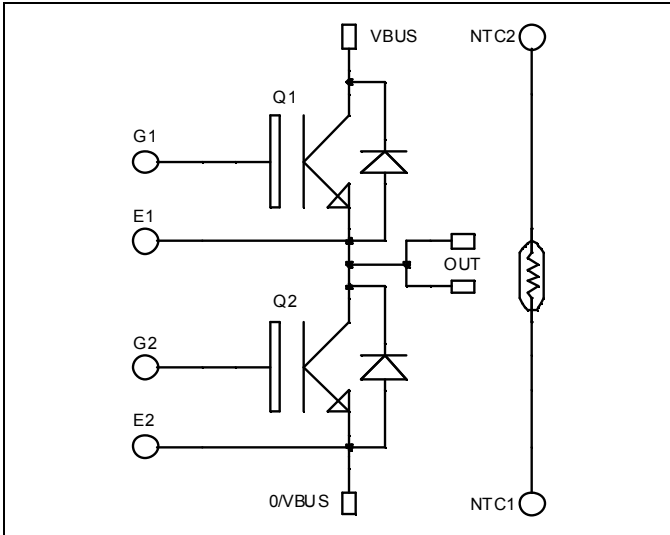


Phase leg NPT IGBT Power Module

$V_{CES} = 600V$
 $I_C = 180A @ T_c = 80^\circ C$



Application

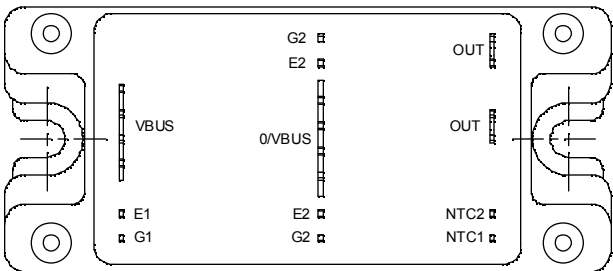
- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

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 | $T_c = 25^\circ C$ | 220 |
| | | $T_c = 80^\circ C$ | 180 |
| I_{CM} | Pulsed Collector Current | $T_c = 25^\circ C$ | 630 |
| V_{GE} | Gate - Emitter Voltage | ± 20 | V |
| P_D | Maximum Power Dissipation | $T_c = 25^\circ C$ | 833 |
| RBSOA | Reverse Bias Safe Operating Area | $T_j = 150^\circ C$ | 400A @ 600V |

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on 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 | $V_{GE} = 0\text{V}$ $V_{CE} = 600\text{V}$ | $T_j = 25^\circ\text{C}$ | | 300 | μA |
| | | | $T_j = 125^\circ\text{C}$ | | 1000 | |
| $V_{CE(sat)}$ | Collector Emitter saturation Voltage | $V_{GE} = 15\text{V}$ $I_C = 180\text{A}$ | $T_j = 25^\circ\text{C}$ | 2.0 | 2.5 | V |
| | | | $T_j = 125^\circ\text{C}$ | 2.2 | | |
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{GE} = V_{CE}, I_C = 2\text{mA}$ | 3 | | 5 | V |
| I_{GES} | Gate – Emitter Leakage Current | $V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$ | | | ± 200 | nA |

Dynamic Characteristics

| Symbol | Characteristic | Test Conditions | Min | Typ | Max | Unit |
|--------------|------------------------------|---|---------------------------|------|-----|------|
| C_{ies} | Input Capacitance | $V_{GE} = 0\text{V}$ $V_{CE} = 25\text{V}$ $f = 1\text{MHz}$ | | 8.6 | | nF |
| C_{oes} | Output Capacitance | | | 0.94 | | |
| C_{res} | Reverse Transfer Capacitance | | | 0.8 | | |
| Q_g | Total gate Charge | $V_{GS} = 15\text{V}$ $V_{Bus} = 300\text{V}$ $I_C = 180\text{A}$ | | 660 | | nC |
| Q_{ge} | Gate – Emitter Charge | | | 580 | | |
| Q_{gc} | Gate – Collector Charge | | | 400 | | |
| $T_{d(on)}$ | Turn-on Delay Time | Inductive Switching (25°C) $V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$ $I_C = 180\text{A}$ $R_G = 2.5\ \Omega$ | | 26 | | ns |
| T_r | Rise Time | | | 25 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 150 | | |
| T_f | Fall Time | | | 30 | | |
| $T_{d(on)}$ | Turn-on Delay Time | Inductive Switching (125°C) $V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$ $I_C = 180\text{A}$ $R_G = 2.5\ \Omega$ | | 26 | | ns |
| T_r | Rise Time | | | 25 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 170 | | |
| T_f | Fall Time | | | 40 | | |
| E_{on} | Turn-on Switching Energy | $V_{GE} = 15\text{V}$ $V_{Bus} = 400\text{V}$ $I_C = 180\text{A}$ $R_G = 2.5\ \Omega$ | $T_j = 125^\circ\text{C}$ | 8.6 | | mJ |
| E_{off} | Turn-off Switching Energy | | $T_j = 125^\circ\text{C}$ | 7 | | |

