Marelli Pro and Elite Platforms

Comprehensive Portfolio Publication

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TABLE OF CONTENTS

Click any heading to view the section

ABSTRACT

As automakers shift to software-driven and electric vehicles with advanced features, Marelli empowers engineering teams to bring pioneering, cost-contained innovations into series production by leveraging modular, high-tech concepts.

Building on pre-developed and validated technologies, Marelli's Pro and Elite platforms facilitate rapid roll-out across trims and model lines, providing a comprehensive portfolio of modular hardware and software features and solutions spanning Lighting, Electronics, Displays, Suspension and Propulsion.

Leveraging the purpose-built foundations of the Lean platform, the Pro platform introduces upscaled innovation for mainstream models, while the Elite platform delivers cutting-edge performance and design freedom for premium and luxury vehicles.

Our comprehensive portfolio papers detail the distinct advantages of each Marelli Pro and Elite platform—Pro and EliteLight, Pro and EliteZone, Pro and EliteCore, ProConnect, ProDisplay, Pro and EliteHorizon, EliteRide, and ProEnergy.

HARDWARE PLATFORMS INTRODUCTION

Aligning innovation with market demands is central to Marelli's strategy. Today, our modular hardware platforms underpin this strategic model, enabling automakers to rapidly address specific requirements across tiered market segments with high growth, high-market share products.

Leveraging deep cross-domain expertise to deliver integrated or standalone solutions at speed, Marelli's scalable platforms streamline development, optimize investment and support more sustainable vehicle architectures.

Developed to offer greater modularity, each platform targets up to 70% reuse of subsystems and components, significantly compressing R&D timelines and mitigating the risks of clean-sheet designs, while accelerating time to market.

Marelli rapidly advances concepts to the minimum viable product stage and co-engineers with OEMs to introduce future-proof features and functionalities.

As a result, automakers gain a technological edge and the agility to act as first movers, seizing early market share.

In addition to hardware, Marelli has developed software platforms that include standalone, decoupled software applications, as well as software-enabled tools and features that drive Software-Defined Vehicles (SDVs).

This integrated approach further fosters co-creation opportunities with automakers and expands personalization options for buyers.

Tailored to fulfill the diverse needs of different vehicle segments and buyers, Marelli's hardware platforms deliver significant competitive advantages, with scalability, cost efficiency, flexibility and reduced timeframes that help automakers get to market fast.

Platform-powered innovation: Accelerating your time to market

A TIERED SYSTEM: LEAN, PRO AND ELITE

Marelli's hardware platforms are structured around three scalable tiers – Lean, Pro and Elite. Each is designed to offer broad coverage across market segments while providing in-depth capabilities across various vehicle systems. With an emphasis on scalability, this model offers flexible, pre-engineered components that allow automakers to efficiently leverage technology without starting from scratch.

Lean is engineered for base trims, entry-level vehicles and value-driven brands. Its fit-for-purpose technology focuses on affordability, sustainability and speed. Lean emphasizes component simplification, reduced development time and design for manufacturing.

Pro puts the focus firmly on scalability. It is Marelli's most versatile and adaptable platform. It targets electric vehicles and mainstream vehicles that offer unique features beyond their class. This approach includes up-scaling well-established innovations from our Lean platform, or value-optimizing high-end features developed for premium vehicles. With the broadest range of customization and feature options, Pro is engineered to meet diverse consumer preferences and budgets across a wide array of vehicle segments.

Elite represents the pinnacle of Marelli innovation. A cycle of continuous investment and development keeps Marelli at the forefront of technological advancement, delivering industry-first products that set new benchmarks. As a result, Elite combines sophisticated features and high-content technology to meet the demands of tech-savvy end users and the most premium vehicle brands in the market.

Pro and Elite platform

Marelli's Pro and Elite platforms introduce advanced levels of feature sophistication and performance. Co-created with OEMs for mainstream models, EVs, and luxury lines, they balance next-generation functionality with targeted efficiency across components, wiring, energy management, manufacturing, and assembly.

Our Pro platform targets the point where feature sophistication, software content, and system integration begin to exceed entry-level architectures, frequently delivering innovative alternatives to state-of-the-art technology, offering much of their performance at a greatly reduced cost.

Our Elite platform pivotally balances groundbreaking innovation with a made-for-manufacturing mindset. Whether through Marelli-owned tooling, plug-and-play compatibility with existing vehicle architectures, or simplified assembly and validation processes, Elite platform solutions are engineered from the outset for series-production viability.

Each platform is founded on homologation-ready technology and remains highly adaptable to individual vehicle programs. Crucially, Pro and Elite platform technologies can be scaled and combined according to program needs, giving automakers the freedom to deploy advanced solutions at the pace and level best suited to each vehicle line.

Key outcomes include:

- More sophisticated features with a simplified architecture
- Faster time to market from pre-developed, production-mature foundations
- Flexibility to adapt to program-specific design, packaging and performance requirements
- Reduced manufacturing and assembly effort through consolidation of components, ECUs, modules and wiring
- Scalable, software-defined capability with Over-the-Air (OTA) upgrades
- Improved efficiency and sustainability through intelligent system design
- Architectural capacity to evolve functionality without major re-design
- Production-ready innovation – including plug-and-play compatibility, Marelli-owned tooling and homologation validation

THE PRO AND ELITE PLATFORM PORTFOLIO

Pro and EliteLight

Marelli's ProLight and EliteLight platforms enable OEM design and engineering teams to bring ambitious front, rear and 360° lighting concepts to series production. Building on the foundations of our LeanLight portfolio, ProLight offers feature-rich and modular solutions for mainstream models, while EliteLight sets industry standards with innovations and next-generation design expertise to distinguish premium and luxury brands.

Both platforms are underpinned by pre-developed, validated technologies that accelerate development and achieve cost-containment goals. Modularity and configurability further support rapid roll-out across trims and model lines, with seamless integration across the full exterior lighting package.

Co-creation uniquely defines Marelli's platform approach. By collaborating with OEMs from the earliest concept phases, Marelli adapts its platform technologies to the specific styling and functional requirements of each program.

The result is adventurous and unconventional lighting designs that would otherwise be difficult to realize within standard development programs.

ProLight Front

- Mono-Functional ADB LED Module
- Bi-Functional ADB LED Module
- Thin-Lens Module
- Configurable Daytime Running Lights
- Daytime Running Lights Light Guide
- Static-Bending Light
- Driver Unit

EliteLight Front

- h-Digi® MicroLED
- Thin Corner-to-Corner Headlamp
- Driver Unit

ProLight Rear

- Thin Lit Lines (Chip-on-Board MiniLED)
- Flat Lit Surfaces (Segmented)
- Hidden Light (Black-Off Appearance)
- 3D Static Effect

EliteLight Rear

- Laser Wire
- Flat Lit Surfaces (Digital)
- Hidden Light (Smartphone-Off Appearance)
- 3D Dynamic Effect

ProLight 360

- Static Ground Projection
- Semi-Dynamic Ground Projection
- Illuminated Logo

EliteLight 360

- Illuminated Panel
- Integrated Display
- Dynamic Ground Projection
- Integrated Sensors & HMI

ProLight Front

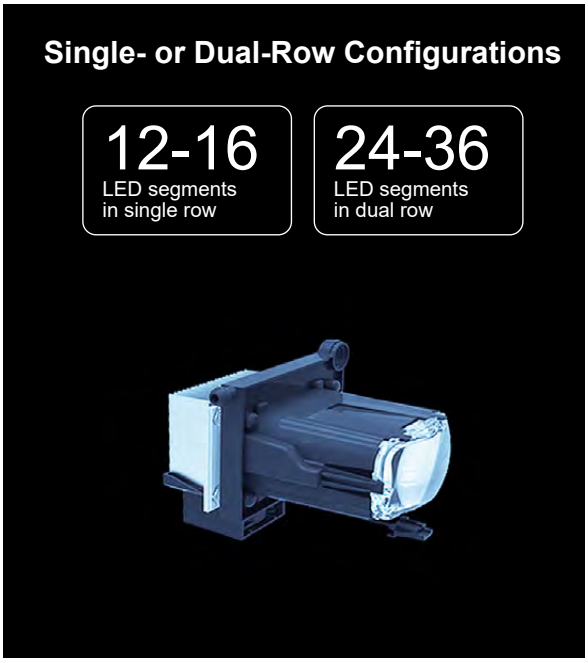
The ProLight Front platform supports feature-rich headlamp configurations with flexible Adaptive Driving Beam (ADB) technology, style-driven Thin-Lens Modules, and optional features including Configurable Daytime Running Lights (DRLs), DRL Light Guides, and compact Static-Bending Lights – providing OEMs with functional and styling options to differentiate and enhance trim levels.

Mono-Functional ADB LED Module

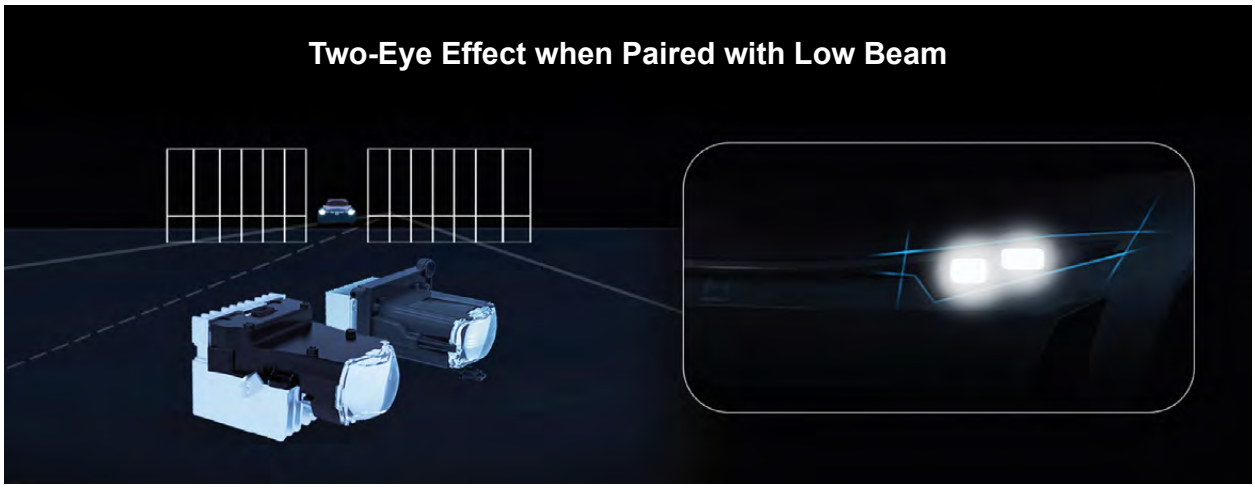
Marelli's m-Light is an off-the-shelf, Mono-Functional ADB LED Module optimized for affordable, time-critical applications, and available in single- or dual-row configurations.

The single-row module is scalable from 12 to 16 LED segments, and provides a pre-designed configuration that requires no additional engineering. Upgrading to dual-row technology expands functionality to between 24 and 36 LED segments, and introduces digital swiveling, while retaining compact dimensions.

Both solutions offer a slimline lens height of just 35 mm, a lens width of only 60 mm, and support signature light options, including a distinctive two-eye appearance when paired with an additional low-beam module.



Globally compliant, the Mono-Functional ADB LED Module is manufactured across Marelli's facilities in Europe, the Americas and Asia.

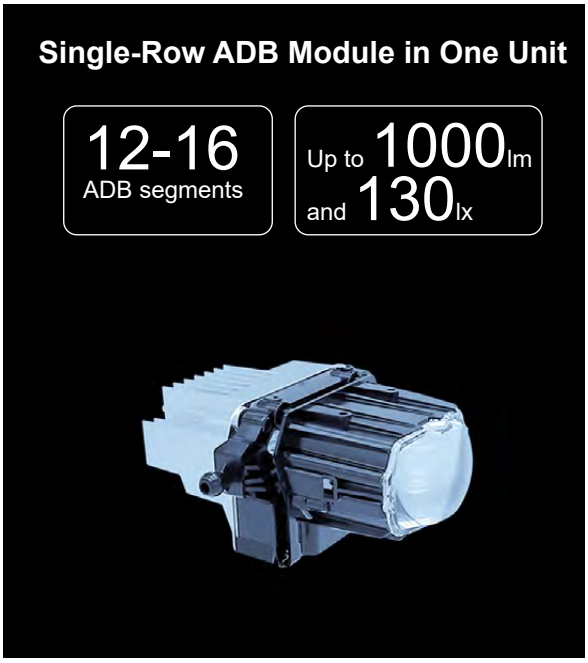


Need to know

- 35 x 60 mm lens height/width
- Single- or dual-row configurations
- 12-16 LED segments (single row) or 24-36 LED segments (dual row)
- Supports two-eye appearance

Bi-Functional ADB LED Module

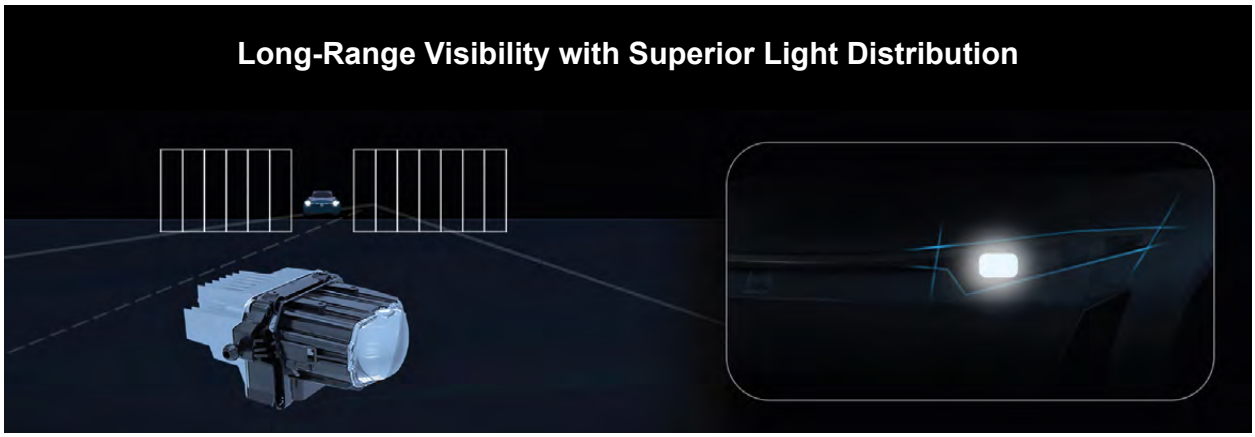
The e-Light 9 LED module features a bi-functional low-beam and single-row ADB module offering between 12 and 16 ADB segments in one compact, passively cooled unit. Offering the greatest performance in the ProLight LED module portfolio, the result is long-range visibility with exceptional light distribution and homogeneity – and a cost-efficient single lens that reduces components and wiring complexity compared with dual-module set-ups.



The module operates seamlessly with Marelli's ProLight Driver Unit, which manages ADB control and beam transitions for precise, software-defined illumination.

Available off-the-shelf to minimize lead time and engineering effort, this bi-functional ADB and low-beam module supports additional customization of the projection lens to styling-specific requirements. Optional mechanical swiveling and a horizontal Cut-off Line (COL) allow further flexibility when combined with additional modules.

Both m-Light and e-Light can be configured with other Marelli technologies – including Configurable DRLs and DRL Light Guides – and tailored for emerging markets such as Brazil and India.



