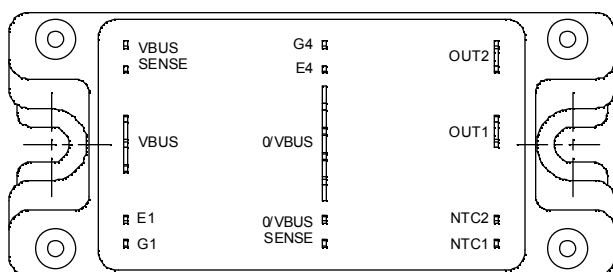
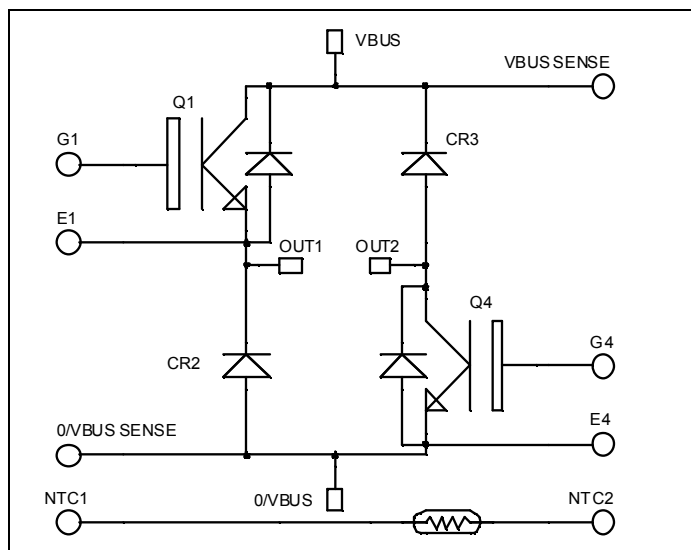


## Asymmetrical - Bridge NPT IGBT Power Module

$V_{CES} = 600V$   
 $I_C = 50A @ T_c = 80^\circ C$



### 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 100 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 TC of VCEsat
- 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          | $T_C = 25^\circ C$  | 65        |
|           |                                       | $T_C = 80^\circ C$  | 50        |
| $I_{CM}$  | Pulsed Collector Current              | $T_C = 25^\circ C$  | 230       |
| $V_{GE}$  | Gate - Emitter Voltage                | $\pm 20$            | V         |
| $P_D$     | Maximum Power Dissipation             | $T_C = 25^\circ C$  | 250       |
| RBSOA     | Reverse Bias Safe Operating Area      | $T_j = 125^\circ C$ | 100A@500V |

**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>$V_{CE} = 600\text{V}$ | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ |     |            | 250<br>500 | $\mu\text{A}$ |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $V_{GE} = 15\text{V}$<br>$I_C = 50\text{A}$    | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ | 1.7 | 2.0<br>2.2 | 2.45       | V             |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}, I_C = 1\text{mA}$            |                                                       | 4   |            | 6          | 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            | $V_{GE} = 0\text{V}$                                                                                                                       |                           |     | 2200 |     | pF   |
| $C_{oes}$    | Output Capacitance           | $V_{CE} = 25\text{V}$                                                                                                                      |                           |     | 323  |     |      |
| $C_{res}$    | Reverse Transfer Capacitance | $f = 1\text{MHz}$                                                                                                                          |                           |     | 200  |     |      |
| $Q_g$        | Total gate Charge            | $V_{GE} = 15\text{V}$                                                                                                                      |                           |     | 166  |     | nC   |
| $Q_{ge}$     | Gate – Emitter Charge        | $V_{Bus} = 300\text{V}$                                                                                                                    |                           |     | 20   |     |      |
| $Q_{gc}$     | Gate – Collector Charge      | $I_C = 50\text{A}$                                                                                                                         |                           |     | 100  |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $25^\circ\text{C}$ )<br>$V_{GE} = 15\text{V}$<br>$V_{Bus} = 400\text{V}$<br>$I_C = 50\text{A}$<br>$R_G = 2.7\Omega$  |                           |     | 40   |     | ns   |
| $T_r$        | Rise Time                    |                                                                                                                                            |                           |     | 9    |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |                                                                                                                                            |                           |     | 120  |     |      |
| $T_f$        | Fall Time                    |                                                                                                                                            |                           |     | 12   |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $125^\circ\text{C}$ )<br>$V_{GE} = 15\text{V}$<br>$V_{Bus} = 400\text{V}$<br>$I_C = 50\text{A}$<br>$R_G = 2.7\Omega$ |                           |     | 42   |     | ns   |
| $T_r$        | Rise Time                    |                                                                                                                                            |                           |     | 10   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |                                                                                                                                            |                           |     | 130  |     |      |
| $T_f$        | Fall Time                    |                                                                                                                                            |                           |     | 21   |     |      |
| $E_{on}$     | Turn-on Switching Energy     | $V_{GE} = 15\text{V}$<br>$V_{Bus} = 400\text{V}$                                                                                           | $T_j = 125^\circ\text{C}$ |     | 0.5  |     | mJ   |
| $E_{off}$    | Turn-off Switching Energy    | $I_C = 50\text{A}$<br>$R_G = 2.7\Omega$                                                                                                    | $T_j = 125^\circ\text{C}$ |     | 1    |     |      |

