Renesas combined in a single chip a high-performance application and a control system optimised for low standby power consumption.



Vehicle gateway SoC test chip

The architecture controls the power supplies of these two subsystems and changes the timing of circuit operation to achieve a balance between performance and power efficiency.

For the second, Renesas developed technology that splits the programme into sections and initially loads and decrypts only an essential portion for start-up, while continuing to load the rest of the programme in parallel. This enables a fast response to Can of 50ms or less, even when using external flash memory.

In the third, Renesas offloaded processing from the CPU to a custom network accelerator, achieving higher efficiency at 9.4Gbit/s/W. Additionally, Renesas boosted efficiency to 11.5Gbit/s/W by switching the routing method from a conventional TCAM approach to a hash table in sram.

And for the fourth, Renesas developed security technology that analyses incoming packets to the SoC. It determines whether they contain essential data, and assigns them to different pathways and control functions within the network accelerator. This prevents interference with data that require high reliability and safeguards in-vehicle data communications from various security threats.

These four technologies have been incorporated into Renesas' R-Car S4 vehicle communication gateway SoC. With this, developers should be able to accelerate advances in EE architectures, implement secure connection with cloud services, and ensure safe and reliable vehicle control at the same time.

Nissan chooses Trimble as positioning source

Nissan will use Trimble's RTX technology as its positioning source, enabling hands-off and guided freeway driving in ProPilot Assist 2.0 driver assistance, available initially on the 2023 Ariya.

While positioning with standard GNSS may drift up to 10m, RTX provides higher accuracy and enables consistent lane determination.

Increasingly being used on freeways, lane-level accuracy via adas is an enabler in the journey to fully autonomous driving.

"Trimble has been at the forefront of precise positioning for decades and has served the automotive segment for nearly as long," said Patricia Boothe, general manager at Trimble.

The ProPilot Assist 2.0 enables hands-off driving while cruising in a single lane. When the vehicle approaches a road divide, or when passing a slower vehicle is possible, the system judges the appropriate timing of branching off or passing based on information from the navigation system and 360° sensing.

Intuitive audio and visual guidance is given to drivers, who are prompted to put both hands on the steering wheel and confirm operations.

The positioning technology, underpinned by integrity monitoring, enables consistent lane-level positioning in complex, real-world driving environments.

RTX positioning technology can provide decimetre-level accuracy in seconds.

Microsoft opts for Otonomo vehicle data

Microsoft has selected Otonomo to support and improve its global mapping services.

The streaming connected-vehicle data from Otonomo will let Microsoft develop enhancements to its mapping services for Microsoft Maps users across Azure, Windows, 365 and Bing, including traffic conditions, accident notices and route optimisation.

Microsoft will use connected-vehicle data including traffic data, road safety events and road sign data to enrich and validate its road network data. With these additional data sets, Microsoft can derive insights to support its mapping products and services, such as new road geometries or turn restrictions.

"Microsoft's robust mapping services offer a wealth of detailed location and traffic data to its users across the company's ecosystem of services, platforms and applications," said Ben Volkow, Otonomo CEO. "We're pleased Microsoft recognised the benefit of the breadth, depth and quality of the connected vehicle data that run through Otonomo."

Russell Dicker from Microsoft added: "The connected vehicle data available through Otonomo will provide a meaningful and high-impact addition to our current processing chains and data sets."

Google helps Mercedes-Benz navigate

Mercedes-Benz plans to build branded navigation using in-car geospatial data and navigation capabilities from the Google Maps platform.

The partnership should let Mercedes-Benz create a driving experience that pairs the information from Google Maps with its luxury brand and feel.

The companies have also agreed to explore collaboration using Google Cloud's artificial intelligence (AI), data and open infrastructure.

Starting immediately, Mercedes-Benz will provide access to features such as place details, provided by Google.

The long-term partnership gives the car maker access to Google's geospatial offering, including detailed information about places, real-time and predictive traffic information, and automatic rerouting.

By embedding these into the upcoming Mercedes-Benz Operating System (MB.Os), users should get a better navigation experience with graphics on the car's high-resolution screen.

The firms will add YouTube to the Mercedes infotainment system and use Google Maps for assisted driving features such as automatic speed adjustments before intersections, roundabouts or bends.

"We are excited to create unique services and elevate the level of convenience for customers," said Ola Källenius, chief executive officer at Mercedes-Benz. "It will be deeply integrated within our signature Mercedes-Benz user interface and fully connected to relevant vehicle functions like the state-of-charge."

As a first step, Mercedes-Benz will give users access to place details provided by Google, helping them find detailed information about more than 200 million businesses and places around the world, including business hours, photos, ratings and reviews.

Mercedes-Benz intends to use Google Cloud's AI and machine-learning capabilities to create, train and deploy new models at speed and enhance customer experiences.

The car maker will also use Google Cloud's data processing platform to analyse fleet data and Google's open infrastructure to innovate and scale from on-premises, to edge, to cloud.

"In addition to enabling Mercedes-Benz to design a customised navigation interface, we'll provide our AI and data capabilities to accelerate their sustainability efforts, advance autonomous driving, and create an enhanced customer experience," said Sundar Pichai, Google CEO.



Users should get a better navigation experience

Soft target doesn't walk like Flintstones

AB Dynamics has launched a pedestrian adas target to help manufacturers develop vehicles and sensor systems.

Limb articulation accurately replicates the gait of a pedestrian moving at various speeds. This is critical for testing sensor systems to ensure the target is correctly categorised as a pedestrian.

The gait is automatically synchronised with the position, speed and acceleration of the target relative to a starting point using the platform's inertial measurement unit. This prevents a phenomenon the team has termed as Flintstoning, where the foot in the stance portion of the gait is not stationary relative to the ground and results in better characterisation.

It has been designed from the ground up to reduce damage to the test vehicle in the case of a collision, which can have cost and time implications on test programmes.

Developed with AB Dynamics' sister company Dynamic Research, the Soft Pedestrian 360 supports tests for improved sensor perception and categorisation as well as decreasing the time and cost of testing through improved robustness.

"Properly representing the stance phase of the gait, when the foot is stationary relative to the ground, can be a critical factor in an AEB system's categorisation of the target as a pedestrian," said Joseph Kelly, chief engineer at Dynamic Research. "Without this attribute, an AEB system could miscategorise the target as something other than a pedestrian and react differently."



Target articulates knee, hip, shoulder and neck



Microchip Colorado Springs campus

Microchip invests $880m to expand SiC production

Microchip Technology plans to invest $880m to expand its silicon carbide (SiC) and silicon production capacity at its Colorado Springs manufacturing facility over the next several years.

One phase of the expansion is to develop and upgrade its 54,000-square-metre Colorado Springs campus for increased SiC manufacturing for use in automotive, e-mobility and other applications.

Microchip was approved for state and local incentives of approximately $47m for the expansion.

Colorado Springs mayor John Suthers said this should create roughly 400 new high-paying jobs for those living in the region. The campus currently employs more than 850 people and produces products from 6-inch wafers.

The manufacturing technology that Microchip is installing will run on 8-inch wafers, which will increase the number of chips produced at this location.

The additional 400 jobs will range from production specialists to technical roles in equipment procurement and management, process control, and test engineering.

Microchip CEO Ganesh Moorthy said: "We see a bright future in the region made possible by great partnerships, state and local incentives, and a strong local talented workforce."

Rich Simoncic, senior vice president of Microchip's analogue businesses, added: "This campus is an integral part of producing our SiC technology to assure our customers with supply certainty as they transition to SiC."

Electrode material boosts EV supercapacitor performance

Researchers at Dongguk University in South Korea have designed and synthesised a novel hybrid composite electrode material that enhances the performance of supercapacitors for use in hybrid electric vehicles (HEVs).

This composite electrode is comprised of cobalt selenide nanorod-copper selenide polyhedron-decorated over graphene oxide (CCS@GO) and is said to offer unprecedented electrochemical properties.

The researchers demonstrated an ecofriendly, economical fabrication, improved charge storage and retention, increased energy and power density attributable to the morphology of the electrode material.

Electronic devices and hybrid electric vehicles (HEVs) need charge storage devices to function well. Most charge storage devices are made from conventional metal sulphide or metal oxide supercapacitor electrodes.

However, poor electrical conductivity and low energy density are major problems in the use of supercapacitors, limiting commercial applications.

In contrast, transition metal selenides offer several enhanced electrochemical properties due to in-built physicochemical properties including high chemical stability, narrow bandgap and low electronegativity that lead to a faster electron-conducting rate than metal sulphides and oxides.

"A composite formed by the combination of metal selenides and carbon template is a fascinating approach to tune the properties of electrodes for electrochemical applications," said Hyun-Seok Kim from Dongguk University, who has been researching 2D materials and nano- and micro-electronics for energy and sensor devices. "Based on this idea, we have designed and constructed a new hybrid composite electrode comprising cobalt selenide nanorod-copper selenide polyhedron-decorated over graphene oxide, using a wet-chemical strategy."

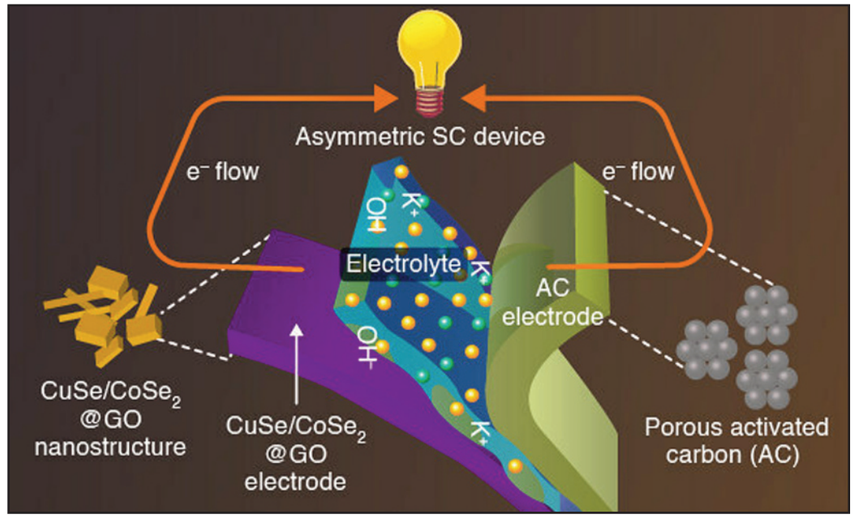
Kim and his research team demonstrated that the resultant composite electrode provides abundant space for migration of ions, and allows swift faradaic redox reactions leading to high storage performance in an electrochemical cell. The team attributed the enhanced electrochemical features to the morphology and high surface area of the electrode material.

They established that the synthesised electrode has outstanding electrochemical charge storage and retention properties.

Using the electrodes, they constructed an asymmetric supercapacitor device with a capacitance of 192.8Fg^{-1} at 1Ag^{-1}; energy density of 54.6Wh kg^{-1}; power density 700W kg^{-1}; and capacitance retention of about 82.5% over 10,000 cycles.

"We achieved our ultimate goal of constructing an electrochemical supercapacitor with improved electrochemical activity and long-term durability," said Kim.

The team used an ecofriendly, cost-effective, energy-efficient, wet-chemical fabrication method with earth-abundant copper and cobalt source materials for developing the electrodes.



