DrivingVisionNews.com
Automotive lighting and driver assistance technologies

Tue, 22 June 2021 Weekly Newsletter NEWSLETTER #704

Editorial

Great Evolution In LED/ADB-HD

The LED industry in automotive is transforming fast, with dynamic changes in the market. The first LED headlamps were unveiled 15 years ago in 2006. Now in 2021, most headlamps are LED-lit, the ADB market share is growing at a galloping pace (except in the United States), and we are now talking about HD headlamps built on numerous different technologies.

With all that in mind, we've decided to present a new series of interviews with VIPs involved in these innovations—especially those from companies who deserve to be better known. The first interview is in today's Newsletter. It's with Dr. Joongkon Son, Samsung's VP Head of automotive LED Sales and Marketing.

Samsung are a world-class leader in semiconductor technology. They're now mass-producing LED light sources for automotive lamps, with advanced semiconductor manufacturing techniques. In today's interview you'll discover their PixCell LED, a super-compact light emitting surface which contains dozens of individual segments, separated by 25-µm silicon walls, perfectly aligned and expertly mounted in a matrix structure. With technology like this, Samsung have created a range of highly efficient headlamp solutions which allow slimmer lamps while enabling substantial design freedom.

And that's just one example; Samsung aren't the only supplier churning out LED innovations. The competition is hot and getting hotter, and in the coming months we'll show you a wide range of new ideas and products from a wide range of companies that might not (yet!) necessarily come to mind when you think of headlamps and their subcomponents.

Be sure to plan for the US DVN Workshop on 21-22 September at Novi, Michigan, near Detroit. This, the 23rd DVN Workshop, will be a power-packed, high-value event with the theme **How to Save Lives in Nighttime Driving**, totally dedicated to technologies for improving safety. Find **all the information on the DVN Website**.

Sincerely yours

In Depth Lighting Technology

DVN Interview: Samsung's Joong-Kon Son

We recently had the great pleasure and privilege to talk with Dr. Joongkon Son, Samsung's VP head of automotive LED sales and marketing. He has been in the LED industry for the last two decades' time, devoting his efforts to enabling improvements within the lighting industry.

Most of Son's work has been devoted to enabling improvements within the lighting industry. After his physics doctoral study in light and matter interactions on semiconductors from the State University of New York at Stony Brook in the U.S., he has spent 20 years at Samsung as an R&D researcher, process engineer, and product manager for Samsung's LED business. His work has spanned basic research, product development, product planning, and sales.
Since 2018, he has been VP in charge of automotive LED sales and marketing activities.

Dr. Son likes the fast, dynamic changes in the LED market, especially in the automotive field, and he believes his company's technological solutions are a critical means for Samsung's many customers to realise their best innovations. His expertise and experience in the field, and his determination to provide the most innovative and reliable light sources, have propelled him to where he is today.

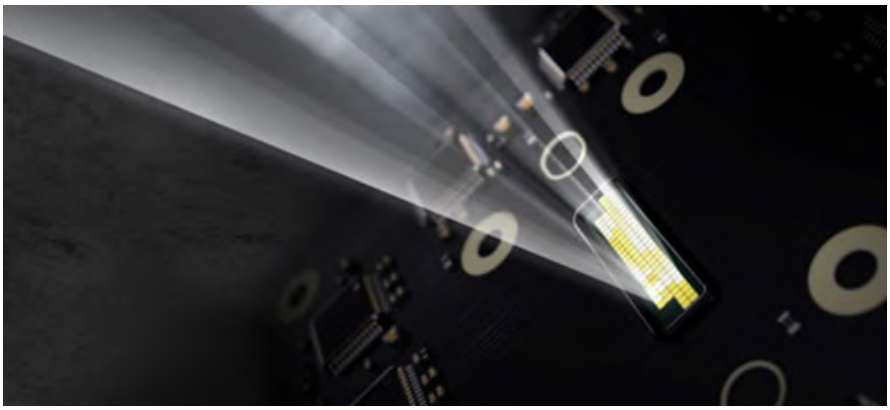
DVN: Could you briefly introduce Samsung Electronics and their main automotive products?

Joongkon Son: Samsung are a world-class leader in semiconductor technology. We view automobiles as an integrated body of high-tech electronic components that can be likened to “running semiconductors,” where the integration of convenience, safety and intelligence continues to rapidly progress. As such, we have played a key role in helping the automotive industry to acquire a stable base of smart driving products like next-generation infotainment systems, telematics, and advanced driver assistance systems (ADAS).

For example, Samsung are now mass-producing LED light sources for automotive lamps. We have been developing innovative automotive light sources for these lamps using advanced semiconductor manufacturing methodology. With a rising focus on ACES (autonomous, connected, electrical, shared) market trends, the vehicle lighting industry has begun developing highly efficient market solutions to complement this shift. To further advance the movement, Samsung have been making meaningful strides in introducing light sources that can be optimised to produce a safer and more comfortable experience on the road for autonomous driving and for electric vehicles.

DVN: What can you tell us about Samsung's new PixCell LED technology?

