

# **Automotive Power Electronics Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, 2018-2028 Segmented By Device Type (Power IC, Module, and Discrete), By Application (Body Electronics, Safety and Security Electronics, and Powertrain), By Propulsion Type (IC Engine Vehicle and Electric Vehicle), By Vehicle Type (Passenger Cars and Commercial Vehicles), By Regional, Competition**

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## **Abstracts**

Global Automotive Power Electronics Market has valued at USD 3.3 billion in 2022 and is anticipated to project robust growth in the forecast period with a CAGR of 4.6% through 2028. The global automotive power electronics market is a dynamic and rapidly evolving sector within the automotive industry. Power electronics refers to the application of solid-state electronics for the control and conversion of electrical energy in various automotive systems. This market has experienced significant growth and transformation due to several key factors influencing demand, technological advancements, and shifting industry dynamics. One of the primary drivers of the global automotive power electronics market is the growing adoption of electric and hybrid vehicles (EVs and HEVs). As the automotive industry transitions toward more sustainable and eco-friendly transportation solutions, power electronics play a pivotal role in the propulsion and energy management systems of these vehicles. The demand for power electronics components, such as inverters and converters, has surged as automakers strive to improve the efficiency and performance of EVs and HEVs. This trend is expected to continue as governments worldwide introduce stricter emissions regulations and incentives for electric vehicle adoption. Additionally, the increasing

integration of advanced driver assistance systems (ADAS) and in-vehicle infotainment systems has driven the demand for automotive power electronics. ADAS systems rely on power electronics for functions like collision avoidance, adaptive cruise control, and automated parking. These features enhance vehicle safety and driver convenience, fueling the market's growth. As consumers' expectations for connectivity and convenience in vehicles rise, power electronics will continue to play a crucial role in delivering the functionality and performance required for modern automotive systems. The ongoing trend toward vehicle electrification and the development of autonomous vehicles are propelling the demand for power electronics further. Electric powertrains in EVs, as well as the sophisticated sensor and control systems in autonomous vehicles, rely heavily on power electronics for efficient energy management and precise control. As automakers invest in research and development to bring electric and autonomous vehicles to market, the automotive power electronics market will experience sustained growth. Moreover, power electronics contribute significantly to improving fuel efficiency in traditional internal combustion engine (ICE) vehicles. Start-stop systems, which automatically turn off the engine when the vehicle is stationary and restart it when needed, rely on power electronics components. This technology has gained widespread adoption as automakers seek to meet stringent fuel efficiency and emissions standards. Consequently, power electronics have a dual role in both conventional and electrified vehicles, making them a critical component in the quest for improved environmental performance. The global automotive power electronics market is characterized by intense competition and technological innovation. Leading automotive electronics manufacturers and suppliers are continually investing in research and development to introduce more efficient and compact power electronics solutions. Efficiency improvements and miniaturization of power electronics components contribute to reduced energy consumption, better thermal management, and overall vehicle performance enhancements. However, challenges such as thermal management and reliability remain significant concerns in the automotive power electronics market. Power electronics components generate heat during operation, necessitating efficient cooling and thermal management solutions. Overcoming these challenges is essential to ensure the long-term reliability and durability of power electronics systems in vehicles. In conclusion, the global automotive power electronics market is a dynamic and integral part of the automotive industry's transformation toward electrification, connectivity, and automation. As automakers and consumers increasingly prioritize sustainability, safety, and performance, the demand for power electronics solutions is poised for sustained growth. Technological advancements and competition among industry players will continue to drive innovation in this market, shaping the future of automotive power electronics.

## Key Market Drivers

### Electrification of Vehicles

One of the primary drivers of the global automotive power electronics market is the electrification of vehicles. The shift toward electric and hybrid electric vehicles (EVs and HEVs) has gained significant momentum in recent years. Electric powertrains, which rely heavily on power electronics components such as inverters, converters, and electric motors, are becoming more prevalent as automakers seek to reduce greenhouse gas emissions, meet stringent fuel efficiency standards, and offer eco-friendly alternatives to traditional internal combustion engine (ICE) vehicles. The demand for power electronics in EVs and HEVs is expected to continue growing as governments worldwide introduce stricter emissions regulations and provide incentives for electric vehicle adoption.

### Advanced Driver Assistance Systems (ADAS)

The increasing integration of advanced driver assistance systems (ADAS) is driving the demand for automotive power electronics. ADAS systems rely on power electronics for functions such as adaptive cruise control, collision avoidance, lane-keeping assistance, and automated parking. These systems enhance vehicle safety by providing real-time data and control over various vehicle functions. As consumers and regulators prioritize safety features, the automotive industry is witnessing a rapid deployment of ADAS technologies, contributing to the growth of the power electronics market.

