

**MAGNETI  
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2018 PROPERTIES

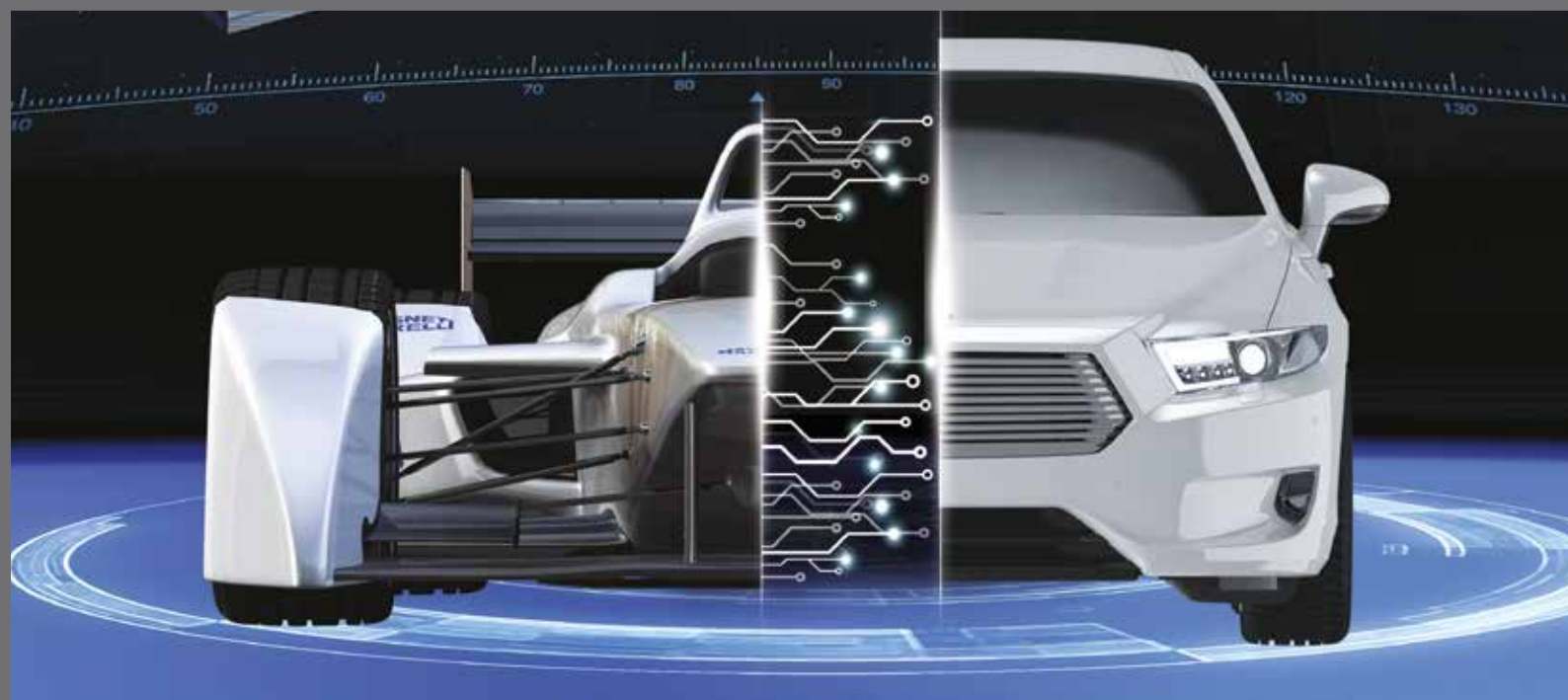
## ELECTRONICS



## LIGHTING



## POWERTRAIN



Magneti Marelli provides smart, streamlined, high-tech and safe solutions in the areas of electronics, lighting, and powertrain for all vehicle classes. Those visiting our booth at CES 2018 will experience the most exceptional conceptual and production technology the company has to offer, with a focus on future trends like autonomous driving, advanced HMI, connectivity and hybrid/electric mobility. We enable global automakers to “Sense What’s Coming”.

Magneti Marelli addresses three areas of the car that are changing rapidly. Our solutions enable vehicles to: sense and connect with what’s around them, display critical feedback to the driver and passengers, and meet stringent environmental and safety requirements. Drawing on nearly 100 years of innovation in motorsport and passenger vehicles, combined with our leadership in automotive technology, we help OEMs bridge the gap as the industry evolves by providing solutions for the vehicles of today and the car of tomorrow.