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 | $V_R = 600\text{V}$ | $T_j = 25^\circ\text{C}$ | | 750 | μA |
| | | | $T_j = 125^\circ\text{C}$ | | 1500 | |
| I_F | DC Forward Current | | | 120 | | A |
| V_F | Diode Forward Voltage | $I_F = 120\text{A}$ | | 1.6 | 1.8 | V |
| | | $I_F = 240\text{A}$ | | 1.9 | | |
| | | $I_F = 120\text{A}$ | $T_j = 125^\circ\text{C}$ | 1.4 | | |
| t_{rr} | Reverse Recovery Time | $I_F = 120\text{A}$ $V_R = 400\text{V}$ $di/dt = 800\text{A}/\mu\text{s}$ | $T_j = 25^\circ\text{C}$ | 85 | | ns |
| | | | $T_j = 125^\circ\text{C}$ | 160 | | |
| Q_{rr} | Reverse Recovery Charge | $I_F = 120\text{A}$ $V_R = 400\text{V}$ $di/dt = 800\text{A}/\mu\text{s}$ | $T_j = 25^\circ\text{C}$ | 520 | | nC |
| | | | $T_j = 125^\circ\text{C}$ | 2800 | | |

Thermal and package characteristics

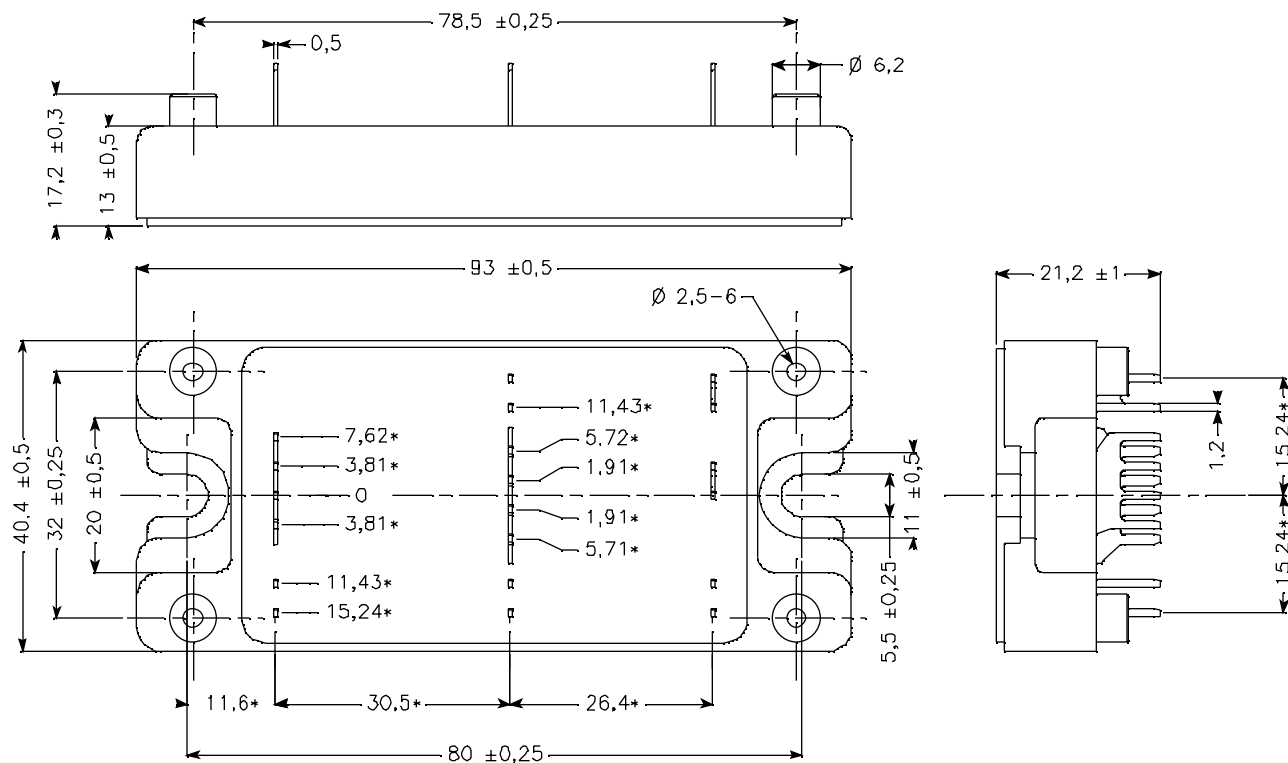
| Symbol | Characteristic | Min | Typ | Max | Unit | |
|-------------------|--|-------------|-----|------|------|-----|
| R _{thJC} | Junction to Case Thermal Resistance | IGBT | | 0.15 | °C/W | |
| | | Diode | | 0.32 | | |
| V _{ISOL} | RMS Isolation Voltage, any terminal to case t=1 min, I _{isol} <1mA, 50/60Hz | 2500 | | | V | |
| T _J | Operating junction temperature range | -40 | | 150 | °C | |
| T _{STG} | Storage Temperature Range | -40 | | 125 | | |
| T _C | 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 ₂₅ | Resistance @ 25°C | | 50 | | kΩ |
| B _{25/85} | T ₂₅ = 298.15 K | | 3952 | | K |