Joongkon Son: The PixCell LED is a first-of-its-kind intelligent headlamp solution that's able to deliver tremendous quality and reliability for the rapidly evolving mobility market. It's well suited for ADB.One of the key performance indicators for an ADB light source is its level of precision, which is where our PixCell LED's technology truly surpasses any of its peers. The PixCell LED contains dozens of individual segments, perfectly aligned and expertly mounted in a matrix structure. Each segment is separated by a silicon wall that minimises optical interference. As a result, the PixCell LED can generate an extraordinary 300:1 contrast ratio—triple the precision level of conventional products, enabling incredible visibility on the road. On top of this contrast and clarity, each piece can engage independently in distinguishing which areas of the road need to be illuminated or kept dark, and meticulously controls an ADB's light distribution.



SAMSUNG PIXCELL LED HEADLAMP LIGHT SOURCE

The development and production of the PixCell LED's unique capabilities is largely due to the strong foundation that has been set for many years through the proliferation of Samsung's industry-leading semiconductor manufacturing expertise. While most traditional GaN LEDs are epitaxially grown on sapphire wafers due to a reduced amount of lattice mismatch between the GaN and sapphire, the PixCell LED adapts GaN-on-silicon technology with its lowered dislocation densities.

Samsung are one of the frontrunners of applying GaN-on-silicon technology in the automotive industry which is a key substrate for Samsung's semiconductor success. In 2009, Samsung began adapting silicon technology for memory semiconductor solutions to LED products such as flashlights, and we've achieved an unmatched level of expertise in LED applications. As a result, our PixCell LED provides the industry's highest contrast ratio.

DVN: What else makes PixCell LED special?

Joongkon Son : I'm glad you asked that. In addition to its high contrast and premium light quality, the PixCell LED has another unique feature: a super-compact light emitting surface that gives multiple benefits.

As mentioned earlier, the PixCell LED is a matrix of multiple individual segments. These are separated by 25-micrometre silicon walls. This distinctive formation makes its light-emitting surface (LES) one-sixteenth the size of comparative LEDs. Correspondingly, its minimised surface reduces the size of other optical components like circuit boards and heat sinks. Moreover, the smaller LES creates light that is straighter and extraordinarily targeted, thereby eliminating the need for a primary lens, and simplifying the optic system. All of this reduces the overall lamp size by 40 to 50 per cent.

Smaller lamps enable the design freedom that most automakers need to establish unique brand identities and more future-oriented designs, given the mass popularisation of electric vehicles and the astounding evolution of mobility.

In regard to energy efficiency, smaller components can also contribute a great deal. In the case of electric vehicles, as I said before, minimising battery consumption and boosting battery performance is a key concern. By lightening the overall weight of an electric vehicle, you can lower the amount of energy required to operate it. In so doing, automobile manufacturers must reduce the weight of as many parts as possible—including headlamps.

DVN: Has PixCell LED been released into the market?

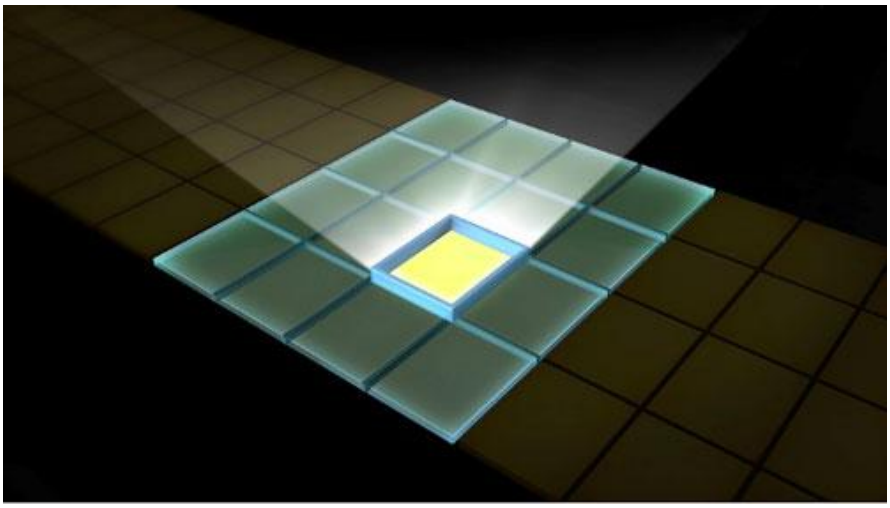
Joongkon Son: Yes, Samsung has been shipping PixCell LEDs to the industry since 2020.

DVN: What are Samsung's advantages in working with the automotive lighting industry?

Joongkon Son: Samsung have been a leader in the overall LED industry by producing lighting solutions of the highest quality and with the highest light efficacy. Most noteworthy, we have engineered technologies that adjust the invisible spectrum of light and pioneered innovative products in the horticulture and human-centric lighting markets. Now, we are in the process of delivering cutting-edge innovation for the automotive sector.

Using Samsung's state-of-the-art semiconductor technology, we intend to produce creative solutions that will advance the evolution of mobility around the world. We will continue to gain deeper insight into the market and our customers' needs, while embracing all of the truly expansive possibilities for LED lighting in the future of automobiles.

DVN: Do you plan to develop lighting solutions tailored for both the premium and general automobile markets?



Joongkon Son: Our relationship with automobiles is transforming cars from simply being a means of transportation to serving as a lifestyle space, or even an everyday companion. As a result, the role of vehicle lighting is becoming increasingly important as this transformation impacts most, if not all, automakers.

We aim to contribute new value to the movement. We believe the industry is moving towards smarter, slimmer, and more eco-friendly solutions, and are developing products that meet these needs, especially for the autonomous driving and green mobility markets.

