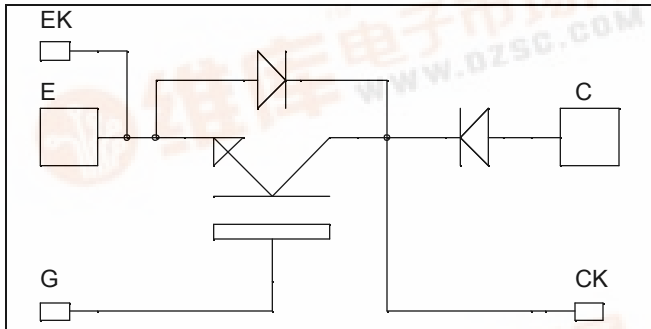




# APTGF200U120DG

## Single Switch with Series diodes NPT IGBT Power Module

$V_{CES} = 1200V$   
 $I_C = 200A @ T_c = 80^\circ C$

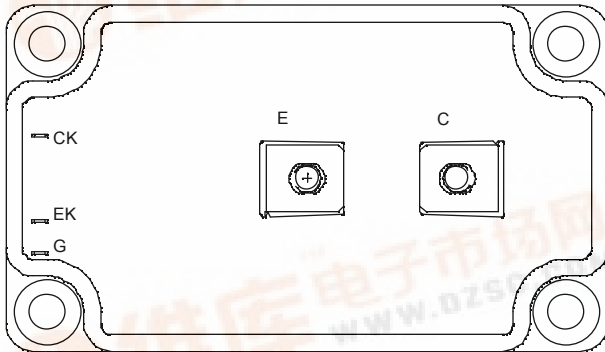


### Application

- Zero Current Switching resonant mode

### Features

- Non Punch Through (NPT) FAST IGBT
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 50 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

- Outstanding performance at high frequency operation
- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive TC of  $V_{CEsat}$
- Low profile
- RoHS compliant

### Absolute maximum ratings

| Symbol    | Parameter                             | Max ratings         | Unit         |
|-----------|---------------------------------------|---------------------|--------------|
| $V_{CES}$ | Collector - Emitter Breakdown Voltage | 1200                | V            |
| $I_C$     | Continuous Collector Current          | $T_c = 25^\circ C$  | 275          |
|           |                                       | $T_c = 80^\circ C$  | 200          |
| $I_{CM}$  | Pulsed Collector Current              | $T_c = 25^\circ C$  | 600          |
| $V_{GE}$  | Gate - Emitter Voltage                | $\pm 20$            | V            |
| $P_D$     | Maximum Power Dissipation             | $T_c = 25^\circ C$  | 1136         |
| RBSOA     | Reverse Bias Safe Operating Area      | $T_j = 150^\circ C$ | 400A @ 1200V |

**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  | $V_{GE} = 0\text{V}$<br>$V_{CE} = 1200\text{V}$ | $T_j = 25^\circ\text{C}$  |     |     | 500       | $\mu\text{A}$ |
|               |                                      |                                                 | $T_j = 125^\circ\text{C}$ |     |     | 750       |               |
| $V_{CE(sat)}$ | Collector Emitter saturation Voltage | $V_{GE} = 15\text{V}$<br>$I_C = 200\text{A}$    | $T_j = 25^\circ\text{C}$  |     | 3.2 | 3.7       | V             |
|               |                                      |                                                 | $T_j = 125^\circ\text{C}$ |     | 4.0 |           |               |
| $V_{GE(th)}$  | Gate Threshold Voltage               | $V_{GE} = V_{CE}, I_C = 4\text{mA}$             |                           | 4.5 |     | 6.5       | V             |
| $I_{GES}$     | Gate – Emitter Leakage Current       | $V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}$   |                           |     |     | $\pm 300$ | nA            |

