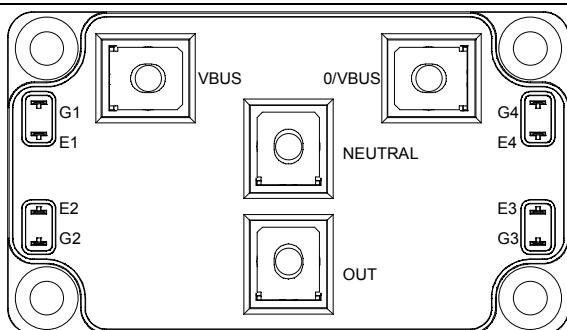
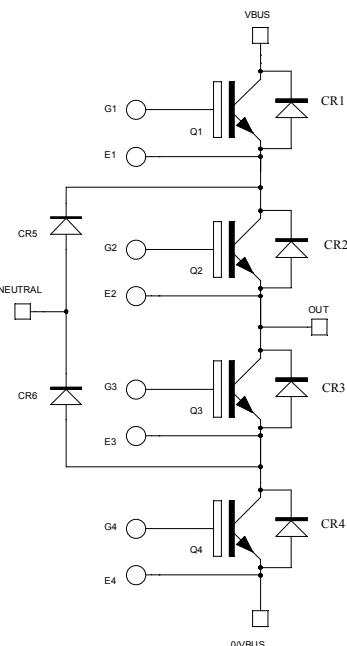


*Three level inverter  
Trench + Field Stop IGBT3  
Power Module*

**V<sub>CES</sub> = 600V  
I<sub>C</sub> = 200A @ T<sub>c</sub> = 80°C**



**Q1 to Q4 Absolute maximum ratings**

| Symbol           | Parameter                             | Max ratings            | Unit        |
|------------------|---------------------------------------|------------------------|-------------|
| V <sub>CES</sub> | Collector - Emitter Breakdown Voltage | 600                    | V           |
| I <sub>C</sub>   | Continuous Collector Current          | T <sub>C</sub> = 25°C  | A           |
|                  |                                       | T <sub>C</sub> = 80°C  |             |
| I <sub>CM</sub>  | Pulsed Collector Current              | T <sub>C</sub> = 25°C  | 400         |
| V <sub>GE</sub>  | Gate – Emitter Voltage                | ±20                    | V           |
| P <sub>D</sub>   | Maximum Power Dissipation             | T <sub>C</sub> = 25°C  | 652         |
| RBSOA            | Reverse Bias Safe Operating Area      | T <sub>j</sub> = 150°C | 400A @ 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

**Q1 to Q4 Electrical Characteristics**

| Symbol               | Characteristic                       | Test Conditions                               |                           | Min | Typ | Max | Unit          |
|----------------------|--------------------------------------|---|---------------------------|-----|-----|-----|---------------|
| $I_{CES}$            | Zero Gate Voltage Collector Current  | $V_{GE} = 0\text{V}$ , $V_{CE} = 600\text{V}$ |                           |     |     | 350 | $\mu\text{A}$ |
| $V_{CE(\text{sat})}$ | Collector Emitter Saturation Voltage | $V_{GE} = 15\text{V}$                         | $T_j = 25^\circ\text{C}$  |     | 1.5 | 1.9 | $\text{V}$    |
|                      |                                      | $I_C = 200\text{A}$                           | $T_j = 150^\circ\text{C}$ |     | 1.7 |     |               |
| $V_{GE(\text{th})}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}$ , $I_C = 3\text{ mA}$       |                           | 5.0 | 5.8 | 6.5 | $\text{V}$    |
| $I_{GES}$            | Gate – Emitter Leakage Current       | $V_{GE} = 20\text{V}$ , $V_{CE} = 0\text{V}$  |                           |     |     | 800 | $\text{nA}$   |