### In-Vehicle Infotainment Systems

In-vehicle infotainment systems have become a standard feature in modern vehicles, offering entertainment, connectivity, and navigation services to drivers and passengers. Power electronics components, including microprocessors, display controllers, and power management units, are essential for the operation of these systems. As consumers' expectations for connectivity and convenience in vehicles rise, the demand for power electronics in infotainment systems continues to grow. The integration of advanced infotainment features, such as touchscreens, voice recognition, and smartphone integration, further amplifies the role of power electronics in enhancing the user experience.

### Vehicle Electrification Efforts

Automakers worldwide are investing heavily in vehicle electrification efforts, driven by

both environmental and market considerations. As they develop electric powertrains for EVs and HEVs, power electronics become a critical component for energy conversion and management. Power electronics are responsible for controlling the flow of electricity from the battery to the electric motor, ensuring optimal performance and efficiency. Automakers' commitment to vehicle electrification is a significant driver of the global automotive power electronics market.

### Autonomous Driving Technologies

The development of autonomous driving technologies is another major driver of the automotive power electronics market. Autonomous vehicles rely on a complex network of sensors, radar systems, cameras, and LiDAR (Light Detection and Ranging) to perceive their surroundings and make real-time decisions. Power electronics play a crucial role in the control and processing of data from these sensors, enabling safe and reliable autonomous operation. As autonomous vehicles move closer to commercial deployment, the demand for power electronics in this segment is poised for substantial growth.

### Fuel Efficiency Improvements in ICE Vehicles

Power electronics also contribute significantly to improving fuel efficiency in traditional internal combustion engine (ICE) vehicles. Start-stop systems, which automatically turn off the engine when the vehicle is stationary and restart it when needed, rely on power electronics components. This technology has gained widespread adoption as automakers seek to meet stringent fuel efficiency and emissions standards. Power electronics components are essential for ensuring smooth and efficient engine restarts, reducing fuel consumption, and lowering emissions.

### Environmental Regulations and Sustainability Goals

Environmental regulations and sustainability goals set by governments and international organizations are driving automakers to develop more fuel-efficient and eco-friendly vehicles. Power electronics are instrumental in achieving these objectives by optimizing energy consumption, minimizing emissions, and enhancing the overall environmental performance of vehicles. The pressure to meet these regulatory requirements and address sustainability concerns acts as a strong driver for the integration of advanced power electronics solutions in automobiles.

### Miniaturization and Integration of Components

Advancements in power electronics technology have led to the miniaturization and integration of components, resulting in more compact and efficient systems. These advancements are not only crucial for enhancing vehicle performance but also for freeing up space within the vehicle for other purposes, such as interior design and passenger comfort. Smaller and integrated power electronics components contribute to improved energy efficiency and reduced weight, further reinforcing their role as key drivers of the market.

### Competitive Landscape and Technological Innovation

The competitive landscape within the automotive power electronics market is intense, with leading manufacturers and suppliers continually investing in research and development to introduce more efficient and compact power electronics solutions. This commitment to innovation results in efficiency improvements, cost reductions, and the development of new power electronics technologies. As competition among industry players intensifies, technological advancements will continue to drive growth and shape the future of the global automotive power electronics market.

### Key Market Challenges

#### Thermal Management

Thermal management is a critical challenge in the automotive power electronics market. Power electronics components generate heat during operation, which can reduce their efficiency and lifespan if not properly managed. Effective cooling systems, heat sinks, and thermal interface materials are essential to dissipate heat and maintain optimal operating temperatures. Managing heat becomes even more crucial in electric vehicles (EVs) and hybrid electric vehicles (HEVs) where power electronics components are subject to high continuous loads. Finding efficient and reliable thermal management solutions while maintaining cost-effectiveness is a significant challenge for manufacturers.

#### Reliability and Durability

Ensuring the reliability and durability of power electronics components is another significant challenge. Power electronics systems must operate flawlessly over an extended period to meet the high standards of automotive safety and performance. Components are exposed to harsh environmental conditions, including temperature

variations, humidity, and vibration, which can accelerate wear and tear. Ensuring that power electronics components can withstand these conditions and continue to function reliably throughout a vehicle's lifespan is a complex engineering challenge.

### Electromagnetic Interference (EMI)

Electromagnetic interference (EMI) poses a considerable challenge in the automotive power electronics market. Power electronics systems generate electromagnetic radiation that can interfere with other electronic systems within the vehicle, potentially leading to malfunctions or safety risks. Minimizing EMI through shielding and filtering techniques is critical, but it adds complexity and cost to power electronics designs. Striking the right balance between EMI mitigation and cost-effectiveness is a significant challenge for manufacturers.

### High Development Costs

The development of advanced power electronics components and systems requires substantial research and development investments. Manufacturers must invest in cutting-edge technology, testing, and validation to meet the demanding performance and safety standards of the automotive industry. The high development costs can be a barrier to entry for smaller companies and startups, limiting competition and innovation within the market.

