

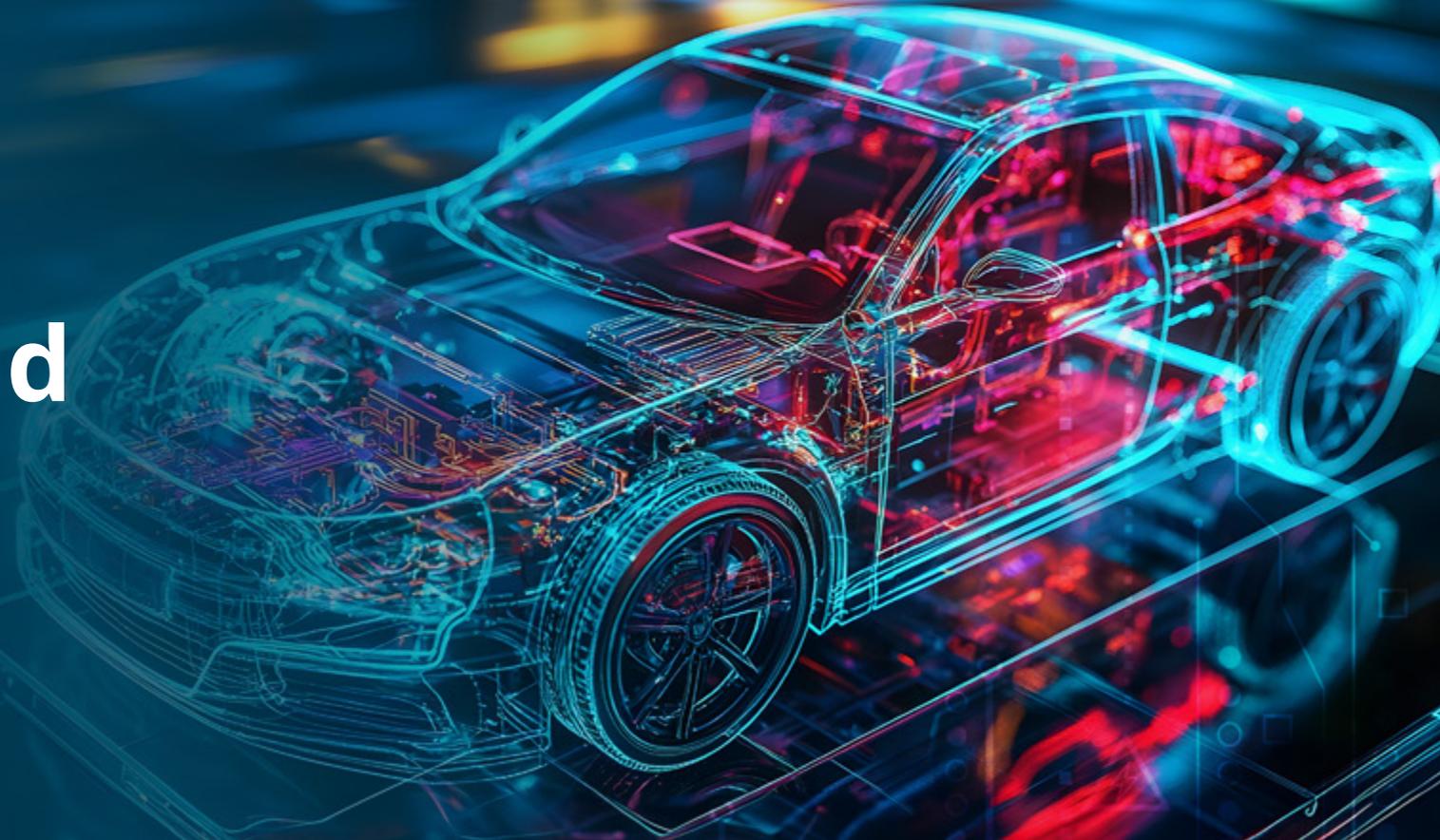
**molex**

REPORT

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# Rewiring the Road

Harnessing the Power of 48V



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OCTOBER 2024

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## INTRODUCTION

As the modern driving experience demands more electronics, the shift toward 48V electrical system technology is rapidly gaining traction, disrupting traditional automotive power architectures. Today's increasingly electrified vehicles needs more. This surge in demand is propelling innovation and investment in 48V systems as automakers seek to enhance vehicle performance and efficiency.

Are we at a tipping point?

48V technology is a key enabler for advanced automotive features such as electric turbocharging, regenerative braking and advanced infotainment systems. It provides a compelling solution for a range of vehicles, from gas-powered to electric, and is poised for widespread adoption.

But it's not that easy. For 48V systems to be successfully implemented, challenges such as standardization and cost reduction must be addressed.

How do we clear the hurdles to move forward? What will it take for 48V power to become the new normal? Let's explore these questions together.



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## THE RISE OF 48V: A NEW STANDARD FOR AUTOMOTIVE POWER

**For decades, 12V electrical systems have powered everything from headlights to entertainment systems in vehicles. But the automotive industry is evolving, and the way vehicles are powered is evolving along with it.**

By quadrupling the system voltage, 48V enables significant advancements in power delivery, representing a substantial departure from the conventional 12V electrical structure. This new level of power enables comprehensive and evolved features such as electric turbocharging, regenerative braking and battery preconditioning for accelerated auxiliary charging, to name a few. From wiring and connectors to power management systems and components, a fundamental redesign is necessary to maximize the technology benefits of 48V.



# CORE COMPONENTS OF A 48V SYSTEM

**48V Battery:** A specialized battery designed to store and deliver higher-voltage electrical energy.

**48V Power Distribution System:** The network of wires, connectors and control units that distributes power within the 48V system.

**Battery Controller:** Regulates the charging and discharging of the 48V battery, optimizing its performance and lifespan.