**Q1 to Q4 Dynamic Characteristics**

| Symbol       | Characteristic                      | Test Conditions  |  | Min  | Typ  | Max  | Unit               |  |
|--------------|-------------------------------------|--|--|------|------|------|--------------------|--|
| $C_{ies}$    | Input Capacitance                   | $V_{GE} = 0\text{V}$<br>$V_{CE} = 25\text{V}$<br>$f = 1\text{MHz}$                                       |  | 12.2 |      |      | $\text{nF}$        |  |
| $C_{oes}$    | Output Capacitance                  |  |  | 0.78 |      |      |                    |  |
| $C_{res}$    | Reverse Transfer Capacitance        |  |  | 0.38 |      |      |                    |  |
| $Q_G$        | Gate charge                         | $V_{GE} = \pm 15\text{V}$ , $I_C = 200\text{A}$<br>$V_{CE} = 300\text{V}$                                |  |      | 2.2  |      | $\mu\text{C}$      |  |
| $T_{d(on)}$  | Turn-on Delay Time                  | $V_{GE} = \pm 15\text{V}$<br>$V_{CE} = 300\text{V}$<br>$I_C = 200\text{A}$<br>$R_G = 1.8\Omega$          | Inductive Switching ( $25^\circ\text{C}$ ) | 115  |      |      | $\text{ns}$        |  |
| $T_r$        | Rise Time                           |  |  | 45   |      |      |                    |  |
| $T_{d(off)}$ | Turn-off Delay Time                 |  |  | 225  |      |      |                    |  |
| $T_f$        | Fall Time                           |  |  | 55   |      |      |                    |  |
| $T_{d(on)}$  | Turn-on Delay Time                  | $V_{GE} = \pm 15\text{V}$<br>$V_{CE} = 300\text{V}$<br>$I_C = 200\text{A}$<br>$R_G = 1.8\Omega$          |  | 130  |      |      | $\text{ns}$        |  |
| $T_r$        | Rise Time                           |  |  | 50   |      |      |                    |  |
| $T_{d(off)}$ | Turn-off Delay Time                 |  |  | 300  |      |      |                    |  |
| $T_f$        | Fall Time                           |  |  | 70   |      |      |                    |  |
| $E_{on}$     | Turn on Energy                      | $V_{GE} = \pm 15\text{V}$<br>$V_{CE} = 300\text{V}$  |  | 0.8  |      |      | $\text{mJ}$        |  |
| $E_{off}$    | Turn off Energy                     | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$  |  | 1.75 |      |      |                    |  |
| $I_{sc}$     | Short Circuit data                  | $I_C = 200\text{A}$<br>$R_G = 1.8\Omega$   |  | 5    |      |      | $\text{mJ}$        |  |
|              |                                     | $T_j = 25^\circ\text{C}$<br>$T_j = 150^\circ\text{C}$  |  | 7    |      |      |                    |  |
| $I_{sc}$     | Short Circuit data                  | $V_{GE} \leq 15\text{V}$ ; $V_{CE} = 360\text{V}$<br>$t_p \leq 6\mu\text{s}$ ; $T_j = 150^\circ\text{C}$ |  |      | 1000 |      | $\text{A}$         |  |
| $R_{thJC}$   | Junction to Case Thermal Resistance |  |  |      |      | 0.23 | $^\circ\text{C/W}$ |  |

