Power Matters.

Silicon Carbide Semiconductor Products

Low Switching Losses

High Power Density

High Thermal Conductivity

Reduced Heat Sink Requirements

High Temperature Operation

Reduced Circuit Size and System Costs

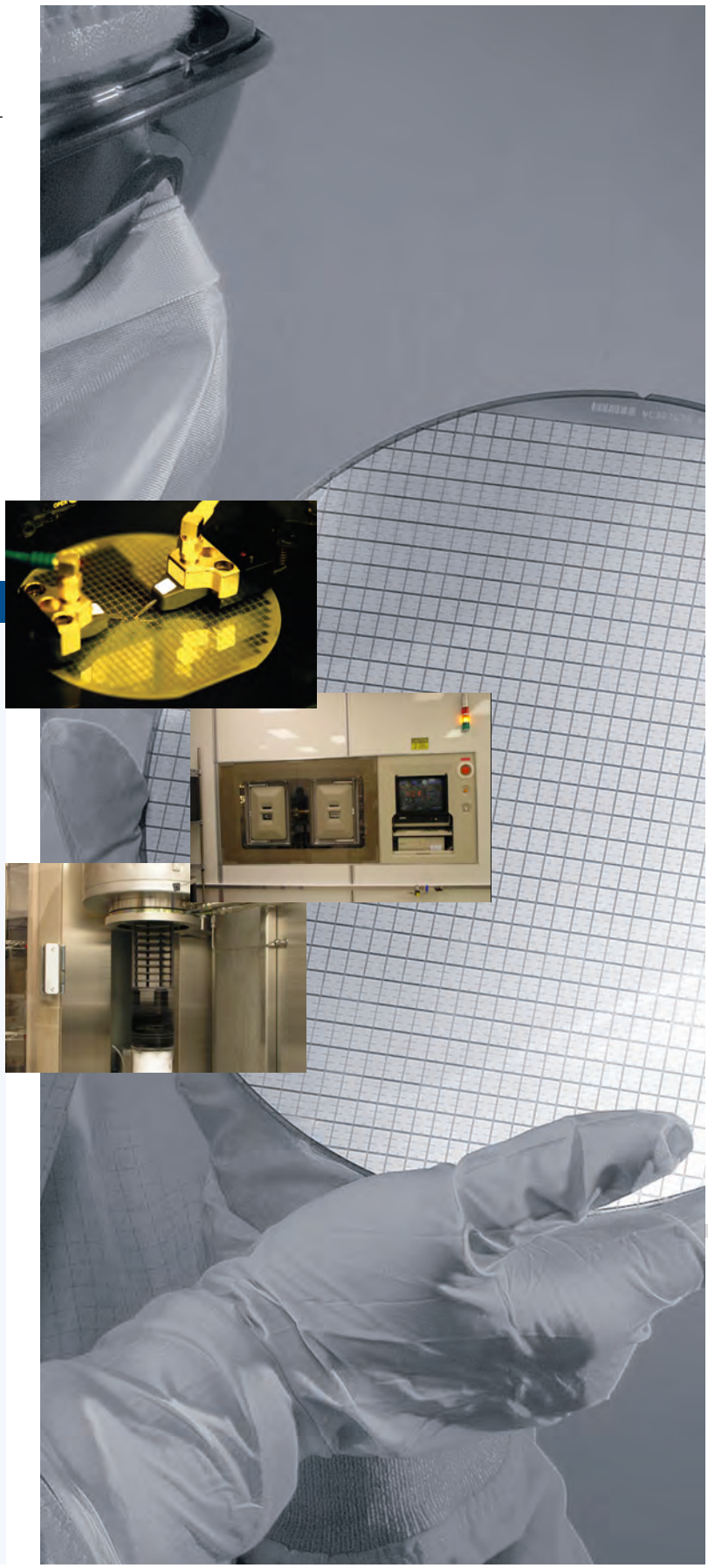
Microsemi

Overview & Resources

Microsemi Corporation has a full silicon carbide (SiC) wafer fab at its Bend, Oregon site. This facility has a 25-year history of innovation and manufacturing of high-voltage high-frequency power semiconductors and is ISO 9001 and JANS certified.

In addition to producing discrete SiC semiconductors, Microsemi has developed a variety of SiC and mixed semiconductor power modules. These modules, incorporating the latest in available technologies, offer rugged operation as well as high efficiency.

Microsemi has a wide ranging interest in partnering with customers to provide the best SiC solution for a specific application.



FULL IN-HOUSE CAPABILITIES

Design

- Silvaco Design and Process Simulator
- TCAD-TMA
- Mask-Making and Layout
- Solid Works & 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

- Atomic Force Microscope
- n-Spec Defect Detection
- SEM/EDAX
- Thermal Imaging

Reliability Testing & Screening

- HTRB, HTGB, TC, PC, HTOL and 85/85
- Wafer Level HTRB/HTGB
- Sonoscan and X-ray

The Power of Silicon Carbide Semiconductors

Breakthrough Technology Combines High Performance & Low Losses

Silicon Carbide (SiC) semiconductors are an innovative new option for power electronic designers looking to improve system efficiency, smaller form factor and higher operating temperature in products covering industrial, 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 and in-house fabrication capabilities.

