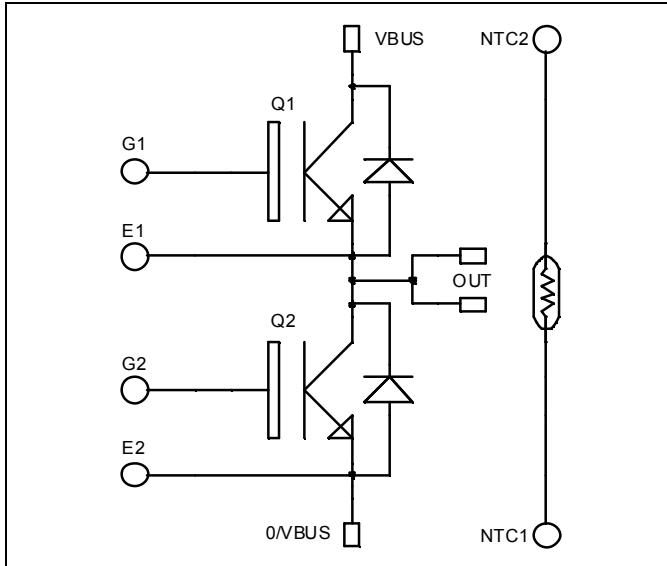


## Phase leg NPT IGBT Power Module

$V_{CES} = 1200V$   
 $I_C = 50A @ T_c = 80^\circ C$



### Application

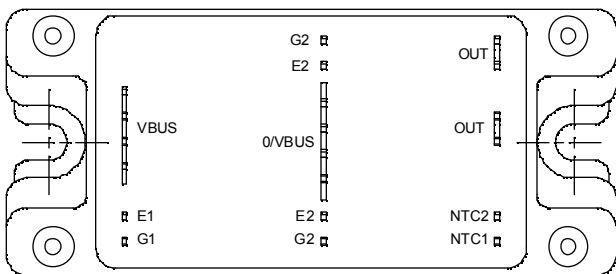
- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

### Features

- Non Punch Through (NPT) Fast IGBT®
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 50 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
- Internal thermistor for temperature monitoring
- High level of integration

### Benefits

- Outstanding performance at high frequency operation
- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Easy paralleling due to positive  $T_C$  of  $V_{CEsat}$
- 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          | $T_c = 25^\circ C$  | 75           |
|           |                                       | $T_c = 80^\circ C$  | 50           |
| $I_{CM}$  | Pulsed Collector Current              | $T_c = 25^\circ C$  | 150          |
| $V_{GE}$  | Gate - Emitter Voltage                | $\pm 20$            | V            |
| $P_D$     | Maximum Power Dissipation             | $T_c = 25^\circ C$  | 312          |
| RBSOA     | Reverse Bias Safe Operating Area      | $T_j = 150^\circ C$ | 100A @ 1200V |

**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  | $V_{GE} = 0\text{V}$<br>$V_{CE} = 1200\text{V}$ |     |            | 250<br>500 | $\mu\text{A}$ |
| $V_{CE(sat)}$ | Collector Emitter saturation Voltage | $V_{GE} = 15\text{V}$<br>$I_C = 50\text{A}$     |     | 3.2<br>4.0 | 3.7        | V             |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}, I_C = 1\text{mA}$             | 4.5 |            | 6.5        | V             |
| $I_{GES}$     | Gate – Emitter Leakage Current       | $V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$       |     |            | 100        | nA            |