Synthesis of novel CCS@GO

Ray tracing reduces need for real-world testing

RFPro has created simulation technology that reduces dependence on real-world testing for developing autonomous vehicles (AV) and adas.

The ray tracing rendering technology is said to be the first to simulate accurately how a vehicle's sensor system perceives the world.

"Until now, the fidelity of simulation hasn't been high enough to replace real-world data," said Matt Daley, operations director at RFPro. "Our ray tracing technology is physically modelled simulation that has been specifically developed for sensor systems to accurately replicate the way they see the world."

The ray tracing graphics engine is a fidelity image rendering system that sits alongside an existing rasterisation-based rendering engine. Rasterisation simulates light taking single bounces through a simulated scene.

This is sufficiently quick to enable real-time simulation and powers RFPro's driver-in-the-loop (DIL) option used across the automotive and motorsports industries.

Ray tracing is software-in-the-loop (SIL) aimed at generating synthetic training data. It uses multiple light rays through the scene to capture all the nuances of the real world accurately. As a multi-path technique, it can reliably simulate the huge number of reflections that happen around a sensor.

This is critical for low-light scenarios or environments where there are multiple light sources to portray reflections and shadows. Examples include multi-storey car parks and illuminated tunnels with bright ambient daylight at their exits, or urban night driving under multiple street lights.

Modern HDR (high dynamic range) cameras used in the automotive industry capture multiple exposures of varying lengths of time, for example, a short, medium and long exposure per frame. To simulate this accurately, RFPro has introduced its multi-exposure camera API.

This ensures the simulated images contain accurate blurring, caused by fast vehicle motions or road vibrations, alongside physically modelled rolling shutter effects.

"Simulating these phenomena is critical to accurately replicating what the camera sees, otherwise the data used to train adas and autonomous systems can be misleading," said Daley. "This is why traditionally only real-world data have been used to develop sensor systems. Now, for the first time, ray tracing and our multi-exposure camera API is creating engineering-grade, physically modelled images enabling manufacturers to fully develop sensor systems in simulation."

Ray tracing is applied to every element in a simulated scene, which has been physically modelled to include accurate material properties to create the highest-fidelity images. As this is computationally demanding, it can be decoupled from real time.

The rate of frame rendering is adjusted to suit the level of detail required.

This enables high-fidelity rendering to be carried out overnight and then played back in subsequent real-time runs. This overcomes the usual trade-off between rendering quality and running speed.



Motion blur in cameras is simulated as illustrated by these traffic cones

Automated driving boosts semiconductor market

The semiconductor market for automated driving will see a ten-year CAGR of 29%, according to IDTechEx.

Overall, the vehicle semiconductor market will have a ten-year CAGR of 9.4%, however semiconductors for automation, adas and autonomy will hit a CAGR of 29%.

This might be an understatement, says the report. The industry has been guilty of saying autonomous vehicles are around the corner for a while, but in some ways they are already here.

This year, the Mercedes S-Class got SAE level-three certification in the USA, following its certification in Germany in 2022. This has huge significance as the S-Class tends to be a trendsetter in the automotive industry.

IDTechEx is confident level-three technologies will trickle down through vehicle price points over the next decade. Even level-four vehicles now have an established presence in some cities.

In Phoenix, Arizona, anyone can use Waymo's completely driverless robotaxis, providing the route and end destination is within select geofenced regions.

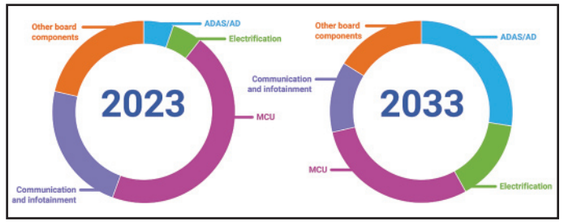
Not only will autonomous vehicles bring more sensors to vehicles, they will also require higher-performing sensors with more expensive and more advanced semiconductor technologies.

Radar, for example, has previously used quite mature 90nm SiGe bicomos technologies, but demand for better performance means 4D imaging radars will be adopting Si cmos technologies with nodes of 40nm and less.

As the node size drops, these radars gain performance, but become more expensive.

Lidar has been coming down in price recently, and its adoption is growing. It is a key sensor for vehicles at level three and above, but will also begin penetrating level two and below.

Near-infra-red lidars are the most deployed at the moment, and their detectors can be built on silicon, making them quite cheap.



Semiconductor distribution in the average car

But the report finds the trend in lidar is towards shortwave infra-red, which brings performance advantages but requires more expensive InGaAs detectors.

Finally, automated vehicles are going to require high-performance computers capable of thousands of Tops. The chips inside these computers are made using advanced processes at semiconductor foundries such as TSMC and Samsung.

This will also impact the automotive semiconductor supply chain; previously, microcontrollers have been the main computers in cars, built on mature technology nodes by established tier-two suppliers such as Infineon and NXP.

But the high-performance computing is beyond their internal fabrication capability, so they outsource to the east Asian giants. But others can do this as well, which is why fabless companies such as Mobileye and Nvidia can get more of a stake in the automotive semiconductor market.

Partnership eases app distribution for cars

Faurecia-Aptoide and Catappult are joining forces to launch a car app distribution service.

Using Faurecia-Aptoide's app store technology, developers can distribute their games and apps in cars. Faurecia Aptoide already works with car makers such as Volkswagen, BMW and Mercedes-Benz.

With the service, available at Catappult, developers can design and fine-tune their apps and games for cars, manufacturers can customise their app stores, and users will get access to a wide range of apps and games tailored to their interests and their cars' capabilities.

The distribution hub is provided to mobile app developers through Catappult, a one-stop shop for apps distribution across multiple channels. This means developers can easily distribute apps in major global app stores and in top car brands to enhance the consumer's car digital experience.

"It's incredibly exciting to launch this service together with Catappult," said Thijs van Herkhuizen, general manager of Faurecia-Aptoide.

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Ambarella puts AI SoC on Samsung 5nm process

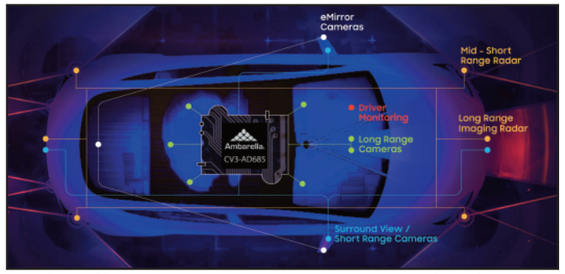
Ambarella is using Samsung's 5nm process technology for its recently announced CV3-AD685 automotive AI central domain controller.

This collaboration could help transform autonomous driving vehicle safety systems by bringing more AI processing performance, power and reliability.

The CV3-AD685 is the first production version of Ambarella's CV3-AD family of automotive AI central domain controllers with tier-one automotive suppliers announcing they will use the SoCs.

Samsung's 5nm technology is optimised for automotive-grade semiconductors with tight process controls and IP for improved reliability and traceability.

"Ambarella and Samsung Foundry have a rich history of collaboration, and we are excited to bring their world-class 5nm technology to our new CV3-AD685 SoCs," said Fermi Wang, CEO of Ambarella. "Samsung's proven automotive process technology allows us to bring new levels of AI acceleration, systems integration and power efficiency to adas and L2+ through L4 autonomous vehicles."



Ambarella SoC uses Samsung 5nm technology

The CV3-AD685 integrates Ambarella's CV-flow AI engine, which includes neural network processing that is 20 times faster than the CV2 SoCs. It also provides general- and neural-vector processing to deliver the performance required for full autonomous driving stack processing, including computer vision, 4D imaging radar, deep sensor fusion and path planning.

"Samsung brings 5nm EUV Finfet technology to automotive applications for unprecedented adas and vision processor performance," said Sang-Pil Sim, EVP at Samsung.

The SoC integrates image processing, a dense stereo and optical flow engine, Arm Cortex A78AE and R52 CPUs, an automotive GPU for visualisations, and a hardware security module.

It features an algorithm-first architecture that provides support for the entire autonomous-driving software stack.

The scalable CV3-AD family, which is built specifically for adas, complements products for assisted driving while advancing vehicle automation. The integrated SoC enables information from various sensors to be fused for L2+ to L4 autonomous driving.

Harman advances preventative maintenance

Samsung subsidiary Harman has created an approach to predictive and preventive maintenance of vehicle electronics in collaboration with Israeli firm ProteanTecs. This combines over-the-air (OTA) technology, deep data analytics and device health monitoring to notify, predict and prevent malfunctions in the entire fleet.

"The world is changing, and the vehicle is evolving to include more and more software," said Michal Geva, vice president at Harman. "The software-defined vehicle is now a reality and, as such, the software within the vehicle must be maintained and updated with the highest performance and availability."

He said ProteanTecs' technology transformed chips into smart sensors for the entire electronic control unit.

"Together we can offer automakers a platform to detect and remedy issues through a variety of OTA techniques," he said. "This collaboration keeps consumer experiences at the forefront, while delivering automotive grade results."

Gal Carmel, executive vice president at ProteanTecs, added: "Predicting and preventing failures of any kind – hardware or software – is imperative to fostering confidence in the next wave of automotive innovation. Harman is a well-recognised leader in the connected vehicle industry, and we welcome this opportunity to collaborate and combine our unique technologies to benefit OEMs and consumers alike."

AUTOMOTIVE WORLD 2023

MAKING CONNECTIONS

Steve Rogerson reports from Automotive World in Tokyo

Goal is to protect lives

Traffic accidents are not completely avoidable but the automotive industry should still be looking at how to protect the lives of more people, according to Kazuo Shimizu, CEO of Technomedia.

He said using autonomous driving to reduce traffic accidents was far in the future, which meant the industry had to look at what could be done today. Here, driver assistance technologies can help.

"The goal is to reduce traffic accidents to zero," he said. "We set the ambitious target to motivate ourselves."

Yoichi Sugimoto, executive chief engineer at Honda R&D, agreed. He said rather than staying at home, the industry had to be proactive in enhancing safety.

"It should be safe for everyone, including pedestrians and cyclists," he said. "And they should enjoy free movement."



Yoichi Sugimoto: "We want to eliminate traffic accidents."

Though the number of traffic fatalities was coming down, the number of serious injuries was staying the same.

"Even with an accident, you have to reduce all injuries, even mild injuries, as the health system is strained due to Covid," Shimizu said.

However, he acknowledged there were many definitions of zero traffic accidents, but that didn't mean it wasn't important to set it as a target. And he said there was a risk at any speed.

"We want to reduce the possibility of drivers making mistakes, and that is what is happening now," he said.

Sugimoto added: "By 2050, we want to eliminate traffic accidents in Honda vehicles, and that includes motorcycles. By 2030, we want to halve the number of traffic deaths, and adas will be important in this."

He said as well as reducing the number of accidents caused by human error, technology could also help reduce accidents caused by the poor health of the driver.

"If the system detects the driver can no longer



Kazuo Shimizu: "We set the ambitious target to motivate ourselves."

be in control, it should stop safely and alert other vehicles," he said. "It will make sounds to wake up the driver. If there is no response, it will stop the vehicle and automatically contact the emergency services."

