

**Boost chopper
NPT IGBT
SiC Chopper diode**

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

Application

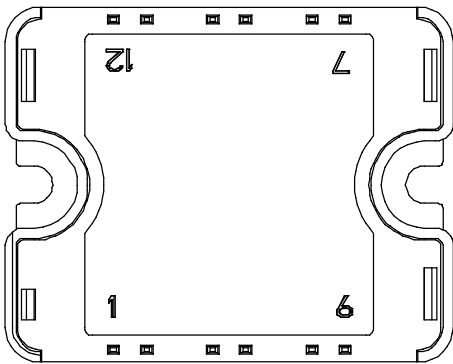
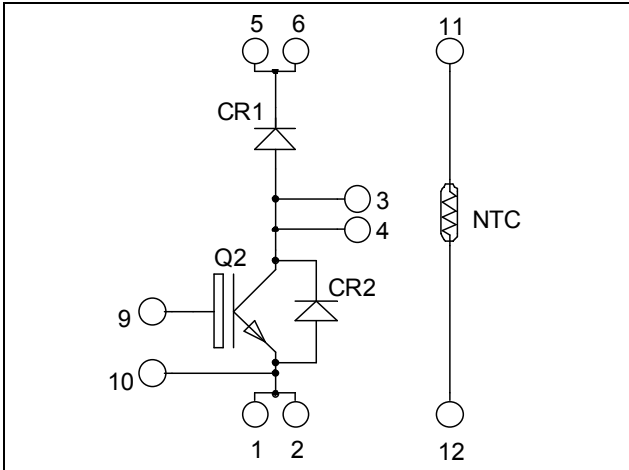
- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction

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) $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$ $I_C = 100\text{A}$ $R_G = 2.2\Omega$ | | 25 | | ns |
| T_r | Rise Time | | | 10 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 130 | | |
| T_f | Fall Time | | | 20 | | |
| $T_{d(on)}$ | Turn-on Delay Time | Inductive Switching (125°C) $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$ $I_C = 100\text{A}$ $R_G = 2.2\Omega$ | | 25 | | ns |
| T_r | Rise Time | | | 11 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 150 | | |
| T_f | Fall Time | | | 30 | | |
| E_{on} | Turn-on Switching Energy | $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$ $I_C = 100\text{A}$ $R_G = 2.2\Omega$ | $T_j = 125^\circ\text{C}$ | 0.6 | | mJ |
| E_{off} | Turn-off Switching Energy | | $T_j = 125^\circ\text{C}$ | 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 |

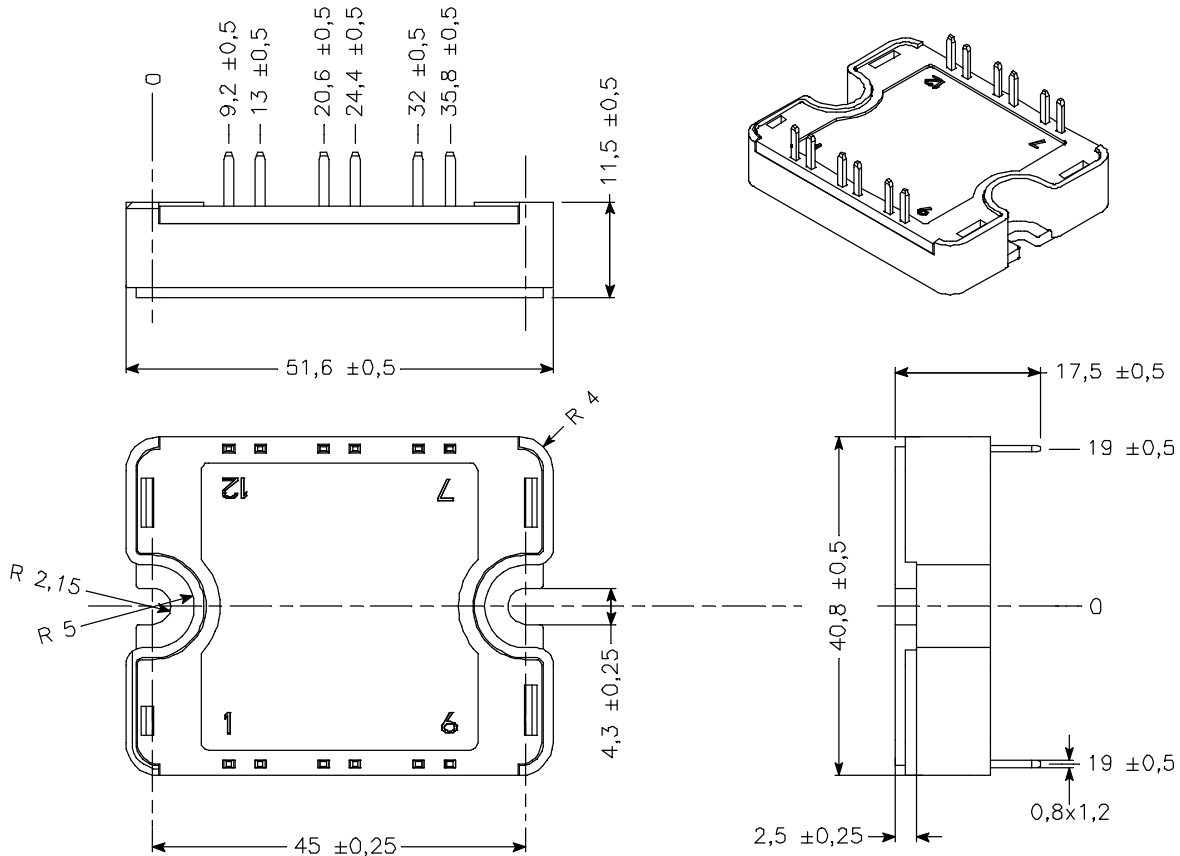
Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