**Dynamic Characteristics**

| Symbol       | Characteristic               | Test Conditions                                      | Min                       | Typ  | Max | Unit |
|--------------|------------------------------|--|---------------------------|------|-----|------|
| $C_{ies}$    | Input Capacitance            | $V_{GE} = 0\text{V}$                                 |                           | 3450 |     | pF   |
| $C_{oes}$    | Output Capacitance           | $V_{CE} = 25\text{V}$                                |                           | 330  |     |      |
| $C_{res}$    | Reverse Transfer Capacitance | $f = 1\text{MHz}$                                    |                           | 220  |     |      |
| $Q_g$        | Total gate Charge            | $V_{GS} = 15\text{V}$                                |                           | 330  |     | nC   |
| $Q_{ge}$     | Gate – Emitter Charge        | $V_{Bus} = 600\text{V}$                              |                           | 35   |     |      |
| $Q_{gc}$     | Gate – Collector Charge      | $I_C = 50\text{A}$                                   |                           | 200  |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $25^\circ\text{C}$ )           |                           | 35   |     | ns   |
| $T_r$        | Rise Time                    | $V_{GE} = 15\text{V}$<br>$V_{Bus} = 600\text{V}$     |                           | 65   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          | $I_C = 50\text{A}$                                   |                           | 320  |     |      |
| $T_f$        | Fall Time                    | $R_G = 5\ \Omega$                                    |                           | 30   |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $125^\circ\text{C}$ )          |                           | 35   |     | ns   |
| $T_r$        | Rise Time                    | $V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 600\text{V}$ |                           | 65   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          | $I_C = 50\text{A}$                                   |                           | 360  |     |      |
| $T_f$        | Fall Time                    | $R_G = 5\ \Omega$                                    |                           | 40   |     |      |
| $E_{on}$     | Turn-on Switching Energy     | $V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 600\text{V}$ | $T_j = 125^\circ\text{C}$ | 6.9  |     | mJ   |
| $E_{off}$    | Turn-off Switching Energy    | $I_C = 50\text{A}$<br>$R_G = 5\ \Omega$              | $T_j = 125^\circ\text{C}$ | 3.05 |     |      |

**Reverse 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         | $V_R = 1200\text{V}$                            |                           |      | 2500<br>500 | $\mu\text{A}$ |
| $I_F$     | DC Forward Current                      | $T_c = 70^\circ\text{C}$                        |                           | 60   |             | A             |
| $V_F$     | Diode Forward Voltage                   | $I_F = 60\text{A}$                              |                           | 2.0  | 2.5         | V             |
|           |   | $I_F = 120\text{A}$                             |                           | 2.3  |             |               |
|           |   | $I_F = 60\text{A}$<br>$T_j = 125^\circ\text{C}$ |                           | 1.8  |             |               |
| $t_{rr}$  | Reverse Recovery Time                   | $I_F = 60\text{A}$<br>$V_R = 800\text{V}$       | $T_j = 25^\circ\text{C}$  | 370  |             | ns            |
|           |   | $di/dt = 400\text{A}/\mu\text{s}$               | $T_j = 125^\circ\text{C}$ | 500  |             |               |
| $Q_{rr}$  | Reverse Recovery Charge                 | $di/dt = 400\text{A}/\mu\text{s}$               | $T_j = 25^\circ\text{C}$  | 1320 |             | nC            |
|           |   |   | $T_j = 125^\circ\text{C}$ | 6900 |             |               |

## Thermal and package characteristics

| Symbol            | Characteristic   | Min         | Typ | Max  | Unit |     |
|-------------------|--|-------------|-----|------|------|-----|
| R <sub>thJC</sub> | Junction to Case Thermal Resistance  | IGBT        |     | 0.4  | °C/W |     |
|                   |  | Diode       |     | 0.65 |      |     |
| 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   |