We have created a lineup of high-efficiency headlamp solutions with which to achieve stellar results, as well as in simplifying headlamp optical systems. All in all, our automotive LED lineup allows manufacturers to build slimmer lamps while enabling substantial design freedom.

Additionally, Samsung have a wide range of cost-competitive LEDs for various car segments. This lineup can spread the adoption rate of LEDs for automobile lamps to all market segments including standard discrete LED lamps. We believe it can increase the accessibility of electric and other green vehicles by lowering their production costs. From premium to entry-level models, we will continue to provide customised solutions that can meet the diverse demands of the automotive market.

DVN: How do you envision the future for Samsung's automotive LED technology?

Joongkon Son: Vehicle lighting, like all auto parts, will continue trending towards becoming smarter, smaller, and more efficient to support safer and more comfortable driving. These

advancements will also likely go hand-in-hand with becoming more environmentally sustainable. For our PixCell LED, this could mean that future models will be sophisticated enough to not only engage or disengage as headlamps, but also utilize light pixels to visually display information in better ways.

Another trend we foresee is LED lighting playing a very significant role in autonomous cars. Once autonomous driving becomes more pervasive, we expect that there will be a larger focus on interior lighting and how it can enhance a driver's experience inside the car. Samsung's advanced spectrum engineering technology is currently designed for horticulture and human-centric lighting, but we believe that it will play a larger part in the field of automotive lighting in the future. I'm really looking forward to seeing how our spectrum engineering technology can help drivers stay more alert or provide them with a sense of relaxation while en route.

DVN:Environmental protection is becoming a critical issue for most businesses today. What efforts are Samsung making to support a more sustainable future?

Joongkon Son: One of the biggest advantages of LED lighting is that the product itself is highly sustainable. LEDs' absence of mercury, and their long lifespan and low energy consumption, are all factors that make them the most sustainable lighting solution.

As an LED component manufacturer, Samsung are always looking for ways to protect the environment, while providing the industry with the highest quality solutions. Between 2019 and 2020, we optimised several large-scale manufacturing processes from an environmental perspective, and set targets to drastically reduce energy consumption in major production lines. In doing so, we have been able to halve our CO_2 emissions.

It goes without saying that technology must serve to improve our standard of living in a way that creates a better world, while protecting the environment. Lighting is no exception. The benefits of LED lighting should extend beyond safety and convenience to also reinforce the path towards a sustainable future.

All of us in the Samsung Electronics LED Business will continue to pursue the limitless possibilities of LEDs in a way that addresses the market's evolving needs and promotes a more environmentally-friendly tomorrow.

Lighting News

Night-Sight Breakthrough: IR Images on Standard Glasses

LIGHTING NEWS

Researchers from the Australian National University (ANU), based in Canberra, and an international team of partners have developed a new technology that allows people to see clearly in the dark. The thin film, described in SPIE's **Advanced Photonics**, is “ultra-compact and one day could work on standard glasses,” the researchers say.

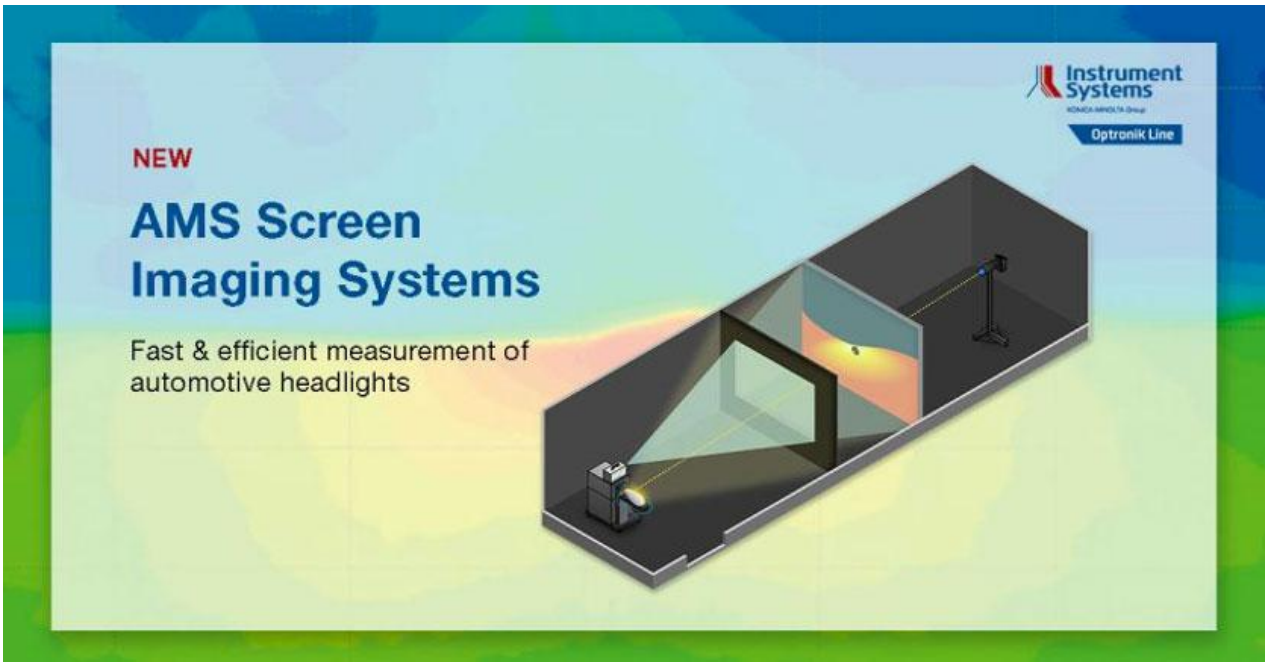
The new prototype is based on nanoscale crystals, and could make it safer to drive at night and walk home after dark. The team also say the work of police and security guards will be easier and safer as the new technology will reduce chronic neck injuries from current cumbersome, bulky night-vision devices.