| 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 | | % |

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

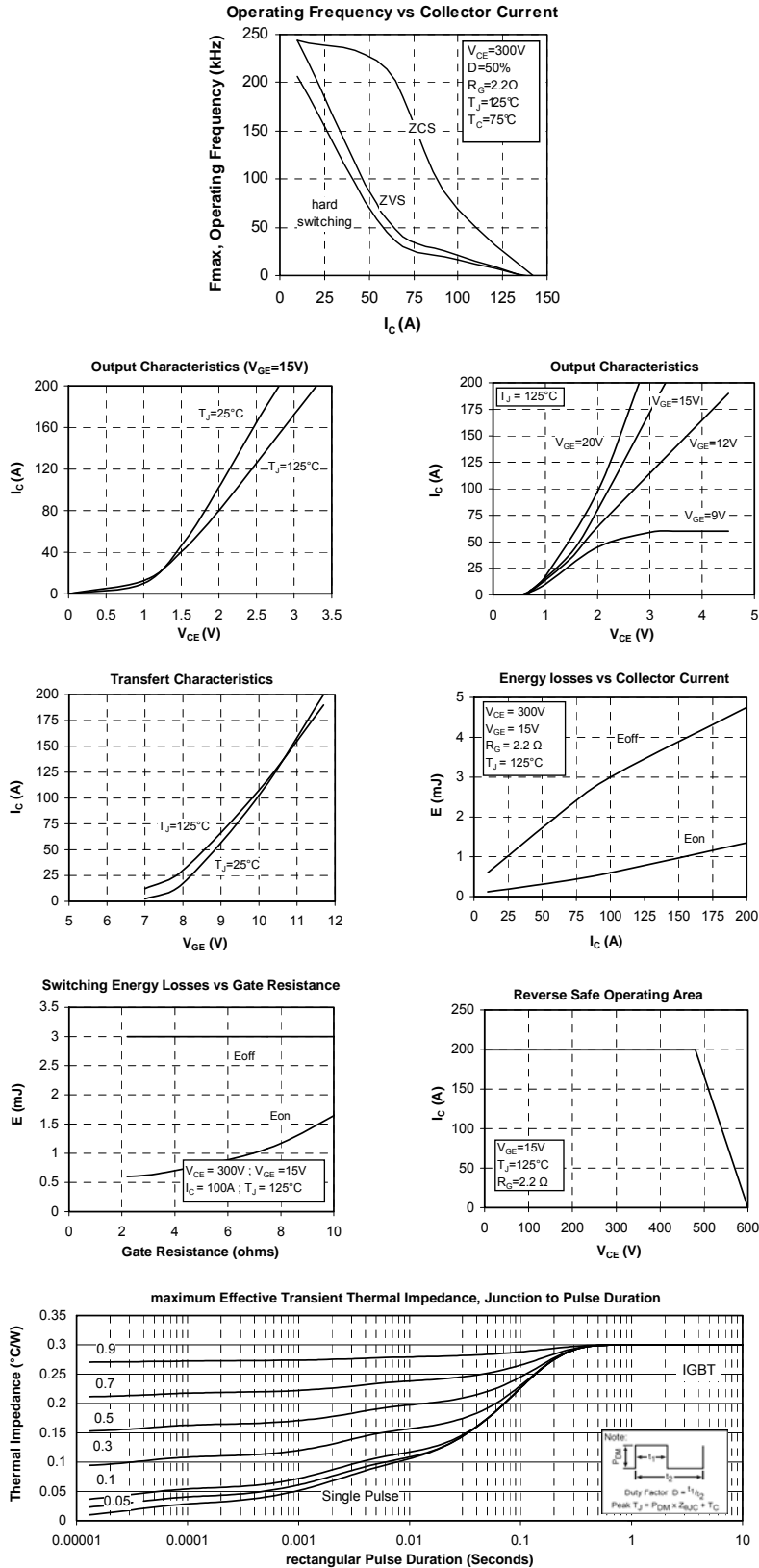
T: Thermistor temperature
 R_T: Thermistor value at T