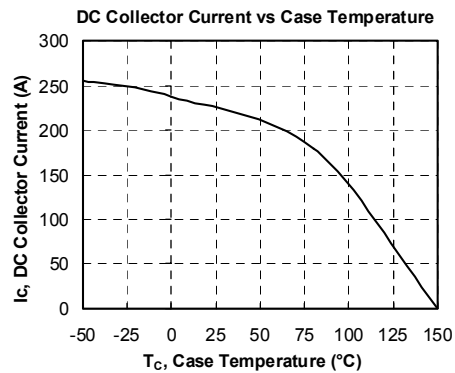
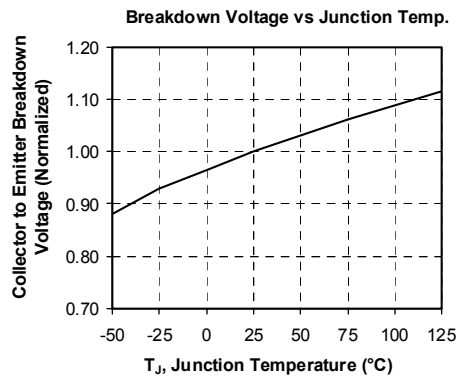
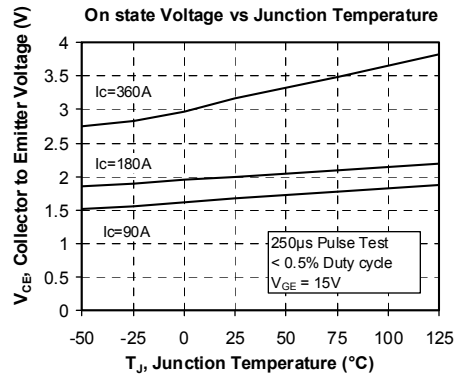
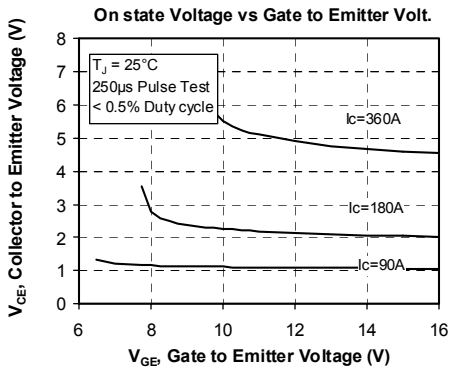
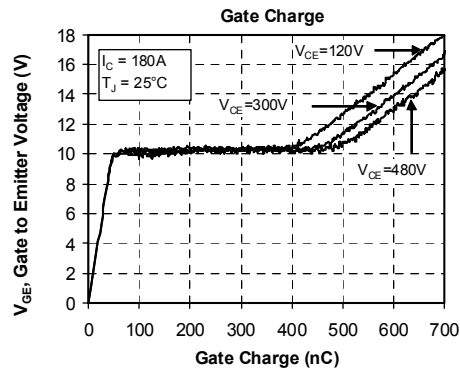
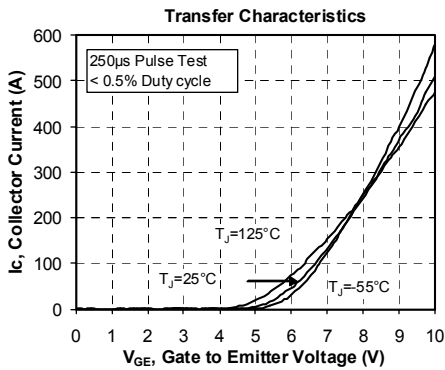
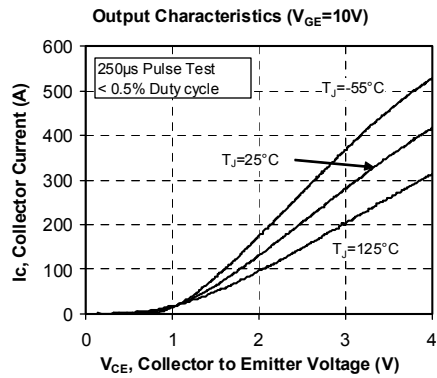
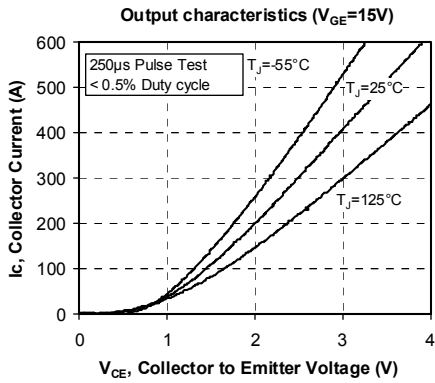
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