Shimizu called for appropriate policies on public roads, citing problems such as pedestrians not making eye contact with drivers because they were looking at their smartphone screens. Educating road users was thus important, but not everyone used the likes of YouTube, so this had to be done in different ways.

"There are three hurdles to tackle," he said. "Technology, regulation and social acceptability. A big hurdle to autonomous driving is public acceptance."

But he said there were big differences in expectations on what autonomous driving would bring.

Sugimoto discussed the different levels of assisted and autonomous driving, and said Honda's focus today was on levels three and four.

"Levels one and two are simply driver assistance, a driver support system," he said. "But for levels three and above, the system is in control. We are focussing on level three and then level four. Level five is far in the future. To realise level three is difficult. There is a huge gap between levels two and three."



Naoki Ota

Semi-solid electrodes

Semi-solid electrodes could improve the price and performance of lithium-ion batteries for electric vehicles, believes Naoki Ota, CEO of 24M Technologies.

"They can reduce production costs by 25 to 40%," he said. "It is a simplified process."

He said the manufacturing platform provided a robust chemistry-agnostic foundation.

Chrysler funded the research, which provides a much lower cell cost and a higher safety and reliability rating. It is also environmentally friendly and fully recyclable.

The process has been commercialised in Asia since 2020 and multiple tens of gigawatts of production capacity is expected to come on line this year and next.

"24M has better capital efficiency and lower operating costs because we use less equipment, labour, energy, space and time," said Ota.

Gate driver IC drives high-voltage devices

Renesas announced a gate driver IC designed to drive high-voltage power devices such as IGBTs and silicon carbide (SiC) mosfets for electric vehicle (EV) inverters.

These ICs provide an interface between the inverter control MCU and the IGBTs and SiC mosfets that deliver power to the inverter. They receive control signals from the MCU in the low-voltage domain and transfer these signals to turn power devices on and off rapidly in the high-voltage domain.

To accommodate the higher voltages of EV batteries, the RAJ-2930004 AGM has a built-in 3.75kV rms isolator, which is higher than the 2.5kV rms isolator in the previous product, and can support power devices with a withstand voltage up to 1.2kV.

In addition, the IC has better CMTI (common mode transient immunity) at 150V/ns or higher, providing reliable communication and increased noise immunity while meeting the high voltages and fast switching speeds for inverter systems.

"It is very robust," said Manabu Kasahara, principal specialist at Renesas. "It lets you support higher voltages and switching speeds."

The product offers the basic functions of a gate driver in a soic-16 package.

It can be used with Renesas IGBTs as well as with IGBTs and SiC mosfets from other manufacturers. In addition to traction inverters, the gate driver IC is suitable for applications that use power semiconductors, such as on-board chargers and DC-DC converters.

"Customers want many kinds of gate driver, so there will be more in the family," said Kasahara. "This is the first. Mass production will be in early 2024 and samples are already out there."

Protection and fault detection functions include on-chip active Miller clamp, soft turn-off, overcurrent protection, under voltage lockout and fault feedback.

Operating temperature is -40 to +125°C, with a maximum junction temperature of +150°C.

To help developers bring products to market quickly, Renesas offers an xEV inverter kit combining gate driver ICs with MCUs, IGBTs and power management ICs, and plans to release a version incorporating this gate driver IC in the first half of this year.



Manabu Kasahara: "There will be more."

Improving architecture offsets costs

Improvements in a vehicle's EE architecture can make it possible to offset some of the additional costs from more powerful vehicle computers needed to handle increased software complexity and enable software-driven revenue streams.



Camille Vuillaume: "A new architecture is needed."

This was the view of Camille Vuillaume, general manager for Bosch in Japan.

Using the acronym space – for software-driven, personalised, automated, connected and electrified – he said the total cost of ownership was the most important concept.

"Managing all these can be very complex," he said. "There are a number of different needs and, because of that, a new architecture is needed."

His talk looked at the different zonal architectures available: multi-gigabit Etrhernet that can support high data sensors and displays; asymmetric Ethernet for when uplink and downlink speeds are not equal as with cameras and displays; IEEE1722 transport protocol for tunnelling legacy protocols such as Can, Lin and Flexray and transporting streams for radar, lidar and video; and multi-protocol routing, which can be difficult without hardware support.

With Ethernet, he said the price could be more competitive.

"We would like 100% Ethernet, but it is not available for everything," he said. "1Gbit/s Ethernet is here today and 10Gbit/s will be available soon. Ethernet reduces the number of different in-vehicle network technologies."

He said current automotive Ethernet was all symmetrical, which created an unbalance as uplink and downlink performance was the same. This meant the links were not optimised and so asymmetrical Ethernet should be considered.

Throughput could be compromised because of translation issues when dealing with the various protocols such as Can, Lin and Flexray.

He suggested a pipeline architecture for increasing throughput and improving jitter and latency.

Reskilling can close education gap

Without cultural change there is no digital transformation, according to Klaus Meder, president of Bosch in Japan, as he explained the importance of reskilling.

He said there was a fundamental gap between the education system and what was needed in workplaces. Reskilling can close that gap.

By 2024, he said about 40% of Bosch's workforce will need up to six months of reskilling.

He said this would be necessary as vehicles move from being hardware defined to mainly software defined.

"We have to change from hardware to software," he said. "This involves cultural change. In the past, we had classroom-style training. Now, learning has to be interactive, voluntary and continuous. We should embrace change."

Many of the courses at Bosch concentrate on Python, data science, machine learning, neural networks and AI.

"The target is changing our mindset," he said.

One scheme implemented goes by the name WOL, for working out loud. Here people with five different goals come together once a week for twelve weeks to discuss the problems they face.

"This increases the probability that they will solve the problems they are working on," said Meder. Bosch has had 720 WOL circles.

"People matter more in digital transformation," he said. "This involves not just reskilling but having an inspiring working environment."

• Bosch is building an R&D headquarters in Yokohama that will be ready next year. It will be the home of all the company's R&D in Japan.



Klaus Meder: "We should embrace change as an opportunity."



Hiroshi Ono with the Nexty demonstration car

Removing strain from vehicle networks

As vehicles move through automated driving levels two, three and four, the number of cameras installed in vehicles will increase, putting strain on vehicle networks as they try to move key images around the car quickly.

Analog Devices is thus putting a lot of focus on its GMSL gigabit multimedia serial link technology.

"There are cameras being installed in vehicles to monitor driver and passengers," said Hiroshi Ono, senior technical leader at Analog Devices. "You have to process the camera data so the vehicle can respond quickly."

The company provides the GMSL serialiser and deserialiser technology to reduce cabling infrastructure by allowing simultaneous transmission of video, audio, control and Gigabit Ethernet data.

"A lot of functional safety features are embedded in the system," said Ono.

It includes Asil-B rated devices and has real-time diagnostic capabilities.

There are more than thirty OEMs already using the technology across North America, China, South Korea and Japan.

Cars though have multiple networks such as Can, Lin and Flexray, which Ono said could be a pain. This is why Analog Devices is pushing its E²B Ethernet to the Edge Bus technology.

"The aim for this is to eliminate the legacy networks and handle it all over Ethernet.," said Ono. "The beauty is that everything can be replaced with Ethernet whether low or high bandwidth."

The idea is to replace a microprocessor and software stack with one E²B device for each sensor. Or, for low data rate sensors, there could be an E²B hub for multiple sensors.

"The first deployment with be in 2025," predicted Ono. "BMW is going to be the first to use this."

This should provide a benefit for future software-defined vehicles as quickly reconfiguring a vehicle can be difficult with multiple networks. This, said Ono, would allow dynamic change using Autosar.

The Analog Devices stand also had a joint demonstration with Toyota subsidiary Nexty Electronics.

The in-vehicle demo showed how bidirectional communications could help vehicle occupants talk with each other whether in the front or back seats even with high levels of noise.

"Even with noise, a passenger can still hear everyone," said Ono. "It detects in-vehicle noise and adjusts the volume accordingly."

The system uses custom microphones and the car's existing pre-installed speakers, as well as DSP-based noise reduction technology.

"You could have a Zoom call in the rear seats and be able to hear everything clearly," said Ono.

This technology is still in prototype with no fixed project yet for a real car but Analog Devices is working closely with Toyota on this.

"There is a good connection there," said Ono.

Novosense wants to tell the world

Chinese analogue and mixed-signal IC company Novosense is keen to tell the world about its products.

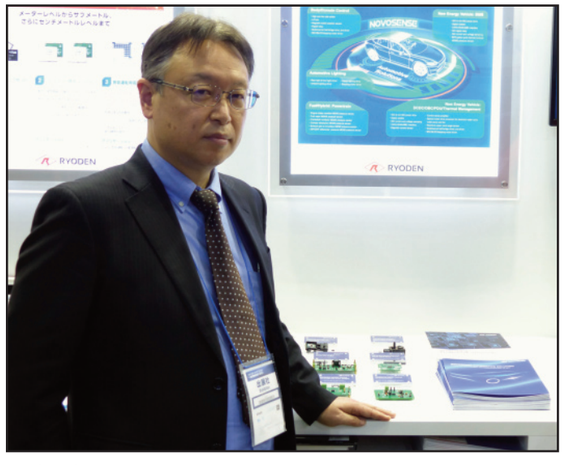
"We have succeeded in China," said Takeshi Kasuya, Novosense field application engineer. "But we want to get this technology to the whole world, and Japan is important. We are here to show them our business."

The company was showing isolators, interfaces, power drivers, current sensors and pressure sensors for applications such as OBC, DC-DC, PDU, thermal management, battery management, inverters and powertrain, automotive lighting, body and vehicle domain control, and other electronics for electrified vehicles.

"Our focus is on the powertrain," said Kasuya, "because EV development is getting more popular, especially in China. We have gate drivers with very good isolation."

Since 2016, Novosense has been developing automotive-qualified products. With mature chip-development capabilities, experience in mass production and quality assurance, the company says it is committed to providing high-performance, robust, reliable products and service for automotive OEMs and tier-ones.

The company has more than 1400 IC products for sale. Its products are distributed in Japan by Ryoden.



Takeshi Kasuya: "We want to get this technology to the whole world."



Yohei Nagao: "It is not realistic to eliminate complexity."

How to deal with software complexity

Toyota is migrating from being an automotive OEM to a mobility company, said Yohei Nagao, the company's project general manager.

Part of this is adopting a concept called software first.

"We want to integrate the strength of software into good hardware to make better cars," he said. "Software and hardware are important. Without both, we can't deliver good vehicles."

He said software let the company address all the countries in which it had a market.

"Software gives us a huge amount of possibilities," he said. "This does not mean it is not complex, but if you say software is getting more complex, this can give a negative impression of software. The problem with complex software is it is hard to ensure quality."

He said this could lead to increased cost to enable quality.

"It is not realistic to eliminate complexity, but we can reduce it," he said. "We have to look at how to deal with complexity and take into consideration cost as well."

While the shift from internal combustion engines to electric vehicles reduces software complexity, the move to automated driving increases it.

"The test approval methods need improving too," he said. "We need test-driven design. It is important to work as a team. You need to look at reducing software complexity from testing and project management perspectives."

No time to lose in security battle

The time delay from a bug being found before a patch is rolled out to all vehicles in a fleet makes cars vulnerable to attack, warned Brian Gorenc, senior director at cyber-security firm Trend Micro.

He said a vulnerability could live in software for years before it was discovered.

