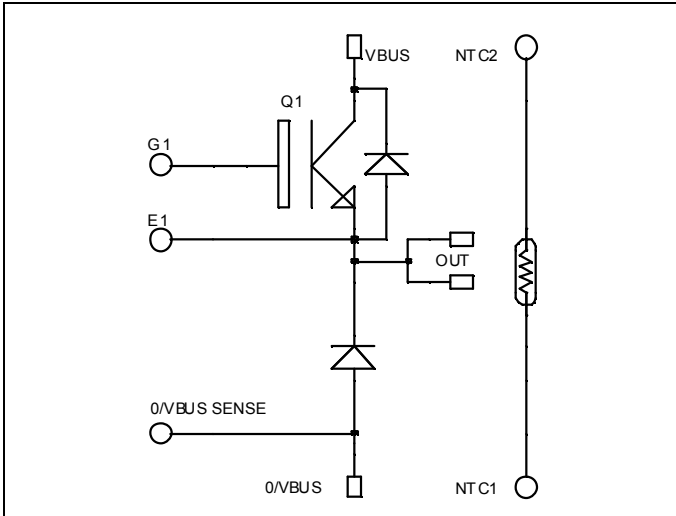


**Buck chopper  
Fast Trench + Field Stop IGBT®  
Power Module**

**$V_{CES} = 1200V$   
 $I_C = 100A @ T_c = 80^\circ C$**

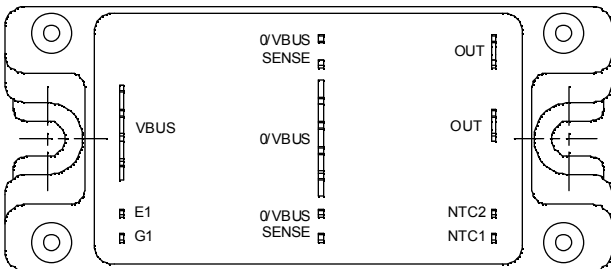


### Application

- AC and DC motor control
- Switched Mode Power Supplies

### Features

- Fast Trench + Field Stop IGBT® Technology
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - Avalanche energy rated
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- Very low stray inductance
  - Symmetrical design
  - Lead frames for power connections
- High level of integration
- Internal thermistor for temperature monitoring



### Benefits

- Stable temperature behavior
- Very rugged
- Solderable terminals for easy PCB mounting
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive TC of VCEsat
- Low profile
- RoHS Compliant

### Absolute maximum ratings

| Symbol    | Parameter                             | Max ratings         | Unit         |
|-----------|---------------------------------------|---------------------|--------------|
| $V_{CES}$ | Collector - Emitter Breakdown Voltage | 1200                | V            |
| $I_C$     | Continuous Collector Current          | $T_c = 25^\circ C$  | 140          |
|           |                                       | $T_c = 80^\circ C$  | 100          |
| $I_{CM}$  | Pulsed Collector Current              | $T_c = 25^\circ C$  | 200          |
| $V_{GE}$  | Gate - Emitter Voltage                | $\pm 20$            | V            |
| $P_D$     | Maximum Power Dissipation             | $T_c = 25^\circ C$  | 480          |
| RBSOA     | Reverse Bias Safe Operating Area      | $T_j = 125^\circ C$ | 200A @ 1100V |

**CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on [www.microsemi.com](http://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  | $V_{GE} = 0\text{V}, V_{CE} = 1200\text{V}$  |                                 |                                 | 250 | $\mu\text{A}$ |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $V_{GE} = 15\text{V}$<br>$I_C = 100\text{A}$ | $T_j = 25^\circ\text{C}$<br>1.4 | $T_j = 25^\circ\text{C}$<br>1.7 | 2.1 | V             |
|               |                                      |  | $T_j = 125^\circ\text{C}$       | 2.0                             |     |               |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}, I_C = 2\text{mA}$          | 5.0                             | 5.8                             | 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            | $V_{GE} = 0\text{V}$  |                           | 7200 |     | pF   |
| $C_{oes}$    | Output Capacitance           | $V_{CE} = 25\text{V}$   |                           | 400  |     |      |
| $C_{res}$    | Reverse Transfer Capacitance | $f = 1\text{MHz}$   |                           | 300  |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $25^\circ\text{C}$ )<br>$V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 600\text{V}$<br>$I_C = 100\text{A}$<br>$R_G = 3.9\Omega$  |                           | 260  |     | ns   |
| $T_r$        | Rise Time                    |   |                           | 30   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |   |                           | 420  |     |      |
| $T_f$        | Fall Time                    |   |                           | 70   |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $125^\circ\text{C}$ )<br>$V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 600\text{V}$<br>$I_C = 100\text{A}$<br>$R_G = 3.9\Omega$ |                           | 290  |     | ns   |
| $T_r$        | Rise Time                    |   |                           | 50   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |   |                           | 520  |     |      |
| $T_f$        | Fall Time                    |   |                           | 90   |     |      |
| $E_{on}$     | Turn on Energy               | $V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 600\text{V}$  | $T_j = 125^\circ\text{C}$ | 10   |     | mJ   |
| $E_{off}$    | Turn off Energy              | $I_C = 100\text{A}$<br>$R_G = 3.9\Omega$  | $T_j = 125^\circ\text{C}$ | 10   |     |      |

**Chopper diode ratings and characteristics**

| Symbol    | Characteristic                          | Test Conditions  | Min                       | Typ | Max   | Unit          |
|-----------|---|--|---------------------------|-----|---|---------------|
| $V_{RRM}$ | Maximum Peak Repetitive Reverse Voltage |  | 1200                      |     |   | V             |
| $I_{RM}$  | Maximum Reverse Leakage Current         | $V_R = 1200\text{V}$   |                           |     | $T_j = 25^\circ\text{C}$<br>250<br>$T_j = 125^\circ\text{C}$<br>500 | $\mu\text{A}$ |
| $I_F$     | DC Forward Current                      |  |                           | 100 |   | A             |
| $V_F$     | Diode Forward Voltage                   | $I_F = 100\text{A}$<br>$V_{GE} = 0\text{V}$                                      | $T_j = 25^\circ\text{C}$  | 1.6 | 2.1   | V             |
|           |   |  | $T_j = 125^\circ\text{C}$ | 1.6 |   |               |
| $t_{rr}$  | Reverse Recovery Time                   | $I_F = 100\text{A}$<br>$V_R = 600\text{V}$<br>$di/dt = 2000\text{A}/\mu\text{s}$ | $T_j = 25^\circ\text{C}$  | 170 |   | ns            |
|           |   |  | $T_j = 125^\circ\text{C}$ | 280 |   |               |
| $Q_{rr}$  | Reverse Recovery Charge                 |  | $T_j = 25^\circ\text{C}$  | 9   |   | $\mu\text{C}$ |
|           |   |  | $T_j = 125^\circ\text{C}$ | 18  |   |               |
| $E_r$     | Reverse Recovery Energy                 |  | $T_j = 25^\circ\text{C}$  | 5   |   | mJ            |
|           |   |  | $T_j = 125^\circ\text{C}$ | 9   |   |               |

**Temperature sensor NTC** (see application note APT0406 on [www.microsemi.com](http://www.microsemi.com) for more information).

| Symbol             | Characteristic             | Min | Typ  | Max | Unit |
|--------------------|----------------------------|-----|------|-----|------|
| R <sub>25</sub>    | Resistance @ 25°C          |     | 50   |     | kΩ   |
| B <sub>25/85</sub> | T <sub>25</sub> = 298.15 K |     | 3952 |     | K    |

