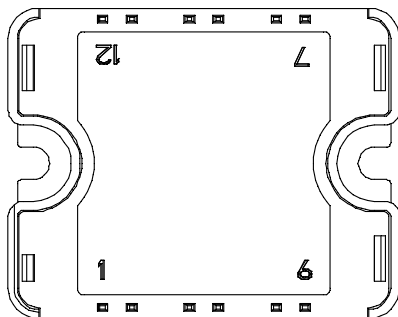
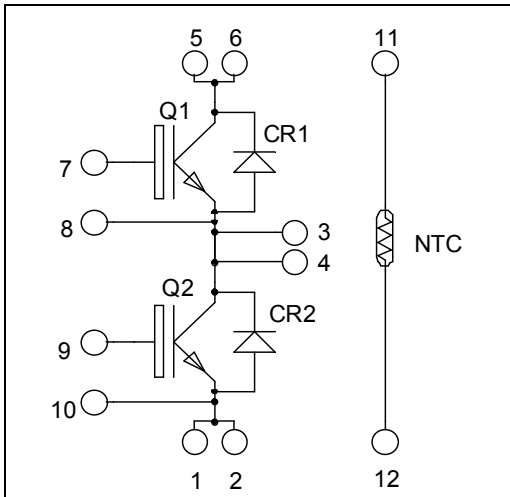


**Phase leg**  
**High speed Trench + Field Stop IGBT4**  
**Power Module**

**$V_{CES} = 650V$**   
 **$I_C = 100A @ T_c = 60^\circ C$**



Pins 3/4 must be shorted together

**Application**

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

**Features**

- **High speed Trench + Field Stop IGBT 4**
  - Low voltage drop
  - Low leakage current
  - Low switching losses
- Very low stray inductance
- Internal thermistor for temperature monitoring

**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

**All ratings @  $T_j = 25^\circ C$  unless otherwise specified**

**Absolute maximum ratings** (per IGBT)

| Symbol    | Parameter                    | Max ratings        | Unit |
|-----------|------------------------------|--------------------|------|
| $V_{CES}$ | Collector - Emitter Voltage  | 650                | V    |
| $I_C$     | Continuous Collector Current | $T_C = 25^\circ C$ | 135  |
|           |                              | $T_C = 60^\circ C$ | 100  |
| $I_{CM}$  | Pulsed Collector Current     | $T_C = 25^\circ C$ | 270  |
| $V_{GE}$  | Gate - Emitter Voltage       | $\pm 20$           | V    |
| $P_D$     | Power Dissipation            | 350                | W    |

**CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

**Electrical Characteristics (per IGBT)**

| Symbol        | Characteristic                       | Test Conditions                 | Min | Typ                        | Max | Unit    |
|---------------|--------------------------------------|---------------------------------|-----|----------------------------|-----|---------|
| $I_{CES}$     | Zero Gate Voltage Collector Current  | $V_{GE} = 0V, V_{CE} = 650V$    |     |                            | 50  | $\mu A$ |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $V_{GE} = 15V$<br>$I_C = 100A$  | 1.4 | $T_j = 25^\circ C$<br>1.85 | 2.3 | V       |
|               |                                      | $T_j = 150^\circ C$             |     | 2.2                        |     |         |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}, I_C = 1.6 mA$ | 4.2 | 5.1                        | 5.6 | V       |
| $I_{GES}$     | Gate – Emitter Leakage Current       | $V_{GE} = 20V, V_{CE} = 0V$     |     |                            | 150 | nA      |

