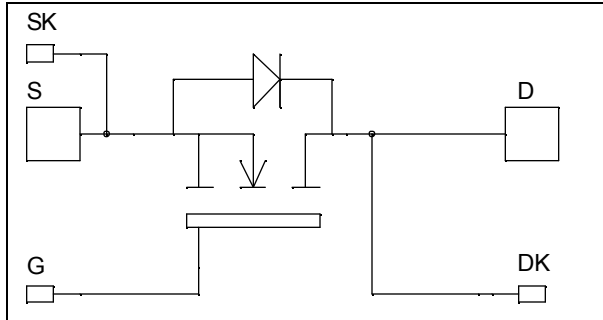


## Single Switch MOSFET Power Module

$V_{DSS} = 500V$   
 $R_{DSon} = 9\ m\Omega\ typ\ @\ T_j = 25^\circ C$   
 $I_D = 497A\ @\ T_c = 25^\circ C$



### Application

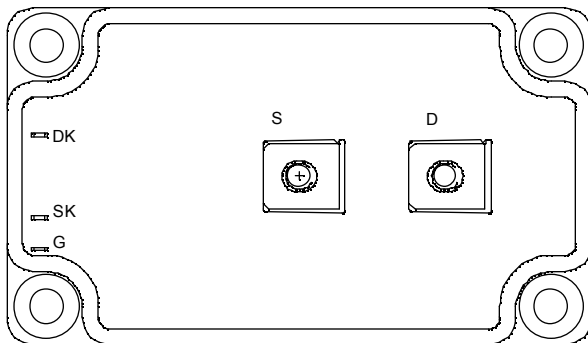
- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

### Features

- Power MOS 7<sup>®</sup> FREDFETs
  - Low  $R_{DSon}$
  - Low input and Miller capacitance
  - Low gate charge
  - Fast intrinsic reverse diode
  - Avalanche energy rated
  - Very rugged
- Kelvin source for easy drive
- Very low stray inductance
  - Symmetrical design
  - M5 power connectors
- High level of integration
- AlN substrate for improved thermal performance

### Benefits

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Low profile
- RoHS Compliant



### Absolute maximum ratings

| Symbol     | Parameter                                         | Max ratings        | Unit       |
|------------|---------------------------------------------------|--------------------|------------|
| $V_{DSS}$  | Drain - Source Breakdown Voltage                  | 500                | V          |
| $I_D$      | Continuous Drain Current                          | $T_c = 25^\circ C$ | 497        |
|            |                                                   | $T_c = 80^\circ C$ | 371        |
| $I_{DM}$   | Pulsed Drain current                              | 1988               | A          |
| $V_{GS}$   | Gate - Source Voltage                             | $\pm 30$           | V          |
| $R_{DSon}$ | Drain - Source ON Resistance                      | 10                 | m $\Omega$ |
| $P_D$      | Maximum Power Dissipation                         | $T_c = 25^\circ C$ | 5000       |
| $I_{AR}$   | Avalanche current (repetitive and non repetitive) | 71                 | A          |
| $E_{AR}$   | Repetitive Avalanche Energy                       | 50                 | mJ         |
| $E_{AS}$   | Single Pulse Avalanche Energy                     | 3000               |            |



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             |
|--------------|---------------------------------|-----------------------------------------------|-----|-----|-----------|------------------|
| $I_{DSS}$    | Zero Gate Voltage Drain Current | $V_{GS} = 0\text{V}, V_{DS} = 500\text{V}$    |     |     | 600       | $\mu\text{A}$    |
|              |                                 | $V_{GS} = 0\text{V}, V_{DS} = 400\text{V}$    |     |     | 3000      |                  |
| $R_{DS(on)}$ | Drain – Source on Resistance    | $V_{GS} = 10\text{V}, I_D = 248.5\text{A}$    |     | 9   | 10        | $\text{m}\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage          | $V_{GS} = V_{DS}, I_D = 30\text{mA}$          | 3   |     | 5         | V                |
| $I_{GSS}$    | Gate – Source Leakage Current   | $V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$ |     |     | $\pm 450$ | nA               |