"The hope then is you send the vulnerability to the vendor and they release a patch and make a public disclosure," said Gorenc. "But it can take 90 to 120 days from notification to patch. When the patch is released, it can take up to 180 days to truly patch the bug."

That means there could be active attacks before the bug is fixed.

"We have seen attacks 24 hours after a patch," he said.

The situation is worse in automotive with the time it can take to deploy a patch out to the fleet.

"This can be an unknown number of days," he said. "Some are done by hand, some over the air, or even by taking the car back to the dealership. That means an attack can happen before the patch has been deployed."



Keisaku Hayashi



Brian Gorenc

And he said as cars became more connected, it was necessary to look at all the infrastructure that could also have bugs.

"To secure an automotive system is therefore extremely challenging," he said.

However, he said though the attack chain on a vehicle could look complex, it was not as complicated as it seemed.

Keisaku Hayashi, general manager in Denso's cyber-security R&D department, said because the car was connected to the outside world, similar measures had to be taken in vehicles as on smartphones and computers.

"To protect the car, you need to analyse the type of threat it is facing," he said. "Once a car is in the market, you have to respond quickly to attacks."

He said there were four layers in a car that needed protecting – the external connection, gateway, in-vehicle networks and ECUs. And you need security measures for hardware and software.

"It is also important to introduce security measures at the factory," he said. "Securing a production line is challenging."

Why a vehicle is like a human body

An autonomous vehicle is like a human body, explained Continental's Michael Niklas-Höret, deputy chair of Autosar, addressing the conference by video link.

He said in a zonal architecture the parts of a car could be mapped directly to parts of a human body.

The eyes, ears, nose, tongue and skin are the body's sensors, equivalent to cameras, lidar, radar, ultrasonics, tyre pressure monitors, pedals, buttons and HMI.

The brain is the vehicle computers and ECU. Muscles are represented by actuators for steering, braking, accelerating, airbag, lights and sound.

The backbone or spine of a human can be compared with a car's service-oriented communication that receives and sends information to and from all the sensors and actuators. The signals are carried along the vehicle's nerves.

He said in the future, all these functions would need looking at to scale them as cars become more automated. Highly automated driving needs to be reliable, available, maintainable, safe and secure, and it will be connected through V2X, IoT and cloud-based services. That brings in security, quality and over-the-air update issues.

Also needed, he said, would be new automotive processor technologies.

"New types of in-vehicle computers are needed," he said. "We have to migrate from old architectures to zonal architectures, and these must be backwards compatible. We can invent everything for security from the beginning."

The move to a zonal architecture is necessary to handle the increases in computing.

"The heart of the zonal architecture is the central computer unit," he said.

INFOTAINMENT



How well will your car know you?

Andy McLean sees the automotive in-cabin experience becoming personalised, digitised and immersive

A mobile device with a slick, touchscreen main user interface gives access to an array of entertainment, information and navigation functions, and provides always-on, mobile broadband internet via a 5G network.

Does this sound like a description of a latest smartphone? Or the latest, automotive, in-cabin experience?

Today, it aptly describes the next generation of immersive, in-cabin experience in cars to be launched in the coming months and years.

The appeal of these automotive, in-cabin experience cars will be as much about their apps, user interface, and audio and video features as it is about driving dynamics, design and comfort, the features that car makers have traditionally drawn on to sell their latest models.

The automotive, in-cabin experience has transformed into a true, digital experience: the software environment in the vehicle enables consumers to make a seamless transition from their home or office to their vehicle, while enjoying the same immersive entertainment options, productivity tools and communication options everywhere.

Third-party apps will run in the car just as they do on the mobile phone; seamless connectivity is truly at hand in today's in-cabin experience.

Seamlessness notwithstanding, while the worlds of the mobile phone and the car are converging, there is one difference: the mobile phone is a personal device that has a single user, while a car is often jointly owned, and the cabin can be a space shared with one or more passengers.

Each person in the cabin might have their own music playlists and playback preferences, as well as different people in their list of contacts to call. Therefore, all these passengers will want to be able to immerse themselves in their own personalised, digital worlds inside the car just as they do outside it.

The key challenge today for automotive technology suppliers is how digitisation and personalisation can be combined for an immersive, yet safe, automotive vehicle, in-cabin experience.

The future of automotive in-cabin is being driven by three concepts: First is the digitisation of content – maps, contacts, media and so on. Secondly is driver and user personalisation and bringing the home environment to the vehicle. And thirdly is an immersive cabin experience, including applications such as noise cancellation to improve in-cabin audio and voice.

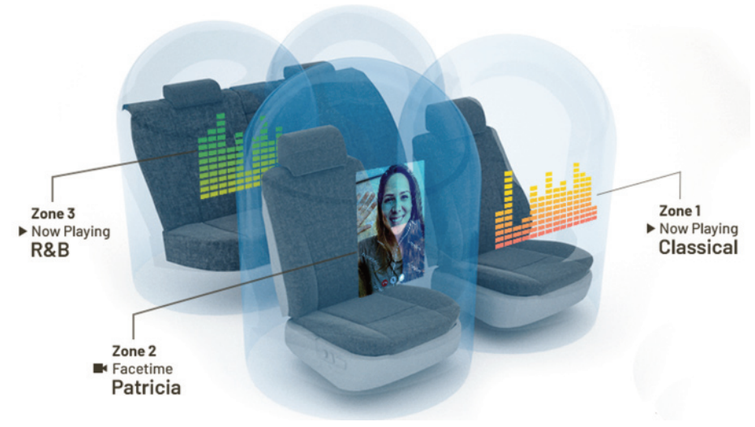
Experience

Technology is finding unique, exciting, new ways to reconfigure the car's digital settings to fit preferences. As soon as the user settles in behind the steering wheel, the camera in the driver monitoring system can perform facial recognition to identify who is in control of the vehicle.

Elsewhere in the cabin, other discreet methods for user identification may be used, such as voice or fingerprint recognition.

Once recognised, personalised comfort settings kick in, including seat position and cabin temperature. As the car is a connected digital device, content and information can be synchronised seamlessly. When the car starts up, its audio system will automatically finish playing the podcast being listening to and continue on to playlists.

As with a phone, the car's entertainment, productivity and other apps will be continually refreshed with over-the-air software updates, a practice pioneered by Tesla but which is set to become routine across the



With advanced noise cancelling and beamforming technologies, everyone in the car has their own, personal audio bubble

automotive industry.

These software updates will be driven by a mix of native and third-party apps the user installed, proving the automotive, in-cabin experience to be as personalised a software environment as a mobile phone.

Immersion

If a car's digital environment provides a personal content library, the cabin needs to provide the stage on which this library may be played.

In the past, the choice of infotainment function affected every passenger's experience. It was either Beethoven or Beyonce on the audio system, not both. Today's automotive vehicle, in-cabin experience is poised to change all that.

Already, luxury vehicles provide a display screen for each passenger.

Now, car makers are deploying technology that creates a personal audio zone for each passenger.

This builds on noise cancellation technology familiar to headphone users and extends it to place each passenger inside an audio bubble. Here, they can listen to their preferred music and make video calls without disturbing anyone else.

Oftentimes, the entertainment unit in a car is the best hi-fi system a consumer owns, better than anything inside their home. It is perhaps surprising, but certainly true, that the quality of the audio system can be the reason a consumer chooses to buy one brand's car rather than a competitor's.

The emergence of personalised audio could accentuate the value of car hi-fi more than ever.



Beamforming voice processing technology in action

Assistant

Consumers have become quite comfortable with talking to a personal digital assistant (PDA) to control home convenience and entertainment functions. "Siri, what time is it?" "Alexa, play my rockin' playlist."

In the car, voice control is not only more convenient than conventional user input technologies such as touchscreens or buttons, it is safer, since it doesn't require the driver to take their eyes off the road.

Gesture-sensing controls can also provide safer ways for the driver to interact with audio, ventilation and other systems in the car.

Implementing this vision of an immersive digital experience in vehicles calls for a combination of advanced technologies and knowledge of the automotive operating environment, with its emphasis on safety, reliability and efficiency.

Automotive manufacturers are already deploying mems microphones with beamforming capabilities for voice control, backed by AI software technology for local speech recognition.

Noise cancellation systems can muffle road noise and create personal audio bubbles, while allowing safety-critical sounds to reach the driver.

Integrating microphones, digital audio systems and DSPs backed by sensors such as accelerometers, the latest noise cancellation technology offers revolutionary performance that provides a silent backdrop for new immersive digital experiences in the cabin.

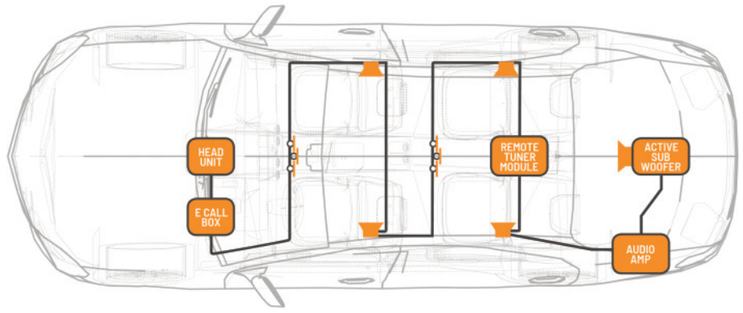
Capabilities

The growing range of software-controlled features in the car is leading to an explosion in the number of network nodes in the car, and in the volume of signals the networks carry.

Traditional networking technologies deployed in the car require extra cabling for every additional node and connection. This means the cable harness is one of the heaviest and most expensive components of a car.

Sophisticated bus network technologies can reduce the length of cabling in the vehicle, resulting in weight savings that can reduce energy consumption. New wireless networks for elements of the car's data or entertainment systems can also eliminate the weight and cost of physical cabling entirely.

The latest serdes technology can provide the high bandwidth requirements needed to transport a burgeoning volume of multitype data to enable sophisticated adas and infotainment capabilities in vehicles. The benefits include faster data aggregation, the ability to maintain data integrity for safety applications, and the capability to enable systems to display different content on multiple screens across the car.



Technology can deliver low latency voice and audio connectivity for an immersive in-cabin experience

Future

Ultimately, uninterrupted and high-speed network connectivity are critical to enable high degree digitisation of the car of tomorrow. Development work continues at a fast rate to help car manufacturers realise a new vision for the automotive, in-cabin experience, one that owes much to the mobile phone, but which respects the safety and reliability priorities of the automotive industry.



