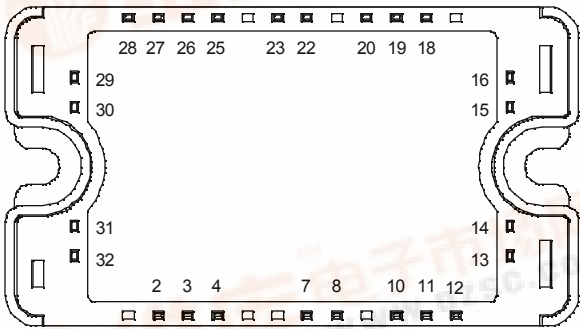
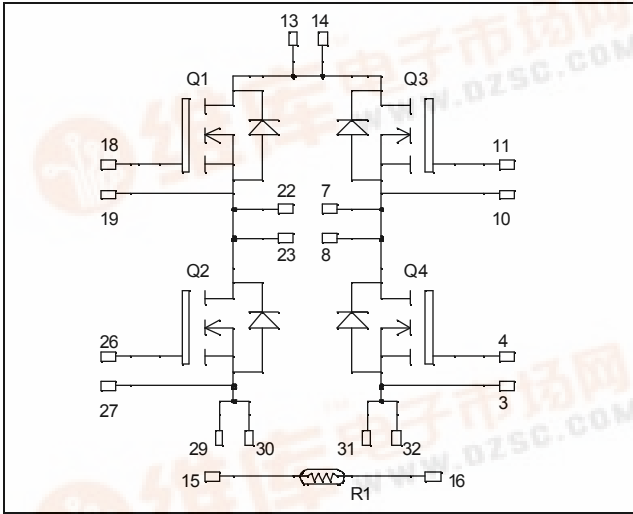




# APT0502

## Full - Bridge MOSFET Power Module

$V_{DSS} = 1000V$   
 $R_{DSon} = 350m\Omega$  typ @  $T_j = 25^\circ C$   
 $I_D = 22A$  @  $T_c = 25^\circ C$



All multiple inputs and outputs must be shorted together  
 Example: 13/14 ; 29/30 ; 22/23 ...

### 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
- Internal thermistor for temperature monitoring
- High level of integration

### Benefits

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- Each leg can be easily paralleled to achieve a phase leg of twice the current capability
- RoHS Compliant

### Absolute maximum ratings

| Symbol     | Parameter   | Max ratings        | Unit       |
|------------|---|--------------------|------------|
| $V_{DSS}$  | Drain - Source Breakdown Voltage                  | 1000               | V          |
| $I_D$      | Continuous Drain Current                          | $T_c = 25^\circ C$ | 22         |
|            |   | $T_c = 80^\circ C$ | 17         |
| $I_{DM}$   | Pulsed Drain current                              | 88                 |            |
| $V_{GS}$   | Gate - Source Voltage                             | $\pm 30$           | V          |
| $R_{DSon}$ | Drain - Source ON Resistance                      | 420                | m $\Omega$ |
| $P_D$      | Maximum Power Dissipation                         | $T_c = 25^\circ C$ | 390        |
| $I_{AR}$   | Avalanche current (repetitive and non repetitive) | 25                 | 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



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 | $V_{GS} = 0V, V_{DS} = 1000V$         |                          |     | 100       | $\mu\text{A}$    |
|              |                                 | $V_{GS} = 0V, V_{DS} = 800V$          | $T_j = 25^\circ\text{C}$ |     | 500       |                  |
| $R_{DS(on)}$ | Drain – Source on Resistance    | $V_{GS} = 10V, I_D = 11A$             |                          | 350 | 420       | $\text{m}\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage          | $V_{GS} = V_{DS}, I_D = 2.5\text{mA}$ | 3                        |     | 5         | V                |
| $I_{GSS}$    | Gate – Source Leakage Current   | $V_{GS} = \pm 30V, V_{DS} = 0V$       |                          |     | $\pm 100$ | nA               |