**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>$f = 1\text{MHz}$                                                                          |                           |     | 13.8 |     | nF   |
| $C_{oes}$    | Output Capacitance           |                                                                                                                                             |                           |     | 1.32 |     |      |
| $C_{res}$    | Reverse Transfer Capacitance |                                                                                                                                             |                           |     | 0.88 |     |      |
| $Q_g$        | Total gate Charge            | $V_{GS} = 15\text{V}$<br>$V_{Bus} = 600\text{V}$<br>$I_C = 200\text{A}$                                                                     |                           |     | 1320 |     | nC   |
| $Q_{ge}$     | Gate – Emitter Charge        |                                                                                                                                             |                           |     | 140  |     |      |
| $Q_{gc}$     | Gate – Collector Charge      |                                                                                                                                             |                           |     | 800  |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $125^\circ\text{C}$ )<br>$V_{GE} = 15\text{V}$<br>$V_{Bus} = 600\text{V}$<br>$I_C = 200\text{A}$<br>$R_G = 1.2\Omega$ |                           |     | 35   |     | ns   |
| $T_r$        | Rise Time                    |                                                                                                                                             |                           |     | 65   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |                                                                                                                                             |                           |     | 320  |     |      |
| $T_f$        | Fall Time                    |                                                                                                                                             |                           |     | 30   |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | Inductive Switching ( $125^\circ\text{C}$ )<br>$V_{GE} = 15\text{V}$<br>$V_{Bus} = 600\text{V}$<br>$I_C = 200\text{A}$<br>$R_G = 1.2\Omega$ |                           |     | 35   |     | ns   |
| $T_r$        | Rise Time                    |                                                                                                                                             |                           |     | 65   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |                                                                                                                                             |                           |     | 360  |     |      |
| $T_f$        | Fall Time                    |                                                                                                                                             |                           |     | 40   |     |      |
| $E_{on}$     | Turn-on Switching Energy     | $V_{GE} = 15\text{V}$<br>$V_{Bus} = 600\text{V}$<br>$I_C = 200\text{A}$<br>$R_G = 1.2\Omega$                                                | $T_j = 125^\circ\text{C}$ |     | 22   |     | mJ   |
| $E_{off}$    | Turn-off Switching Energy    |                                                                                                                                             | $T_j = 125^\circ\text{C}$ |     | 12.2 |     |      |

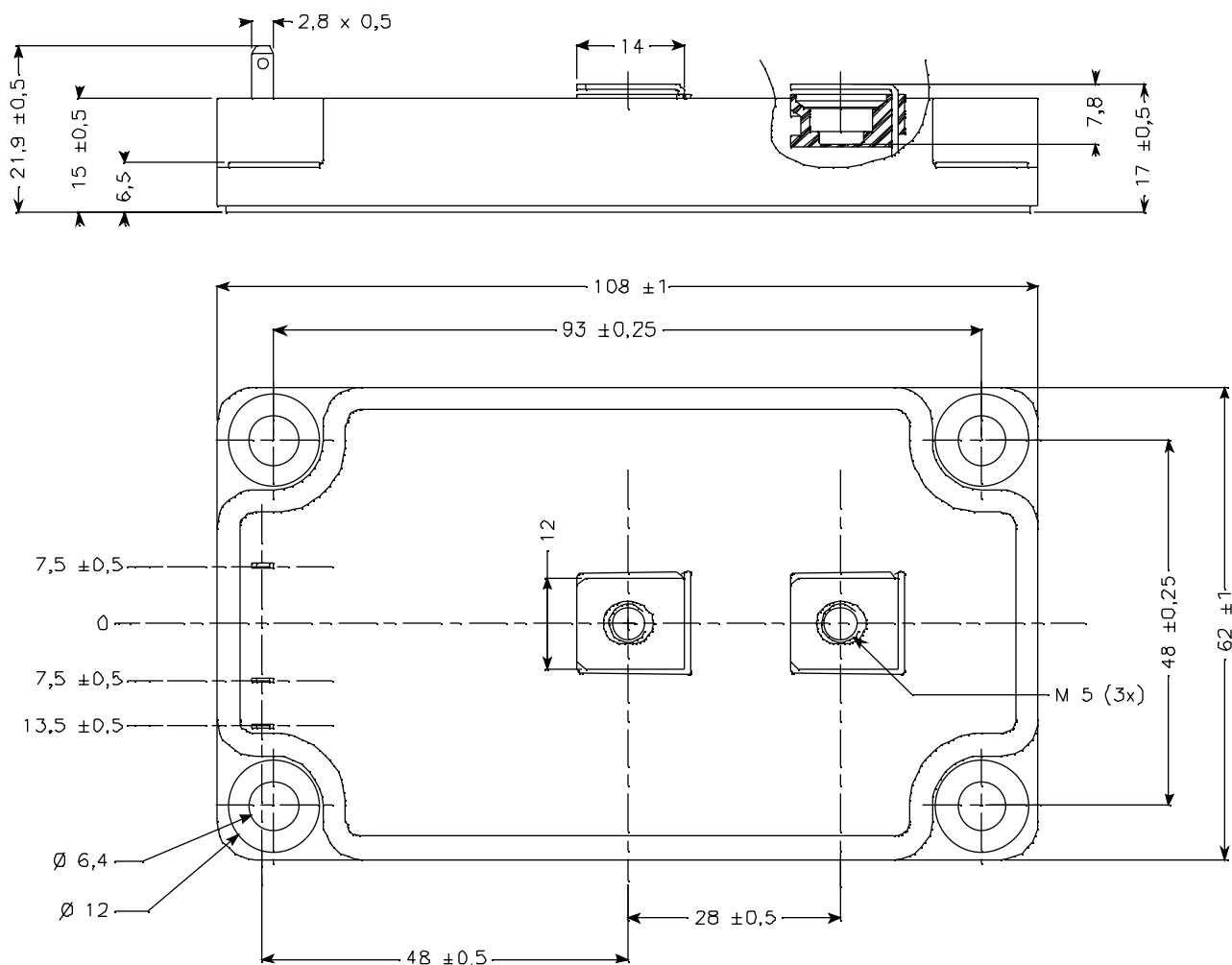
**Series diode ratings and characteristics**

