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Weekly Newsletter

DVN
Lighting & ADAS

NEWSLETTER #831

Editorial

DVN At Marelli AL&S HQ

DVN's Paul-Henri Matha and Gerd Bahnmüller were invited to Marelli Automotive Lighting & Sensing's headquarters and front lighting competence centre at Reutlingen. After a warm welcome, we were shown numerous new developments and innovations in presentations; in the light tunnel, and with samples. Then we had a great and detailed interview with the new R&D Vice President Raj Vazirani. Read about it all in this week's edition of your DVNewsletter.

Marelli Automotive Lighting & Sensing (Marelli AL&S) has a global presence with development teams in 15 locations. Innovations are driven forward in Reutlingen (focus on front lighting); Tolmezzo (focus on rear lighting), and Shanghai (focus on the Asian market). Electronics development and sensor integration are also based in Reutlingen. With three standardized ECUs, Marelli AL&S can control all their numerous light modules, from the simple mono e-Light up to the more complex HD microLED modules. The trend in vehicle electronics towards zonal architecture is also actively

supported with series applications, concepts, and prototypes for software-free front and rear lights. The specialists at Marelli AL&S see the greatest opportunities for radar sensors when it comes to integrating sensors into front lighting.

The Marelli AL&S team also presented some highlights for the rear lighting. In addition to a prototype with an integrated display, two new samples were particularly impressive: an OLED combination rear light with multiple 64-segment OLED panels surprises with animation even while driving. The new rear light of the BMW M4 brings the laser back into focus with three 'red wires' made of glass fibres that float freely in the space of the rear light.

In addition to the on running development of LED modules in all performance classes and designs, there are numerous innovations in the appealing design of the daytime running light and front position light functions. Elaborately-designed massive light blocks with corresponding texturing are just one example of the focus being placed on headlight design. The team also presented their ideas for electric vehicles with lighting increasingly extended to the entire front end. There is a particular focus on the use of these new possibilities for communication and signalling with attractive displays.

One impressive feature of the LED modules is the range of Marelli AL&S' standardized concept that covers the diverse requirements in terms of performance, installation space and number of segments for ADB functionality. We would particularly like to highlight the modules shown with a slit design for light emission surface with a height of just 15 mm. Here the high beam module, also available in a matrix version, is also illuminated during dipped beam operation. The top-of-the-range module is the microLED HD module just launched in the Volkswagen Touareg. It, and the software control developed by VW, impressed us with its lighting performance and features such as highway lane light and pedestrian warning on country roads in the night driving test.

Another surprise of the night drive was the 16-segment matrix ADB module prototype in accord with US regulations. In the test environment of the night drive with slightly wet roads, there seemed hardly any difference to the performance of an ECE-ADB matrix application. A very successful development that gives us hope that ADB will also find its way into the USA despite the difficult regulatory conditions there.

All in all, this afternoon and evening was a day full of surprises and interesting information. Many thanks to the Marelli AL&S team – keep up the good work!

In Depth Lighting Technology

Interview: Raj Vazirani, Marelli Automotive Lighting & Sensing R&D VP

DVN: Welcome to the lighting community. You've never been involved in lighting in your career. What was your motivation to enter the vehicle lighting industry?

Raj Vazirani: That's correct to most of the extent, however working on one of the important functions of lighting such as ADB is not completely new to me, I have been involved in development of ADB algorithms since 2012 when I switched from telecom to automotive. My motivation to join Marelli Automotive Lighting & Sensing was mainly to bring lighting and sensing worlds together and how it will enable and improve both areas of the automotive industry. The second reason is that in lighting, software and electronics content is increasing by many folds and will increase even further which is where I have gained most of the experience in last 22 years.

DVN: Tell us a little more about your background.

R.V.: I did my Diploma and bachelor's in electronics engineering in 2002 and started working in the telecom industry from then until 2012. During this time, I worked in software, product quality, project management, and various different engineering roles within product life cycle development. This continued when I switched from the telecom to the automotive industry after Nokia mobile phones announced closure of their engineering site in Ulm and I decided to join Continental's newly formed ADAS

business unit in 2012, and since then I have been enjoying my professional journey in the automotive industry.

DVN: What is your first impression after half a year in this new profession?