**Sense What’s Coming from Magneti Marelli.**

## ELECTRONICS

**E-COCKPIT (SEAMLESS COMPLEX MULTI-DISPLAY)**

The trend in Central Information Displays (CID) in premium vehicles is that it is becoming increasingly important to provide functionality that matches the vehicle's style. Digitalization of the cluster and interior controls allow for the development of seamless multi-display integration to create full cockpit displays that can include:

- Integration behind a single decorative piece (monolithic aspect), using a back panel to hide displays
- Displays that can accommodate a flat and/or curved surface with enhanced optical bonding
- Complex structures to enable a plastic or glass decorative panel
- Integrated touchscreen and sensors for display proximity, gesture control or smart buttons

Magneti Marelli is focused on providing solutions that support the display of information and controls on any surface, as opposed to only flat ones. The company is also developing the backstage elements of the e-Cockpit with up-to-date solutions including the Electronic Control Unit (ECU) for Infotainment, Instrument Cluster, Cockpit ECU, HMI ECU, Telematic Box and Smart Antenna.

**Advanced Switchable Viewing Angles for Display Information Privacy**

The evolution of the cockpit is putting more emphasis on providing content dedicated to passengers, however this introduces safety concerns for the driver. Passenger content can be viewed by the driver while the car is parked or in autonomous mode, otherwise it needs to be restricted to the passenger to reduce driver distraction. Suppliers and OEMs are focused on providing enriched content currently prohibited (such as a full-length movie) in prep for autonomous driving, and reducing light stress on the driver at night.

Magneti Marelli is currently working on proposed displays with switchable viewing angles.

**ADVANCED RESPONSIVE AND DISTRIBUTED HMI**

Combined with the e-Cockpit, Magneti Marelli is proposing innovative advanced HMI solutions and tools (such as our HMI Design Experience Showcase) to enhance the driver and passenger experience. Multiple displays can support toggling content between different areas of the cockpit.

Advanced Responsive Design allows for:

- Singular HMI logic to be used in various cockpit display configurations
- The predisposed HMI to be set to full/light, content/control, or pure display in allocated displays or a display area

Content distribution allows for:

- Manual allocation of content based on user request (pushing HMI to a specific display)
- Dynamic allocation of content based on the context
- Variation of the interaction in function based on the user or allocated display

## ADVANCED HMI DISPLAYS

According to an Accenture survey, consumers value in-car technology more than the car's driving performance. Driver demand for technology powered by the infotainment display has been growing steadily, creating a massive market opportunity. Magneti Marelli's contribution to this trend is through the development of state-of-the-art displays not only for the driver, but for both front and rear seated passengers.

### Large and Multi Reconfigurable Display 37" Showcase (Portal Showcase)

Our Portal Showcase is a shared view display providing content for everyone in the vehicle. With its large size and multiple (37" bar type) reconfigurable displays, it puts information in the right location at the right time. It incorporates AMOLED (Active-Matrix Organic Light-Emitting Diode), a display technology primarily used in smartwatches and mobile phones. AMOLED displays consist of millions of LEDs and emit light directly, therefore providing better contrast, more vibrant colors, real blacks, and a wider viewing angle than traditional displays.

The Portal Showcase incorporates flat, 1.5mm thick displays bonded to a curved surface. It features capacitive touch, facial recognition and low energy consumption.

### "Door-To-Door" Concept Display Showcase (Lima Cockpit Showcase)

The hallmark of our Lima Cockpit Showcase is that it demonstrates the concept of an e-Cockpit with four main areas of information and control distribution: driver, shared central, front passenger and rear seats.

The cockpit is a monolithic aspect door-to-door display area. Surrounding a typical installation of a digital cluster and CID, information has been added on the side for interior control and the possibility of an e-mirror. The CID has satellites that manage displays (with asymmetric functions for driver/passenger) for interior control or user-oriented control extension of the CID. The passenger is equipped with a display featuring a privacy function. For additional comfort, the driver can use a unique "soft touch" controller located in the armrest.

The HMI allows for information to be distributed to any of the displays (within contextual functionality) and provides the user with optimal interaction. Passenger entertainment is available through a dual display allowing for content to be watched (head rest) or enabling more interaction (back seat). Our facial recognition system reinforces the empathy of the HMI to the driver.

