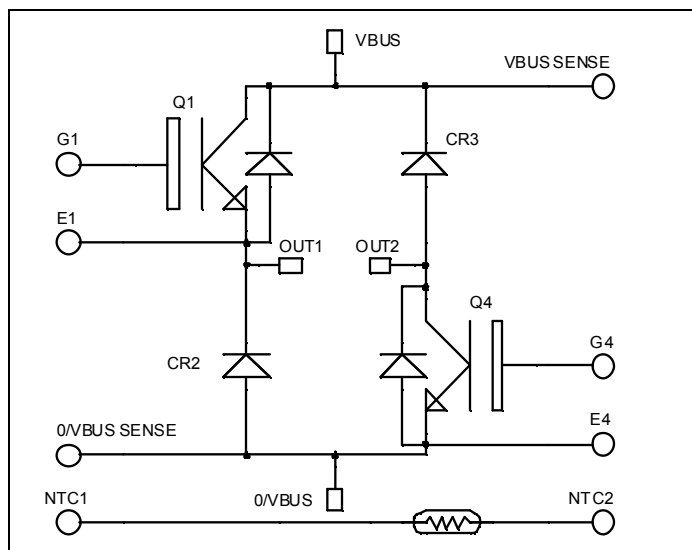


## Asymmetrical - Bridge Trench + Field Stop IGBT® Power Module

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

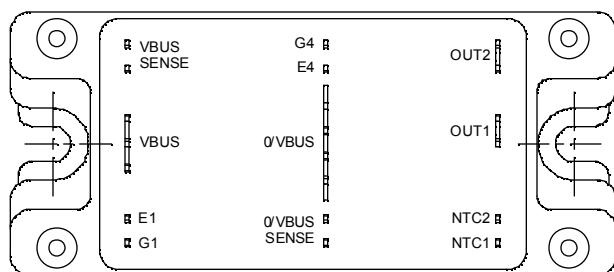


### Application

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

### Features

- 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
  - Avalanche energy rated
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- 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

- Stable temperature behavior
- Very rugged
- Solderable terminals for easy PCB mounting
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- 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          | $T_C = 25^\circ C$<br>80<br>$T_C = 80^\circ C$<br>50 | A    |
| $I_{CM}$  | Pulsed Collector Current              | $T_C = 25^\circ C$<br>100                            | A    |
| $V_{GE}$  | Gate - Emitter Voltage                | $\pm 20$                                             | V    |
| $P_D$     | Maximum Power Dissipation             | $T_C = 25^\circ C$<br>176                            | W    |
| RBSOA     | Reverse Bias Safe Operating Area      | $T_J = 150^\circ C$<br>100A @ 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  | $V_{GE} = 0\text{V}$ , $V_{CE} = 600\text{V}$ |                                                       |            | 250 | $\mu\text{A}$ |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $V_{GE} = 15\text{V}$<br>$I_C = 50\text{A}$   | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 1.5<br>1.7 | 1.9 | V             |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}$ , $I_C = 600\mu\text{A}$    | 5.0                                                   | 5.8        | 6.5 | V             |
| $I_{GES}$     | Gate – Emitter Leakage Current       | $V_{GE} = 20\text{V}$ , $V_{CE} = 0\text{V}$  |                                                       |            | 600 | nA            |