**Dynamic Characteristics**

| Symbol       | Characteristic               | Test Conditions   | Min | Typ  | Max | Unit          |
|--------------|------------------------------|---|-----|------|-----|---------------|
| $C_{iss}$    | Input Capacitance            | $V_{GS} = 0V$   |     | 5.2  |     | nF            |
| $C_{oss}$    | Output Capacitance           | $V_{DS} = 25V$  |     | 0.88 |     |               |
| $C_{rss}$    | Reverse Transfer Capacitance | $f = 1\text{MHz}$   |     | 0.16 |     |               |
| $Q_g$        | Total gate Charge            | $V_{GS} = 10V$  |     | 186  |     | nC            |
| $Q_{gs}$     | Gate – Source Charge         | $V_{Bus} = 500V$  |     | 24   |     |               |
| $Q_{gd}$     | Gate – Drain Charge          | $I_D = 22A$   |     | 122  |     |               |
| $T_{d(on)}$  | Turn-on Delay Time           | <b>Inductive switching @ <math>125^\circ\text{C}</math></b><br>$V_{GS} = 15V$<br>$V_{Bus} = 670V$<br>$I_D = 22A$<br>$R_G = 5\Omega$ |     | 18   |     | ns            |
| $T_r$        | Rise Time                    |   |     | 12   |     |               |
| $T_{d(off)}$ | Turn-off Delay Time          |   |     | 155  |     |               |
| $T_f$        | Fall Time                    |   |     | 40   |     |               |
| $E_{on}$     | Turn-on Switching Energy     | <b>Inductive switching @ <math>25^\circ\text{C}</math></b><br>$V_{GS} = 15V, V_{Bus} = 670V$<br>$I_D = 22A, R_G = 5\Omega$          |     | 900  |     | $\mu\text{J}$ |
| $E_{off}$    | Turn-off Switching Energy    |   |     | 623  |     |               |
| $E_{on}$     | Turn-on Switching Energy     | <b>Inductive switching @ <math>125^\circ\text{C}</math></b><br>$V_{GS} = 15V, V_{Bus} = 670V$<br>$I_D = 22A, R_G = 5\Omega$         |     | 1423 |     | $\mu\text{J}$ |
| $E_{off}$    | Turn-off Switching Energy    |   |     | 779  |     |               |

**Source - Drain diode ratings and characteristics**

| Symbol   | Characteristic                         | Test Conditions  | Min                       | Typ  | Max | Unit          |
|----------|--|--|---------------------------|------|-----|---------------|
| $I_S$    | Continuous Source current (Body diode) | $T_c = 25^\circ\text{C}$                                   |                           |      | 22  | A             |
|          |  | $T_c = 80^\circ\text{C}$                                   |                           |      | 17  |               |
| $V_{SD}$ | Diode Forward Voltage                  | $V_{GS} = 0V, I_S = -22A$                                  |                           |      | 1.3 | V             |
| $dv/dt$  | Peak Diode Recovery ❶                  |  |                           |      | 18  | V/ns          |
| $t_{rr}$ | Reverse Recovery Time                  | $I_S = -22A$<br>$V_R = 670V$<br>$di/dt = 100A/\mu\text{s}$ | $T_j = 25^\circ\text{C}$  |      | 320 | ns            |
|          |  |  | $T_j = 125^\circ\text{C}$ |      | 650 |               |
| $Q_{rr}$ | Reverse Recovery Charge                | $I_S = -22A$<br>$V_R = 670V$<br>$di/dt = 100A/\mu\text{s}$ | $T_j = 25^\circ\text{C}$  | 3.6  |     | $\mu\text{C}$ |
|          |  |  | $T_j = 125^\circ\text{C}$ | 9.72 |     |               |

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

 $I_S \leq -22A$     $di/dt \leq 700A/\mu\text{s}$     $V_R \leq V_{DSS}$     $T_j \leq 150^\circ\text{C}$