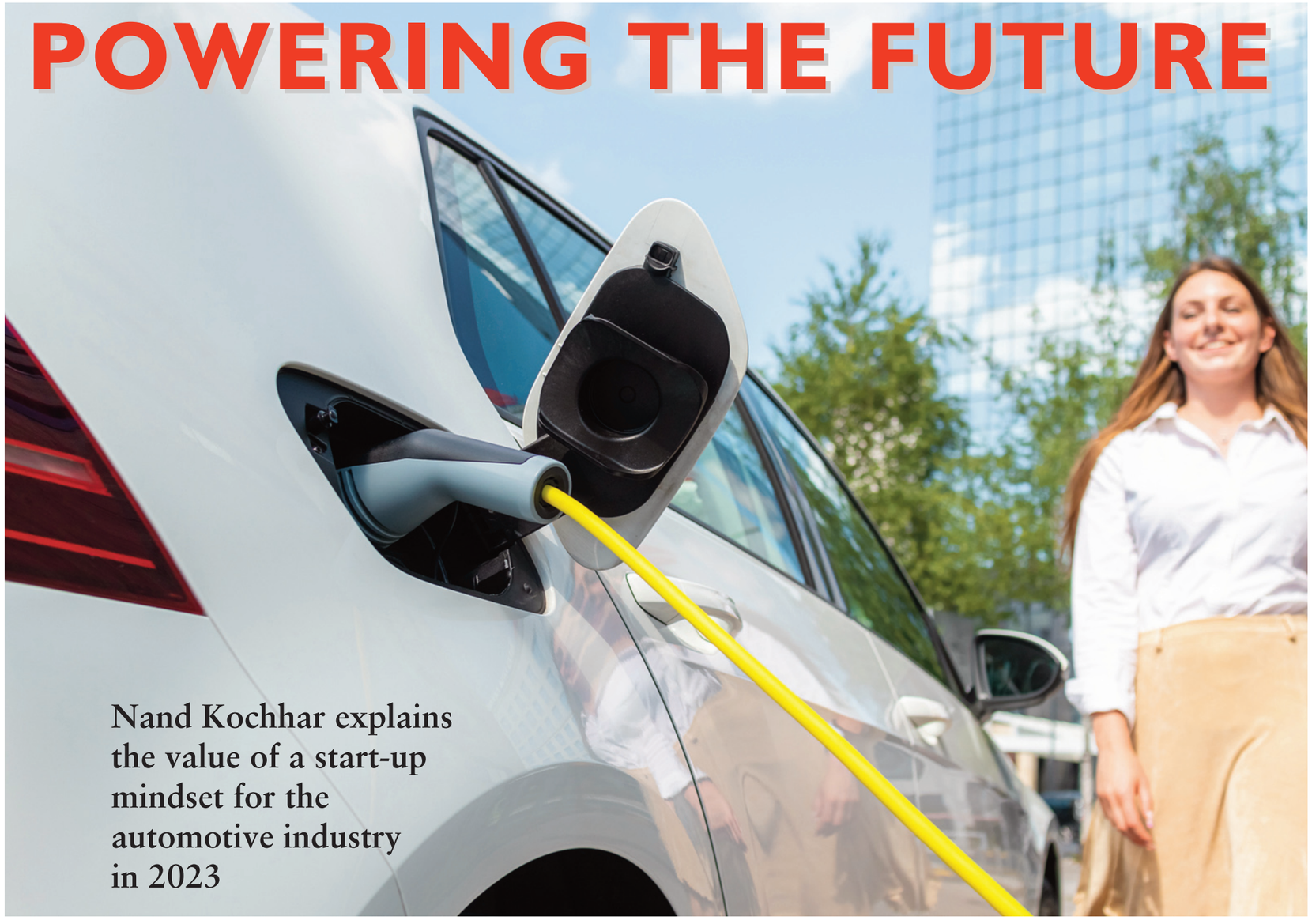
Andy McLean is a vice president at Analog Devices



Getting consumers to love connected cars

DEVELOPMENT

POWERING THE FUTURE



Nand Kochhar explains the value of a start-up mindset for the automotive industry in 2023

The year 2023 will be a critical year for automotive companies. Automakers will be required to transform fundamental aspects of their businesses and organisations to meet the needs of the future of mobility.

Years of development in adas, vehicle electrification, software, electronics and other technologies are coming to fruition, driving a massive shift in the composition of the automotive market.

As the industry pushes to bring increasingly advanced mobility to market in 2023, it will also have to overcome significant challenges. Traditional automotive supply chains will need to adapt to support the growing need for batteries, electronics and other electrical components in modern vehicles.

In the face of shrinking development timelines, a growing need for innovation, ever-evolving consumer demands and unpredictable supply chain disruptions, automakers of all sizes must become more agile, collaborative and responsive in an increasingly dynamic automotive landscape.

Meanwhile, the shifting nature of vehicle development will continue to reshape the core skills and competencies demanded by automotive engineering teams.

Trends

The automotive industry is in the middle of a widespread transformation of both the nature of vehicles and the ways in which they are used by consumers. This transformation is the result of technological, regulatory and societal changes all pushing for greater safety, sustainability, equity and convenience in human mobility.

The result has been a rapid rise of vehicle electrification and continued development of automated driving features and autonomous vehicles.

Automakers are already feeling the impact of autonomous vehicle development in the marketplace as the competition to produce new and advanced vehicle features continues to mount. Automakers today must focus on the development of advanced features and functions to stand out in a competitive marketplace.

As the emphasis on advanced vehicle features continues to grow, so too does the importance of software and electronics to vehicle functionality and desirability among consumers.

For automakers, the development of these advanced features and self-driving capabilities should not be a full-autonomy-or-bust proposition.

In pursuit of the vision of true self-driving vehicles, companies can develop new vehicle features and implement them in the real world. The explosion of advanced driver assistance systems, or adas, is a good example.

These systems help drivers by automating specific driving tasks in very limited conditions, such as an automated emergency braking systems that can bring a vehicle to a stop from low speeds if it is about to collide with an object ahead.

Meanwhile, electric vehicles (EVs) have been cemented as a key part of the automotive market of tomorrow. EVs are an important tool in global efforts to reduce emissions and the overall impact of transportation and mobility systems on the environment, a fact which is increasingly motivating the buying decisions of consumers around the world.

At the same time, many governments, from the municipal to the national level, are adopting new regulations that incentivise or mandate the production and use of EVs. In response to these pressures, automakers are developing entirely new product lines of electrified, attractive and technology-laden vehicles.

As the automotive market is reshaped by the combined forces of technological advancement, consumer demands and government regulations, the demands on automotive companies are also changing.

Supply chain disruptions are likely to continue to cause difficulties for automakers in 2023. This will be particularly true as EVs become more widespread, placing additional demand on the supply of key materials and components for battery packs.

The skills required by automotive development teams are also in flux as the nature of vehicles continues to change. Software engineering is an increasingly important process in the overall vehicle development. Automotive companies are therefore aggressively expanding their software teams and capabilities to offer the features

DEVELOPMENT

and functions demanded in modern vehicles.

Adapting

As the industry progresses in 2023, how can automotive companies adapt to these new challenges? The key is to embrace the mindset of a start-up.

Start-ups have the advantage of agility and responsiveness to a highly dynamic automotive market. They can develop and implement products or new vehicle features quickly and, as a result, often deliver on exciting ideas before the competition.

Start-ups often also foster frequent and effective collaboration across domains and teams, helping drive rapid innovation and novel engineering.

Start-up automakers exhibit a few characteristics that help them achieve the collaboration and efficient engineering required by tomorrow's automotive market.

First, they are relatively small when compared with large automotive OEMs. Engineering departments may be only a dozen people, instead of a few hundred, and these various teams are often collocated, all working in the same office and able to converse and exchange ideas frequently.

Start-ups also tend to employ more young engineers, who have been raised, educated and trained in a digital world. They can quickly adapt to new digital tools and are already familiar with the many computer and software systems on which any modern company will inevitably rely.

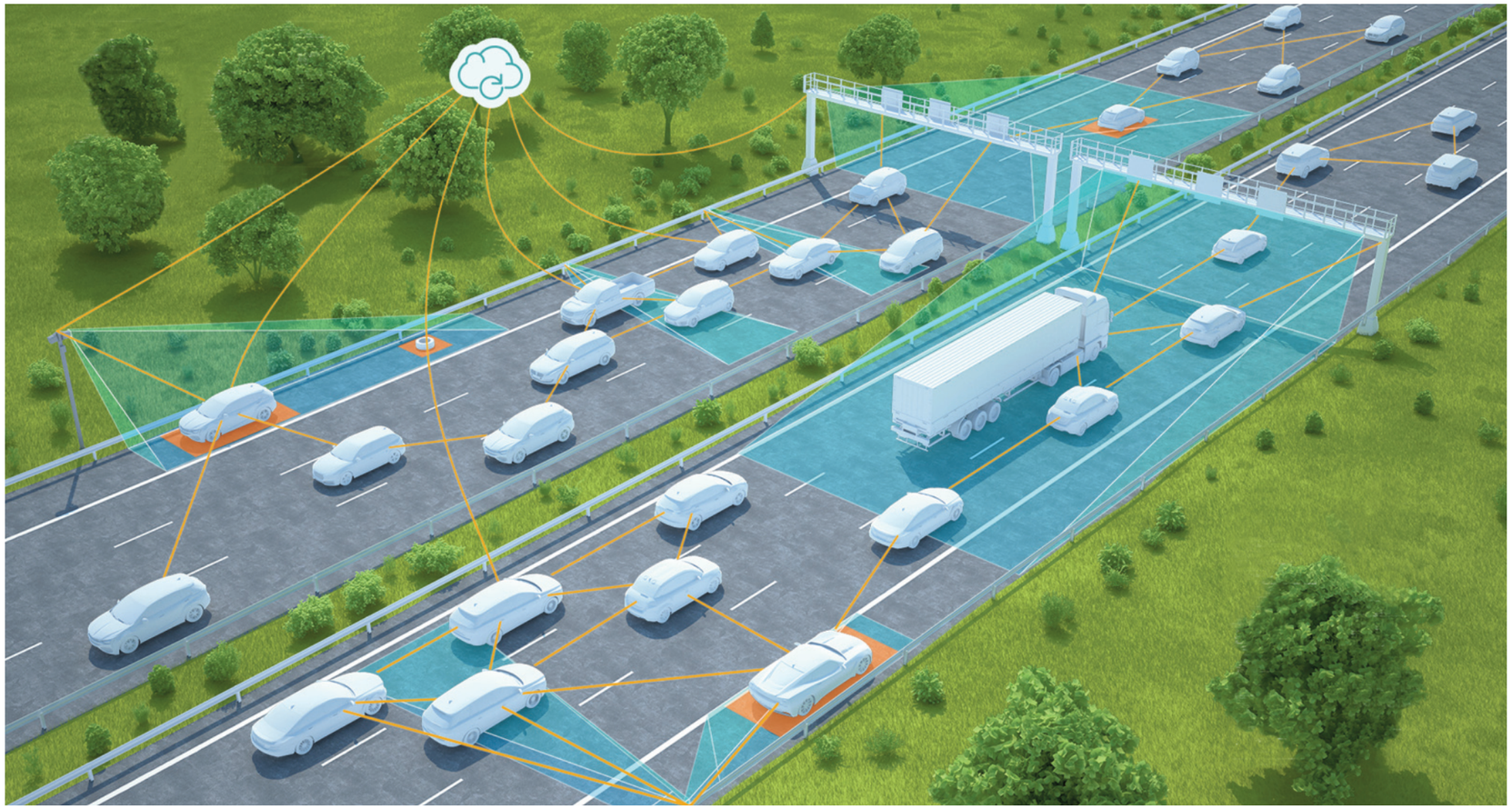
They also possess skillsets in line with the future direction of the automotive industry.

Finally, start-ups focus their development efforts and resources on innovation. Their best chance in a competitive automotive market is to create vehicles that have innovative features, designs and more. In fact, they are often fully focused on the creation of one vehicle, with all efforts of the company going towards the production of one exciting and innovative vehicle.

