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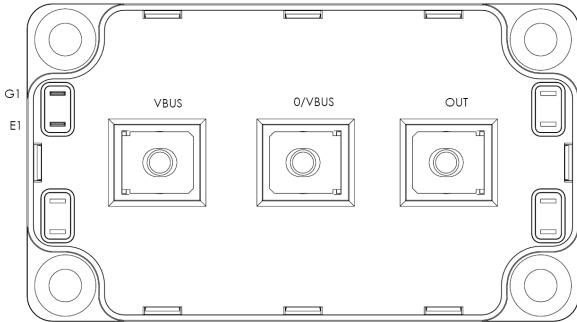
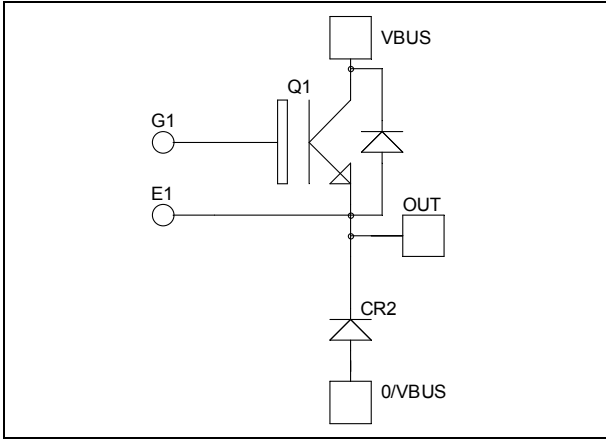
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*Buck chopper  
High speed Trench + Field Stop  
IGBT4 Power module*

**$V_{CES} = 1200V$   
 $I_C = 300A @ T_c = 80^\circ C$**



**Application**

- AC and DC motor control
- Switched Mode Power Supplies

**Features**

- **High speed Trench + Field Stop IGBT 4**
  - Low voltage drop
  - Low leakage current
  - Low switching losses
- Kelvin emitter for easy drive
- Very low stray inductance
- M5 power connectors

**Benefits**

- Outstanding performance at high frequency operation
- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Low profile
- RoHS compliant

**All ratings @  $T_j = 25^\circ C$  unless otherwise specified**

**Absolute maximum ratings**

| Symbol    | Parameter                    | Max ratings        | Unit |
|-----------|------------------------------|--------------------|------|
| $V_{CES}$ | Collector - Emitter Voltage  | 1200               | V    |
| $I_C$     | Continuous Collector Current | $T_C = 25^\circ C$ | 500  |
|           |                              | $T_C = 80^\circ C$ | 300  |
| $I_{CM}$  | Pulsed Collector Current     | $T_C = 25^\circ C$ | 960  |
| $V_{GE}$  | Gate - Emitter Voltage       | $\pm 20$           | V    |
| $P_D$     | Power Dissipation            | 1500               | W    |

 **CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

**Electrical Characteristics**

| Symbol        | Characteristic                       | Test Conditions                  | Min  | Typ                        | Max  | Unit    |
|---------------|--------------------------------------|----------------------------------|------|----------------------------|------|---------|
| $I_{CES}$     | Zero Gate Voltage Collector Current  | $V_{GE} = 0V, V_{CE} = 1200V$    |      |                            | 200  | $\mu A$ |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | $V_{GE} = 15V$<br>$I_C = 300A$   | 1.78 | $T_j = 25^\circ C$<br>2.05 | 2.42 | V       |
|               |                                      | $T_j = 150^\circ C$              |      | 2.6                        |      |         |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}, I_C = 10.4 mA$ | 5.3  | 5.8                        | 6.3  | V       |
| $I_{GES}$     | Gate – Emitter Leakage Current       | $V_{GE} = 20V, V_{CE} = 0V$      |      |                            | 480  | nA      |