R.V.: I am highly impressed with amount of contribution by Marelli Automotive Lighting & Sensing towards the lighting industry and its evolution which is very evident in all the talks I have had with most of the customers, suppliers, and partners so far who highly talk about our experts and their knowledge. Being at ISAL for the first time was very interesting and a learning experience in itself; the most impressive part was to meet so many experienced lighting professionals across the industry and many of them have worked at Marelli AL&S at some point of their career which gave me an impression that this place has a history of creating and grooming lighting professionals. Also, I believe that Marelli AL&S is very well aware of the future trends of lighting functions and their scalability and hence investing further in the Electronics and software, at the same time strengthening our core lighting expertise.

DVN: There have been many innovations in vehicle lighting over the last decade. How do you see the future of lighting and what do you think are the megatrends?

R.V.: The performance lighting, so main light functions, especially ADB functionalities and high resolution via micro-LED will surely undergo further development, for example for US ADB.

Electronic lighting control will also evolve in the first step to the zonal light domain controller.

Speaking of megatrends, styling, and communication through light and the 360-degree lighting approach—so not just in head and taillights—will play an increasingly significant role in future to move ahead toward a software-defined vehicle. Another trend which is also a necessity of our time that is determined by lack of resources might be attempts to more sustainable products.

DVN: How is Marelli Automotive Lighting & Sensing responding to this evolution?

R.V.: ADB will be, as just mentioned, further developed. Here, we work on serial projects to ensure the very strict US ADB requirements. We successfully brought our h-Digi® microLED lighting system with the ams OSRAM Eviyos® 2.0 micro-pixel light source in series, and we work on the next generation of the microLED technology. In terms of lighting electronics, EE architecture will change from de-centralized to vehicle-centralized architecture. Here, we already use our light domain controllers in series products. As lighting functions become more and more independent from dedicated ECUs, we are preparing for offering lighting software-as-a-product (SaaP) solutions that will gain more and more importance.

Speaking of above-mentioned megatrends, our first 'intelligent social display', part of the car2x communication approach, is in series production for a pioneering Chinese OEM. Our signalling near-field ground projections fit perfectly in this development while our illuminated front panels offer the opportunity for brand styling through light. Also here, we offer solutions to multiple international OEMs to meet various trends in various markets.

With regards to the necessity of becoming more sustainable, we will soon introduce our minimum viable products (MVP) that use fewer components and focus on lean processes and using a high percentage of recycled materials, still offering the usual great performance.

ISD (Intelligent Social Display) on Hiphi Y, 2023

DVN: How do you see the evolution of ADB systems, one of the most important innovations in vehicle lighting?

R.V.: Next to the focus on performance that will surely remain, a part of future ADB generations will be very much styling-driven. There will be slim modules that can be more visible or less visible—yet they must still fulfil all requirements and realize all ADB functionalities. The creations are always strongly driven by the styling and desire of OEMs. Standardization of ADB modules—also the stylish ones—would be a reasonable development to reduce prices. This would require standardization trends at OEM side though.

DVN: And what role will HD- and UHD-systems (4 kilopixels to 1.3 megapixels) play in this ADB growth?

R.V.:Our 1.3 million pixels are in series for a few years. Our microLED-based ADB system, h-Digi® microLED, has currently a maximum capability of 25,000 micropixels. Since mid-2023 the system is in series for the Volkswagen Touareg using a configuration with around 20,000 micropixels. Yet, we also move ahead to reach a higher spread and make a step toward popularization of the microLED technology entering in the high-volume segment with our next step. Additionally, as mentioned above, we already work on the next microLED generation with even higher resolution of fantastic 100,000 micropixels.

DVN: What are the highlights of that headlamp just launched in the Touareg? How does this new 20-kilopixel HD-system compared to 1.3-megapixel DLP solution started in 2020?

R.V.: The h-Digi® microLED headlamp system for the Volkswagen Touareg offers very good resolution for very precise ADB light distribution, for such lighting functions as dynamic curve light, and for assistant projections on the road; those are the most distinctive features of the HD light. Light carpet, guiding lines, blind spot warning, lane-changing assist, or a marker light to illuminate and warn pedestrians during poor visibility.