Clearly, not all aspects and characteristics of a start-up will be helpful for other companies to try to instil in their culture and processes. Instead, automotive companies of all sizes should focus on two key aspects.



Start-up companies tend to have smaller engineering departments and teams that support collaboration and agile workflows



The makeup of the automotive marketplace is changing as the demand for advanced features and functionality alter the nature of vehicles; this has been particularly true with the rise of adas and partial self-driving capabilities

First, companies should seek to improve their ability to collaborate across domains and teams both internally and with partner organisations. Secondly, companies should foster innovative designs and thinking to stand out in an increasingly crowded marketplace.

And the best method of adopting these characteristics is through the digital transformation of the company's culture and processes.

Transformation

Digital transformation lets companies adopt a new approach to mobility development and engineering. Digitalisation enables companies to connect their entire lifecycle through a digital backbone, with information flowing bidirectionally throughout the organisation.

Even partner companies can be incorporated securely into a digital backbone, ensuring faster and easier collaboration between organisations, and supporting accountability to overall sustainability goals.

Key to this approach is a comprehensive digital twin that captures every aspect of the vehicle design and production. Using such a digital twin, automotive companies can connect engineering teams from across the electrical, electronic, software and mechanical domains. This not only helps companies overcome the complexity of future vehicles, but also fosters a culture of collaboration and innovation in the company that will carry it through the challenges of tomorrow.

Conclusion

Digitalisation is a powerful enabler of technological innovation, collaboration and informed decision making. By investing in digital transformation, companies of all sizes can tackle the challenges of developing the vehicles of the future by removing longstanding boundaries to collaboration and by fostering innovation through the increased use of available data.

These capabilities will be crucial to all automakers as they pursue the future of mobility.



Nand Kochhar is a vice president at Siemens Digital Industries Software

POWER TECHNOLOGIES

ROAD TO AUTONOMY

Power modules help Kodiak integrate autonomous technology into commercial trucking fleets



Commercial trucking is the backbone of the US economy. That has never been more evident than in the past few years, as Covid-19-related supply chain disruptions gripped the country. At the same time, it's becoming harder to find people who want to drive lorries.

The average American truck driver is about 48 years old and even higher for long-haul truckers, which may help explain why there was a shortage of 80,000 drivers in the USA last year, according to the American Trucking Association.

Kodiak Robotics long-haul trucking autonomous technology, the KodiakDriver, includes a modular hardware system, known as SensorPods, that integrate most sensors needed to see its environment using the truck's traditional mirror-mount points.

Many industry analysts believe long haul commercial trucking is likely to be the first major use case of autonomous vehicle technology as highway driving is a less complicated problem to solve compared with the many nuances of negotiating secondary roads and city streets.

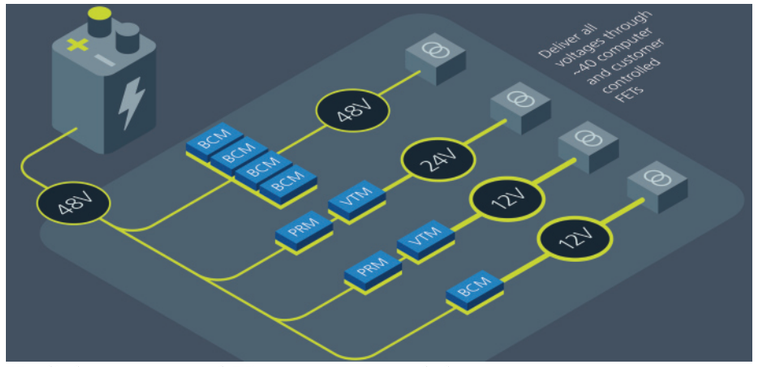
Additionally, from an economic standpoint, the trucking industry can benefit more from vehicle autonomy. The cost of an autonomous driving system is more easily amortised in a truck that operates for between one million and three million kilometres.

Plus, the average human-driven truck is only used for 7.5 hours a day, due to hours-of-service limitations. An autonomous truck can double or even triple truck use, only stopping to refuel, and receive and pick up new loads.

Autonomy

Against that backdrop, Kodiak Robotics was launched in 2018 with a focus on developing autonomous technology for the long-haul environment that can be integrated into carriers' fleets. The firm's autonomous technology, the KodiakDriver, includes a modular hardware system, known as SensorPods that integrate the majority of sensors needed to see its environment using the truck's traditional mirror-mount points.

The pods' modular design lets them be swapped on and off within minutes, which increases fleet uptime without the need for specially-trained technicians to install the devices and recalibrate the sensor network.



Kodiak uses several Vicor power modules

Kodiak uses a sparse mapping approach, which contains the information needed to make autonomy possible, rather than data heavy and hard to update HD maps. The maps are complemented by Kodiak Vision, a sensor fusion system that uses data from radar, cameras and lidar to see the road in all conditions.

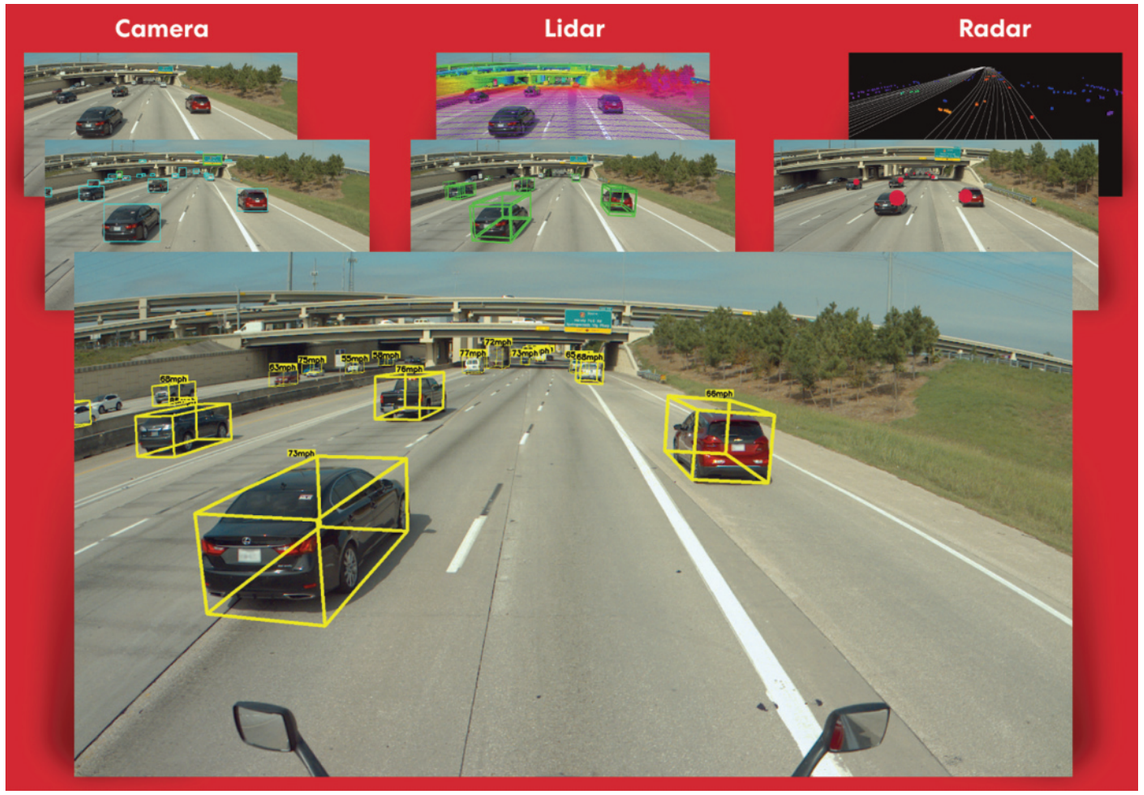
Since launching its operations hub just south of Dallas, Texas, in 2019, Kodiak has been focusing on safely developing a system that can handle the demanding long-haul environment. Last year alone it has completed multiple pilots with some of the biggest names in freight, including four uninterrupted round trips from Dallas to Atlanta with the KodiakDriver continuously operating.

Since August 2022, Kodiak has been making autonomous freight deliveries in Texas for flat-pack furniture retailer Ikea, operating seven days a week between a distribution centre in Baytown and the Ikea store in Frisco.

"The Kodiak team represents some of the most experienced people in the autonomous vehicle industry," said Don Burnette, the company's founder and CEO. "This has allowed us to take the most direct path to success, versus the trial-and-error approach that was common when the industry was starting."

Power

Kodiak quickly identified three areas in an AV trucking environment where the power system design needed to be uncompromising: reliability, efficiency and the ability to perform in-system health monitoring.



Sparse mapping approach contains the information to make autonomy possible, rather than data heavy and hard to update HD maps

These requirements are what drew Kodiak to partner with Vicor's custom design subsidiary, Vicor Power Systems. This group designs high-density, high-performance power systems using power modules that are suitable for autonomous vehicle systems.

The Kodiak power system uses several Vicor power modules to support their sensor needs that require 12, 24 and 48V power supply buses. These include the NBM6123, BCM6123, PRMs and VTMs. All the power modules deliver reliable, efficient power conversion in small packages.

Vicor also provided design support to enable a controllable output feature to every component in the system and optimising component health by monitoring the voltage and current on all Kodiak sensors.

The Kodiak platform includes four basic buses that must be directed to specific sensors, actuators and processors. Each output is monitored and individually controlled through a proprietary Can bus.

Vicor also provided battery charging for a 48V system when the truck is garaged and plugged in. The AC shore power system maintains the battery charge level when the engine is not running, so maintenance engineers can use the vehicle indoors.

By using the 48V system on the truck, Kodiak can reduce the size of the cabling, saving weight and space, and enabling the vehicle for high-power applications.

Future

Commercial transportation is underappreciated, yet it is indispensable to global economic stability. Today, Kodiak stands ready to revolutionise this industry with autonomous transportation that will enable more reliable and efficient trucking.

Vicor serves users in enterprise and high-performance computing, industrial equipment and automation, robotics, UAVs, electric vehicles and transportation, satellites, aerospace, and military.

HOW FAR HAVE WE COME?



Where it all started – the Ford Model T

Henry Quigley looks at how vehicle technology has changed dramatically over the years

The first commercially available car hit the roads in 1908 when Ford released the Model T, and over the next 114 years car ownership has become more common than ever before. There were estimated to be nearly 1.5 billion vehicles worldwide in 2022.

Not only have the looks of the cars evolved over time, but the technology inside them has become a lot more sophisticated. This, in turn, has improved the quality of life behind the wheel. But how much have things really changed?

The technology in cars has continued to evolve to make them safer and easier to operate. But what does the future hold for car technology?

Early years

One of the earliest technological advancements made in cars was the shift away from using hand cranks to electric ignition starters around 1912. First introduced on a Cadillac, this transition was inspired to prevent the number of injuries that could be caused by the car backfiring.

This includes wrists being twisted into unnatural positions and even resulting in broken jaws.

The innovation for cars to be started by keys wouldn't come

until 1949 when Chrysler introduced this to their vehicles.

The next evolution that helped cars drive more efficiently was the introduction of coil spring suspension, which came in 1934. Initially employed on both leading wheels of the vehicle, before being added to all four, it worked to absorb the shock of bumpy roads. This allowed for a much smoother journey and it became standard for years to come.