**Dynamic Characteristics**

| Symbol       | Characteristic                      | Test Conditions  | Min                 | Typ  | Max | Unit         |
|--------------|-------------------------------------|--|---------------------|------|-----|--------------|
| $C_{ies}$    | Input Capacitance                   | $V_{GE} = 0V$<br>$V_{CE} = 25V$<br>$f = 1MHz$  |                     | 17.6 |     | nF           |
| $C_{oes}$    | Output Capacitance                  |  |                     | 1    |     |              |
| $C_{res}$    | Reverse Transfer Capacitance        |  |                     | 0.9  |     |              |
| $Q_G$        | Gate charge                         | $V_{GE} = 15V, I_C = 300A$<br>$V_{CE} = 960V$  |                     | 1290 |     | nC           |
| $T_{d(on)}$  | Turn-on Delay Time                  | Inductive Switching ( $25^\circ C$ )<br>$V_{GE} = \pm 15V$<br>$V_{Bus} = 600V$<br>$I_C = 300A$<br>$R_G = 1.6\Omega$  |                     | 30   |     | ns           |
| $T_r$        | Rise Time                           |  |                     | 57   |     |              |
| $T_{d(off)}$ | Turn-off Delay Time                 |  |                     | 290  |     |              |
| $T_f$        | Fall Time                           |  |                     | 16   |     |              |
| $T_{d(on)}$  | Turn-on Delay Time                  | Inductive Switching ( $150^\circ C$ )<br>$V_{GE} = \pm 15V$<br>$V_{Bus} = 600V$<br>$I_C = 300A$<br>$R_G = 1.6\Omega$ |                     | 30   |     | ns           |
| $T_r$        | Rise Time                           |  |                     | 49   |     |              |
| $T_{d(off)}$ | Turn-off Delay Time                 |  |                     | 366  |     |              |
| $T_f$        | Fall Time                           |  |                     | 48   |     |              |
| $E_{on}$     | Turn on Energy                      | $V_{GE} = \pm 15V$<br>$V_{Bus} = 600V$<br>$I_C = 300A$   | $T_j = 150^\circ C$ | 26   |     | mJ           |
| $E_{off}$    | Turn off Energy                     | $R_G = 1.6\Omega$  |                     | 16   |     |              |
| $R_G$        | Integrated gate resistor            |  |                     | 2.5  |     | $\Omega$     |
| $I_{sc}$     | Short Circuit data                  | $V_{GE} \leq 15V; V_{Bus} = 600V$<br>$t_p \leq 10\mu s; T_j = 150^\circ C$   |                     | 1000 |     | A            |
| $R_{thJC}$   | Junction to Case Thermal Resistance |  |                     |      | 0.1 | $^\circ C/W$ |

**Chopper diode ratings and characteristics**

| Symbol     | Characteristic                      | Test Conditions                                      | Min                 | Typ | Max   | Unit         |
|------------|-------------------------------------|--|---------------------|-----|-------|--------------|
| $V_{RRM}$  | Peak Repetitive Reverse Voltage     |  |                     |     | 1200  | V            |
| $I_{RM}$   | Reverse Leakage Current             | $V_R = 1200V$  |                     |     | 400   | $\mu A$      |
| $I_F$      | DC Forward Current                  | $T_c = 80^\circ C$                                   |                     | 400 |       | A            |
| $V_F$      | Diode Forward Voltage               | $I_F = 400A$   |                     | 2.4 | 3.5   | V            |
|            |                                     | $I_F = 600A$   |                     | 2.7 |       |              |
|            |                                     | $I_F = 400A$<br>$T_j = 125^\circ C$                  |                     | 1.8 |       |              |
| $t_{rr}$   | Reverse Recovery Time               | $I_F = 400A$<br>$V_R = 800V$<br>$di/dt = 800A/\mu s$ | $T_j = 25^\circ C$  | 385 |       | ns           |
|            |                                     |  | $T_j = 125^\circ C$ | 480 |       |              |
| $Q_{rr}$   | Reverse Recovery Charge             | $I_F = 400A$<br>$V_R = 800V$<br>$di/dt = 800A/\mu s$ | $T_j = 25^\circ C$  | 4.2 |       | $\mu C$      |
|            |                                     |  | $T_j = 125^\circ C$ | 21  |       |              |
| $R_{thJC}$ | Junction to Case Thermal Resistance |  |                     |     | 0.096 | $^\circ C/W$ |