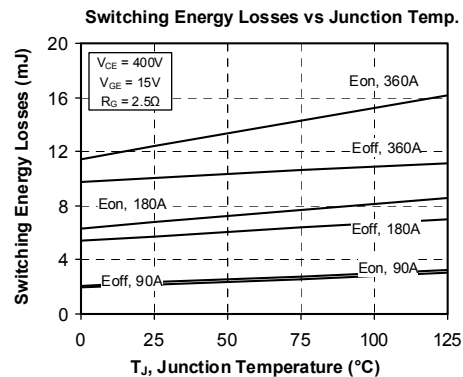
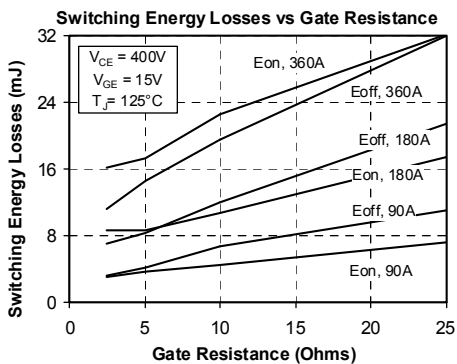
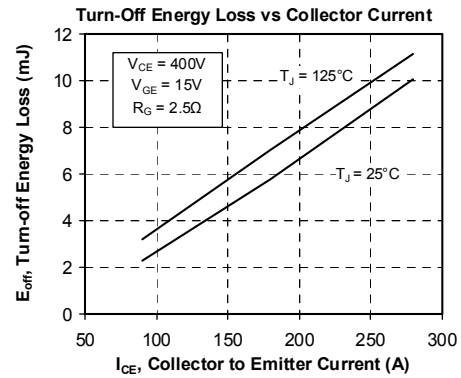
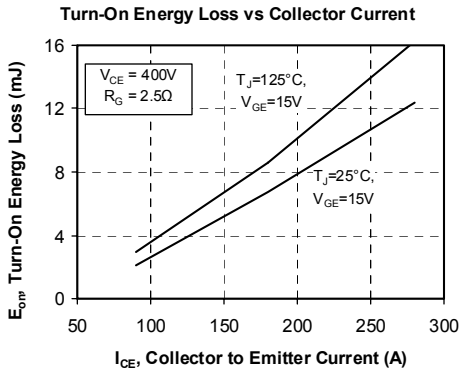
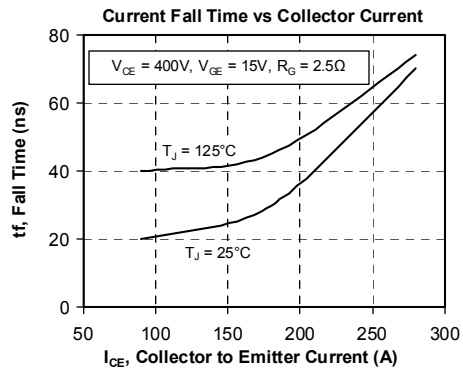
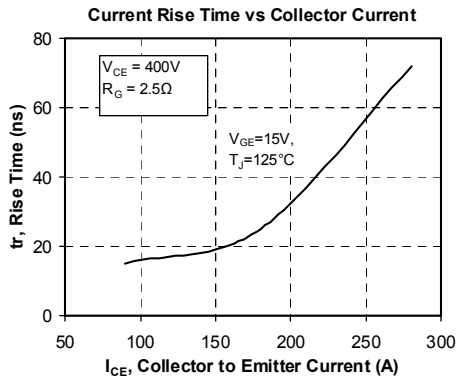
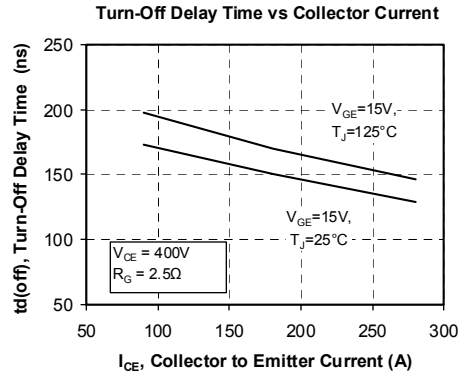
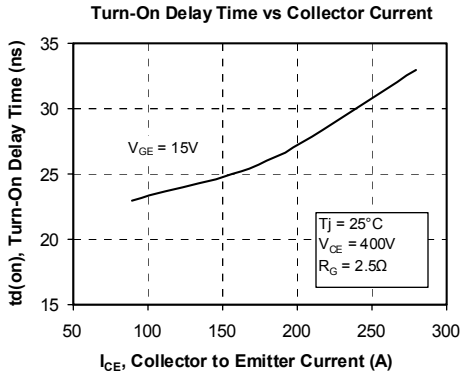
T: Thermistor temperature
 R_T: Thermistor value at T