Before this technology was added, which arguably makes driving so much safer, there were several changes to reflect the needs of the driver. However, these weren't safety features, and were instead cigarette lighters in the early 1920s and the first in-car entertainment with radios in the 1930s.

Safety first

Seatbelts are so important to car safety that the UK government has helped outline just how crucial they can be in instances of crashes, stating that you're twice as likely to be fatally injured when not wearing one. Given how safe they are, it surprising they weren't introduced to vehicles until 1959, when Volvo announced them in all their cars going forward. This means they were first implemented after the Chrysler Imperial introduced motorists to air conditioning.

Since then, they have become a necessity to be installed on every seat in a car but wearing them didn't become a law until 1970 in parts of Australia, which was the first country to introduce such legislation. Other countries followed suit.

Within the time between the invention of the seatbelt and wearing them becoming a legal requirement while in motion, the world of motoring was introduced to a number of advancements that are all commonplace in modern cars. These include electric windows, catalytic converters, intermittent windscreen wipers and cassette deck systems.

Braking is another system that is vital to car safety, and making sure the car doesn't break during sharp emergency stops can be the difference between crashing and staying safe. Anti-lock braking systems (ABS) were first conceptualised in the 1920s and became standard issue in cars from the 1990s.

One big step that cars made was the invention and implementation of catalytic converters. This was first invented by Eugene Houdry in 1973 with the aim of creating a device to add to cars that takes the harmful gases that cars produce and converts them into non-harmful substances. It became law to have one installed in petrol cars in 1993 in the European Union and the UK.



Jaguar E-Pace represented a huge leap



Electric ignition starters were first introduced on a Cadillac around 1912

Beyond

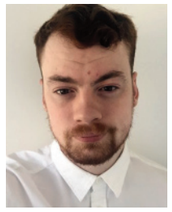
Moving into the present and the future, one of the most important changes to the cars that are commercially available is what is used to power them. Over the past two decades, there have been huge leaps in the development and production of electric vehicles (EVs) and hybrids, such as the new Jaguar E-Pace. This can be seen in statistics showing that by the end of 2022 there were more than sixteen million EVs on the roads worldwide, triple the amount in 2018.

The more EVs that go from the showrooms to the roads will more likely lead to further advancements in the battery technology associated with them. Additionally, with various governments planning to stop the sale of new petrol and diesel vehicles in the near future, the focus of motoring is likely to shift more to sustainable vehicle practices.

Artificial intelligence (AI) and automation are also making their way into the motoring industry, with conversations around whether computer-generated algorithms could help make driverless cars a viable option for the roads. This could help people with disabilities or older generations who need to travel get to destinations without needing to rely on taxis or public transport.

Given how fast technology evolves, there may be technology in development for cars that can't even be conceptualised.

Beyond the ideas of vehicles that double for roads and flying, there might be manufacturers looking to incorporate the likes of AI in ways to make this new technology a must-have in future vehicles.



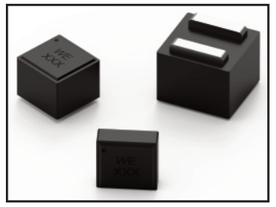
Henry Quigley is a content producer for Jardine Motors

Inductor handles high currents

An AEC-Q200 certified SMD inductor from Würth Elektronik has the capability of up to 50.6A saturation current and the ability to handle high current transient peaks.

The WE-XHMA uses flat wire coil and a composite core material to ensure low copper losses and stable behaviour under temperature fluctuations.

It is particularly suitable for use in DC-DC converters for high current supply and FPGAs, as well as filter applications. When used in switching power supplies, the compact coil shows hardly any temperature-dependent fluctuations in terms of inductance and saturation current.



The higher energy density and the compact design due to the use of flat wire also make it interesting for switched-mode power supplies.

Flat wire has the advantage that a larger cross-sectional area can be achieved with the same space requirement, thereby reducing resistance.

Furthermore, it shows a lower skin effect at higher frequencies and the heat dissipation towards the circuit board is, because of the flat thermally conducting surface, also better than round wire.

The compact moulded magnetically shielded coils have an operating temperature of -40 to +125˚C. It is available from stock in SMT styles 6030, 6060, 8080, 1090 and 1510, and with saturation currents from 9.3 to 50.6A.

Free samples for developers are provided.

Tantalum capacitors offer low ESR

Automotive grade surface-mount polymer tantalum moulded chip capacitors from Vishay are designed to deliver improved performance in high temperature, high humidity conditions.

The AEC-Q200 qualified Polytech T51 vPoly-Tan series is said to offer lower ESR, lower voltage derating and a benign failure mode while maintaining higher volumetric efficiency than traditional tantalum capacitors.

In addition, these advantages are said to set this technology above multilayer ceramic chip capacitors (MLCC) and aluminium capacitors in a comparable capacitance range.

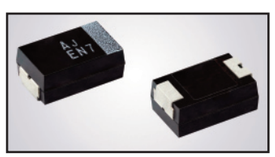
Offered in the D (EIA 7343-31) and V (7343-20) case sizes, the devices have a capacitance range from 6.8μF to 330μF over voltages from 2.5 to 35V and a capacitance tolerance of ±20%.

Featuring a conductive polymer cathode system, the capacitors provide ESR from 40mΩ to 120mΩ at +25˚C.

They operate up to +125˚C with voltage derating above +105˚C and a high temperature load time to 2000 hours.

Combined with ripple current to 2.37A, the capacitors are suitable for decoupling, smoothing and filtering in switch mode and point of load power supplies for automotive adas, infotainment and other in-vehicle electronic systems.

Featuring lead (Pb)-free terminations, the series is RoHS-compliant, halogen-free and Vishay Green. Samples and production quantities are available with lead times of 20 weeks.





Current transducer

A current transducer from Danisense is mainly for automotive EV test benches and battery testing and evaluation.

Featuring an aperture of 41.2mm, the DN1000ID enables power cables with large power connectors to be easily fitted to EV test benches allowing for quick changeovers.

The large aperture is an important advantage as test bench operators often face the issue that the power connectors fitted to the power cables are bigger than the diameter of the cable, making it difficult to fit them in the aperture of the current transducer and often requiring additional work to solve this problem.

The device is said to offer a compromise between the 1kA nominal current and aperture size by keeping the best measuring performances in accuracy and phase shift.

It uses stable closed loop fluxgate technology. Linearity is 1ppm, 5ppm offset, and it has a compact aluminium housing.

DC-DC converter cuts noise countermeasures

An isolated flyback DC-DC converter from Rohm is for gate driver power supplies in xEV applications such as electric compressors and PTC heaters.

As applications such as electric compressors for AC and PTC heaters are driven by high voltages, it is necessary to isolate the primary circuit that includes the battery from the secondary circuit comprised of the motor and other systems to ensure safety.

However, in addition to larger mounting area and power consumption, conventional isolated circuits require noise countermeasures for switching frequencies that vary with output current.

The BD7Fx05EFJ-C uses a circuit configuration that achieves stable switching frequency characteristics without requiring a photocoupler, decreasing application size together with workload for noise design countermeasures.

Analogue design technology eliminates the need for photocouplers, transformer auxiliary windings and peripheral components conventionally necessary to detect secondary-side voltage and current.

It solves problems with photocouplers, such as large power consumption, fluctuating detection accuracy due to temperature, and deterioration over time.

It is possible to reduce the number of components including the photocoupler used for current detection by ten compared with general isolated flyback power supply circuits.

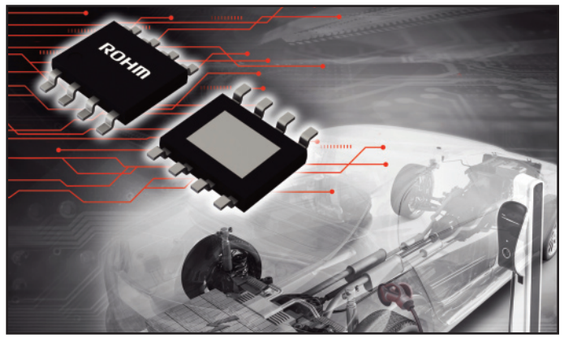
An adaptive control function fixes the switching on time, ensuring a stable frequency of around 350kHz regardless of output power.

Complying with the Cispr 25 automotive EMC standard requires considerable noise design from 150 to 300kHz, but as the converters do not fall within this band, noise countermeasures can be simplified.

A spread spectrum function reduces radiated noise.

There are multiple protection circuits along with a function that stabilises the output voltage.

The DC-DC converter IC is suitable for gate driver power supplies that must be isolated from the battery for safety.



PBT grade suits millimetre-wave radar

Polyplastics Group has launched an electrically conductive grade of polybutylene terephthalate (PBT) for millimetre-wave radar in the automotive industry.

Duranex PBT 201EB provides electromagnetic wave shielding as an added effect of electrical conductivity, helping reduce assembly work.

In adas, millimetre-wave radar sensors measure the distance, speed and angle of objects such as approaching cars by sending and receiving electromagnetic waves in millimetre-wave bands.

The market for millimetre-wave radar is rapidly expanding due to increased use for periphery monitoring of vehicles, including on the rear side, thanks to its ability to recognise distances and other parameters accurately in inclement weather and at night.

The use of electrically conductive grades such as PBT 201EB in radio wave absorbing materials can contribute to reduced processing costs and greater design freedom.

Previously, electromagnetic wave-absorbing materials have been partially incorporated on the back side of radomes that transmit electromagnetic waves. Incorporating electromagnetic wave-absorbing materials has the effect of reducing millimetre-wave reflection noise and inhibiting the occurrence of detection error, increasing the accuracy of detection.

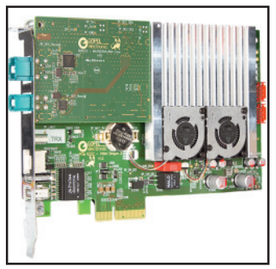
However, a process to attach conventional rubber electromagnetic wave absorbers to the back of radomes has been problematic.

Tools test camera and display adas

With the Video Dragon 6222 product family, Göpel is providing tools for testing camera- and display-based adas.

The Video Dragon combines frame grabber and generator functions in one device and can process video data of the FPD-Link II/III and IV, GMSL-2 and 3, and Apix-2 and 3 standards.

Thanks to its modular design – consisting of a base module with exchangeable video interface modules – it can be used flexibly and adapted to requirements.



Different video interface modules let it be used as a project-specific multi-channel grabber or generator across all vehicle OEMs. Another application is the system test of an ECU network such as a head unit and a display unit or between driver assistance cameras and the corresponding image processing unit.

In the latter mode, it works in so-called pass-through operation where it receives the data from a real transmitter, forwards them directly to the real receiver and creates a copy of these data, which are imperceptible to the transmitter and receiver, and which can then be transferred to the connected test PC via the PC host interface.

Functions such as sideband communication via uart, I²C, SPI, MII, CanFD bus interface for residual bus simulation, and a digital IO interface are available as options.

The G-patch module break-out box, which is also available as an option, provides the connector type required in the user project for connecting the DUT to the Video Dragon and enables the power supply to the DUT at the same time.

For coaxially connected DUTs such as driver assistance cameras, this is referred to as power over coax (PoC).