### HMI Design Experience Showcase

Geared towards designers, our HMI Design Experience Showcase demonstrates Magneti Marelli's ability to simplify the development of an HMI. Based on a WYSIWYG (What You See Is What You Get) principle, the tool offers pre-visualization of results on a computer without compilation, and most importantly, provides the connectivity to allow visualization and direct modification of the final product (ECU and display). All current domains for light/complex ECU, responsive, 2D and 3D, are covered by the tool.

Magneti Marelli uses the tool internally to deliver programs to OEMs around the world based on customer vision, and it can be deployed as a self-service tool for our customer's design teams.

### 27" Cockpit Display Showcase

Our 27" Cockpit Display is a low-cost design developed locally in China for delivery to the Chinese automotive market. It features two 12.3" Thin-Film Transistors (TFTs) and 720p HD resolution. The displays are mounted horizontally and bonded on flat glass to produce a large rectangular fully digital cluster. A single ECU, integrated into the cluster, manages the contents of both displays. This display costs 15-20% less than competitive versions, is lightweight, and will be in production in late 2018.

### 27" Dual AMOLED with TOUCH Functionality Showcase (Janus Display Showcase)

Our Janus Display Showcase is another info-cluster ECU solution proposed by Magneti Marelli. It integrates a single ECU capable of managing the cluster display and central infotainment display. The ECU box can be installed anywhere in the dashboard allowing for flexible styling of the displays.

The showcase combines our Portal and 27" Cockpit Display experiences to provide a dual AMOLED display assembled on complex glass (curved and flat) with touchscreen functionality. An additional "Butler" display enhances the cockpit control for the driver or the passenger (depending upon orientation) and offers controls to increase comfort and driving safety (the display can be rotated to change modes). Distribution, responsiveness and adaptation are the highlights of this HMI.

## CLUSTERS

No longer a simple depiction of speed and fuel level, the vehicle dashboard is evolving thanks to advancements in electronics and digital displays. Once reserved only for premium vehicles, digital clusters are becoming smaller in size and weight and are making an appearance in low to mid-range vehicles. As cars become "smart", digital displays will be mandatory in order to display the navigation and infotainment features consumers demand.

Far from a niche supplier, Magneti Marelli provides a full-range of low, medium and high-end instrument clusters, with the ability to customize to specific market needs based on OEM requirements. Our complete product range includes analog, hybrid and full digital clusters, leveraging our expertise in hardware and software development, mechatronics, optics, and screen printing.

### Entry-Level 3D dials Instrument Cluster (Fiat Panda)

For OEMs looking for an entry-level cluster for an A segment vehicle, the one we developed for the Fiat Panda could be the perfect fit. It's back to basics with this one – it features plastic injection molded parts, draws minimal power, is lightweight and low cost. 3D dials have been integrated for the main gauge indicators.

### 3.5" TFT Instrument Cluster (Fiat 500X)

The instrument cluster we developed for the Fiat 500X is a step up from basic – it features a 3.5" TFT display and can accommodate imagery and content within the HMI. OEMs can include functionality like interior/exterior temperature, navigation information, radio station details, and the driver's name integrated within the cluster.

**7" Full Color TFT Instrument Cluster (Jeep Compass)**

Our Jeep Compass cluster is an example of an enhanced digital cluster, featuring a larger 7" full color TFT display. This design allows OEMs to feature richer, more detailed information for the driver with a display area larger than a standard cell phone. Reduce driver distraction by duplicating pertinent information from the center stack, like simplified (zoomed in) navigation details, in the cluster.

**7" "High-End" Complex Instrument Cluster (Audi A4)**

A higher-end cluster with a complex electrical architecture is featured in the 2016 Audi A4. This powerful cluster features a 7" TFT display and is capable of complex security features like key or driver recognition. The design requires more sophisticated mechanics, component construction, assembly and verification than "lower-end" clusters.

**Integrated V2X Demo on Current 7" TFT Instrument Cluster (based on Jeep Renegade)**

Our Jeep Renegade cluster clearly illustrates our ability to integrate HMI functionality smoothly and seamlessly. Magneti Marelli provides the hardware and sensors to enable a variety of V2X use case scenarios (not yet in production) within the HMI. The cluster can be adapted to include additional functionality like vehicle-to-pedestrian (V2P) technology. We work closely with OEMs to determine the best way to integrate the functionality their buyers want.