Need to know

- Low beam and single-row ADB module in one unit
- Up to 1000 lm (low beam alone) and 130 lx, 2000 lm (combined low beam and ADB)
- Optional horizontal COL for combination with High Definition (HD) module
- Optional mechanical swiveling

Thin-Lens Module

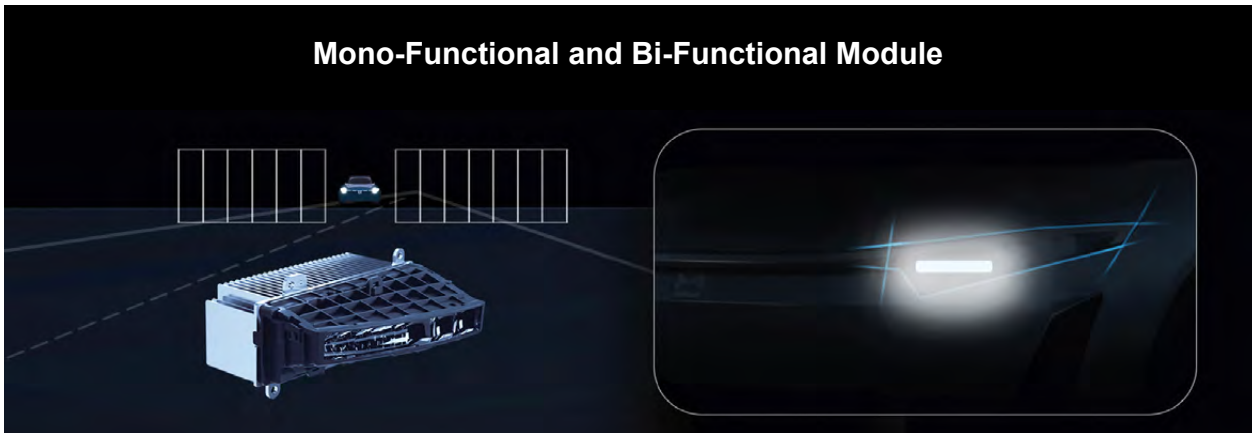
The Thin-Lens Module uses proven ADB and LED technology from Marelli's platform-based m-Light and e-Light products but applies them in a fully customizable format. This allows carmakers to benefit from pre-development of up to 70% for minimal lead time and engineering effort while adapting to the design and performance-driven requirements of each project.

A lens height of only 15 mm and passive cooling enables slimline styling no thicker than a finger, while Marelli is first to allow modules to be configured vertically, horizontally or in combination.

ADB segments are scalable from 12 to 22 in one row, while signal functions can be seamlessly integrated on-demand.

Our Thin-Lens Module offers mono-functional LED solutions for low beam, high beam or ADB high beam, or a bi-functional option that combines low beam with either high beam or ADB high beam.

A signature two-eye appearance can be achieved through an optional ambient-light feature that keeps the high-beam or ADB module illuminated even when inactive.



Need to know

- Mono-Functional LED Modules for low, high, or ADB high beam
- Bi-Functional LED Modules combine low beam with high beam or ADB high beam
- Flexible lens height and width
- Supports combined horizontal and vertical configurations
- Seamlessly integrated signal functions (optional)

Configurable Daytime Running Lights

Configurable Daytime Running Lights (DRLs) deliver super-bright, software-defined lighting signatures with a standardized electronic architecture and passive cooling. The flexible mechanical and optical design concept allows horizontal, vertical or combined layouts to meet each project's styling and performance-driven requirements. Signal functionality can be optionally integrated.

Software-defined content enables customizable light patterns and communication features – such as unique driving-mode signatures or user-defined animations.

Need to know

- Software-defined light patterns and communication features
- Horizontal, vertical or combined layouts
- Optional integration of signal functions

Daytime Running Lights Light Guide

The DRL Light Guide combines distinctive lighting aesthetics with exceptional optical clarity. Engineered for design freedom and with a flexible mechanical architecture, these 3D-shaped, edge-lit guides can be configured horizontally, vertically or in combination to complement any headlamp architecture. Turn indicators can be supplied as a dedicated light guide or integrated within the same optic.

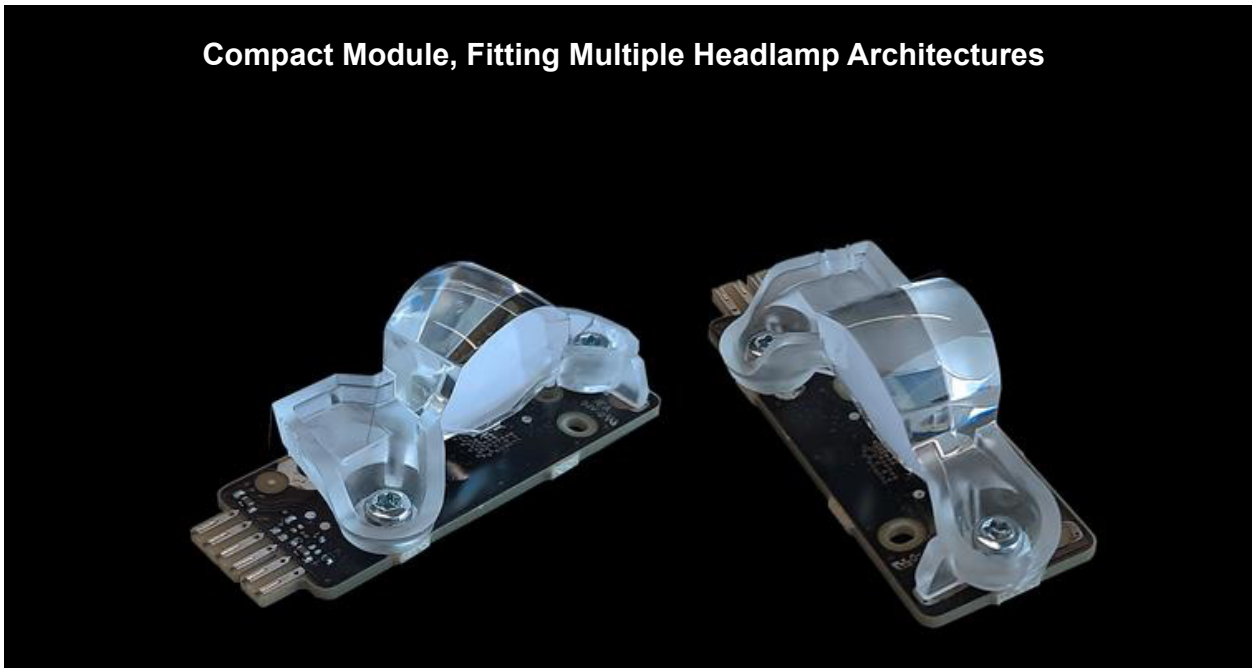
Need to know

- 3D-shaped, edge-lit optical design
- Horizontal, vertical or combined layouts
- Optional integrated signal functions

Static-Bending Light

Easily integrated into existing headlamp designs, Static Bending Light is a miniature module combining a Polymethyl Methacrylate (PMMA) primary optic, double-chip LED Printed Circuit Board Assembly (PCBA), and aluminum heat sink/holding frame into a single, space-efficient unit. It delivers best-in-class photometric and thermal performance, and angles the headlamp beam into corners for enhanced visibility.

The compact design is ideal for installation in restricted areas, while a flexible interface and project-specific thermal management allow adaptation across multiple headlamp architectures. Standardized geometry, optics and PCBA eliminate the need for additional engineering. Only two optics variants and three Printed Circuit Board (PCB)/connector options are required to meet OEM requirements, delivering a 50% cost reduction at the PCB level compared with the first generation.



Need to know

- Combined PMMA primary optic and LED PCBA
- Best-in-class photometric and thermal performance
- 50% PCB cost reduction vs first generation

Driver Unit

Providing centralized software control over the ProLight platform, the Driver Unit is a high-performance, fully scalable Lighting Electronic platform concept designed to power and control actuators (including LED light sources, stepper motors and fans), execute application software and ensure full diagnosis capability of all actuators and sensors inside the headlamp. It balances best-in-class affordability with efficiency and sustainability, and reduces both weight and production cycle times.

The modular Driver Unit PCBA supports multiple configurations and output requirements within a pre-developed platform, enabling rapid adaptation to different vehicles and regions, including China. The whole Driver Unit system is fully configurable via parameter settings, enabling fast time to market and significantly reduced application efforts across an OEM's carlines, without the need for hardware or software changes.

Optimized for the Software-Defined Vehicle (SDV) era, the Driver Unit is available either as a microcontroller-based variant (with software on board) or microcontroller-free for zonal architectures.

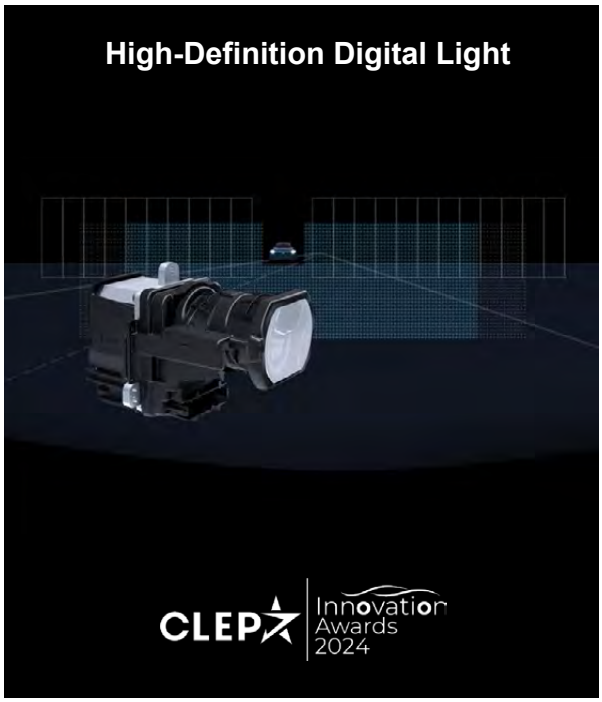
Need to know

- Powers, controls and monitors all actuators, including LEDs, stepper motors and fans
- Fully scalable hardware for multiple configurations and outputs
- Most affordable in class
- Optionally MCU-free for zonal architectures

EliteLight Front

The EliteLight Front platform represents Marelli's most advanced lighting solutions, combining ultra-slim styling with high-resolution microLED projection and intelligent, software-driven personalization. Designed for premium and luxury vehicles, it empowers automotive designers to realize bold, minimalist aesthetics while enabling seamless integration within SDV architectures.

h-Digi® MicroLED



The award-winning h-Digi® MicroLED module integrates our first-to-market 1.3-million-pixel Digital Micromirror Device (DMD) with a compact, 40% lighter ADB architecture.

The result is a high-definition digital-light solution that is cost- and energy-efficient, and scalable across vehicle segments through a common optical concept and electronic interface.

MicroLED supports high-resolution HD-ADB, and Dynamic Bending Light (DBL) for the low-beam, with beam shape, direction and intensity managed in real time at pixel level. Welcome animations and road projections further support guiding lanes, lane positioning and personalization opportunities, with OTA feature updates.

A compact 40 x 50 mm lens delivers a 1:4 field of illumination with densities of 26,000 pixels (px). Real-time pixel management minimizes glare and optimizes sharp transitions between bright and dark zones, enhancing driver comfort and safety with premium optical performance.

Marelli's microLED platform supports scalable control architectures. Algorithms can run directly within the headlamp ECU, removing the need for a separate video controller at vehicle level and enabling advanced lighting functions at significantly lower cost with simplified wiring. This integrated approach also eliminates changes to the OEM's Electrical/Electronic (E/E) architecture when upgrading from the Pro to Elite platform.

The system is realized with Marelli's high-definition ECU – the only in-headlamp graphics generator in series production – enabling advanced functions and cross-platform compatibility.

Our microLED module utilizes the same E/E architecture interface as the Pro platform, enabling seamless integration with Marelli's Bi-Functional ADB Module while supporting upgrades. All tooling, including the front lens and lens carrier, is Marelli owned and fully amortized, accelerating time to market with reduced investment.

Need to know

- Cost and energy efficient high-definition digital light
- High-resolution ADB, DBL, guideline and road projections, welcome animations
- Architecture compatibility:
  - In-lamp ECU execution (no external video controller required)
  - Compatible with Marelli HD-ECU (in-headlamp graphics generator)
  - MCU-free option for centralized / SDV architectures

Thin Corner-to-Corner Headlamp

Marelli's Thin Corner-to-Corner Headlamp marks a breakthrough in front-end vehicle design, combining lighting, communication and sensing technology in one product. The seamless design concept is already proven in series production, and integrates the functionality of two headlamps into a continuous illuminated front section, consisting of a homogeneous 13 mm-high RGB light bar stretching the full vehicle width, as well as an illuminated logo and sensor.

Powered by Marelli's modular electronic architecture, multiple lighting technologies are integrated within the ultra-slim design, including microLED modules for low and high beam, intelligent Red, Green, Blue (RGB) illumination, animated DRLs, turn indicators, thin ADB and positioning lights with a lens height of 4-8 mm. Optional communication displays and ground-projection technology can be integrated to enable enhanced personalization, information and brand signatures. Sensors can also be incorporated for a cleaner appearance and improved protection.

Need to know

- 45 mm ultra-slim, full-width design
- 13 mm light strip height microLED modules for low and high beam
- Intelligent RGB illumination
- DRLs and turn indicators
- Thin ADB
- Optional in-lamp communication display, ground projection, illuminated logo

Driver Unit

The Driver Unit is a centralized, high-performance lighting electronic platform optimized for Marelli's advanced EliteLight portfolio.

Unique in the market, it integrates all application software – including a fully flexible graphic rendering algorithm – and eliminates requirements for an external domain controller. Network management is fully configurable across vehicle model lines, allowing OEM-specific adaptation without hardware or software redesign.

The modular toolkit enables flexible PCBA population with one fan output, several microcontroller flash options, and a single compact housing variant delivering up to 60 W total LED output power – meeting global technical and homologation requirements, including for China.

Combining state-of-the-art control logic with high efficiency, the Driver Unit achieves best-in-class affordability, improved sustainability, a 15% weight reduction compared with similar driver units, and significantly shorter production cycle times for faster time to market.

Need to know

- Fully scalable software configuration
- Integrates all application software
- Most affordable in class
- 15% lighter than comparable units

ProLight Rear

From homogeneous, sculptural lines to expansive illuminated surfaces and hidden-until-lit signatures, the ProLight Rear platform gives OEM designers freedom to create eye-catching rear lighting designs with affordable technology. Modular platforms are key, minimizing development effort and investment while retaining the flexibility to tailor dimensions, optical configurations, surface treatments and signature effects to project-specific requirements.

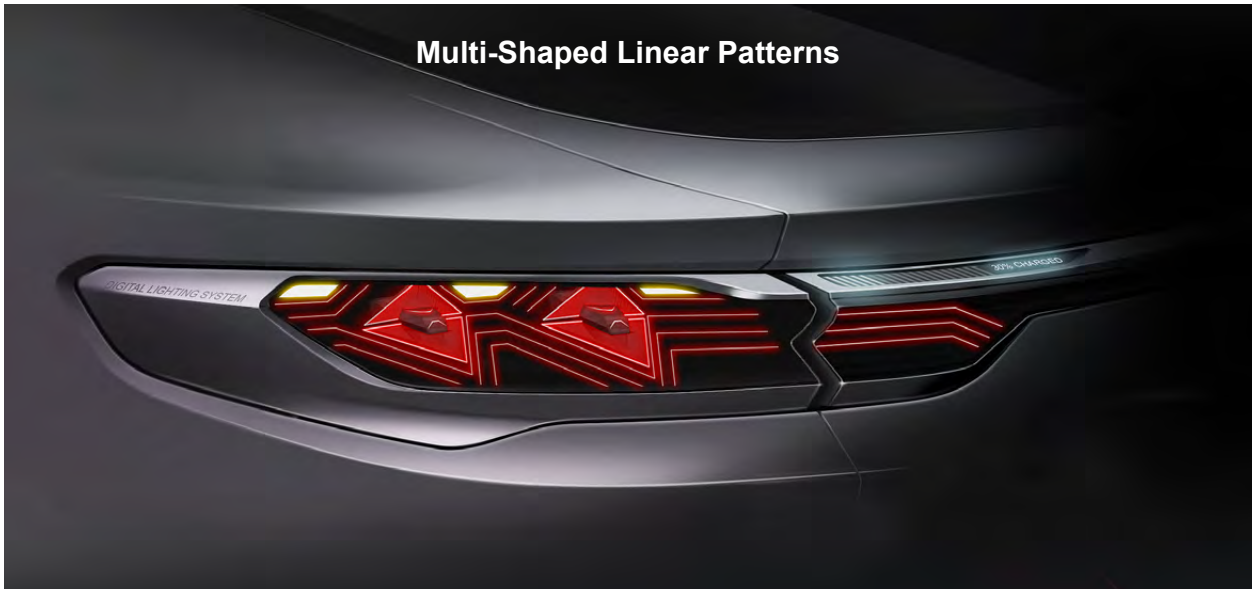
Thin Lit Lines (Chip-on-Board MiniLED)

Offering greater versatility and performance than light-guide technology – and better efficiency and packaging than optical fiber and laser systems – Thin Lit Lines on the Pro platform provide distinctive, premium rear light styling affordably.

