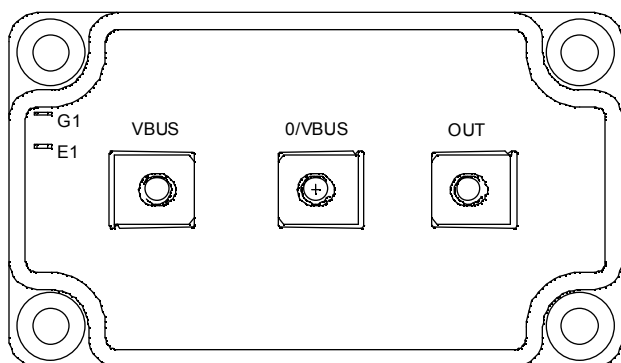
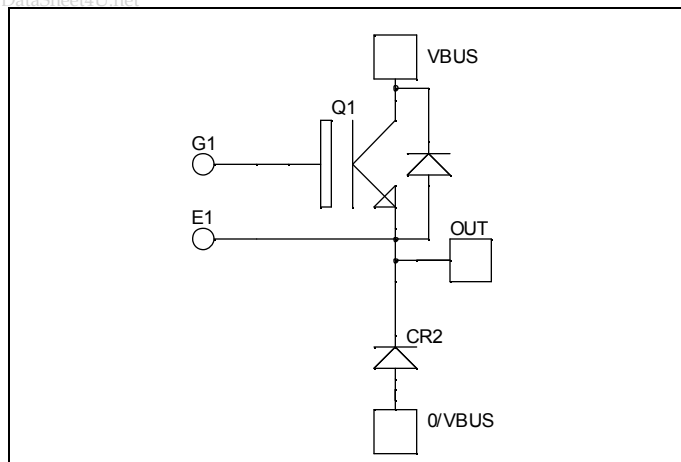


**Buck chopper  
Trench + Field Stop IGBT®  
Power Module**

$$V_{CES} = 600V$$

$$I_C = 450A @ T_c = 80^{\circ}C$$

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## Application

- AC and DC motor control
- Switched Mode Power Supplies

## 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
- Very low stray inductance
  - Symmetrical design
  - M5 power connectors
- High level of integration

## Benefits

- Stable temperature behavior
- Very rugged
- 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          | $T_C = 25^{\circ}C$  | A           |
|           |                                       | $T_C = 80^{\circ}C$  |             |
| $I_{CM}$  | Pulsed Collector Current              | $T_C = 25^{\circ}C$  | 600         |
| $V_{GE}$  | Gate - Emitter Voltage                | $\pm 20$             | V           |
| $P_D$     | Maximum Power Dissipation             | $T_C = 25^{\circ}C$  | 1750        |
| RBSOA     | Reverse Bias Safe Operating Area      | $T_j = 150^{\circ}C$ | 900A @ 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  | $V_{GE} = 0\text{V}$ , $V_{CE} = 600\text{V}$ |                                                       |            | 500 | $\mu\text{A}$ |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $V_{GE} = 15\text{V}$<br>$I_C = 450\text{A}$  | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 1.4<br>1.5 | 1.8 | V             |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}$ , $I_C = 2\text{mA}$        | 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            | $V_{GE} = 0\text{V}$                                                                                                                          |                                                       | 37           |     | nF   |
| $C_{oes}$    | Output Capacitance           | $V_{CE} = 25\text{V}$                                                                                                                         |                                                       | 2.3          |     |      |
| $C_{res}$    | Reverse Transfer Capacitance | $f = 1\text{MHz}$                                                                                                                             |                                                       | 1.1          |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $25^\circ\text{C}$ )<br>$V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 300\text{V}$<br>$I_C = 450\text{A}$<br>$R_G = 1\Omega$  |                                                       | 130          |     | ns   |
| $T_r$        | Rise Time                    |                                                                                                                                               |                                                       | 55           |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |                                                                                                                                               |                                                       | 250          |     |      |
| $T_f$        | Fall Time                    |                                                                                                                                               |                                                       | 60           |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $150^\circ\text{C}$ )<br>$V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 300\text{V}$<br>$I_C = 450\text{A}$<br>$R_G = 1\Omega$ |                                                       | 145          |     | ns   |
| $T_r$        | Rise Time                    |                                                                                                                                               |                                                       | 60           |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |                                                                                                                                               |                                                       | 320          |     |      |
| $T_f$        | Fall Time                    |                                                                                                                                               |                                                       | 80           |     |      |
| $E_{on}$     | Turn on Energy               | $V_{GE} = \pm 15\text{V}$<br>$V_{Bus} = 300\text{V}$<br>$I_C = 450\text{A}$<br>$R_G = 1\Omega$                                                | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 2.25<br>4.2  |     | mJ   |
| $E_{off}$    | Turn off Energy              |                                                                                                                                               | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 12.8<br>15.7 |     | mJ   |

