VEHICLE electronics

The monthly magazine for automotive electronics engineers

Bosch and Daimler partner on autonomous driving

Bosch and Daimler are joining forces to advance the development of fully automated and driverless vehicles.

The two companies have entered into a development agreement to bring fully automated (SAE level four) and driverless level five driving to urban roads by the beginning of the next decade.

Bosch and Daimler vision of urban transport

The objective is to develop software and algorithms for an autonomous driving system.

By introducing fully automated and driverless driving to the urban environment, the two companies aim to improve the flow of traffic in cities, enhance safety on the road and provide an important building block for the way traffic will work in the future.

The technology will, among other things, boost the attraction of car sharing. It will allow people to make the best possible use of their time in the vehicle and open up mobility opportunities for people without a driver's licence, for example.

The prime objective of the project is to achieve the production-ready development of a driving system that will allow cars to drive fully autonomously in the city. The idea behind it is that the vehicle should come to the driver rather than the other way round. Within a specified area of town, people will be able to order an automated shared car via their smartphone. The vehicle will then make its way autonomously to the user and the onward journey can commence.

• To get automated driving off the ground in China, Bosch is collaborating with Chinese internet group Baidu and map providers AutoNavi and NavInfo to use information collected by radar and sensors to generate and update maps.

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Analog Devices and Renesas collaborate on radar demo

Analog Devices and Renesas Electronics are collaborating on a 77 to 79GHz system-level radar sensor demonstrator with the goal to improve adas applications and enable autonomous driving vehicles.

The demonstrator combines the RH850/V1R-M microcontroller from the Renesas Autonomy platform with ADI's Drive 360 28nm cmos RF-to-bits technology.

"This innovative system approach will significantly reduce risk by providing digital interoperability at the system level for our customers," said Chris Jacobs, general manager at Analog Devices. "The new RH850/V1R-M MCU, coupled with ADI's high-performance Drive 360 radar platform, will bring unparalleled performance to adas and autonomous driving systems."

The seamless system-level operation of these two technologies will make driving safer by enabling earlier detection of smaller and faster moving objects at greater distances.

It should lower radar integration efforts and reduce evaluation risks for automotive OEMs and tier-one suppliers.

"Radar sensors play a crucial role for all adas or automated driving functions," said Jean-Francois Chouteau, vice president of Renesas. "This cooperation ideally combines the best of ADI and Renesas assets to deliver performance and enable OEMs and tier-one suppliers to reduce development cost and time to market."

Tibco provides Insight into Mercedes F1

Tibco Software is providing the Mercedes Formula One team with analytics through its Insight platform.

"The 2017 Formula One race calendar provides a unique way to showcase the power of our advanced analytics technologies through supporting the success of the Mercedes-AMG Petronas motorsport team in such a competitive and dynamic sport," said Murray Rode, chief executive officer of Tibco.

The platform uses visual, predictive and real-time streaming analytics, integration, and business process management technologies. Featuring interconnected data, systems and analytics, it fuses multiple technologies to form an intelligent digital nervous system across data, software, field equipment, technical teams and management staff. This helps generate actionable insights and execute them for real-time performance optimisation.

"To stay ahead in motorsport, you have to continually innovate and be able to make quick decisions based on sound information and judgment," said Toto Wolff, head of Mercedes-Benz Motorsport. "Working with the Tibco Insight platform will enable us to optimise our performance in these areas, benefitting not only our strategic decisions at the racetrack, but also how we operate back at the factory."

Delphi deals with Valens and Rosenberger advance vehicle connectivity

Delphi Automotive has signed strategic agreements with Rosenberger and Valens for development work in Automotive Ethernet and vehicle connectivity.

"Connected vehicle platforms require robust electrical architectures to transfer greater amounts of data at increasingly faster rates and the Rosenberger partnership allows Delphi to work with another industry leader to support common standards for Automotive Ethernet architecture," said Majdi Abulaban, senior vice president at Delphi.

Rosenberger is involved in automotive RF connection systems and has experience in other industries such as telecoms, medical, and test and measurement. It provides connection systems to enable adas, automated driving and connected vehicle platforms.

Delphi and Rosenberger have agreed to engage in a technical partnership and will collaborate on Ethernet products for the transportation market.

Delphi made a strategic investment in Valens because of its signal processing capability, a key enabler for the expanding connectivity and computing needs in vehicles.

"Demand for increased connectivity, active safety and greater vehicle automation requires best-in-class signal and power distribution capabilities along with a robust data management strategy," said Kevin Clark, Delphi chief executive officer. "Delphi's vision is to enable the brain and nerve centre of the vehicle through our leadership in computing and electrical architecture. This partnership strengthens our capability in this space."

Valens is the developer of HDbaseT, a standard for transmission of ultra-HD video, audio, Ethernet and controls data. Valens introduced its HDbaseT technology to address the connected car market, including the increasing amount of bandwidth and wiring required for infotainment and adas.

"The connected car is one of the world's most remarkable innovations, and we are committed to delivering the necessary infrastructure to realise its potential," said Dror Jerushalmi, chief executive officer of Valens. "Working with Delphi, Valens is better positioned to accelerate the adoption of HDbaseT Automotive as the technology of choice for in-vehicle connectivity."

Arm camera ISP boost for imaging safety applications

Arm has announced its first multi exposure, multi camera ISP for the automotive market.

As the number of cameras per car increases and sensor fusion technologies get smarter, the Mali-C71 supports the rise in the number of and sophistication of safety applications that use imaging data and computer vision in next-generation adas.

The Mali-C71 processes the multiple exposures from the camera, stitches them together to create an ultra WDR frame, processes the frame at high precision and then sends it across to a display or a computer vision engine following appropriate dynamic range compression.

It also brings low latency, error detection with more than 300 dedicated fault detection circuits, and system-level certification to the highest automotive standards.

Harman integrates digital displays and services

At Auto China in Shanghai last month, Harman, now a subsidiary of Samsung, announced a platform that integrates all of a car's digital displays and the information and services behind them.

The digital cockpit is scalable and integrates the operation and functions of the instrument cluster and centre stack infotainment to deliver a seamless experience.

The compute platform can drive multiple functional domains within the car, including the centre displays and infotainment, instrumentation cluster, adas, audio and sound management, lighting, e-mirrors, navigation, drive assist, and even an intelligent personal assistant.

"For too long, a car's integral cockpit components have been fragmented," said Phil Eyler, executive VP at Harman.

NXP appoints Mobiliya for software development

NXP has selected Texas software engineering company Mobiliya as its software development partner for Linux and FreeRtos on MAC 57D5xx MCUs.

The company has experience in the embedded space with expertise in platform enablement and will be NXP's commercialisation support partner for the device.

"This reflects the strong capabilities we have in embedded systems," said Krish Kupathil, CEO of Mobiliya. "Mobiliya looks forward to supporting NXP customers who chose MAC57D5xx for a variety of applications ranging from mid-range instrument clusters to multi display and HUD management used in automotive."

The Linux and FreeRtos software enablement package delivered by Mobiliya will help small and medium-sized developers deliver products for instrument clusters.

The MCU family, based on the Arm Cortex M and A processors, is a multi-core architecture for mid-range instrument clusters such as automotive infotainment systems.

"NXP is taking a significant step to reduce development cycle time for instrument cluster applications by partnering with Mobiliya to deliver the enabling software to our automotive and industrial customers," said Ross McOuat, VP at NXP.

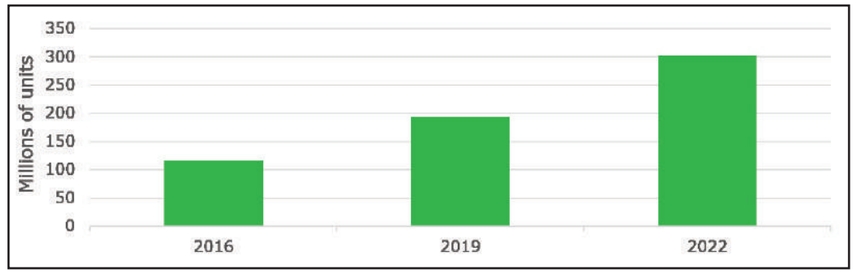
- NXP and China Academy of Information & Communications Technology, a subsidiary of China's Ministry of Industry & Information Technology, have signed a strategic cooperation agreement to foster innovation in intelligent transportation and securely connected vehicles.

Adas applications to top 302m units by 2022, says IHS

Global automotive applications of adas will surpass 302 million units annually in 2022, according to analysis from IHS Markit.

The researcher forecasts that global adas growth will be led in part by introductions of automated autopilot, driver monitoring systems, and side and rear mirror cameras, each aimed at making the driving activity safer, more convenient or more efficient.

This growth is enabled by advances in sensor technologies including radar, camera and lidar that will number more than 232 million units annually in 2022, the report says. Combined, implementation of these technologies will enable higher levels of automated driving on a global scale.



Global adas application system production according to IHS

"Many OEMs have started offering partially automated systems that execute accelerating, braking and steering together," said Aaron Dale, senior automotive analyst at IHS Markit. "These systems combine multiple sensors and multiple single-function adas features to allow the vehicle to drive, albeit under driver supervision. While some of these individual technologies are well-established, combining functions and sensors requires higher levels of integration as well as substantial computing power."

Current systems manage the driving task at low speeds as well as high and can complete lane changes with driver input. Future systems may use artificial intelligence to navigate more complex driving environments on their own. This functionality extends the integration of forward-sensing systems such as adaptive cruise control, lane keeping assist and traffic sign recognition by integrating blind spot information and rear-sensing to provide complete 360˚ awareness.

Automated driving systems today have guided the industry into SAE level two definitions where constant driver supervision is required. The first level three capable systems are just around the corner, which will remove the need for constant driver supervision in certain circumstances, such as in traffic jams or on well-maintained stretches of highway. Consumer acceptance remains a key question on the path to widespread adoption.

Side and rear mirror cameras offer another opportunity for growth but regulation has hindered widespread adoption. Japan was first to revise regulations in 2016 citing advances in camera quality, and other markets are expected to follow in the years to come.

Applications for 77GHz radar are providing car makers with higher resolution awareness in the short to mid-range distances around the vehicle. A new generation of lidar sensors will offer useful complementary and redundant coverage as more highly automated driving systems come to market.

Aid to night driving simulation

Synopsys has introduced v2017.03 SR1 of LucidDrive software for night-driving simulations to evaluate the road performance of headlights.

The technology provides precise simulations of vehicle lighting beam patterns and their appearance on the road, allowing designers to assess and improve performance throughout product development.

The latest version contains realistic simulations of headlight response to dynamic traffic and road conditions, such as traffic jams, lane changes, bends and oncoming vehicles.

Consortium aims to rate cyber security

A Horiba Mira led 5*Stars consortium has been established in the UK to focus on automotive cyber security. The consortium will research and develop a methodology to assure that connected autonomous vehicles components and systems have been designed and tested to the relevant cyber security standards.

The aim of the consortium is to develop a five-star type consumer rating framework, analogous to existing Euro NCap type ratings for vehicle safety.