**Thermal and package characteristics**

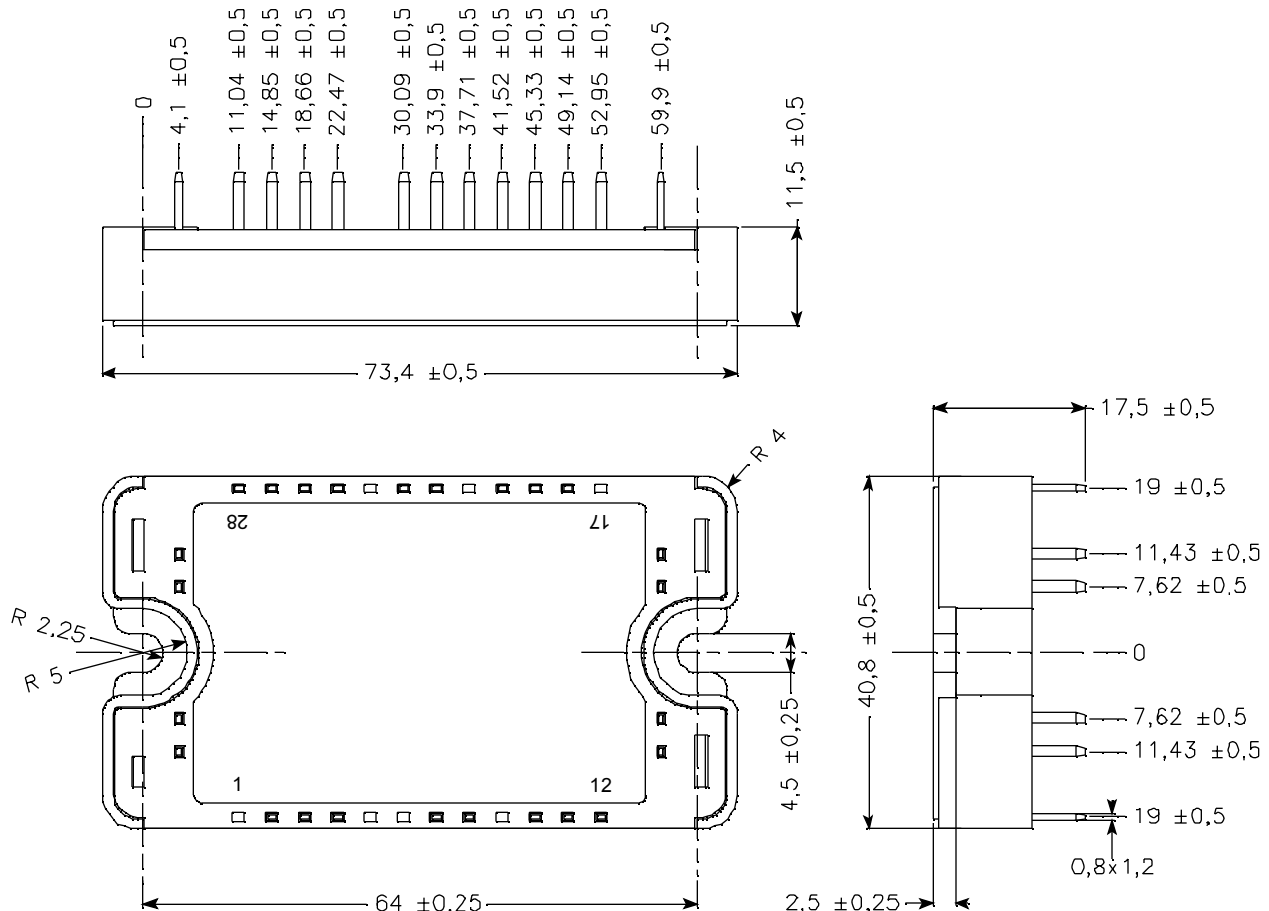
| Symbol            | Characteristic  | Min         | Typ | Max  | Unit |     |
|-------------------|---|-------------|-----|------|------|-----|
| R <sub>thJC</sub> | Junction to Case Thermal Resistance   |             |     | 0.32 | °C/W |     |
| V <sub>ISOL</sub> | RMS Isolation Voltage, any terminal 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 | M4  | 2.5  | 4.7  | N.m |
| Wt                | Package Weight  |             |     |      | 110  | g   |

**Temperature sensor NTC** (see application note APT0406 on [www.microsemi.com](http://www.microsemi.com) for more information).

