

Silicon Carbide Semiconductor Products



Low Switching Losses

Low Gate Resistance

High Power Density

High Thermal Conductivity

High Avalanche (UIS) Rating

Reduced Heat Sink Requirements

High Temperature Operation

Reduced Circuit Size and System Costs

Overview

Silicon Carbide (SiC) is the ideal technology for higher switching frequency, higher efficiency, and higher power (>650 V) applications. Target markets and applications include:

- Commercial aviation—actuation, air conditioning, power distribution
- Industrial—motor drives, welding, UPS, SMPS, induction heating
- Transportation/automotive—EV battery charger, onboard chargers, H/EV powertrain, DC-DC converter, energy recovery
- Smart energy—PV inverter, wind turbine
- Medical—MRI power supply, X-Ray power supply
- Defense and oil drilling—motor drives, auxiliary power supplies

SiC MOSFET and SiC Schottky Barrier Diode product lines from Microsemi increase your system efficiency over silicon MOSFET and IGBT solutions while lowering your total cost of ownership by enabling downsized systems and smaller/lower cost cooling.

Full In-House and Foundry Capabilities

Design

- Silvaco design and process simulator
- TCAD-TMA
- Mask-making and layout
- Solid works and FEA

Process

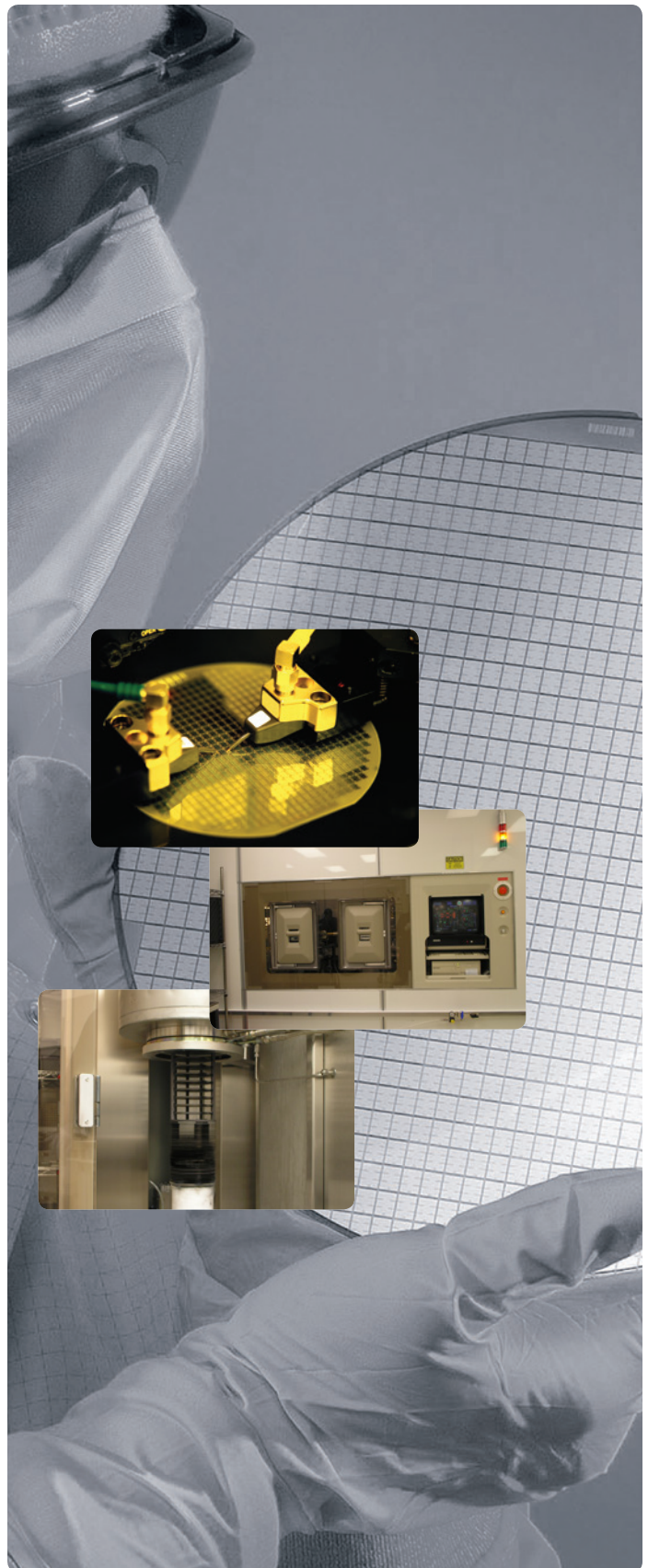
- High-temperature ion implantation
- High-temperature annealing
- SiC MOSFET gate oxide
- ASML steppers
- RIE and plasma etching
- Sputtered and evaporated metal deposition