SP1 Package outline (dimensions in mm)

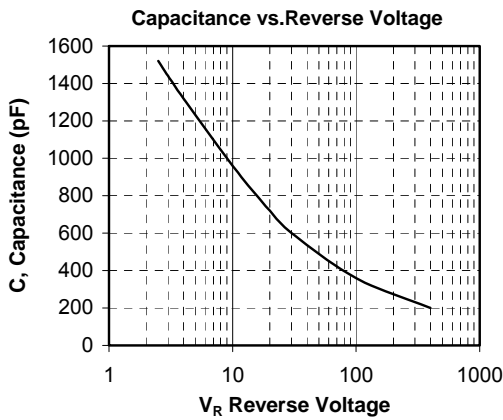
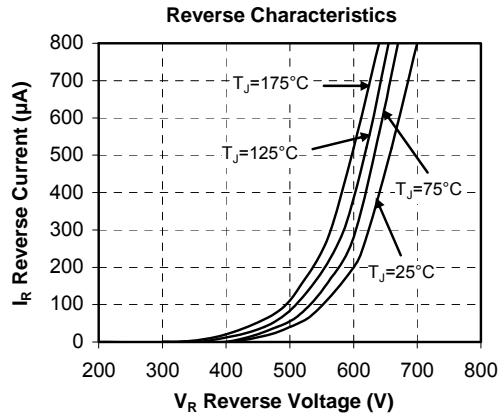
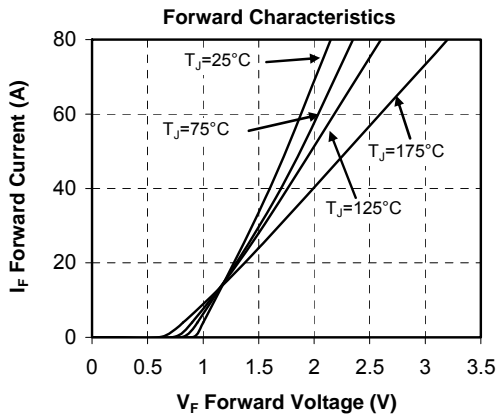
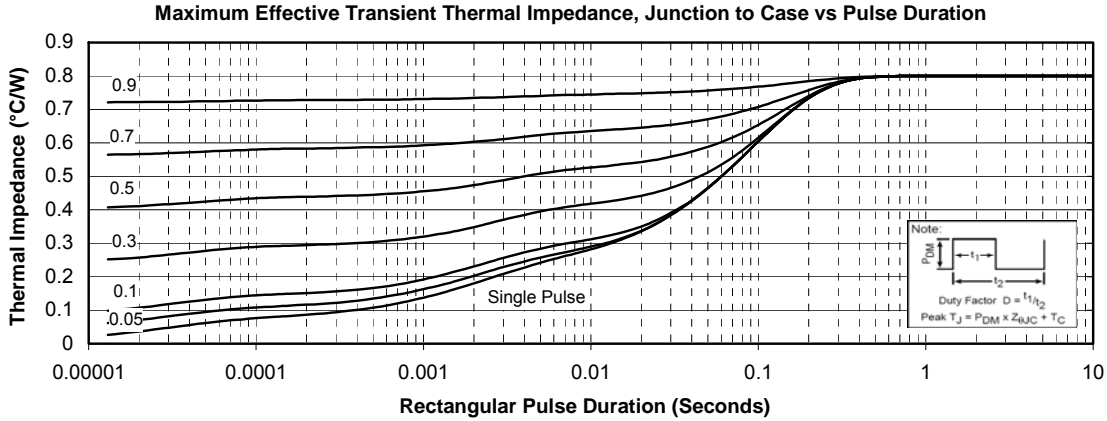


See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

Typical IGBT Performance Curve



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.