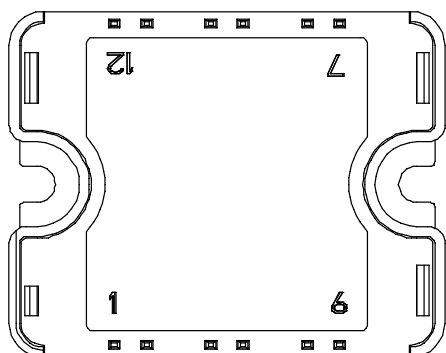
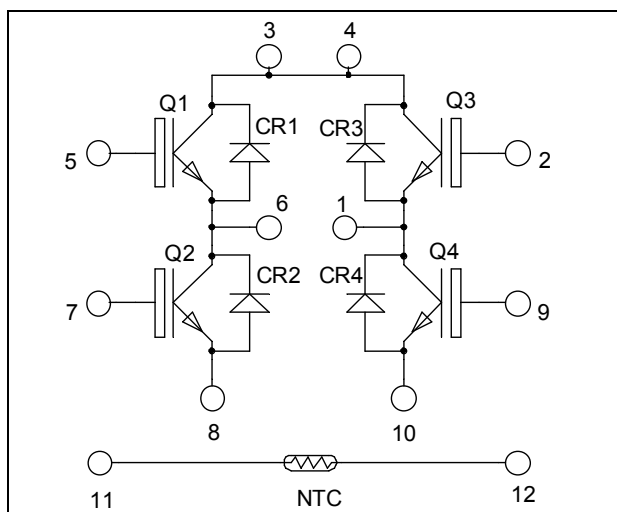


**Full bridge  
Trench + Field Stop IGBT®  
Power Module**

**$V_{CES} = 600V$   
 $I_C = 20A @ T_c = 80^\circ C$**



Pins 3/4 must be shorted together

## Application

- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

## Features

- 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
  - RBSOA and SCSOA rated
- Very low stray inductance
  - Symmetrical design
- 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

## Absolute maximum ratings

| Symbol    | Parameter                             | Max ratings         | Unit       |
|-----------|---------------------------------------|---------------------|------------|
| $V_{CES}$ | Collector - Emitter Breakdown Voltage | 600                 | V          |
| $I_C$     | Continuous Collector Current          | $T_C = 25^\circ C$  | 32         |
|           |                                       | $T_C = 80^\circ C$  | 20         |
| $I_{CM}$  | Pulsed Collector Current              | $T_C = 25^\circ C$  | 40         |
| $V_{GE}$  | Gate - Emitter Voltage                | $\pm 20$            | V          |
| $P_D$     | Maximum Power Dissipation             | $T_C = 25^\circ C$  | 62         |
| RBSOA     | Reverse Bias Safe Operating Area      | $T_J = 150^\circ C$ | 40A @ 550V |

**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  | $V_{GE} = 0V, V_{CE} = 600V$                          |     |            | 250 | $\mu A$ |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $V_{GE} = 15V$<br>$I_C = 20A$                         |     | 1.5<br>1.7 | 1.9 | V       |
|               |                                      | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ |     |            |     |         |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}, I_C = 300\mu A$                     | 5.0 | 5.8        | 6.5 | V       |
| $I_{GES}$     | Gate – Emitter Leakage Current       | $V_{GE} = 20V, V_{CE} = 0V$                           |     |            | 300 | nA      |

**Dynamic Characteristics**

| Symbol       | Characteristic               | Test Conditions                             | Min                                                   | Typ         | Max | Unit |
|--------------|------------------------------|---------------------------------------------|-------------------------------------------------------|-------------|-----|------|
| $C_{ies}$    | Input Capacitance            | $V_{GE} = 0V$                               |                                                       | 1100        |     | pF   |
| $C_{oes}$    | Output Capacitance           | $V_{CE} = 25V$                              |                                                       | 70          |     |      |
| $C_{res}$    | Reverse Transfer Capacitance | $f = 1MHz$                                  |                                                       | 35          |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $25^\circ\text{C}$ )  |                                                       | 110         |     | ns   |
| $T_r$        | Rise Time                    | $V_{GE} = \pm 15V$                          |                                                       | 45          |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          | $V_{Bus} = 300V$                            |                                                       | 200         |     |      |
| $T_f$        | Fall Time                    | $I_C = 20A$<br>$R_G = 12\Omega$             |                                                       | 40          |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $150^\circ\text{C}$ ) |                                                       | 120         |     | ns   |
| $T_r$        | Rise Time                    | $V_{GE} = \pm 15V$                          |                                                       | 50          |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          | $V_{Bus} = 300V$                            |                                                       | 250         |     |      |
| $T_f$        | Fall Time                    | $I_C = 20A$<br>$R_G = 12\Omega$             |                                                       | 60          |     |      |
| $E_{on}$     | Turn-on Switching Energy     | $V_{GE} = \pm 15V$<br>$V_{Bus} = 300V$      | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 0.11<br>0.2 |     | mJ   |
| $E_{off}$    | Turn-off Switching Energy    | $I_C = 20A$<br>$R_G = 12\Omega$             | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 0.5<br>0.7  |     | mJ   |