**DC/DC Converter:** The circuitry that controls and manages the flow of electrical power within the 48V system.

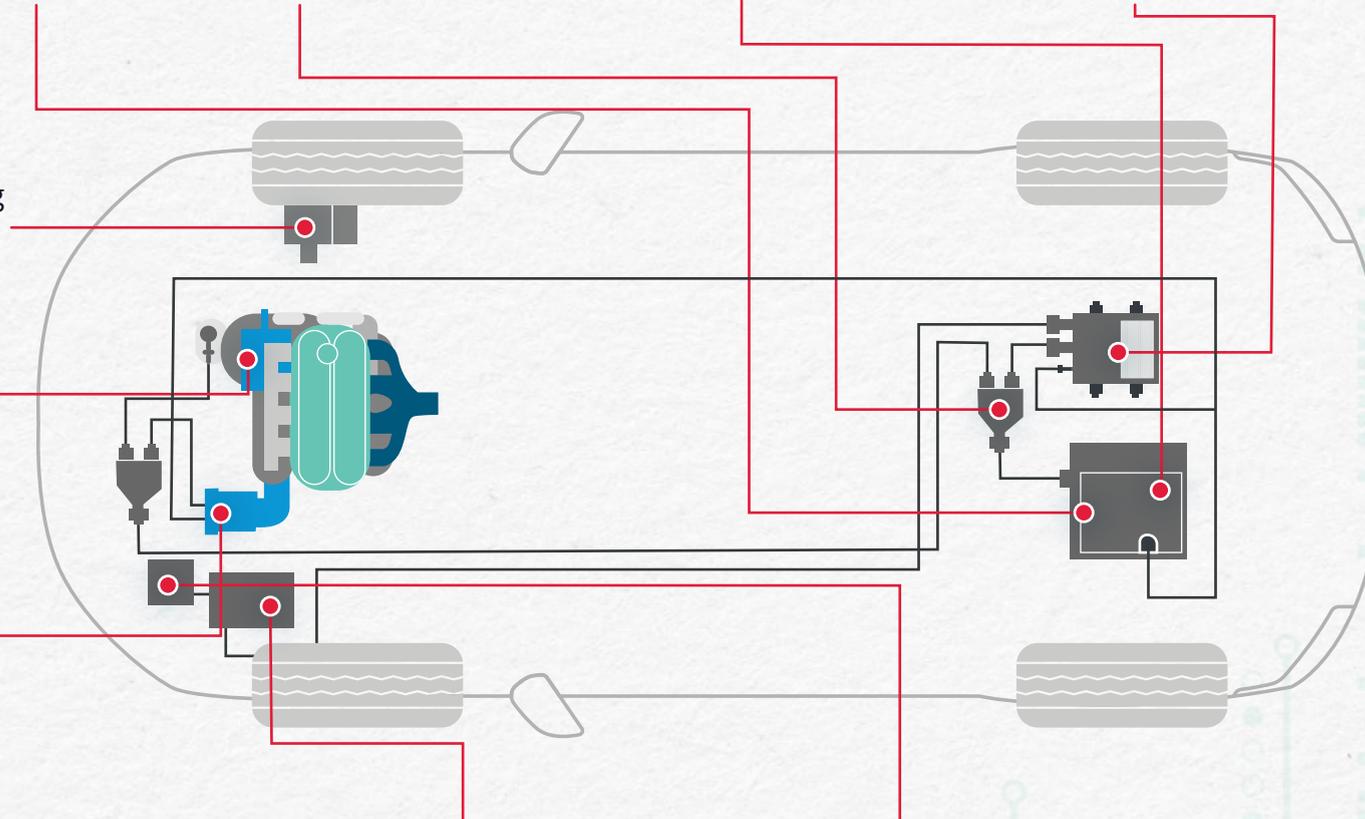
**Hybrid Controller:** Manages the interaction between the 48V and 12V systems, ensuring efficient power distribution and optimal performance.

**48V Electric Motor:** Electric motor designed to operate on the 48V system for various vehicle functions.

**Power Electronics:** The circuitry that controls and manages the flow of electrical power within the 48V system.

**12V Battery:** Powers essential vehicle functions like headlights, radios and other accessories.

**12V Electrical Distribution Center:** Distributes power throughout the 12V system, ensuring that all components receive the necessary voltage.



## KEY CHARACTERISTICS OF 48V SYSTEMS

It's important to focus on what differentiates 48V systems from traditional 12V systems. In addition to the fundamental components described above, here are the overarching features that highlight the evolution of vehicle power systems.

### Higher Voltage

While increasing voltage from 12V to 48V can reduce amperage in some applications, assessing the system's overall power requirements is crucial. Larger wire gauge might be sufficient for certain components, but high-power demands, like those of electric motors or high-power accessories, may still require bulky cables. Striking the right balance between voltage, amperage and wire gauge is essential to optimizing system efficiency and performance.

### Increased Power Capacity

48V systems offer a significant boost in power output. This increased capacity enables the electrification of essential vehicle components, such as power steering pumps, air compressors and water pumps. By operating independently from the engine's accessory drive, these components are expected to allow optimization for efficiency and reliability.

### Improved Efficiency

Reduced resistive losses in power transmission contribute to higher efficiency. Powering electric compressors and pumps directly from the 48V system reduces the engine load, enabling it to operate more efficiently. Regenerative braking, a core component of 48V systems, also significantly heightens efficiency by recovering energy that would otherwise be lost as heat.

### Flexibility and Scalability

48V technology is adaptable to a wide range of vehicle architectures, from traditional internal combustion engine (ICE) vehicles to fully electric models. This flexibility allows automakers to gradually introduce 48V systems into their product lines, as we will explore later. Additionally, 48V architecture lays the groundwork for future electrification strategies, offering a scalable path to higher voltage systems as battery technologies advance.

By understanding these core characteristics, we can better appreciate the benefits and applications of 48V technology in the automotive industry, recognizing the significant leap forward that 48V represents.



## 48V SYSTEM VERSATILITY AND EFFICIENCY

New 48V technology serves as a versatile platform that enhances vehicle efficiency and performance and benefits both traditional and electric vehicles. What does this mean for each market?

### For Traditional Vehicles

48V systems present significant advantages over traditional 12V systems, including improved power delivery for advanced features such as electric turbocharging, idle stop-start and regenerative braking. While some of these functions are possible with 12V systems, the higher voltage of 48V systems enables them to operate with greater efficiency and effectiveness. Additionally, 48V systems are better equipped to handle more demanding electrical loads, which translates to enhanced vehicle performance and improved fuel economy.