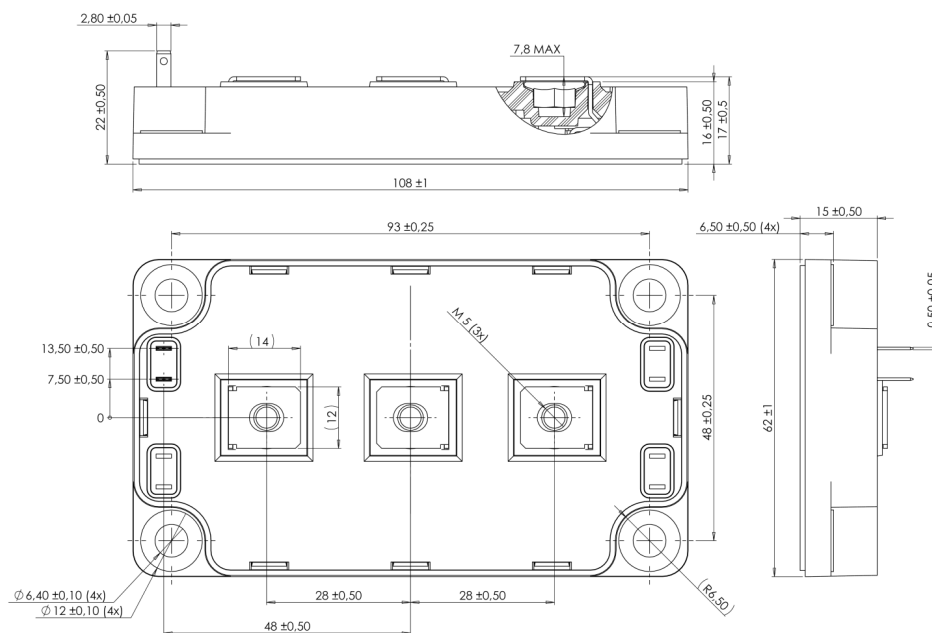
## IGBT parallel diode ratings and characteristics

| Symbol            | Characteristic                      | Test Conditions  |                        | Min  | Typ | Max  | Unit |
|-------------------|-------------------------------------|--|------------------------|------|-----|------|------|
| V <sub>RRM</sub>  | Peak Repetitive Reverse Voltage     |  |                        |      |     | 1200 | V    |
| I <sub>RM</sub>   | Reverse Leakage Current             | V <sub>R</sub> =1200V  |                        |      |     | 100  | μA   |
| I <sub>F</sub>    | DC Forward Current                  |  | T <sub>c</sub> = 70°C  |      | 30  |      | A    |
| V <sub>F</sub>    | Diode Forward Voltage               | I <sub>F</sub> = 30A   |                        |      | 2.6 | 3.5  | V    |
|                   |                                     | I <sub>F</sub> = 60A   |                        |      | 3.2 |      |      |
|                   |                                     | I <sub>F</sub> = 30A   | T <sub>j</sub> = 125°C |      | 1.8 |      |      |
| t <sub>rr</sub>   | Reverse Recovery Time               | I <sub>F</sub> = 30A<br>V <sub>R</sub> = 800V<br>di/dt = 200A/μs | T <sub>j</sub> = 25°C  |      | 300 |      | ns   |
|                   | T <sub>j</sub> = 125°C              |  |                        | 360  |     |      |      |
| Q <sub>rr</sub>   | Reverse Recovery Charge             | I <sub>F</sub> = 30A<br>V <sub>R</sub> = 800V<br>di/dt = 200A/μs | T <sub>j</sub> = 25°C  |      | 360 |      | nC   |
|                   | T <sub>j</sub> = 125°C              |  |                        | 1700 |     |      |      |
| R <sub>thJC</sub> | Junction to Case Thermal Resistance |  |                        |      |     | 1.2  | °C/W |