**Reverse 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         | $V_R = 600V$                                         | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ |              | 100<br>350 | $\mu A$ |
| $I_F$     | DC Forward Current                      |                                                      | $T_c = 80^\circ\text{C}$                              | 20           |            | A       |
| $V_F$     | Diode Forward Voltage                   | $I_F = 20A$<br>$V_{GE} = 0V$                         | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 1.6<br>1.5   | 2          | V       |
| $t_{rr}$  | Reverse Recovery Time                   |                                                      | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 100<br>150   |            | ns      |
| $Q_{rr}$  | Reverse Recovery Charge                 | $I_F = 20A$<br>$V_R = 300V$<br>$di/dt = 1600A/\mu s$ | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 1.1<br>2.3   |            | $\mu C$ |
| $E_r$     | Reverse Recovery Energy                 |                                                      | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 0.23<br>0.50 |            | mJ      |

## Thermal and package characteristics

| Symbol            | Characteristic                                                           |             |       | Min  | Typ | Max  | Unit |
|-------------------|--------------------------------------------------------------------------|-------------|-------|------|-----|------|------|
| R <sub>thJC</sub> | Junction to Case Thermal Resistance                                      |             | IGBT  |      |     | 2.4  | °C/W |
|                   |                                                                          |             | Diode |      |     | 3.25 |      |
| V <sub>ISOL</sub> | RMS Isolation Voltage, any terminal to case t=1 min, I isol<1mA, 50/60Hz |             |       | 2500 |     |      | V    |
| T <sub>J</sub>    | Operating junction temperature range                                     |             |       | -40  |     | 175  | °C   |
| T <sub>STG</sub>  | Storage Temperature Range                                                |             |       | -40  |     | 125  |      |
| T <sub>C</sub>    | Operating Case Temperature                                               |             |       | -40  |     | 100  |      |
| Torque            | Mounting torque                                                          | To heatsink | M4    | 2.5  |     | 4.7  | N.m  |
| Wt                | Package Weight                                                           |             |       |      |     | 80   | g    |