## Dynamic Characteristics

| Symbol       | Characteristic               | Test Conditions                                                                                                                                | Min                                                   | Typ          | Max | Unit |
|--------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------------|-----|------|
| $C_{ies}$    | Input Capacitance            | $V_{GE} = 0\text{V}$                                                                                                                           |                                                       | 3150         |     | pF   |
| $C_{oes}$    | Output Capacitance           | $V_{CE} = 25\text{V}$                                                                                                                          |                                                       | 200          |     |      |
| $C_{res}$    | Reverse Transfer Capacitance | $f = 1\text{MHz}$                                                                                                                              |                                                       | 95           |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $25^\circ\text{C}$ )<br>$V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 300\text{V}$<br>$I_C = 50\text{A}$<br>$R_G = 8.2\Omega$  |                                                       | 110          |     | ns   |
| $T_r$        | Rise Time                    |                                                                                                                                                |                                                       | 45           |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |                                                                                                                                                |                                                       | 200          |     |      |
| $T_f$        | Fall Time                    |                                                                                                                                                |                                                       | 40           |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $150^\circ\text{C}$ )<br>$V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 300\text{V}$<br>$I_C = 50\text{A}$<br>$R_G = 8.2\Omega$ |                                                       | 120          |     | ns   |
| $T_r$        | Rise Time                    |                                                                                                                                                |                                                       | 50           |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |                                                                                                                                                |                                                       | 250          |     |      |
| $T_f$        | Fall Time                    |                                                                                                                                                |                                                       | 60           |     |      |
| $E_{on}$     | Turn-on Switching Energy     | $V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 300\text{V}$<br>$I_C = 50\text{A}$                                                                     | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 0.3<br>0.43  |     | mJ   |
| $E_{off}$    | Turn-off Switching Energy    | $R_G = 8.2\Omega$                                                                                                                              | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 1.35<br>1.75 |     |      |

## 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>$T_j = 150^\circ\text{C}$ |            | 250<br>500 | $\mu\text{A}$ |
| $I_F$     | DC Forward Current                      |                                                                                 | $T_c = 80^\circ\text{C}$                              | 50         |            | A             |
| $V_F$     | Diode Forward Voltage                   | $I_F = 50\text{A}$<br>$V_{GE} = 0\text{V}$                                      | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 1.6<br>1.5 | 2          | V             |
| $t_{rr}$  | Reverse Recovery Time                   | $I_F = 50\text{A}$<br>$V_R = 300\text{V}$<br>$di/dt = 1800\text{A}/\mu\text{s}$ | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 100<br>150 |            | ns            |
| $Q_{rr}$  | Reverse Recovery Charge                 |                                                                                 | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 2.6<br>5.4 |            |               |
| $E_r$     | Reverse Recovery Energy                 |                                                                                 | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 0.6<br>1.2 |            | mJ            |
|           |                                         |                                                                                 |                                                       |            |            |               |
|           |                                         |                                                                                 |                                                       |            |            |               |

**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    |

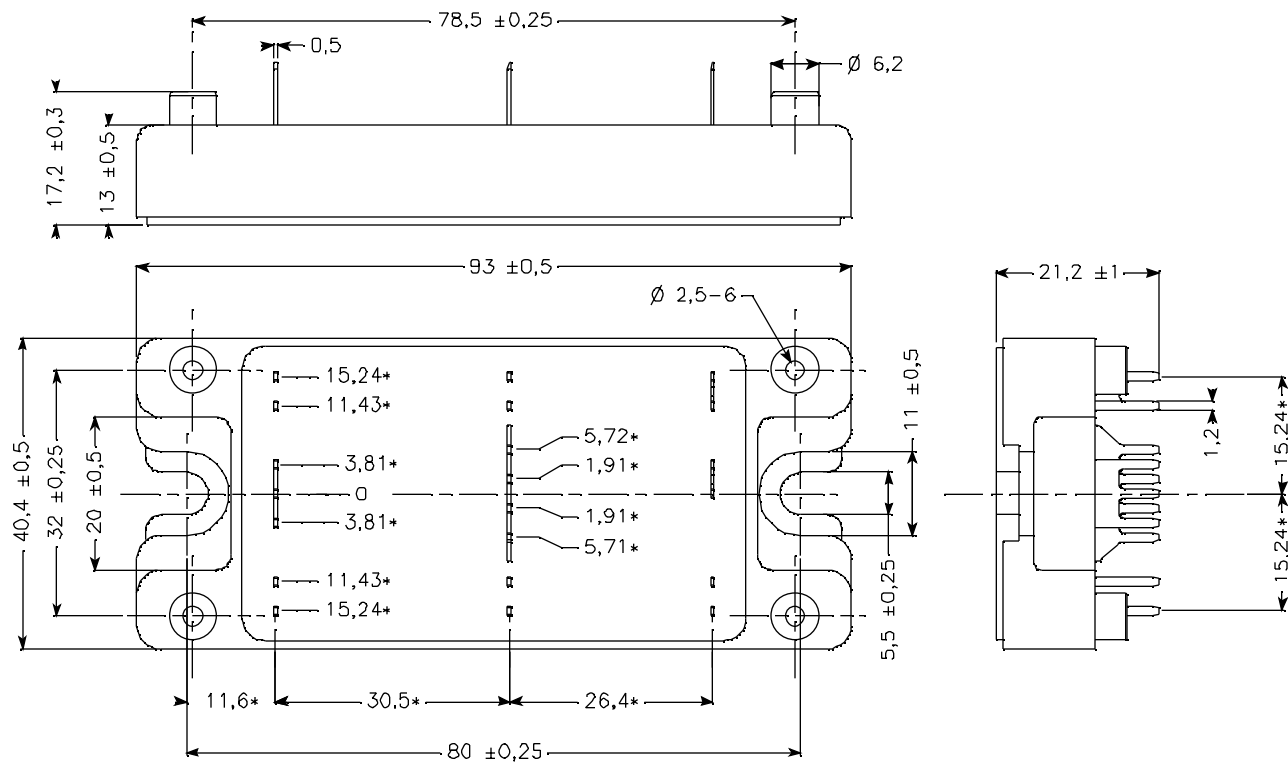
$$R_T = \frac{R_{25}}{\exp \left[ B_{25/85} \left( \frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