## 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         | $V_R = 600\text{V}$                       | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ |                                                       |            | 250<br>500 | $\mu\text{A}$ |
| $I_F$     | DC Forward Current                      |                                           | $T_c = 70^\circ\text{C}$                              |                                                       | 60         |            | A             |
| $V_F$     | Diode Forward Voltage                   | $I_F = 60\text{A}$                        |                                                       |                                                       | 1.6        | 1.8        | V             |
|           |                                         | $I_F = 120\text{A}$                       |                                                       |                                                       | 1.9        |            |               |
|           |                                         | $I_F = 60\text{A}$                        | $T_j = 125^\circ\text{C}$                             |                                                       | 1.4        |            |               |
| $t_{rr}$  | Reverse Recovery Time                   | $I_F = 60\text{A}$<br>$V_R = 400\text{V}$ |                                                       | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ | 130<br>170 |            | ns            |
| $Q_{rr}$  | Reverse Recovery Charge                 | $di/dt = 200\text{A}/\mu\text{s}$         |                                                       | $T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ | 220<br>920 |            |               |

**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    |

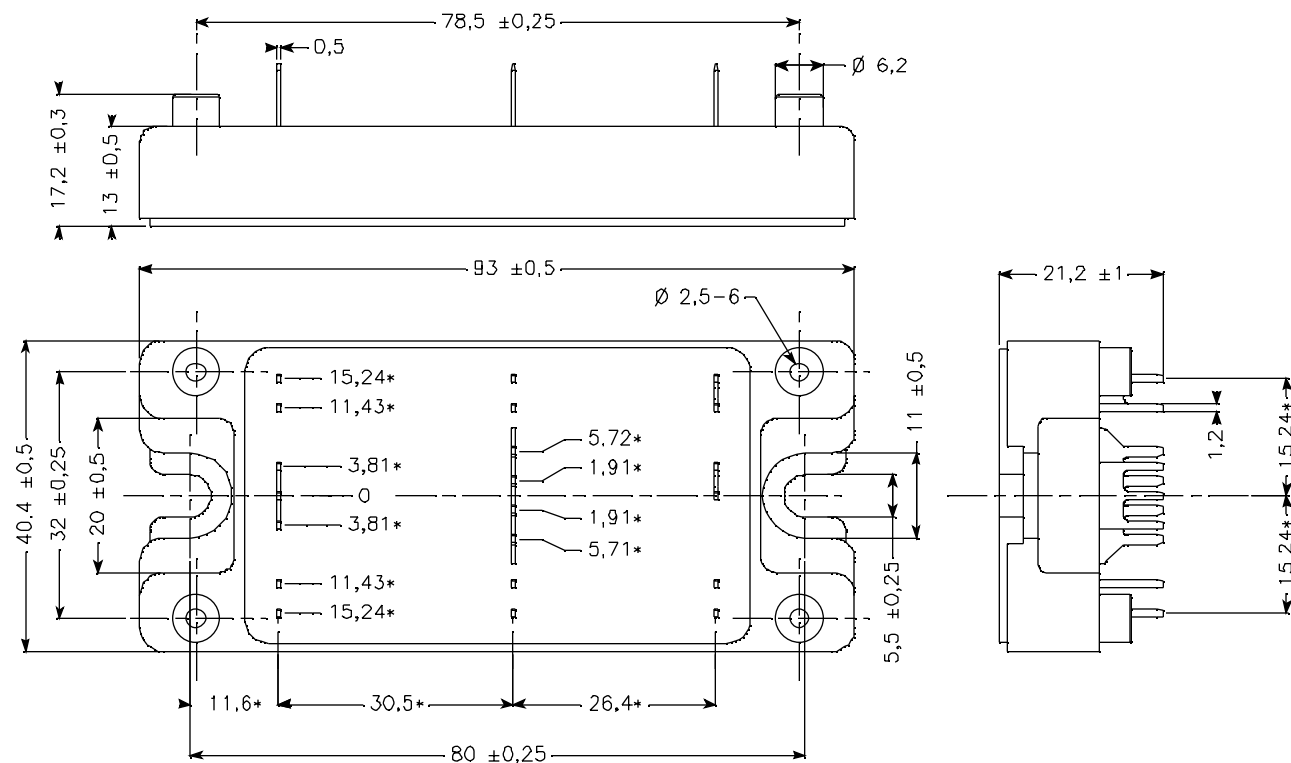
$$R_T = \frac{R_{25}}{\exp \left[ B_{25/85} \left( \frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

