High Power Applications with low losses - Silicon Carbide

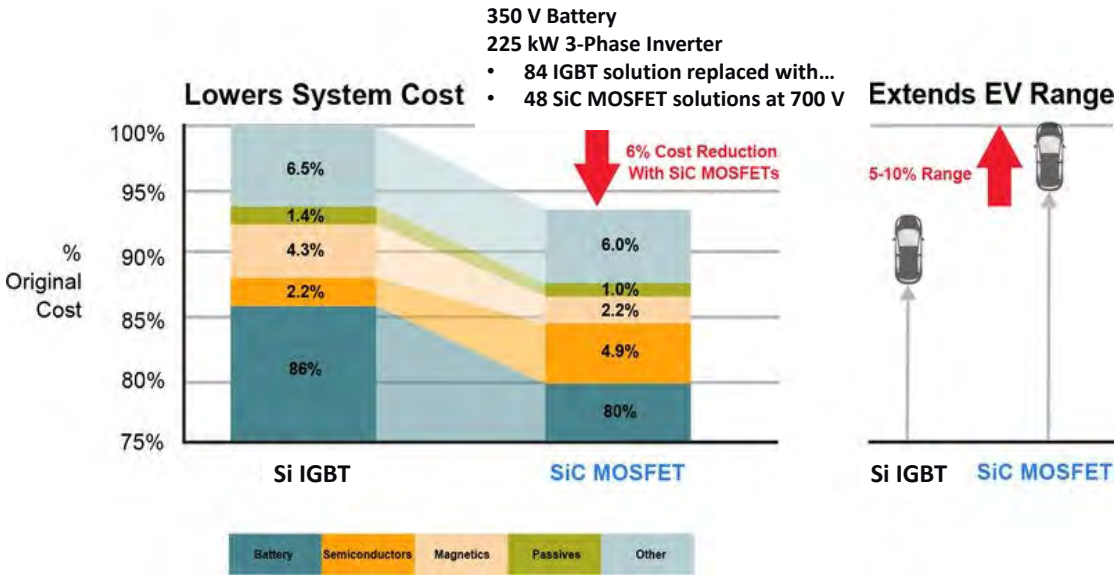
SiC is the perfect technology to address high-frequency and high-power densitiy applications → Lower power losses Higher frequency cap. Higher junction temp. → Easier cooling Downsized system Higher reliability

Silicon Carbide (SiC) semiconductors provide an innovative option for power electronic designers looking for improved system efficiency, smaller form factor and higher operating temperature in products covering industrial, transportation/automotive, medical, aerospace/aviation, defense and communication market segments. Microchips next-generation SiC MOSFETs and SiC SBDs are designed with higher repetitive Unclamped Inductive Switching (UIS) capability at rated on-resistance or current. The SiC MOSFETs maintain high UIS capability at approximately 10–25 Joules Per Square Centimeter (J/cm2) and robust short circuit protection. Microchip's SiC Schottky Barrier Diodes (SBDs) are designed with balanced surge current, forward voltage, thermal resistance and thermal capacitance ratings at low reverse current for lower switching loss. In addition, the SiC MOSFET and SiC SBD die can be paired together for use in modules. SiC MOSFET and SiC SBD products from Microchip will be qualified to the AEC-Q101 standard.

SiC is the ideal technology for higher-switching-frequency, higher-efficiency and higher-power (>650 V) applications.

Characteristics	SiC vs. Si	Results	Benefits
Breakdown field (MV/cm)	10x higher	Lower on-resistance	Higher efficiency
Electron sat. velocity (cm/s)	2x higher	Faster switching	Size reduction
Bandgap energy (ev)	3x higher	Higher junction temperature	Improved cooling
Thermal conductivity (W/m.K)	3x higher	Higher power density	Higher current capabilities

SiC offers better performance and overall lower system cost



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Design-in Expertise and Service