### Supply Chain Disruptions

The global automotive power electronics market is susceptible to supply chain disruptions, which can impact the availability of critical components and materials. Factors such as geopolitical tensions, natural disasters, and unforeseen events like the COVID-19 pandemic can disrupt the supply chain, leading to production delays and increased costs. Manufacturers must carefully manage their supply chains, diversify sourcing options, and develop contingency plans to mitigate the impact of supply chain disruptions.

### Standardization Challenges

Standardization within the automotive power electronics market can be a double-edged sword. While standardization can promote interoperability and reduce development costs, it can also stifle innovation and differentiation among manufacturers. Achieving a balance between standardized components and systems and the need for innovation



and customization is a challenge that the industry must address. Moreover, global variations in regulatory standards and requirements complicate the standardization process.

### Shortage of Skilled Workforce

The development and maintenance of power electronics systems require a skilled workforce with expertise in electrical engineering, electronics, and thermal management. However, there is a shortage of qualified professionals with the specialized knowledge required to design, test, and troubleshoot power electronics components and systems. This shortage of skilled workers can hamper the industry's ability to innovate and meet growing demand.

### Complexity of System Integration

The integration of power electronics systems into modern vehicles is a complex undertaking. These systems must seamlessly interact with other vehicle components, including the engine, transmission, battery, and various sensors. Achieving compatibility, optimal performance, and safety in a rapidly evolving technological landscape is challenging. Furthermore, as vehicles become more connected and autonomous, the complexity of system integration increases, demanding advanced software and hardware solutions.

### Cybersecurity Concerns

With the increasing connectivity of vehicles, cybersecurity has become a significant concern in the automotive power electronics market. Ensuring the security of power electronics systems and preventing unauthorized access is critical to protect vehicle safety and user data. As vehicles become more reliant on software and communication networks, they become potential targets for cyberattacks. Developing robust cybersecurity measures while maintaining system performance and functionality is a challenging balancing act.

### Cost Pressure

Cost pressures are a perennial challenge in the automotive industry, including the power electronics segment. Automakers and consumers alike seek cost-effective solutions that offer value for money. However, the development and production of high-quality power electronics components can be expensive. Striking the right balance

between cost efficiency and maintaining product quality, reliability, and safety is a continuous challenge for manufacturers.

## Key Market Trends

### Electrification of Vehicles

The electrification of vehicles, including electric vehicles (EVs) and hybrid electric vehicles (HEVs), is a dominant trend in the automotive power electronics market. Automakers are investing heavily in electric powertrains to meet stringent emissions regulations and consumer demand for eco-friendly transportation options. Power electronics are at the heart of these electric powertrains, converting and managing electrical energy for propulsion. This trend is expected to accelerate as governments worldwide introduce stricter emissions standards and incentives for electric vehicle adoption.

### High-Voltage Systems

As EVs become more prevalent, there is a trend toward high-voltage systems in the automotive power electronics market. High-voltage systems offer several advantages, including increased efficiency, reduced energy losses, and the ability to deliver more power to the electric motor. These systems require specialized power electronics components such as high-voltage inverters and converters. Manufacturers are developing innovative solutions to meet the growing demand for high-voltage power electronics.

### Advanced Battery Management

Battery management systems (BMS) are a critical component of electric and hybrid vehicles, and they rely heavily on power electronics for monitoring and control. The trend in battery management is toward more advanced and intelligent systems that optimize battery performance, extend battery life, and ensure safe operation. Power electronics play a crucial role in managing battery charging and discharging, balancing individual cells, and providing real-time data to improve battery efficiency.

### Energy Recovery Systems

Energy recovery systems, such as regenerative braking, are gaining prominence in the automotive power electronics market. These systems capture and store energy during



deceleration and braking, then use it to assist the vehicle during acceleration, reducing energy consumption and improving fuel efficiency. Power electronics components, including inverters and converters, facilitate the seamless operation of these energy recovery systems, enhancing overall vehicle performance.

### SiC and GaN Semiconductor Adoption

Silicon carbide (SiC) and gallium nitride (GaN) semiconductors are gaining traction in the automotive power electronics market. These advanced semiconductor materials offer higher efficiency, faster switching speeds, and improved thermal performance compared to traditional silicon-based semiconductors. As automakers seek to maximize the efficiency of electric powertrains and reduce energy losses, the adoption of SiC and GaN semiconductors is expected to increase.

### Integration of Multiple Functions

To optimize space, weight, and cost, there is a trend toward integrating multiple functions into a single power electronics module. These integrated modules combine inverters, converters, and other power electronics components, streamlining the design and manufacturing processes. Integrated solutions help reduce complexity, save space, and improve overall system efficiency in electric and hybrid vehicles.