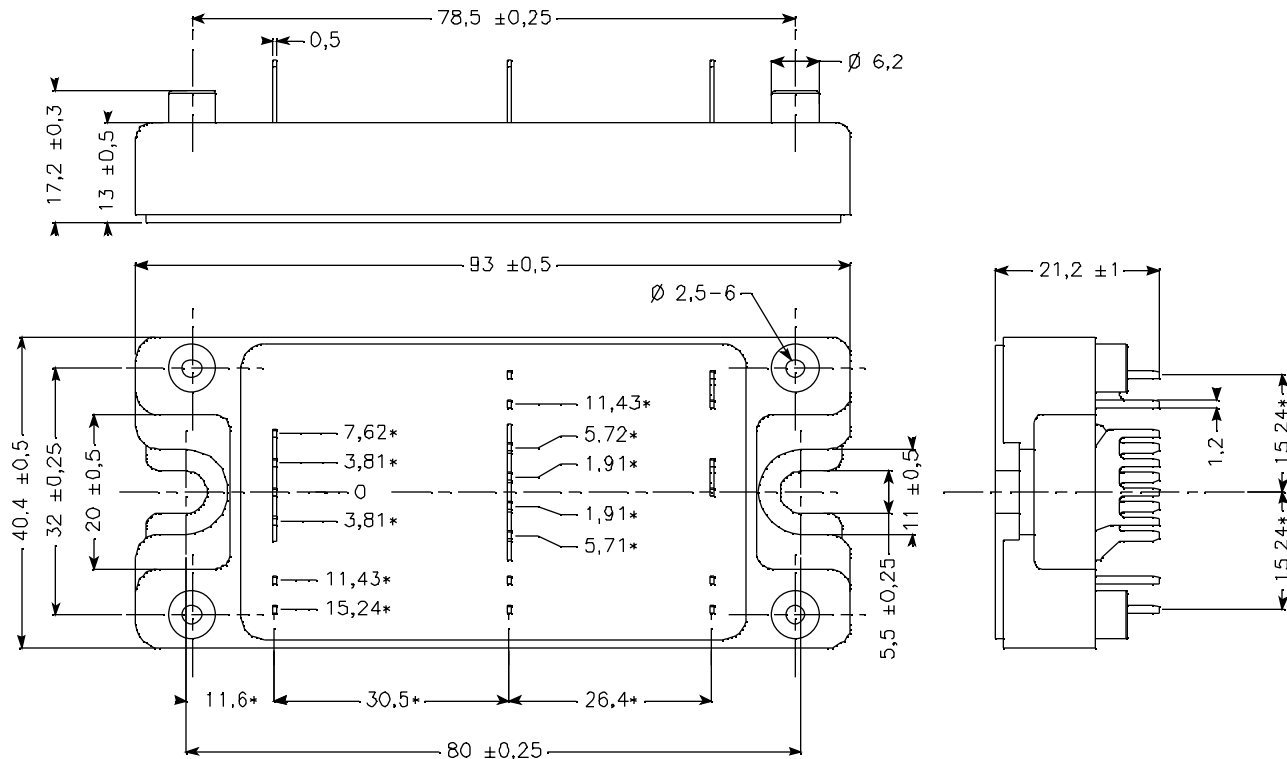
## Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