"The race for developing connected and autonomous vehicles is accelerating and as a government we are determined to build on our strengths and ensure the UK is at the forefront of this revolution," said Greg Clark MP, secretary of state for business, energy and industrial strategy. "We have an excellent record in innovation in the UK and, through our industrial strategy, we will build on our strengths so the UK auto sector remains world-leading. That is why we have announced support today for 5*Stars as schemes like these will be key to turning research and development into anchoring future production."

Other partners in the consortium are Ricardo, Roke, Thatcham Research and Axillium Research. It will receive grant funding from the UK's innovation agency, Innovate UK.

"This project is a major step forward in not only clarifying the risks associated with connected autonomous vehicles for the insurance industry, but also in increasing consumer confidence," said Chris Reeves, head of connected autonomous vehicles at Horiba Mira. "The project will also help to realise the commercial opportunity connected autonomous vehicles bring for the UK, and we're delighted to lead a consortium of global players capable of addressing this major emerging challenge."

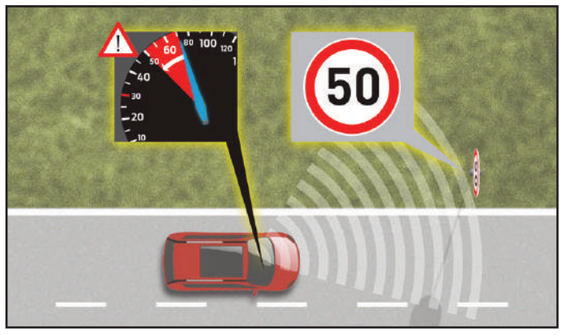
Peter Shaw, chief executive at Thatcham Research, added: "Car security, and specifically cyber security, is one of the top concerns of UK insurers. We are increasingly seeing more connected vehicles launched every month, whether that is loaded with a new app, or the ability to connect with the cloud to access data. Wherever there is a digital element in the car, it is vulnerable to attack. Consumers and insurers need to know what potential risk this connectivity has."

• Horiba Mira has joined forces with Coventry University to launch an automotive research centre dedicated to developing intelligent, connected vehicle technology. The Centre for Connected & Autonomous Automotive Research will pioneer and test developments to support the rapid growth within the global intelligent mobility sector and address future transport needs.

Ford combines technologies to meet speed limits

Ford has introduced an intelligent speed limiter that combines the functions of two Ford technologies: adjustable speed limiter that enables drivers to set a maximum vehicle speed manually; and traffic sign recognition that provides drivers with the latest detected speed limit, cancellation signs and overtaking restrictions via the instrument cluster display.

Drivers can choose between speed limiting systems in the vehicle menu using the steering wheel controls, and activate them using the speed controls. Maximum speed can be set and then raised or lowered in increments.



Ford helps drivers stay within the speed limit

The technology uses speed limit information from the traffic sign recognition system. It can also use map data for improved accuracy.

Drivers can set a speed tolerance of slightly above the detected speed limit.

The system does not apply the brakes but smoothly controls engine torque by electronically adjusting the amount of fuel delivered.

Nexteer and Dongfeng form EPS joint venture

Nexteer Automotive and Dongfeng Motor Parts have agreed to form a joint venture to design and manufacture electric power steering systems in China.

"The formation of a joint venture between Nexteer and Dongfeng Components signifies an expanded relationship in which both companies will greatly benefit," said Tao Liu, senior vice president at Nexteer Automotive. "By providing our advanced steering technologies specifically tailored to the needs of our customers like Dongfeng, we continue to increase our presence in the growing Chinese market which is a core component of Nexteer's strategy for profitable growth."

Nexteer's business in the Asia-Pacific now accounts for 24 per cent of the company's total revenue, nearly doubling in the past three years. In 2016, Nexteer launched 21 customer programmes in the region and has since been expanding manufacturing capabilities to meet demand.

The company provides EPS for Dongfeng affiliated vehicles, including the Peugeot 2008 crossover. Pending regulatory approval, the joint venture will become a strategic in-house producer of passenger vehicle EPS within the Dongfeng group.

"We continue to seek strategic alliances with OEMs and other business partners," said Mike Richardson, president of Nexteer Automotive. "The opportunity to join Dongfeng Components in a unique role of JV partner and producer of EPS for future vehicle platforms further expands our presence in the Asia-Pacific region and contributes to our overall revenue growth objectives."

After clearing regulatory approvals, the joint venture facility will be located close to the Dongfeng group headquarters in Wuhan, China.

Continental algorithm analyses road conditions

Sensors and cloud data classify road as dry, wet, covered with snow or icy

Continental is developing an algorithm to detect the typical features for the four different road conditions of dry, wet, snow-covered and icy. The version for detecting wet conditions is undergoing advanced testing at vehicle manufacturers.

"We use sensors available in the vehicle for the Road Condition Observer to gain information on the grip of the road surface," said Bernd Hartmann, head of Continental's adas and tyre interactions project group. "This knowledge allows us to adjust the functions of advanced driver assistance systems to the current road conditions. For example, to prevent an impending collision, automatic emergency braking must be initiated considerably earlier on a wet road than on a dry road."

Currently, it is solely the task of drivers to assess the weather conditions and to combine this with observations of the vehicle's surroundings to draw the correct conclusions on the condition of the road. In the future, the algorithm could support the driver, letting the adas detect adverse conditions and reacting suitably and in good time.

"Automated driving also requires us to make judging the condition of the road technically possible for the system," said Hartmann. "An automated vehicle in particular must know if it is icy so that it can safely drive around the next corner."

In addition to the vehicle dynamics sensors in the car, a mono camera is also used. Electronic stability control (ESC) is available in nearly every car as standard and mono cameras are available in an increasing number of vehicles due to the growing distribution of driver assistance systems.

The algorithm classifies the road condition based on the evaluation of the surroundings using camera images from the front of the car, comparison with vehicle dynamics data from the ESC, knowledge of local and regional weather data, and tyre behaviour. In a subsequent step, a friction coefficient can be derived from this.

"Where possible such a system should be implemented with the existing sensors," said Hartmann. "We have already been able to do this with wet road surface detection. In addition to detecting wet roads, in the next stage there will be a vehicle dynamics model integrated into the ESC control unit that detects low friction coefficient values and can optimise the ESC actions accordingly."

During further development, the information of the algorithm will flow into a 360° environment model that is prerequisite for a comprehensive understanding of the overall driving scenario. The environment model is generated through the fusion of different information sources. The integration of the road geometry, localisation and traffic regulation recognition, model-based tracking of moving objects, and identification of free space play an important role.

"This creates a comprehensive data basis for safe automated driving across all weather types," said Hartmann.

PATH TO AUTONOMY

Steve Rogerson reports from last month's Autotronics show in Taiwan

AutoTronics Taipei The 12th Taipei International Automobile Electronics Show AUTOTRONICS APR. 19-22 2017 NANGANG Exhibition Center

Working together on autonomous driving

Taiwan knows that if the country is to become a major player in the future world of adas and autonomous driving then its individual companies cannot do it alone. This is why the Taiwan Automotive Research Consortium (TARC) could be a key factor as it combines industry and academic knowledge to tackle the latest research and development and, most importantly, provide a route for that technology to find its way back into industry.

Max Chang demonstrates the autonomous vehicle driving simulator

Consortium members include the Automotive Research & Testing Center (ARTC), Metal Industries Research & Development Centre (MIRDC), Mechanical & System Research Laboratories (MSL), Industrial Technology Research Institute (Itri), Material & Chemical Research Laboratories (MCL), the National Chung-Shan Institute of Science & Technology (NCSIST), and their private-company partners.

TARC exhibited 21 new technologies and products, plus an autonomous technology reality demo that let the general public on-site experience an autonomous vehicle equipped with home-grown adas technologies passing through ten automated-driving circumstances.

Demonstration of vision-based forward object detection system

"This is an industrial development alliance to form an R&D platform that can also forge alliances with overseas companies," said Max Chang, deputy manager of ARTC.

The exhibit focussed on two planks of the consortium's work – intelligence and electric vehicles formed into six major demonstrations.

The vision-based forward object detection system can detect in real time pedestrians, motorcycles and bicycles, other vehicles, and various types of obstacles.

"It uses a neural network to keep learning," said Chang. "It can be taught the characteristics of different objects. This will be key for autonomous vehicles. We are cooperating with local universities in joint development work."

But he said that this year the plan was to transfer the work to some local Taiwanese companies.

The autonomous vehicle driving simulator builds up the test circumstances and scenes for adas, including vehicle physics model and simulated signals of related interfaces, and simulated control algorithms and models. This can shorten development time by 30 to 50 per cent, as well as reducing costs for vehicle makers.

With the long-distance floating multi-screen HUD, laser micro projection technology and a long-distance floating light-path design mean that all traffic information can be projected in front of the car windshield 2m away, reducing the risk of driver's eye fatigue and distraction. The triple display of navigation map, around-view monitor and driving information can let the driver get all traffic information under safer conditions.

"Traditionally, these systems project just in front of the driver," said Chang, "but this is about two metres away to make it easier on the eyes."

This technology has already been transferred to a private company but details have not yet been released.

The cooperative vehicle positioning system integrates multiple positioning-enhancing systems to provide 30cm accuracy and stability from different sensors to meet requirements for future autonomous vehicles.

"A general GPS is not stable and is subject to interference from high buildings and so on," said Chang. "This uses different devices to adjust the GPS information such as an inertial measurement unit and odometer."

In the electric vehicle section, the highlight was an aluminium vehicle frame for helping reduce weight to extend the vehicle's range. This is a modular frame that can be adapted to different vehicle designs. The consortium has built a prototype using 3D printing technology that has a range of 60 to 100km.

A belt starter generator (BSG) has been developed to replace the traditional engine alternator with an electric motor that serves as a generator and a starter motor. This can simultaneously power the stop-start and power-assist functions and help cut emission by a fifth compared with traditional combustion-engine vehicles.

The final demonstration was of cloud-based real-time fleet management technology targeted at electric vehicles that can show not just the vehicle's position but also the condition of its battery pack.

Renesas sees Taiwan as start of supply chain

Because of the importance of Taiwan in the automotive supply chain, Renesas is working with engineers and universities to get its products designed in from the start, according to Eric Wang, director of the firm's FAE division in the country.

"Taiwanese companies can be very important in the automotive supply chain," he said. "So we try to design into the Taiwanese company, which is how we get into the automotive supply chain. So we are working with many third parties in Taiwan."

These include Pegatron, which is investing heavily in its manufacturing facilities as it expects to start producing iPhones for Apple. But the company is also targeting tier ones in the automotive industry as it moves away from its PC business.

"There are many companies that are moving from PCs to automotive," said Wang. "Pegatron is a good example. They did OEM design for PCs but now they are expanding into automotive. They see it as a new segment."

He said that because the PC market was getting smaller, many manufacturers were looking for new applications, and automotive was a major one of those.

"Many PC manufacturers want to expand to new businesses, and automotive is one of those," said Wang. "Another is health care."

He said that though Taiwan had no big name car maker, it was focussing on the aftermarket.

"The aftermarket is suitable for Taiwan," he said. "They are working with a lot of Chinese companies and Japanese car makers. They are also looking at Europe. There are a lot of automotive parts with Taiwanese components inside even though the product itself is not Taiwanese."

Renesas is also working closely with universities in the country.