**CR1 to CR4 diode ratings and characteristics**

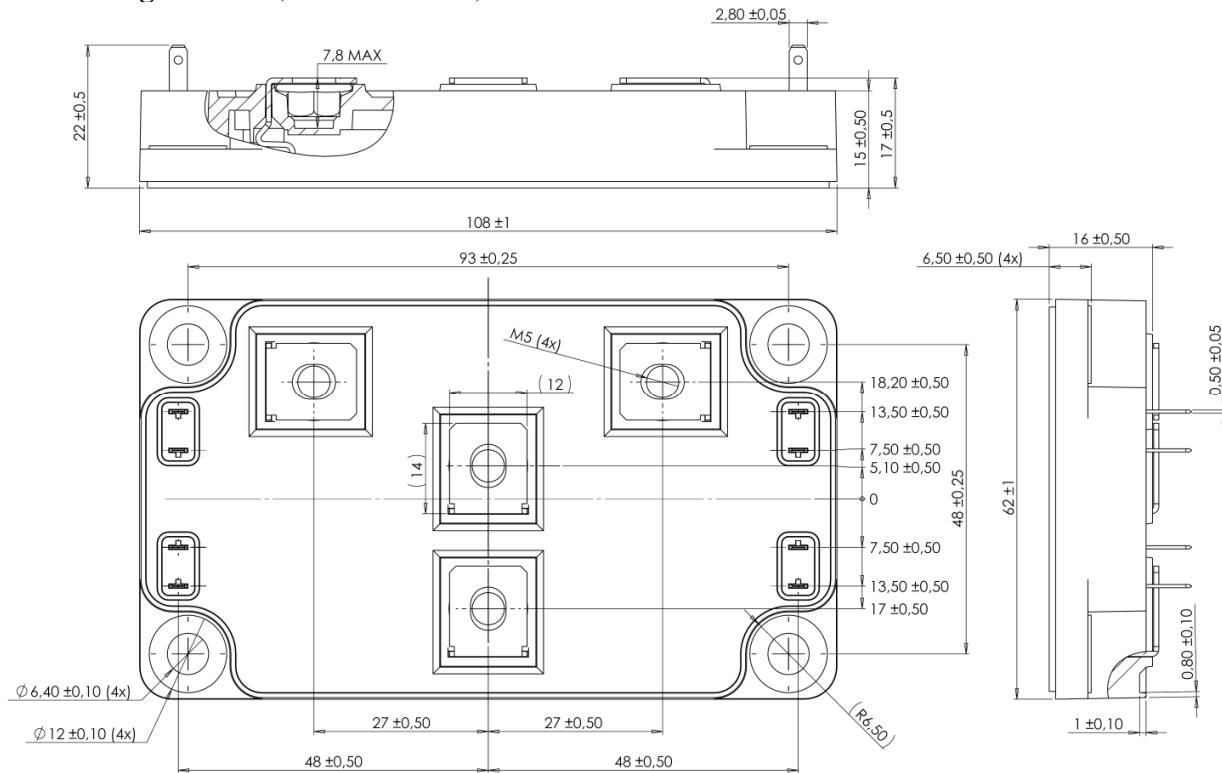
| Symbol            | Characteristic                          | Test Conditions  |                        | Min | Typ  | Max  | Unit |  |
|-------------------|---|--|------------------------|-----|------|------|------|--|
| V <sub>RRM</sub>  | Maximum Peak Repetitive Reverse Voltage | V <sub>R</sub> =600V   | T <sub>j</sub> = 25°C  | 600 |      |      | V    |  |
| I <sub>RM</sub>   | Maximum Reverse Leakage Current         |  | T <sub>j</sub> = 150°C |     | 150  | 400  | μA   |  |
| I <sub>F</sub>    | DC Forward Current                      |  | T <sub>c</sub> = 80°C  |     | 150  |      | A    |  |
| V <sub>F</sub>    | Diode Forward Voltage                   | I <sub>F</sub> = 150A<br>V <sub>GE</sub> = 0V                      | T <sub>j</sub> = 25°C  |     | 1.6  | 2    | V    |  |
|                   |   |  | T <sub>j</sub> = 150°C |     | 1.5  |      |      |  |
| t <sub>rr</sub>   | Reverse Recovery Time                   | I <sub>F</sub> = 150A<br>V <sub>R</sub> = 300V<br>di/dt = 2800A/μs | T <sub>j</sub> = 25°C  |     | 100  |      | ns   |  |
|                   |   |  | T <sub>j</sub> = 150°C |     | 150  |      |      |  |
| Q <sub>rr</sub>   | Reverse Recovery Charge                 |  | T <sub>j</sub> = 25°C  |     | 7.2  |      | μC   |  |
|                   |   |  | T <sub>j</sub> = 150°C |     | 15.2 |      |      |  |
| E <sub>rr</sub>   | Reverse Recovery Energy                 |  | T <sub>j</sub> = 25°C  |     | 1.7  |      | mJ   |  |
|                   |   |  | T <sub>j</sub> = 150°C |     | 3.6  |      |      |  |
| R <sub>thJC</sub> | Junction to Case Thermal Resistance     |  |                        |     |      | 0.52 | °C/W |  |