Lead researcher Dr Rocio Camacho Morales says “Our technology is able to transform infrared light, normally invisible to the human eye, and turn this into images people can clearly see—even at distance. We have made visble the invisible. We've made a very thin film, consisting of nanometre-scale crystals, hundreds of times thinner than a human hair, that can be directly applied to glasses and acts as a filter, allowing you to see in the darkness of the night".

The technology is extremely lightweight, cheap, works at room temperature, and is easily produced —compared to current high-end infrared imaging technology, which requires cryogenic freezing to work and is costly to produce.

Instrument Systems: AMS Screen Imaging System

LIGHTING NEWS



The AMS Screen Imaging System is a new, highly efficient measurement tool for all automotive front lighting applications. As a turnkey solution, it provides fast and precise analyses for a wide range of lighting scenarios with advanced headlamps. The measurement procedure combines camera-based images on a projection screen (screen photometry) with goniometric far-field measurements in the photometric lab.

Key features of the AMS Screen Imaging System are:

- Measurement of HD, ADB, matrix, pixel, and all other headlamps
- Ultra-fast determination of light distribution using a LumiCam 2400B camera
- Goniometer integration and image stitching to measure complete distributions
- Geometrical and photometrical calibration source ACS 630 included
- Seamless integration into the proven LightCon user software environment
- Compliance check according to ECE / SAE / ICAO / FAA regulations
- Extensive graphical visualisation for isocandela diagrams

Geely Vision Starburst Unveiled

LIGHTING NEWS

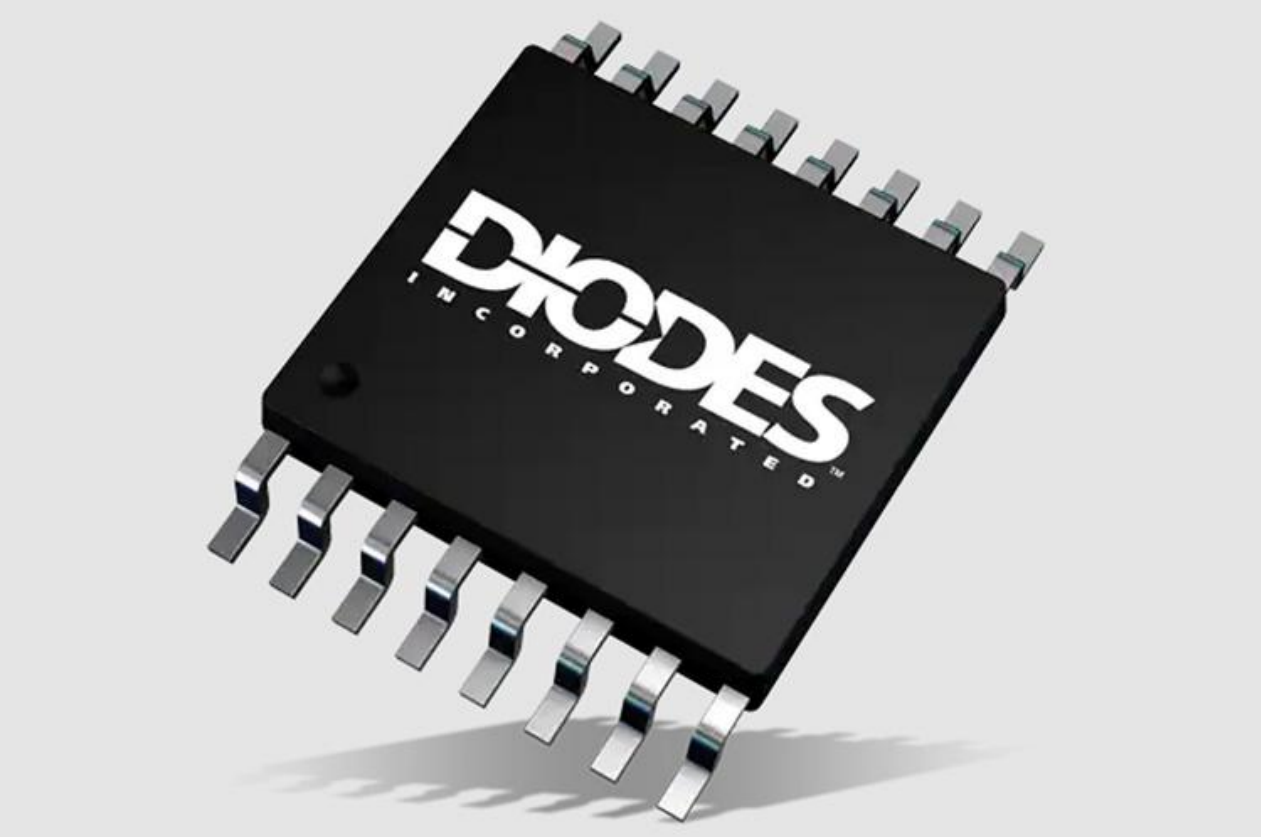
Geely have shown their new Vision Starburst, a space-inspired design vision they say will form the basis of future Geely models. Central to the company's design direction is a unity between the exterior and interior, colour and materials, and the car and the user.

