

**Boost chopper
NPT IGBT
SiC Chopper diode**

**$V_{CES} = 600V$
 $I_C = 90A @ T_c = 80^\circ C$**

Application

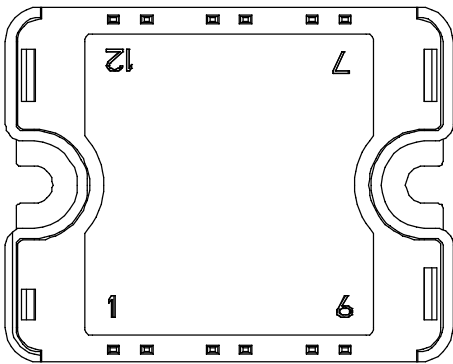
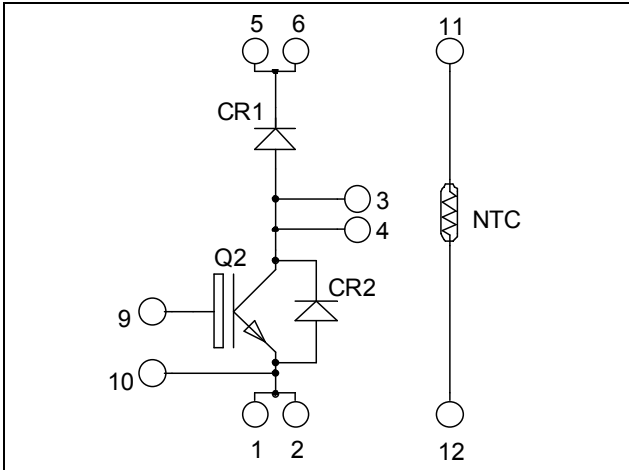
- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction

Features

- **Non Punch Through (NPT) Fast IGBT**
 - Low voltage drop
 - Low tail current
 - Switching frequency up to 100 kHz
 - Low leakage current
 - RBSOA and SCSOA rated
- **Chopper SiC Schottky Diode**
 - Zero reverse recovery
 - Zero forward recovery
 - Temperature Independent switching behavior
 - Positive temperature coefficient on VF
- Very low stray inductance
- Internal thermistor for temperature monitoring
- High level of integration

Benefits

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- RoHS Compliant



Pins 1/2 ; 3/4 ; 5/6 must be shorted together

Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
V_{CES}	Collector - Emitter Breakdown Voltage	600	V
I_C	Continuous Collector Current	$T_c = 25^\circ C$	110
		$T_c = 80^\circ C$	90
I_{CM}	Pulsed Collector Current	$T_c = 25^\circ C$	315
V_{GE}	Gate - Emitter Voltage	± 20	V
P_D	Maximum Power Dissipation	$T_c = 25^\circ C$	416
RBSOA	Reverse Bias Safe Operating Area	$T_j = 150^\circ C$	200A @ 600V

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

All ratings @ $T_j = 25^\circ\text{C}$ unless otherwise specified

Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_{CES}	Zero Gate Voltage Collector Current	$V_{GE} = 0\text{V}, V_{CE} = 600\text{V}$			250	μA
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15\text{V}$ $I_C = 100\text{A}$	$T_j = 25^\circ\text{C}$	2	2.5	V
			$T_j = 125^\circ\text{C}$	2.2		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 1.5\text{mA}$	4.5	5.5	6.5	V
I_{GES}	Gate – Emitter Leakage Current	$V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$			400	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	$V_{GE} = 0\text{V}; V_{CE} = 25\text{V}$		4.3		nF
C_{res}	Reverse Transfer Capacitance	$f = 1\text{MHz}$		0.4		
Q_G	Gate charge	$V_{GE} = 15\text{V}; V_{CE} = 300\text{V}$ $I_C = 100\text{A}$		240		nC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C)		25		ns
T_r	Rise Time	$V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$		10		
$T_{d(off)}$	Turn-off Delay Time	$I_C = 100\text{A}$		130		
T_f	Fall Time	$R_G = 2.2\Omega$		20		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C)		25		ns
T_r	Rise Time	$V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$		11		
$T_{d(off)}$	Turn-off Delay Time	$I_C = 100\text{A}$		150		
T_f	Fall Time	$R_G = 2.2\Omega$		30		
E_{on}	Turn-on Switching Energy	$V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$ $I_C = 100\text{A}$	$T_j = 125^\circ\text{C}$	0.6		mJ
E_{off}	Turn-off Switching Energy	$R_G = 2.2\Omega$	$T_j = 125^\circ\text{C}$	3		
I_{sc}	Short Circuit data	$V_{GE} \leq 15\text{V}; V_{Bus} = 360\text{V}$ $t_p \leq 10\mu\text{s}; T_j = 125^\circ\text{C}$		450		A