Direct-emissive light output from the LED array allows extremely sharp contrast lines, or – with an optional diffusive top layer – soft and uniform illumination. The light lines can follow gently contoured surfaces, offer subtle depth variation, and be arranged in horizontal and vertical layouts.

Signal functions can be flawlessly embedded – Marelli's latest demonstrator is the world's thinnest at just 1.1 mm thick.

Homologated to global standards, Thin Lit Lines is also transferable to interior automotive applications, supporting unified lighting signatures throughout the vehicle.



Need to know

- Sharp contrast lines with optional diffusive top layer
- Horizontal or vertical layouts
- Bendable to surface contours
- Ultra-thin 1.1 mm signal functions available

Flat Lit Surfaces (Segmented)

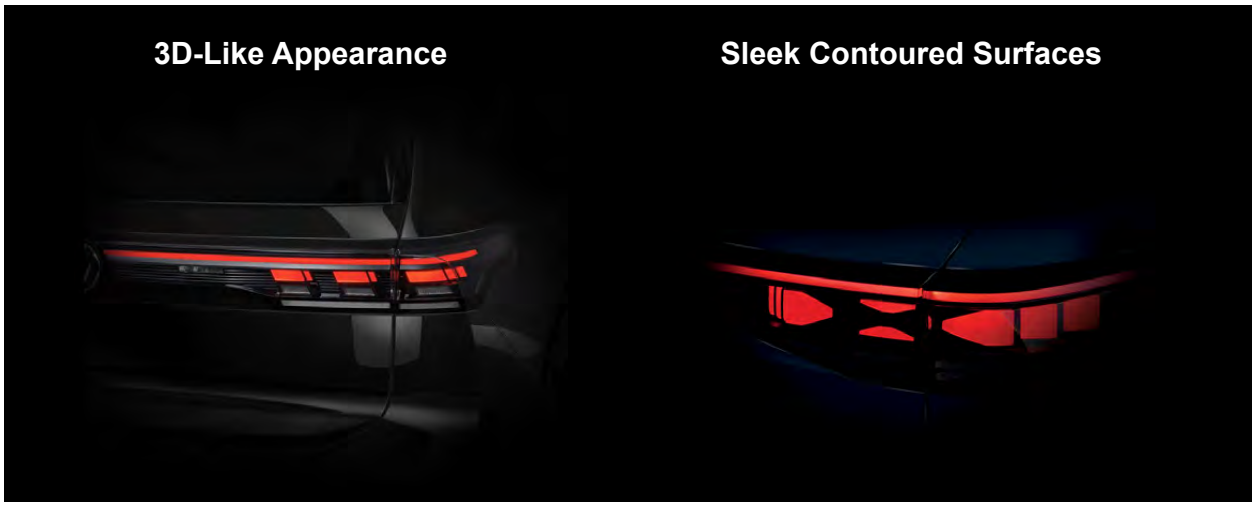
Delivering visual uniformity across extended areas, our FoliaLED-based Flat Lit Surfaces complement the sharper edges and linear aesthetics of Thin Lit Lines to offer exciting new lighting design opportunities.

A Marelli innovation, the technology combines optical quality and ultra-thin, homogeneous illumination comparable to OLED lighting with reduced cost and a simplified architecture. Extensive standardization dovetails with flexibility in both mechanical and optical design. Using standard LEDs with edge in-coupling and a light curtain or diffusing optics, Flat Lit Surfaces delivers continuous, uniform illumination across the entire lighting surface.

By positioning LEDs along the edge of segmented zones and optimizing the optical pathway, distinct areas maintain a high homogeneity and can be controlled independently for animation or dynamic signaling without the complexity of multilayer LED arrays. Decorative exterior films, textures and color finishes enable extensive vehicle-specific differentiation, and the technology is adaptable to contoured surfaces.

Flat Lit Surfaces' efficiency extends to packaging, reducing components from the eight parts typically found in competitor systems to just three – the frame, light curtain and reflector – achieving an overall module thickness of around 4 mm.

Homologated to Economic Commission for Europe (ECE), China Compulsory Certification (CCC) and Society of Automotive Engineers (SAE) standards, Flat Lit Surfaces provide a scalable, cost-efficient solution for automotive designers to create visually distinctive illuminated surfaces.



Need to know

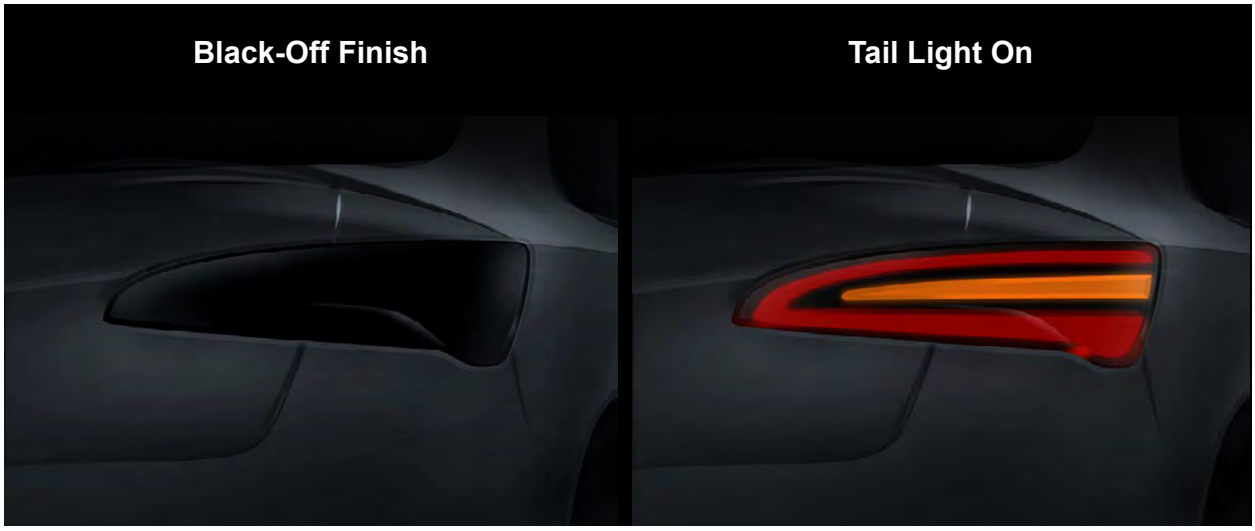
- Cost-effective alternative to OLED
- Edge in-coupled LEDs with light curtain or diffusing optics
- Tail, stop, turn functions
- Uniform illumination across entire lighting surface

Hidden Light (Black-Off Appearance)

Hidden Light provides hidden-until-lit illumination for a sleek black appearance that integrates smoothly with exterior body surfaces. A cost-effective alternative to the Elite platform, its modular architecture can be adapted to project-specific dimensions, optical layouts and mechanical fixations, while maintaining best-in-class high photometric performance.

The system supports tail, stop, turn, fog and reverse functions, and enables 2D or 3D-like visual effects, with elements arranged horizontally, vertically or in combination for flexible styling execution.

Achieving four times the photometric efficiency of our first-generation concept, Hidden Light offers higher visible light output using the same power input, representing a sustainable solution for stylish rear lighting signatures.



Need to know

- Black-off appearance
- 4x improvement in photometric efficiency vs first generation
- Tail, stop, turn, fog and reverse
- 2D and 3D visual effects

3D Static Effect

Our 3D Static Effect creates a 3D hologram-like rear visual signature to support brand identity and differentiation by vehicle line or trim.

Light from standard edge in-coupled LEDs enters a single-layer plate containing tens of thousands of optical elements that refract and redirect light. This produces both perceived depth within the tail lamp and the illusion that the image is floating above it.

An algorithm converts the designer's graphic into precise micro-lens geometry, which is formed directly into the plate surface during molding, eliminating requirements for films, printed layers and other secondary elements.

Homologated to ECE and SAE standards, Marelli's 3D Static Effect offers flexible mechanical and optical design configurations, and simplified integration compared with multi-layer optical alternatives.

Need to know

- Edge in-coupled LEDs and micro Fresnel lenses
- 2D or 3D rear visual signatures
- Algorithm converts design intent to production reality

EliteLight Rear

The EliteLight Rear platform delivers state-of-the-art illumination and brand-defining visual signatures to elevate flagship models to new heights. Showcasing world-first innovations, Marelli's most advanced rear lighting platform unites advanced optical materials, ultra-fine illumination control and software-enabled dynamic effects with cutting-edge, production-mature platforms.

Laser Wire

Marelli's Laser Wire rear lamp is a world-first application of red laser technology in rear automotive lighting, introducing exceptional optical clarity and visual distinction to series production. Recognized as a CES 2024 Innovation Award Honoree and already applied in premium OEM applications, the system uses a standardized red laser diode as the light source, with the laser light edge in-coupled into an optical sidelight fiber, forming a Laser and Optical Fiber rear lamp architecture adaptable in both length and diameter.

This flexible architecture enables ultra-thin, laser-based light signatures of approximately 1.2 mm and supports differentiated signature designs across vehicle lines while reducing development effort.

Laser technology provides additional visual distinction through a characteristic speckle appearance, created by the diffraction of light within the fiber, to deliver a signature effect that cannot be replicated with LED-based solutions.

Precision optical coupling ensures consistent luminance and uniformity, while real-time closed-loop monitoring provides Class 1 eye safety, automatically shutting down the source if any deviation or leakage is detected.

Delivering thinner and more refined lighting signatures than light guide-based alternatives, with power consumption approximately three times lower than comparable LED solutions, Laser Wire technology offers a premium, high-definition lighting identity with proven series-production maturity.

Need to know

- World-first red laser rear-lighting application
- Ultra-thin laser wire elements ~1.2 mm
- Adaptable length and diameter
- Signature speckle effect
- Real-time closed-loop monitoring

Flat Lit Surfaces (Digital)

Flat Lit Surfaces brings Digital OLED technology to series-production rear lighting with 2000-plus nit luminance, industry-first 2.5D flexibility and centralized domain control. It enables vivid, differentiated signature designs while supporting a streamlined, software-ready electrical architecture.

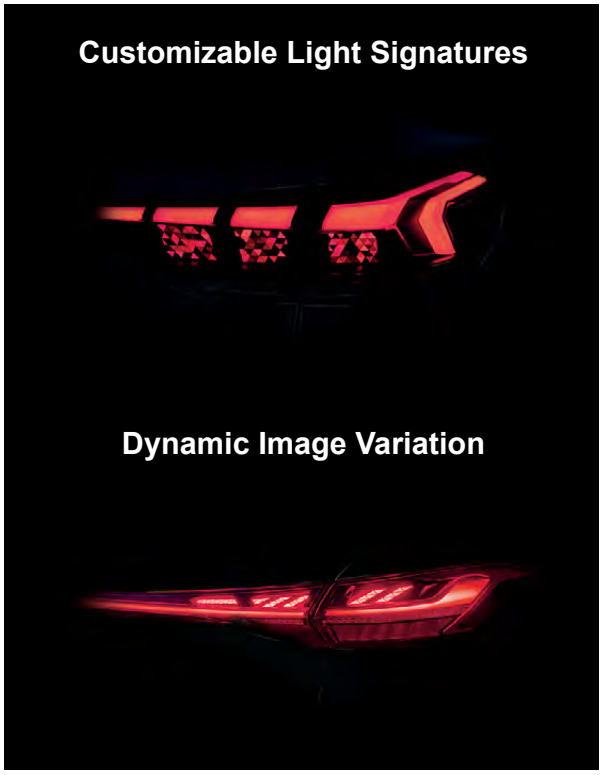
The system uses individually addressable segments to deliver animated turn, tail and stop signatures, with more than 100 customizable patterns deployable across vehicle lines and trims. Designs can also be adjusted in-vehicle or via smartphone apps to support model personalization and user experience features.

A segment pitch of less than 0.1 mm creates a continuous, uniform light surface with no visible segmentation, while 2.5D bendable construction allows the illuminated surface to follow gentle curvature within the rear lamp assembly. Fixation and encapsulation are engineered to maintain performance under thermal, vibration and mechanical stress for a 15-year service life. White, amber, red and super red color options support both functional signaling and signature styling, with smooth, precise animation.

Daytime visibility improves by around 50% versus earlier OLED generations, and because the OLED panel itself is the emitting surface with a typical thickness of around 1 mm, Flat Lit Surfaces offers significant weight and packaging advantages versus LED-based assemblies.

Centralized domain control brings additional benefits, with streamlined system integration and support for future SDV functions, including Vehicle-to-Everything (V2X) communication for hazard and proximity signaling.

Meeting or exceeding global homologation requirements, Flat Lit Surfaces provides a mature, scalable pathway to advanced rear lighting signatures.



Need to know

- Animated turn, tail, stop functions
- White, amber, red, super red
- 2.5D bendable construction
- 100+ customizable patterns
- 10 ms refresh rate
- Centralized domain control

Hidden Light (Smartphone-Off Appearance)

Hidden Light delivers a seamless hidden-until-lit appearance for flagship models, achieving a sleek, monolithic black surface inspired by smartphone design in its unlit state and homogeneous 2D and 3D rear-lamp signatures when illuminated.

High-power LEDs are mounted on a PCB within an aluminum frame to manage the greater thermal loads associated with a high-opacity outer lens and the diffusing film essential for a deep black unlit appearance.

Tail, stop, turn, fog and reverse functions can all be integrated, with signature graphic elements arranged horizontally, vertically or in combination.

Production-mature and homologated to ECE, CCC and SAE standards, Hidden Light is ideally positioned for luxury model lines that demand refined aesthetics and minimalist surfacing.

Need to know

- Monolithic sleek black surface
- Tail, stop, turn, fog, reverse functions
- 2D and 3D illuminated designs
- Horizontal or vertical layouts

3D Dynamic Effect

Marelli's 3D Dynamic Effect brings software-defined visual content to rear lighting, combining playful graphical elements inspired by Tokyo's forced-perspective billboards with homologation-compliant core lighting functionality.

A high-density matrix deploys miniLEDs in 0.2 to 1.0 mm package sizes, with a selectable pitch of approximately 0.5 to 1.5 mm, allowing resolution, brightness, performance, power consumption and cost to be tuned to individual project needs. RGB, red-only or all-white configurations support tail, stop, DRL and position lighting in compliance with ECE, SAE and CCC standards.