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  |     | 0.5 | °C/W |
|                   |                                                                           |             |    | Diode |     | 0.9 |      |
| 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   |     | 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    |

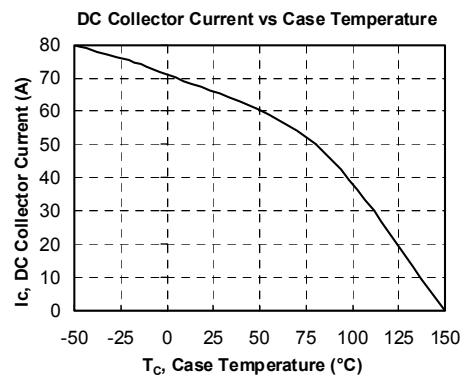
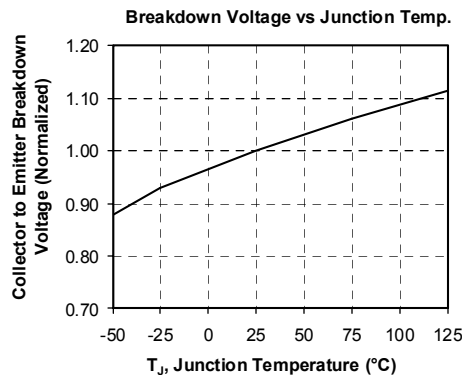
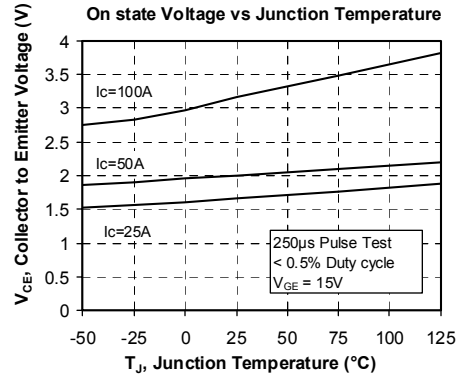
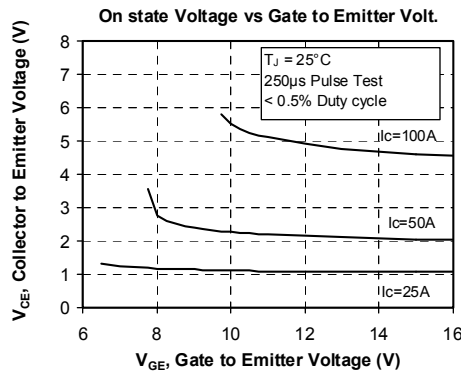
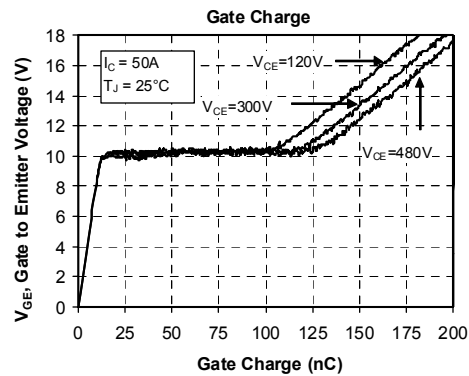
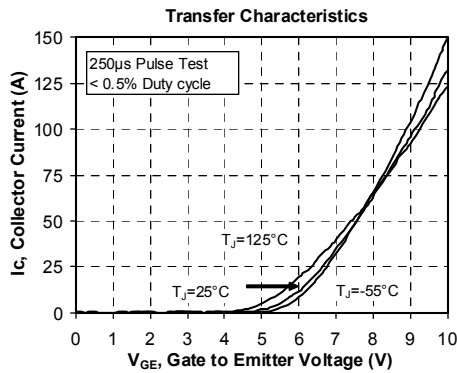
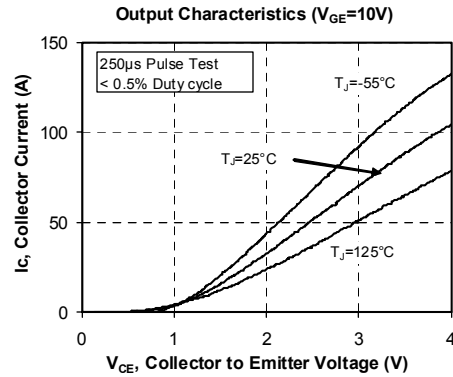
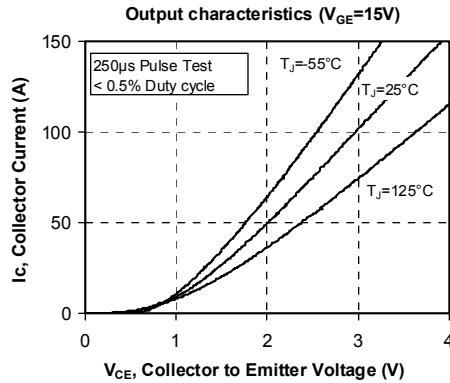
## SP4 Package outline (dimensions in mm)