"We provide a platform for them to make other platforms for adas and the like," said Wang. "We can meet all the requirements for customisation for our customers in Taiwan. We work with the universities and third parties to do the customisation. And that means the end customer buys our product."

Eric Wang: "We provide a platform for them to make other platforms."

Rewards for innovation

A windshield type head-up display from E-Lead Electronics scooped the gold medal in the electronics section in this year's innovation awards.

This has a projection distance of around 2.5m and uses augmented reality technology to integrate the road environment and driver information. The information is projected onto the 23cm transparent screen, and it can be seen by drivers wearing polarised sunglasses.

"This is aimed at OEMs," said the company's Steve Yang, "because you need a special coating on the windscreen."

The company also has a mirror HUD that will project the screen from a smartphone onto the windscreen, though Yang was quick to point out this was not for watching movies while driving but for projecting, say, information from a GPS app.

"We have developed the OEM version with several OEMs and will launch in 2018," he said. "Two of the OEMs are in China but we can't say who because we are still in the development stage."

Lori Lin: "If there is a car crash, the data are not lost."

Also on show from the company was a rear-view camera that detects moving objects and gives a warning to the driver, say for a pedestrian passing by when reversing, and a blind-spot detection system that can detect cars and motorcycles.

"We want to do this for OEMs and the aftermarket," said Yang.

One of the silver awards went to Max's Industrial for a hybrid suspension system that lets a mobile phone control the height of the bottom of the vehicle above the ground.

"You can use your phone to raise and lower the chassis," said Lori Lin from Taitra, Taiwan's external trade development council. "This means you won't scratch the lower part of your car when you go up and down hills. When the chassis is lower, it is more comfortable because there is less vibration. When it raises, it automatically brings in a dampening system to reduce the vibration."

Steve Yang: "You need a special coating on the windscreen."

Another silver award went to ATBS Technology for a system that receives real-time information about traffic and weather and to the car's internal networks. This streams driving behaviour data along with GPS information and the state of the tyres to the cloud.

"If there is a car crash, the data are not lost because they are stored in the cloud," said Lin.

Chang Hao Industrial picked up a silver award for a motorcycle self-levelling headlamp that uses internal sensors to detect the dynamic tilt angle of the bike. This information is used to drive a set of small motors that adjust the tilt angle of the headlamp accordingly.

"This lets it illuminate the road correctly no matter what the tilt on the motorbike," said Lin.

Trans Electric's dual dash cam picked up a bronze award. This can record either what is going on inside the vehicle or be attached to the rear windscreen for a rear view.

"It can shoot inside and outside of the car," said Lin. "And it turns on within one second rather than five to ten seconds with other cameras. This can be vital in a car crash for recording footage."

A smartphone fingerprint wireless immobiliser from Tesor Plus received bronze and will not let the car start without the correct fingerprint being placed on the smartphone sensor.

"You connect the phone to lock and unlock the car," said Lin.

Another bronze was won by Good Will Instrument for its MSO-2000 mixed-signal oscilloscope. For use in testing by car manufacturers, it can communicate through the Can and Lin bus.

"It can be used in all stages of manufacture," said Liso Yu Ju, director at Good Will Instrument. "It will also be used by the manufacturers of GPS and dashboard systems."

Liso Yu Ju: "It can be used in all stages of manufacture."

Three-in-one magic

A three-in-one battery tester, charger and doctor was the highlight on Feng Yao's stand, and the Magic Charger also managed silver in the innovation awards.

"This is a very unique product," said Sean Fu, business vice president. "It works like a normal battery charger but the beauty is the battery doctor that can increase voltage and capacity."

After repeated use of a lead-acid battery, sulphate crystals form on the battery plate. The Magic Charger generates resonant electric pulses that shatter the crystals. It cannot, however, do anything about more serious problems such as a broken plate.

"We think this can double the life of an average battery," said Fu.

Sean Fu with the Magic Charger

While some products exist that can generate pulses to shatter crystals on the anode, this can repair both the anode and cathode at the same time.

"It is a bigger challenge to generate pulses on cathodes," said Fu. "We hope lead-acid pollution can be reduced due to prolonged battery life."

For a motorcycle battery, a charge and repair will take about ninety minutes rising to about three hours for a car battery.

The unit on show was only a prototype with the final product planned for between three and six months time.

"We need to do some more tests," said Fu. "We also need to set a reasonable and profitable target price."

DVR records four channels

Making its debut at the show was the MS-715 DVR from Chinese firm Shenzhen Mingshang.

"We launched this last month," said export sales manager Kitty Zhou. "The main markets we are targeting are America and Europe, but we are also looking at Australia. We are targeting car makers and wholesalers."

The main application, she said, would be inside a bus so that the driver could see what was going on outside the vehicle as well as keep an eye on passengers inside.

"It can also be used by truck drivers to give them a side view," she said.

It has an 18cm monitor and uses dual SD cards. It supports four-channel audio-video and has automatic video recording. Audio and video can be recorded synchronously. GPS and 3G communications can be built in as an option.

Kitty Zhou: "We launched this last month."

Public transport test boost

The Taiwanese government's focus on smart public transportation has given the country's electronics industry a home grown testbed as it moves from traditional ICT sectors into the automotive market, according to Paul Chou, secretary general of the Taiwan Telematics Industry Association.

"Ten years ago, they started to explore the telematics industry and they put in financial resources to do that," said Chou. "There wasn't much of a business then. So the government started putting money into the infrastructure of the public transportation system."

The government subsidies targeted lorries and buses leading to the country having 15,000 buses, 20,000 coaches, 40,000 lorries and 100,000 taxis all equipped with a common-standard telematics unit.

"More than ninety per cent of the buses have the telematics equipment," said Chou.

This includes GPS and digital video recording equipment to monitor everything that is happening in and around the vehicle, and what the driver is doing.

"If the bus companies do not follow the standard, they do not get the government subsidies, so everyone does it," said Chou.

Now the government is switching its focus to electrifying its public transport fleet.

"We want to cut pollution," said Mei-Hua Wang, vice minister in the Ministry of Economic Affairs. "Electric vehicles are very important in that. It is difficult to change habits, to tell the people not to ride motorcycles, so we have to change our way of thinking by making the motorcycles smarter and greener."

Paul Chou: "More than ninety per cent of the buses have the telematics equipment."

She said the country was making more electric buses and e-transportation available, which would add momentum to Taiwan's economy.

"We want to grow and shine on the world's stage," she said. "We are combining the IT, automotive and electronics industries together. Taiwan can integrate the best of industries into one. We can see a collective effort. We will continue to give the automotive industry more support to help integrate auto-electronics technology."

Mei-Hua Wang: "We want to grow and shine on the world's stage."

Cub partners Chrysler and GM

Cub Elecparts is working with Chrysler and General Motors in the USA on building a factory-approved dealer option for its blind spot detection radar system.

The company, which once specialised in tyre pressure monitoring, still a major part of its business, is switching its attention to adas with a 77GHz radar-based unit that can handle lane-departure warning, forward collision alert, door open alert, blind spot detection and rear cross traffic alert.

"We have gone for radar because cameras do not work in heavy snow and other bad weather," said Lily Chen, Cub's sales manager.

For this, the company is also working with OEMs, one Chinese and one "more local" with the aim for it to be included in model year 2018 and available as an aftermarket retrofit in July.

And Cub is testing an autonomous emergency braking system on a couple of cars. "It has to be model specific for AEB," said Chen.

Lily Chen: "We went for radar."

Everlight increases LED segments

Everlight Electronics hopes to make the most of its new US$300m LED factory in Taiwan as it brings its latest segmented headlights from research to production over the next three years.

The firm has a prototype 24-segment glare-free high beam LED module that can automatically turn on and off different segments to light up different parts of the road ahead. But it is now looking at an 84-segment segment module and by 2020 1024 segments.

"We want to fine tune all the pixels to focus on very small objects," said Min Shie, who heads the company's automotive product marketing department. And he does not think this will drive the cost through the roof.

"The cost of LEDs is coming down year by year," he said. "By 2020, the 1024-segment model may cost less not more."

The company is working with Chinese car makers and an Indian OEM but wants to start working also with the American and European manufacturers.

"Car makers say it will be three to four years before this is in a road car," said Shie. "We are working on prototypes."

At the show, Everlight landed a silver medal in the innovation awards for the 24-segment matrix driving beam technology.

Min Shie: "The cost of LEDs is falling."

Balancing bus batteries

Mobiletron is working with a Japanese electric bus company to develop a battery management system (BMS) for keeping batteries healthy with the goal for it to be deployed from 2018.

"The BMS will let us re-use batteries after they have worn out," said Miriam Lu (pictured), Mobiletron sales manager. "If the battery is at only 80 per cent, you can't use it in a vehicle but it can have other uses such as in a mobile phone base station. It could also be used for a fork-lift truck."

Mobiletron is a major shareholder in the Sumitomo bus company, which will switch to the Mobiletron system from its current ones made by Panasonic and other companies.

One of the key features of the system is the passive balancer, which means even if the lowest cell reaches full capacity the cell can still consume power by changing into heat intentionally. The active balancer allows cells with different capacities to be charged or discharged to their full range.

Bridge to industry

Set up two years ago, a government funded research organisation to link businesses with universities was showing its developments in the automotive field.

The National Programme for Intelligent Electronics (NPIE) Bridge for example has been working with National Chiao Tung University on vision-based electronics technology for scanning distances to other vehicles and pedestrians for adas applications such as forward collision warning, automatic stop and go, and lane departure warning.

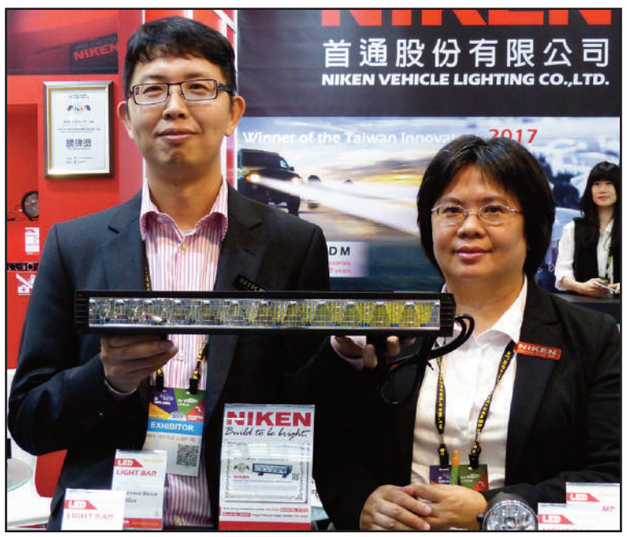
Susan Chang: "We want to link businesses with universities."

"We want to link businesses with universities," said Susan Chang, project manager for NPIE Bridge. "We have students doing projects that can link to business needs."

A similar project with Feng Chia University is combining two and three dimensional stereo-vision information to improve object recognition. And one with the Southern Taiwan University of Science & Technology is producing a Can bus OBDII bridge to link vehicle diagnostics with V2V communications for fleet management applications and for monitoring air pollution.

Reverse LEDs improve light bar

A clever way of arranging the LEDs in a light bar has allowed Niken Vehicle Lighting to pack more LEDs into the same space to reduce the size or increase the brightness to power ratio.