In addition to the connection option via coax using Fakra connectors, the G-Patch module also has the option of connecting the DUT via STP, based on HSD, H-MTD and other suitable connectors.

Configuration and operating software is included for Windows and Linux operating systems.

Based on graphical and interactive dialogues, it enables configuration and parameterisation of the Video Dragon and immediately puts users in a position to put applications into operation and visualise the results.

The use in customised test systems with individual test software frameworks has also been considered.

For example, Video Dragon can be integrated into user software such as C code and LabView via a generic API.

The family includes the stand-alone G-Car 6222, PCIe-6222 PCI Express card and PXIe-6222 PXI Express module.

Power module passes tests

Visic Technologies has successfully tested its 2.2mΩ 650V half-bridge power module, consisting of four parallel 8mΩ power fets in a three-phase configuration, on a dyno-test-bench using a PMSM motor at an automotive OEM.

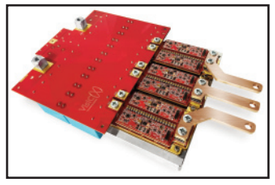
This has proven that the D³GaN (direct drive d-mode gallium-nitride) technology is suitable for high-power automotive applications. Concerns about parallelisation and oscillations caused by fast-switching transients have been addressed.

The inverter phase current reached 350A RMS, 500A peak, at 400V, although test system set-up limitations prevented higher currents, of which the 2.2mΩ power module is capable.

Worldwide harmonised light-vehicles test procedure driving cycle testing was executed and achieved comparable efficiency with commercial silicon carbide (SiC) modules, despite using early non-optimised module prototypes.

This means D³GaN can deliver higher efficiency, improving car costs through lighter, smaller power systems and a smaller battery size, without compromising the car's driving range.

In addition, the D³GaN technology, based on a GaN-on-silicon semiconductor process, is delivering better than SiC performance at the more competitive silicon cost level.





Supercapacitors

Automotive supercapacitors from Kyocera AVX are cylindrical, electrochemical and double-layer.

The five SCC supercapacitors are tested and qualified to AEC-Q200, which means they can withstand test conditions that replicate mechanical and electrical conditions in vehicle applications.

They have a rugged form factor to improve reliability, and they exhibit high capacitance, low ESR and pulse power handling characteristics.

They can be used alone or with primary or secondary batteries to extend backup times and battery life and leverage instantaneous pulse power.

Uses include electronic mechanical latching, e-calling, electronic recording, regenerative braking, power and backup power.

They are rated for 25F and 2.7V, 100F and 2.7V, 10F and 3V, 35F and 3V, and 100F and 3V.

They comply with UL 810A, RoHS and Reach requirements.

Thermal interface material resists heat and vibration

A one-component thermal interface material from Parker Hannifin's Chomerics division has 2.4W/m-K thermal conductivity for automotive applications.

The Therm-A-Gap Gel 20 offers easy dispensing and is fully cured – no secondary cure required – to accommodate the sector's reliability requirements for thermal cycling and high-temperature environments.

The material's heavy paste-like consistency enables controlled dispensing, applied in variable thicknesses up to 4mm, to suit the needs of automotive applications that include ECUs, converters, inverters, on-board chargers, adas control modules and infotainment.

It needs low compressive force to deform under assembly pressure, subjecting components, solder joints and wire leads to few stresses.

Low oil bleeding reduces the generation of greasy substances on the surface of the heat sink or substrate during use. This is important as oil bleed can lead to reduced electrical performance in the form of lower surface resistance and breakdown voltage.

Further, surrounding impurities and particles may adsorb in or adhere to the oil, causing a potential threat to product performance and lifespan.

It also resists movement under vibration and offers tackiness, both of which are important for automotive applications.

The product is also suitable for cross-industry applications, including power supplies and semiconductors, memory and power modules, microprocessors and graphics processors, flat panel displays, and consumer electronics.

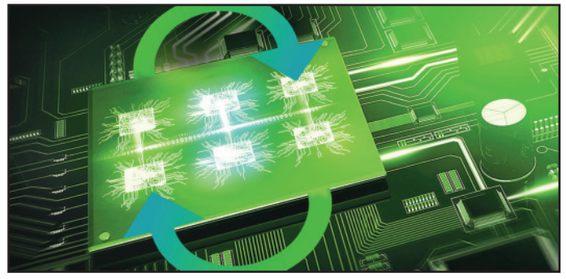
Operating temperature is -55 to +200°C. It is available in syringe, cartridge and pail packaging formats.



Starter kit adds OTA to Autosar platform

Elektrobit has added over-the-air (OTA) update capabilities to the Autosar Adaptive platform with its EB Corbos starter kit.

It provides car makers and tier-one suppliers with software for developing ECUs based on Autosar Adaptive plus a component that distributes OTA software updates.



The starter kit version 2.9 and later integrates EB Corbos with the EB Cadian Sync UCM Master OTA update tool.

The kit ensures software in an automotive operating system can be easily deployed, enhanced and maintained.

It provides a standardised, safe and secure way to install, update and uninstall software in architectures based on Autosar Adaptive.

High-side switch boosts reliability

An intelligent high-side switch has been developed by Diodes to improve automotive reliability.

The ZXMS81045SPQ Intellifet device can deliver high power from a small footprint, while providing protection and diagnostic capabilities.

It is suitable for driving 12V automotive loads, such as LEDs, bulbs, actuators and motors in body control and lighting systems.

The device has a 41V-rated n-channel fet with onboard circuitry that protects against short circuits, manages inrush currents, and safeguards against overvoltage conditions including load dumps.

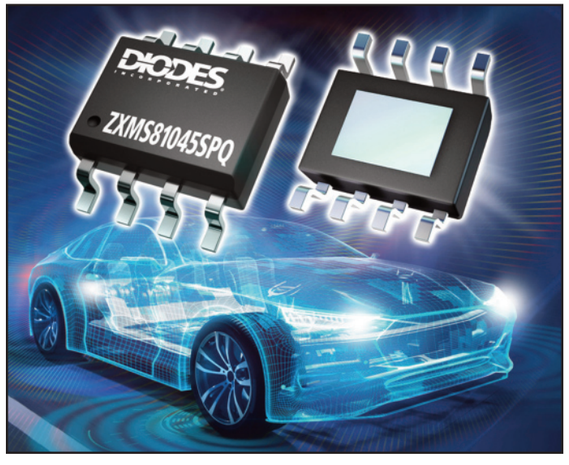
In addition, it has overtemperature protection with auto-restart, plus protection against ESD.

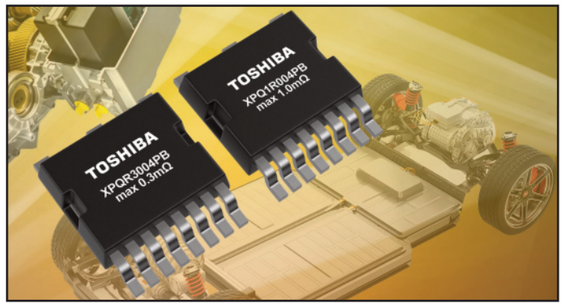
Loss of ground and reverse polarity protection can also be implemented with the aid of a few external components.

A dedicated current sense pin provides precision analogue current monitoring of the output and fault indication for short to battery, short to ground and open load detection.

The footprint can be smaller than relays, fuses and discrete circuits. It is also a form, fit and functional equivalent for existing power switch devices, where improved product supply is needed.

Qualified to AEC-Q100, PPAP capable and manufactured in IATF 16949 certified facilities, it is supplied in a SO-8EP package.





Mosfets support larger currents

Two automotive-grade 40V n-channel power mosfets from Toshiba use the large transistor outline gull-wing leads package format, known as L-TOGL.

They each have high drain current ratings (400A for the XPQ-R3004PB and 200A for the XPQ-1R004PB), plus respective on-resistance values of 0.3mΩ and 1mΩ.

There is no internal post structure (solder connection) on these devices. This is achieved by connecting the source and outer leads with a copper clip.

The use of a multi-pin structure for the source leads reduces the package resistance and associated losses by about 70% compared with the existing TO-220SM(W) package.

The resulting drain current rating of the R3004PB represents a 60% increase over the existing TKR74F04PB housed in the TO-220SM(W) package.

Furthermore, the thick copper frame reduces junction-to-case thermal impedance. It is 0.2°C/W for the R3004PB and 0.65°C/W for the 1R004PB. This eases heat dissipation, lowers operating temperatures and enhances reliability.

For use in automotive applications at temperatures up to +175°C, they are both AEC-Q101 qualified.

Their gull-wing leads reduce mounting stress and allow easy visual inspection, helping improve the solder joint reliability.

When used in high-current automotive applications, such as semiconductor relays or integrated starter generators, they enable designs to be simplified and the number of mosfets required to be fewer. This means size, weight and cost reductions can be realised.

High-side gate drivers simplify scaling

One-, two- and four-channel automotive high-side gate drivers from ST Microelectronics come in a common Power SSO-16 package style, with pin assignments that simplify scaling circuit designs to add more driver channels.

The gate drivers target applications throughout the vehicle, including safety, comfort, powertrain, body electronics, infotainment and driver assistance systems.

Meeting the LV124 test schedule for deep cold cranking permits use with heavy loads such as engine starters and ensures operation even in extreme winter conditions. With standby current at a few microamps, they reduce the drain on the battery when the vehicle is turned off and not being used.

The drivers use proprietary VIPower M0-9 technology, which permits integration within a small die size in addition to high current capability and efficiency.

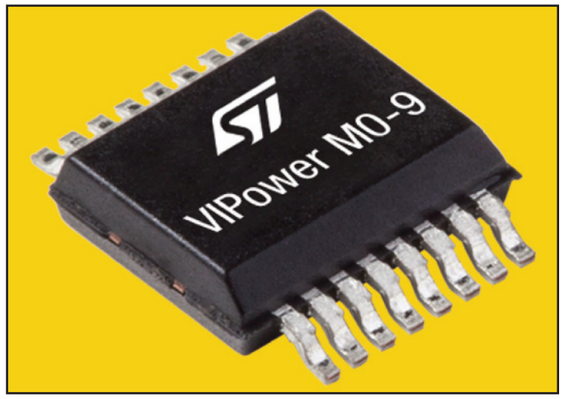
On-chip features include protection such as load-current limiting, load-dump protection up to 35V and limiting of fast thermal transients. Flexible reset management lets the designer configure the driver's responses to faults to meet the application.

The drivers provide reverse-battery protection through self-turn-on capability, which limits the power dissipation on the PCB to a survivable level.

Diagnostic capabilities include high-accuracy proportional load-current sensing that permits detecting malfunctions in the load, such as disconnection of an LED string. There is also overload, short-to-ground, short-to-VCC and off-state open-load detection. All diagnostics are maintained whether the driver is turned on or off, permitting faults to be detected even when the load is not supplied.

There are five single-channel drivers, VN90-04AJ, 06AJ, 08AJ, 12AJ and16AJ. The dual-channel drivers are the VND90-08AJ, 12AJ, 16AJ and 25AJ. The VNQ90-25AJ and 80AJ each have four channels.

All are housed in the PowerSSO-16 package, which has a 6.0 by 4.9mm footprint and is 1.7mm high, and are pin-to-pin compatible. They are also compatible with the previous M0-7 family.



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