Analytical and Support

- SEM/EDAX
- Thermal imaging
- Photo Emission Microscope system (Phemos 1000)

Reliability Testing and Screening

- AEC-Q101
- Wafer-level HTRB/HTGB
- Sonoscan and X-ray



The Power of Silicon Carbide Semiconductors

Breakthrough Technology Combines High Performance with Low Losses

Silicon Carbide (SiC) semiconductors are an innovative new option for power electronic designers looking to improve system efficiency, with a smaller form factor and higher operating temperature in products covering industrial, automotive, medical, mil-aerospace, and communication market segments. Microsemi is proud to be at the forefront of this game changing technology with a comprehensive portfolio of SiC solutions.

Extremely Low Switching Losses

- Zero reverse recovery charge improves system efficiency

High Power Density

- Smaller footprint device reduces system size and weight

High Thermal Conductivity

- 2.5x more thermally conductive than silicon

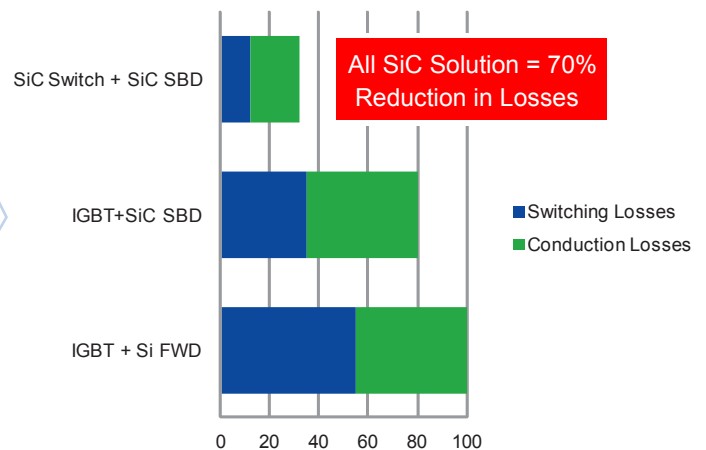
Reduced Sink Requirements

- Results in lower cost and smaller size

High Temperature Operation

- Increased power density and improved reliability

Reduction in Losses Model Inverter



SiC is the perfect technology to address high-frequency and high-power-density applications

Lower power losses
Higher frequency cap.
Higher junction temp.

Easier cooling
Downsized system
Higher reliability

Automotive



Industrial



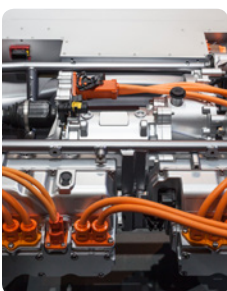
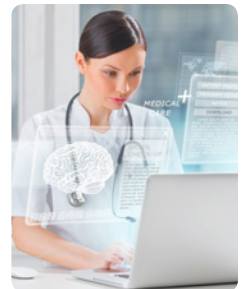
Aviation



Defense



Medical



Power Modules

SiC Power Module Advantages

- High-speed switching
- Low input capacitance
- Low profile
- Lower system cost
- Low switching losses
- Low drive requirements
- Minimum parasitic inductance
- Increased reliability