### For EVs

48V systems serve as a secondary power source for auxiliary components in EVs, easing the load on the primary **high-voltage battery**. In some instances, 48V architecture can accelerate charging times by aiding battery preconditioning. Incorporating 48V electronics aids overall EV efficiency by minimizing power losses, maximizing component performance and boosting energy recovery.

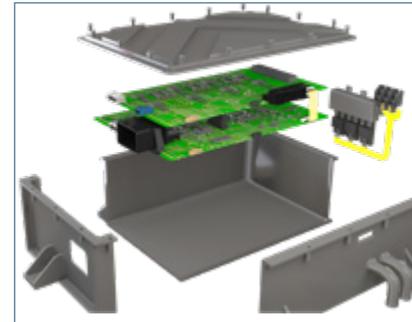


Offering a versatile range of connectors specifically engineered for the complexities of EV systems, Molex assists automakers in addressing key challenges.

[Learn more →](#)

## KEEPING UP WITH CONNECTORS

While 12V connectors have been adequate for decades, 48V electrical systems need a new level of connector performance and reliability. While 12V connectors may be able to handle higher currents, they would need to be designed with larger contact areas or different materials to ensure reliable performance and prevent overheating. This can lead to increased size and weight. However, because of advancements in 48V connector technology, advanced mid-voltage connectors can provide highly effective support for 48V automotive power systems.



Molex provides high-power, automotive-grade connectors for EV controllers that meet industry standards. These connectors offer integrated capabilities and provide exceptional design flexibility.

[Learn more →](#)

### Material Science Advancements

While 48V connectors may utilize similar materials as 12V connectors, specific materials and their properties are crucial for ensuring reliable and efficient performance in 48V applications. Advanced materials like high-temperature resistant plastics and specialized metal alloys can enhance insulation, conductivity and overall durability, meeting the demanding requirements of 48V systems.



### **Design Innovations**

Enhanced contact designs are essential to reduce contact resistance and improve current handling capabilities. This can be achieved through multiple contacts or larger contact surface areas. Robust locking mechanisms ensure secure connections in harsh automotive environments. Redesigned connector housings with larger contact areas and improved sealing mechanisms are also necessary to effectively handle higher currents and ensure reliable performance in 48V systems.

### **Manufacturing Processes**

Precision manufacturing ensures tight tolerances and consistent performance, which is crucial for 48V connectors. Automated assembly processes facilitate production efficiency and minimize errors.

### **Testing and Validation**

Advanced connectors undergo rigorous testing for performance validation under extreme conditions, including temperature cycling, vibration and humidity. Computer-aided engineering (CAE) tools can simulate connector performance and identify potential design vulnerabilities during the development stages.

By incorporating these advancements, connector manufacturers can produce products that meet the stringent specifications of 48V automotive systems, ensuring reliable and efficient power delivery.

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## PAVING THE WAY FOR 48V SUCCESS

The transition to 48V technology presents significant opportunities, but the path forward will require solutions such as standardization and cost reduction. As it adopts this new electrical architecture, the automotive industry must navigate a range of challenges. Success will require strategic planning, continuous innovation and strong industry collaboration.

If the shift to 48V systems were simple, it would already be standard across the industry. However, a combination of technical and economic challenges has slowed the transition.

### CORE OBSTACLES TO WIDESPREAD 48V ADOPTION

The adoption of 48V systems faces two major hurdles: cost and complexity. First, the upfront investment in 48V components, including batteries, power electronics and electric motors is likely to be higher than for traditional 12V systems, which can impact vehicle prices and potentially limit consumer interest. Second, integrating 48V technology into existing vehicle platforms is expected to require significant engineering efforts. Ensuring compatibility with current electrical systems and safety features adds both development time and costs for OEMs.



## Technical Challenges in Connectivity

Interconnectivity and compatibility are critical hurdles in 48V system integration. This involves a deep understanding of the multiple requirements and complexities of the vehicle architecture and, therefore, a careful connector selection to ensure system reliability and efficiency. These systems must support reliable and secure data communication to optimize the performance of the 48V-powered components. Engineers must also address electromagnetic interference (EMI) to ensure safe and reliable vehicle operation, preventing disruption between the high-voltage system and other electronic components. The higher voltage levels in 48V systems can lead to increased EMI emissions, making it more challenging to shield against interference than it is with lower voltage systems. Wiring and harness designs are crucial, as higher voltage and current requirements introduce challenges related to weight, space and cost.

## Design Considerations

Incorporating 48V systems calls for careful thermal management and electrical system architecture modifications to ensure optimal performance and reliability. To prevent overheating, engineers must include efficient cooling systems for 48V components, such as the battery and power electronics, into the overall vehicle thermal management strategy. Modifying the electrical architecture of existing vehicle models to accommodate 48V components while ensuring compatibility with the existing 12V system demands careful planning and design.



## Solutions and Strategies to Overcome 48V Challenges

Overcoming barriers to 48V system adoption warrants a strategic, collaborative approach. For manufacturers and tiers, addressing these challenges means quickly delivering clear value.

Reducing costs is critical for both manufacturers and consumers. Achieving economies of scale is one effective strategy. Standardizing components across vehicles can decrease manufacturing complexity and costs. Whether through shared drivetrains or uniform infotainment systems, standardization enables more efficient production while supporting the adoption of advanced power systems.



Automakers and OEMs can enhance system integration through modular design. Modular components empower automakers to adapt to various vehicle platforms, streamline component usage and reduce development time. This approach also futureproofs systems and makes responding to market trends and technological advancements easier.

Successful 48V system integration demands painstaking attention to technical details. Standardizing connectors can simplify assembly and reduce costs. To ensure secure and reliable data communication within the 48V system and with other vehicle components, manufacturers should establish robust communication protocols. Additionally, implementing effective EMI shielding and developing lightweight, durable wiring solutions can lead to significant weight and cost savings without compromising performance or reliability.

Engineers have options regarding difficult design considerations. They can address thermal management concerns by adopting advanced cooling technologies, such as liquid cooling and heat exchangers, to manage thermal loads effectively. Flexible and scalable electrical system architectures are essential to accommodate 48V components while maintaining compatibility with existing systems.