In comparison to h-Digi® microLED, the 1.3-million-pixel h-Digi® system offers, of course, a higher resolution for road projections. However, the projections by the h-Digi microLED system on the VW Touareg are in their shape and size very well adapted to the given 20,000 micropixel resolution. At the same time, the microLED system offers a wider field of illumination by the HD module, beneficial for all the main light functions, including ADB. So, the 20,000 micropixel HD system offers all the most important safety functions at better efficiency.

DVN: Do you think the arrival of electric vehicles will change the evolution of lighting?

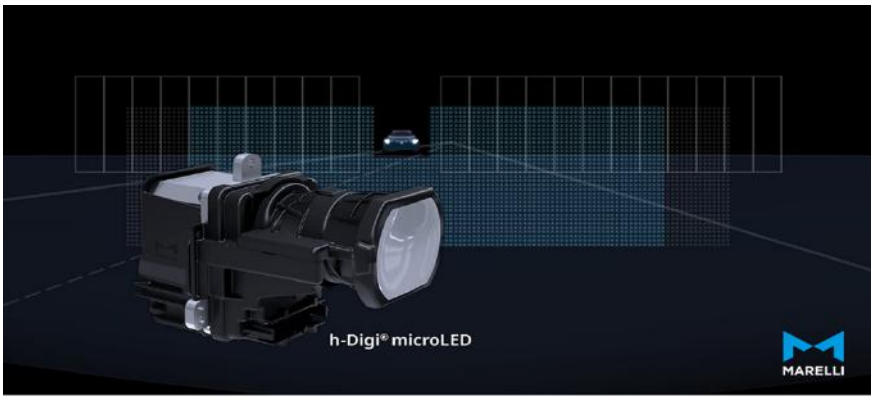
R.V.: Whether electric or conventional, cars need light. Electrification will surely further push exterior lighting development toward more efficiency in terms of power consumption and less weight. At the same time, the content of exterior lighting is increasing as electrification offers a new playground for lighting. Illuminated front panels are a good example here.

DVN: How important are these new products like illuminated front panels, displays and logos for Marelli AL&S?

R.V.: They are very important for Marelli AL&S and they will become more important—not just for us but also for OEMs. They are a great opening for interaction between lighting and the entire car front; currently for purpose of styling and brand signature, that might be even highlighted by illuminated logos. In future, illuminated front panels and displays might be also used for communication purposes.

DVN: Marelli AL&S has always produced wonderful and powerful modules, headlights, and taillights. Can you tell us some of the new interesting lighting products from Marelli AL&S?

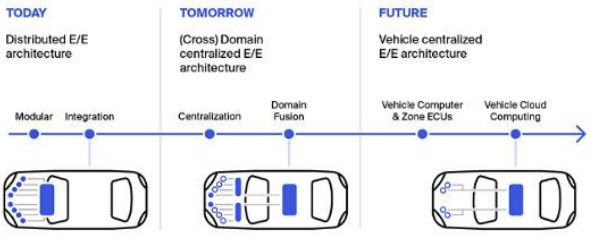
R.V.: Our h-Digi® microLED is a great brand-new series product from Marelli AL&S. Also, our latest series slim modules are impressive. You will have opportunity to test both during the night drive. In the area of taillights, our laser wire rear lamps were launched recently. But there are more taillight innovations to announce, and you will see them soon as well. Just stay tuned.



DVN: What role do you think electronics and software will play for tier-1 lighting suppliers in the future?

R.V.: As mentioned above, centralization of EE architecture and software-as-a-product, all developments are basis and contribution on the way to the software-defined vehicle. We are working on creating such kind of scalable products to be competitive in future.

We have also developed a special user interface which helps to work on lighting functions with a click of a button, design as you like during concept phase without talking to any software developer. Guess what, you don't even need the actual hardware.



DVN: Will Marelli Automotive Lighting & Sensing get more into the sensor business? If so, which sensors are you targeting?

R.V.: We focus on integration of sensors in our lighting products. With integration of radar and camera sensors in our lamps, we enable multiple long- and short-range assistance systems. But it is not our target to develop sensors on our own as of today. However, the automotive industry is changing at a rapid pace like never before, hence we have to respond to it accordingly.

DVN: Your previous activities have all been related to ADAS. How do you see the future, in the next 10 years, in autonomous cars and non-autonomous cars?