| 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    |

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

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

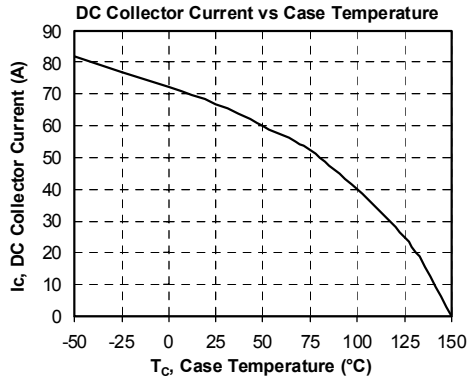
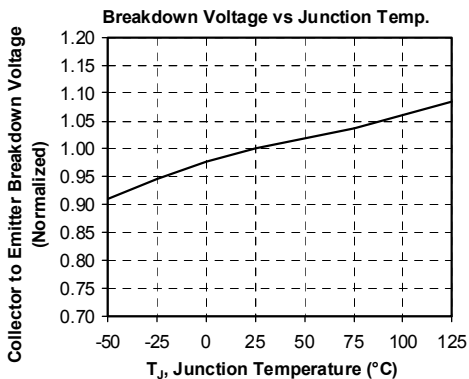
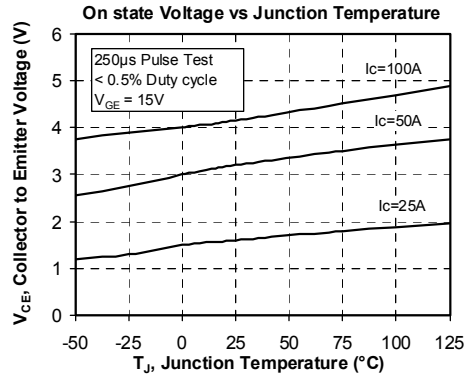
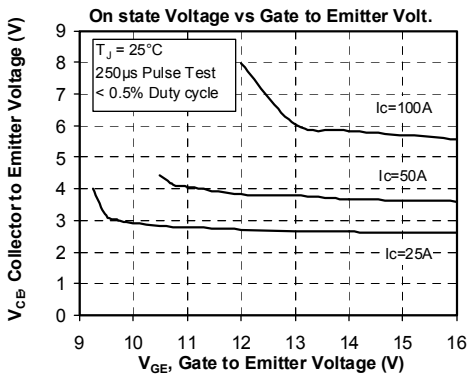
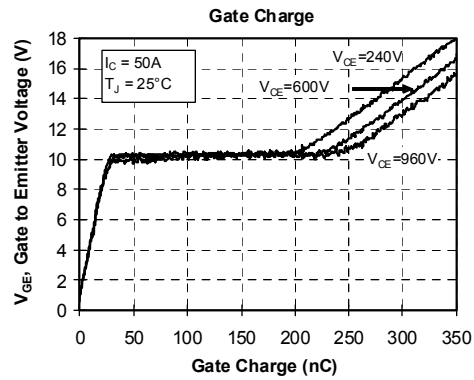
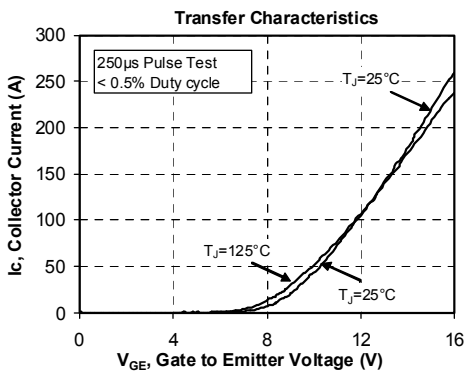
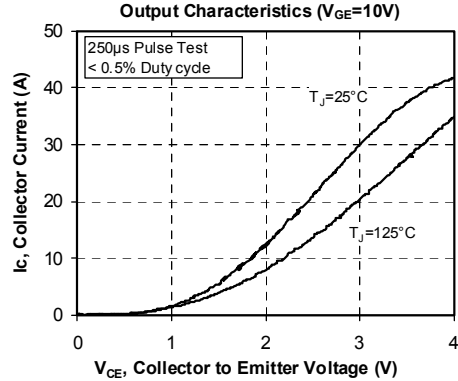
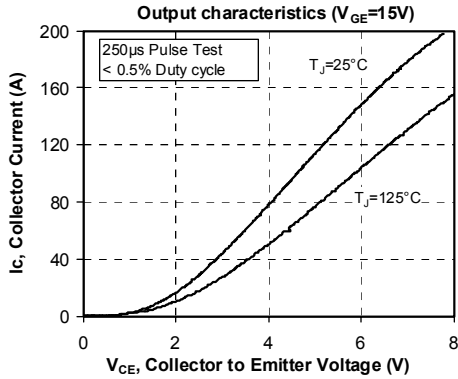
## SP4 Package outline (dimensions in mm)