This will involve work from every stakeholder, from design to the final product, but achieving widespread popularity of the 48V system will allow the automotive industry to continue making meaningful technological leaps.

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# IGNITING AUTOMOTIVE INNOVATION: OPENING NEW ROADS

Initially focused on mild and plug-in hybrid vehicles, 48V systems offer broad applicability across the automotive landscape, including traditional ICE vehicles. Far from being just a transitional step, 48V technology represents an even larger platform for groundbreaking innovation. Let's delve into why this is the case.

## UNLOCKING NEW VEHICLE CAPABILITIES

The increased electrical power density from 48V systems opens up a wide range of possibilities for expanding vehicle performance, comfort and functionality.

### Enhanced Powertrain Performance

By powering electric compressors or motors, 48V systems can drive turbochargers or superchargers independently of the engine, eliminating turbo lag and boosting low-end torque. Additionally, these systems enable efficient energy recovery during deceleration, storing energy in the battery for later use and optimizing fuel consumption and overall performance.



### **Advanced Comfort and Convenience**

48V technology transforms comfort and convenience features by enabling the efficient operation of electrically powered components such as air compressors, water pumps and power steering systems. This translates to more responsive and efficient climate control, precise engine temperature management and superior steering responsiveness, elevating the experience for both the driver and passengers.

### **Improved Driver Assistance Systems**

Advanced driver assistance systems (ADAS) greatly benefit from the robust power delivery of 48V systems. By delivering higher current and voltage, these systems can efficiently power the sensors, actuators and control units required for ADAS functionalities. From radar to LiDAR systems to electric power steering and braking, 48V ensures reliable and responsive operation, elevating vehicle safety and driver confidence. This enhanced power delivery paves the way for more complex ADAS functions, such as automated parking, highway pilot and — ultimately — full autonomous driving.

### **Precise Control and Customization of Cabin Environments**

Elevating vehicle comfort and luxury, 48V systems enable more complex and sophisticated features than traditional 12V systems. This includes — but is certainly not limited to — accessories such as multi-contour seat adjustment, advanced ventilation systems and enhanced climate control. This expanded capability creates a more refined and personalized experience for drivers and passengers alike.

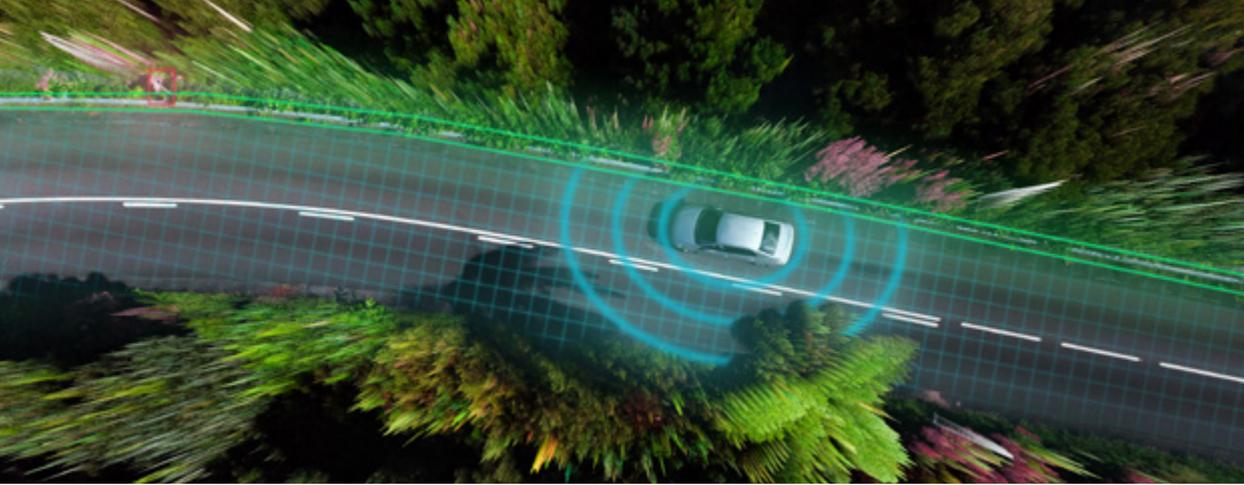


Molex collaborates with the automotive industry to develop advanced connectivity solutions for modern in-cabin features that enhance the driving experience.

[Learn more →](#)

### **Vehicle-to-Load (V2L) Capabilities**

48V power systems open the potential for V2L options, turning vehicles into mobile power sources. With sufficient power density, 48V systems can enable bidirectional power flow, allowing stored energy to be discharged to external devices. This functionality expands a vehicle's utility, enabling it to power camping equipment, electronic devices or even serve as a backup power source during emergencies.



## POTENTIAL OF 48V IN EMERGING VEHICLE SEGMENTS

The development of 48V power systems provides additional opportunities beyond passenger car in-vehicle features and accessories. It extends to promising potential gains in emerging vehicle segments.



**Off-road vehicles** can leverage 48V power to tackle challenging terrain. Electric power assist for steering, suspension and winches can elevate off-road performance and capability. Additionally, 48V systems can bolster vehicle stability and control in demanding conditions.



**Electric and hybrid powertrains** benefit from 48V technology as a foundational step toward full electrification. By supplementing electric motors and components, 48V systems optimize performance and efficiency in hybrid vehicles. Also, 48V supports functions like battery management and thermal management, ensuring optimal system operation.



**Specialized vehicles**, such as those used in agriculture, construction and mining, can harness 48V power to increase productivity and efficiency. By powering hydraulic pumps, compressors and other auxiliary systems electrically, these vehicles can achieve improved performance, reduced operator fatigue and greater responsiveness. This shift to electric-powered components aligns with industry trends toward more efficient, reliable systems, like the development of electric steering and braking in automobiles.



**Autonomous vehicles (AVs)** rely on robust power systems, and 48V technology delivers. By supplying reliable power to sensors, actuators and control units, 48V facilitates the advanced functionality needed for autonomous driving. Although full autonomous vehicle deployment is still in its early stages, 48V will certainly help AVs along their path toward more widespread deployment.