Chopper SiC diode ratings and characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage		600			V
I_{RM}	Maximum Reverse Leakage Current	$V_R = 600\text{V}$	$T_j = 25^\circ\text{C}$	200	800	μA
			$T_j = 175^\circ\text{C}$	400	4000	
I_F	DC Forward Current		$T_c = 100^\circ\text{C}$	40		A
V_F	Diode Forward Voltage	$I_F = 40\text{A}$	$T_j = 25^\circ\text{C}$	1.6	1.8	V
			$T_j = 175^\circ\text{C}$	2	2.4	
Q_C	Total Capacitive Charge	$I_F = 40\text{A}, V_R = 300\text{V}$ $di/dt = 1200\text{A}/\mu\text{s}$		56		nC
C	Total Capacitance	$f = 1\text{MHz}, V_R = 200\text{V}$		260		pF
		$f = 1\text{MHz}, V_R = 400\text{V}$		200		

Thermal and package characteristics

Symbol	Characteristic	Min	Typ	Max	Unit	
R _{thJC}	Junction to Case Thermal Resistance	IGBT		0.3	°C/W	
		SiC chopper diode		0.8		
V _{ISOL}	RMS Isolation Voltage, any terminal to case t=1 min, I _{isol} <1mA, 50/60Hz	4000			V	
T _J	Operating junction temperature range	-40		150	°C	
T _{STG}	Storage Temperature Range	-40		125		
T _C	Operating Case Temperature	-40		100		
Torque	Mounting torque	To heatsink	M4	2.5	4.7	N.m
Wt	Package Weight				80	g

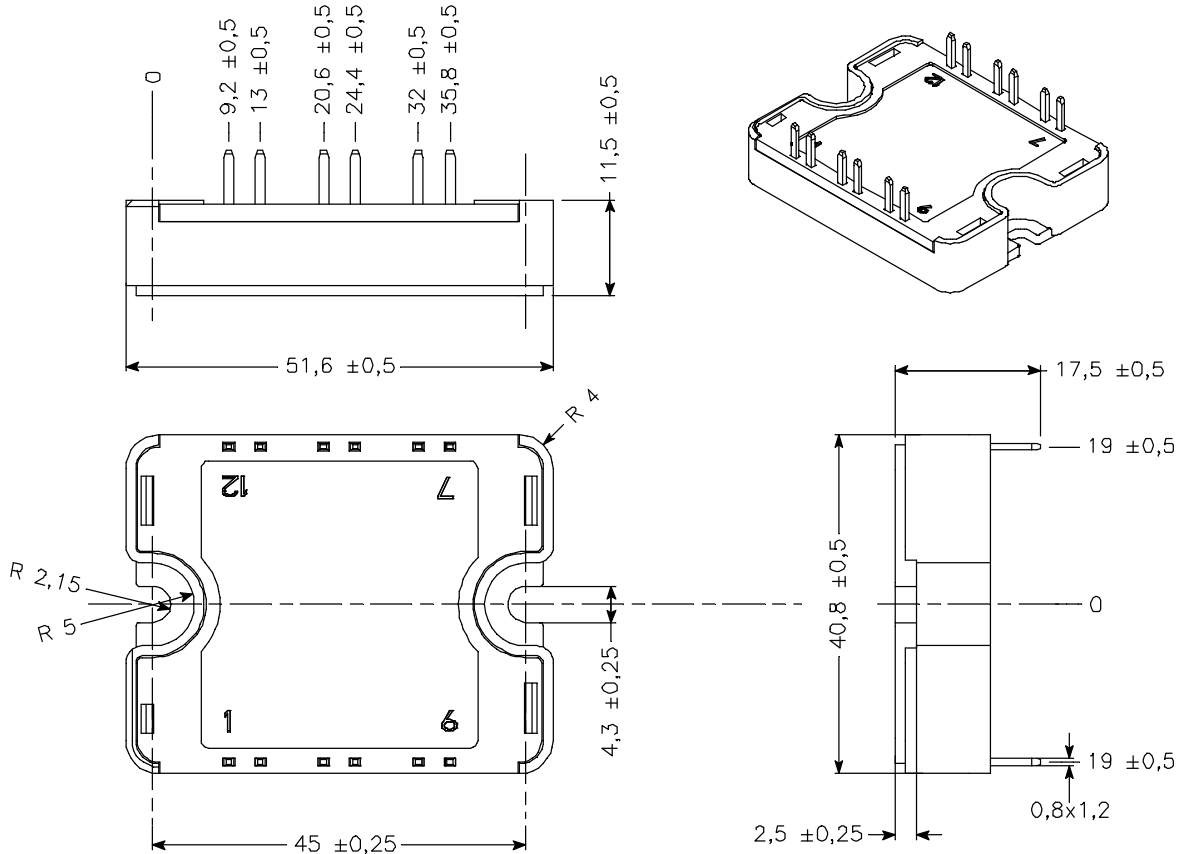
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