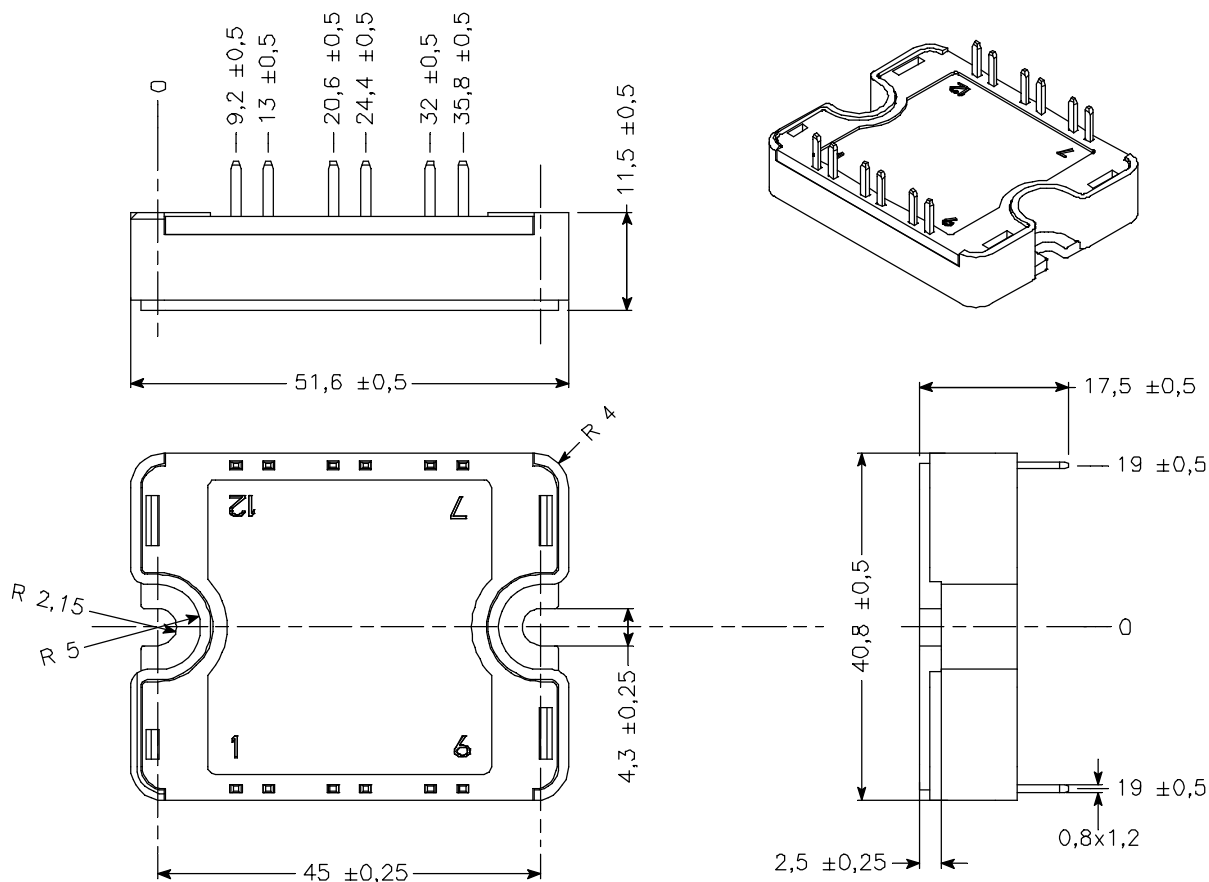
## Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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

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

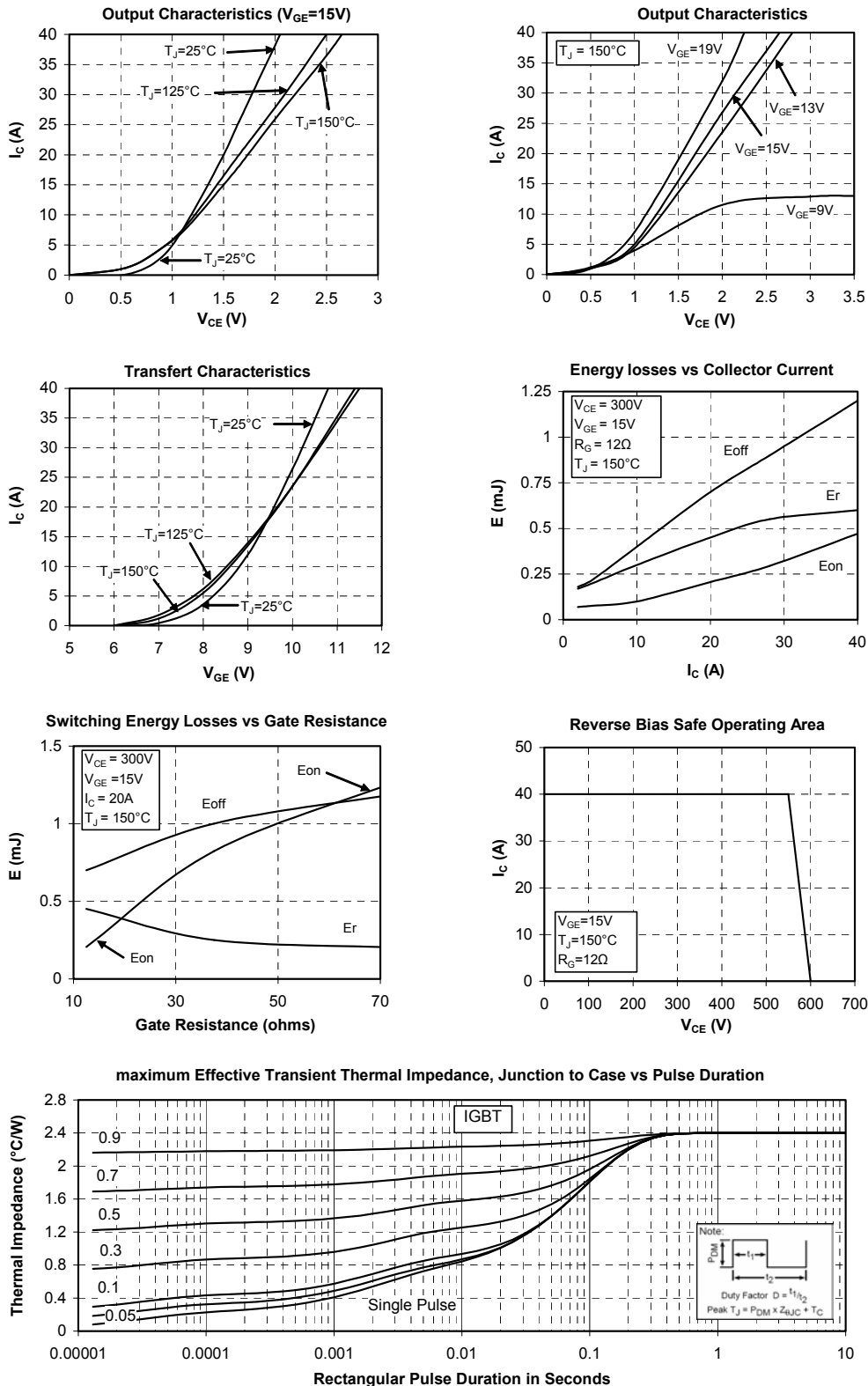
T: Thermistor temperature  
R<sub>T</sub>: Thermistor value at T