**Dynamic Characteristics (per IGBT)**

| Symbol       | Characteristic                      | Test Conditions  | Min                 | Typ  | Max  | Unit         |
|--------------|-------------------------------------|--|---------------------|------|------|--------------|
| $C_{ies}$    | Input Capacitance                   | $V_{GE} = 0V$<br>$V_{CE} = 25V$<br>$f = 1MHz$  |                     | 6100 |      | pF           |
| $C_{oes}$    | Output Capacitance                  |  |                     | 232  |      |              |
| $C_{res}$    | Reverse Transfer Capacitance        |  |                     | 180  |      |              |
| $Q_G$        | Gate charge                         | $V_{GE} = 15V, I_C = 100A$<br>$V_{CE} = 480V$  |                     | 630  |      | nC           |
| $T_{d(on)}$  | Turn-on Delay Time                  | Inductive Switching (25°C)<br>$V_{GE} = \pm 15V$<br>$V_{Bus} = 400V$<br>$I_C = 100A$<br>$R_G = 3.6\Omega$  |                     | 19   |      | ns           |
| $T_r$        | Rise Time                           |  |                     | 33   |      |              |
| $T_{d(off)}$ | Turn-off Delay Time                 |  |                     | 197  |      |              |
| $T_f$        | Fall Time                           |  |                     | 21   |      |              |
| $T_{d(on)}$  | Turn-on Delay Time                  | Inductive Switching (150°C)<br>$V_{GE} = \pm 15V$<br>$V_{Bus} = 400V$<br>$I_C = 100A$<br>$R_G = 3.6\Omega$ |                     | 19   |      | ns           |
| $T_r$        | Rise Time                           |  |                     | 29   |      |              |
| $T_{d(off)}$ | Turn-off Delay Time                 |  |                     | 227  |      |              |
| $T_f$        | Fall Time                           |  |                     | 22   |      |              |
| $E_{on}$     | Turn on Energy                      | $V_{GE} = \pm 15V$<br>$V_{Bus} = 400V$<br>$I_C = 100A$<br>$R_G = 3.6\Omega$                                | $T_j = 150^\circ C$ | 2.4  |      | mJ           |
| $E_{off}$    | Turn off Energy                     |  |                     | 2    |      |              |
| $R_G$        | Integrated gate resistor            |  |                     | 2    |      | $\Omega$     |
| $I_{sc}$     | Short Circuit data                  | $V_{GE} \leq 15V ; V_{Bus} = 400V$<br>$t_p \leq 5\mu s ; T_j = 150^\circ C$                                |                     | 700  |      | A            |
| $R_{thJC}$   | Junction to Case Thermal Resistance |  |                     |      | 0.44 | $^\circ C/W$ |

**Diode ratings and characteristics (per diode)**

| Symbol     | Characteristic                      | Test Conditions                                       | Min                        | Typ | Max  | Unit         |
|------------|-------------------------------------|---|----------------------------|-----|------|--------------|
| $V_{RRM}$  | Peak Repetitive Reverse Voltage     |   |                            |     | 650  | V            |
| $I_{RM}$   | Reverse Leakage Current             | $V_R = 650V$  |                            |     | 50   | $\mu A$      |
| $I_F$      | DC Forward Current                  | $T_c = 25^\circ C$                                    |                            | 100 |      | A            |
| $V_F$      | Diode Forward Voltage               | $I_F = 100A$<br>$V_{GE} = 0V$                         | $T_j = 25^\circ C$<br>1.6  |     | 2    | V            |
|            |                                     |   | $T_j = 150^\circ C$<br>1.5 |     |      |              |
| $t_{rr}$   | Reverse Recovery Time               | $I_F = 100A$<br>$V_R = 300V$<br>$di/dt = 2000A/\mu s$ | $T_j = 25^\circ C$         | 125 |      | ns           |
|            |                                     |   | $T_j = 150^\circ C$        | 220 |      |              |
| $Q_{rr}$   | Reverse Recovery Charge             |   | $T_j = 25^\circ C$         | 4.7 |      | $\mu C$      |
|            |                                     |   | $T_j = 150^\circ C$        | 9.9 |      |              |
| $E_{rr}$   | Reverse Recovery Energy             | $T_j = 25^\circ C$                                    | 1.1                        |     | mJ   |              |
|            |                                     | $T_j = 150^\circ C$                                   | 2.4                        |     |      |              |
| $R_{thJC}$ | Junction to Case Thermal Resistance |   |                            |     | 0.77 | $^\circ C/W$ |