**Chopper diode ratings and characteristics**

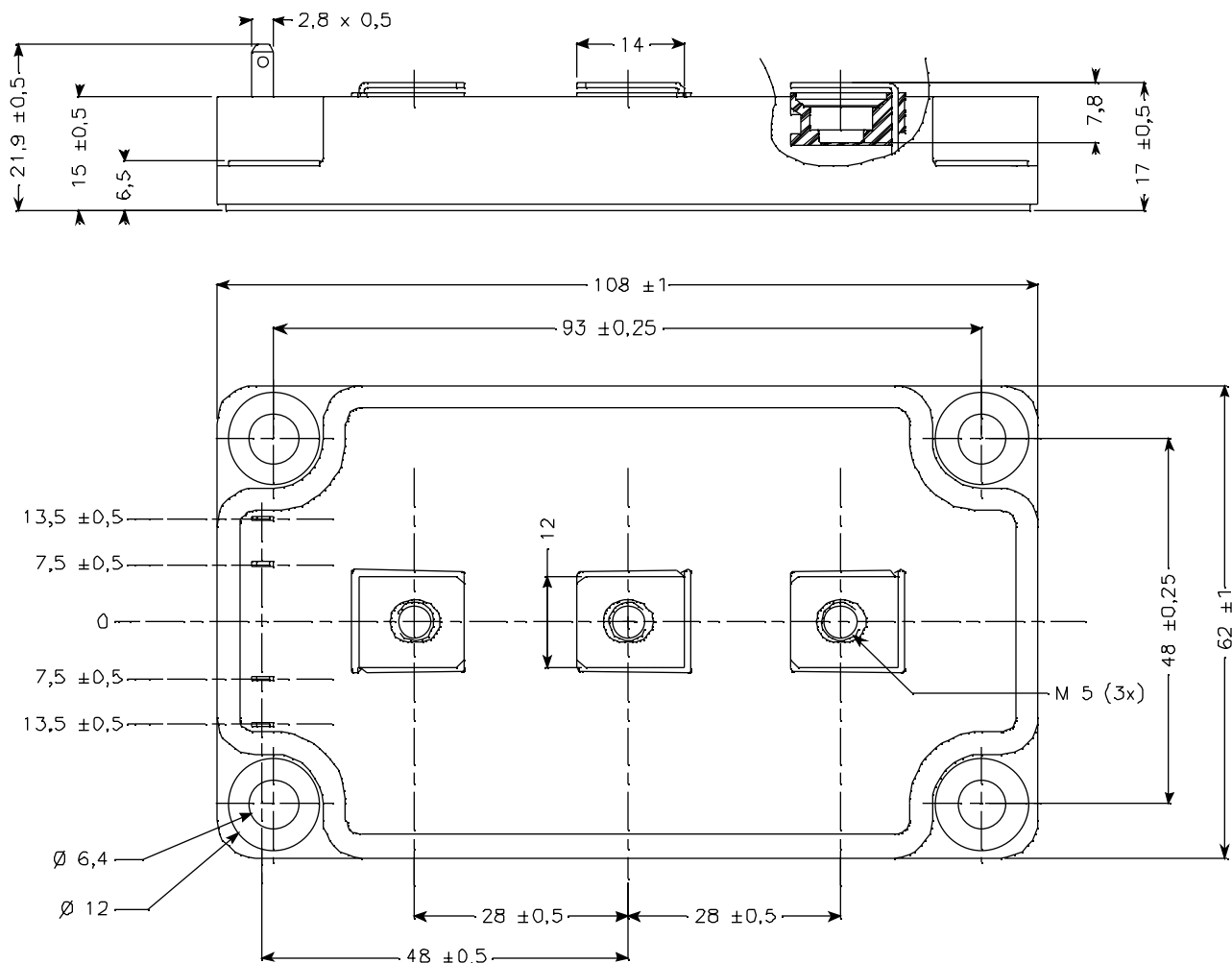
| Symbol    | Characteristic                          | Test Conditions                                                                  | Min                                                   | Typ          | Max        | Unit          |
|-----------|-----------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------|--------------|------------|---------------|
| $V_{RRM}$ | 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>$T_j = 150^\circ\text{C}$ |              | 200<br>500 | $\mu\text{A}$ |
| $I_F$     | DC Forward Current                      |                                                                                  | $T_c = 80^\circ\text{C}$                              | 450          |            | A             |
| $V_F$     | Diode Forward Voltage                   | $I_F = 450\text{A}$<br>$V_{GE} = 0\text{V}$                                      | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 1.5<br>1.4   | 1.9        | V             |
| $t_{rr}$  | Reverse Recovery Time                   | $I_F = 450\text{A}$<br>$V_R = 300\text{V}$<br>$di/dt = 4000\text{A}/\mu\text{s}$ | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 120<br>210   |            | ns            |
| $Q_{rr}$  | Reverse Recovery Charge                 |                                                                                  | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 20.3<br>42.8 |            | $\mu\text{C}$ |
| $E_r$     | Reverse Recovery Energy                 |                                                                                  | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$ | 5.2<br>10.6  |            | mJ            |