The 3D Dynamic Effect uses pixel-level illumination control to create animated signatures, detailed graphic effects and brand logos. This complements the continuous surface illumination of Flat Lit Surfaces and integrates with both ProLight and EliteLight rear-lighting platforms, with support for software-defined animation streaming and V2X visual communication.

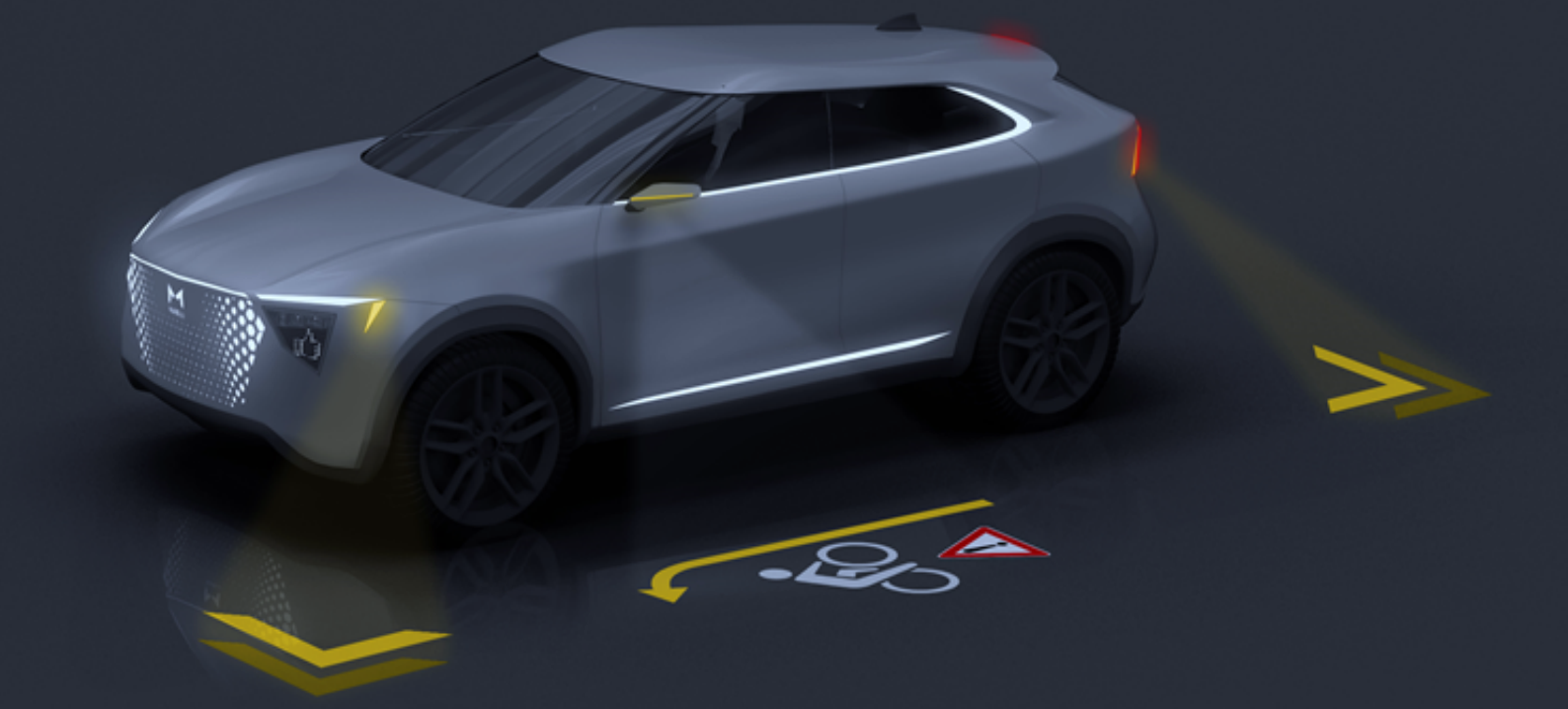
A standardized Marelli Driver Unit is available as a production-ready control solution, with optional 10BASE-T1S Ethernet providing high-bandwidth integration into vehicle architecture. The result is a versatile, production-ready solution to innovative 3D signatures, software-defined content, and scalability across model lines.

Need to know

- High-density miniLED matrix
- RGB, red, white
- Tail, stop, DRL, position light
- SDV animated streaming
- V2X visual communication

ProLight 360

Marelli's ProLight 360 platform gives design and engineering teams the creative tools to deliver unified lighting signatures and animation sequences around the full vehicle exterior – including ground projection of welcome and warning symbols, and illuminated logos. Developed from Marelli's standardized optical and technical foundations, it facilitates affordable trim differentiation with the versatility to adapt to model-specific requirements.



Near-Field Ground Projection

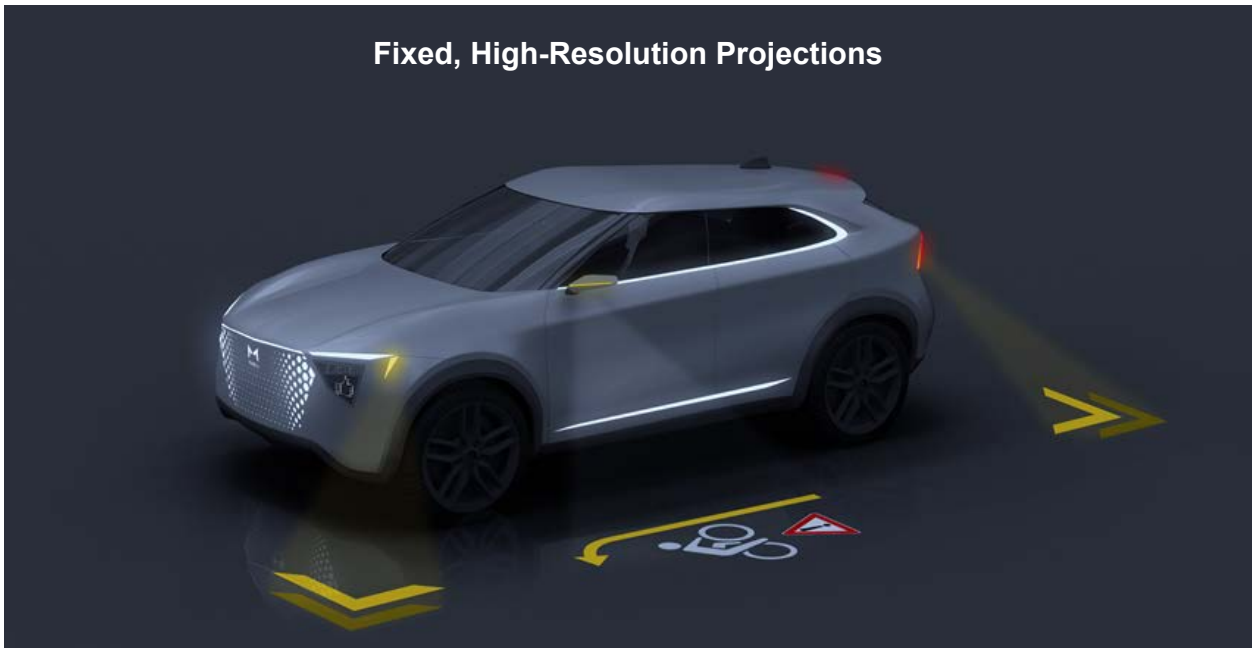
Marelli's modular Near-Field Ground Projection directs controlled light patterns onto the road surface for welcome interactions, brand signatures and functional signaling. The ProLight 360 platform offers two variants – Static and Semi-Dynamic – which can be integrated into headlamps and tail lamps, as well as in doors, mirrors and underbody locations.

Control is handled through the in-lamp Driver Unit with or without a microcontroller, and can be orchestrated to create unified 360° lighting projections with minimal system complexity.

Static Ground Projection

Fixed, high-resolution projections include logo and light-carpet effects, as well as turn indicator and reverse parking guide lines, all customizable to brand-specific designs and user personalization to enrich the function.

With its compact packaging and flexible integration, Static Ground Projection provides a scalable solution to lighting projections with minimal system complexity and cost.



Need to know

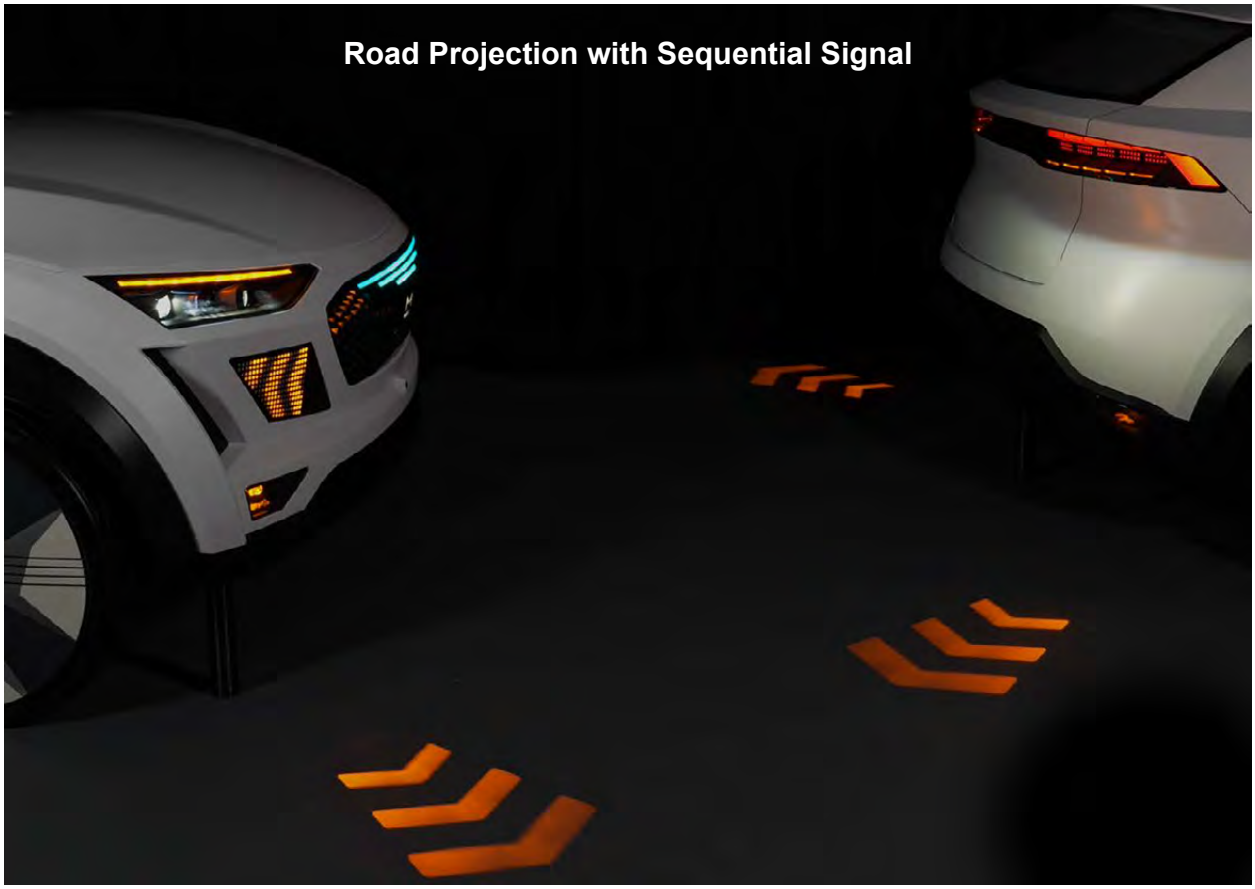
- Fixed, high-resolution projections
- No stray light or double images
- Homogeneous appearance
- No colored edges

Semi-Dynamic Ground Projection

Marelli was among the first to bring Semi-Dynamic Ground Projection to series production, enabling welcome signatures and white or amber Signal Road Projection (SRP) cues to be packaged within one compact, cost-efficient module.

A three-LED architecture with a gobo-style pattern element projects basic images such as the turn indicator or reverse warning, with vivid luminance of more than 2400 lx.

In its most affordable configuration, Semi-Dynamic Ground Projection can be integrated with headlamp and tail-lamp optics to enable re-use of the existing electronics architecture and minimize system complexity. Where higher graphic clarity is required, a dedicated micro-projection module can be specified, supporting sharper definition and installation around the vehicle.



Need to know

- White reversing and amber turn indicator road projections
- Single compact module
- Optional higher-definition module for sharper imagery
- 3 LEDs for sequential animation

Illuminated Logo

Capitalizing on the regulation evolution permitting large illuminated front and rear logos, Marelli's Illuminated Logo combines distinctive brand signatures day and night with the option to integrate a radar and heating functionality. The result is a visually cleaner appearance, enhanced radar sensor protection, and consistent Advanced Driver Assistance Systems (ADAS) performance in wintertime.

Edge in-coupled LEDs inject light into a thin optical layer behind the front or rear logo for homogeneous lighting and a consistent white or red color in light-on states, and white or metallic light-off states.

Thanks to Marelli's efficient simulation toolchain, the controlled optical stack thickness ensures a low attenuation in production, meeting the typical performance requirements for reliable sensor operation.

Compliant with ECE, CCC and SAE standards, Marelli's Illuminated Logo leverages standardized end-of-line measurement and wire embedding tooling for cost-efficient deployment across vehicle lines.

Need to know

- Edge in-coupled LEDs for homogeneous illumination
- White color match for both light-on and light-off
- Optional metallic appearance for light-off
- Rear emblem possible

EliteLight 360

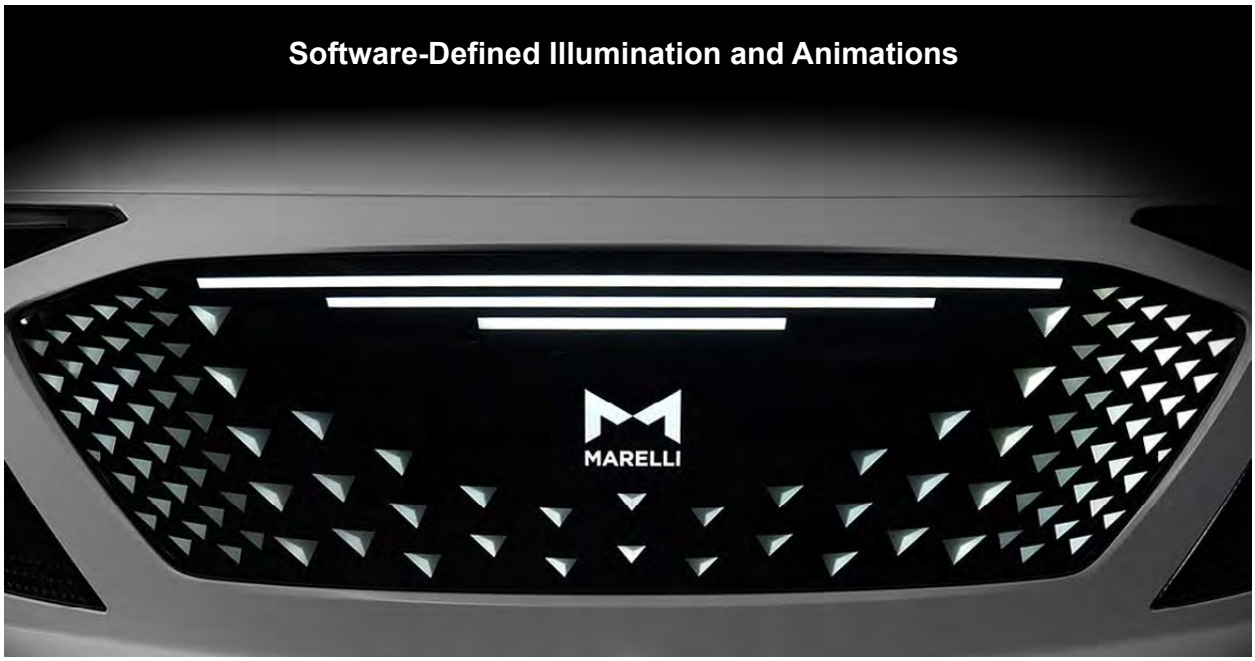
EliteLight 360 sets the benchmark for advanced 360° lighting customization, optical V2X communication technologies and SDV content. Flexible to program-specific requirements, the platform features illuminated panels, displays and world-first innovations such as dynamic near-field ground and wall projection. Modular optical foundations and standardized E/E architectures reduce investment and accelerate time to market.