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

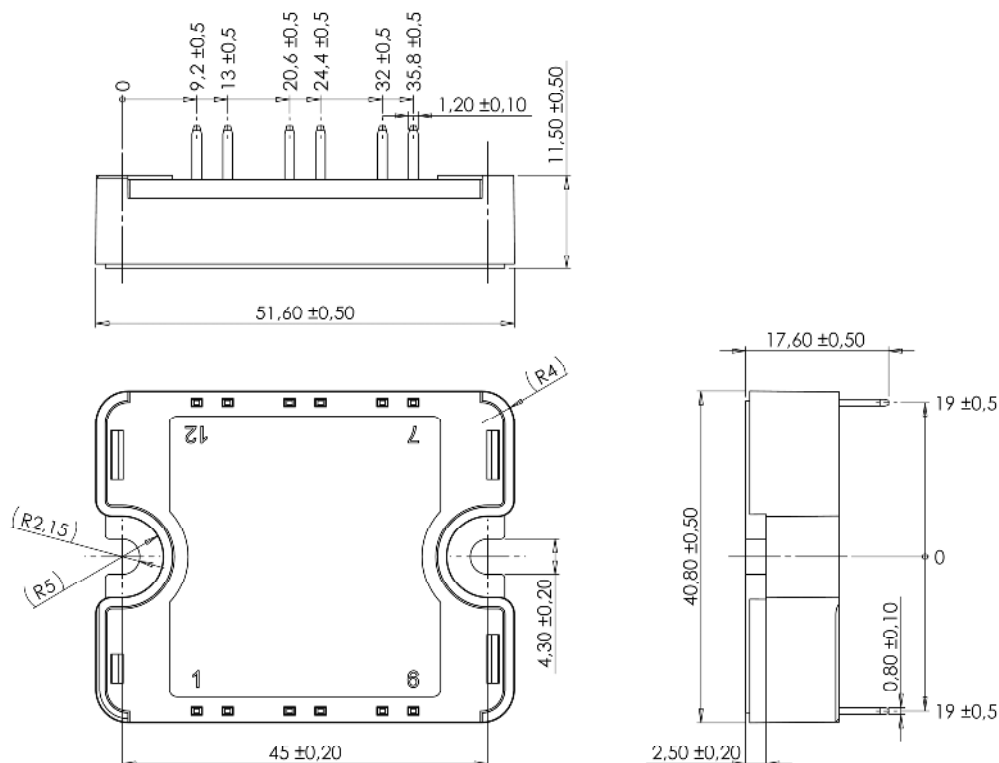
| Symbol                            | Characteristic             | Min | Typ  | Max | Unit |
|-----------------------------------|----------------------------|-----|------|-----|------|
| R <sub>25</sub>                   | Resistance @ 25°C          |     | 50   |     | kΩ   |
| ΔR <sub>25</sub> /R <sub>25</sub> |                            |     | 5    |     | %    |
| B <sub>25/85</sub>                | T <sub>25</sub> = 298.15 K |     | 3952 |     | K    |
| ΔB/B                              | T <sub>C</sub> = 100°C     |     | 4    |     | %    |

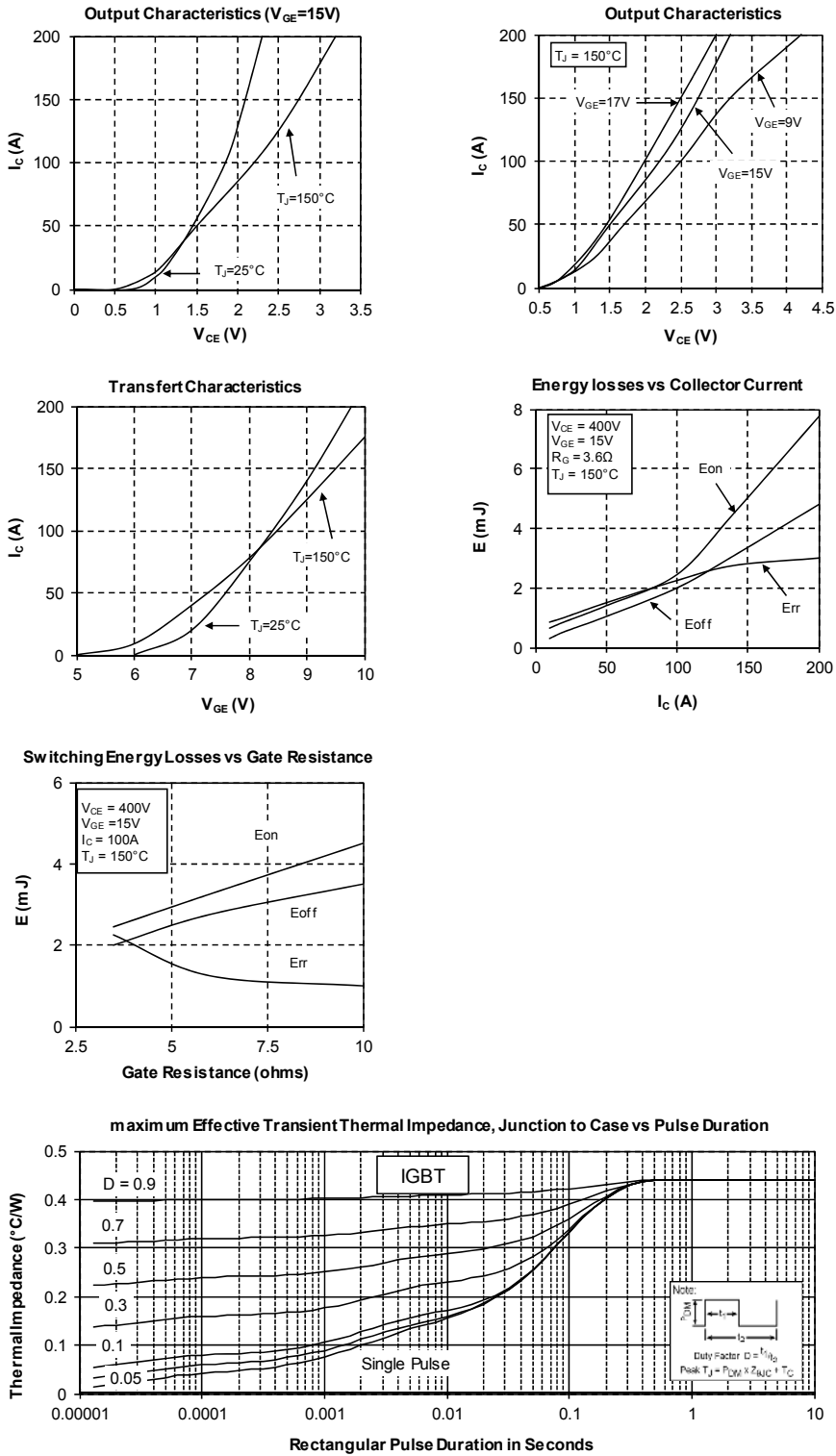
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