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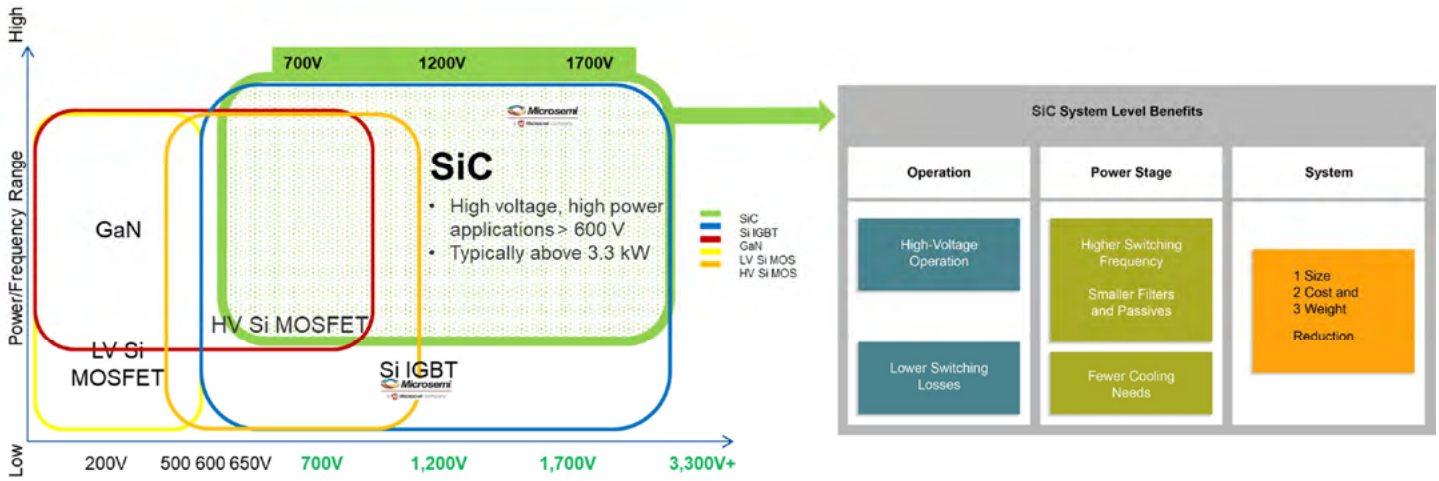
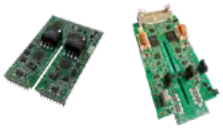


Product Family	Product Packages	Sub Product Family	Key Differentiation
Power Discretes		◆ SiC die ◆ Discrete SiC MOSFETs ◆ Discrete SBDs (Schottky Barrier Diodes)	◆ One of the broadest portfolios on the market ◆ QSS (Quality, Supply, Support) ◆ 30+ years in dev, design and support of power discretes
Power Modules		◆ SiC MOSFET power modules ◆ SiC Diode power modules	◆ Standard packages and architectures available ◆ Standard and Custom power modules ◆ Flight proven heritage on both Boeing and Airbus Platforms = proven reliability in critical applications ◆ High design flexibility
Integrated Power Solutions		◆ Power Control Module (PCM), Hybrid Power Drive Modules (HPD/HPE)	◆ Highest level of integration and reliability for flight critical applications ◆ Standard SiC solution available as well semi-custom SiC and IGBT offerings available ◆ Partial discharge, current monitoring, over voltage, solenoid drive, short circuit protection, digital interface for control, screw and solder options
Digital Programmable Gate Drivers		◆ Gate Driver Cores ◆ Plug & Play Gate Driver Boards	◆ Patented Augmented Switching™ reduces voltage overshoot, ringing, system noise, EMI ◆ Robust Short Circuit protection rapidly detects and protects against overcurrent faults

Applications

- Industry: Motor drives, welding, UPS, SMPS, induction heating
- Automotive: Electric Vehicle (EV) battery chargers, on board chargers, Hybrid Electric Vehicle (HEV) powertrains, DC-DC converters, energy recovery
- Smart energy: Photovoltaic (PV) inverters, wind turbines
- Medical: MRI power supply, X-ray power supply
- Commercial aviation: Actuation, air conditioning, power distribution
- Defense: Motor drives, auxiliary power supplies, integrated vehicle systems

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