## Thermal and package characteristics

*Symbol Characteristic*

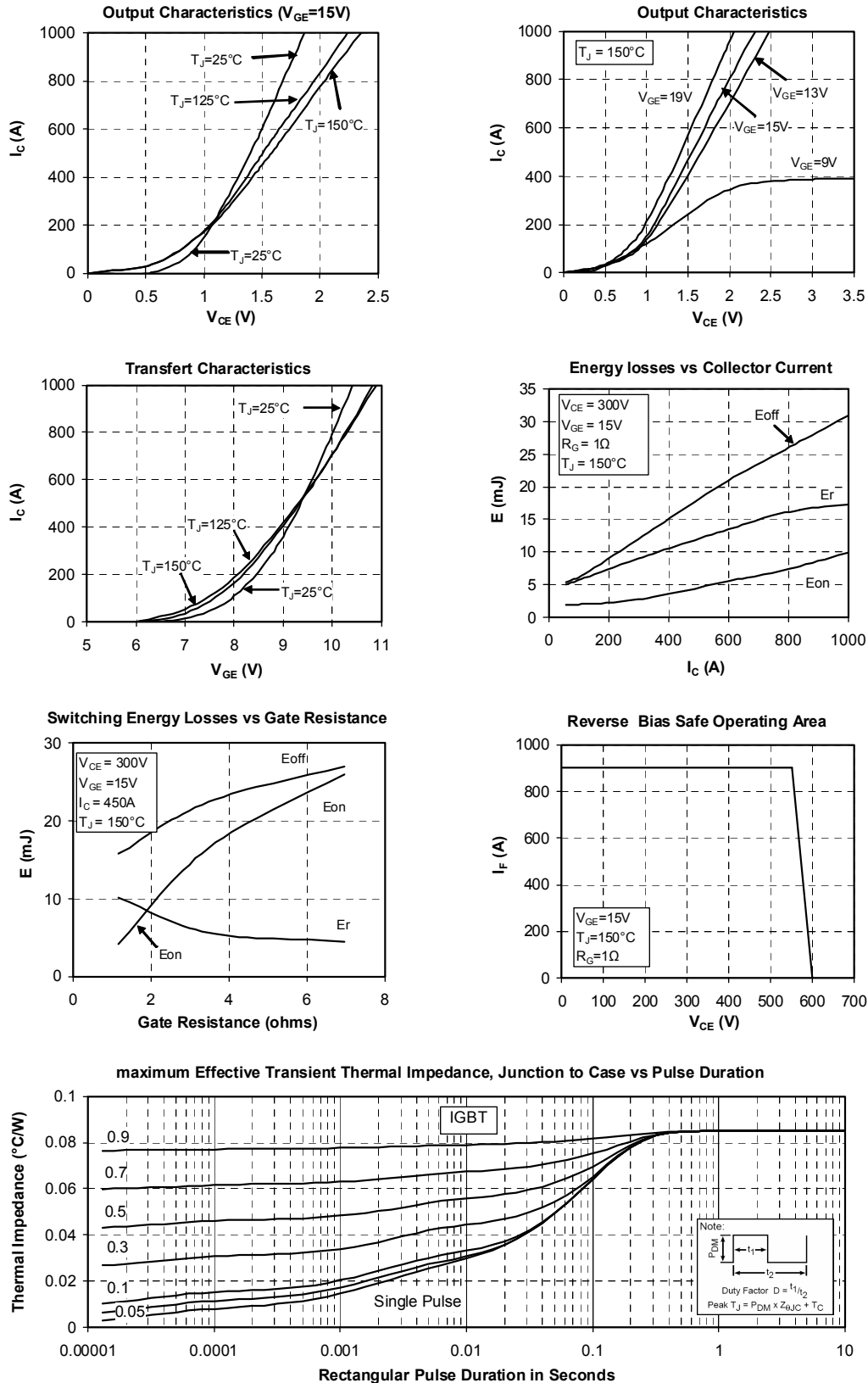
|            |                                                                                     |               | <i>Min</i> | <i>Typ</i> | <i>Max</i> | <i>Unit</i> |
|------------|-------------------------------------------------------------------------------------|---------------|------------|------------|------------|-------------|
| $R_{thJC}$ | Junction to Case Thermal Resistance                                                 | IGBT          |            |            | 0.085      | °C/W        |
|            |                                                                                     | Diode         |            |            | 0.14       |             |
| $V_{ISOL}$ | RMS Isolation Voltage, any terminal to case $t = 1$ min, $I_{isol} < 1$ mA, 50/60Hz |               | 2500       |            |            | V           |
| $T_J$      | Operating junction temperature range                                                |               | -40        |            | 175        | °C          |
| $T_{STG}$  | Storage Temperature Range                                                           |               | -40        |            | 125        |             |
| $T_C$      | Operating Case Temperature                                                          |               | -40        |            | 100        |             |
| Torque     | Mounting torque                                                                     | To heatsink   | M6         | 3          | 5          | N.m         |
|            |                                                                                     | For terminals | M5         | 2          | 3.5        |             |
| Wt         | Package Weight                                                                      |               |            |            | 280        | g           |