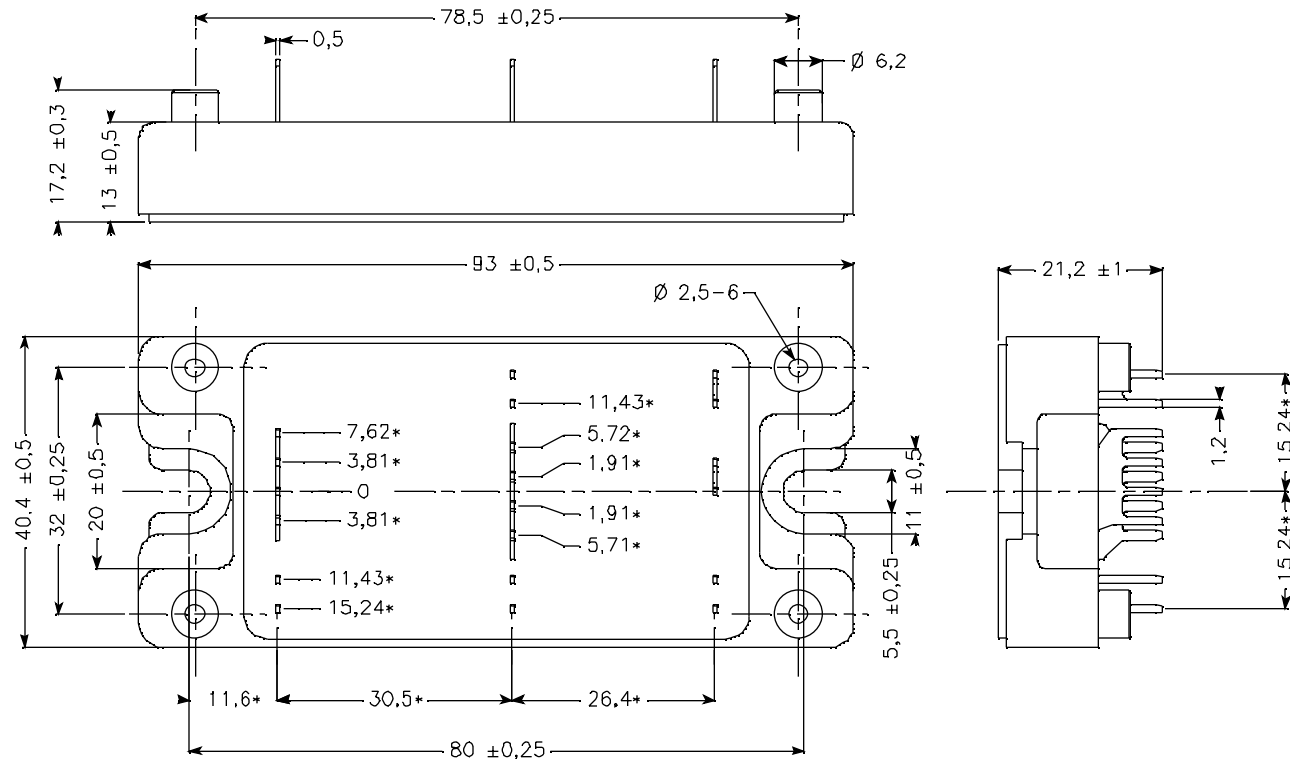
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

## Thermal and package characteristics

| Symbol            | Characteristic   | Min         | Typ | Max  | Unit |     |
|-------------------|--|-------------|-----|------|------|-----|
| R <sub>thJC</sub> | Junction to Case Thermal Resistance  | IGBT        |     | 0.26 | °C/W |     |
|                   |  | Diode       |     | 0.48 |      |     |
| V <sub>ISOL</sub> | RMS Isolation Voltage, any terminal to case t=1 min, I <sub>isol</sub> <1mA, 50/60Hz | 2500        |     |      | V    |     |
| T <sub>J</sub>    | Operating junction temperature range   | -40         |     | 150  | °C   |     |
| T <sub>STG</sub>  | Storage Temperature Range  | -40         |     | 125  |      |     |
| T <sub>C</sub>    | Operating Case Temperature   | -40         |     | 100  |      |     |
| Torque            | Mounting torque  | To Heatsink | M5  | 2.5  | 4.7  | N.m |
| Wt                | Package Weight   |             |     |      | 160  | g   |

