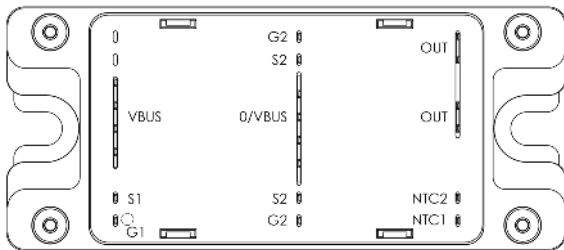
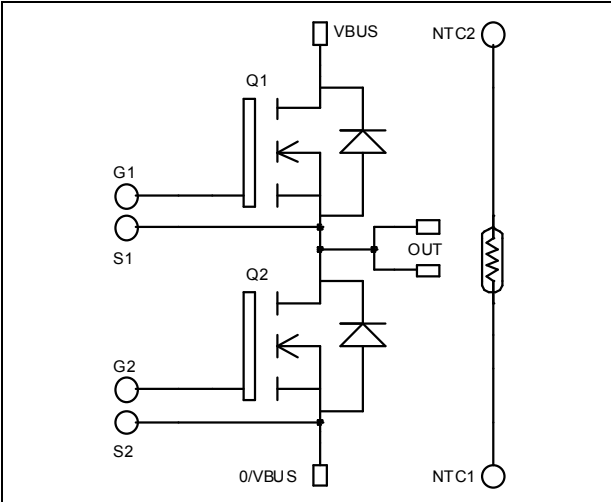


## Phase leg MOSFET Power Module

$V_{DSS} = 1000V$   
 $R_{DSon} = 180m\Omega \text{ typ @ } T_j = 25^\circ C$   
 $I_D = 43A \text{ @ } T_c = 25^\circ C$



### 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
  - Lead frames for power connections
- 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
- RoHS compliant

### Absolute maximum ratings

| Symbol     | Parameter   | Max ratings        | Unit      |
|------------|---|--------------------|-----------|
| $V_{DSS}$  | Drain - Source Breakdown Voltage                  | 1000               | V         |
| $I_D$      | Continuous Drain Current                          | $T_c = 25^\circ C$ | 43        |
|            |   | $T_c = 80^\circ C$ | 33        |
| $I_{DM}$   | Pulsed Drain current                              | 172                | A         |
| $V_{GS}$   | Gate - Source Voltage                             | $\pm 30$           | V         |
| $R_{DSon}$ | Drain - Source ON Resistance                      | 210                | $m\Omega$ |
| $P_D$      | Maximum Power Dissipation                         | $T_c = 25^\circ C$ | 780       |
| $I_{AR}$   | 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](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 | $V_{GS} = 0V, V_{DS} = 1000V$       |     |     | 200       | $\mu\text{A}$    |
|              |                                 | $V_{GS} = 0V, V_{DS} = 800V$        |     |     | 1000      |                  |
| $R_{DS(on)}$ | Drain – Source on Resistance    | $V_{GS} = 10V, I_D = 21.5A$         |     | 180 | 210       | $\text{m}\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage          | $V_{GS} = V_{DS}, I_D = 5\text{mA}$ | 3   |     | 5         | V                |
| $I_{GSS}$    | Gate – Source Leakage Current   | $V_{GS} = \pm 30V, V_{DS} = 0V$     |     |     | $\pm 150$ | $\text{nA}$      |

**Dynamic Characteristics**

| Symbol       | Characteristic               | Test Conditions  | Min | Typ  | Max | Unit          |
|--------------|------------------------------|--|-----|------|-----|---------------|
| $C_{iss}$    | Input Capacitance            | $V_{GS} = 0V$<br>$V_{DS} = 25V$<br>$f = 1\text{MHz}$   |     | 10.4 |     | $\text{nF}$   |
| $C_{oss}$    | Output Capacitance           |  |     | 1.76 |     |               |
| $C_{rss}$    | Reverse Transfer Capacitance |  |     | 0.32 |     |               |
| $Q_g$        | Total gate Charge            | $V_{GS} = 10V$<br>$V_{Bus} = 500V$<br>$I_D = 43A$  |     | 372  |     | $\text{nC}$   |
| $Q_{gs}$     | Gate – Source Charge         |  |     | 48   |     |               |
| $Q_{gd}$     | Gate – Drain Charge          |  |     | 244  |     |               |
| $T_{d(on)}$  | Turn-on Delay Time           | <b>Inductive switching @ 125°C</b><br>$V_{GS} = 15V$<br>$V_{Bus} = 670V$<br>$I_D = 43A$<br>$R_G = 2.5\Omega$ |     | 18   |     | $\text{ns}$   |
| $T_r$        | 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 @ 25°C</b><br>$V_{GS} = 15V, V_{Bus} = 670V$<br>$I_D = 43A, R_G = 2.5\Omega$          |     | 1800 |     | $\mu\text{J}$ |
| $E_{off}$    | Turn-off Switching Energy    |  |     | 1246 |     |               |
| $E_{on}$     | Turn-on Switching Energy     | <b>Inductive switching @ 125°C</b><br>$V_{GS} = 15V, V_{Bus} = 670V$<br>$I_D = 43A, R_G = 2.5\Omega$         |     | 2846 |     | $\mu\text{J}$ |
| $E_{off}$    | Turn-off Switching Energy    |  |     | 1558 |     |               |