| Symbol    | Characteristic                     | Test Conditions                                                                 |                           | Min  | Typ | Max  | Unit          |
|-----------|------------------------------------|---------------------------------------------------------------------------------|---------------------------|------|-----|------|---------------|
| $V_{RRM}$ | Maximum Repetitive Reverse Voltage |                                                                                 |                           | 1200 |     |      | V             |
| $I_{RM}$  | Maximum Reverse Leakage Current    | $V_R = 1200\text{V}$                                                            | $T_j = 25^\circ\text{C}$  |      |     | 750  | $\mu\text{A}$ |
|           |                                    |                                                                                 | $T_j = 125^\circ\text{C}$ |      |     | 1000 |               |
| $I_F$     | DC Forward Current                 |                                                                                 | $T_c = 70^\circ\text{C}$  |      | 240 |      | A             |
| $V_F$     | Diode Forward Voltage              | $I_F = 240\text{A}$                                                             |                           |      | 2   | 2.5  | V             |
|           |                                    | $I_F = 480\text{A}$                                                             |                           |      | 2.3 |      |               |
|           |                                    | $I_F = 240\text{A}$                                                             | $T_j = 125^\circ\text{C}$ |      | 1.8 |      |               |
| $t_{rr}$  | Reverse Recovery Time              | $I_F = 240\text{A}$<br>$V_R = 800\text{V}$<br>$di/dt = 800\text{A}/\mu\text{s}$ | $T_j = 25^\circ\text{C}$  |      | 400 |      | ns            |
|           |                                    |                                                                                 | $T_j = 125^\circ\text{C}$ |      | 470 |      |               |
| $Q_{rr}$  | Reverse Recovery Charge            | $I_F = 240\text{A}$<br>$V_R = 800\text{V}$<br>$di/dt = 800\text{A}/\mu\text{s}$ | $T_j = 25^\circ\text{C}$  |      | 4.8 |      | $\mu\text{C}$ |
|           |                                    |                                                                                 | $T_j = 125^\circ\text{C}$ |      | 16  |      |               |