By targeting these emerging vehicle segments, the 48V technology can expand its market reach and contribute to the overall electrification of the transportation industry.

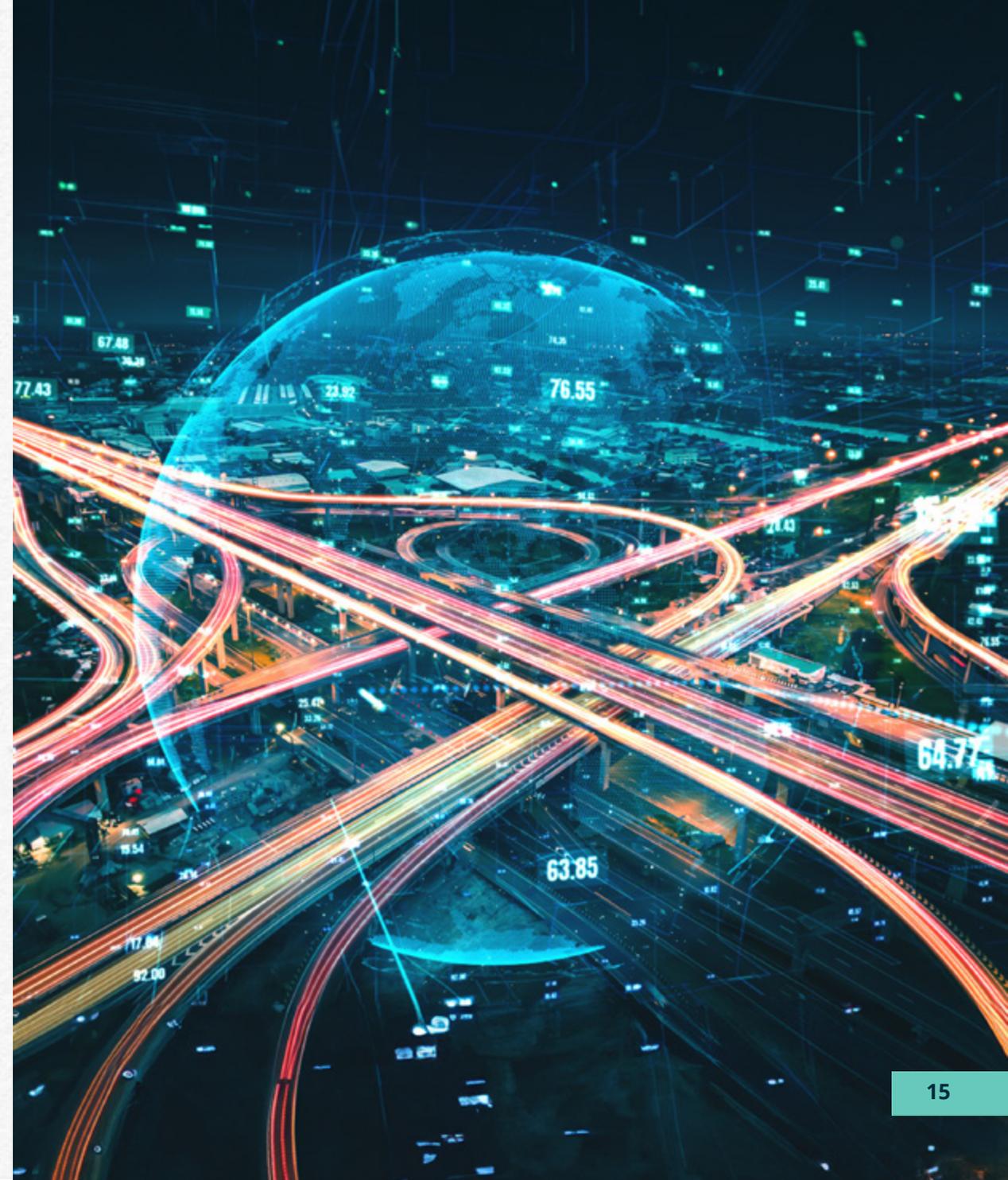
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# THE JOURNEY TO FULL 48V ADOPTION

## A STRATEGIC, PHASED APPROACH FOR THE SUCCESSFUL TRANSITION FROM 12V TO 48V

The automotive industry is undergoing a major transformation as it moves from traditional 12V electrical systems toward more advanced electrified powertrains. While fully electric vehicles are gaining traction in market share, mild hybrid electric vehicles (MHEVs) with 48V systems offer a viable interim solution. These vehicles combine the benefits of electrification with the familiarity of internal combustion engines. MHEVs deliver these advantages without the significant costs and infrastructure requirements associated with EVs.

Despite the promise of 48V technology, its adoption is still in the relatively early stages. While some automakers have introduced mild hybrid models, the technology is far from reaching its full potential. To accelerate the transition to a 48V future, a comprehensive roadmap is essential. The following guide outlines key strategies to answer the question: how do we get from here to there?



## 1 DEVELOP MODULAR 48V PLATFORMS

A modular 48V platform offers a standardized, flexible architecture that can be tailored to various vehicle sizes, types and power demands. This platform consists of interchangeable components, such as electric motors, inverters, DC-DC converters and batteries, which can be combined in different configurations to meet specific vehicle needs. Like building blocks, this approach enables automakers to efficiently develop and produce a diverse range of vehicles while maximizing component sharing and reducing development costs. Ideally, a modular 48V platform would be utilized across a broad spectrum of vehicles within an automaker's lineup.

By developing modular 48V platforms, automakers can elevate economies of scale, shorten time to market and maintain the flexibility to adapt to changing market trends and consumer preferences. This standardized approach also simplifies the integration of advanced features, such as electric power steering, electric compressors and thermal management systems.

## 2 FOSTER COLLABORATION

Strategic partnerships are key to accelerating 48V system development and expanding market penetration. Automakers and component suppliers must collaborate to overcome technical challenges and establish industry standards. This close cooperation is essential for optimizing system integration, reducing development costs and speeding up time to market.

Joint research and development should focus on upgrading components such as inverters, electric motors and energy storage systems. Equally important is establishing standardized communication and electrical architectures to ensure smooth integration across different vehicle models. By pooling expertise and resources, the industry can work together to broaden the market reach of 48V systems.