**12.3" "High-End" full TFT Color Instrument Cluster (PSA DS7 Crossback)**

Magneti Marelli supplied the 12.3" TFT cluster to PSA for inclusion in the 2017 DS7 Crossback. This cluster is about as "high-end" as you can get and is available for high volume production. We are supporting the PSA Group in Europe and Dongfeng Motors in China with multi-country delivery of 4-5 variants of the cluster. The cluster features animated mechanics, and designs that vary based on market requirements.

**AUTONOMOUS VEHICLE**

Magneti Marelli's advanced electronics team in Turin, Italy, has been working on autonomous vehicle development since 2013. Achievements since then include:

- **2014:** First highway "proof of concept" use cases performing autonomous functions such as: traffic jam navigation, vehicle passing, lane changing, merging and exiting the freeway.
- **2015:** Valet parking function was successfully performed.
- **2016:** Embedded functionality in an automotive platform.
- **2017:** Began developing urban use cases; and began defining LiDAR (Light Detection And Ranging), cameras, Smart Corner sensor integration and Perception ECU (Sensor Fusion & object detection) as products

Current "proof of concepts" focus on an embedded ECU that receives inputs from sensors (radar, LiDAR, cameras, ultrasonic sensors) and performs Sensor Fusion, and further fusions, with data received from the GPS, HD maps and the in-vehicle network. We then conduct a threat assessment, define action and path planning, then manage steering, braking and throttling in place of the driver. Magneti Marelli can provide OEMs with solid-state LiDAR solutions for autonomous and connected vehicles through our partnership with LeddarTech.

**CYBERSECURITY**

The more electronics, sensors and computers that are added to vehicles to support autonomous and connected technology, the greater the risk for vehicle hacking. Magneti Marelli develops cybersecurity solutions that enable all components of the car to communicate safely and effectively, while preventing vehicle tampering like mileage reduction and unauthorized tuning of the Engine Control Unit. We provide unique encryption and encoding for crucial systems such as Instrument Clusters, Infotainment, ECUs and even Powertrain Components.

**Our cybersecurity solutions:**

- Prevent and mitigate remote cyber-attacks
- Preserve OEM/Tier 1 assets including vehicle drivability and personal driver data
- Detect and record intrusions in the on-board vehicle network

**Cybersecurity product portfolio:**

- **Crypto Library** - cryptographic functions for automotive
- **Data Diode** - on-board diagnostics (OBD) port firewall
- **Cybersecurity Software Stack** - for common automotive secure micro controllers featuring our Hardware Security Module
- **Vehicle Penetration Test Strategy** - procedure for vehicle vulnerability assessment
- **Intrusion Detection System** - software component for detection and recording of in-vehicle intrusions
- **Vehicle Recovery System** - software component that implements suitable reactions to detected intrusions

**FACIAL RECOGNITION**

There's no shortage of potential applications for facial recognition technology within a vehicle. Leveraging an in-vehicle camera to scan the driver's face, facial recognition software captures personal preferences to adjust the car's settings each time that driver climbs behind the wheel. This individual profile could include favorite radio stations or a music playlist, specific instrument cluster and display settings, and seat and mirror positions.

While many companies are introducing driver monitoring applications to support autonomous and connected vehicles, Magneti Marelli's facial recognition solution is different in that it requires very little computing power and works without complex hardware.

We're able to interface the image recognition output with our HMI to dynamically adapt the car's environment.

Visitors to our booth are welcome to participate in our interactive facial recognition display.

## SMART CORNER

Earlier this year Magneti Marelli announced an investment in solid-state LiDAR company LeddarTech for the joint development of complete LiDAR systems. This partnership aligns with Magneti Marelli's evolution, especially in the areas of lighting and electronics, toward developing components to support autonomous driving. Booth visitors can see first-hand our fully functional Smart Corner technology, built into the headlamps and tail lamps of a 2017 Chrysler Pacifica Hybrid.

Smart Corner integrates autonomous equipment (camera, radar, LiDAR) into advanced projector headlamps and tail lamps to provide OEMs with the required functionality for autonomous driving, while maintaining beautiful aesthetics and world-class lighting performance. Smart Corner is a turnkey solution that saves OEMs money and weight while ensuring the highest quality and appearance.