From the front the Vision Starburst presents a parabolic-styled grille and a new light design supposedly representing the release of energy. The detailing takes inspiration from stellar rays with the folding and crossing lines creating a dramatic looking exterior.

The front end exemplifies the DVN perception (see Editorial, 15 June 2021) that the trend of design is to have main lights less and less visible in favour of design-forward LED DRLs and decorative lights.

Three-Channel LED Driver Simplifies Rear Lighting Designs

LIGHTING NEWS



Diodes Incorporated have expanded their portfolio of devices supporting automotive exterior illumination with the new AL5873Q linear LED driver targeted at simplifying combination rear lamp designs.

Each of the AL5873Q's three channels can drive up to 250mA, and is set via two reference resistors, which are connected to the driver IC's REF1 and REF2 pins. Support for two different LED current levels enables more streamlined lighting systems, as the same LEDs can be used in rear lamp clusters for tail and brake lamps. This lowers the BOM cost substantially.

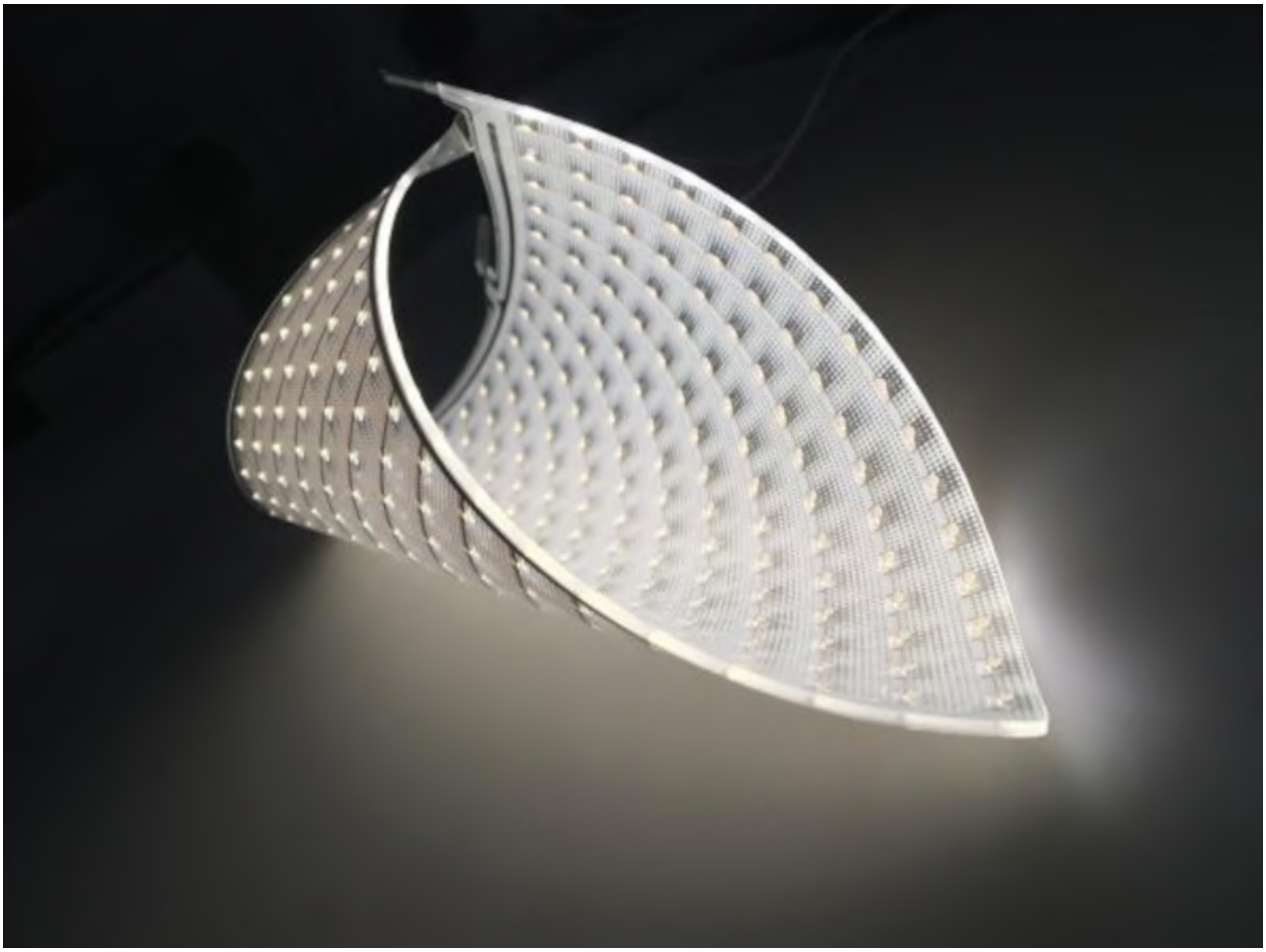
The AL5873Q has analog and master PWM dimming control functionality, supporting a maximum PWM frequency of 1kHz. The PWM dimming function is pivotal in improving current accuracy when LEDs are being driven at low current levels. The current on each channel is regulated to a ±4 per cent tolerance, which allows better channel-to-channel matching. To conserve power, the AL5873Q goes into standby mode if no PWM signal is detected.