Eric Shih and Niki Lin with the light bar

Traditional light bars have the LEDs placed side by side, which creates less bright gaps where the beams meet. The Niken system has the LEDs squeezed back-to-back using a reflective surface to send light from the rear-facing LEDs forward, thus producing a more uniform light.

"LEDs can be more expensive than a normal bulb," said sales manager Eric Shih, "but we have the reverse LED with reflector to make it more attractive."

Fellow sales manager Niki Lin added: "It is also forty per cent brighter."

The NK0507 light bar can be attached to 12 or 24V vehicles and can be used in most markets. It can accept inputs from 9 to 32V and the smallest 18cm model produces 1200 lumen. There are also 28 and 51cm versions.

It is IP69K rated and draws 21W. The housing is aluminium.

"We want to target Europe and America," said Shih.

The NK0507 light bar landed a silver medal in this year's innovation awards.

INFOTAINMENT

FAST TRACK

Carmelo De Mola presents a cost efficient, robust and scalable physical layer for high-speed networked infotainment systems supporting different network topologies

High-bandwidth in-vehicle infotainment (IVI) systems with data rates higher than 100Mbit/s have been historically offered in high-end cars; however, more and more economical and high-volume passenger vehicles are also beginning to offer high-bandwidth IVI capabilities.

Independently from the software-based features that different IVI systems can offer, all share a common base: the need for robust and high-bandwidth underlying physical-layer technology.

Historically, optical Most 150 networks have served the purpose of being the high-bandwidth infotainment physical layer, fulfilling all the demanding OEM requirements with respect to the high bandwidth, scalability, low weight, high robustness, EMC and the capability to fit in to the limited available space in vehicles. However, in spite of the listed features, its cost has represented a barrier for some high-volume car manufacturers.

The need to answer the market demand for a cost-down path for the IVI physical layer, capable of fulfilling the challenging automotive requirements, has triggered an innovation process that has generated a new standardised physical layer for IVI networks based on coaxial cables.

Coaxial cables have many design merits, including:

Vehicle Electronics

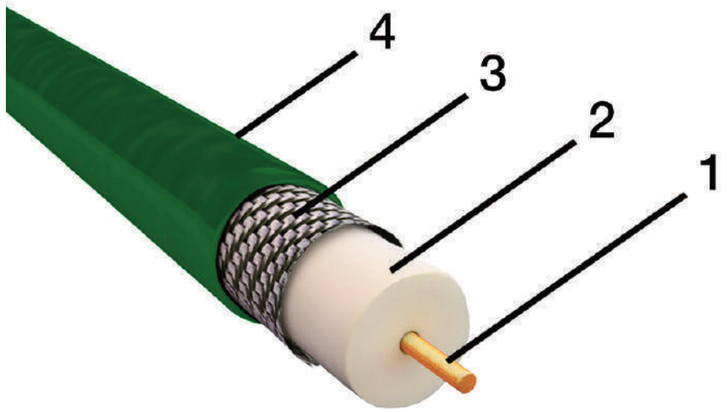


Fig. 1: Cutting model of a coaxial cable: 1 centre core conductor; 2 inner dielectric insulator; 3 metallic shield; and 4 plastic jacket

- Supporting high-bandwidth data transfer;
- High shielding effectiveness – robust EMC performance;
- Available automated connectors assembly process;
- Satisfying demanding mechanical requirements such as bending capability and high temperature range;
- Cost effective for automotive grade;
- Tightly controlled impedance, enabling full-duplex mode of operation; and
- Making power transmission along with data possible over the same cable.

Furthermore, they have already been used in the automotive industry for decades with a proven track record as point-to-point connection cables. Examples of this include being used for connections between antenna and radio or connections between antenna and a GSM module; therefore, the existing infrastructure for highly-automated production and the corresponding supply chain is well established.

Consequently, automotive requirements regarding temperature range and mechanical requirements are fulfilled as well. Additionally, a standard for automotive connector models (Fakra) is also available and has been adopted by different suppliers. Fakra connectors exist in many different shapes and are provided with different colour and mechanical coding schemes allowing an easy and time-optimised assembling process at the vehicle production line. Fakra connectors fulfil the demanding automotive requirements as well and can be produced using methods with a high grade of automation.

Fig. 1 illustrates the cross section of a coaxial cable. This model shows at a glance the biggest advantage of a coaxial cable, as the electric field associated to the signal transmitted through the core conductor (1) is contained within the space limited by the metallic shield (3). The consequence of this is that the coaxial cable does not radiate energy externally. At the same time, the shield (3) protects the core conductor (1) from external electric fields providing high signal immunity.

These two properties of coaxial cables are responsible for the robust electromagnetic compatibility (EMC) performance that facilitates the positioning of a coaxial cable in a vehicle. This also represents a cost saving factor because there is no need to develop special cable routing or observe strict limitations for positioning coaxial cables.

Coaxial cables provide features that are not available in a classic optical Most system. One of these advantages is based on the controlled impedance of coaxial cables that makes it possible to have a dual simplex (DS) communication and a bidirectional full duplex (FD) communication as well. This allows the implementation of additional network topologies in comparison with the classic Most ring and represents an important innovation in IVI networks. For special use cases a combination of DS communications and FD communications could also be implemented.

Table 1: Summary of possible network topologies on a coaxial physical layer for IVI systems

Communication	Topology
Dual simplex	Ring
Full duplex	Point-to-point connection
Full duplex	Daisy chain
Full duplex	Star
Dual simplex and full duplex	Hybrid

Table 1 summarises possible topologies that can be implemented using a coaxial physical layer.

What follows shows in detail all the networks topologies that can be implemented using a coaxial physical layer.

The classic Most ring on a coaxial physical layer can be implemented as it is shown in Fig. 2. This kind of network topology is based on unidirectional DS communications that require a return cable that closes the ring structure.

Using FD communications instead allows designers to implement topologies that are otherwise not possible. For example, considering a two-node system, a pure point-to-point connection as shown in Fig. 3 can be realised. In this case, thanks to the bidirectional communications of the FD coaxial line, there is no need to put in place a return cable.

The biggest advantage of this topology is a system cost saving of up to a half is achieved compared with a classic optical two nodes Most ring. This cost saving option is very interesting for high-volume car manufactures because with a two-node system a basic but powerful infotainment system, consisting of a head unit and an amplifier, can be implemented.

For more complex architectures with three or more nodes, the FD communications allow designers to implement a daisy chain topology between the IVI nodes. An example of a three-node infotainment system in a daisy chain topology is shown in Fig. 4. Also in this case, the absence of a re-

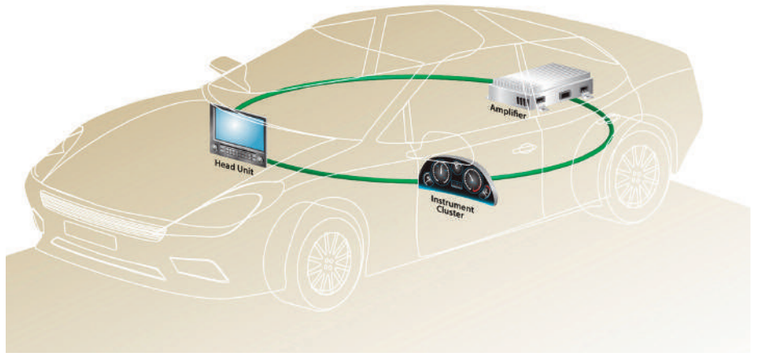


Fig. 2: Infotainment system consisting of three nodes connected in a ring topology based on dual simplex coaxial physical layer

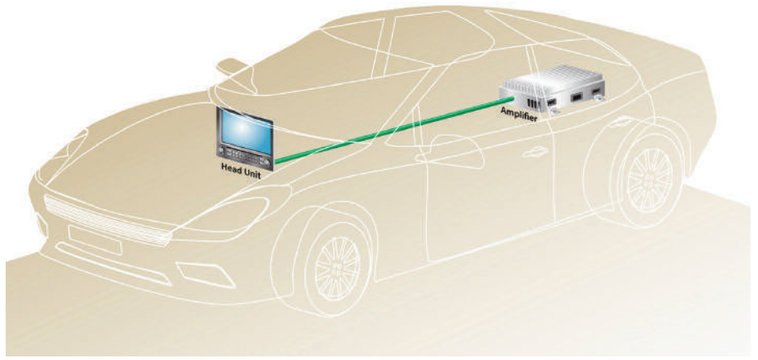


Fig. 3: Infotainment system consisting of two nodes connected in a point-to-point connection based on a full duplex coaxial physical layer

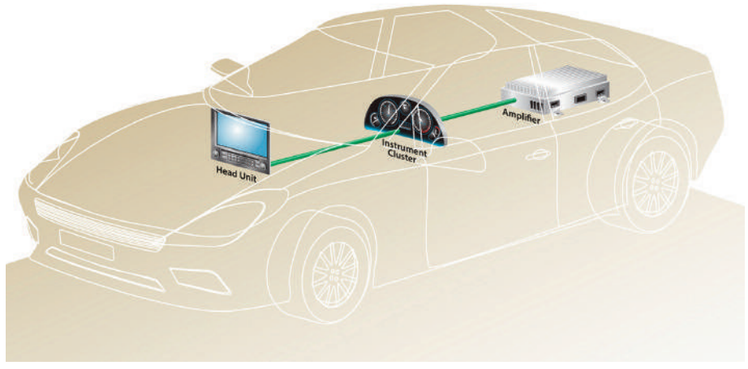


Fig. 4: Infotainment system consisting of three nodes connected in a daisy chain based on a full duplex coaxial physical layer

turn cable simplifies the car assembly process and contributes to overall system cost reduction.

Another network topology that is possible with three or more nodes on a coaxial physical layer using FD communications is the hub configuration. An application example is shown in Fig. 5. An in-car display unit acting as a hub is connected point-to-point with two rear-view cameras that substitute for external mirrors.

The combination of DS and FD communications allows designers to add new applications to an existing infotainment system based on the ring topology. An example could be to add an audio sub-domain with a microphone network to an existing system that was originally developed without supporting a microphone network.

All shown topologies optionally support the transmission of power over the coaxial data line. This allows designers to save dedicated power lines and connectors for each node in the network that is powered over the coaxial cable. This permits cost and weight savings, as well as an easier car assembly process.

Architectures shown in Figs. 5 and 6 are perfect examples for illustrating the advantages of the transmission of power over the coaxial cable.