R.V.: ADAS content has increased significantly in all our cars in most of the countries reaching from basic features such as ACC and lane keeping function to city stop and go, automatic lane changing and more. I have personally got so much used to it that I regard these functions as necessary, any time I plan to change my car. The automotive industry has come from basic ADAS to ADAS L^{2+} in a very quick time. After all,

automotive industry used to be perceived as very slow-moving industry when it came to such complex functions and their acceptance. This trend will continue, and the first self-driving taxis are already out there. Some of the OEMs have already received L^3 certifications for mass production in one region or a part of the world which will be also seen in big numbers on commercial vehicles as it brings huge cost benefits. Fully autonomously driving cars will have their own market share in the industry as today the younger generation believes more and more in asset sharing then asset owning. This brings a completely new dimension in automotive industry and its market outlook.

DVN: What role and what significance will the use of OLEDs and displays play in the future for rear lights?

R.V.: The significance of OLEDs in rear lights will lie in their unique properties and the design possibilities they provide. OLEDs offer unique shapes and patterns allowing individual control for distinctive signatures, moreover the infinite contrast and uniform illumination can improve visibility and safety. With the increase of segments in a single OLED panel, communication will be also possible addressing certain use cases. OLED is also a direct-emitting light source and therefore more energy efficient compared to traditional sources. Additionally, the simplification of the optical architecture together with the low weight of the light source will contribute to overall vehicle weight reduction.

Displays on the other end will provide design flexibility, allowing for dynamic lighting patterns, customizable signatures, and unique visual experiences. In the future display technology will also enable all the upcoming scenario of visual communication V2V and V2P. This can enhance safety on the road by providing clear indications of the driver's intentions, vehicle status and improving visibility for other road users. If we consider miniLED technology, there will be also the possibility to use the same display to implement tail, stop and turn functionalities thanks to the high brightness and efficiency of the technology. Also, this will contribute to an overall vehicle weight reduction.

DVN: Is there anything else you would like to mention?

R.V.: I feel quite honoured today to have this talk with two very experienced professionals in Lighting world and I would like to thank you for this opportunity. We at Marelli Automotive Lighting & Sensing have been working on some very innovative and at the same time attractive products. I can just say it is going to get very interesting from here on.

Lighting News

DVN Night Drive: VW Touareg

LIGHTING NEWS

Just after our Marelli Automotive Lighting & Sensing visit, we did a night drive test with Gerd and Marelli team and tested 2 vehicles. As a lighting engineer, I really like a night drive. It has always been part of my job. And especially this Forest country road next to Reutlingen.

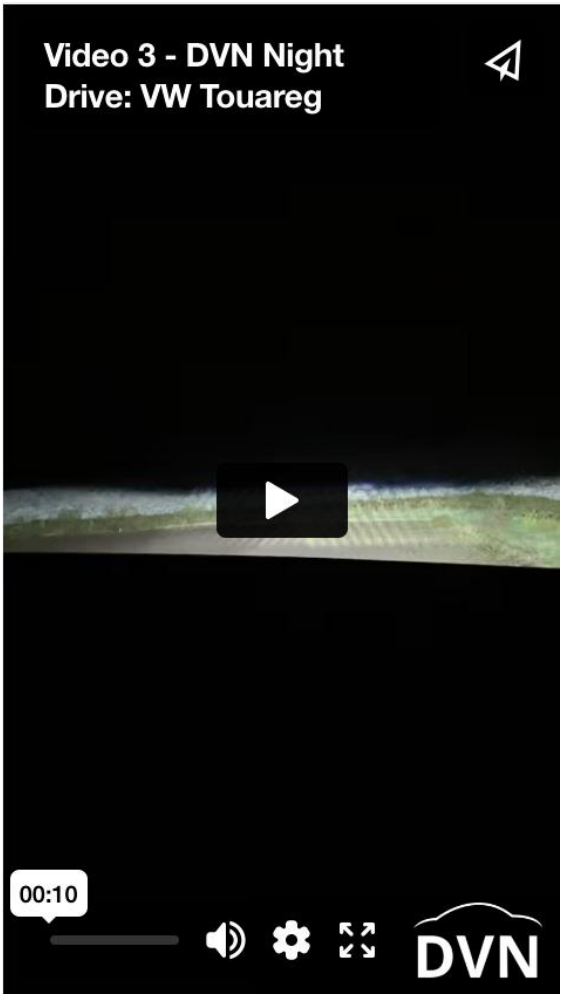
It reminds me of memorable tests I did more than 15 years ago with Michael Hamm, Kamislav Fadel, and Gerd during their time at Marelli (And Elo Rosenhahn, still driving the car and explaining the lighting content), testing the world-first full-LED lamps on the Audi R8.