### Smart Corner:

- Provides a flexible platform to incorporate the technology required by the OEM
- Is designed to meet all sensor functions while maintaining styling aesthetics
- Minimizes the requirement for separate packaging, wire routing, connectors, and projections on the exterior of the vehicle

## VEHICLE-TO-EVERYTHING (V2X)

Vehicle-to-Everything (V2X) is a communication system that will improve safety by increasing awareness of the environment around a vehicle, helping the driver to avoid abrupt maneuvers and possible accidents. The U.S. Department of Transportation has estimated that V2X can prevent 80 percent of all accidents for unimpaired drivers by alerting them to hidden dangers that can't be sensed by traditional on-board equipment. V2X provides for a safe traffic information exchange, giving drivers advance notice of potentially dangerous situations and more time to react.

### Why Magneti Marelli for V2X?

Magneti Marelli has been a supplier of embedded telematics since 2002 and a developer of V2X solutions since 2010. Our V2X solutions feature hardware based on a flexible electronics architecture that's easily adapted to V2X chipset evolutions and scalable to computational needs. Our modular software architecture is easily portable to different chipsets and compliant with both US and European standards. We expertly integrate V2X driver warnings within the HMI, for display in the instrument cluster or center stack.

#### V2X use cases include:

Electronic Emergency Brake Light | Stationary Vehicle | Forward Collision Warning | Left Turn Assist  
Intersection Movement Assist | Control Loss Warning | In-Vehicle Road Sign Warning

V2X encompasses V2I (Vehicle-to-Infrastructure), V2P (Vehicle-to-Pedestrian) and V2V (Vehicle-to-Vehicle) technology. Visitors to our booth can experience our smartphone-based V2P demonstration, and see how we integrate a variety of V2X use cases seamlessly within a Jeep Renegade cluster.

## WIRELESS CHARGING

See the wireless charger we developed for a client in our booth. Wireless charging removes the wire connection for charging mobile devices and delivers a number of benefits over traditional cable connectors, some of which aren't always obvious:

- Eliminates the need for multiple chargers, adapters and cords
- Keeps devices at a high level of charge to help extend battery life while charging
- Gives vehicle interiors new flexibility for distributing power to multiple points as needed
- Provides a natural location to introduce access to embedded mobile phone communication channel (Near Field Communication or NFC) to pair seamlessly with the vehicle

# LIGHTING



With traditional light sources like halogen and xenon being a solid and reliable set of solutions, Magneti Marelli's Automotive Lighting division is focusing its efforts on developing chip-mounted LED solutions to address the needs of all vehicle segments. According to IHS, LEDs are used in 16% of headlamps on the market today, with that number expected to increase to 30% by 2022. LEDs offer greater styling possibilities, reduced energy consumption and increased safety and performance, all at a cost that's lower than other light sources. Visitors to our booth at CES can also see our OLED tail lamp prototype, winner of the Red Dot Design award. Other innovations include our adaptive all-LED tail lamp, 84 pixel matrix headlamp, the first laser high beam on the road, and the first adaptive all-LED headlamp with multi-color chips.

### **s-Light**

Magneti Marelli's Automotive Lighting division has developed the scalable s-Light, a family of optical LED modules, to address OEM demand for increased functionality within tight space constraints. The s-Light achieves three "s" targets: it's short, small and slim. The module uses a projector combined with an inner reflector to optimize space; at 135mm deep (max) and a lens height of just 40mm, it's 18% shallower than its predecessor, the e-Light, and boasts a 22% shorter lens. We will have two s-Light modules on display in our booth: one dual function low beam/high beam module and another featuring low beam and seven (7) segment ADB (Adaptive Driving Beam).

### **L-Light**

Our L-Light is an integrated LED module with two projector units, boasting a thin profile and large beam opening. The projectors can be combined to provide low beam, high beam and ADB functionality. With a lens size of 100mm x 25mm, the L-Light can accommodate the trend towards longer and thinner headlamp shapes and styling, as designers move away from round projector modules. The L-Light has garnered interest from several OEMs and is being incorporated into advanced planning. We will feature two versions of the L-Light in our booth; one low beam/high beam module and another with low beam and 18 segment ADB.