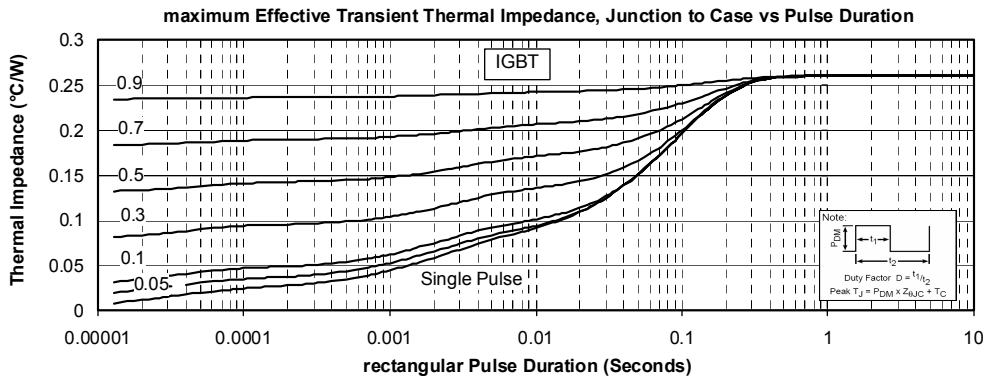
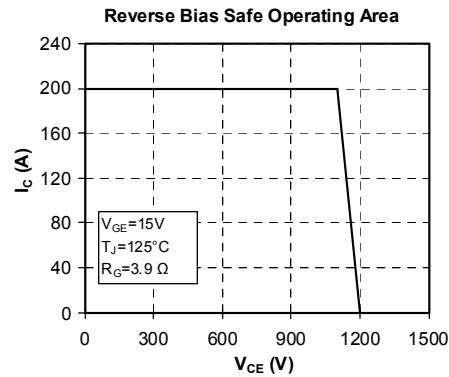
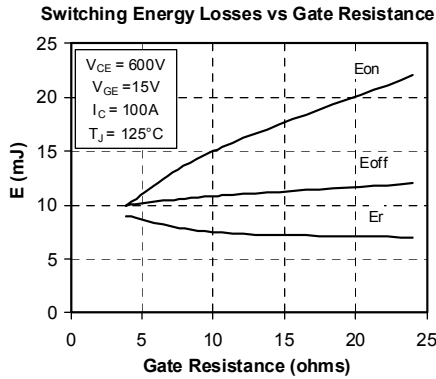
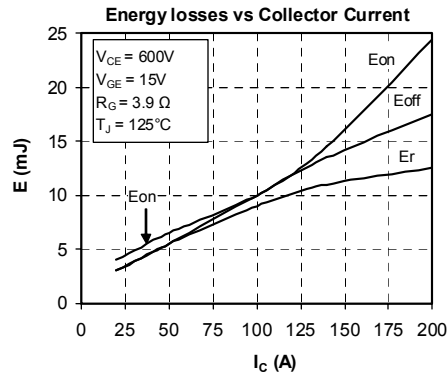
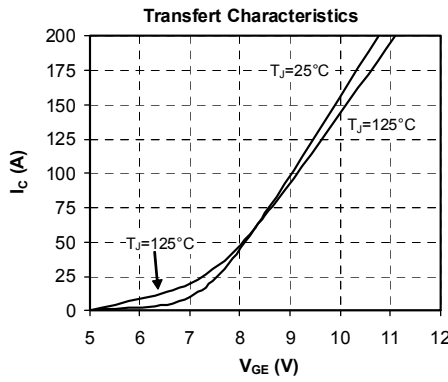
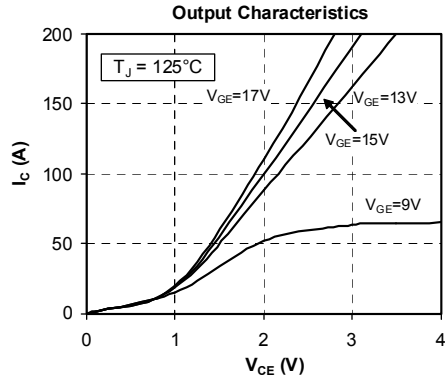
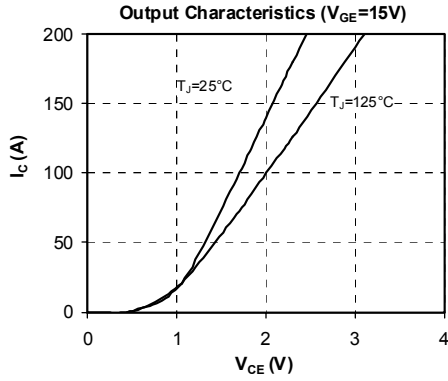
## SP4 Package outline (dimensions in mm)