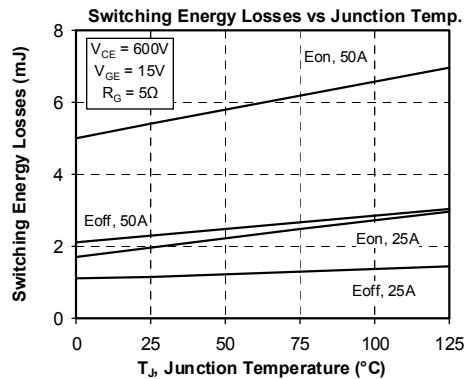
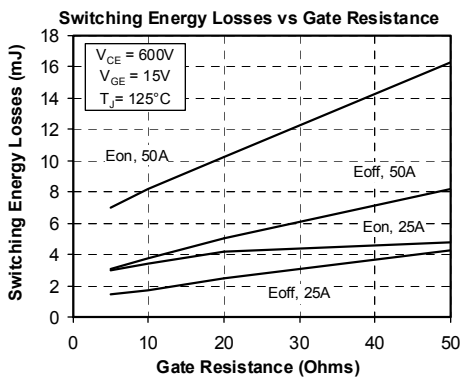
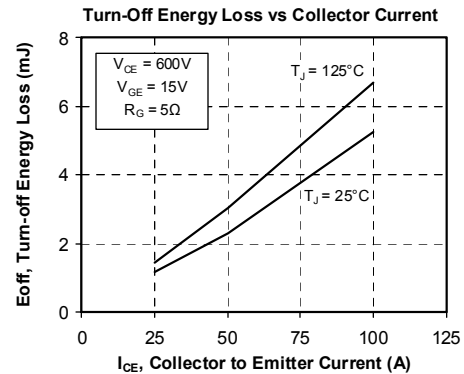
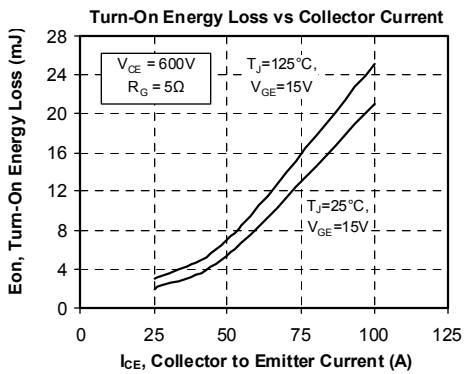
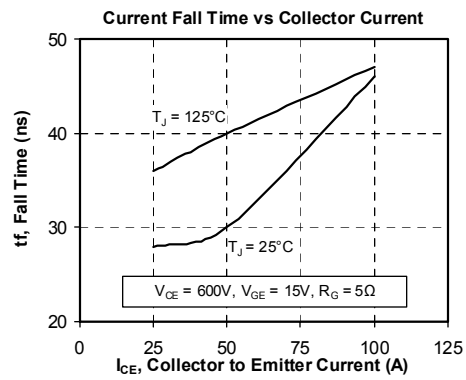
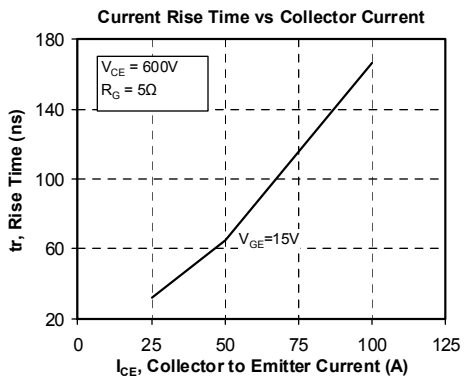
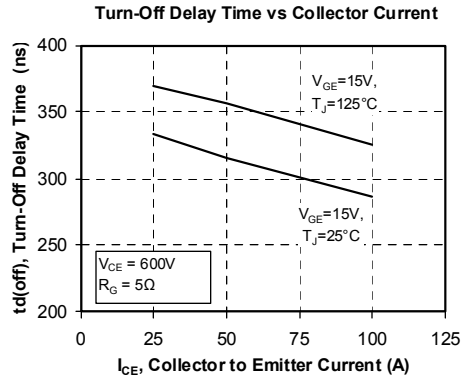
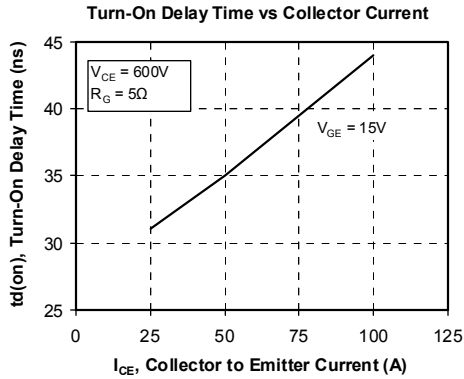