Symbol	Characteristic	Min	Typ	Max	Unit
R ₂₅	Resistance @ 25°C		50		kΩ
ΔR ₂₅ /R ₂₅			5		%
B _{25/85}	T ₂₅ = 298.15 K		3952		K
ΔB/B		T _C = 100°C	4		%

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
 R_T: Thermistor value at T

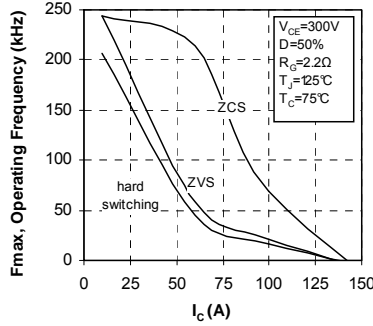
SP1 Package outline (dimensions in mm)



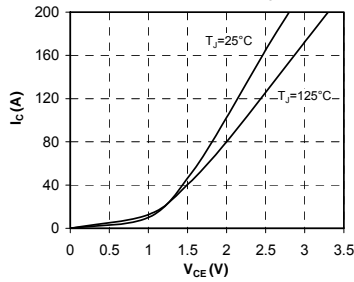
See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

Typical IGBT Performance Curve

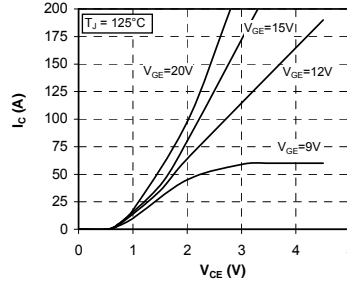
Operating Frequency vs Collector Current



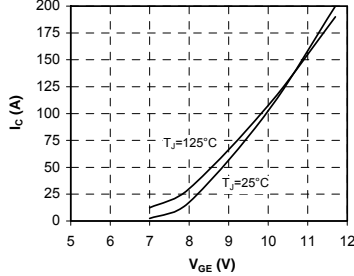
Output Characteristics ($V_{GE}=15V$)



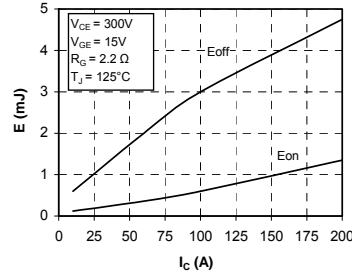
Output Characteristics



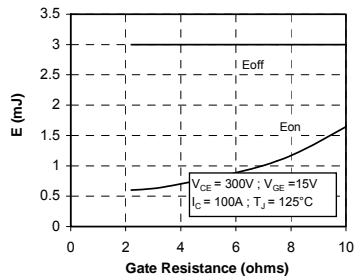
Transfer Characteristics



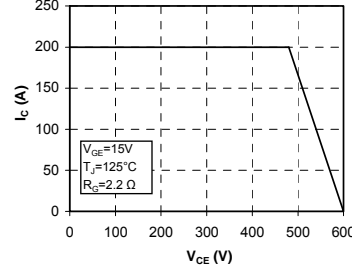
Energy losses vs Collector Current



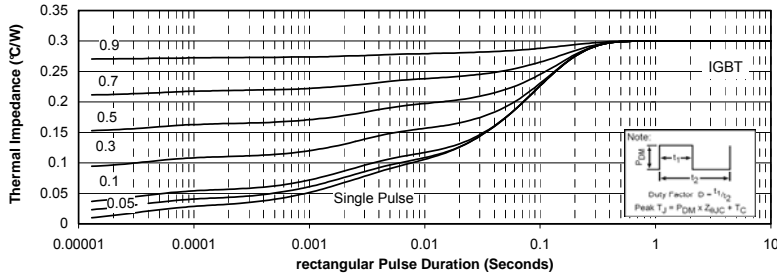
Switching Energy Losses vs Gate Resistance