The AL5873Q has built-in protection features with a bidirectional (input/output) fault pin which flags any faults and allows up to four devices to have their fault pins connected together, so that any faults identified are commonly reported. As part of its protection feature set, an internal junction temperature monitoring circuit reduces the LED current if its defined threshold temperature is exceeded. In addition to this thermal foldback, thermal shutdown and LED string-open/-short protection mechanisms are also included, as well as input undervoltage lockout.

***Diodes Incorporated**, a Standard and Poor's SmallCap 600 and Russell 3000 Index company, deliver high-quality semiconductor products to the world's leading companies in the consumer electronics, computing, communications, industrial, and automotive markets.*

Faurecia Buy DesignLED to Get Into Interior Lighting

LIGHTING NEWS



Scottish flexible LED lighting technology specialist DesignLED have been bought by automotive equipment giant Faurecia. The entire designLED team will transfer to Faurecia and will continue to develop its technology from its current base.

“This is a hugely important and exciting milestone in the evolution of designLED,” said DesignLED CEO Stuart Bain. “In recent years we have established the company as a leader in automotive lighting and HMI innovation. Looking to the future, the designLED team will be able to utilise Faurecia’s global reach, international customer base and world-class engineering and manufacturing skills to accelerate adoption of our differentiated display and back-lighting technology. The management team and employees are excited to move forward at pace under this new ownership".

Edouard da Silva, Faurecia Clarion Electronics' Displays Global Product Line Director, says "DesignLED’s advanced technologies and team will enrich Faurecia’s display technologies ecosystem. Immersive experiences are fast becoming a defining factor in mobility, and through the acquisition of DesignLED we aim to strengthen Faurecia’s unique positioning in cockpit user experiences".

***DesignLED**, founded in 2004 and based in the Alba Centre in Livingston, Scotland, develop flexible technology for automotive lighting and human machine interface (HMI) applications.*

***Faurecia,** headquartered in Nanterre, France, have 266 industrial sites, 39 R&D centres, and 114,000 employees in 35 countries. The company includes Clarion Electronics, formerly a divison of Hitachi.*

Hella's New Work Lamps

LIGHTING NEWS

Hella are launching a new work lamp series for agricultural machinery, construction machinery, forklifts, trucks, trailers, and municipal vehicles.
The S-Series complements the existing Modul 70, Modul 90 and Power Beam work lamp families.

The new lamps come in round and square shapes, and as surface- and flush-mounted versions. Thanks to the universal and slim design, vehicle manufacturers can easily and quickly replace their existing halogen headlamps by the new LED ones, which provide homogeneous illumination with a colour temperature of around 6,500K. The work lamps are produced in Austria according to the latest technological standards. The housing and the lens are made of special plastics, which reduces the weight compared to glass and metal while providing a high level of corrosion resistance. The new, modern cooling fin design ensures optimum heat dissipation, which increases the efficiency and lifetime of the work lamps. The integrated thermal management also helps to further increase the work lamp's lifetime. The lamps produce their full light output at ambient temperatures between -40 and +50 °C. If there is a risk of overheating, the lamps automatically dim.

The S-series work lamps are available in close-range and long-range illumination. Versions with 1,000 Lm will be launched in early summer, followed by 2,000-Lm products in Autumn. A 4,000-Lm version of the Modul 90 S-series will also be available at the end of the year. Further model and illumination variants are already in development.

Driver Assistance News

Velodyne's New Velabit: Smaller, Lighter, Better

DRIVER ASSISTANCE NEWS

Velodyne Lidarhave launched the next generation of their Velabit™ sensor, which addresses the cost, safety, and design challenges of autonomous solutions while delivering state-of-the-art performance.
Equipped with Velodyne’s breakthrough proprietary micro-lidar array architecture (MLA), the Velabit delivers what Velodyne's customers have been asking for: an ultra-wide field of view (FoV) and higher resolution.