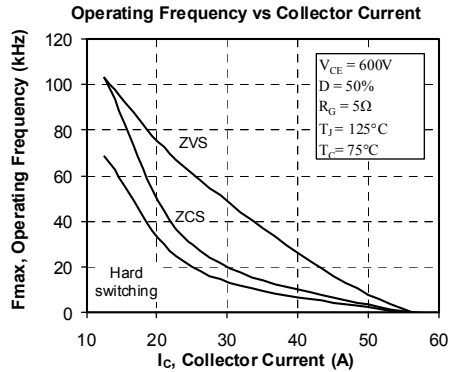
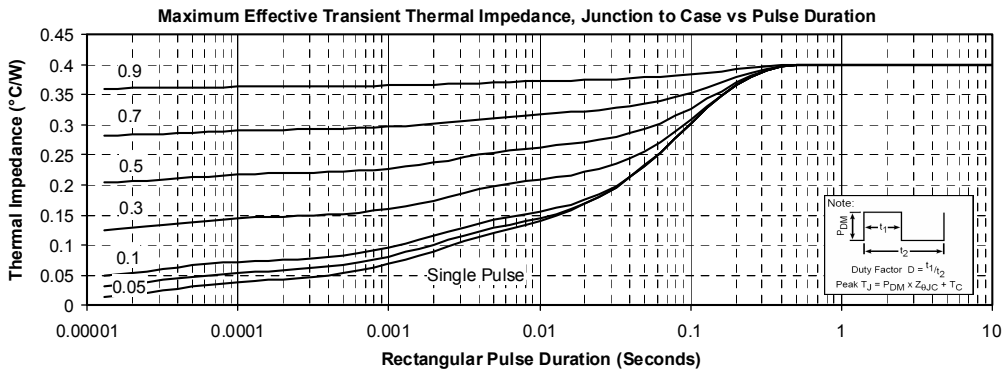
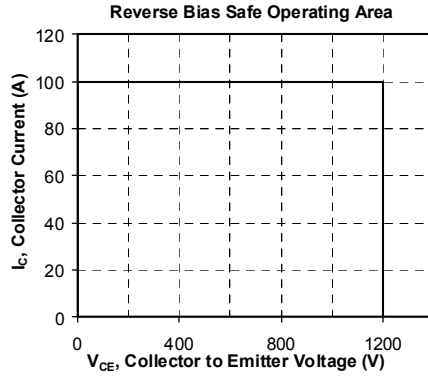
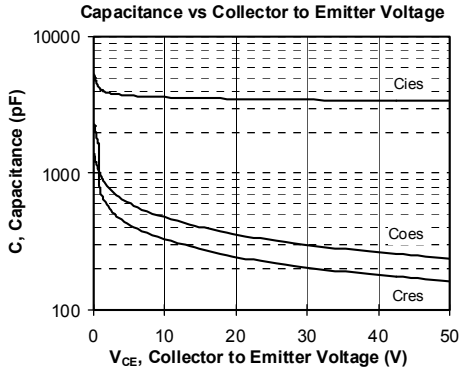
ALL DIMENSIONS MARKED "\*" ARE TOLERENCED AS:  $\pm 0,1$

See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

## Typical Performance Curve







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