**CR5 & CR6 diode ratings and characteristics**

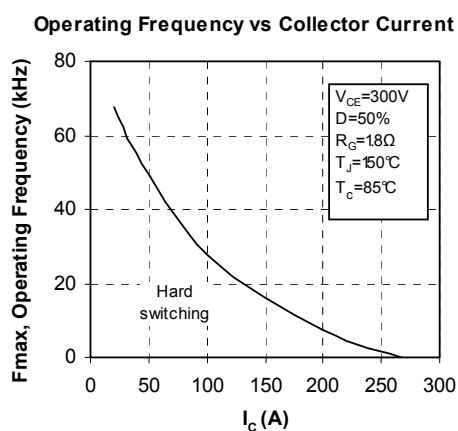
| Symbol            | Characteristic                          | Test Conditions  |                        | Min | Typ  | Max  | Unit |  |
|-------------------|---|--|------------------------|-----|------|------|------|--|
| V <sub>RRM</sub>  | Maximum Peak Repetitive Reverse Voltage | V <sub>R</sub> =600V   | T <sub>j</sub> = 25°C  | 600 |      |      | V    |  |
| I <sub>RM</sub>   | Maximum Reverse Leakage Current         |  | T <sub>j</sub> = 150°C |     | 150  | 400  | μA   |  |
| I <sub>F</sub>    | DC Forward Current                      |  | T <sub>c</sub> = 80°C  |     | 200  |      | A    |  |
| V <sub>F</sub>    | Diode Forward Voltage                   | I <sub>F</sub> = 200A<br>V <sub>GE</sub> = 0V                      | T <sub>j</sub> = 25°C  |     | 1.6  | 2    | V    |  |
|                   |   |  | T <sub>j</sub> = 150°C |     | 1.5  |      |      |  |
| t <sub>rr</sub>   | Reverse Recovery Time                   | I <sub>F</sub> = 200A<br>V <sub>R</sub> = 300V<br>di/dt = 2800A/μs | T <sub>j</sub> = 25°C  |     | 125  |      | ns   |  |
|                   |   |  | T <sub>j</sub> = 150°C |     | 220  |      |      |  |
| Q <sub>rr</sub>   | Reverse Recovery Charge                 |  | T <sub>j</sub> = 25°C  |     | 9.4  |      | μC   |  |
|                   |   |  | T <sub>j</sub> = 150°C |     | 19.8 |      |      |  |
| E <sub>rr</sub>   | Reverse Recovery Energy                 |  | T <sub>j</sub> = 25°C  |     | 2.2  |      | mJ   |  |
|                   |   |  | T <sub>j</sub> = 150°C |     | 4.8  |      |      |  |
| R <sub>thJC</sub> | Junction to Case Thermal Resistance     |  |                        |     |      | 0.39 | °C/W |  |