Illuminated Panel

Marelli's Illuminated Panel technology enables illumination to span the full width of the vehicle front – and elsewhere if regulations allow – enhancing communication and pedestrian safety. Software-defined illumination modes and animations are updateable over-the-air. The backlit panel uses a clear outer lens, with the illumination pattern created either through a translucent white patterned layer or patterns of a decorative foil – the latter requiring no additional re-tooling for small-series production.

The opportunity to add a polyurethane outer coating ensures surface durability. Natural UV and heat activates a self-healing chemistry to restore minor scratches and stone chips for long-term optical clarity, maintaining a pristine appearance and vehicle resale value. Additional benefits include a 60% reduction in CO_2 emissions and 99% lower Volatile Organic Compounds (VOC) release, simplified manufacturing that no longer relies on access to a hard-coating production line, and improved consistency.

Area-specific adjustment of metal coatings creates radar-transparent regions, supporting the integration of ADAS sensors behind the panel with low attenuation. The illuminated panel can also incorporate position light and dynamic turn indicator functions, with discrete zones defined in white, amber or – to communicate autonomous operation – cyan.



Need to know

- Backlit panel with white, amber, cyan illumination
- Functional position light photometry
- Radar integration

Integrated Display

Marelli's Integrated Displays can be realized with either OLED-TFT or LED-based technology, and integrated anywhere around the vehicle. Meeting functional signaling requirements and taillight photometric standards, they support enhanced optical V2X communication technologies and dynamic, interactive SDV content – with potential new revenue streams unlocked via additional downloads.

Marelli is first to present full hardware and software integration for OLED-TFT active-matrix displays in the automotive industry – offering OEMs an end-to-end solution with accelerated development and 30% cost savings versus miniLED technology. Compatible with domain control and optimized for state-of-the-art zonal SDV architectures, OLED-TFT Integrated Displays enable precision sequencing of graphics within the lamp and coordinated visual orchestration around the vehicle.

Ultra-thin (<2 mm) and with a high pixel-density pitch of ~0.2-0.4 mm, red OLED-TFT Integrated Displays deliver full styling freedom and precise animation control. Future 360° deployment is under development.

A modular electronic architecture supports scalability across vehicle programs, with standardized display modules and interfaces available to further reduce investment.

Marelli is first to combine the styling freedom of direct-emissive miniLEDs with network-integrated signaling functionality. Easier to integrate with existing vehicle architectures, miniLED brings the versatility of red, white or RGB illumination for animated tail, stop, DRL and position light logos, along with in-lamp messaging. It supports the same SDV-ready, V2X-compatible electronic architecture as OLED-TFT, while a standardized miniLED display Driver Unit significantly accelerates time to market.

Need to know: Integrated Display OLED-TFT

- Functional signaling and tail photometry
- Available in red
- Thickness <2 mm
- Streaming capability
- SDV content/V2X communication Human Machine Interface (HMI)

Need to know: Integrated Display MiniLED

- Red, white or RGB
- Animated tail, stop, DRL, position light logo functions and in-lamp messaging
- Standardized miniLED display Driver Unit

Dynamic Ground Projection

Marelli's Ground Projection portfolio offers state-of-the-art 360° lighting animations and projections to improve functional safety and enrich user experiences. Two Dynamic options are available – a DMD solution offering full-color dynamic ground and wall projections, and a microLED alternative optimized for higher brightness and daytime visibility.

Developed on standardized platform architectures to support scalable integration and competitive system cost, both can be packaged flexibly in head and tail lamps, doors, mirrors and underbody locations.

Software-controlled sequencing enables full 360° exterior lighting animations coordinated around the vehicle, with support for software-defined content that can be updated over-the-air – enriching user interaction with the potential to create additional OEM revenue streams.

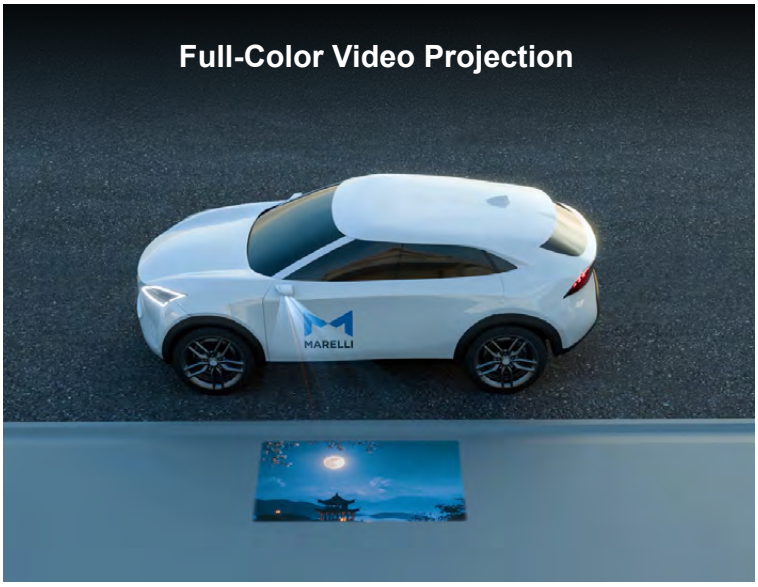
Already in series production, Dynamic Ground Projection based on DMD technology can be provided as an aftermarket pico-projector option compatible with standard door courtesy lamp apertures and connectors. This enables OEMs to trial customer uptake as part of an aftermarket accessories program, and is customizable via smartphone app or infotainment system.

Marelli's solution integrates a world-first combination of wall and ground projection in a compact, efficient single-lens design. Offering market-leading cost competitiveness, the digital light-processing technology is also compatible with in-car use.

A DMD-based micro-projection engine delivers full-motion RGB graphics or white projections for dynamic welcome animations, expressive brand projections, and functional communication sequences.

Wall projection introduces new opportunities including garage-wall parking guidance and welcome animations.

Fast activation (<100 ms) and rapid content transitions (<50 ms) support seamless sequencing between animations.

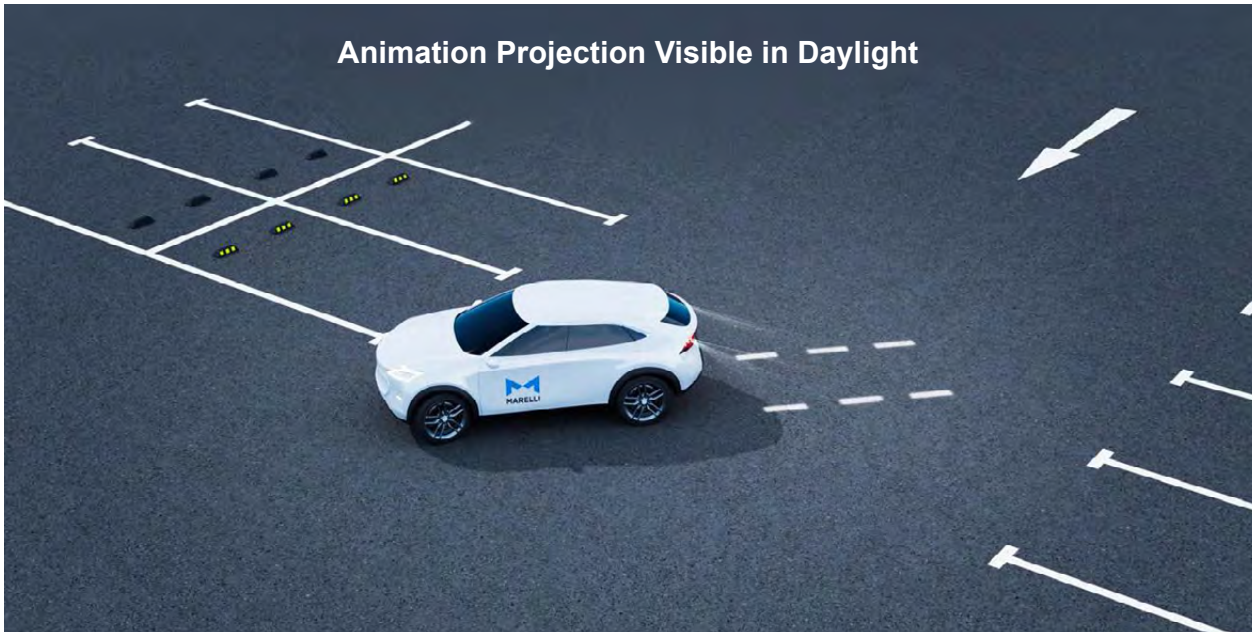


Need to know

- Full-color dynamic ground and wall projections
- Customizable projection area
- Fast activation (<100 ms) and content change (<50 ms)
- SDV content

Daytime Dynamic Ground Projection

Daytime Dynamic Ground Projection delivers full dynamic white projection with optimized daylight visibility. Using a production-mature microLED light engine, the technology supports up to 6000 lx output with 60% daytime visibility and the cost efficiency, robustness and accelerated time to market of a proven architecture. A compact short-lens optical design allows the projection area and packaging to be tailored to program-specific styling requirements.



Need to know

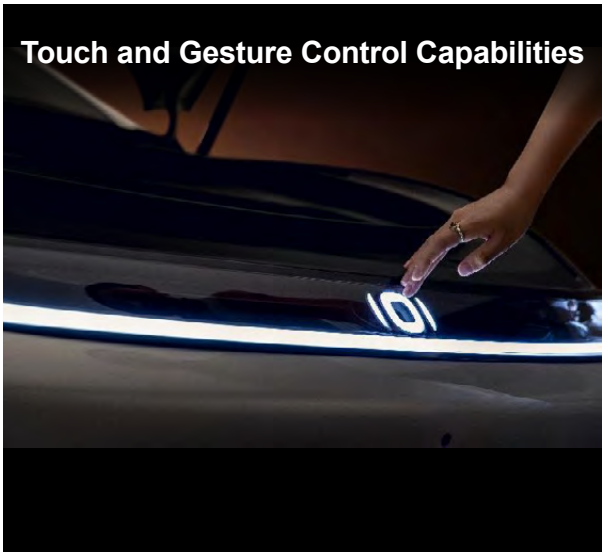
- Full dynamic white projection
- 60% daytime visibility
- Short optical lens system

Integrated Sensors and HMI

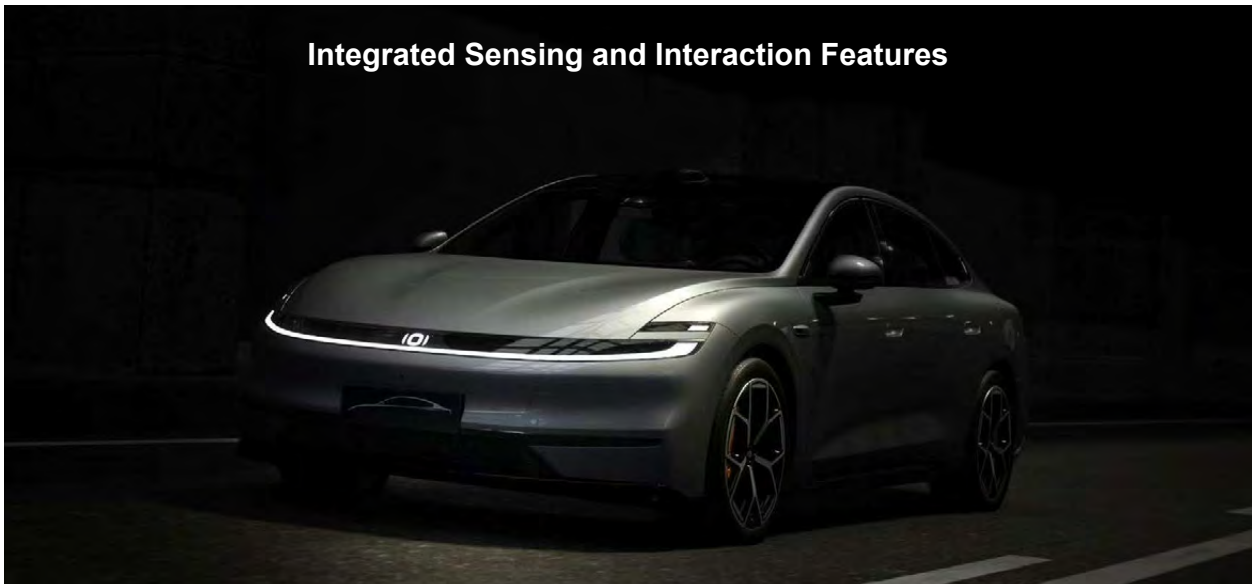
Engineered to optimize production-line efficiency, Integrated Sensors and HMI technology consolidates multiple sensing and interaction systems within a single lighting assembly such as Marelli's Thin Corner-to-Corner Headlamp.

This deep integration eliminates the need for additional assembly stations and operators, and reduces assembly complexity and vehicle weight through simplified harnesses and the elimination of brackets and connectors.

World-first in-lamp touch sensor integration provides control capabilities, such as opening the engine compartment with a knock.



Embedding ADAS radar sensors within the fixed enclosure of a front or rear lamp improves aesthetics, offers a higher mount for a superior view of the vehicle surroundings, and eliminates the paint-related signal attenuation common in bumper-mounted systems.