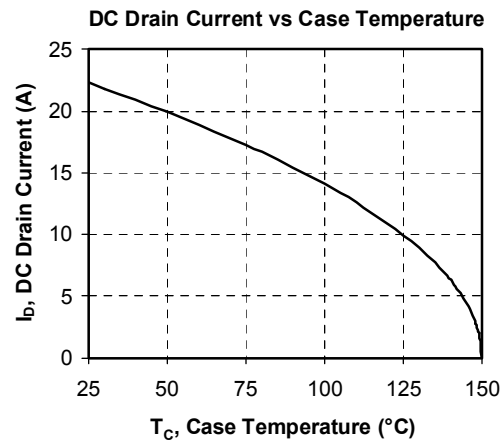
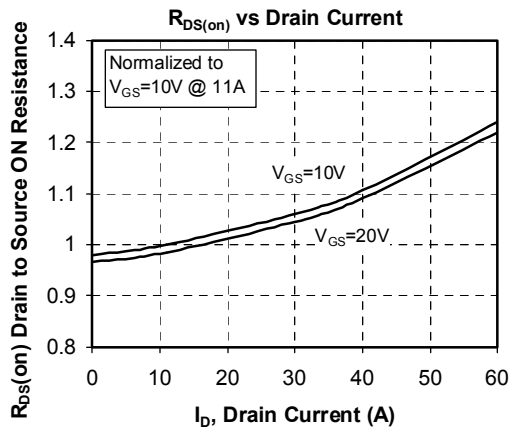
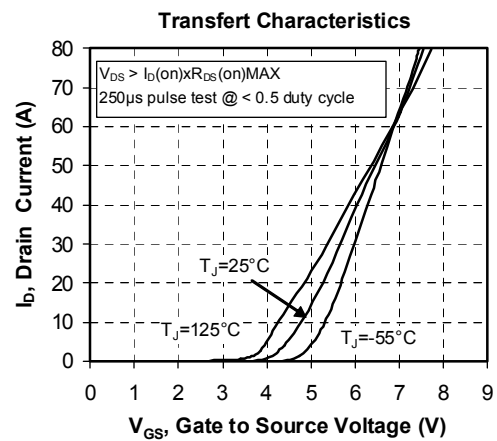
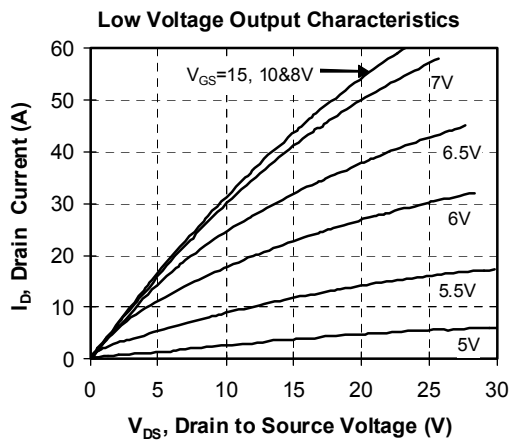
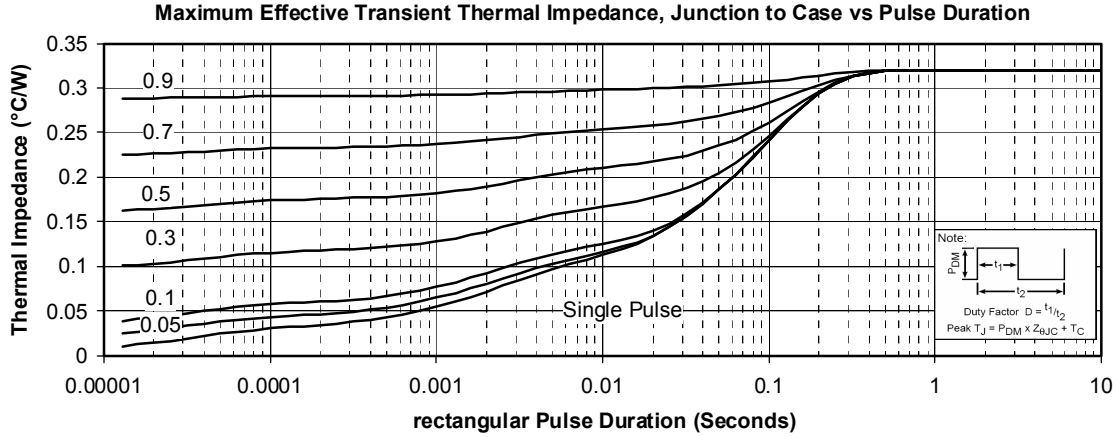
| Symbol             | Characteristic             | Min | Typ  | Max | Unit |
|--------------------|----------------------------|-----|------|-----|------|
| R <sub>25</sub>    | Resistance @ 25°C          |     | 50   |     | kΩ   |
| B <sub>25/85</sub> | T <sub>25</sub> = 298.15 K |     | 3952 |     | K    |