**Dynamic Characteristics**

| Symbol       | Characteristic               | Test Conditions                                                                                                                                             | Min | Typ  | Max | Unit |
|--------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| $C_{iss}$    | Input Capacitance            | $V_{GS} = 0\text{V}$                                                                                                                                        |     | 63.3 |     | nF   |
| $C_{oss}$    | Output Capacitance           | $V_{DS} = 25\text{V}$                                                                                                                                       |     | 12.4 |     |      |
| $C_{rss}$    | Reverse Transfer Capacitance | $f = 1\text{MHz}$                                                                                                                                           |     | 0.63 |     |      |
| $Q_g$        | Total gate Charge            | $V_{GS} = 10\text{V}$                                                                                                                                       |     | 1200 |     | nC   |
| $Q_{gs}$     | Gate – Source Charge         | $V_{Bus} = 250\text{V}$                                                                                                                                     |     | 300  |     |      |
| $Q_{gd}$     | Gate – Drain Charge          | $I_D = 497\text{A}$                                                                                                                                         |     | 630  |     |      |
| $T_{d(on)}$  | Turn-on Delay Time           | <b>Inductive switching @ <math>125^\circ\text{C}</math></b><br>$V_{GS} = 15\text{V}$<br>$V_{Bus} = 333\text{V}$<br>$I_D = 497\text{A}$<br>$R_G = 0.5\Omega$ |     | 21   |     | ns   |
| $T_r$        | Rise Time                    |                                                                                                                                                             |     | 42   |     |      |
| $T_{d(off)}$ | Turn-off Delay Time          |                                                                                                                                                             |     | 96   |     |      |
| $T_f$        | Fall Time                    |                                                                                                                                                             |     | 100  |     |      |
| $E_{on}$     | Turn-on Switching Energy     | <b>Inductive switching @ <math>25^\circ\text{C}</math></b><br>$V_{GS} = 15\text{V}, V_{Bus} = 333\text{V}$<br>$I_D = 497\text{A}, R_G = 0.5\Omega$          |     | 6    |     | mJ   |
| $E_{off}$    | Turn-off Switching Energy    |                                                                                                                                                             |     | 6.2  |     |      |
| $E_{on}$     | Turn-on Switching Energy     | <b>Inductive switching @ <math>125^\circ\text{C}</math></b><br>$V_{GS} = 15\text{V}, V_{Bus} = 333\text{V}$<br>$I_D = 497\text{A}, R_G = 0.5\Omega$         |     | 9.48 |     | mJ   |
| $E_{off}$    | Turn-off Switching Energy    |                                                                                                                                                             |     | 6.96 |     |      |

**Source - Drain diode ratings and characteristics**

| Symbol   | Characteristic                         | Test Conditions                                                                  | Min                       | Typ | Max  | Unit          |    |
|----------|----------------------------------------|----------------------------------------------------------------------------------|---------------------------|-----|------|---------------|----|
| $I_S$    | Continuous Source current (Body diode) | $T_c = 25^\circ\text{C}$                                                         |                           |     | 497  | A             |    |
|          |                                        | $T_c = 80^\circ\text{C}$                                                         |                           |     | 371  |               |    |
| $V_{SD}$ | Diode Forward Voltage                  | $V_{GS} = 0\text{V}, I_S = -497\text{A}$                                         |                           |     | 1.3  | V             |    |
| $dv/dt$  | Peak Diode Recovery ①                  |                                                                                  |                           |     | 18   | V/ns          |    |
| $t_{rr}$ | Reverse Recovery Time                  | $I_S = -497\text{A}$<br>$V_R = 333\text{V}$<br>$di/dt = 600\text{A}/\mu\text{s}$ | $T_j = 25^\circ\text{C}$  |     |      | 300           | ns |
|          |                                        |                                                                                  | $T_j = 125^\circ\text{C}$ |     |      | 600           |    |
| $Q_{rr}$ | Reverse Recovery Charge                | $I_S = -497\text{A}$<br>$V_R = 333\text{V}$<br>$di/dt = 600\text{A}/\mu\text{s}$ | $T_j = 25^\circ\text{C}$  |     | 15.6 | $\mu\text{C}$ |    |
|          |                                        |                                                                                  | $T_j = 125^\circ\text{C}$ |     | 60   |               |    |