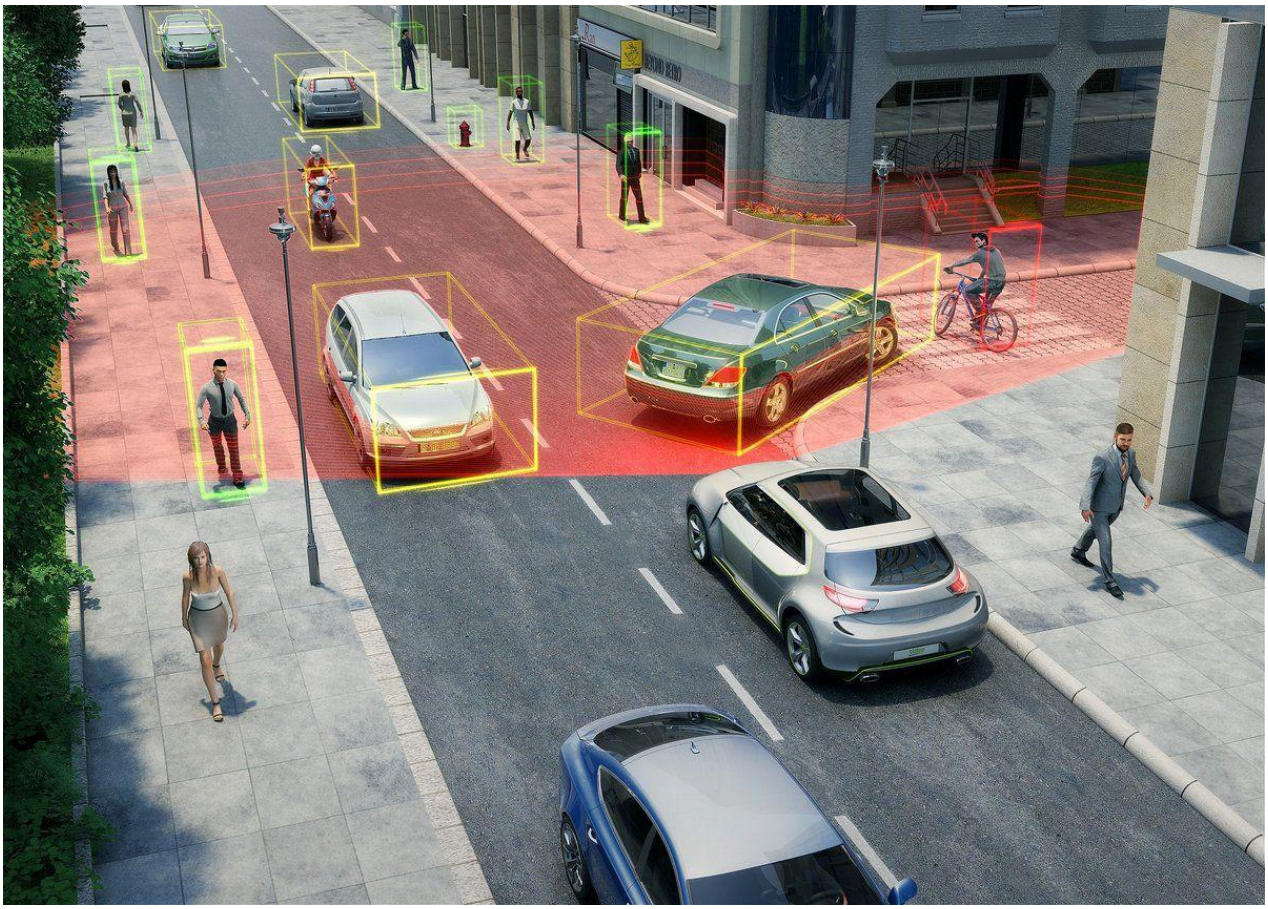
The solid-state Velabit sensor now has a simultaneously achievable maximum horizontal FoV of 90° and maximum vertical FOV of 70°, approximately three times more points per second than the previous model. The new Velabit leverages all of what Velodyne have learnt to offer a configurable and dynamic field of view and a high-resolution zoom capability.

This lightweight, compact, and versatile Velabit sensor features low power consumption to maximise battery life and vehicle range. The small size and low cost allow the sensor the unique ability to be used in multiple industries and for critical safety applications, such as Automotive and new mobility and Autonomous mobile robots.

Engineered to be an optimal automotive-grade lidar solution for ADAS and autonomous vehicles. Velabit can fill sensing gaps, helping automakers achieve full coverage around a vehicle. The sensor enables robust perception coverage for ADAS features including Blind-Spot Monitoring, Cross-Traffic Detection, and Pedestrian Automatic Emergency Braking.

Thanks to Lidar, Level 3 is a Reality

DRIVER ASSISTANCE NEWS



Regulations are evolving in line with technological advances, in several countries, Germany, Japan, South Korea, US, and UK, having recently authorized level 3 automated passenger vehicles on their roads.
The Honda Legend is able to drive in automated mode in certain conditions, such as on highways and in dense traffic (up to the statutory speed limit of 60km/h), meaning the driver can temporarily relax and take their attention off the road ahead in complete safety. The vehicle is equipped with lidar.

Lidar is a cutting-edge technology that allows the vehicle to perceive its surroundings with absolute precision, by measuring the time it takes for light beams to travel between objects and back. It's quite simple – level 3 autonomy can only be achieved using lidar technology combined with a series of sensors (cameras, radars, ultrasonic sensors, etc.). For more on Lidar, register at our November 15-16, 2021 Lidar conference in Frankfort.

Restraint Control Systems

DRIVER ASSISTANCE NEWS


VW ID3


Kia Sorento


Mazda MX-30


Seat Leon


LR Defender

FIVE CARS ZQUIPPED WITH VEONEER RCS WINING EURO NCAP 5 STARS

Occupant safety systems rely on active sensors and microprocessors to trigger pre-crash and in-crash occupant protection, such as tightening safety belts and deploying airbags, when a collision is inevitable. Critical crash information is sent over e-call to emergency services and recorded for post-crash analysis.

Veoneer say they're the leading supplier of restraint control systems. RCS microprocessors decide when a seatbelt pre-tensioner should be triggered and when an airbag system should be deployed. The microprocessor is supported by satellite sensors mounted in the door beam, the pillar between the doors, the rocker panel, and various locations near the front of the vehicle, to provide acceleration data to enable early and appropriate deployment of the airbags and seatbelt pre-tensioners.

Veoneer's camera-based vision systems gives the driver an additional pair of eyes, scanning the vehicle's surroundings for danger; advanced algorithms developed in-house analyse and interpret the street scene even in complex scenarios.

During 2020, Euro NCAP tested 11 car models. Six of these vehicles with Veoneer’s top-performing RCS earned a 5-star rating: the **Seat Leon, Mazda MX-30, VW ID.3**, **Land Rover Defender, and** Kia **Sorento**.