## Thermal and package characteristics

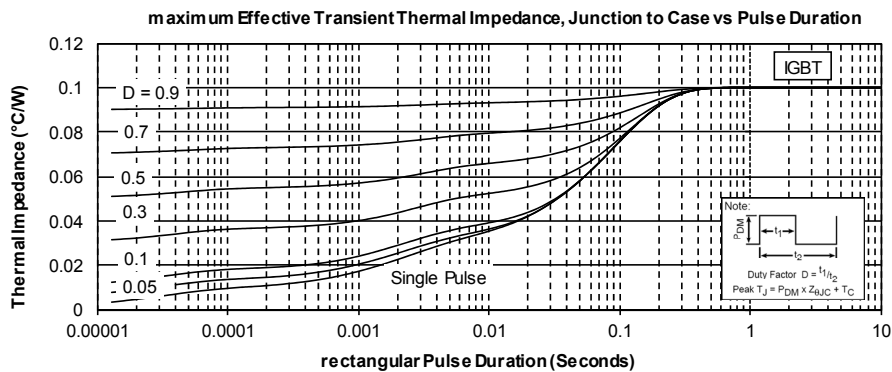
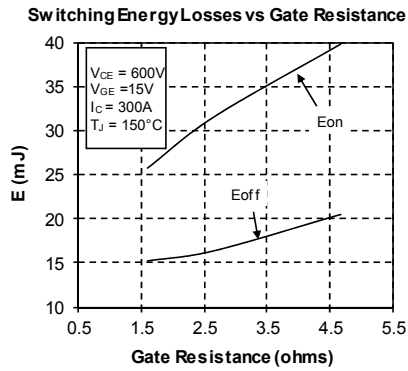
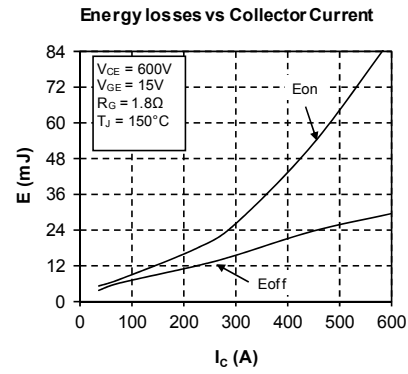
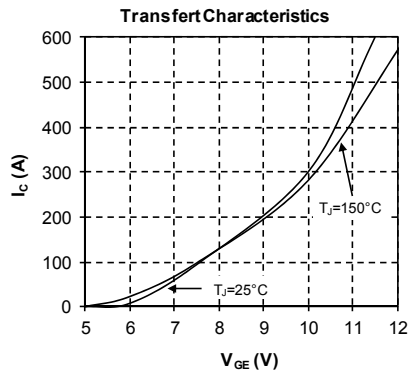
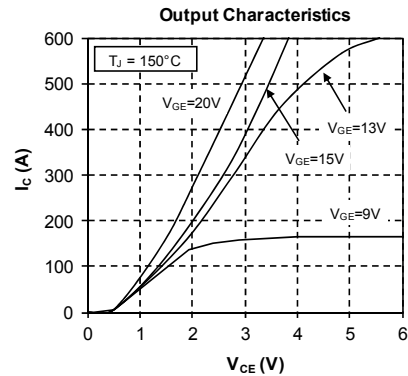
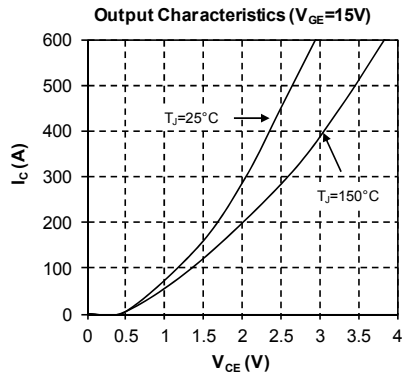
| Symbol            | Characteristic   | Min           | Max                   | Unit |     |
|-------------------|--|---------------|-----------------------|------|-----|
| V <sub>ISOL</sub> | RMS Isolation Voltage, any terminal to case t=1 min, 50/60Hz | 4000          |                       | V    |     |
| T <sub>J</sub>    | Operating junction temperature range                         | -40           | 175                   | °C   |     |
| T <sub>JOP</sub>  | Recommended junction temperature under switching conditions  | -40           | T <sub>Jmax</sub> -25 |      |     |
| T <sub>STG</sub>  | Storage Temperature Range                                    | -40           | 125                   |      |     |
| T <sub>C</sub>    | Operating Case Temperature                                   | -40           | 125                   |      |     |
| Torque            | Mounting torque  | To heatsink   | M6                    | 3    | N.m |
|                   |  | For terminals | M5                    | 2    |     |
| Wt                | Package Weight   |               |                       | 300  | g   |