### Wireless Charging Systems

Wireless charging systems for electric vehicles are gaining momentum in the market. These systems use power electronics to transfer electrical energy wirelessly from a charging pad to the vehicle's battery. The convenience of wireless charging is driving its adoption, particularly in urban areas where charging infrastructure is expanding. Power electronics are essential for efficiently managing wireless charging systems and ensuring safe and reliable energy transfer.

### Autonomous Driving Technologies

The development of autonomous driving technologies is influencing the role of power electronics in vehicles. Autonomous vehicles rely on advanced sensor systems, such as LiDAR and radar, which require precise power management and control. Power electronics enable the operation of these sensor systems, facilitating real-time data processing and decision-making for autonomous driving. As autonomous vehicles move closer to commercial deployment, the demand for power electronics in this segment is

expected to grow.

### Software-Centric Approach

The automotive industry is adopting a more software-centric approach, emphasizing the role of software in power electronics systems. Software controls various aspects of power management, energy distribution, and safety in electric and hybrid vehicles. Manufacturers are investing in advanced software solutions to optimize power electronics performance, enable over-the-air updates, and enhance cybersecurity.

### Environmental Sustainability

Environmental sustainability is a pervasive trend influencing the global automotive power electronics market. As consumers and regulators prioritize eco-friendly transportation solutions, power electronics play a critical role in achieving sustainability goals. Manufacturers are developing power electronics components and systems that minimize energy consumption, reduce emissions, and enhance the overall environmental performance of vehicles. This trend aligns with global efforts to combat climate change and reduce the carbon footprint of the automotive industry.

### Increased Connectivity

The growing demand for connectivity in vehicles is influencing power electronics systems. Connected vehicles rely on power electronics for various functions, including communication, data processing, and entertainment. The integration of advanced connectivity features, such as 5G connectivity and vehicle-to-everything (V2X) communication, requires power electronics to manage data transmission and processing efficiently.

### Segmental Insights

#### Device Type Insights

The global Automotive Power Electronics market is segmented based on the type of device used. Power ICs, power modules, and power discrete devices are the primary divisions. Power ICs have been the dominant segment due to their extensive use in powertrain and safety applications. However, the power modules segment is expected to witness substantial growth owing to their increasing use in electric vehicles. Lastly, power discrete devices maintain a steady demand in the market due to their usage in a

wide range of automotive applications.

### Application Type Insights

Based on application type, the automotive power electronics market can be segmented into body electronics, chassis & powertrain, infotainment & telematics, and safety & security systems. Body electronics, infotainment, and telematics are expected to witness significant growth due to the increasing demand for luxury and comfort features in vehicles. Chassis and powertrain applications are also projected to show substantial growth, driven by the increasing use of electric vehicles and the need for efficient power management systems. Safety and security systems, underpinned by advanced driver assistance systems (ADAS), represent a key growth area due to heightened consumer and regulatory focus on vehicle safety.

### Regional Insights

The global Automotive Power Electronics market is influenced by a variety of regional factors. In North America, for instance, the market is primarily driven by the widespread adoption of electric vehicles, fueled by stringent government regulations concerning vehicle emissions. Europe, with its strong automotive industry, is a significant contributor, with Germany leading the pack in power electronics technology due to its robust automotive manufacturing sector. Meanwhile, Asia-Pacific is expected to display rapid growth, owing to increasing environmental awareness and growing demand for electric vehicles, particularly in China and India. Lastly, the Middle East and Africa, although currently holding a smaller market share, present promising potential with the progressive development of their automotive industries.

### Key Market Players

Infineon Technologies AG

Texas Instruments Incorporated

Renesas Electronics Corporation

NXP Semiconductors

STMicroelectronics

Microsemi Corporation

Vishay Intertechnology Inc.

Semiconductor Components Industries LLC

Toyota Industries Corporation

Valeo Group

Report Scope:

In this report, the Global Automotive Power Electronics Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

Automotive Power Electronics Market, By Device Type:

Power IC

Module

Discrete

Automotive Power Electronics Market, By Application Type:

Body Electronics

Safety and Security Electronics

Powertrain

Automotive Power Electronics Market, By Propulsion Type:

IC Engine Vehicle

Electric Vehicle

Automotive Power Electronics Market, By Vehicle Type:

Passenger Cars

Commercial Vehicles

Automotive Power Electronics Market, By Region:

North America

United States

Canada

Mexico

Europe & CIS

Germany

Spain

France

Russia

Italy

United Kingdom

Belgium

Asia-Pacific

China

India

Japan

Indonesia

Thailand

Australia

South Korea

South America

Brazil

Argentina

Colombia

Middle East & Africa

Turkey

Iran

Saudi Arabia

UAE

## Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Automotive Power Electronics Market.

## Available Customizations:

Global Automotive Power Electronics Market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

## Company Information



Detailed analysis and profiling of additional market players (up to five).

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