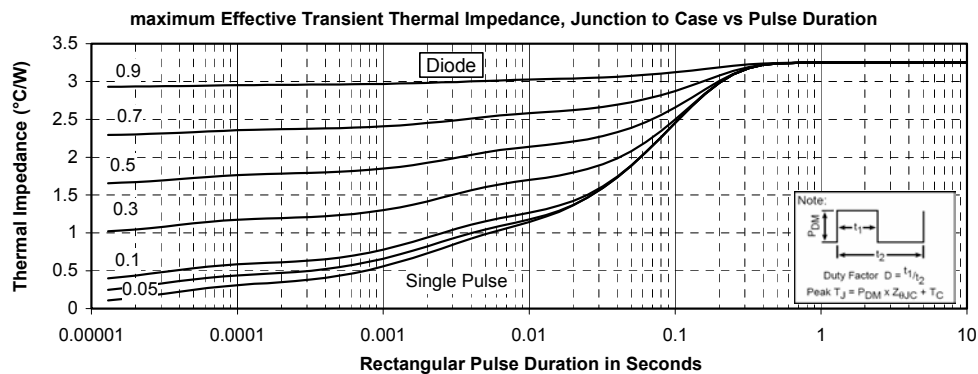
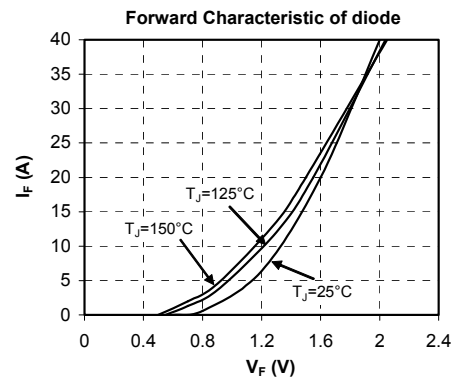
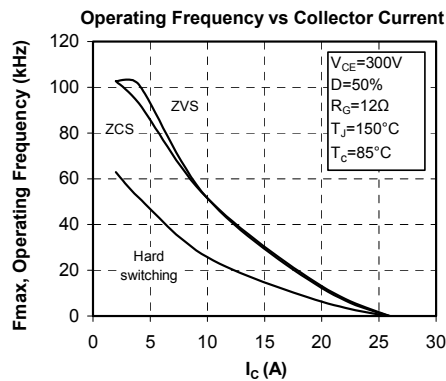
## SP1 Package outline (dimensions in mm)



See application note 1904 - Mounting Instructions for SP1 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical Performance Curve





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