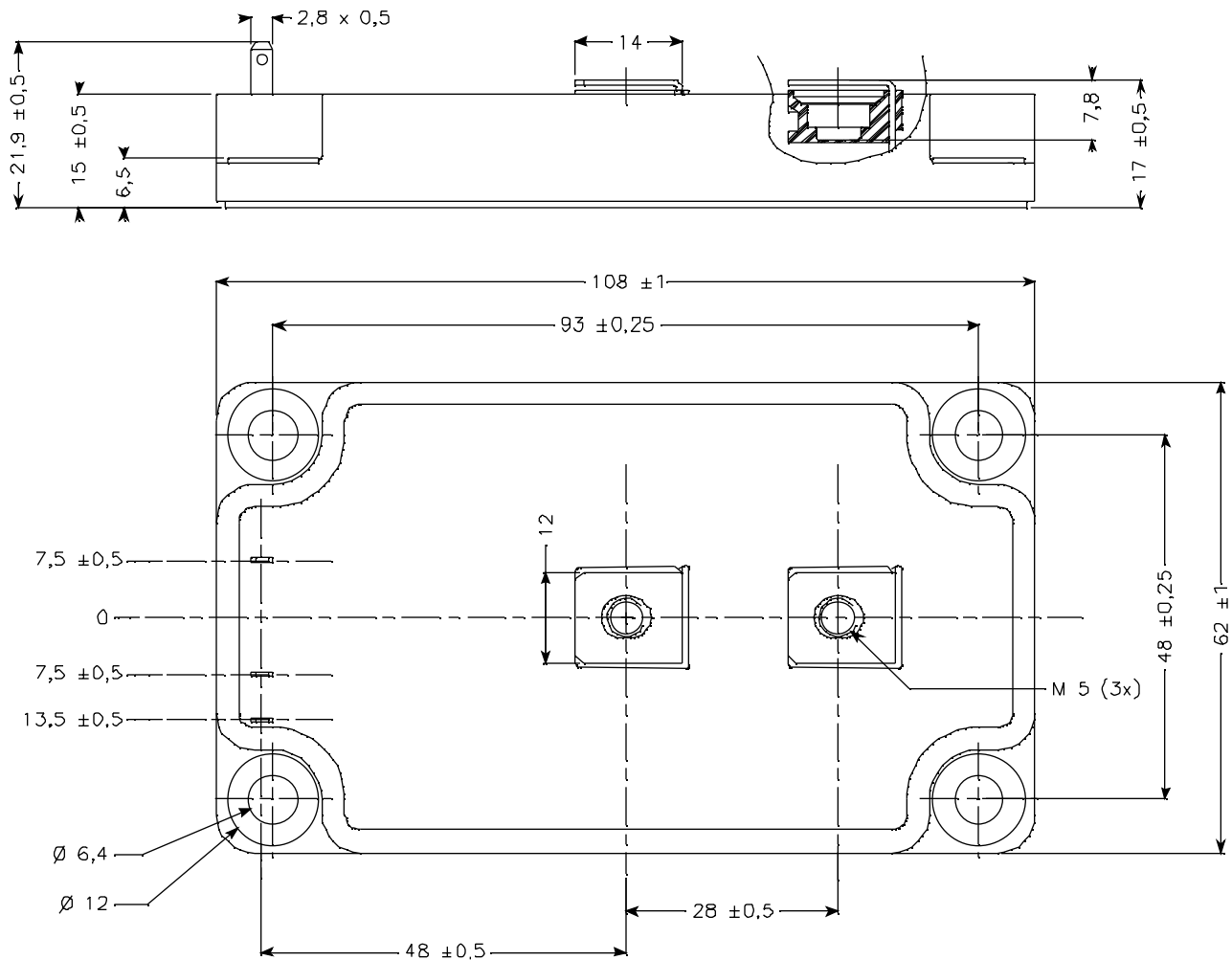
 ①  $dv/dt$  numbers reflect the limitations of the circuit rather than the device itself.

$$I_S \leq -497\text{A} \quad di/dt \leq 700\text{A}/\mu\text{s} \quad V_R \leq V_{DSS} \quad T_j \leq 150^\circ\text{C}$$