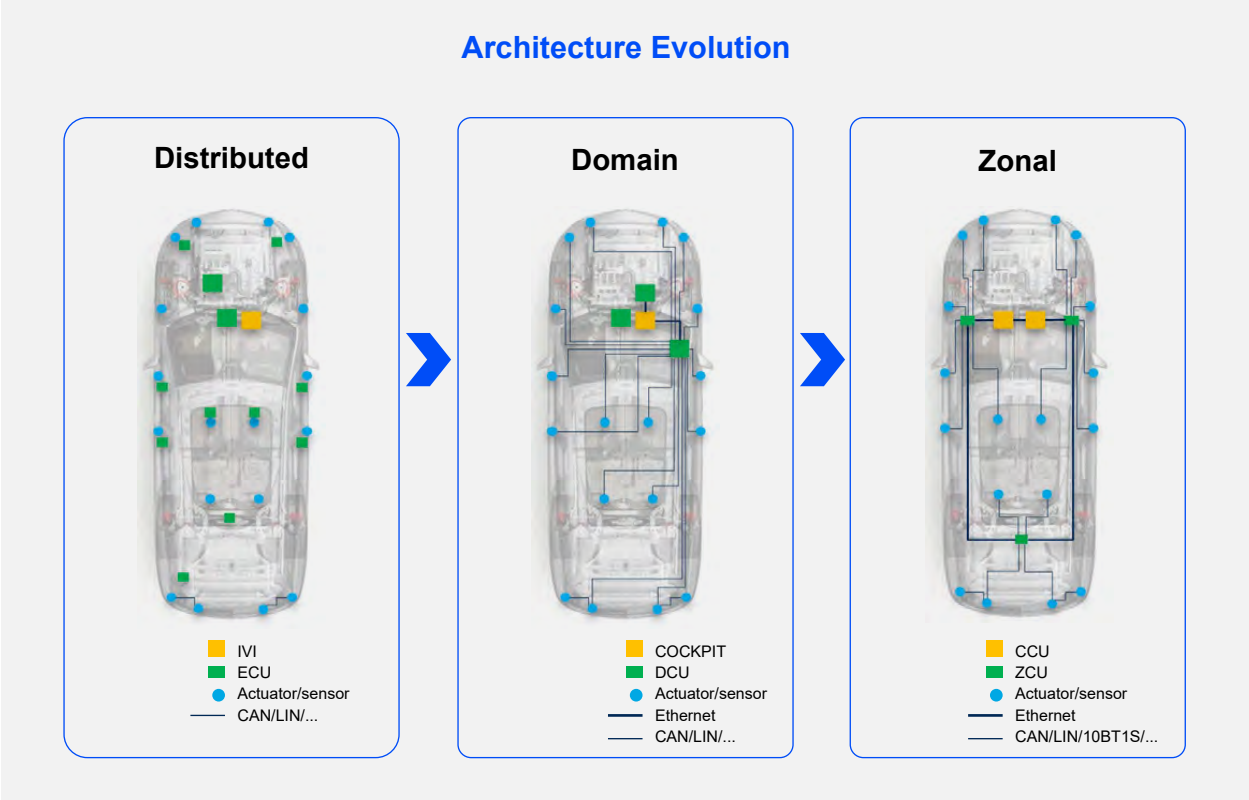
Need to know

- Combines sensing and interaction features in one lamp
- Supports touch or gesture-based user actions
- Streamlines assembly and components
- Improves radar performance by eliminating paint-related signal attenuation

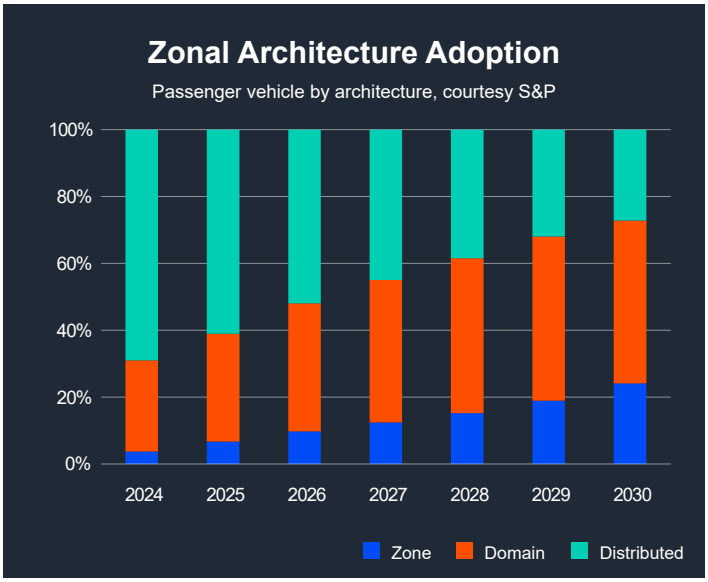
Pro and EliteZone

Leveraging expertise developed since its first zonal technologies debuted in 2022, Marelli's tiered LeanZone, ProZone and EliteZone platforms support the transition to centralized E/E architectures and the SDV through modular, scalable designs that accelerate time to market and adapt to evolving OEM requirements.

All three platforms draw on Marelli's market-leading position in vehicle electronics, system integration and unrivaled cross-domain expertise to consolidate multiple vehicle functions into geographic zones. Each zone is connected to the vehicle network via an Ethernet backbone link for data transmission. This approach reduces vehicle weight, cost and system complexity through shorter, more localized CAN/LIN lines and up to 75% fewer ECUs, while enabling higher-bandwidth and lower-latency communication across the network.



Additionally, the Marelli Advantage platform features a portfolio of over 50 stand-alone software applications — available or in development — that support a wide range of vehicle control functions, offered independently of hardware.



While the entry-level LeanZone supports an initial step into zonal architectures through consolidation of complementary domains such as body and (e-fuse-based) power distribution, ProZone and EliteZone introduce a fundamentally different software-defined architecture. With significantly higher processing capability and hypervisor-enforced domain isolation, they enable safety-critical and non-safety-critical workloads from multiple domains to run in parallel within the zone.

Together, ProZone and EliteZone play a critical role in managing the growing complexity of modern E/E architectures in highly differentiated vehicles, where electrification, connectivity, advanced driving assistance and software-defined functionality place increasing challenges on legacy architectures.

Co-creation is central to Marelli's zonal architecture philosophy. As an increasing number of domains are consolidated within zones, Marelli welcomes a collaborative approach across businesses and partners to meet common objectives. With S&P Global forecasting that around 22% of all vehicles will adopt zonal architectures by 2030, ProZone and EliteZone are ideally positioned to support this large-scale transition.

ProZone

Built on Infineon AURIX™ TC48x/TC4x microcontrollers, ProZone is Marelli's Zone Control Unit (ZCU) that provides the processing capacity and safety mechanisms to manage up to three mixed domains simultaneously within the zone. The platform combines MCU-integrated Ethernet capability, including low-latency 10BASE-T1S, CAN and LIN for in-zone communication.

Virtualization enables the isolation and simultaneous operation of safety-critical and non-safety critical operating systems up to ASIL D standards. A Data Routing Engine (DRE) manages deterministic, low-latency data exchange between domains, edge nodes and the wider vehicle network, supporting the execution of extremely time-sensitive applications.

ProZone also introduces Remote Control Protocol (RCP), which allows real-time control of sensor and actuator logic to be centralized in the ZCU or even in the Central Computing Unit (CCU) rather than distributed over multiple satellite MCUs. Proven through safety-critical applications such as anti-pinch control, which requires end-to-end latency of approximately two milliseconds, RCP enables the implementation of simplified, MCU-free modules, with sensing and actuation retained locally.

Additional latency-dependent functions located in the same area can also migrate to the zone. For instance, audio amplification can be consolidated alongside anti-pinch control in the zone, with virtualization maintaining the appropriate isolation between software stacks.

By reducing ECU count, centralizing software, isolating domains sharing the same ZCU and enabling them to be updated discretely over the air, ProZone optimizes system integration and lifecycle management while reducing E/E architecture complexity.

Need to know

- 3 domains
- Up to 3 kDMIPS
- 100MB/1000MB Ethernet
- 20 CAN & LIN
- Hypervisor
- Up to ASIL D
- Remote Control Protocol (RCP) client for MCU-free edge nodes
- Audio Video Bridging (AVB)

EliteZone

EliteZone is Marelli's most advanced ZCU, scaling our ProZone concept to deliver greater processing capability and higher communication capacity, while the dedicated Ethernet switch introduces significantly higher bandwidths.

Designed around state-of-the-art Infineon AURIX™ TC4Dx/TC4Zx microcontrollers, EliteZone supports up to four mixed domains running simultaneously within the zone. Hypervisor-based virtualization ensures robust partitioning between operating systems, enabling the coexistence of safety-critical and non-safety-critical workloads to ASIL D certified standards.

With up to 6 kDMIPS of processing performance, dual-port Gigabit Ethernet and additional Input/Output (I/O) capacity, EliteZone builds in additional headroom for higher feature integration and more demanding real-time applications within a single ZCU.

Crucially, EliteZone integrates dedicated Ethernet switch hardware that operates independently of the zonal MCU.

This enables higher bandwidths, more ports, and lower power consumption compared with MCU-based Ethernet, particularly as the number of connected devices increases.

By simplifying the most complex electrical architectures in feature-rich luxury vehicles, while optimizing performance and network coordination, EliteZone represents the ultimate expression of Marelli's zonal architectures.

Need to know

- 4 domains
- Up to 6 kDMIPS
- 2 port GB Ethernet with switching
- 20+ CAN & LIN
- Hypervisor
- Data Routing Engine
- Up to ASIL D
- Remote Control Protocol (RCP) client for MCU-free edge nodes
- Audio Video Bridging (AVB)

Pro and EliteCore

Marelli pioneered the first series-production integrated cockpit solution in 2020, enabling automakers to manage both digital instrument clusters and In-Vehicle Infotainment (IVI) on a single platform.

Building on this experience, Marelli created the modular Core platform family. Today, the Core line-up of Central Computing Units (CCUs) – LeanCore, ProCore and EliteCore – leverages this foundation, together with learnings from millions of units manufactured to date, to deliver off-the-shelf solutions for software-defined vehicles.

Built on Marelli's fifth-generation E/E architecture – and offering capability far beyond entry-level LeanCore – Pro and EliteCore support multiple displays and cameras with advanced graphics, superior responsiveness, AI-enabled applications and consistent performance in demanding thermal conditions.

A high-performance CCU consolidates ECUs and streamlines hardware, the Board Support Package and middleware into a single system-on-chip (SoC), managing multiple operating systems through hypervisor technology to ASIL B safety standards.

Both architectures enable cloud connectivity to integrate additional services and applications. Phone mirroring via Android Auto™ and Apple CarPlay™ is also supported.

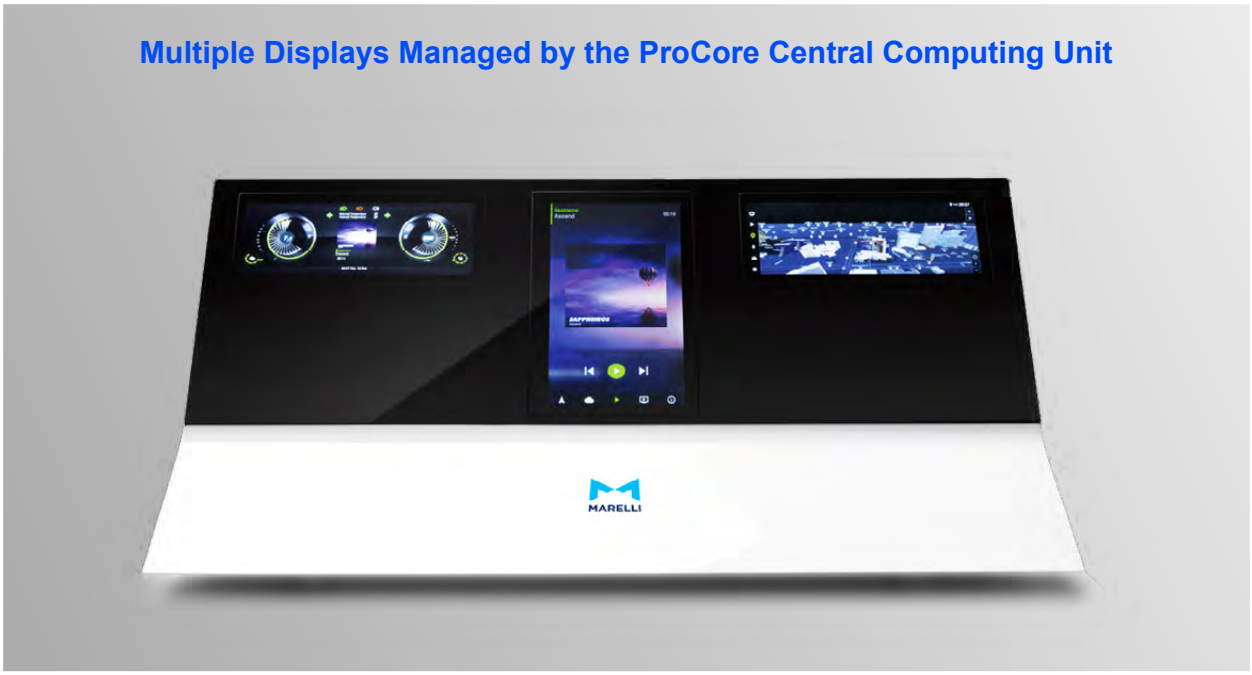
ProCore

ProCore balances high performance with cost-efficiency and is ideal for EVs and vehicles prioritizing sustainable innovation. Unifying multiple ECUs in a single controller, it can manage up to four displays and five cameras – including driver monitoring systems.

A fourth-generation Qualcomm Technologies 7255 system-on-chip (SoC) provides higher Central Processing Unit (CPU) and Graphics Processing Unit (GPU) capability to support advanced display management and software functionality beyond that of LeanCore. An embedded Neural Processing Unit (NPU) introduces AI-driven functions such as natural-language recognition and driver monitoring, with headroom for further AI-enabled features without costly hardware redesigns.

The NPU allows the CPU to devote more capacity to the resource-intensive tasks of additional screens. With the option to relocate audio DSP processing into ProCore and distribute audio into the zones, it also enables more sophisticated control of advanced audio features and the capability to update them over the air.

Multiple Displays Managed by the ProCore Central Computing Unit



Need to know

- Up to 4 displays and 5 cameras
- Qualcomm Technologies 7255 processor
- 126 kDMIPS with 840 GFLOPS
- Integrated audio DSP
- Hypervisor
- 3 CAN
- ASIL B

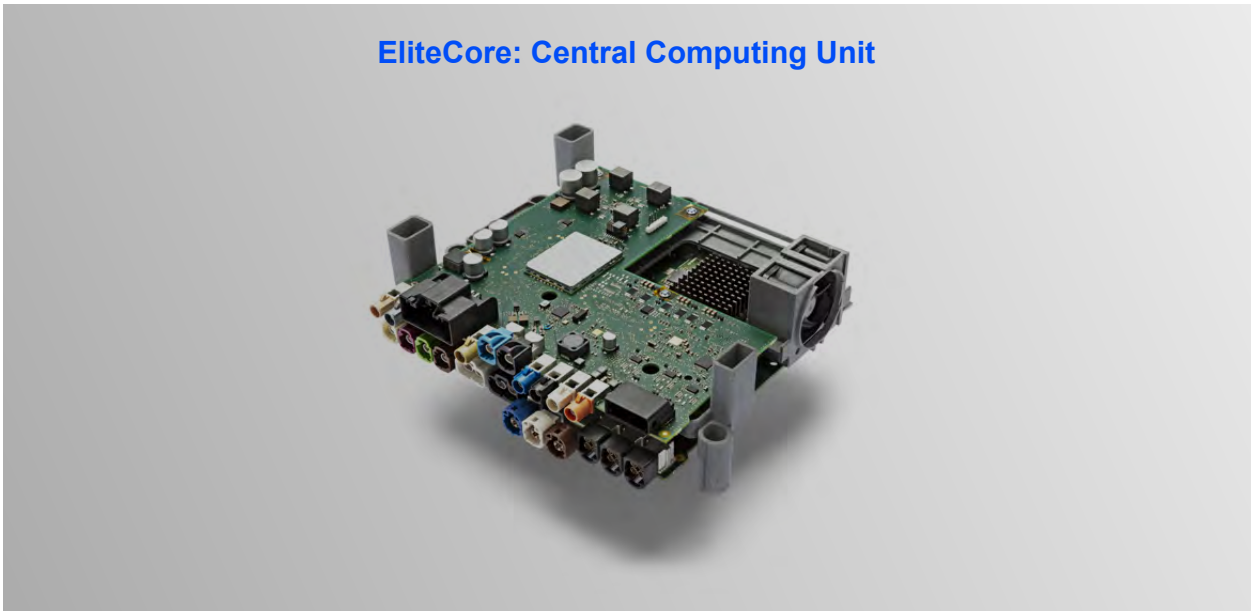
EliteCore

EliteCore stands at the forefront of zonal architectures, combining industry-first innovations with unparalleled computing capabilities and next-generation in-cabin technology experiences for luxury and premium brands.

A state-of-the-art Qualcomm processor with 230 kDMIPS and 6 TFLOPS – more than double the feature capability of ProCore – supports up to 12 displays and 12 cameras, providing performance for richer graphics, higher-resolution rendering and greater synchronization of workloads without compromising responsiveness.

EliteCore is designed to host a wider set of ADAS level-2 functions, including enhanced driver monitoring, pedestrian and cyclist detection, and advanced surround-view visualization. More sophisticated GPU and NPU hardware support the greater processing demands of these applications while maintaining stable performance under multiple heavy workloads and thermal stress.