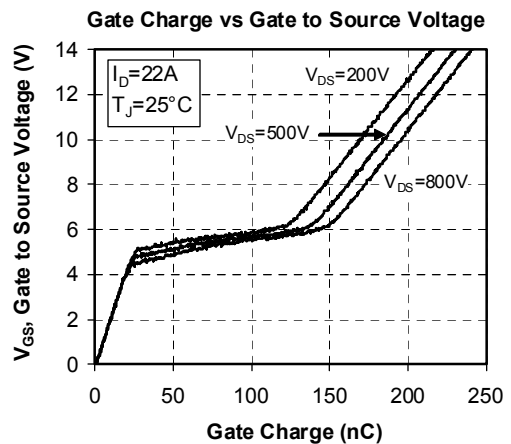
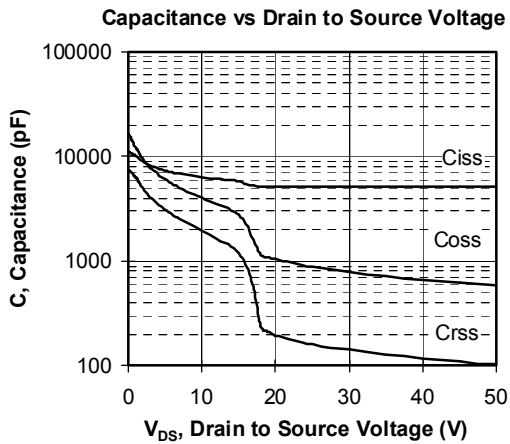
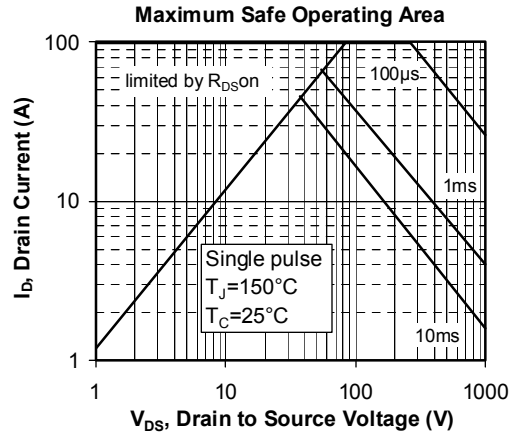
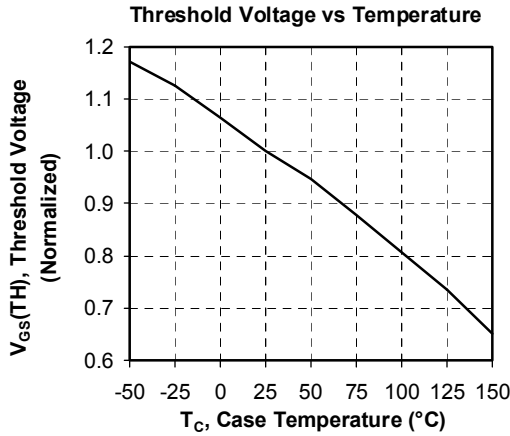
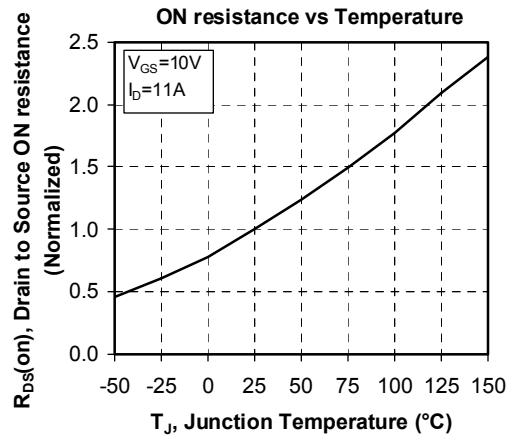
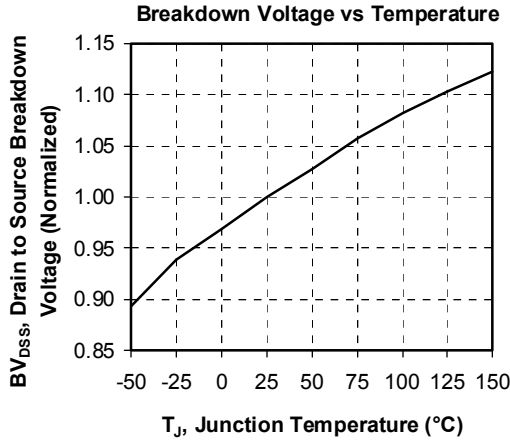
$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

