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Wide Bandgap Semiconductors (SiC, GaN) for Power Devices Fundamental and Design

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Abstract: *The increasing demand for high-efficiency, compact, and high-performance power electronic systems has driven the shift from traditional silicon-based devices to Wide Bandgap (WBG) semiconductors, particularly Silicon Carbide (SiC) and Gallium Nitride (GaN). These materials offer significantly superior electrical properties compared to conventional silicon, including higher breakdown voltage, faster switching speeds, greater thermal conductivity, and lower power losses. SiC is well-suited for high-voltage, high-temperature applications such as electric vehicles and renewable energy systems, whereas GaN excels in high-frequency, low-to-medium voltage systems like chargers and RF electronics. This paper explores the advantages, use cases, and future trends of WBG semiconductors in the power electronics industry.*

The abstract talks about how new materials called Wide Bandgap semiconductors (SiC and GaN) are replacing traditional silicon in power electronics. These materials are better because they can handle higher voltages, switch faster, and work well in hotter environments.

SiC is best for high-power applications like electric vehicles and solar systems.

GaN is great for small, high-speed devices like mobile chargers and wireless electronics.

The paper mainly focuses on their advantages, applications, and what the future looks like for these technologies in the electronics industry..

Keywords: Wide Bandgap, SiC, GaN, Power Devices, High Efficiency, Power Electronics, Fast Switching, Electric Vehicles

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