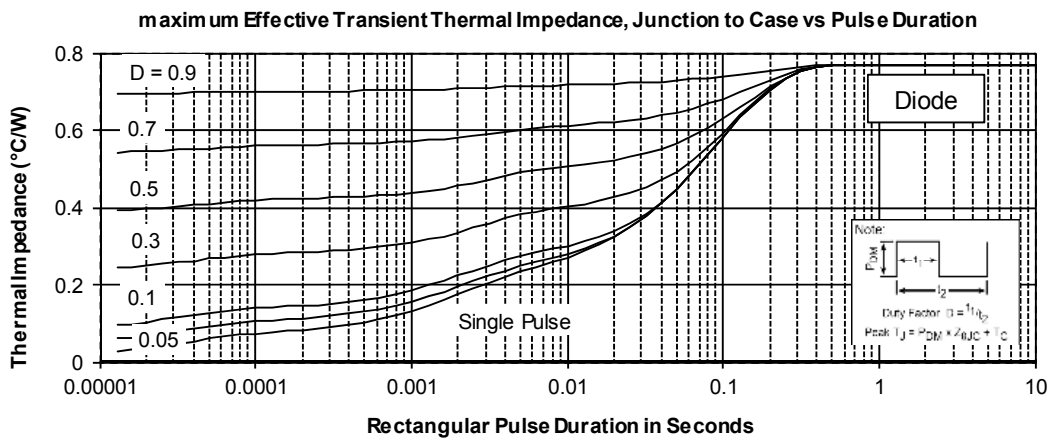
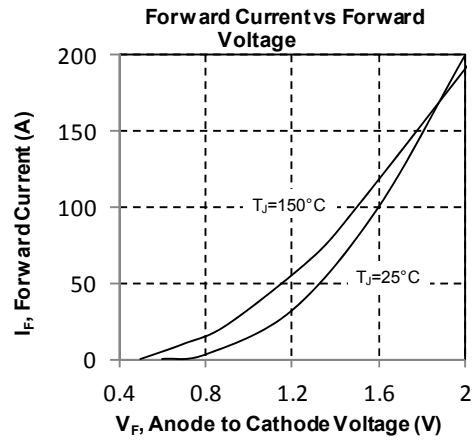
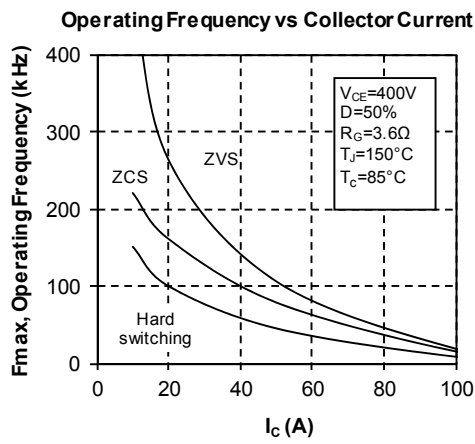
T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

**Thermal and package characteristics**

| Symbol            | Characteristic   | Min         | Max                   | Unit |    |     |
|-------------------|--|-------------|-----------------------|------|----|-----|
| V <sub>ISOL</sub> | RMS Isolation Voltage, any terminal to case t = 1 min, 50/60Hz | 4000        |                       | V    |    |     |
| T <sub>J</sub>    | Operating junction temperature range                           | -40         | 175                   | °C   |    |     |
| T <sub>JOP</sub>  | Recommended junction temperature under switching conditions    | -40         | T <sub>Jmax</sub> -25 |      |    |     |
| T <sub>STG</sub>  | Storage Temperature Range                                      | -40         | 125                   |      |    |     |
| T <sub>C</sub>    | Operating Case Temperature                                     | -40         | 125                   |      |    |     |
| Torque            | Mounting torque  | To heatsink | M4                    | 2    | 3  | N.m |
| Wt                | Package Weight   |             |                       |      | 80 | g   |

**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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