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        |     | 0.85 | °C/W |
|                   |                                                                                      | Diode       |     | 1.42 |      |
| 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         |     | 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 | M5  | 2.5  | N.m  |
| Wt                | Package Weight                                                                       |             |     | 160  | g    |

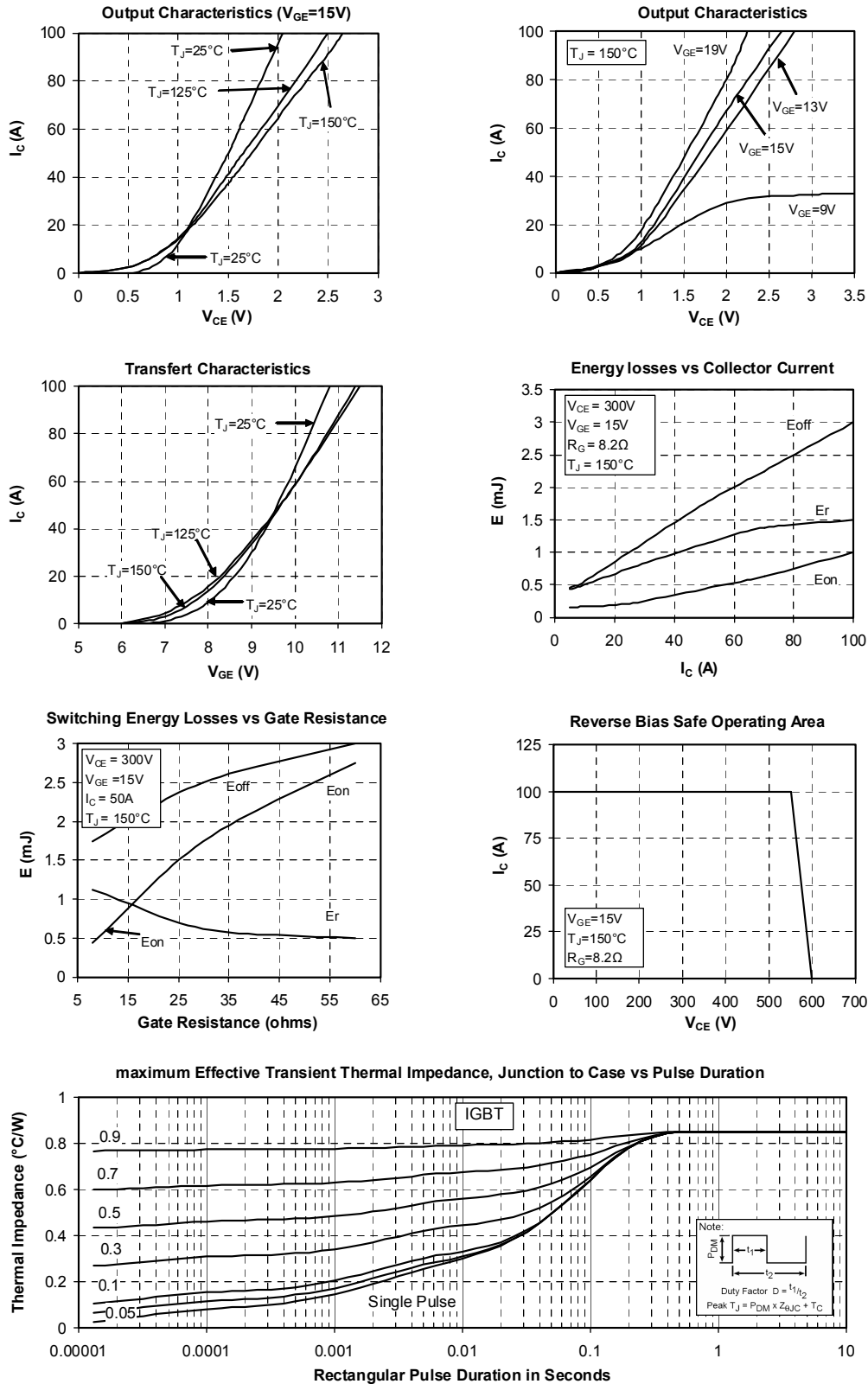
## SP4 Package outline (dimensions in mm)