**Source - Drain diode ratings and characteristics**

| Symbol   | Characteristic                         | Test Conditions  | Min                       | Typ | Max  | Unit |               |
|----------|--|--|---------------------------|-----|------|------|---------------|
| $I_S$    | Continuous Source current (Body diode) | $T_c = 25^\circ\text{C}$                                     |                           |     | 43   | A    |               |
|          |  | $T_c = 80^\circ\text{C}$                                     |                           |     | 33   |      |               |
| $V_{SD}$ | Diode Forward Voltage                  | $V_{GS} = 0V, I_S = -43A$                                    |                           |     | 1.3  | V    |               |
| $dv/dt$  | Peak Diode Recovery ①                  |  |                           |     | 18   | V/ns |               |
| $t_{rr}$ | Reverse Recovery Time                  | $I_S = -43A$<br>$V_R = 670V$<br>$di_S/dt = 200A/\mu\text{s}$ | $T_j = 25^\circ\text{C}$  |     |      | 320  | $\text{ns}$   |
|          |  |  | $T_j = 125^\circ\text{C}$ |     |      | 650  |               |
| $Q_{rr}$ | Reverse Recovery Charge                |  | $T_j = 25^\circ\text{C}$  |     | 7.2  |      | $\mu\text{C}$ |
|          |  |  | $T_j = 125^\circ\text{C}$ |     | 19.5 |      |               |

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

$I_S \leq -43A$     $di/dt \leq 700A/\mu\text{s}$     $V_R \leq V_{DSS}$     $T_j \leq 150^\circ\text{C}$

**Thermal and package characteristics**

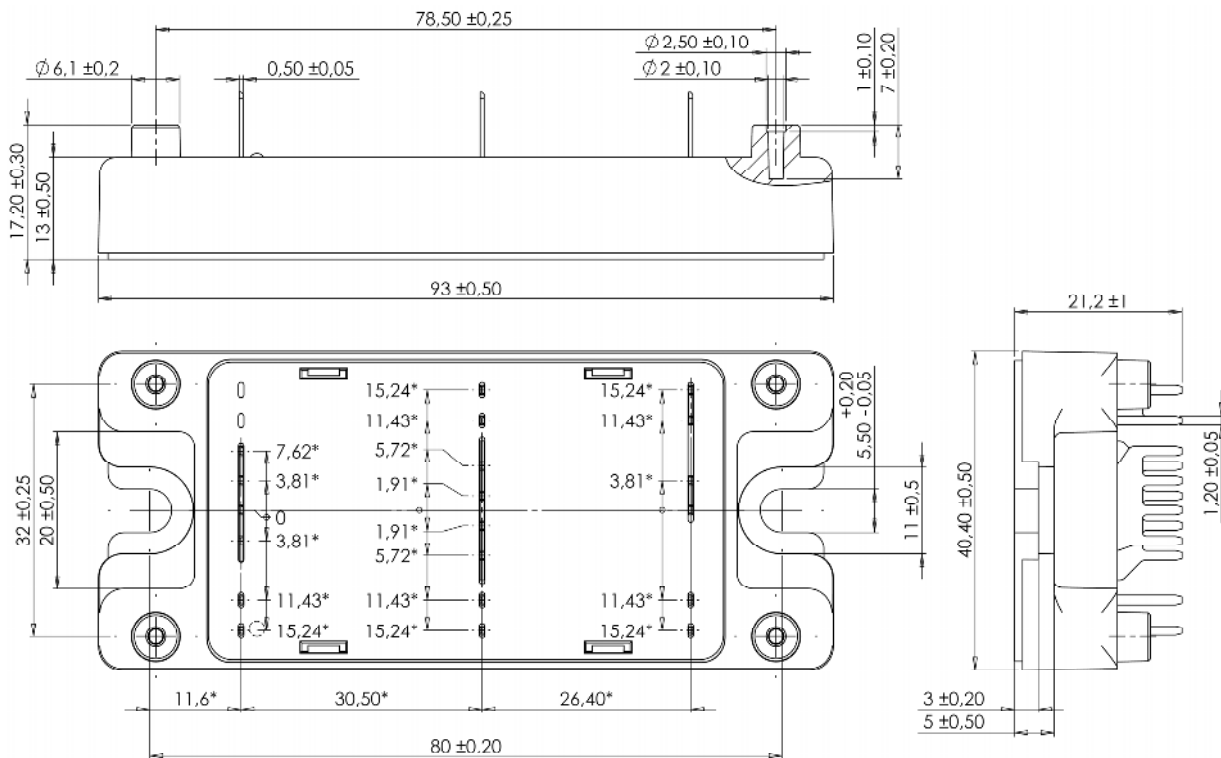
| Symbol            | Characteristic   | Min         | Typ | Max  | Unit |     |
|-------------------|--|-------------|-----|------|------|-----|
| R <sub>thJC</sub> | Junction to Case Thermal resistance                          |             |     | 0.16 | °C/W |     |
| V <sub>ISOL</sub> | RMS Isolation Voltage, any terminal to case t=1 min, 50/60Hz | 4000        |     |      | V    |     |
| T <sub>J</sub>    | Operating junction temperature range                         | -40         |     | 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 | M5  | 2.5  | 4.7  | N.m |
| Wt                | Package Weight   |             |     | 160  | g    |     |