## Thermal and package characteristics

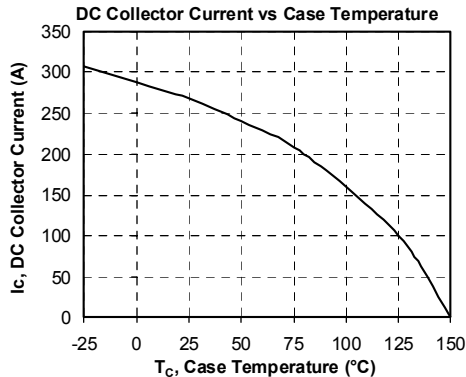
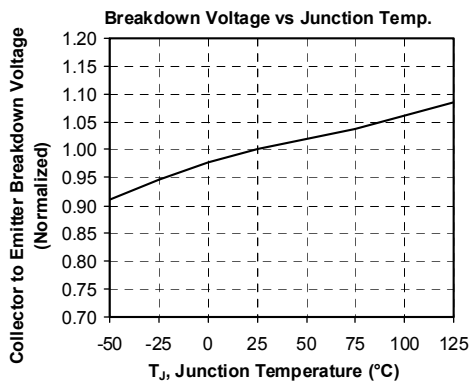
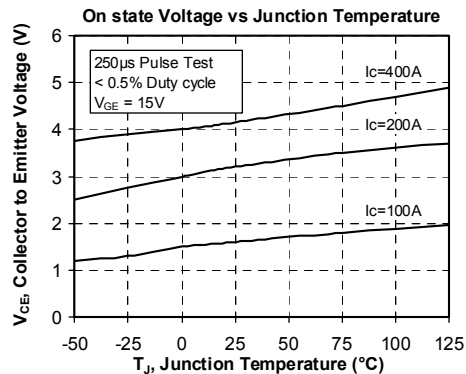
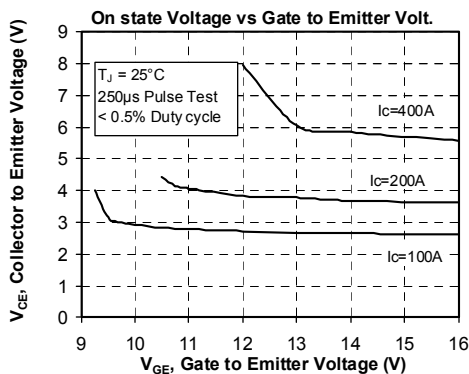
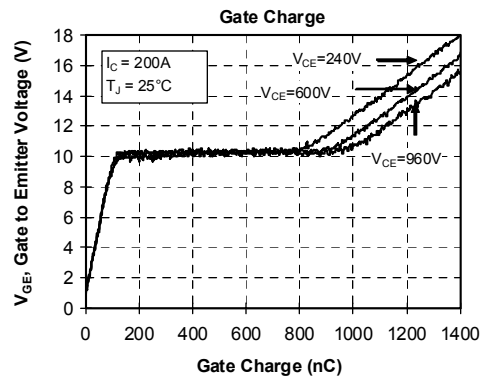
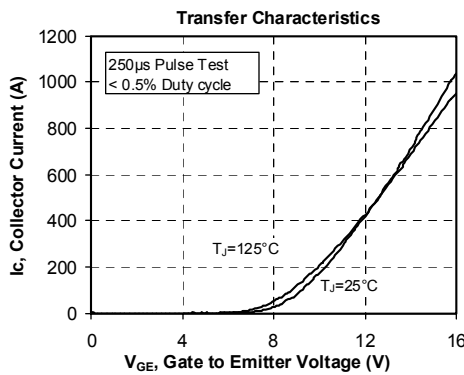
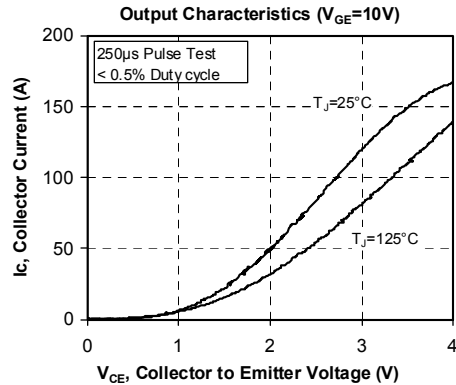
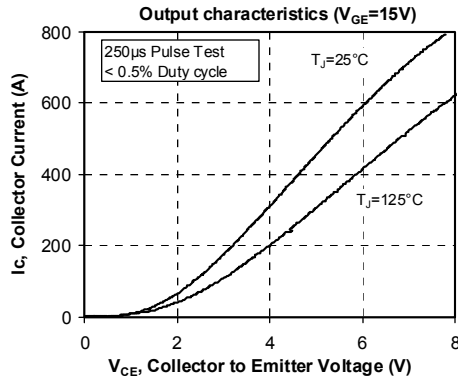
| Symbol            | Characteristic                                                                          |               | Min  | Typ | Max  | Unit |
|-------------------|-----------------------------------------------------------------------------------------|---------------|------|-----|------|------|
| R <sub>thJC</sub> | Junction to Case Thermal Resistance                                                     | IGBT          |      |     | 0.11 | °C/W |
|                   |                                                                                         | Diode         |      |     | 0.23 |      |
| 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  |     | 150  | °C   |
| T <sub>STG</sub>  | Storage Temperature Range                                                               |               | -40  |     | 125  |      |
| T <sub>C</sub>    | 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    |