## 3 CONTINUED TECHNOLOGICAL ADVANCEMENTS

Ongoing research and development are crucial to fine-tuning 48V system performance and reducing costs over time. And these are key to accelerating widespread adoption. Focus areas include advancing battery technology to increase energy density, power output and lifespan while finding cost-saving opportunities.

However, automotive design engineers must also prioritize the development of more efficient and compact power electronics, such as inverters and DC-DC converters, to improve system capabilities and minimize losses. Advancements in electric motors and generators, particularly in power density and torque output, are also important for fine-tuning system performance. Additionally, innovative thermal management solutions are vital to maintaining optimal operating conditions for 48V components and extending their lifespan.

By following these steps and applying knowledge gained along the way, the automotive industry can gradually transition to full 48V adoption while mitigating risks and maximizing benefits.

# THE ROLE OF ZONAL ARCHITECTURE IN FACILITATING 48V INTEGRATION

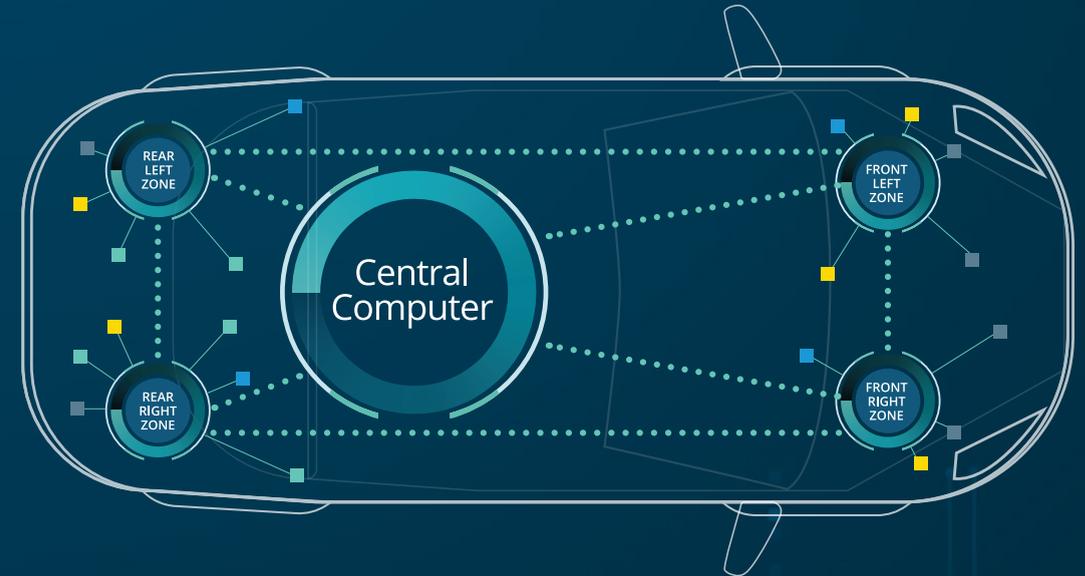
**Zonal architecture** provides a clear advantage over traditional vehicle electrical systems when incorporating 48V technology. By segmenting the vehicle into distinct electrical zones, each with its own control unit and power supply, this approach simplifies the implementation of 48V components.

## Enhanced Flexibility and Scalability

Encouraging greater design flexibility for 48V systems, zonal architecture permits automakers to customize voltage levels and component selection for each zone, maximizing performance and efficiency. Additionally, this architecture supports easier scalability across various vehicle models, accelerating time-to-market.

## Better Power Distribution

Managing power distribution within specific zones reduces electrical losses and boosts system efficiency. With dedicated power supplies for each zone, voltage levels are fine-tuned for different components, bolstering overall vehicle performance.



## Reduced Wiring Complexity

Zonal architecture simplifies the vehicle's electrical wiring, reducing weight, cost and manufacturing complexity. Fewer wires and connections also mean a lower risk of electrical faults.

## Superior System Reliability

By distributing control and incorporating multiple power supply points, zonal architecture improves redundancy and fault tolerance. In the event of a failure in one zone, the system can continue operating with minimal disruption.

As the automotive industry transitions to electrified powertrains, zonal architecture will be vital to optimizing vehicle performance and reducing development costs.