### **MXB 2x12 ADB**

Our MXB module was developed specifically to provide ADB functionality only, and is used in conjunction with a separate low beam module. It boasts a higher resolution than our seven and 12 segment s-Light ADB versions. For OEMs with styling requirements that include a two module solution for low beam/high beam/ADB, the MXB could be an ideal choice. Multiple vehicle segments can be addressed with a combination of modules; for example a base version vehicle could be equipped with a single s-Light, while a premium version of that same vehicle could include a low beam specific module (s-Light) and one specific to ADB (MXB). The MXB family offers a single row solution with 12 or 16 segments, or a two row solution with 24 or 32 pixels. It closes the gap between the s-Light with 12 segments and the PHB with 84 pixels.

### **PHB 84 Pixel**

Our PHB 84 Pixel ADB module boasts 84 LEDs, making it capable of providing a much higher resolution than other ADB modules, much like the difference between watching a standard TV and an HDTV. It provides low beam, high beam and ADB functionality in one all-encompassing unit. The PHB is a high-end, premium vehicle solution capable of various light patterns such as town and highway light, and Adverse Weather Adaptation in addition to high-level ADB functionality. The PHB can be seen in the new Mercedes S-class vehicle.

**Bi e-Light Neo**

Our Bi e-Light Neo is the next generation of our efficient, robust and compact e-Light, an optoelectronic LED module using collimating optics, a mirror shutter, aluminum heatsinks and glass lenses as secondary optics. The Neo is a low-cost, halogen replacement available with or without an integrated LED driver, and targets entry-level vehicle segments with its low price tag. It provides low beam and high beam functionality with lumen output of 500 and 350, respectively. While not yet in production, booth visitors can see our prototype in person at CES.

**f-LUX**

Not a traditional module, our f-LUX concept is a standard light source consisting of PCB-mounted LEDs, a connector and a heat sink. It is a low-cost halogen replacement that features a reflector rather than a projector and is scalable, available in two-chip, three-chip or four-chip LED configurations. OEM styling needs and performance requirements will dictate the use of a two, three or more chamber module. The f-LUX can achieve an IIHS "good" rating, which is difficult to attain with a reflection system.

**HEADLAMPS AND TAIL LAMPS****Laser Headlamp (Audi R8)**

Our sensor-controlled LED headlamp, featuring a laser high beam spotlight for improved visibility, can be seen on the Audi R8. The low beam is generated by an e-Light module powered by 11 LEDs, while the high beam is achieved with one five-chip-array and another three-chip-array complementing the low beam. The Daytime Running Light (DRL) is emitted through a multiple light guide, while the long attractive shape is in line with Audi's signature brand styling. The laser spotlight is activated when the vehicle's speed exceeds 70 km/h and is deactivated automatically when facing oncoming or proceeding traffic. A wiping turn signal is achieved by a multiple light guide powered by nine single amber LEDs. For safety reasons, the laser light source in our exhibit headlamp has been replaced with a blue low power LED.

**Matrix Headlamp with Double Projection (Audi A5)**

Our intelligent all-LED matrix headlamp, as seen in the Audi A5, features an 800 lumen low beam powered by seven LED chips. Our high beam is precise, camera-controlled, glare-free, and capable of achieving 1800 lumens on the road, while our "four-eye-design" provides perfect light homogeneity. The DRL is indicative of Audi's signature styling, and serves as a positioning lamp when dimmed to 10% power. The headlamp boasts a progressive turn signal powered by nine LED chips that underscores the energetic character of the vehicle.

**Class 84-Pixel Headlamp (Mercedes S)**

The Mercedes S-Class features our all-LED ADB headlamp with 84-pixel-matrix. Integrated electronics and a camera control the light distribution. Due to the pixel technology, the ADB functionality with glare-free high beam is more precise than ever before. 44 individually dimmed LED chips emit 1300 lumens on the road in low beam mode. With an additional 40 individually commanded LED chips the high beam is generated totaling 2000 lumens on the road. The DRL function is realized by three light guides powered by two white LEDs (each), and serves as a positioning lamp when dimmed to 10% power. The turn signal function, powered by nine

yellow LED chips complements the warning lights. Three blue LEDs emit the distinctive "welcome" function making it easy to find the car in a crowded parking lot.

**All-LED Tail Lamp (Ferrari GTC4Lusso)**

The Ferrari GTC4Lusso features our all-LED tail lamp that includes cylindrical optics and micro optics to create a homogenous, distinctive ring to achieve Ferrari's signature look. The tail lamp consists of 173 LEDs overall, with 60 of those LEDs allocated for the stop (braking) function. Two LEDs illuminate the road once driving in reverse, while a multi-parabolic profile aims the light in different directions to fulfill government regulations. Three LEDs in the outer element create the fog light to enhance visibility during bad weather conditions. The turn indicator is powered by 60 LEDs behind a thick inner lens.