**Temperature sensor NTC** (see application note APT0406 on www.microsemi.com for more information).

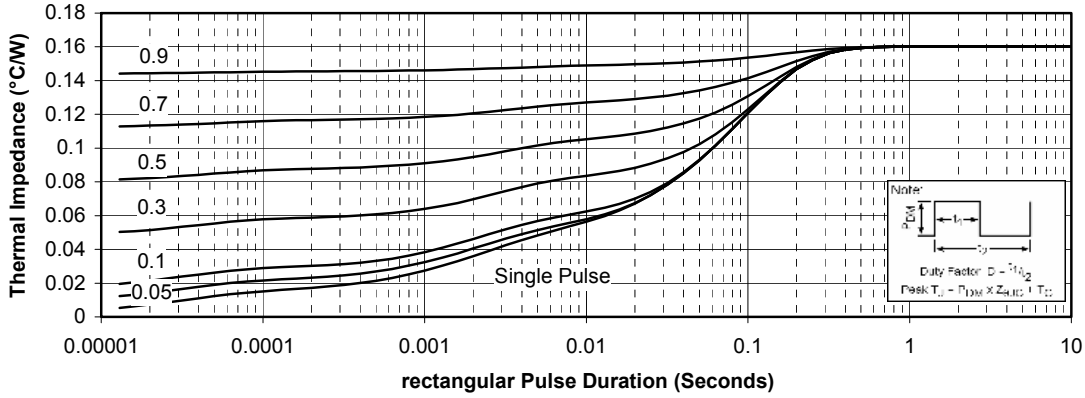
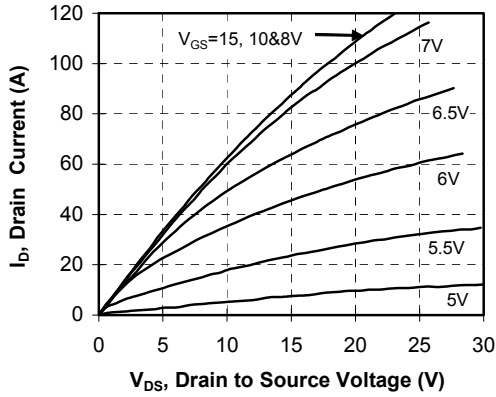
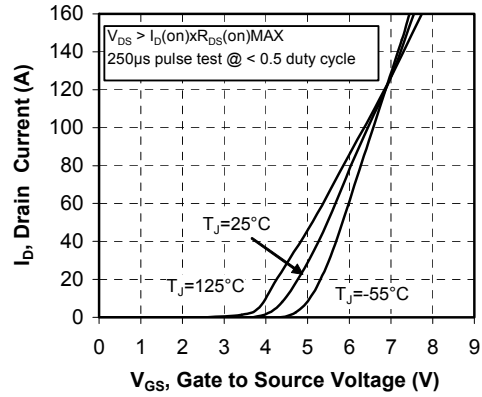
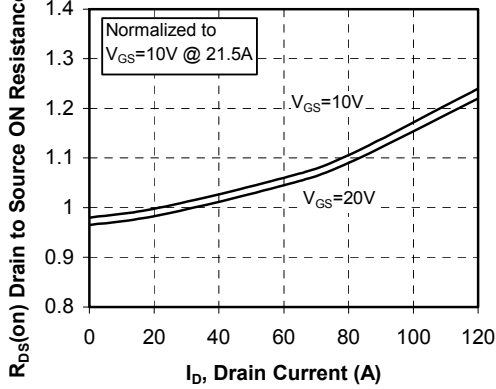
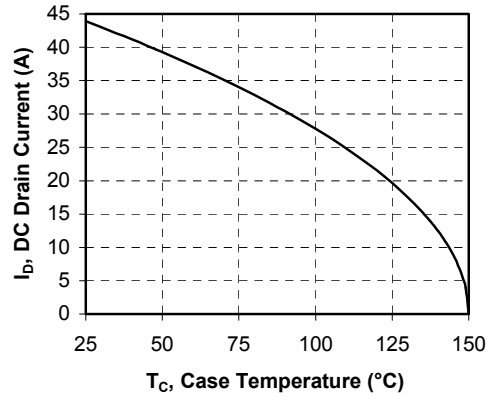
| Symbol             | Characteristic             | Min | Typ  | Max | Unit |
|--------------------|----------------------------|-----|------|-----|------|
| R <sub>25</sub>    | Resistance @ 25°C          |     | 50   |     | kΩ   |
| B <sub>25/85</sub> | T <sub>25</sub> = 298.15 K |     | 3952 |  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