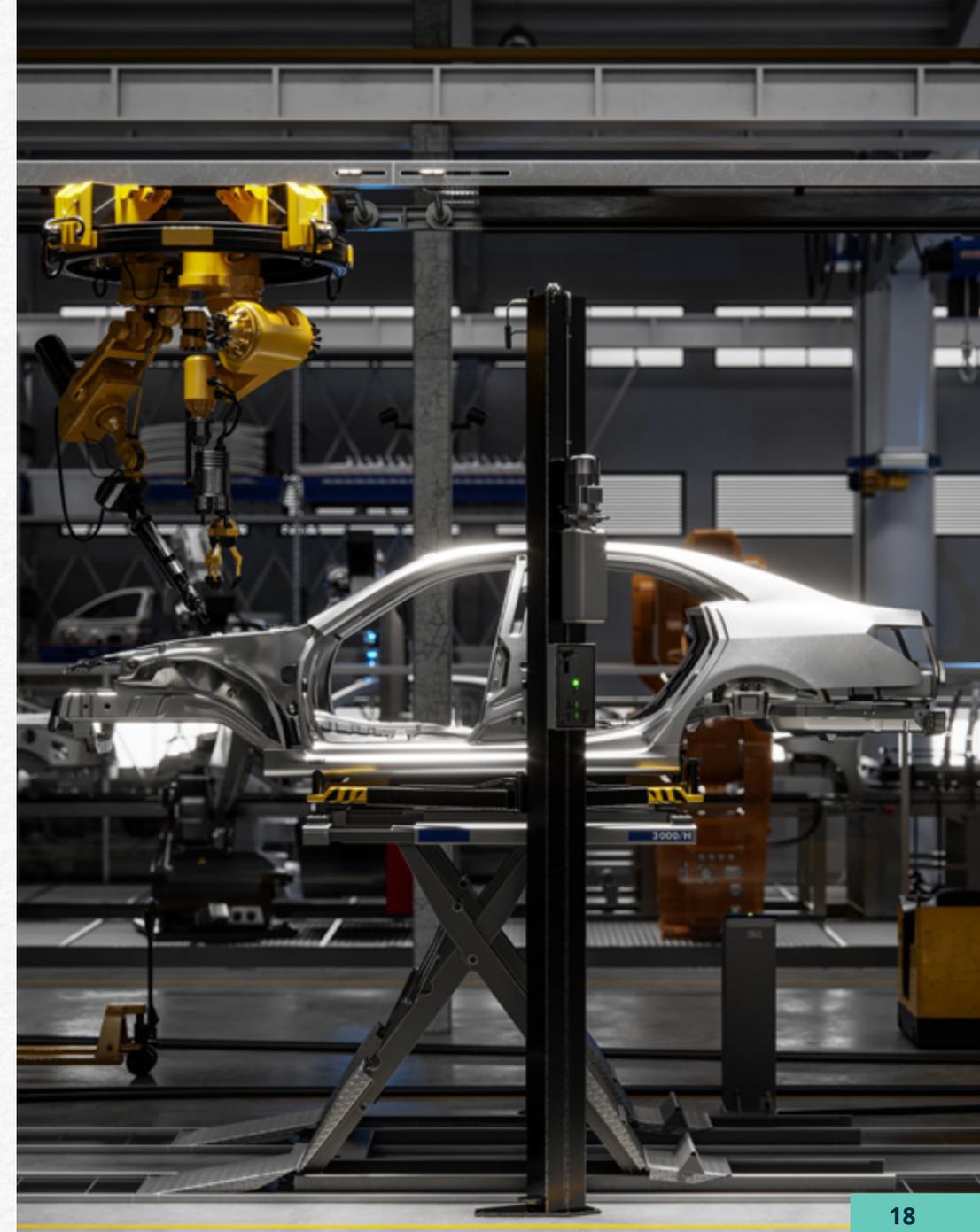
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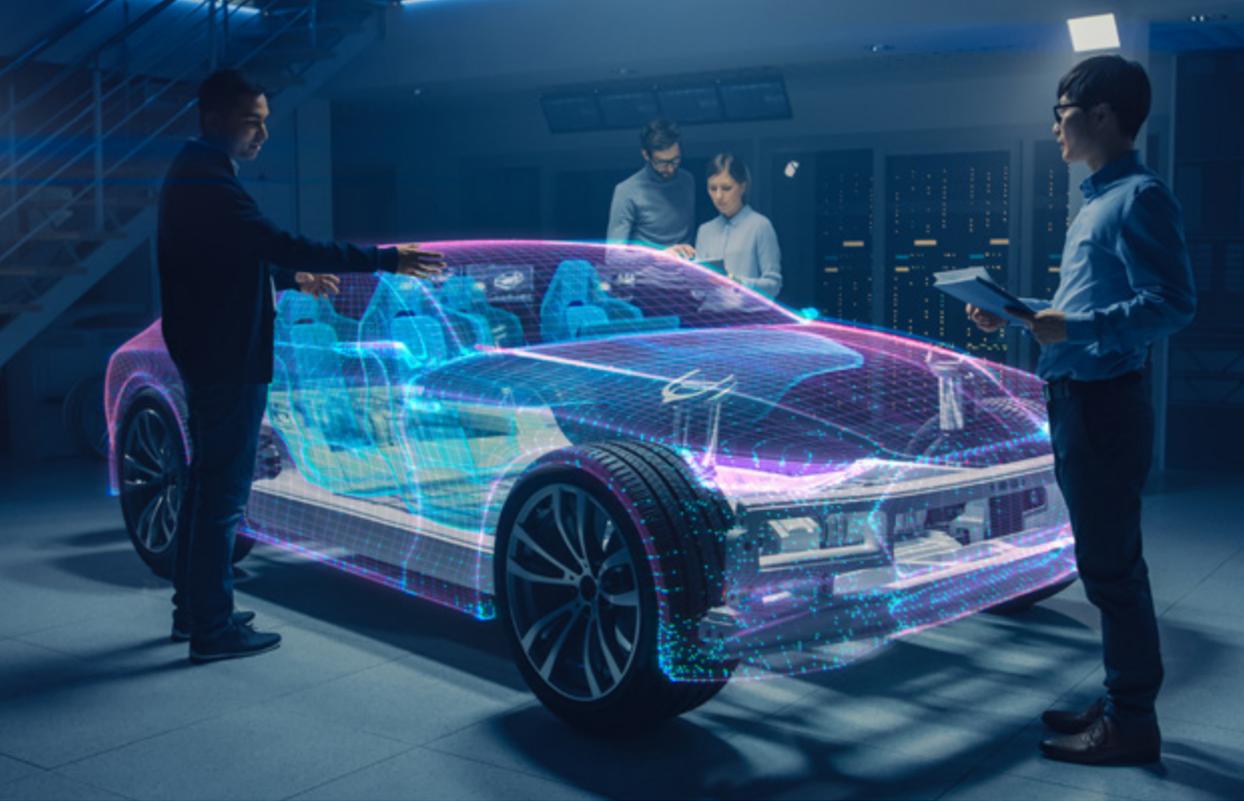
# SMALL AND SCRAPPY OR TRIED-AND-TRUE? A BALANCED MINDSET FOR ACCELERATING 48V DEPLOYMENT

Established automakers, known for their engineering prowess and manufacturing capabilities, have long driven automotive innovation. However, with rapid technological advancements and shifting consumer preferences, a more agile approach is essential. Startups innovate quickly and adapt to market changes, while traditional automakers offer resources and decades of experience. By merging these strengths, the industry can accelerate the integration of transformative technologies like 48V systems.

## KEY STRATEGIES FOR NIMBLE PROGRESS

Traditional automotive manufacturing processes optimized for large-scale production can present challenges for rapid 48V system development. To overcome these hurdles, automakers must adopt agile methodologies tailored to the unique characteristics of 48V technology. Integrating practices such as rapid prototyping, iterative design, and flexible manufacturing can significantly accelerate product development and enhance overall efficiency.