We drove a demo-car with a 16-segment matrix system compliant with the U.S. FMVSS 108 ADB specifications, and a VW Touareg with MicroLED headlamp equipped with one HD module and a Bi-Matrix e-Light module.

Our impressions, particularly of the Touareg:

- Very wide high beam thanks to e-light module performance. High beam width covers the full driver field of view. No longer does one feel confined in a rectangular box made of light.
- Very narrow glare-free zone around the preceding car. This is the great advantage of the HD technology with very high resolution.
- Interesting carpet light on the motorway, focusing the driver's attention on the road.
- Amazing welcome sequence done with the HD pixelization capabilities.

Here are some videos we've prepared for you; come and ride along with us on the night drive:



Optica and DVN Online Industry Meeting on OLEDs and MicroLEDs

LIGHTING NEWS

DVN was co-organizing a meeting on OLEDs and MicroLEDs together with OPTICA. While OPTICA is less known in automotive, they are a professional society of individuals and companies with an interest in optics and photonics. OPTICA publishes journals and organizes conferences and exhibitions in the wide field of all kinds of optics, photonics, image science and vision. It currently has about 488,000 customers in 183 countries, including nearly 300 companies. The roots of OPTICA are the Optical Society of America, a scientist society founded 1916.

This Online Industry meeting was held on 21 November. About 70 participants joined the Online conference. The conference can now be streamed via Youtube. Presentations came from various companies like Forvia (F), Jabil Optics (D), OledWorks (U.S.), Noctiluca (PL), eLux (U.S.), ALLOS (D), XDisplay company (U.S.), QNA Technology (PL).

The basic question that OPTICA positioned was the question what the presenting companies could do for the optical community and what the optical community could do for them. This interesting starting question did spark very interesting discussions about the use of glass or plastic, radical new ideas on how to bring colour in microLED displays and technical qualifications of new ideas to be integrated in new top of the bench products.

Eduard da Silva from FORVIA showed in his presentation the new approaches for high resolution multi-display full spreading dashboards from pillar to pillar. Mr. Da Silva showed their expectation that displays are prospering in cockpits with about 5% growth rate until 2028. Immersive displays offer improved awareness, new design freedom and optimized cost. Hendrik Zachmann from Jabil showed that light extraction could be significantly improved by their advanced nanomaterials. Michael Boroson from OledWorks explained the success of OLED technology enabling high luminance automotive qualified panels that deliver 10 – 20kcd/m². Paul Schuele from eLux Display demonstrated his companies' ability on high volume manufacturing of displays, achieving full assembly of 520k µLEDs on a 12" module in less than 10 minutes. Nikhil Jain from XDisplay company showed how his company could produce

transfer-printed ICs, giving 40% to 50% power savings. Artur Podhorodecki from QNA Technology presented a very interesting new approach of creating blue quantum dot for quantum inks. Igor Nakon from QustomDot presented the quantum dot approach for green and red quantum ink.

Summary:

Jose Pozo from OPTICA started an intense discussion of all participants on innovation and transfer to real products. Especially the manufacturing of MicroLED displays and the use of innovative quantum dot ink could be a new approach. Quantum dots are nanometer-sized colour sources. Integrating those supersmall structures in quantum dot ink could be a new way to bring colour onto MicroLED displays when they are assembled. This conference was a successful exchange of innovative companies searching innovative partners.

First ADB Standard and Application Salon Held at Ningbo

LIGHTING NEWS

On 21 November, 2023, the "First Automotive ADB Standard and Industrial Application" salon was held in Ningbo. It was hosted by the China National Technical Standards Innovation Base (Automotive) and undertaken by Huawei Technologies, China Automotive Research Institute Automobile Inspection Center (Ningbo), and Jinye Auto Lamp. More than 60 participants gathered, representing vehicle and lighting makers, testing and certification institutions, experts and representatives of the Lighting Sub-standard Committee of the Automotive Standards Committee. With the rubric of **Lighting Upgrade in Automotive Intelligent Roads**, nine experts from automakers, lighting companies, and scientific research institutions shared the technical trends of ADB regulations and processes, industrial applications, user experience, use scenarios, vehicle safety improvement, ADB upgrades, and light sources.