Valeo, Navya Strengthen Their Collaboration

DRIVER ASSISTANCE NEWS

Valeoand Navya have decided to step up their technological and industrial collaboration in autonomous shuttles. The Navya shuttles, which are being operated worldwide, are already equipped with Valeo technologies. The aim is to ramp up the R&D program to build and commercialise L^4 autonomous driving systems within three years.

The collaboration will focus in particular on cameras, artificial intelligence software, and ECUs. Valeo will provide Navya with the sensors and associated algorithms that will enable the vehicle to closely perceive its surroundings, and Navya will share the technical and functional data collected during experimentation.

Valeo offer ultrasonic sensors, cameras, radars, and Scala, the first 3D lidar to enter series production that meets the demanding specifications of the automotive industry.
Valeo also provide the control unit, which integrates and processes the collected data. The control unit maps out a detailed 360° image of the vehicle's surroundings and uses algorithms to detect objects and provide safety functions.

Navya CEO Etienne Hermite says"With this agreement, Navya will open up new opportunities for Valeo's components and subsystems while enhancing autonomous mobility solutions, all with the goal of reinforcing our position as a leading supplier of L^4 AVs". And Geoffrey Bouquot, CTO and VP of Strategy at Valeo, says "Stepping up our collaboration with Navya will allow us to test our latest ADAS technologies in real-life situations. Our partnership is a concrete illustration of Valeo's DNA: developing innovations that are driving the future of mobility toward cleaner, safer, smarter solutions".

Marelli AL, and Xenomatix Boost Up Lidar

DRIVER ASSISTANCE NEWS

Marelli Automotive Lighting, under a joint development agreement signed with Xenomatix, will create a new range of automotive lidar modules backed by AL's strong background in optics and electronics.

The jointly-developed full solid-state lidar modules, using mature VCSEL and CMOS technologies, are the base of a reliable and affordable sensor offering. This novel lidar technology has no moving parts, which makes it immune to automotive shocks and vibrations. There is no mechanical scanning involved, unlike on spinning or MEMS-based lidars..

Different module types are combined in standalone lidar units, or embedded into lamps (the Marelli SmartCorner concept) and other parts of the car to achieve short-, mid-, and long-range distance measurement sensors. These modules come with diverse fields of view and resolutions to match customers' requirements.

General News

Car Brands Dominate in Europe

GENERAL NEWS

*extract from the Brand Finance Europe repor*t

The total value of the 500 most valuable brands in Europe dropped by 10 per cent during the pandemic, from €1.96tn to €1.76tn, and the automotive sector is the most valued sector on the continent, representing 14 per cent of the total brand value of the 2021 ranking. That's according to the latest report from Brand Finance.

• Mercedes-Benz is the most valued brand in Europe, at nearly €50bn.

• Ferrari is the strongest brand in Europe, benefiting from an AAA + rating.

• More than half of the top 500 brands originate from just three countries: Germany, France, and the UK.

Automotive is the most valued sector on the continent, with the 27 brands included in the Brand Finance Europe 500 for 2021. German brands still dominate the automotive industry across Europe, with the seven brands represented totaling €171bn, or ¾ of the industry's total. Here again, Mercedes-Benz is in the № 1 slot as the most valued brand in Europe, with a brand value of €50bn. Volkswagen (€40bn), BMW (€34bn), and Porsche (€29bn) place № 3, № 5, and № 6, respectively.

Aside from measuring the dollar value of brands, Brand Finance also determines Brand Strength, which is the relative strength score for each brand assessing marketing investment, stakeholder image and economic performance.

Daimler CEO predicts strong 2021, even better 202

GENERAL NEWS

Extract of interview with Automotive News Europe

Ola Kallenius, CEO of Daimler, is pushing the automaker farther into the digital realm with plans to digitalize the entire sales and distribution network, all while aiming to lower the company's break-even point.

About EV

We are launching four electric cars. With the EQS, we are launching a vehicle on the first fully dedicated large EV platform in the U.S. The transformation is going to continue and increase in intensity over the next few years. In this decade, the auto industry will be turned on its head, and we will significantly change both our technological industrial footprint and in some areas also our business model.

About CO2

We are absolutely on track, not just in Europe but around the world. When we started talking about our EV plans in 2019 and how we would meet our CO2 target in Europe many people were skeptical. However, quarter by quarter, our 2020 EV sales increased quite significantly, especially in the fourth quarter. Therefore, we expect to meet the CO2 targets for Europe for 2020.

About xEV sales

Our xEVs -- plug-in hybrids and full-electric models -- accounted for a single-digit percentage of our global sales. In the first quarter of this year, we were at about 10 percent globally and 25 percent in Europe. In volumes, xEVs in the quarter were about 59,000 units, of which 16,000 pure electric. By the way, our plug-in hybrids are class leading in terms of their performance range, which is more or less 100 km based on WLTP guidelines.

About Daimler priority

To meet the very ambitious climate targets, my main priority would be to invest in expanding the charging infrastructure throughout Europe. That way we preserve the precious individual freedom of mobility while also addressing CO2. That would be my No. 1 priority.

About outlook

2022 could be even stronger than 2021. While there are a lot of unknown external factors, vehicle demand is likely to grow in the second half of this year and that trend is expected to continue into 2022. That should help the industry on its path toward recovery from the pandemic. In our particular case, the fresh portfolio we have today because of the number of products that we are launching, should result in a strong 2021 for us, and that should continue in 2022.