Leading the way in cockpit-domain consolidation, EliteCore has the capacity to manage the most advanced in-cabin infotainment systems and support the continued evolution of software-defined vehicle technologies.



Need to know

- Up to 12 displays and 12 cameras
- Qualcomm Technologies 8295 processor
- 230 kDMIPS with 6 TFLOPS
- Integrated audio DSP
- Hypervisor
- 3 CAN
- ASIL B

ProConnect

Marelli's ProConnect platform is a cost-optimized, scalable Connected Cockpit Module designed to integrate with centralized and zonal E/E architectures. It consolidates cluster, IVI, 4G/5G telematics, e-Call and a Driver Monitoring System into a single module, supporting four displays and six cameras while reducing system complexity and cost. ProConnect provides WiFi, Bluetooth and smart-mobile connectivity, with Marelli pioneering the integration of Affordable 5G RedCap – a telematic solution offering a streamlined version of 5G at a similar cost point as 4G.

A fourth-generation Qualcomm 7255 SoC enables features normally associated with more expensive processors – such as 3D surround-view monitoring – by optimizing software only where it delivers measurable benefits. A customizable daughterboard allows additional interfaces and technologies including Affordable 5G RedCap to be added without redesigning the main SoC board. This significantly reduces engineering expenditure for new vehicle programs and supports the scalability of more advanced features from a common base.

Partnerships with software providers and cloud platforms support software-defined architectures by enabling expanded feature sets and the capability to update them throughout the vehicle lifecycle.

ProConnect also contributes to faster cycle times, lower weight and reduced Bill of Materials (BoM) costs through fewer wiring harness connection points and ECUs.

The result is advanced connectivity and interactive in-cabin experiences with reduced cost, streamlined E/E architectures and support for future scalability.

Need to know

- Qualcomm Technologies 7255 processor
- 120 kDMIPS with 0.9 TFLOPS
- Customizable daughterboard
- Optional Affordable 5G RedCap
- Up to 4 displays and 6 cameras
- WiFi, Bluetooth and LTE connectivity
- Faster cycle times, lower weight and reduced BoM

ProDisplay

ProDisplay supports industry trends toward larger, slimmer, and more capable automotive infotainment and cluster displays. These displays integrate seamlessly with the high-technology, minimalistic designs of today's premium EVs and differentiated vehicle interiors.

Developed on scalable miniLED backlight technology with full-array local dimming, ProDisplay significantly improves the visual clarity, efficiency and packaging of conventional edge-lit LED solutions, while offering an affordable and durable alternative to the slimline designs and high optical performance of OLED.

ProDisplay supports a wide range of screen sizes and formats, from compact central displays to pillar-to-pillar solutions, with the flexibility to integrate curved surfaces and reduced-bezel concepts.

Full-array local dimming is central to ProDisplay's consistent visual performance. By selectively controlling backlight zones, it enhances perceived contrast and color depth, improving legibility in bright sunlight and at different viewing angles, while supporting effective halo management of high-contrast content.

Local dimming also minimizes partial panel illumination when the display is inactive, enabling a seamless black-on-black transition between the screen area and surrounding glass for a more sophisticated appearance.

By dynamically dimming or switching off backlight zones, ProDisplay supports improved power efficiency compared with continuously illuminated edge-lit solutions, alongside robust thermal management. Optional capabilities include Hidden Display and Display Privacy.

Engineered with an optimized backlight unit architecture and scalable deployment of the MiniLED backlight array, ProDisplay balances advanced optical performance with the cost control to support mainstream and premium vehicle programs.

Need to know

- MiniLED backlight full-array local dimming
- Slimline screen with full black appearance when inactive
- High brightness and contrast with deep color perception
- Improved viewing angles and sunlight visibility versus edge-lit LED
- Effective halo management
- Lower power consumption (compared to edge-lit backlight solutions)
- Extended lifetime and higher performance stability (compared to OLED)
- Brightness >= 1000 nits
- Contrast ratio 30,000:1
- Resolution 2560 x 1440

Pro and EliteHorizon

Marelli's HorizonView portfolio unites elements of conventional Head-Up Displays (HUDs) and digital screens into a single, integrated solution that presents information in the driver or passenger field of view.

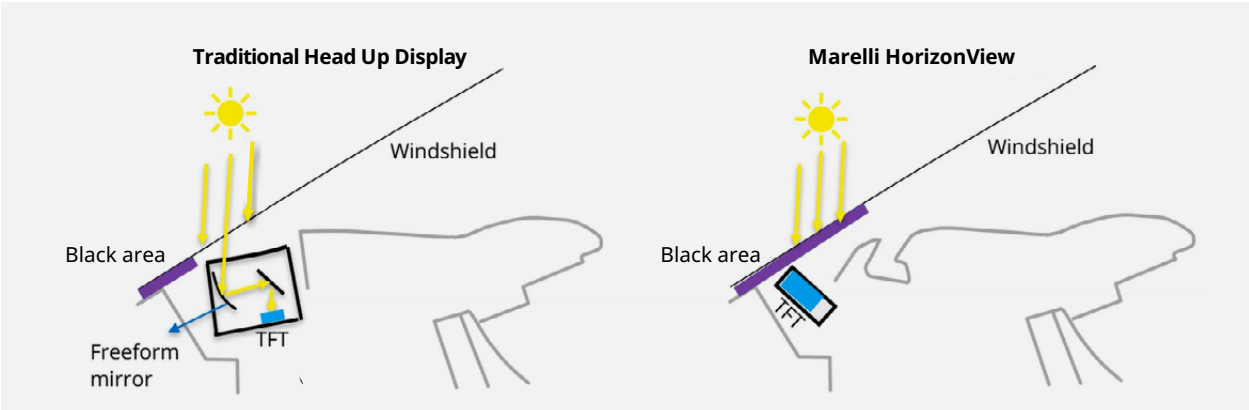
High-quality 2D reflections are projected onto a sleek, adaptable "black blade" that is either integrated along the bottom edge of the windshield or appears to float in front of it, providing an alternative reflection surface to conventional windshield-based HUDs.

Images are generated by a single or multiple Picture Generation Units (PGU) based on LCD (Liquid Crystal Display) MiniLED local dimming backlight technology to deliver high-contrast information with brightness of up to 3000 cd/m^2. Compared with edge-lit based solutions, HorizonView technology ensures effective halo management and postcard-effect avoidance.

The result is optimal visibility across a wide range of lighting conditions, including when wearing polarized sunglasses, plus support for larger viewing angles than conventional HUD technology.

Building on the foundation of entry-level LeanHorizon, which introduces a single display designed to replace or complement the traditional instrument cluster behind the steering wheel, ProHorizon and EliteHorizon extend the concept through scalable, multi-screen configurations along the lower edge of the windshield, with optical performance configured according to OEM requirements.

More compact and affordable than traditional HUD architectures based on complex optical mirror assemblies, and offering a distinctive, high-technology appearance with minimal additional parts, Marelli's scalable HorizonView represents a breakthrough in display technology.



Need to know

- LCD-based Thin-Film Transistor (TFT) source with MiniLED local dimming backlight
- Up to two displays (ProHorizon) or three displays (EliteHorizon)
- High readability under various ambient conditions
- National Television System Committee (NTSC) 110% color gamut
- Image Distance: ~ 1000mm
- Brightness: up to 3000 cd/m^2
- Imager: TFT Low-Temperature Polycrystalline Silicon (LPTS)

ProHorizon

ProHorizon supports up to two coordinated display zones along the lower edge of the windshield, enabling information to be presented in the driver's line of sight above the steering wheel and within the central display area.

Based on an LCD MiniLED local dimming backlight, ProHorizon minimizes partial illumination when content is inactive, supporting a clean, integrated appearance with reduced driver distraction.

ProHorizon is particularly well suited to EVs and differentiated vehicles, where space efficiency, interior integration and a distinctive digital experience are key.

EliteHorizon

EliteHorizon represents the most advanced evolution of Marelli's HorizonView technology, delivering superior-quality reflections across up to three display areas. This provides a pragmatic, production-mature pathway to scaling the HorizonView concept across the full instrument panel, while retaining flexibility to adapt to dashboard design.

EliteHorizon also lays the foundations for a forthcoming single full-width display solution that allows content – such as immersive welcome graphics – to flow from pillar-to-pillar uninterrupted.

With cutting-edge technology and expansive scale, EliteHorizon is designed to elevate the sophistication of luxury and premium vehicles.

EliteRide

Marelli's EliteRide portfolio sets the benchmark in fully active suspension systems, spearheading the automotive shift fueled by smarter, more sustainable expectations and accelerated by electrification.

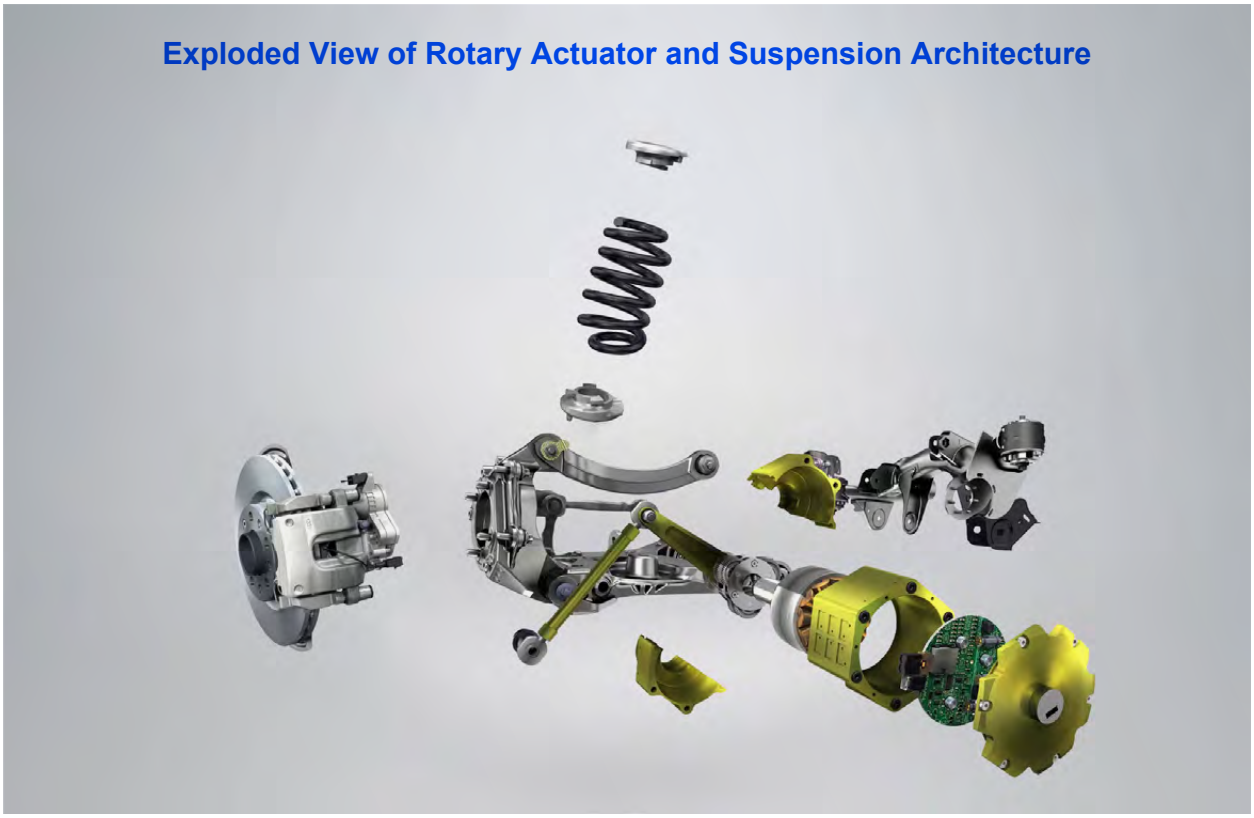
Enabled by centralized SDV control, and predictive AI algorithms, EliteRide brings together Marelli's pioneering Fully Active Electromechanical Suspension and Fully Active Electrohydraulic Suspension to adjust chassis performance in real-time for superior ride comfort, handling, and safety.

Achieving up to 80% energy efficiency, EliteRide demonstrates Marelli's continuous commitment to industry-leading innovation.

Fully Active Electromechanical Suspension

Marelli is first to develop oil-free Fully Active Electromechanical Suspension, an innovative solution designed for superior driving comfort and control across a wide range of vehicle segments. The technology won a 2025 Automotive News PACEpilot Award, and received a "Commendable" honor at the 2023 Digital Engineering Awards. Replacing traditional shock absorbers with one electromechanical rotary actuator per corner, the advanced system provides exceptional control of vertical dynamics, brings new freedom in vehicle design, and offers high efficiency of 80% with only a minimal weight increase over a conventional shock absorber.

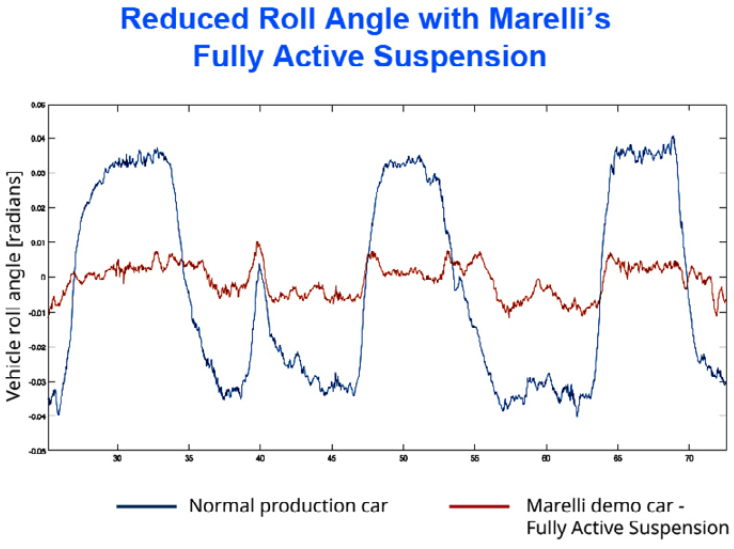
Powered by a 48 V battery – and engineered for future compatibility with 400-800 V vehicle architectures – each smart rotary actuator comprises a brushless motor and high-ratio epicycloid reduction gear connected to the suspension arm via a push rod. Suspension stroke is therefore governed by motor rotation.



Data from accelerometers, stroke sensors mounted on the suspension, and the vehicle network – including brake pressure, vehicle speed, gear selection, accelerator position and steering angle – is processed in just five milliseconds by the control unit. Smart algorithms subsequently calculate the optimal stroke target for each actuator, and the brushless motor acts on the suspension spring in as little as three milliseconds when activated by its dedicated inverter.

The result is damping characteristics optimized for every road surface and driving situation, generated either reactively or predictively to minimize roll, pitch, yaw and vibration, while maximizing tire contact patch, providing a true “magic carpet” experience. This enhances in-cabin comfort and helps reduce motion sickness during activities such as reading, using a laptop and watching videos.

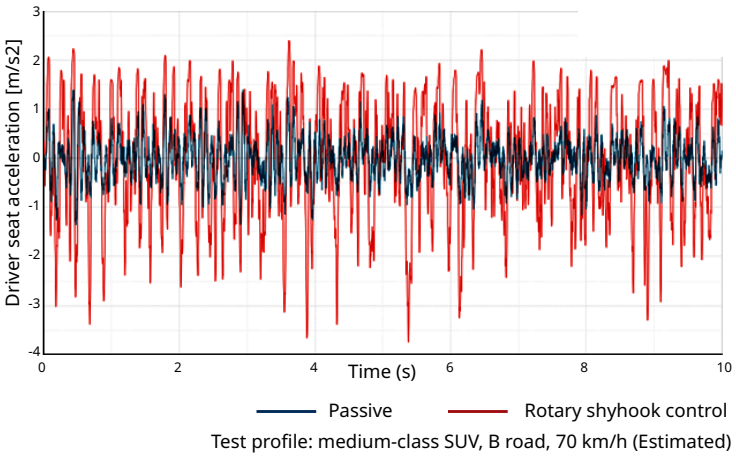
While the system power theoretically enables Fully Active Electromechanical Suspension to introduce negative forces, it is typically calibrated for zero pitch or roll angle during normal driving, while maintaining natural handling responses in more dynamic scenarios.