This salon activity raised the issue of ADB standards and industrial applications, focused on topics such as application scenarios, technical difficulties, and solutions, and conducted in-depth exchanges and discussions in the form of expert speeches and panel discussions, which provided important support for the formulation of ADB standards and the development of product technology industry.

The theme salon activity of the Innovation Base is positioned as a source of automotive cutting-edge technology promotion and an incubator for standards work, focusing on the cutting-edge technology of the automotive industry, uniting the forces of the industry to form a consensus and promote the development of high-quality technology and standards in the automotive industry.

Sun Jiakang of FAW-VW said in addition to cities and developed areas, the vast countryside, suburbs, intercity and highway conditions are suitable for ADB usage in China.

Guo Zhaobin of Nio said the ADB experience depends on the capabilities of the whole vehicle, and excellent system capabilities can bring customers a safe and comfortable driving experience, but misidentification and mishandling may cause customers to have doubts, so the perception and algorithm based on ADB functions need to be further developed.

Huawei's Liu Shengjun said accurate lighting relies on high-brightness, high-quality imaging optical systems, and small models of fusion perception based on large ADS models.

Yao Qi from Fudan University put forward professional academic opinions for the development of ADB from the perspective of human vision factors and machine vision needs.

And Zhao Zhun of CATARC Tianjin introduced the current content of ADB road function verification and optical evaluation and the content of future test specifications.

Fine Lines for BMW Taillight

LIGHTING NEWS

The breakthrough design of the BMW M4 CSL's taillights is a study in thin lit lines, using innovative Laser Wire technology. A red laser diode was developed and used here for the first time in exterior vehicle lighting. The Marelli Rear Light Competence Center Tolmezzo succeeded in coupling very thin optical fibres to the new red laser to create the amazing new speckling-laser effect.

Bright Lights, Big City: Los Angeles Auto Show Part II

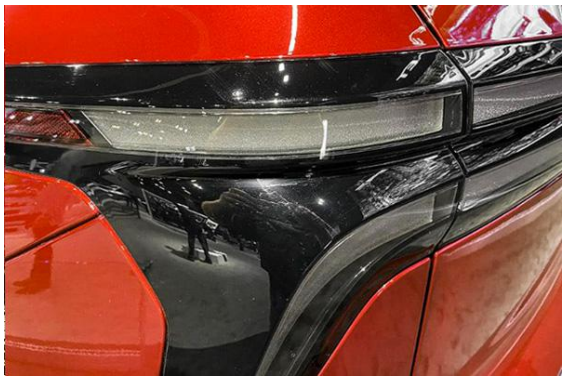
LIGHTING NEWS

Here's this week's batch of new and interesting lights we examined at Automobility LA 2023, the Los Angeles auto show. As you'll see, there's an enormous amount of thought and design talent being put into lights all over the car. Let's jump right in with the taillights on the Chevrolet Silverado EV. It's a big, bold sculpture in red-white-and-chrome, with carbon-fibre-look accents, horizontal-shelf elements facing the rear, and chevrolet callout amidst techno-mesh appliqué on the outboard face.

The Silverado EV's front lighting involves what looks like a full-width light stripe (we couldn't verify its function as such on the show car) extending into the upper signal lights, with a bifunctional LED headlight projector nestled in a nacelle below, all surrounding a body-colour panel where the radiator grille would be on a combustion-engine truck.

The Chevrolet Traverse has an attractive sandy texture to the white-when-off light elements in its black-framed rear lamps.

Switch them on by stepping on the brake or putting on the turn signal, and they light up in red with eye-pleasing homogeneity (also: BRIGHT!)



The texture-and-homogeneity theme carries forward to the front signals, too, which are smoothly faired into a black frame of their own in the upper/outboard wing of a giant black grille area. BiLED projector headlamps are below, in a black field of their own, with a body-coloured fence around. The side marker light and reflector are in the leading edge of the front wheel arch.

Even the turn signal repeater is eye-catchingly homogeneous.

This Ford Bronco Raptor has a strong lollipop-on-its-side design to the turn signal/daytime running lights, which encircle and split the round headlamps. The three amber lights in the middle of the grille are Identification Lamps, required in the U.S. and Canada on vehicles over 2,032 mm wide.