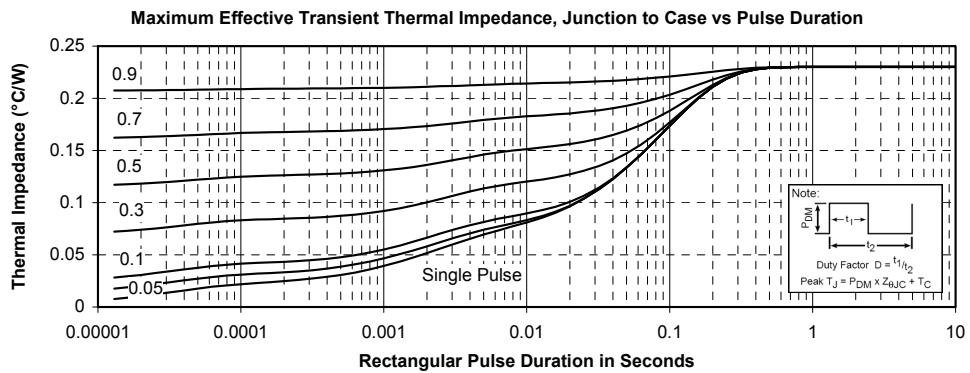
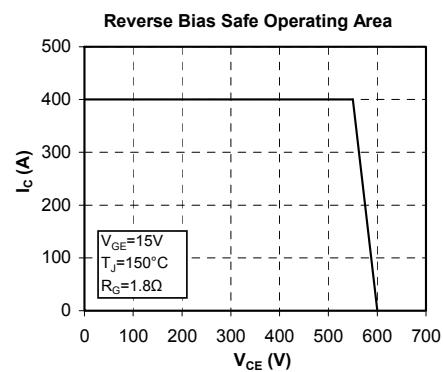
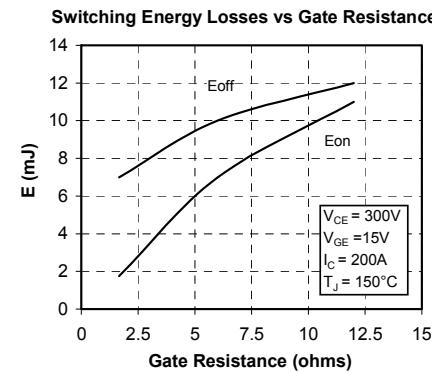
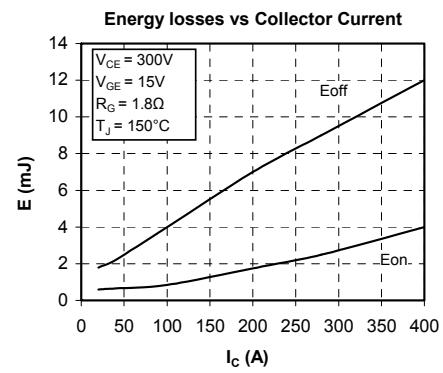
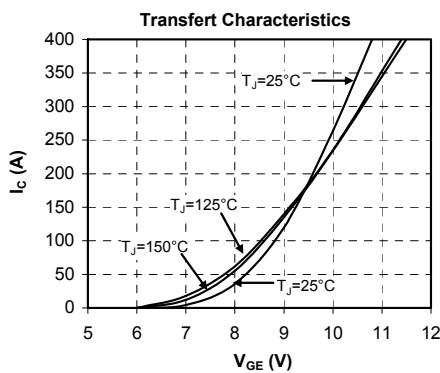
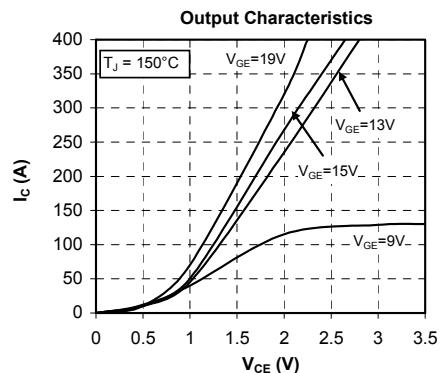
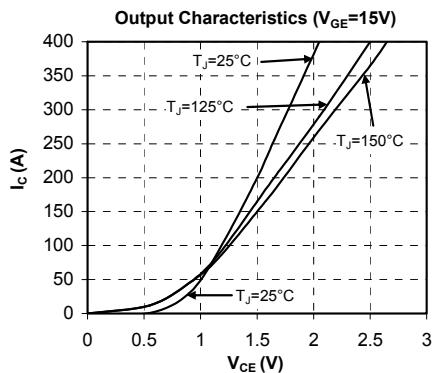
**Thermal and package characteristics**