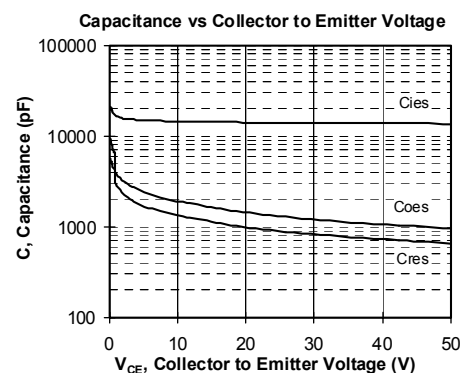
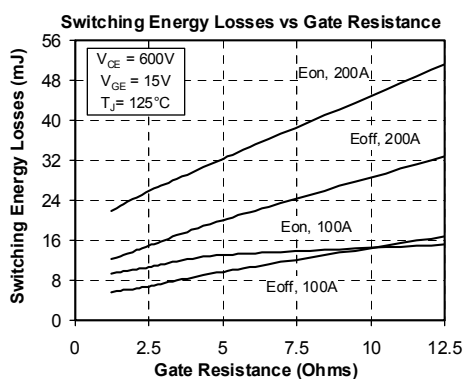
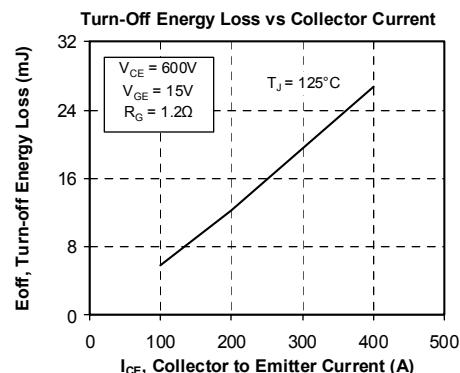
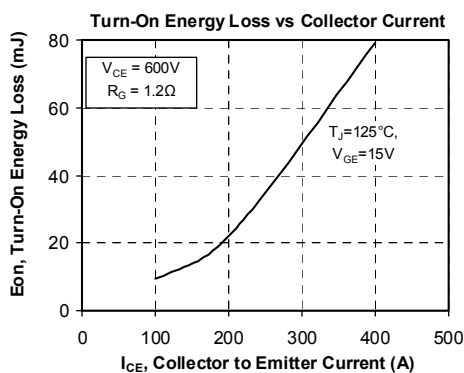
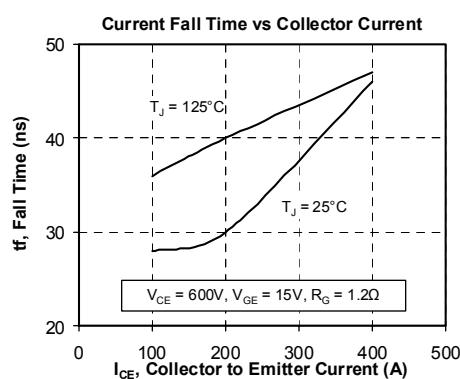
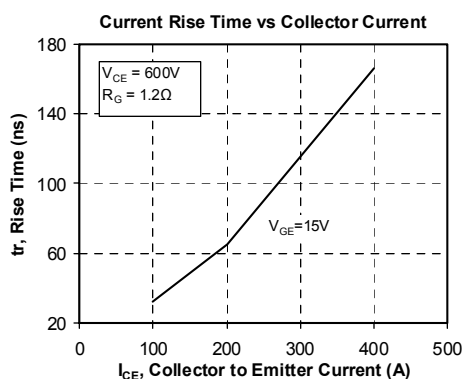
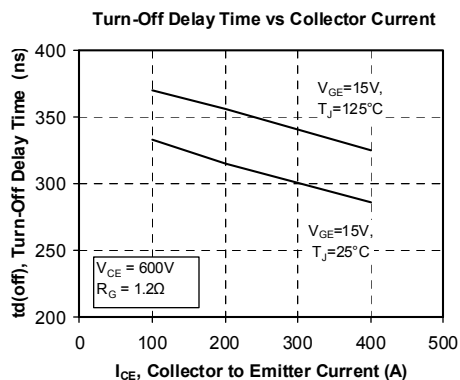
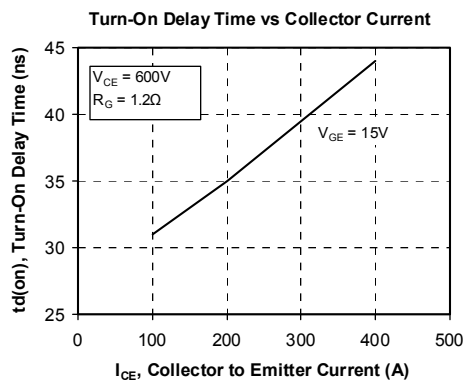
## SP6 Package outline (dimensions in mm)