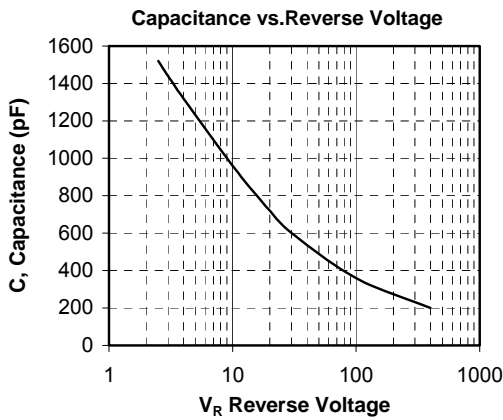
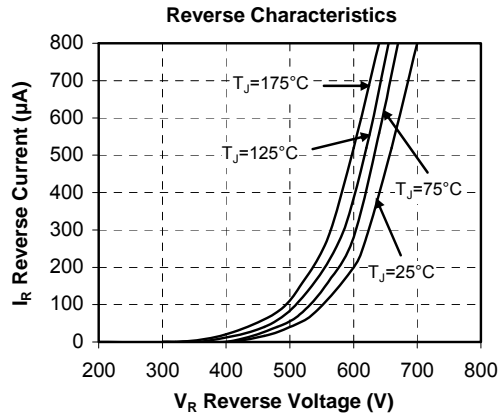
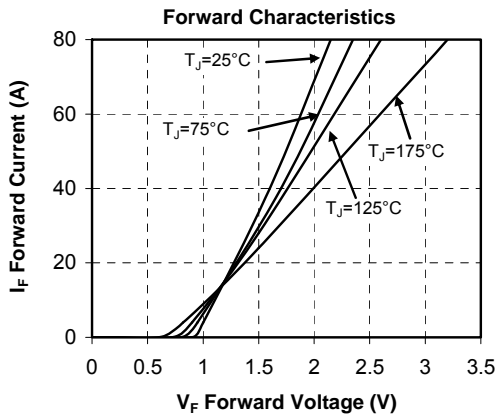
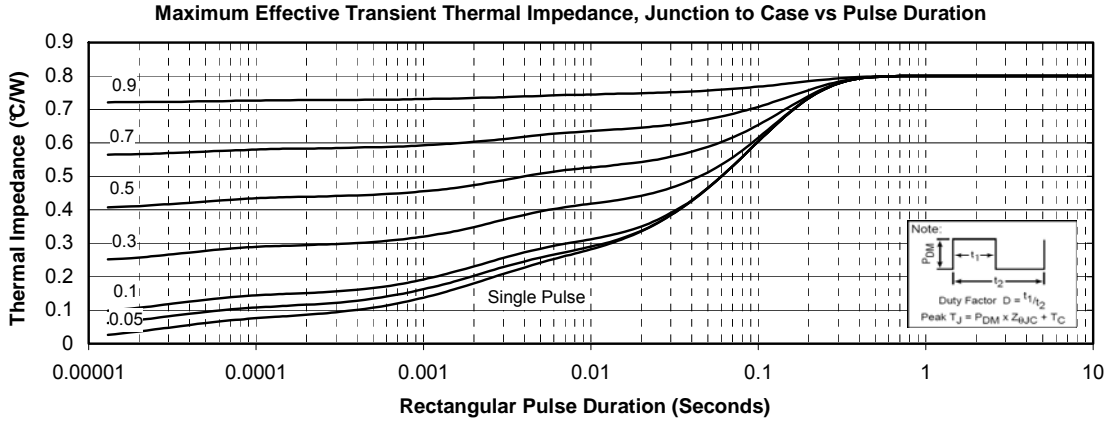
Reverse Safe Operating Area



maximum Effective Transient Thermal Impedance, Junction to Pulse Duration



Typical SiC chopper diode Performance Curve



Microsemi reserves the right to change, without notice, the specifications and information contained herein

Microsemi's products are covered by one or more of U.S. patents 4,895,810 5,045,903 5,089,434 5,182,234 5,019,522 5,262,336 6,503,786 5,256,583 4,748,103 5,283,202 5,231,474 5,434,095 5,528,058 6,939,743 7,352,045 5,283,201 5,801,417 5,648,283 7,196,634 6,664,594 7,157,886 6,939,743 7,342,262 and foreign patents. U.S and Foreign patents pending. All Rights Reserved.