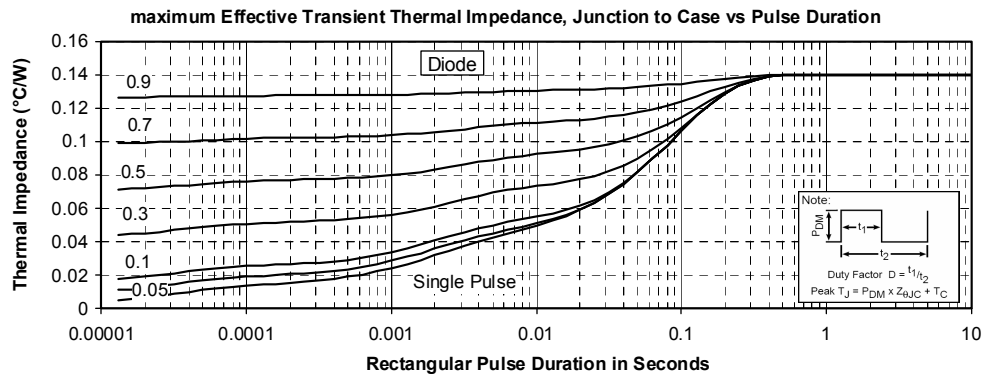
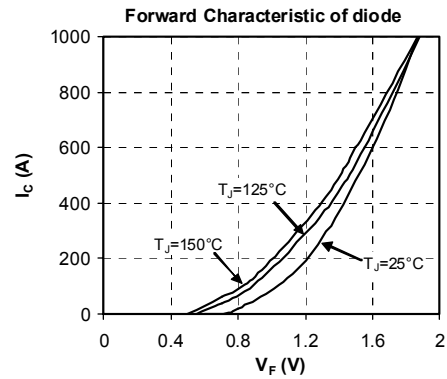
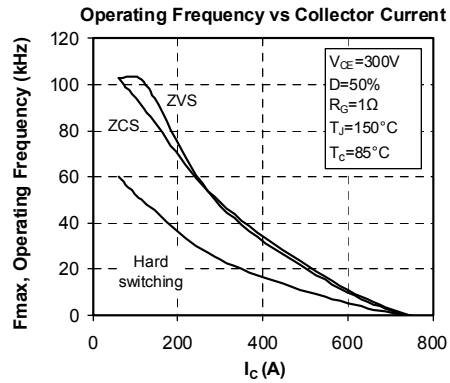
## SP6 Package outline (dimensions in mm)



See application note APT0601 - Mounting Instructions for SP6 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical Performance Curve





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