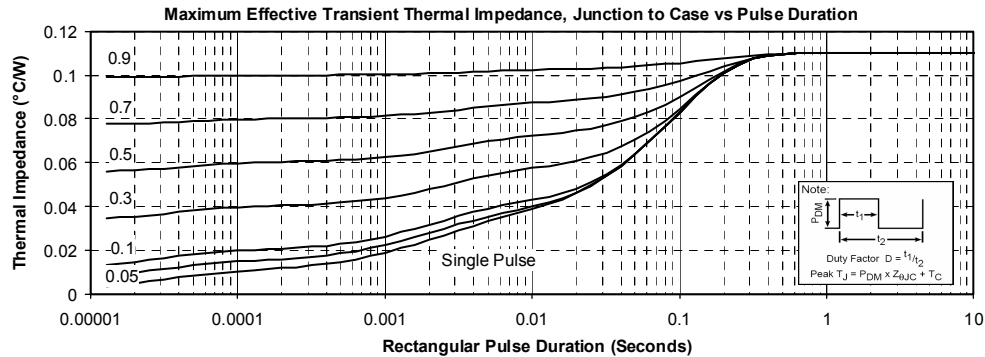
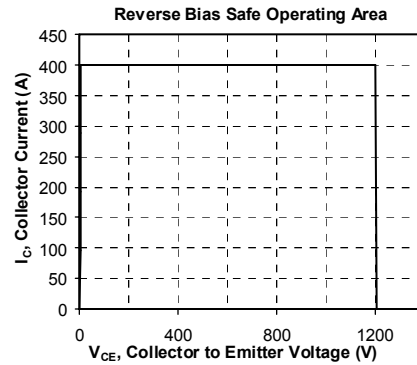
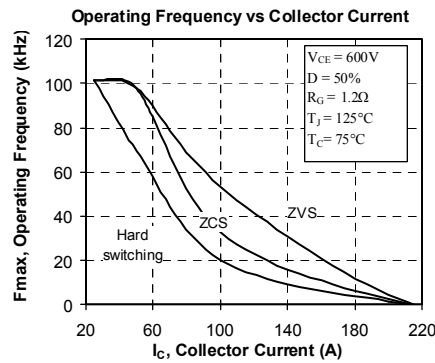


See application note APT0601 - Mounting Instructions for SP6 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical Performance Curve







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