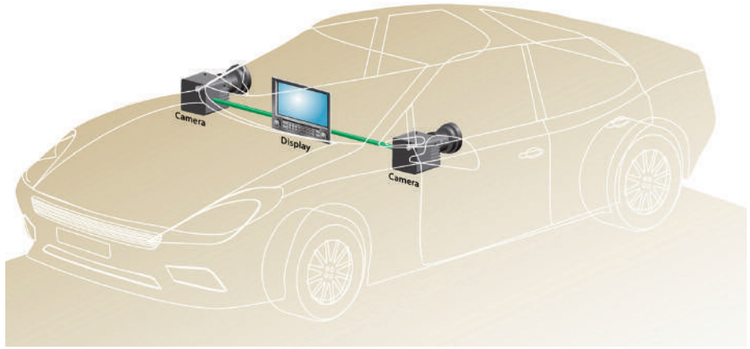


Fig. 5: Example of hub configuration based on coaxial physical layer

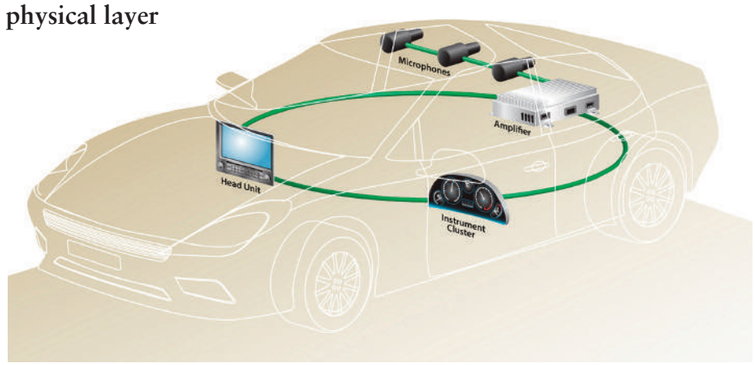


Fig. 6: Example of how an existing infotainment system based on a coaxial physical layer ring can be expanded with the addition of a daisy chain

In fact the camera and microphone modules have a small form factor and therefore the possibility to use a single connector that supports data as well as power transmission simplifies the mechanical design of the modules.

Table 2 presents a comparison of physical layer costs for IVI networks based on a two-node system. The clear result of the comparison is that a network based on a coaxial physical layer offers the best performance-to-cost ratio.

The advantages of adopting a high-speed networked infotainment system based on coaxial physical layer are obvious. Adoption of this technology by OEMs will begin rolling out this year and the market looks likely to embrace it with open arms.

Table 2: Cost comparison between different physical layer technologies

Physical layer technology	Relative cost	Bandwidth	Comment
Coaxial cable supporting full duplex	1	Multi-Gbit/s	2x chokes + 2x connector + 6m coax cable
Optical supporting dual simplex	4	Multi-Gbit/s	2x FoT + 2x PoF-connector + 2x 6m PoF cable

Carmelo De Mola is product marketing manager for Microchip Technology

FUNCTIONAL SAFETY

NO HIDING PLACE

Kerry Johnson and Chris Hobbs discuss replication techniques for finding errors in safety-critical automotive systems

The growing popularity of adas and automated driving is fuelling the demand for powerful CPUs in the automotive industry. To meet this demand, semiconductor manufacturers are pushing technology to the point where, for the first time in history, hardware is becoming less reliable. This problem arises from two major factors – physics and complexity.

On the physics front, CPUs run at faster clock speeds, producing more heat, and use smaller transistors, which can now be measured in numbers of atoms. Heat causes accelerated wear-out; the hotter the part operates, the sooner it fails. Die shrink leads to transistors that are extremely susceptible to faults caused by electromagnetic interference, secondary particles such as alpha particles and neutrons, and cross-talk between neighbouring cells. These problems also occur in dram systems – in modern multi-gigabyte drams, bit errors can be expected on the order of one per hour.

On the complexity front, manufacturers have been adding more inter-related functionality to each CPU. Unfortunately, CPUs ship with bugs, many of which are found only after the chip goes into production; known bugs are documented in the manufacturer's errata sheets. These bugs can affect computations and give erroneous results, thereby causing safety vulnerabilities. The probability of such errors directly impacts the ISO 26262 Asil rating.

Verification

To detect and recover from these errors, system designers must implement compensation mechanisms. In one approach, the system performs each computation two or more times and then compares the results. Some microcontrollers implement a technique known as hardware lockstep, in which two CPUs execute the same instructions at the same time, with dedicated hardware comparing the results. If the hardware detects a mismatch, an independent diagnostic routine determines which CPU was faulty, and system software then takes remedial action. Unfortunately, this technique generally only supports replicas rather than diverse implementations, can't detect software bugs – both CPUs will "correctly" execute the buggy code – and it does not scale as the number of replicas is fixed by the hardware.

Also, it isn't practical for today's high-performance hardware, where there is far too much internal state for a hardware checker to analyse.

In practice, a system can use software to verify the operation of the hardware. The developer implements a replicated copy of the software, and the two or more replicas are used to perform the verification. Each replica performs safety-critical computations – for instance, "given these conditions, can acceleration be applied?" – and some middleware runs the computations with synchronisation points invisible to the application.

Each replication scheme has its advantages and disadvantages. In the identical replica model, two identical computations running on different threads using different memory will yield the same correct result, except when a transient hardware or random software error occurs. In that case, the error should affect only one of the instances, not both. The middleware can then determine which version is correct.

Of course, this approach cannot correct for bugs in the software itself. To do so, a system could use fraternal replicas, which perform the same computations, but using different algorithms. If these replicas come to the same conclusion – for instance, both agree that acceleration can be applied – there is greater overall confidence that the result is correct.

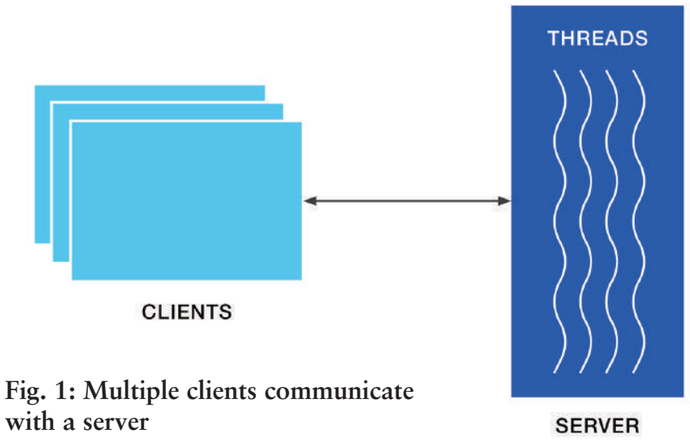


Fig. 1: Multiple clients communicate with a server

Implementing replication

A system designer can implement the replication schemes transparently, using middleware that is interposed in the middle of the communications path between two components. In a microkernel OS, where all software components communicate with each other through message passing, the designer can take advantage of naturally occurring synchronisation points that make it easy to interpose the middleware and have it check subsystem operation. In a typical microkernel-based system, a server process provides services to its clients; see Fig. 1.

To ensure that the service is reliable and available, a replica-based system uses multiple instances of the server. The role of the middleware is to ensure that system events such as requests from clients are delivered to all server instances in exactly the same order. From the client's perspective, there appears to be only one server; from the server's perspective, it believes it is executing alone. The middleware duplicates the messages from the client and distributes them to each server instance. The middleware then receives the responses from each server and compares the results to ensure the servers agree. The application developer needs to pay no attention to replication or diversity. See Fig. 2.

Replication points, that is places to insert the middleware and support multiple replicas, must occur at the right level of granularity. Duplicating every mathematical computation or function call is too fine-grained, and results in higher development costs and slower runtime performance. The ideal replication granularity is implemented at the component level. In fact, the implementation of Posix API functions in a microkernel OS serves as a good model for this approach.

Consider an application that opens a file and reads some data. Decoupling the application from the file system provides an excellent insertion point for the middleware.

If, instead of talking to the file system, the application talks with the middleware and the middleware talks to replicated file system servers, redundancy and checking can occur at that natural decoupling point, in a manner completely transparent to the application itself, and to the file system implementation. By designing other components within the system at a similar level of granularity, the system designer can insert replicas at the process-to-process communication boundaries. The flexibility offered by the OS is important here: if the OS allows replicas or diverse applications to

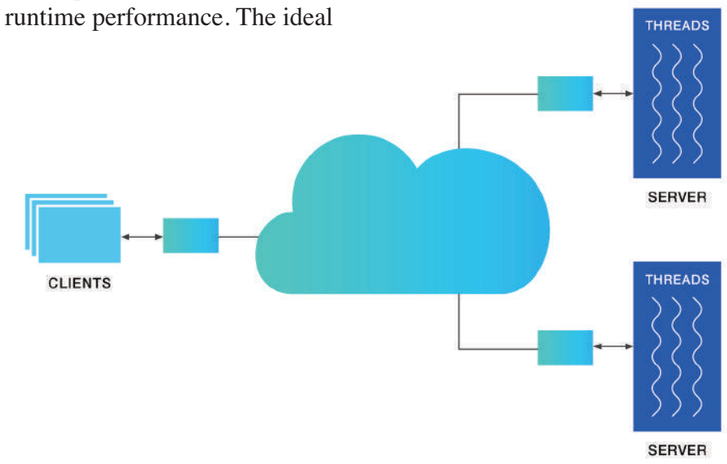


Fig. 2: Multiple clients connect to a middleware layer, which communicates on their behalf with multiple servers; the middleware ensures that the servers' results are in agreement

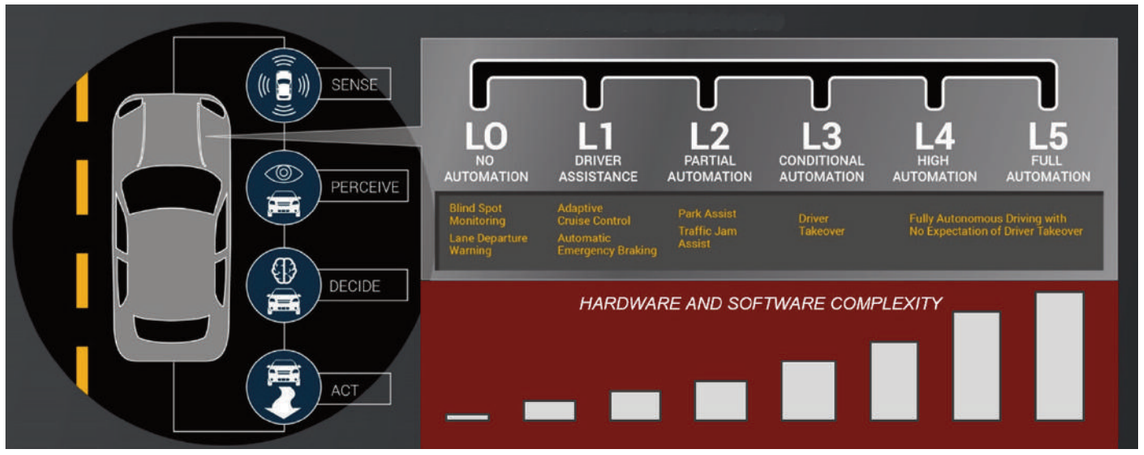


Fig. 3: Levels of driving automation and resultant increases in complexity

be seamlessly partitioned across processor cores, the implementation of a replication strategy becomes easier.

Server models

As mentioned, the system designer can choose between two main server models – identical and fraternal, with fraternal being further categorised as peer fraternal and monitor fraternal.

In the identical model, the servers can run on the same CPU, on different cores in a multi-core system or even on different systems connected by a network. This model offers a measure of scalability and potential redundancy in case of hardware failure: the same software must produce the same results; if it doesn't, then it's a hardware issue.

In the peer fraternal model, the system uses diverse but fully functional versions of the servers, for example the same source code compiled by different compilers. The expectation is that any failures would be in the implementation domain, effectively bugs in the implementation.

The monitor fraternal model also uses diverse servers, but one server has full functionality and the other has reduced monitor functionality.