A vehicle equipped with Fully Active Electromechanical Suspension can maintain 0° roll angle up to 0.5 g on a 45 m radius roundabout at 40 km/h – compared with 2.1° for vehicles with passive or semi-active shock absorbers – and peaks at 1.7° at 0.87 g, less than half the roll of conventional systems.

In side-by-side tests with medium-class SUVs equipped with semi-active shock absorbers and Fully Active Electromechanical Suspension, the fully active technology reduced peak-to-peak body acceleration by 46%. At 70 km/h on a typical B-road, it also reduced the Root Mean Square (RMS) vertical acceleration at the driver's seat by 55%.

Minimized Driver Seat Acceleration for Enhanced In-Cabin Comfort



Test profile: medium-class SUV, B road, 70 km/h (Estimated)

Passive safety is also enhanced – the actuators can place the suspension in an optimized state if an impact is unavoidable, even when the vehicle is stationary. This minimizes the risk of rollover should the vehicle leave the road.

Weighing approximately 6.8 kg, each actuator is 50% lighter than an electrohydraulic alternative and is mounted low and inboard on the vehicle body. This introduces new freedom in vehicle design, reduces the center of gravity, and removes requirements for hydraulically interlinked circuits and anti-roll bars.

The motor is also mounted on the vehicle body, rather than inside the fully active shock absorber – lowering unsprung mass and removing requirements for liquid cooling.

Lightweight, Compact, Fits Multiple Suspension Architectures

This oil-free technology can also provide all functionality at almost zero “energy cost” for the vehicle. Energy harvesting on the suspension rebound stroke delivers a high efficiency rate of 80%, with up to 11 W per corner regenerated at 70 km/h on a typical B-road.

With ride and handling characteristics largely defined by software, Fully Active Electromechanical Suspension reduces hardware changes between model lines, supports development through Digital Twin simulation, and can be updated over-the-air to expand comfort, handling and safety capabilities over time. The simplified chassis architecture also opens opportunities to optimize vehicle design in early development phases, potentially streamlining assembly processes.

Further benefits include integration with ADAS systems to level the car body for collision mitigation, and energy harvesting for system efficiency up to 40%.

Need to know

- Tri-phase permanent magnet electric motor
- Epicycloid reduction gear with leverage mechanism
- Fully oil free
- Compatible with 48 V power electronics
- New freedom in vehicle design
- 80% energy efficiency
- 6.8 kg weight
- 50% lighter than Fully Active Electrohydraulic Suspension
- 55% reduction in RMS driver-seat vertical acceleration*
- 46% reduction in peak-to-peak body acceleration**
- 0° body roll to 0.5 g
- <3 ms actuation time

* Compared with a medium-class SUV equipped with passive shock absorbers
** Compared with a medium-class SUV equipped with semi-active shock absorbers

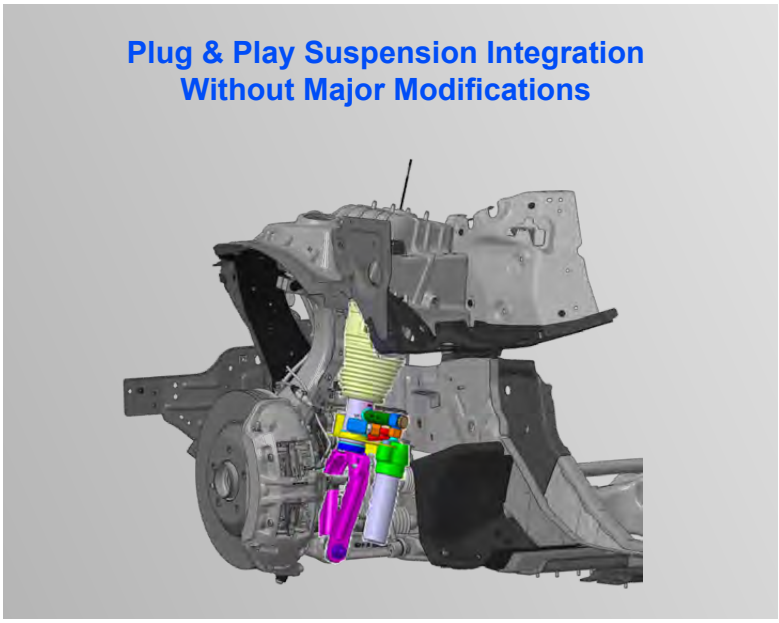
Fully Active Electrohydraulic Suspension

Marelli's Fully Active Electrohydraulic Suspension enables OEMs to transition effortlessly to next-generation chassis technology while delivering driving dynamics and comfort comparable to Fully Active Electromechanical Suspension systems.

A true plug-and-play solution for existing vehicle architectures, it replaces conventional shock absorbers of similar geometry, simplifying integration with both coil and pneumatic springs.

It also avoids modifications to suspension arms or anti-roll bar mounting points.

Each actuator body incorporates a piston with an electronically controlled dual-stage valve and integrated gas accumulator. A compact hydraulic pump, driven by a 48 V tri-phase permanent magnet electric motor, generates actuation pressure.



The control system processes inputs from one suspension-stroke sensor per damper, a gyroscopic accelerometer, and Controller Area Network (CAN) data for brake pressure, vehicle speed, gear selection, accelerator position, and steering angle to calculate optimal actuator response. Actuation occurs in under 25 ms, at pressures up to 120 bar, and applies forces up to 3000 N per corner to counter body movements and minimize vibration.

Compared with simulation results for passive and semi-active shock absorbers, RMS vertical acceleration is reduced 45% on a rough road at 70 km/h, with peak-to-peak vertical acceleration down 30-40% at the same speed. Lateral performance matches that of Fully Active Electromechanical Suspension, maintaining 0° of static roll up to 0.5 g, and less than 50% of the static roll angle of passive and semi-active shock absorbers beyond that threshold.

Fully Active Electrohydraulic Suspension: Front and Rear Actuators

Need to know

- Plug-and-play for existing suspension architectures
- Hydraulic actuator with gas accumulator
- Dual-stage electronic valve
- Hydraulic motor pump with 156 l/min
- Tri-phase permanent magnet electric motor
- Compatible with 48 V power electronics
- 120 bar pressure
- Customizable motor pump bracket design and pipe connection
- 13 kg weight
- 40% reduction in RMS vertical acceleration *
- 30-40% reduction in peak-to-peak acceleration *
- 0° body roll to 0.5 g
- Actuation <25 ms

* Simulation results comparing semi-active technology and Fully Active Electrohydraulic Suspension

ProEnergy

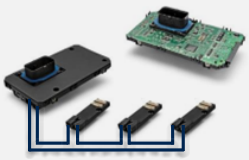
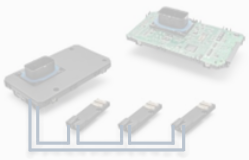
As battery technology advances, Marelli's new-generation Battery Management Control Unit (BMCU) addresses the increasing hardware and software complexity in energy management – building on expertise from the innovative first implementation in the 2010 Nissan Leaf.

The BMCU monitors the condition of battery cells to ensure safety, maximize driving range and prolong battery life. Marelli's solutions for Battery Management Systems (BMSs) offer benefits such as reduced system complexity and cost with improved efficiency.

This new generation of BMCU is built on Marelli's scalable Energy platform – an approach designed to streamline development and accelerate time-to-market. The platform strategy is a core part of Marelli's innovation model, enabling automakers to quickly adapt to diverse performance and market requirements.

As illustrated below, our Energy platforms comprise three main product families – LeanEnergy, ProEnergy and EliteEnergy – with architectural variants tailored to specific needs. These solutions are co-developed in close collaboration with our Original Equipment Manufacturer (OEM) partners to meet market demands.

Marelli Energy Platform Portfolio

	LeanEnergy	ProEnergy	EliteEnergy*
Architecture	 Centralized	 Distributed wired	 Distributed wired
	 Distributed wired	 Distributed wireless	 Distributed wireless
System Voltage	400 V	Up to 1000 V	
SOC/SOH	Cell equivalent model		EIS + AI algorithm with high performance microcontroller
Platform	Microcontroller family, vehicle communication, battery monitoring ICs, I/O		
Custom	Mechanics (connectors, case) and PCB shape, customer-specific contents		

*Future development

Marelli's approach leverages modular design principles, where foundational components such as the main Microcontroller Unit (MCU), communication lines and battery-monitoring integrated circuits are shared across platforms, ensuring consistency and efficiency. Meanwhile, mechanical components are crafted to remain bespoke, enabling customization that aligns with OEM-specific integration requirements.

By targeting up to 70% reusability in our design efforts, Marelli aims to achieve an overall 20-25% reduction in time to market and a 20% reduction in bill of materials costs compared to project-specific products, all while capitalizing on economies of scale.

This streamlined approach paves the way for the timely market readiness of energy management solutions.

Distributed Wired and Wireless Battery Management Control Unit

ProEnergy is a state-of-the-art and highly adaptable BMCU for modern EV architectures spanning 400 V to 1000 V. Building on LeanEnergy's cost-effective foundations, it offers a more advanced feature set and Input/Output (I/O) designed for higher-voltage vehicles.

A choice of distributed wired or distributed wireless architectures is optimized for space-constrained vehicle layouts and for efficient scaling across different battery pack sizes and voltages.

The Battery Management Unit (BMU) can be located away from the battery pack when packaging constraints dictate, with cell monitoring and balancing delegated to modular Cell Supervising Circuits (CSCs) mounted directly on battery-pack modules. This results in very short wiring between the CSCs and cells, with a longer wiring harness linking the CSCs to the BMU through a daisy-chain loop. Regardless of battery voltage, the BMU remains identical, with the required number of CSCs added or removed to meet pack specifications. Optional wireless communication offers additional efficiencies through a significant reduction in communication cables, simplified battery-pack design and shorter assembly-line times. Despite a modest cost increase for the BMCU, it enables a net savings at vehicle level.

Standard battery management functions include State-of-Charge (SOC) and State-of-Health (SOH) calculations, thermal management, charge/discharge control, cell temperature and voltage monitoring, cell balancing and comprehensive safety management. A seamless interface with the E/E architecture enables functions beyond core battery control, such as safety triggers in the event of an impact.

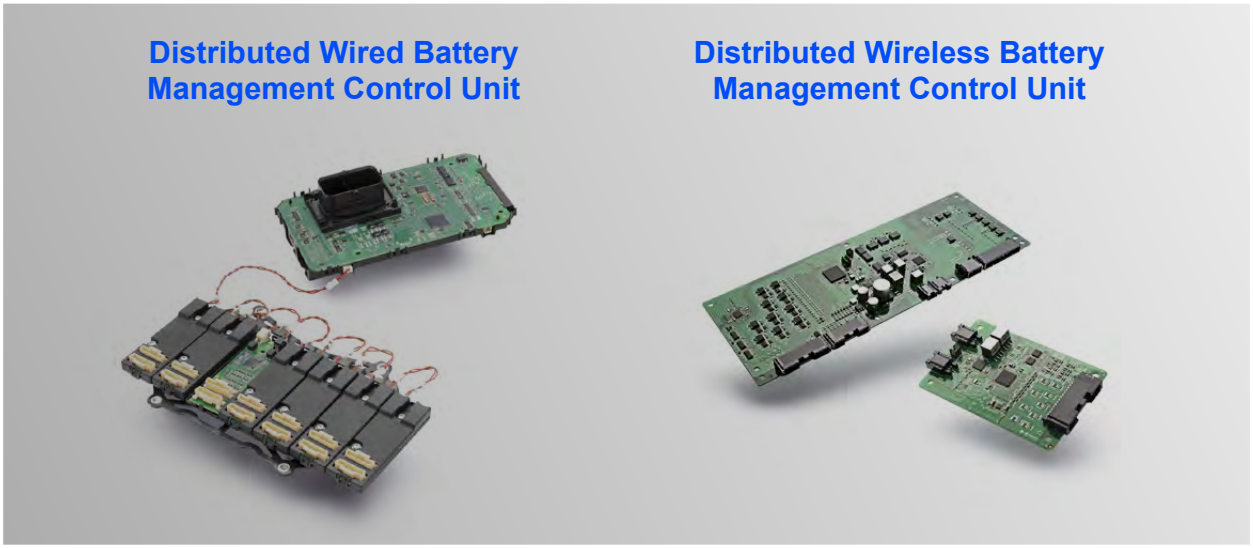
Advanced functions include a Real-Time Clock (RTC) with more accurate scheduling of balancing cycles when the vehicle is inactive, supporting improved battery life. A shunt sensor integrated on the edge of the PCB and mounted on the busbar improves current measurement and simplifies pack design, while solid-state pre-charge improves reliability at higher voltages.

To mitigate reduced charging speeds at lower voltage stations, ProEnergy includes dual-stack pack management with a switchable configuration. In architectures where an 800 V battery comprises two strings of 400 V, for instance, ProEnergy allows both strings to be charged simultaneously in parallel on a 400 V infrastructure.

A two- or three-board layout supports the separation of the low-voltage control board and high-voltage sensing board into independent PCBs, with flexible positioning of the high-voltage board for improved packaging and thermal performance. A third board can be specified when additional separation is required.

For functional safety, ProEnergy integrates a pyro-fuse in series with the main contactors to provide rapid, irreversible battery isolation in the event of a heavy impact or when a contactor fails to open.

To additionally reduce BMCU complexity, cost and dimensions, Marelli's future BMCU roadmap includes the introduction of a microcontroller-free architecture, in which the BMCU will transmit real-time cell data for processing in a Zone Control Unit. Looking further ahead, EliteEnergy will introduce Marelli's most advanced BMCU to date, with state-of-the-art functionality including Electrochemical Impedance Spectroscopy (EIS), AI-based algorithms to optimize battery management, and a high-performance MCU.
With functions already in development, Start of Production (SOP) for EliteEnergy is targeted for 2030, with a foundation prototype available as early as 2028 – offering OEMs the potential to streamline development time and costs.



Need to know

- Distributed wired or wireless architectures
- Modularity supports 400 – 1000 V battery packs
- Dual-stack pack management
- RTC

Innovation @Speed.

At Marelli, we believe speed is the new currency in automotive. In a world defined by shifting consumer expectations, rapid tech evolution, and intense competition, getting to market faster isn't just an advantage — it's essential.

Marelli empowers automakers to move with speed and purpose. As a trusted technology partner, we offer scalable platforms, software-defined vehicle enablement tools, production-ready solutions, and fast innovation cycles designed to shorten development timelines and unlock early market opportunities.

We enable speed-to-market in four distinct ways:

- **Platform Products** – Tiered, modular hardware and software solutions engineered for speed, scalability, and smart customization.
- **Software-Defined Vehicle Enablement Tools** – Supporting future-focused E/E architectures with flexible hardware, decoupled software, and cloud virtualization tools that accelerate development.
- **Ready-to-Offer Technologies** – Proven, production-ready innovations built for immediate integration and impact.
- **Minimum Viable Product Innovation** – From concept to working prototype in as little as 90 days, our agile innovation process enables co-creation with automakers for rapid product development.

This paper illustrates how Marelli's Pro and Elite platform products accelerate time to market through modular, cost-effective design, pre-validated components, and streamlined integration.