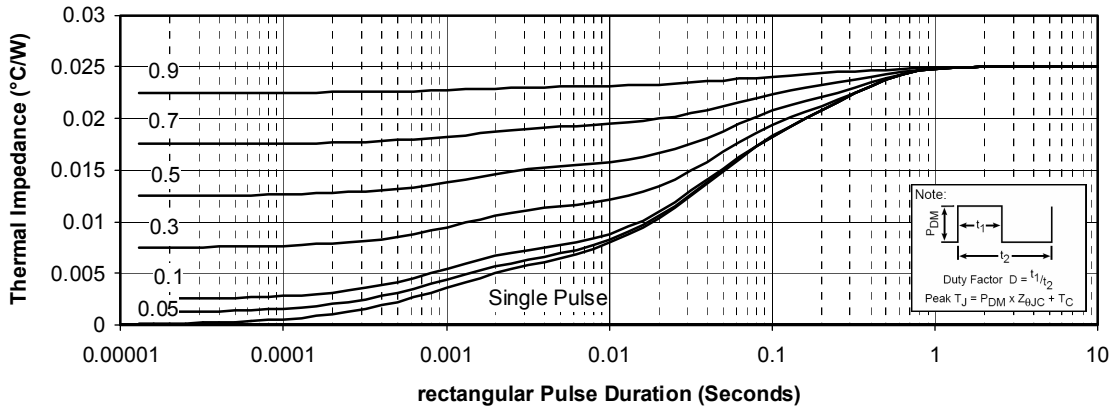
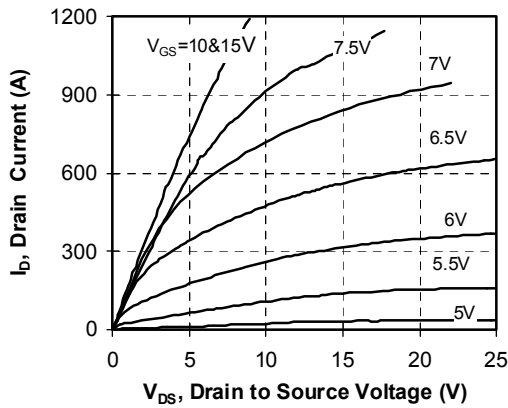
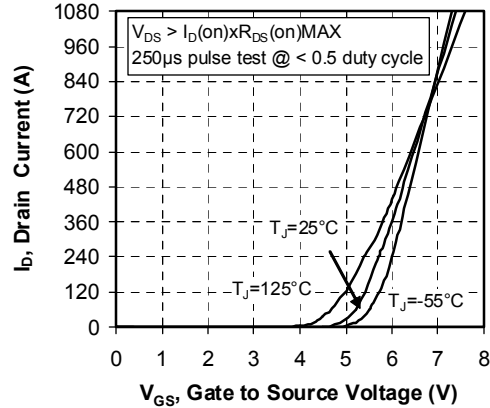
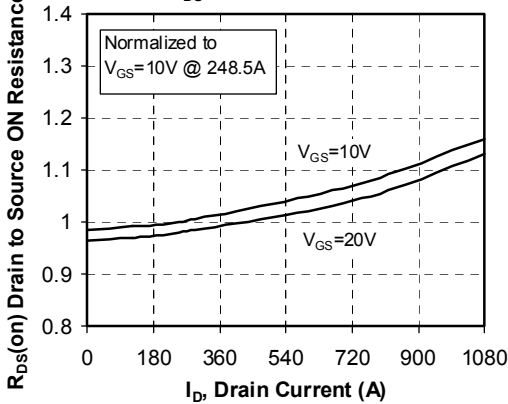
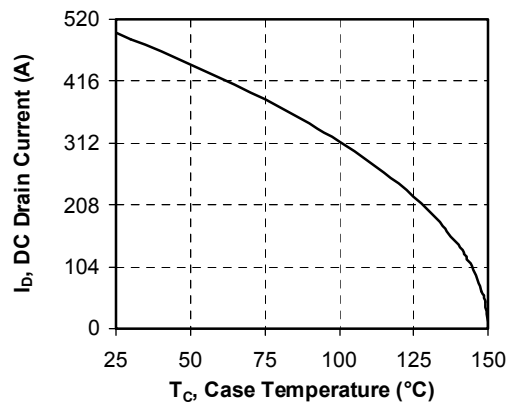
## Thermal and package characteristics