**Headlamp LED ECU (BMW)**

The ECU (Electronic Control Unit) we developed for BMW is an example of our lighting and body electronics expertise at work. It controls all lighting and actuator functions of an intelligent semi-conductor based headlamp. Controlled functions include: LED low/high beam, glare-free high beam, static bending light, 3D DRL, turn indicator, sidemarker, as well as the stepper motors for leveling (for motor way light) and swiveling (for dynamic curve light and GHB) and the cooling fan.

**OLED-Tail Lamp Prototype**

Automotive Lighting is working on new optical solutions that incorporate OLED (organic LED). As opposed to LEDs which are point light sources, OLEDs are surface lights and are most commonly used in turn indicators and tail lamps. Because OLEDs produce light in thin layers, they are ideal for applications that require flat or flexible light. 3D effects can be created through segmentation (light modules can be individually controlled) increasing design flexibility. Our organic LED (OLED) tail lamp prototype incorporates ten OLEDs for tail functionality and six for turn signal functionality.



# POWERTRAIN



The pressure's on for OEMs worldwide to meet stringent, government mandated fuel economy and CO<sup>2</sup> emissions standards, or face paying hefty penalties. Vehicle electrification, in addition to an automaker's overall lightweighting program, is one of the best ways to reduce carbon emissions, increase efficiency and reduce oil dependency. Magneti Marelli's extensive experience in conventional and electric motorsports has led to the production of Kinetic Energy Recovery Systems (KERS) and electric motors that cross over to the commercial vehicle market. Our powertrain components are designed to meet stringent ISO 26262 standards for functional safety of electrical systems.

## 48V BELT STARTER GENERATOR

Our mild hybrid 48v Belt Starter Generator (BSG) is an electric motor with integrated electronics, replacing the standard alternator and potentially the starter motor as automaker's increase production of hybrid and electric vehicles. Our BSG leverages KERS technology, recuperating energy from braking and driving it back to power the Internal Combustion Engine (ICE) and electrical systems.

Tapping into kinetic energy from the ICE which is then transferred to a storage device, the BSG can provide torque assistance to the engine and enable start-stop capability, saving on fuel consumption and reducing emissions. State-of-the-art hairpin winding technology maximizes power density and reliability suitable for the North American truck market. And you'll be hard pressed to find another supplier that integrates electronics with the motor the way we do.

### BSG Specifications:

- Coolant Type: Air, 105°C Max Air Temperature
- Efficiency (Peak): 90%
- Max Speed: 18,000 rpm
- Power (Cont): 5kW
- Power (Peak): 12kw
- Torque (Peak): 67Nm
- Voltage: 48 VDC (nominal); overall range of 36–52 VDC

## HIGH VOLTAGE POWER INVERTER MODULE (PIM)

Magneti Marelli's PIM, included in the current model year Chrysler Pacifica Hybrid Minivan, supports medium range electric mode driving, up to 30 miles or more on a single charge. At 400 volts, it provides extremely effective regenerative braking, while maximizing performance and efficiency. It drives two electric motors in the same housing and is directly mounted to the transmission. No cables! The PIM is built to withstand harsh vehicle underhood requirements, such as high temperature and vibration, which is difficult to achieve with integrated power electronics all within a class-leading envelope.

Because it's a double inverter, the specifications below are related to each integrated inverter, nominally equal in terms of performance.

**PIM Specifications:**

- Coolant Type: Liquid, 75°C Max Temperature
- Efficiency (Peak): Up to 96%
- Phase Current (Cont): 200Arms (each)
- Phase Current (Peak): 420Arms (each)
- Power (Peak): 150kW
- Voltage: 260-420 VDC
- Weight: <10Kg



Magneti Marelli designs and produces advanced systems and components for the automotive industry. With 86 production units, 12 R&D centers in 19 countries, approximately 43,000 employees and a turnover of 7.9 billion Euro in 2016, the group supplies all the major carmakers in Europe, North and South America and the Asia Pacific region. The business areas include Electronic Systems, Lighting, Powertrain, Suspensions and Shock Absorbers, Exhaust Systems, Aftermarket Parts & Services, Plastic Components and Modules, Motorsport. Magneti Marelli is part of FCA.

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