While all three models are useful and can be intermixed, the monitor fraternal model offers an interesting cost savings. Consider the certification costs of each model:

- The identical model has no diversification, so the full development and certification process and cost for the Asil rating must be borne by the software.
- The peer fraternal model uses diversification, so the overall combination of the multiple diverse instances contributes to both reliability and availability, but the software cost is double or more, depending on the number of diversities.
- The monitor fraternal model has successfully been used in other industries. The concept of a monitor is also known as a safety bag, a much simpler piece of software that ensures that the overall decisions being made are sane and safe. From a certification cost point of view, you certify the main server software, and the much simpler monitor, with less certification effort. By combining the server with a monitor, you also increase the Asil level of the software. The monitor effectively provides Asil enrichment because it is another diverse instance.

The architecture described provides a very flexible and dynamic way of detecting random errors that have affected the safety of a system. The underlying principle is that of the strong ordering of events to all members of server group. This provides software virtual locked-step that does not suffer from the limitations of hardware locked-step.

As servers may join and leave groups dynamically, the level of resilience can be tuned to the environment within which the system is operating.

Chris Hobbs is a software safety specialist and Kerry Johnson is senior product manager at Blackberry QNX

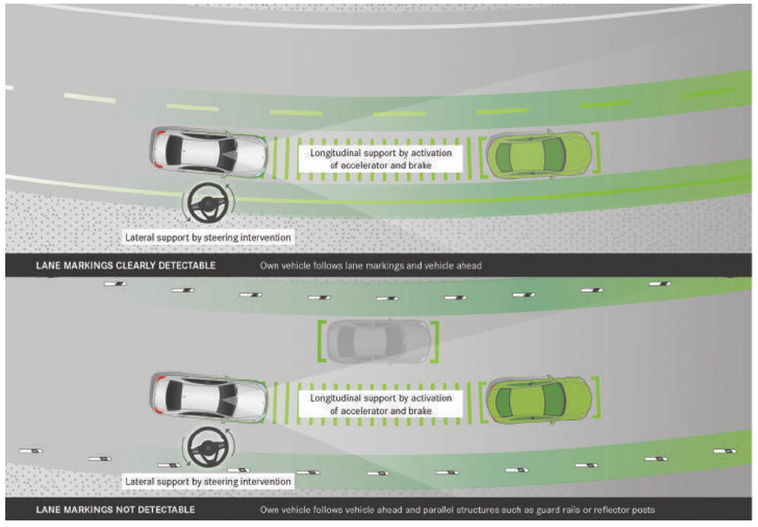
Look! No hands

The Mercedes S Class is set to take driver assistance to a new level

With extended driving assistance functions, the Mercedes Benz S Class will this autumn be taking a further step towards autonomous driving. Distronic active distance and steering assist will help the driver keep a safe distance and with steering, and the vehicle speed will be automatically adjusted in bends and at junctions.

Also on board are active emergency stop assist and an improved active lane change assist.

"The new S Class raises Mercedes-Benz intelligent drive to the next level," said Michael Hafner, head of automated driving and active safety at Mercedes Benz. "We are approaching the goal of automated driving more purposefully and faster than many people suspect. From the autumn, the new S Class will be able to support its driver considerably better than all systems which have been available to date."



Active distance assist with active steering assist

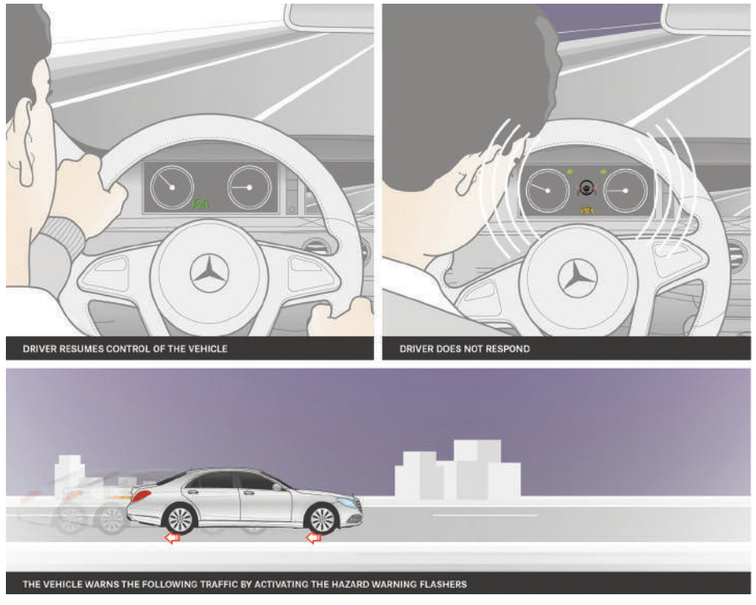
With the new driving assistance generation, autonomous driving is becoming yet more tangible. The scope of automated driving functions has been expanded in line with practical needs and now provides further enhanced, tangible driver benefits on virtually all types of road.

Thanks to enhanced camera and radar systems, the vehicle has a better view of the traffic: in addition, for the first time it makes use of map and navigation data to calculate driving behaviour.

The driver is also able to see at a glance which assistance functions have been selected, and to which situations the systems are reacting at present. Clearly understood icons – for example a steering wheel with hands on both sides – give information both on the screen and in the head-up display. All functions are now controlled from the steering wheel.

"We have always programmed the software for the assistance functions in-house," said Hafner. "This means that we can implement new ideas very quickly."

The speed pre-set in Distronic is predictively reduced according to the route ahead of bends, junctions, roundabouts or toll booths, then increased back up. If the route has been selected using the navigation system, the S Class also responds accordingly: if the car is in the slow lane, it is decelerated when approaching the desired motorway exit. The same applies to junctions where the navigation route prescribes a turn-off or ahead of which the driver activates the turn indicator.



Active emergency stop assist if the driver is unable to respond

The reduction in speed depends on the selected transmission mode of eco, comfort or sport. In eco mode, the cornering speed is configured to harmonise with steering assist. This means automated driving for longer periods is also a reality on country roads. On highways and motorways, active distance assist controls the distance from the vehicle ahead at a speed from 0 to 210km/h, and keeps the car on track.

Coasting characteristics, such as on downhill slopes, can now also be taken into account. In the interests of smooth and efficient driving, the speed is reduced in good time. If the vehicle is equipped with a drive system suitable for gliding (coasting with the engine off), this mode is automatically activated when the eco transmission mode is active.

When the driver wants to change lanes on multi-lane roads – recognised by the navigation system – at speeds from 80 to 180km/h, it is now sufficient to nudge the indicator stalk. Within the next ten seconds, the sensor system checks, with the driver, whether the next lane is clear in front of, alongside and behind the vehicle, also taking into account the speed of any other vehicles. When there is no other vehicle within the relevant safety zone, the driver is supported in changing lane. The initiated lane change is indicated in the instrument cluster and on the head-up display.

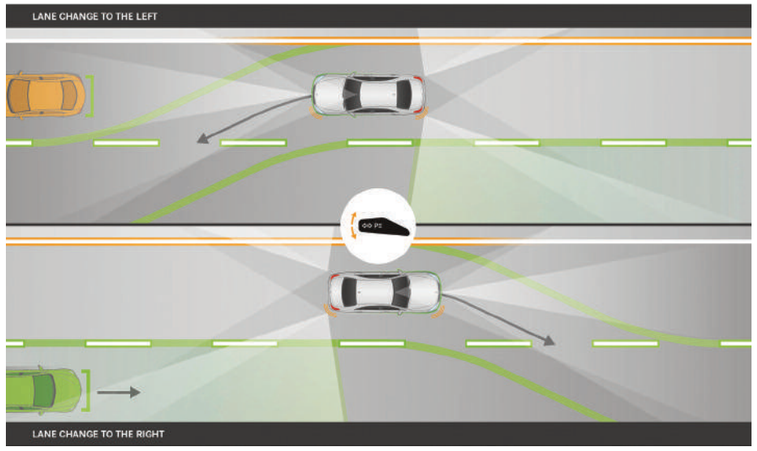
With Comand Online, active speed limit assist – an engageable subfunction of traffic sign assist – can recognise sign gantries and road works signs. Known limits, such as 50km/h in built-up areas or 100km/h on country roads, are also adopted from the navigation system. Active distance assist adapts the vehicle's speed to the recognised speed limits automatically. In certain cases, the speed can be adapted in anticipatory mode on the basis of map data.

On roads without speed limits, such as stretches on German motorways, the recommended speed – in this case 130km/h – is adopted as the set speed. This speed can be adjusted by the driver. The desired maximum speed is always adopted in the course of the journey when the speed limit is lifted. It remains pre-set until the vehicle leaves the motorway or until the engine is switched off.

In stop-and-go traffic on motorways, stops of up to 30s are now possible, within which the S Class automatically moves off and follows the traffic ahead.

Active emergency stop assist brakes the vehicle to a standstill in its lane if it detects that the driver is no longer actively driving the vehicle while it is on the move with active steering assist switched on. If there is no steering wheel movement over a predefined period, the system gives the driver a visual and audible prompt to place his or her hands on the wheel. If the driver fails to respond after repeated visual and

The S Class will help drivers overtake more safely



Active lane change assist supports steering into neighbouring lane

audible prompts by moving the steering wheel, accelerating, braking or pressing the touch control button on the steering wheel, the car will be slowed down in the identified lane until it comes to a standstill.

At speeds below around 60km/h the following traffic is warned by hazard warning lamps. When the vehicle comes to a standstill, the parking brake is engaged automatically and the emergency call system activated. The vehicle is also unlocked, to give first aiders access to the interior. The functions are aborted as soon as the driver takes control of the vehicle again.

Active brake assist with cross-traffic function can help the driver avoid impending collisions with vehicles ahead, stationary or crossing vehicles and with people if the driver fails to take any action to defuse the dangerous situation. This assistance takes the form of:

- a distance warning from a warning lamp in the instrument cluster, if the distance from a vehicle in front is inadequate;
- an additional audible warning when a danger of collision is identified;
- autonomous emergency braking to avoid a collision with moving stationary or crossing vehicles ahead;
- autonomous emergency braking for pedestrians; and
- situation-related braking assistance as soon as the driver applies the brakes.

Evasive steering assist can support the driver in taking evasive action when pedestrians are detected in the danger zone in front of the vehicle and the driver initiates such action. The system then applies additional steering torque in the direction in which the driver is performing an evasive manoeuvre. This helps the driver evade the pedestrian in a controlled manner and to stabilise the vehicle on its evasive course.

This system can warn the driver by pulsed vibrations on the steering wheel when the vehicle is unintentionally drifting out of its lane at speeds between 60 and 200km/h. If the vehicle passes over a continuous line, it can pull the vehicle back into lane by applying the brakes on one side. In the case of a broken line, such intervention takes place only when there is a danger of collision with a vehicle in the next lane, including danger from oncoming traffic.

In the speed range from around 10 to 200km/h, this can provide the driver with a visual alert, plus an audible alarm when a turn indicator is actuated, to warn of a danger of side collisions with other vehicles, including bicycles, for example. At speeds above 30km/h, automatic braking on one side of the vehicle can additionally be applied to help avoid a side collision at the last moment.