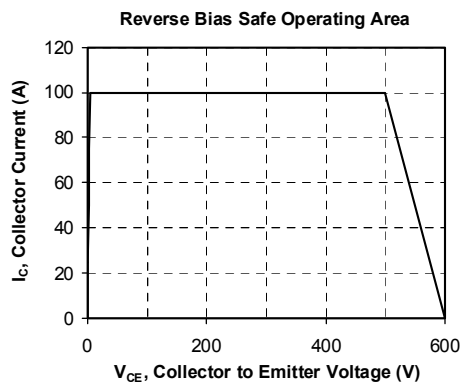
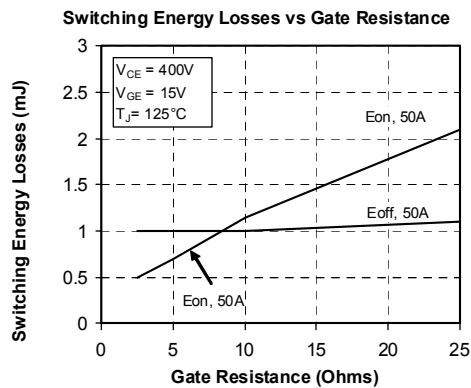
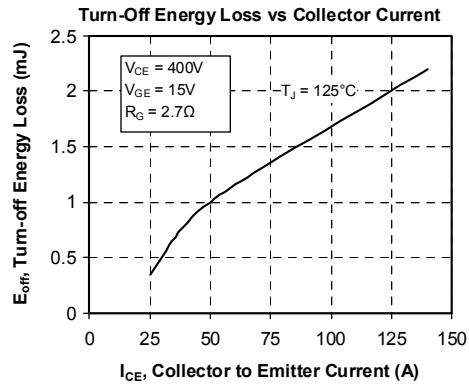
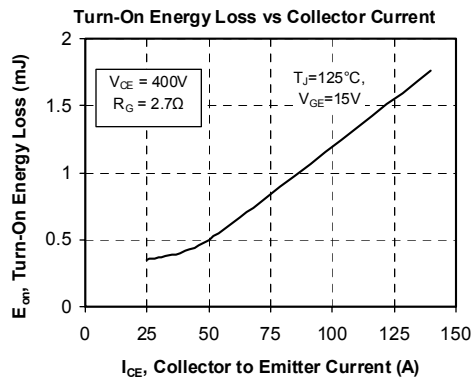
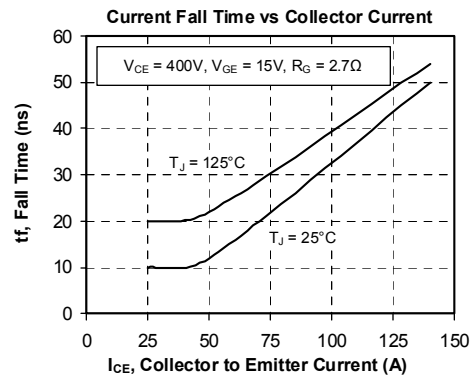
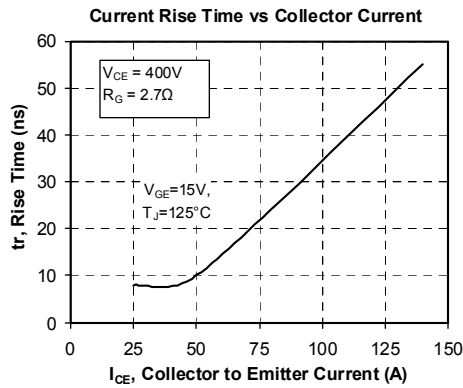
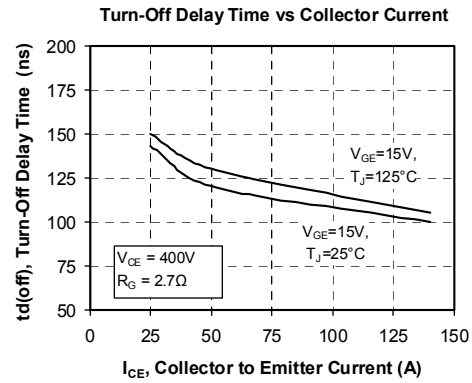
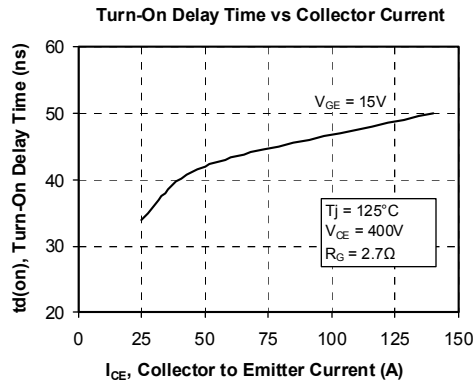