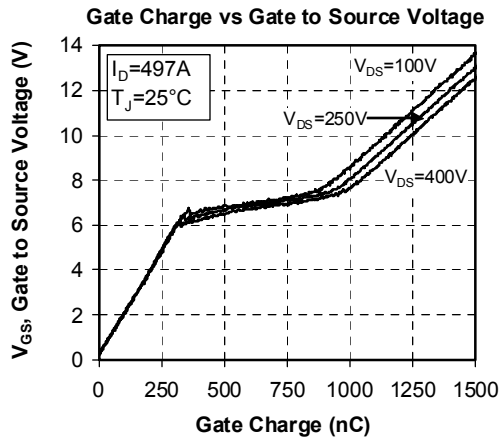
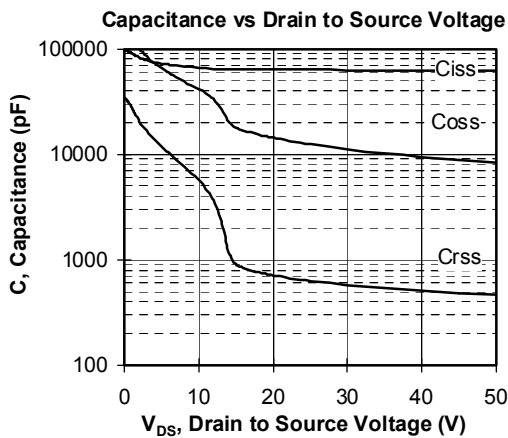
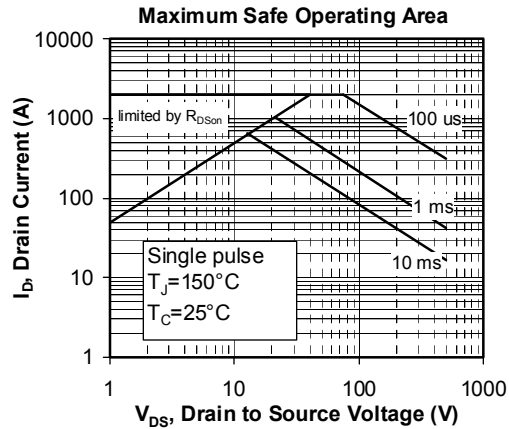
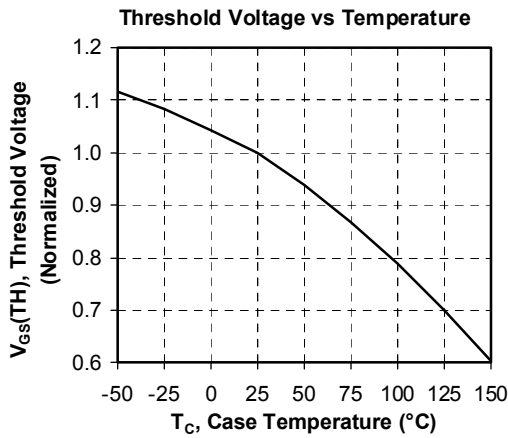
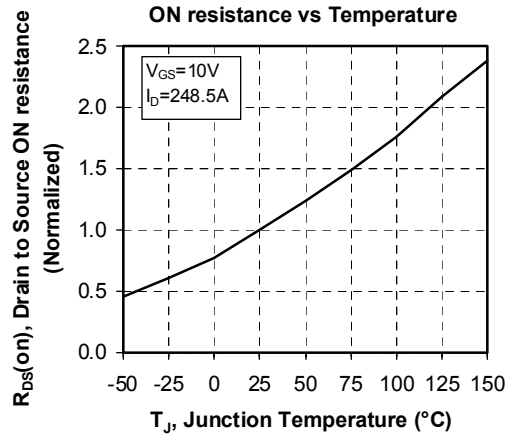
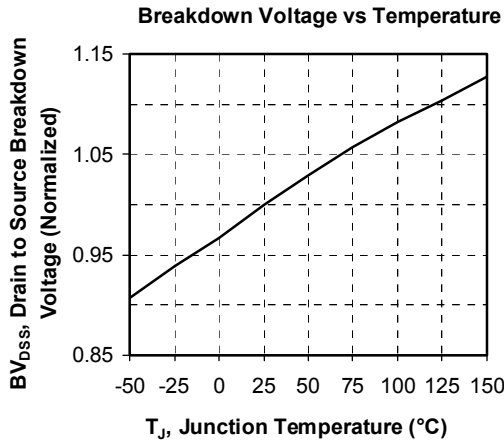
| Symbol     | Characteristic                                                                  | Min           | Typ | Max   | Unit |     |
|------------|---------------------------------------------------------------------------------|---------------|-----|-------|------|-----|
| $R_{thJC}$ | Junction to Case Thermal Resistance                                             |               |     | 0.025 | °C/W |     |
| $V_{ISOL}$ | 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           |     | 150   | °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    |     |