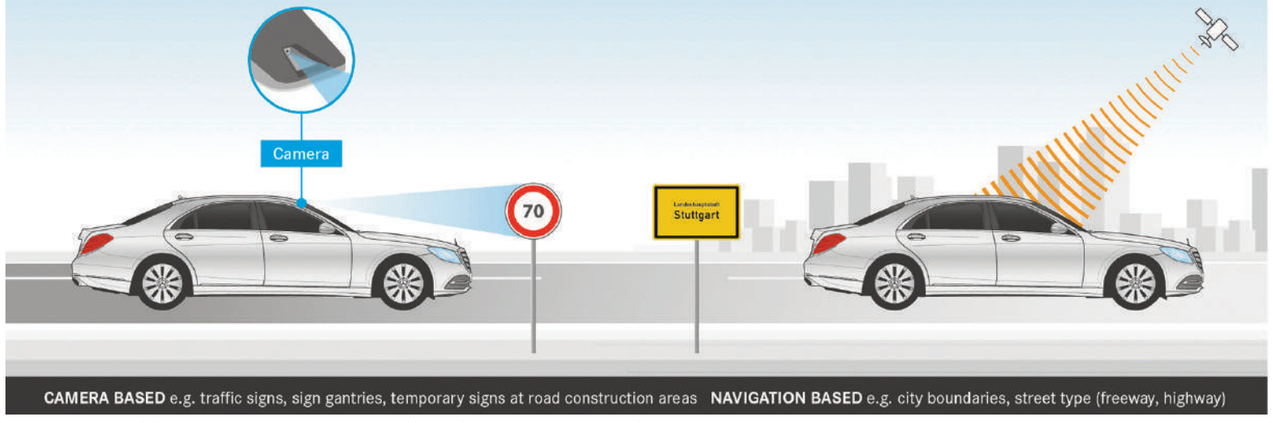
Image recognition and information from the digital road map in the navigation system allow the permitted maximum speed and any restrictions on overtaking for the current route section and zebra crossings to be computed and shown in the instrument cluster. Additional restrictions such as speed limits in wet conditions – warning when the windscreen wipers are switched on – or speed limits for lorries only are also taken into account or ignored as appropriate in the individual case concerned. The road speed is compared with the maximum permissible speed. If set to do so by the driver, a visual or visual-acoustic warning is given if the speed limit is exceeded. No-entry signs are also recognised and the driver is prompted to check the vehicle's direction of travel. A warning additionally appears in the instrument cluster and on the head-up display when persons are detected in the area of zebra crossings.

Information concerning hazardous situations that a vehicle on the road has detected is made available to all other V2X users to give drivers an early warning. As with live traffic information, reports transmitted by V2X are shown on the Comand Online map display. Depending on the situation, a warning by voice output can be given when approaching a hazard.

Active parking assist with Parktronic supports the driver in searching for a parking space and when entering or leaving parallel or end-on parking spaces. In the case of end-on parking spaces it is active in both forward and reverse direction. It manoeuvres the vehicle automatically into the selected parking space. With blind spot assist, rear cross traffic alert can warn the driver of cross traffic when reversing out of end-on parking spaces and can initiate automatic braking if necessary. In the case of active parking assist with 360° camera, all-round vision is made possible by the reversing camera and three additional cameras. The information is presented clearly in full HD in a choice of different views on the central display.

Remote parking assist lets the driver manoeuvre the vehicle into tight parking spaces or garages by smartphone, to facilitate entering and alighting from the vehicle. The vehicle can be manoeuvred into parallel and end-on parking spaces in both forward and reverse direction. Manoeuvring out of end-on parking spaces is also possible, for example if the driver returns to the vehicle to find it has been blocked in. In Explore mode, the vehicle can be manoeuvred straight forward or in reverse by up to 15m, avoiding detected obstacles. In narrow passageways, following confirmation by the driver, the vehicle can fold in the exterior mirrors so it can approach the detected obstacle more closely, for example a narrow garage entrance.

Route-based speed adjustment



Active speed limit assist automatically adapts to detected speed limits

IC converts voltages with protection

A power management IC from Allegro Microsystems uses a buck or buck-boost pre-regulator to convert automotive battery voltages into a regulated intermediate voltage, complete with control, diagnostics and protections.

The output of the A4408 supplies a 5V, 115mA tracking and protected LDO, a 3.3V, 165mA LDO, a 5V, 325mA LDO, and an adjustable output synchronous buck regulator at 1.25V, 700mA.

The device is suitable for under-bonnet applications, including electronic power steering, transmission control units, ABS, adas and emissions control modules.

The device's watchdog timer can be programmed to accept a wide range of clock frequencies. It has a fixed activation delay to accommodate processor start-up. And it can act as an enable-disable pin to facilitate initial factory programming or field reflash programming.

Diagnostic outputs include a power-on-reset output. POK5V indicates the status of the 5V protected LDOs. Fault flag 0 and 1 retain the last fault to reset the microcontroller. Dual bandgaps, one for regulation and one for fault checking, improve long-term reliability.

Enable inputs include a logic-level and two high-voltage inputs. A track pin can set the reference of the tracking regulator to either the 5 or 3.3V output, so the device can be adapted across multiple platforms with different sensor types. The mode pin selects the power-on-reset under-voltage threshold for the outputs.

Protection features include under- and over-voltage lockout on all four CPU supply rails. In case of a shorted output, all linear regulators feature foldback overcurrent protection. In addition, the V5P output is protected from a short-to-battery event. Both switching regulators include pulse-by-pulse current limit, hiccough mode short-circuit protection, LX short-circuit protection, missing asynchronous diode protection and thermal shutdown.

The device is supplied in a 1.2mm maximum height, 38-lead etssop package with exposed thermal pad.

Remote dimmer eases balancing

The RDU remote dimming unit from Blue Wolf eases balancing problems across mixed LED and incandescent bulb-type lighting circuits in cockpits, cabins and vehicles.

Existing dimmer technology supplies mixed LED and incandescent lighting circuits with the same output voltage resulting in unbalanced light levels. The unit solves this problem by having a user configurable output curve for each channel resulting in balanced light output between all channels.

With the Easy Balance software built in, users can define their own power output curves for each channel output. It comes with four user defined output channels and can be increased to eight channels with an optional expansion module.

Each channel is capable of supplying 2.5A and all output levels are based on dimming inputs from 0 to 100% into the RDU.

Besides balancing light outputs, it can be configured to power seat heaters and fans and to control outputs for blackout mode.

Size is 5.45 by 2.94 by 11.85cm and it weighs 200g. The unit is suitable for retrofit and OEM applications.

Synchronous step-down regulator maintains efficiency

An 8A, 65V input capable synchronous step-down switching regulator has been introduced by Linear Technology, recently acquired by Analog Devices.

Its Silent Switcher 2 architecture uses two internal input capacitors as well as internal BST and INTVCC capacitors to reduce the area of the hot loops.

Combined with well controlled switching edges and internal construction with an integral ground plane and the use of copper pillars in lieu of bond wires, the LT8645S can reduce EMI and EMC emissions.

This improved EMI and EMC performance is not sensitive to board layout, simplifying design and reducing risk even when using two layer PCBs.

The device can pass the automotive Cispr 25, class five peak EMI limits with a 2MHz switching frequency over its entire load range. Spread spectrum frequency modulation is also available to reduce EMI and EMC levels further.

Synchronous rectification delivers efficiency up to 94% with a switching frequency of 2MHz. Its 3.4 to 65V input voltage range suits dual cell transportation, 48V automotive and industrial applications.

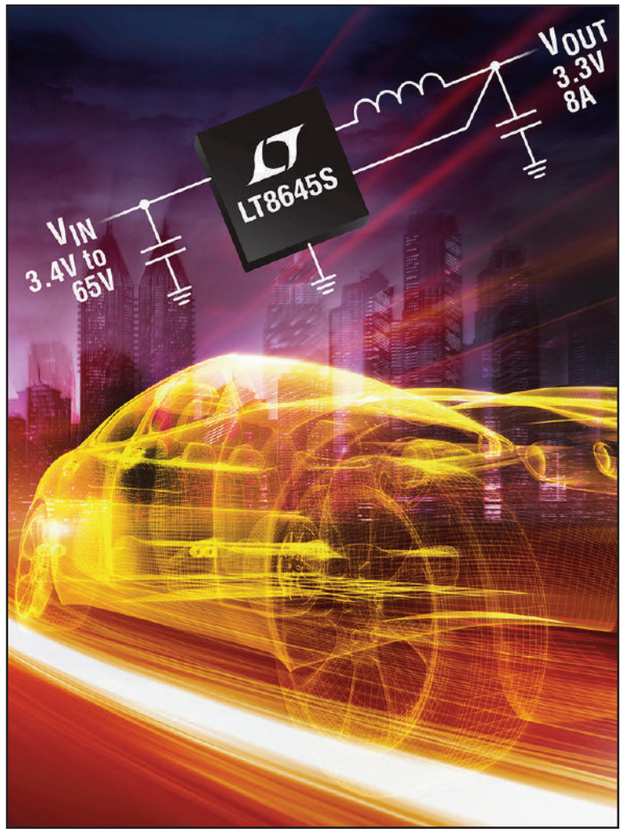
The internal high efficiency switches can deliver up to 8A of continuous output current to voltages as low as 0.97V. Burst mode operation provides 2.5μA of quiescent current, suitable for applications such as automotive and transportation always-on systems that need to extend operating battery life.

The design maintains a minimum dropout voltage of 60mV at 1A under all conditions for automotive cold-crank.

Furthermore, a minimum on-time of 40ns enables 2MHz constant frequency switching from a 24V input to a 2.0V output, enabling designers to optimise efficiency while avoiding critical noise-sensitive frequency bands.

The 32-lead, 4 by 6mm LQFN package and high switching frequency keeps external inductors and capacitors small, providing a compact, thermally efficient footprint.

The device uses internal top and bottom power switches with the necessary boost diode, oscillator, control and logic circuitry integrated into a single die. Low ripple burst mode maintains high efficiency at low output currents while keeping output ripple below 10mV P-P.



For applications requiring the lowest noise operation, it can be programmed to run in pulse-skipping mode. Its switching frequency is programmable and synchronisable from 200kHz to 2.2MHz.

Current mode topology enables fast transient response and loop stability. Other features include internal compensation, a power good flag, output soft-start and tracking, and thermal protection.

An industrial temperature version is tested and guaranteed to operate from a -40 to +125˚C operating junction temperature.

Door-zone controllers reduce external circuitry

Monolithic devices from ST Microelectronics integrate power-management and failsafe circuitry previously implemented using external devices for automotive door-zone controllers.

The L99DZ100G/GP for front-door applications and L99DZ120 for rear-door controls help designers save space as well as increase reliability and energy efficiency. With software compatibility between the family members, they also help simplify development.

The firm's proprietary BCD8S automotive technology provides the key to achieving this single-chip product that meets power-management and failsafe demands in door-zone applications with features that include embedded half-bridge and high-side drivers up to current ratings of 7.5A.

There are also high-speed Can and Lin 2.2a (SAE J 2602) interfaces, control blocks, and protection circuitry.

The L99DZ100GP adds support for ISO 11898-6 HS-Can selective wake-up that increases energy savings by allowing infrequently-used ECUs to remain powered down while connected to the Can bus.