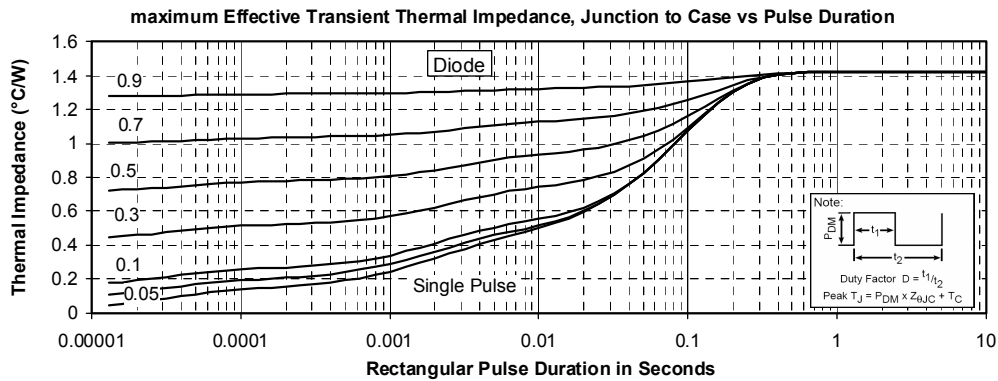
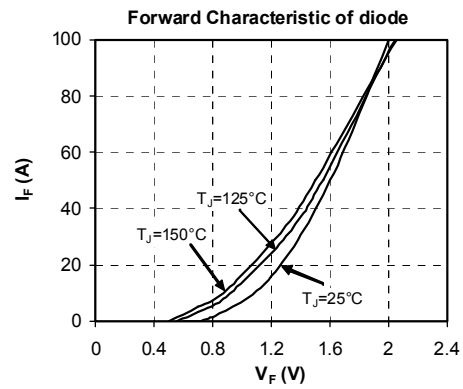
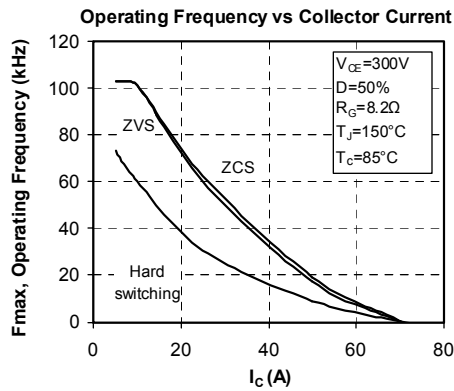


ALL DIMENSIONS MARKED "\*" ARE TOLERENCED AS:  $\pm 0.1$

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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