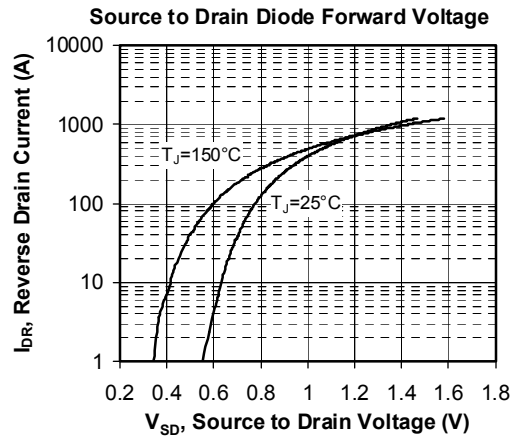
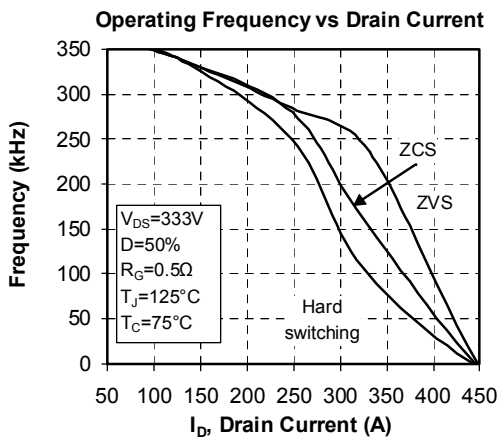
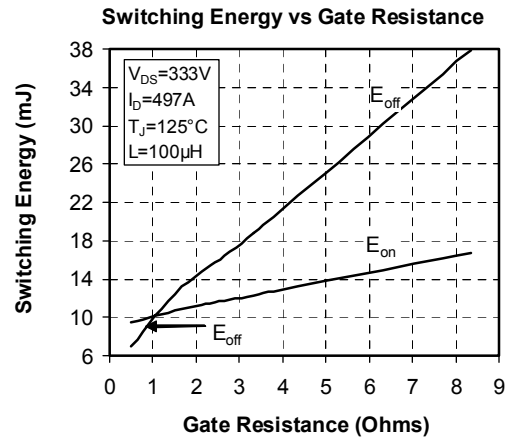
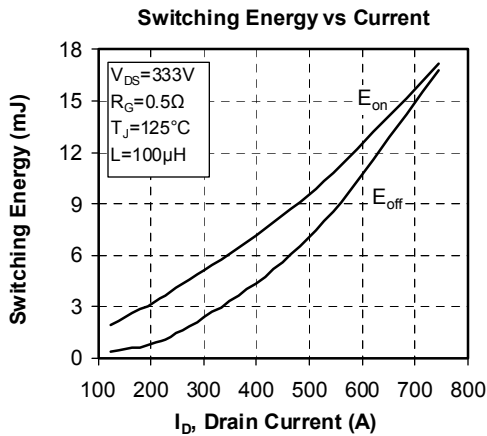
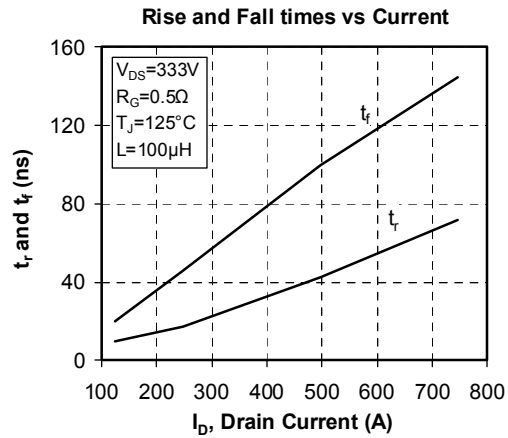
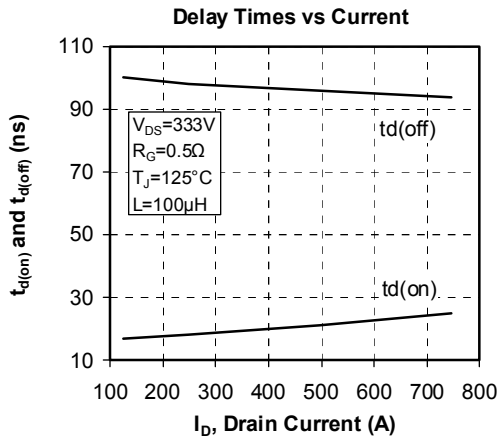
## SP6 Package outline (dimensions in mm)



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

**Typical Performance Curve**
**Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration**

**Low Voltage Output Characteristics**

**Transfer Characteristics**

 **$R_{DS(on)}$  vs Drain Current**

**DC Drain Current vs Case Temperature**






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