Both front-door controller variants integrate mosfet half-bridges for driving up to five DC motors and can drive an external H-bridge. There are eight LED drivers and a further two drivers for bulbs, a gate driver for a mirror heater and a control module for electrochrome glass.

Voltage regulators for external circuitry such as a microcontroller and sensors, as well as associated timers, watchdogs, reset generators and protection are also provided. The L99DZ120 contains similar features, tailored to requirements for rear doors, including motor drivers for electric windows.

Automatic LED duty-cycle compensation ensures consistent brightness as the vehicle supply voltage fluctuates. Thermal clusters allow outputs to be disabled individually if an event such as a short circuit occurs. This lets unaffected outputs operate normally.

They are packaged as LQFP64 devices.

Resistors provide control

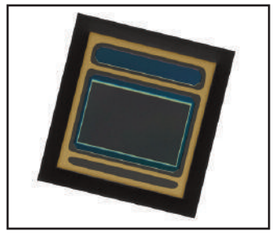
AEC-Q200 qualified resistors from TT Electronics are suitable for automotive control systems.

The WRM-HP precision metal film MELF resistors combine precision with tolerance to surge conditions.

The WRM0204HP and WRM0207HP are rated at 0.4 and 1W, respectively. The former specifies a maximum 5s overload voltage of 400V and the latter 700V. Standard values from R10 to 1M0 are available in E24 and E96 ranges. Temperature range is -55 to +155˚C.

Precision level is ±0.1% resistance tolerance and ±15ppm/˚C TCR.

Physically, they comprise a homogeneous sputtered metal alloy film on a high-grade ceramic rod. The resistance is adjusted to final value by a helical laser cut in the film, and the resistor body is protected by a lacquer coating.



Sensor mitigates flicker

A 2.45 effective megapixel cmos image sensor for automotive cameras, the Sony IMX390CQV type 1/2.7, is equipped with an LED flicker mitigation function that reduces flickering when shooting LED signs and traffic signals, as well as an HDR function capable of 120dB wide dynamic range shooting.

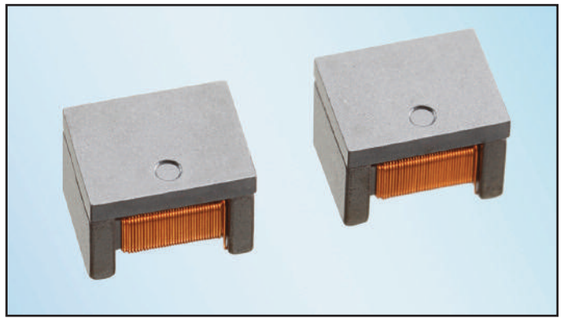
The device can simultaneously mitigate LED flicker and shoot in HDR, made possible by the pixel structure and exposure method. It can produce high-quality colour images in light conditions as low as 0.1 lux, equivalent to moonlight.

The plan is for it to meet AEC-Q100 grade two requirements this fiscal year. The company has also introduced a development process that complies with ISO 26262 and Asil C.

It is for forward-sensing cameras for adas and for substitutes for conventional rear-view mirrors.

Choke suits power over coax

A choke for automotive power over coax (PoC) applications is available from TDK. The ADL 3225V wire wound inductor, which has a DC resistance of 0.9Ω, features high impedance over a frequency spectrum of 1MHz to 1GHz.



DC superimposition characteristics separate the power from the signal path, for example for the signals of sensors and cameras that are connected via Automotive Ethernet.

Rated inductance is 47μH and rated current is 300mA. It is qualified to AEC-Q200 and measures 3.2 by 2.5 by 2.4mm.

PoC applications require high impedance at the branch of the power line and the signal line to prevent the high-frequency signal from causing interference on the power line with its low load impedance. The proprietary structural design and winding combined with the automated manufacturing process ensures the electrical properties and reliability of the inductors.

The growing number of sensors and cameras in cars is driving the need to speed up the communications between the many ECUs. Communications protocols such as Automotive Ethernet with a data rate up to 100Mbit/s and low-voltage differential signalling with a transmission rate up to 1.5Gbit/s are both being used for the image signals from on-board camera to the main circuit board. PoC, in which both the data and power are transmitted simultaneously over the same coaxial cable, reduces the weight of wire harnesses and improves fuel consumption.

Shunt resistor improves accuracy

An automotive-grade power metal strip battery shunt resistor from Vishay provides a 36W power capacity in the 8518 case size.

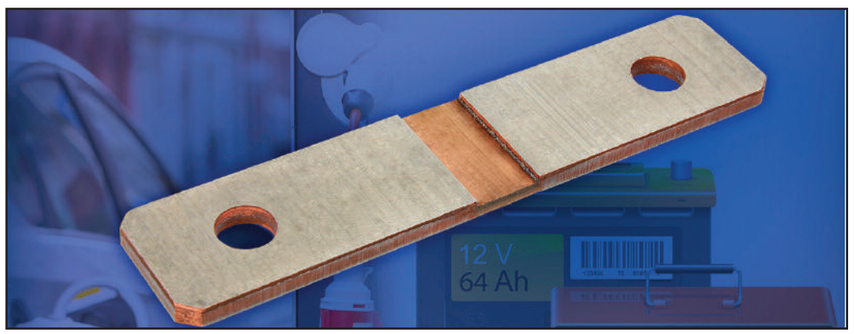
With resistance values down to 50$\mu\Omega$, the Dale WSBS8518-14 could lead to increased accuracy and lower costs compared with Hall Effect current sensing devices, while its tin plating on the terminals assists with PCB mounting and protects against corrosion.

The AEC-Q200 qualified device uses a proprietary processing technique that produces resistance values of 50, 100, 125 and 250$\mu\Omega$.

These values could allow for more accurate data to determine battery charge and discharge, thus helping designers meet battery management requirements for applications in petrol, diesel, hybrid and electric cars and lorries, as well as in electric forklifts and other heavy industrial applications.

The device has a solid metal manganese-copper alloy resistive element with TCR of ±20ppm/˚C and an all-welded construction. The resistor has inductance values of less than 5nH, thermal EMF down to less than 1μV/˚C, and an operating temperature of -65 to +170˚C.

The device is RoHS-compliant, halogen-free and Vishay Green.



Middleware path to safety certification

Connext DDS from Real-Time Innovations is said to accelerate development of robust autonomous driving systems and give developers an efficient path from prototyping to production and safety certification.

It provides core connectivity to autonomous driving applications as well as other safety-critical applications in other industries.

The Data Distribution Service (DDS) standard, implemented in the product has its roots in autonomous robotics.

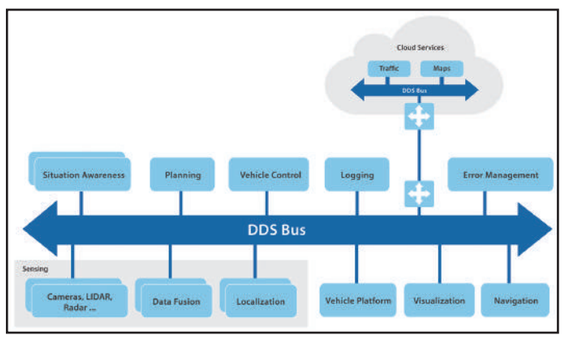
This middleware technology delivers microsecond latency, safety certification, fine-grained security and operational readiness.

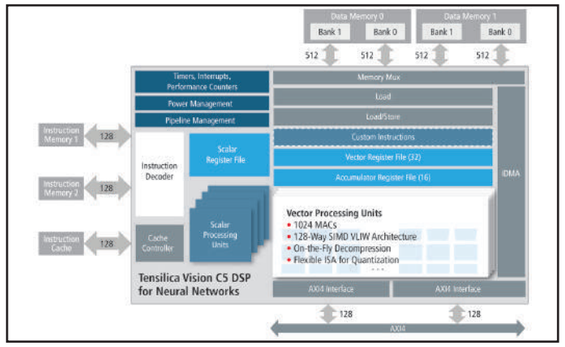
Similar to a database, data-centric connectivity uses a well-defined data model as a shared interface for interaction between different components. Data-centric systems can be designed to detect and manage data model changes and adapt to these changes at runtime. This makes a data-centric connectivity approach effective in any application with self-learning or self-remediation requirements, such as autonomous driving.

In large projects, data centricity also helps reduce application interdependencies to enable parallel component development and rapid integration. It handles most of the functions that a message-centric model requires in an application, reducing the application's complexity.

There is guaranteed latency and control over data flow and network bandwidth. The middleware handles communications details, allowing applications to focus on the processing of data.

Applications and systems share data using a common data model across all components.





DSP core optimised for sensor fusion

A standalone, self-contained neural network DSP IP core from Cadence is optimised for vision, radar, lidar and fused-sensor applications with high-availability neural network computational needs.

The Tensilica Vision C5 DSP is for the automotive, surveillance, drone, mobile and wearable markets and has a computational capacity of 1TMac/s.

Architected as a dedicated neural-network optimised DSP, it accelerates all neural network computational layers – convolution, fully connected, pooling and normalisation – not just the convolution functions. This frees up the main vision and imaging DSP to run image enhancement applications independently while the Vision C5 runs inference tasks.

By eliminating extraneous data movement between the neural network DSP and the main vision and imaging DSP, it is said to use less power than other neural network accelerators. It also offers a simple, single-processor programming model for neural networks.

Silicon area is less than 1mm². It has 1024 8bit macs or 512 16bit macs for both 8 and 16bit resolutions.

The VLIW SIMD architecture is 128-way, 8bit SIMD or 64-way, 16bit SIMD. It is architected for multi-core designs, enabling a multi-teramac product. There are integrated iDMA and AXI4 interfaces.

It uses the same software toolset as the Vision P5 and P6 DSPs.

The DSP supports variable kernel sizes, depths and input dimensions and accommodates several coefficient compression and decompression techniques; support for new layers can be added as they evolve.

No sweat for touchscreen controller

A capacitive touchscreen controller from Cypress Semiconductor is waterproof and is not affected by sweaty fingers. It can also handle glove touch and is resistant to electromagnetic interference. The EMI resistance is driven by the company's proprietary AutoArmor technology.

The automotive TrueTouch CYAT8165X controller targets screens up to 21.7cm and joins a portfolio that includes controllers for screens up to 38.4cm.

AutoArmor meets car manufacturers' electromagnetic compatibility (Cispr 25) specifications and requirements for chip-level emissions (IEC 61967), conducted (IEC 62132) and radiated (ISO 11452) immunity.

It uses automatic frequency hopping to prevent false touches caused by EMI from other electronic systems, and it uses TX frequency spreading to reduce electromagnetic emissions.

The family delivers linearity for fingers of different sizes and gloves of various materials and thicknesses, including ski gloves, and automatically switches between glove and finger tracking without requiring the driver to switch settings.

The controllers include up to 48 IOs with a host processor interface through I²C or SPI, which helps improve touchscreen responsiveness.

With the firm's DualSense technology to execute self-capacitance and mutual-capacitance measurements in the same device, the family provides water rejection and wet finger tracking for seamless performance in real-world conditions, including the presence of water droplets, condensation or sweat.

The controllers are based on a 32bit Arm Cortex M-Core processor.

AEC-Q100 qualified products are expected this quarter and they are available in 100-pin TQFP packages.

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