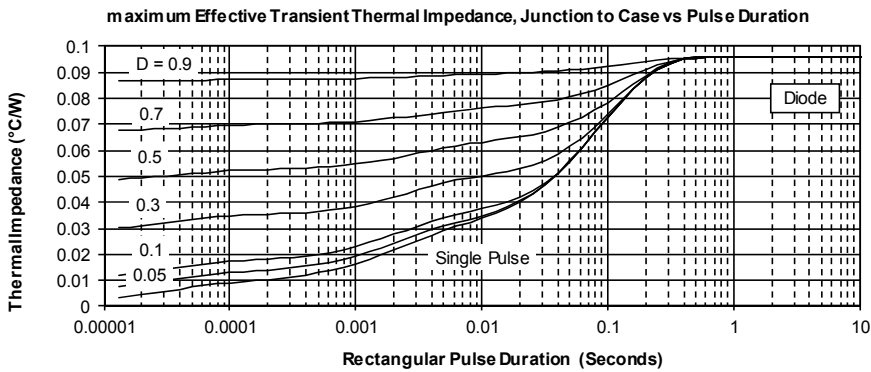
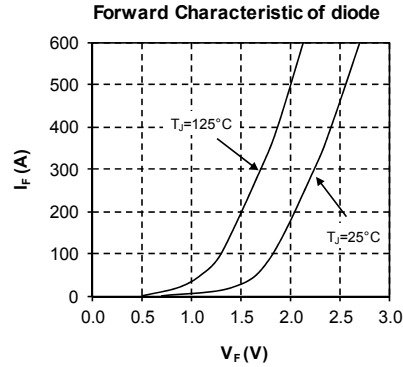
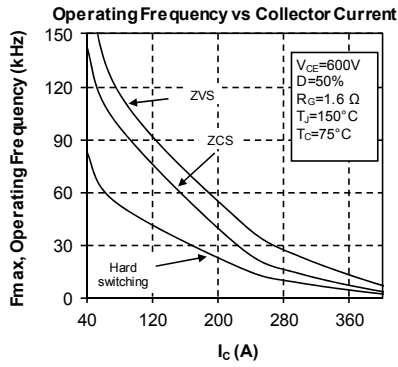
## Package outline (dimensions in mm)



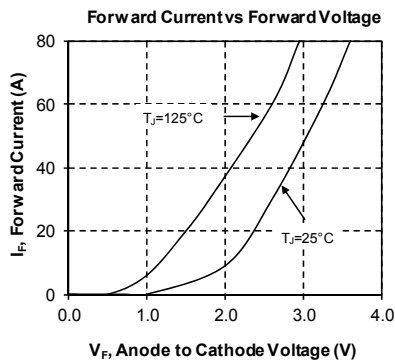
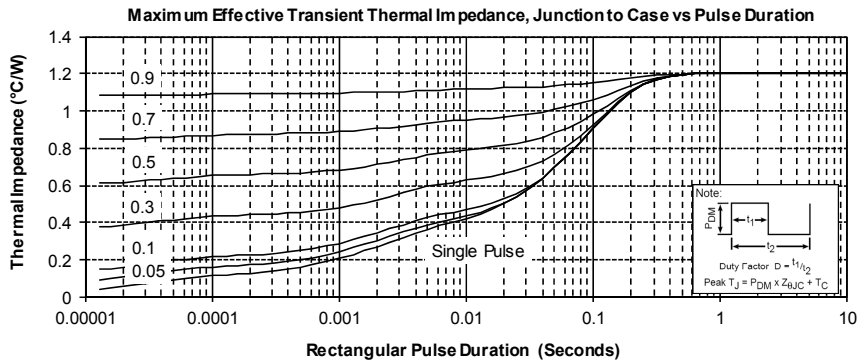
See application note APT0601 - Mounting Instructions for SP6 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical IGBT & chopper diode Performance Curve





## IGBT parallel diode Typical Performance Curve



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