Standard Modules

Part Number	Type	Electrical Topology	Voltage (V)	Current (A)	Package Type	
APT2X20DC60J	Diode module	Dual diode	600	20	SOT227	
APT2X30DC60J				30	SOT227	
APT2X40DC60J				40	SOT227	
APT2X50DC60J				50	SOT227	
APT2X60DC60J				60	SOT227	
APT2X20DC120J			1200	20	SOT227	
APT2X40DC120J				40	SOT227	
APT2X50DC120J				50	SOT227	
APT2X60DC120J				60	SOT227	
APT40DC60HJ			Full bridge	600	40	SOT227
APTDC40H601G		40			SP1	
APT20DC120HJ		1200		20	SOT227	
APTDC20H1201G				20	SP1	
APT40DC120HJ				40	SOT227	
APT30SM120JCU2	MOSFET module	Boost chopper	1200	30	SOT227	
APT100MC120JCU2				100	SOT227	
APTSM120HM50CT3AG		Full bridge		59	SP3F	
APTMCM120HM17CT3AG				110	SP3F	
APTMCM120AM55CT1AG		Phase leg		40	SP1	
APTSM120AM55CT1AG				59	SP1	
APTMCM120AM25CT3AG				80	SP3F	
APTMCM120AM20CT1AG				100	SP1	
APTSM120AM25CT3AG				118	SP3F	
APTMCM120AM12CT3AG				150	SP3F	
APTMCM120AM08CD3AG				185	D3	
APTMCM120AM09CT3AG				200	SP3F	
APTSM120AM08CT6AG				293	SP6	
APTMCM170AM60CT1AG		1700	40	SP1		
APTMCM170AM30CT1AG			80	SP1		
APTMCM60TL11CT3AG		Three level inverter	600	20	SP3F	
APTMCM60TLM55CT3AG				40	SP3F	
APTMCM60TLM14CAG				160	SP6	
APTMCM120HR11CT3AG			1200	20	SP3F	
APTMCM120HRM40CT3AG		50		SP3F		
APTSM120TA10CT3AG		30		SP3F		
APTSM120TAM34CT3AG		55		SP3F		
APTSM120TAM33CTPAG		89		SP6P		
APTMCM120TAM17CTPAG		100		SP6P		
APTMCM120TAM12CTPAG		150		SP6P		

Customization

Microsemi offers a complete engineering solution with mix and match capabilities in terms of package, interconnection, configuration, performance, and cost.

Out of the existing standard power modules product line, Microsemi can offer simple, modified, or fully customized parts to meet 100% of our customers' needs.

- Design expertise
- Low profile packages
- Extended temperature capabilities
- Pin locating flexibility
- High power density
- Mix of silicon

Discrete Products

SiC Schottky Barrier Diodes

Part Number	Voltage (V)	I _F (A)	V _F (Typical at 25°C)	Package
MSC010SDA070K	700	10	1.5	TO-220
MSC030SDA070K		30	1.5	TO-220
MSC050SDA070B		50	1.5	TO-247
MSC010SDA120B	1200	10	1.5	TO-247
MSC010SDA120K		10	1.5	TO-220
MSC030SDA120B		30	1.5	TO-247
MSC030SDA120S		30	1.5	D3PAK
MSC050SDA120B		50	1.5	TO-247
MSC050SDA120S		50	1.5	D3PAK
MSC010SDA170B	1700	10	1.5	TO-247
MSC030SDA170B		30	1.5	TO-247
MSC050SDA170B		50	1.5	TO-247

SiC MOSFETs

Part Number	Voltage (V)	Current (A)	R _{DS(ON)} (Typical)	Package
APT35SM70B	700	35	125 mΩ*	TO-247
APT35SM70S				D3PAK
APT70SM70B	700	58	75 mΩ*	TO-247
APT70SM70S				D3PAK
APT70SM70J				SOT-227
APT130SM70B	700	78	35 mΩ*	TO-247
APT130SM70J				SOT-227
APT25SM120B	1200	25	140 mΩ	TO-247
APT25SM120S				D3PAK
APT40SM120B	1200	40	80 mΩ	TO-247
APT40SM120S				D3PAK
APT40SM120J				SOT-227
APT80SM120B	1200	80	40 mΩ	TO-247
APT80SM120S				D3PAK
APT80SM120J				SOT-227

*Preliminary current and typical R_{DS(ON)} values. Consult the datasheet for device ratings by package.

SiC MOSFETs

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
Positive temperature coefficient		Self regulation	Easy paralleling

SiC Modules= Higher Power Density

Parameter	Microsemi APTGLQ300A120G	Microsemi APTMC120AM20CT1AG	Comparison: SiC vs Si
Semiconductor type	Trench4 IGBT	SiC MOSFET	
Ratings at Tc=25°C	500 A/1200 V	143 A/1200 V	
Package type	SP6: 108 mm × 62 mm	SP1: 52 mm × 41 mm	3x smaller
Current at 30 kHz Tc=75°C, D=50%, V=600 V	130 A	130 A	
Current at 50 kHz Tc=75°C, D=50%, V=600 V	60 A	115 A	~2.0x higher
Eon+Eoff at 100 A Tj=150°C, V=600 V	16.0 mJ	3.4 mJ	4.7x lower

Microsemi is continually adding new products to its
industry-leading portfolio.

For the most recent updates to our product line and for detailed
information and specifications, please call, email, or visit our website.

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