### **Cross-Functional Teams and Flexible Project Management**

Automakers can benefit from expanding efforts to speed up 48V deployment through cross-functional teams. By bringing together diverse expertise from engineering, design, marketing and other areas, these teams create a collaborative environment that mirrors the agile structure of startups, enabling traditional automakers to respond more effectively to customer desires.

Agile methodologies, initially rooted in software development, are now being embraced by automakers. Frameworks like Scrum and Kanban empower teams to work flexibly, prioritize tasks effectively, and deliver results efficiently.

### **Iterative Development**

Automakers should adopt an iterative development model to shorten development timelines and enhance responsiveness. This approach allows teams to rapidly prototype, test and refine 48V systems by breaking the process into smaller, manageable cycles. It's a calculated approach that minimizes risks by focusing on incremental improvements rather than overhauling entire systems.

### **A Customer-Centric Approach**

Prioritizing customer feedback ensures that product development aligns with consumer needs. Companies that excel in this area build strong customer relationships, delivering features and experiences that address pain points and resonate with drivers. Engaged customers often become brand advocates, encouraging adoption, positive perceptions and sales.

### **Partnerships and Collaborations**

Strategic partnerships with tech startups, component suppliers and research institutions enable automakers to leverage cutting-edge advancements in automotive technology. Collaborations focused on specific 48V components, systems integration or battery technology can yield groundbreaking results and bring new products to market faster.

## DIFFERENTIATED BENEFITS

Applying startup strategies to established automakers' processes can unlock a unique set of advantages. By combining the best of both worlds — proven techniques and startup speed — automakers can set themselves apart from the rest of the field.

### Accelerated Market Response

Automakers can cultivate a culture of rapid decision-making and iteration by empowering smaller, cross-functional teams. This nimble approach supports faster development cycles, quicker market entry and the ability to swiftly adapt to evolving trends and consumer preferences, providing a competitive edge.

### Increased Product Innovation and Enhanced Product Quality

Dedicated teams focused on specific 48V projects encourage experimentation and rapid problem solving. This facilitates swift prototyping and testing, potentially leading to advanced solutions that address quality issues, augment reliability and ultimately deliver superior product performance.

By integrating quality assurance into this agile framework, automakers can balance speed and innovation with proven reliability, ensuring new 48V systems meet stringent standards. Leveraging testing protocols, automakers lower risks associated with rapid development. Combining rigorous testing with agile practices, they identify and address potential issues early, differentiating them from newer companies and traditional competition.

Implementing these strategies significantly boosts automakers' ability to innovate, adapt and compete in the rapidly evolving automotive market.



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# MOLEX: DRIVING AUTOMOTIVE ADVANCEMENTS WITH EVERY CONNECTION

As a global leader in connectivity solutions, Molex is driving support for the development of vehicles with 48V systems. The **MX150 Mid-Voltage Connector system** exemplifies our commitment to addressing the evolving needs of the automotive industry.

Engineered for efficient assembly and reduced package size, the MX150 delivers a robust, reliable solution for 48V wiring applications. Capable of handling up to 60V, this connector system supports using smaller wire gauges to reduce both weight and cost while maintaining high performance. Its versatility and compatibility with oil-cooled electric motors make the MX150 a top choice for automotive manufacturers.

Molex is committed to forging strong customer partnerships and developing tailored solutions that tackle industry challenges. By combining our technical expertise with customer insights and powerful automotive design and manufacturing capabilities, we are shaping the future of automotive connectivity in a 48V world.



## CARESOF GLOBAL: PIONEERING INSIGHTS INTO TESLA'S 48V EVOLUTION

Caresoft Global, a leader in automotive engineering analysis, performed an in-depth teardown of Tesla's Cybertruck, the first vehicle of its kind to implement 48V technology. By carefully disassembling the vehicle and analyzing its components, Caresoft uncovered how Tesla's shift to 48V impacts system efficiency, wiring complexity and vehicle performance. Its findings highlight the transformative potential of this architecture for future electric vehicles while identifying key challenges manufacturers need to address on the road to 48V.

### KEY FINDINGS

#### Enhanced Efficiency

48V systems reduce energy losses and enable lighter wiring harnesses, resulting in significant copper reduction and scalability, ultimately lowering costs. By decreasing the vehicle's reliance on materials such as copper, manufacturers can help mitigate potential raw material shortages and future availability constraints. This also reduces

**Caresoft**<sup>®</sup>



the vehicle's carbon footprint by minimizing material consumption. By decreasing mass, manufacturers are able to achieve higher EV range with the same battery or similar range with a smaller battery system.

### **Cost Reduction**

The shift to 48V technology also has the potential to reduce costs for OEMs by reducing the quantity of copper within the vehicle, leading to significant raw material cost savings. By optimizing the wiring design, manufacturers can reduce the weight of harnesses, resulting in smaller battery requirements and lower manufacturing and raw material costs. The reduction in copper weight also enhances overall vehicle scalability, making it a strategic decision for automakers seeking to streamline costs.

### **Improved Performance**

The higher voltage and lower current in 48V systems enhance component functionality while reducing noise, vibration and harsh environment impacts. These improvements not only contribute to a better driving experience, — they also support manufacturers in addressing emerging consumer expectations for vehicle performance and comfort. Higher voltage with a lower current enables further feature/content implementation which was previously inhibited by capacity of the 12V/16V volt system.

### **Future Potential**

48V technology supports advanced features and wider industry adoption, making it a strategic move for automakers. The scalability of 48V enables seamless integration across a range of vehicles, from luxury to mass-market models.

## **CONCLUSION**

Tesla's adoption of 48V technology highlights its potential to transform the automotive industry. By carefully evaluating its key benefits and challenges, manufacturers can make strategic decisions about integrating 48V systems into their next-generation vehicles.

## **CARESOF'S EXPERTISE**

By meticulously disassembling vehicles and analyzing their components, Caresoft identifies opportunities for optimization, cost reduction and improved performance. This expertise is invaluable for manufacturers seeking to understand the complexities of 48V systems and develop effective strategies for their successful implementation.

For more insights, [read Caresoft's full 48V analysis.](#)



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