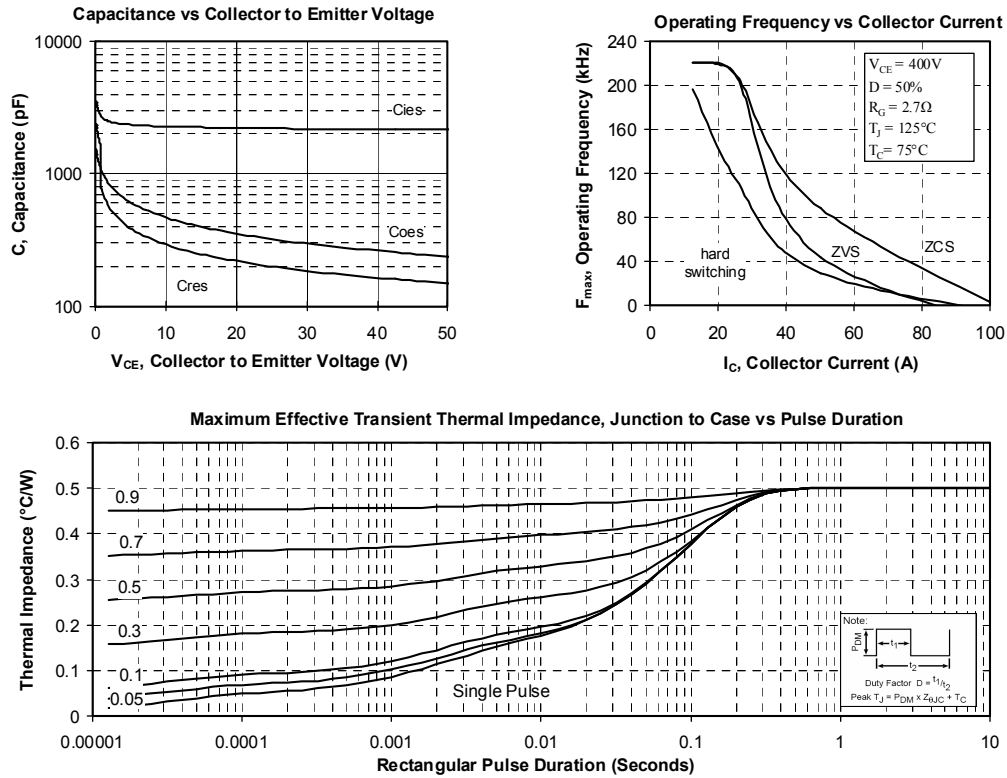
ALL DIMENSIONS MARKED "\*" ARE TOLERENCED AS:  $\pm 0.1$

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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