There's some magic in these headlamps: they're almost completely blacked out when unlit, no matter what angle they're viewed from. Most blackout techniques for reflector headlamps only work at certain angles, but even with a camera flash, these remain dark. Neat trick!

The Raptor's taillights have dual 3 × 3 grids of LEDs, proudly dotty. They're not just doubled up like this for style; the same wide-vehicle lighting regs that require identification lamps also require redundant rear position lamps (a "tail" and a "clearance" light on each side). The reversing lamp brings its own LED dots to the party, and appears to provide enough light for the driver to actually see, not just for the vehicle to check a compliance box.

The rear identification lamps are built into the CHMSL above the rear-mount spare tire.



That's not a turn signal repeater on the wing mirror, it's an Australian-style side marker light shining amber frontward and red rearward. Neither required nor forbidden in America (like repeaters!).

The Ford Bronco Sport presents a different flavour of the Ranger range's lollipop-on-its-side front lighting design theme. Rather than the Raptor's amber combination turn/DRL, here there's a white DRL sandwiched by two amber turn signal bars. Instead of a blacked-out over-and-under reflector headlamp, it's a BiLED projector. And the side marker light and reflector are low on the wraparound portion of the bumper fascia.

The Bronco Sport's taillight is quite different to that on the Raptor variant, too, with a homogeneous red wraparound band for the tail light, and bulb-type red brake, amber turn signal, and white reversing lights. Old meets new!

This G90 is a good place to start looking at Genesis lightstyle themes. The taillights are a study in line art.

A side-on look at the G90 shows Genesis' bold side lights, which carry the twin-horizontal design theme of the front lights along the full length of the fender. This, with the help of the wheel arch, crafts a 3D sculpture of the works.

Up front, the G90 has two glittering rows of elegant light cubes behind glass (polycarbonate), and here we see that there's really no bad angle for the brand's uniquely strong side-light treatment, whether the side lights are serving their turn signal purpose… or not

The Genesis GV80 Coupé presents with a variant on the twin-horizontal-bands lightstyle. The theme is put to great effect all around the car, and in the front lamp we see interesting interspersing of signal light cubes (textured front lens) with headlamp light cubes (clear front lens).

The GV60 puts emphasis on the negative space—the body coloured strip—between the two light bands in its all-red rear lamp…and in the headlamp, which rather than interspersing, groups the signal cubes outboard and the headlight cubes inboard. The cubes themselves are like sculpted ice.

This Honda Prologue concept's taillights are a museum-quality eye-feast of blocks and walls and textures, all behind a window-clear lens.
Not quite a full-width red light band, but the smoothly-lit tail light bar spans the body- and hatchgate-mounted lamps, and in the hatchgate lamp the shelf-shaped reversing light completes the package.

The Prologue concept's front combination lamp has a big, thick, scaly-textured upper bar for the turn signal and daytime running light, above one of Honda's unusual two-and-one reflector headlight setups: the inboard and outboard chambers provide the low beam, while the third chamber between those—hiding in blackness when not in use—provides the high beam.

China new vehicle releases

LIGHTING NEWS

Hongqi HS3 Hybrid

The new HS3 Hybrid compact SUV is priced at C¥188,800 (USD $26,500; €24,200).

The great big front grille makes the fish-hook DRLs look small. A black band loops around the LED headlamps below the DRLs. The rear lighting has the trendy full-width design, with a blackout effect.

Hongqi H9+ Endless Edition

This model is based on the Hongqi H9+ and incorporates elements of traditional Chinese art.The price starts at C¥800,000 ($112,800; €103,000). The frontal design is similar to that on the HS3: a big waterfall grille; clamshell-profile upper LEDs, a full-width LED light strip, and headlamps de-emphasized by the design of the front fascia.

Xiaomi SU7

Xiaomi's first car is a pure electric sedan which comes in two versions, the SU7 and SU7 Max. The lighting design, like the car's overall design, appears to be the result of long hours looking at Tesla cars.

General News

BYD's 6-millionth NEV

GENERAL NEWS

BYD's 6 millionth new energy vehicle, a Fangchengbao Leopard 5, recently left the assembly line at the maker's Zhengzhou plant—just over three months after their 5-millionth, a Denza N7, was completed this past August.