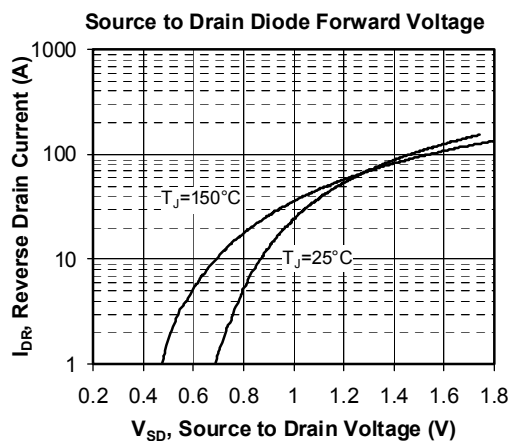
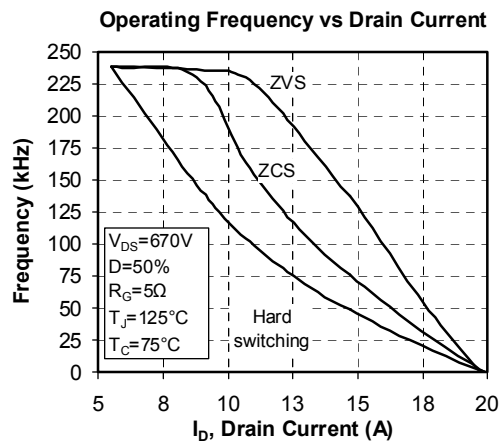
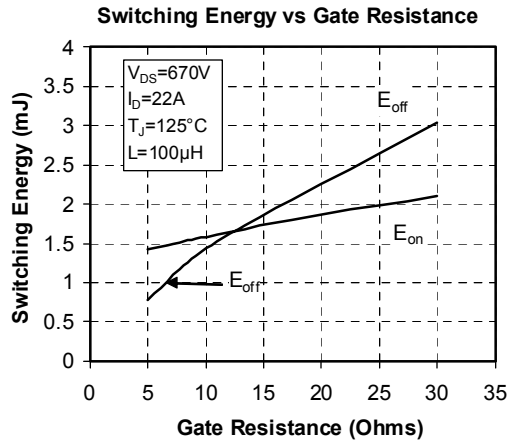
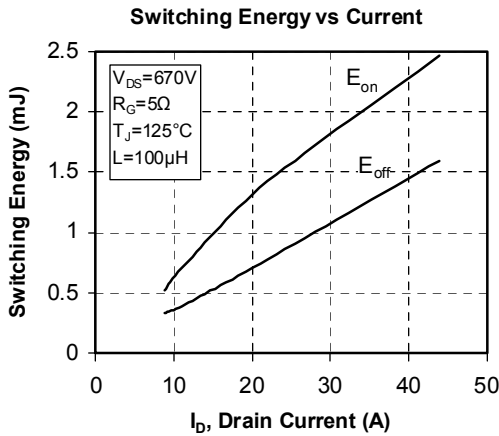
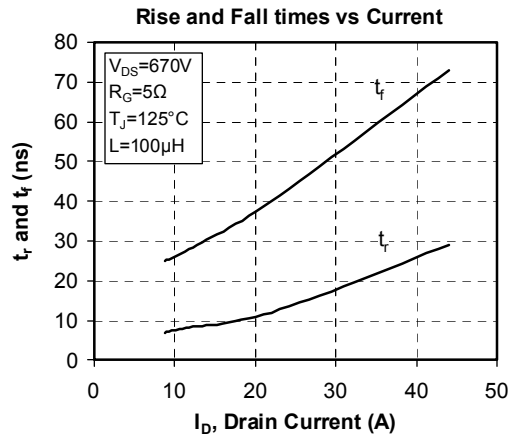
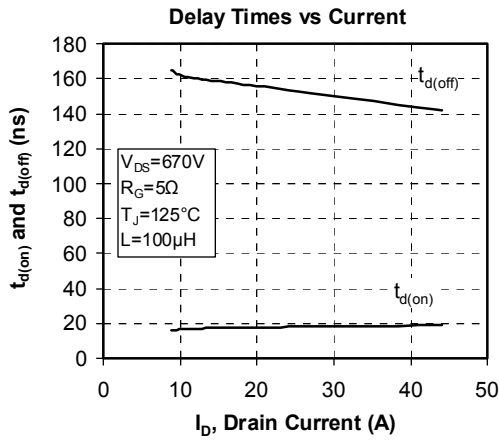
T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

**SP3 Package outline** (dimensions in mm)

 See application note 1901 - Mounting Instructions for SP3 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical Performance Curve







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