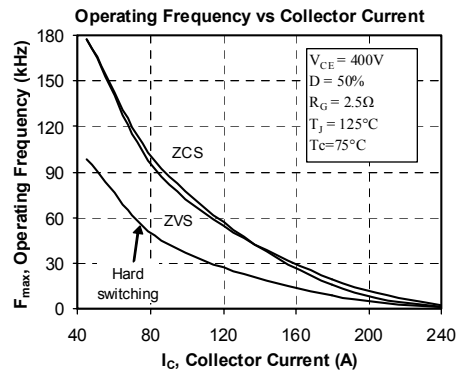
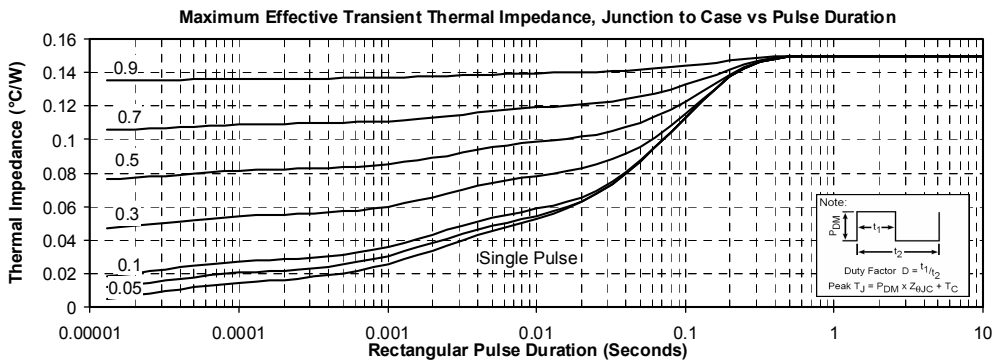
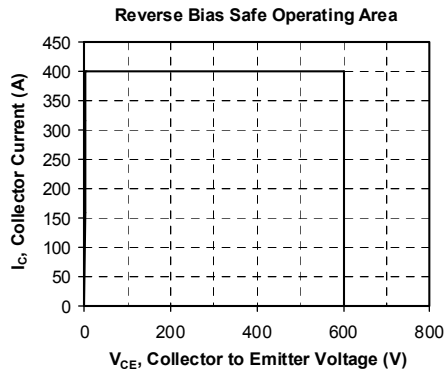
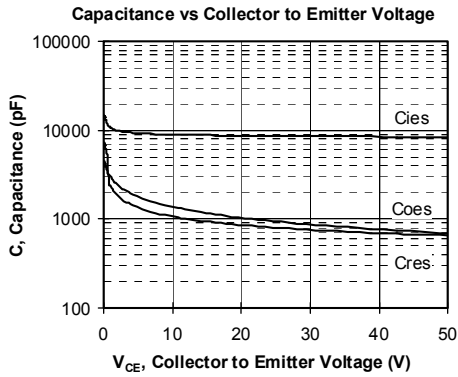
SP4 Package outline (dimensions in mm)

 ALL DIMENSIONS MARKED "*" ARE TOLERANCED AS: ± 0.1

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

Typical Performance Curve







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