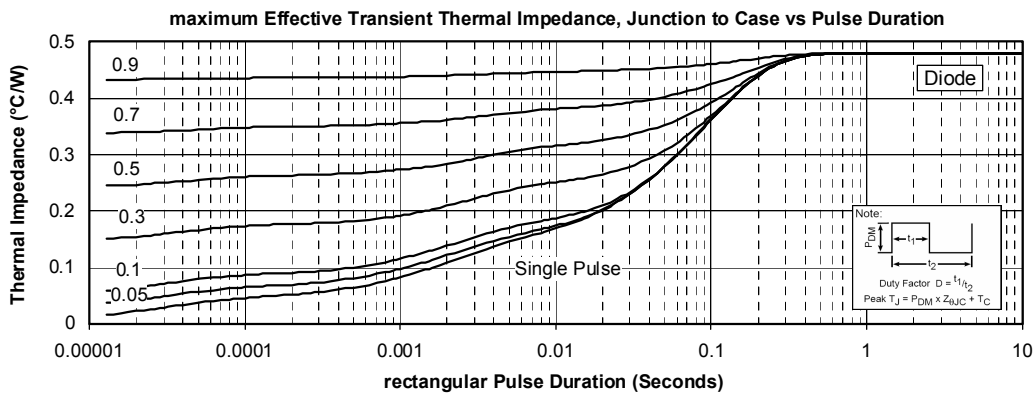
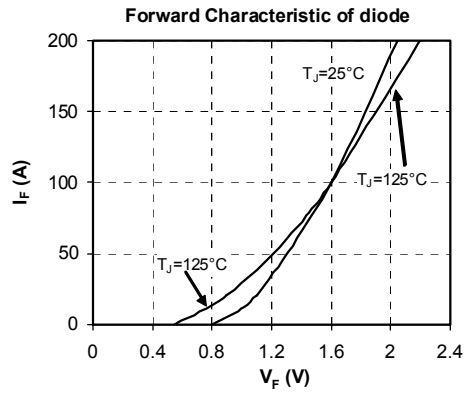
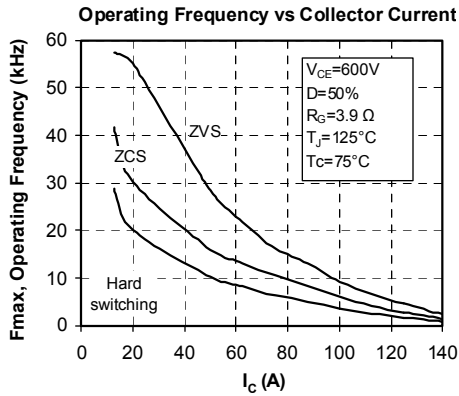


ALL DIMENSIONS MARKED "\*" ARE TOLERANCED AS:  $\pm\phi 1$

See application note APT0501 - Mounting Instructions for SP4 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical Performance Curve





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