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

AUTOMOTIVE	INDUSTRIAL	AVIATION	DEFENSE	MEDICAL

Power Modules

SiC Power Module Advantages

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

STANDARD MODULES

P/N	Type	Electrical Topology	Voltage (V)	Current (A)	Package Type
APT2X30DC60J	Diode module	Dual diode	600	30	SOT227
APT2X40DC60J				40	SOT227
APT2X60DC60J				60	SOT227
APT2X20DC120J			1200	20	SOT227
APT2X50DC120J				50	SOT227
APT40DC60HJ		Full bridge	600	40	SOT227
APTDC40H601G				40	SP1
APT20DC120HJ			1200	20	SOT227
APTDC20H1201G				20	SP1
APT40DC120HJ				40	SOT227
APTSM70TAM60CT3AG	Mosfet Module	3 phase bridge	700	49	SP3F
APTSM120TA10CT3AG			1200	30	SP3F
APT50SM70JCU2		Boost chopper	700	49	SOT227
APT30SM120JCU2			1200	30	SOT227
APT100MC120JCU2				100	SOT227
APTSM70HM30CT3AG		Full bridge	700	97	SP3F
APTSM120HM50CT3AG			1200	59	SP3F
APTMC120HM17CT3AG				110	SP3F
APTSM70AM30CT1AG		Phase leg	700	97	SP1
APTSM70AM15CT3AG				194	SP3F
APTSM70AM05CT6AG				480	SP6
APTMC120AM55CT1AG			1200	40	SP1
APTSM120AM55CT1AG				59	SP1
APTMC120AM25CT3AG				80	SP3F
APTMC120AM20CT1AG				100	SP1
APTSM120AM25CT3AG				118	SP3F
APTMC120AM12CT3AG				150	SP3F
APTMC120AM08CD3AG				185	D3
APTMC120AM09CT3AG				200	SP3F
APTSM120AM08CT6AG				293	SP6
APTMC170AM60CT1AG			1700	40	SP1
APTMC170AM30CT1AG				80	SP1
APTMC60TL11CT3AG		Three level inverter	600	20	SP3F
APTMC60TLM55CT3AG				40	SP3F
APTMC60TLM14CAG				160	SP6
APTMC120HRM40CT3AG			1200	50	SP3F
APTSM70TAM20CTPAG		Triple Phase leg	700	146	SP6P
APTSM120TAM33CTPAG			1200	89	SP6P
APTMC120TAM17CTPAG				100	SP6P
APTMC120TAM12CTPAG				150	SP6P

Optional Materials: • AlN substrate • Si3N4 Substrate • AlSiC base plate material • Temperature sensor • Press fit terminals (for SP3 package)

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
- High power density
- Low profile packages
- Extended temperature capabilities
- Pin locating flexibility
- Mix of Silicon

SIC SCHOTTKY DIODES

Volts	$I_{F(avg)}$ Amps	V_F volts Typ 25° C	Diode Series	Part Number	Package Style
SINGLE					
1700	10	1.5	SCE	APT10SCE170B	TO-247
1200	10	1.5	SCD	APT10SCD120B	TO-247
	10	1.5	SCD	APT10SCD120K	TO-220
	20	1.5	SCD	APT20SCD120B	TO-247
	20	1.5	SCD	APT20SCD120S	D^3
	30	1.5	SCD	APT30SCD120B	TO-247
	30	1.5	SCD	APT30SCD120S	D^3
650	10	1.5	SCD	APT10SCD65K	TO-220
	20	1.5	SCD	APT20SCD65K	TO-220
	30	1.5	SCD	APT30SCD65B	TO-247
DUAL					
1200	2 x 10	1.5	SCD	APT10SCD120BCT	TO-247

SILICON CARBIDE (SIC) MOSFETS

$BV_{(DSS)}$ Volts	$R_{DS(ON)}$ Ohms	$I_{D(Cont)}$ Amps	Part Number	Package Style
700V	0.100	35	APT35SM70B	TO-247
	0.100	35	APT35SM70S	D3
	0.053	70	APT70SM70B	TO-247
	0.053	70	APT70SM70S	D3
	0.053	70	APT70SM70J	ISOTOP®
	0.033	130	APT130SM70B	TO-247
	0.033	130	APT130SM70J	ISOTOP®
1200V	0.140	25	APT25SM120B	TO-247
	0.140	25	APT25SM120S	D3
	0.080	40	APT40SM120B	TO-247
	0.080	40	APT40SM120S	D3
	0.080	40	APT40SM120J	ISOTOP®
	0.040	80	APT80SM120B	TO-247
	0.040	80	APT80SM120S	D3
	0.040	80	APT80SM120J	ISOTOP®
1700V	0.800	5	APT5SM170B	TO-247
	0.800	5	APT5SM170S	D3

Microsemi Patented Technology. Manufactured in Bend, Oregon USA

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

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

Microsemi Advantages vs. Competition

- Lowest Conduction Losses at High Temperature
- Low Switching Losses
- Highest Short Circuit Withstand Rating
- Lowest Gate Resistance
- Patented SiC Technology

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