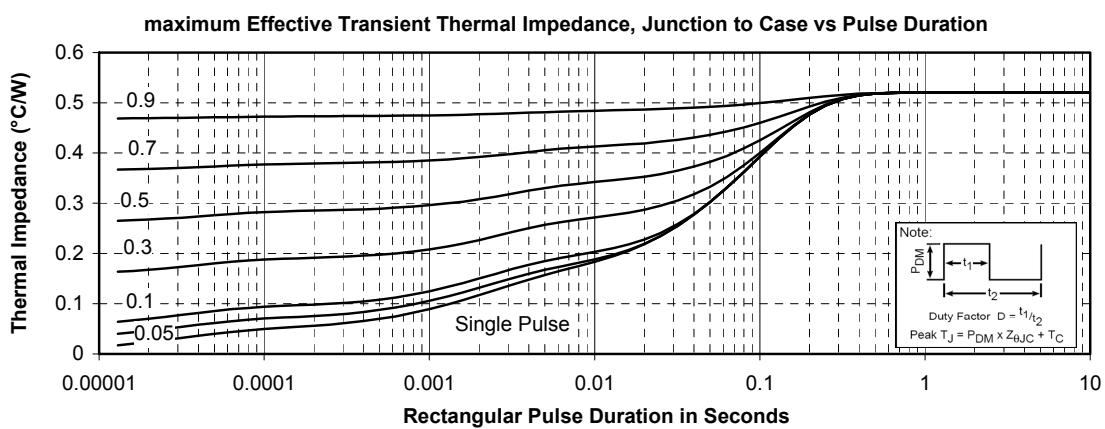
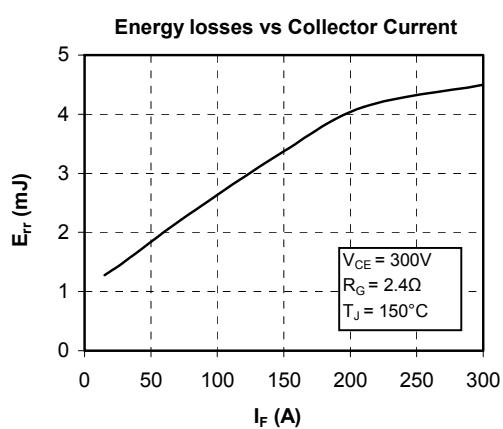
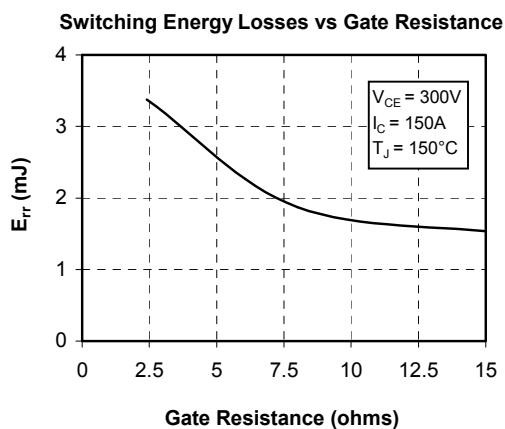
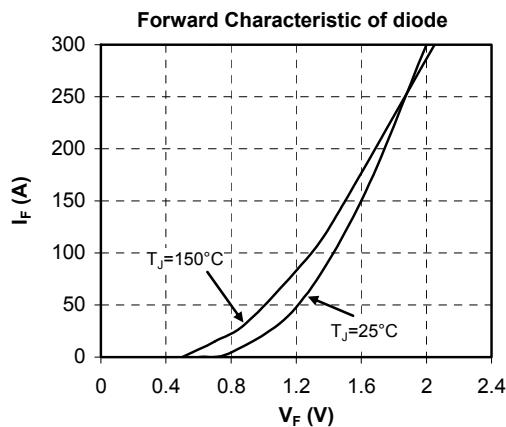
| Symbol            | Characteristic   |               |    | Min  | Typ | Max | Unit |
|-------------------|--|---------------|----|------|-----|-----|------|
| V <sub>ISOL</sub> | RMS Isolation Voltage, any terminal to case t = 1 min, 50/60Hz |               |    | 4000 |     |     | V    |
| T <sub>J</sub>    | Operating junction temperature range                           |               |    | -40  |     | 175 | °C   |
| T <sub>STG</sub>  | Storage Temperature Range                                      |               |    | -40  |     | 125 |      |
| T <sub>C</sub>    | Operating Case Temperature                                     |               |    | -40  |     | 100 | N.m  |
| Torque            | Mounting torque  | To heatsink   | M6 | 3    |     | 5   |      |
|                   |  | For terminals | M5 | 2    |     | 3.5 |      |
| Wt                | Package Weight   |               |    |      |     | 300 | g    |

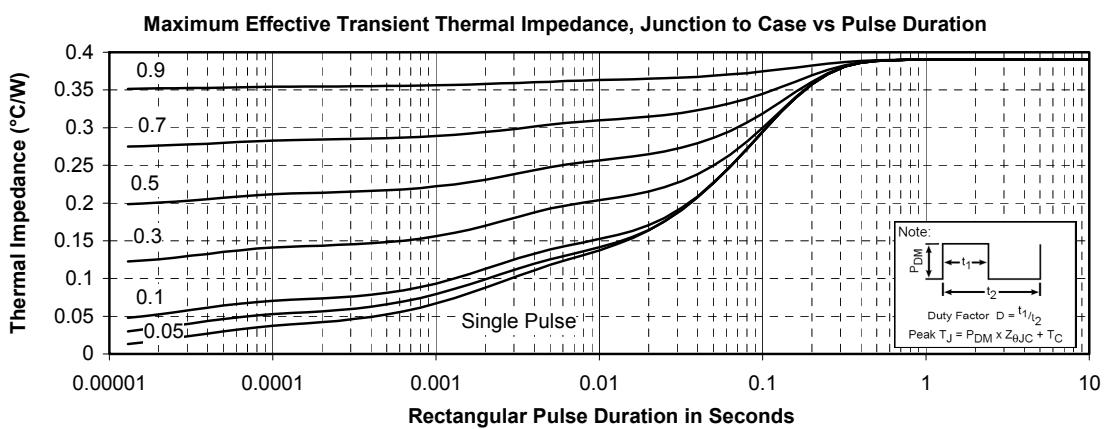
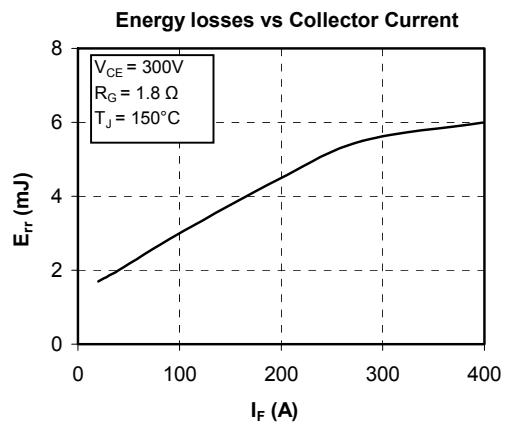
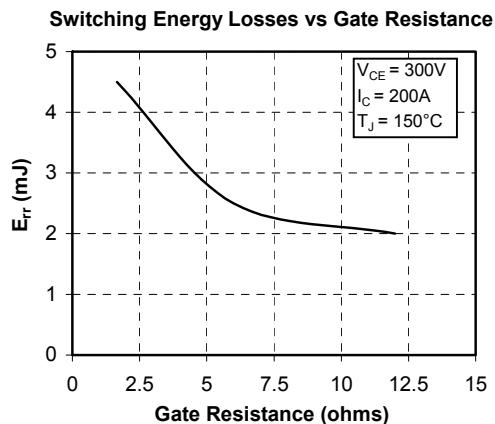
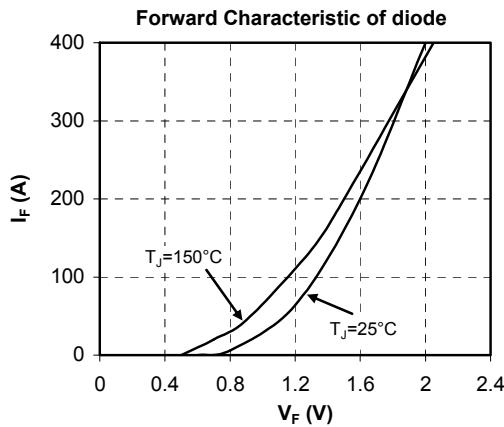
**SP6 Package outline** (dimensions in mm)


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

**Q1 to Q4 Typical performance curve**




**CR1 to CR4 Typical performance curve**


**CR5 & CR6 Typical performance curve**


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