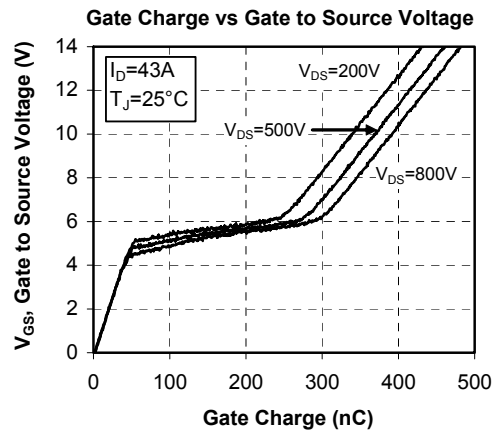
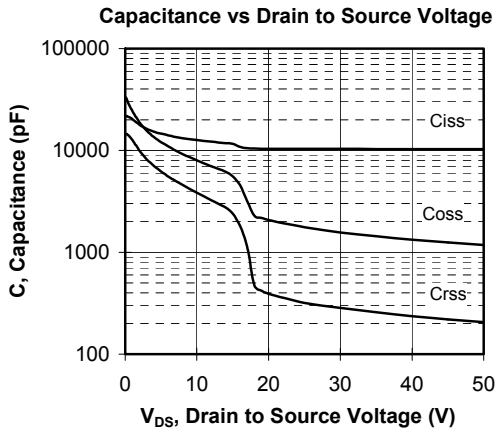
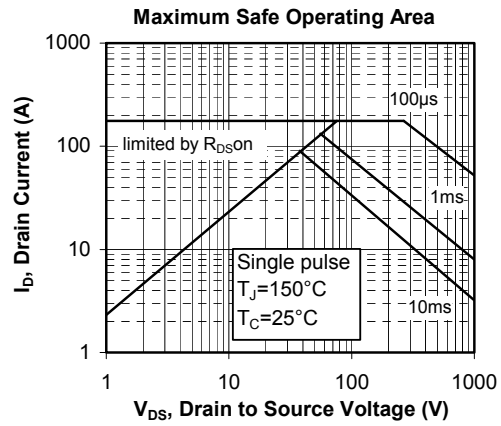
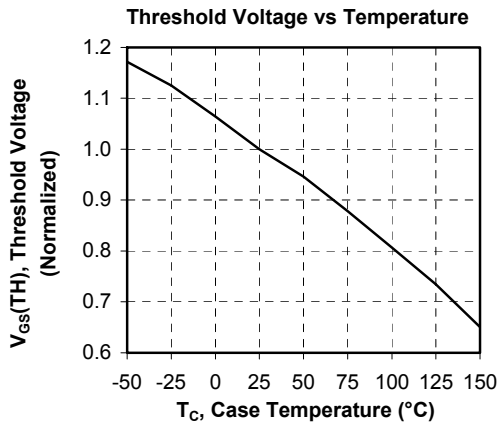
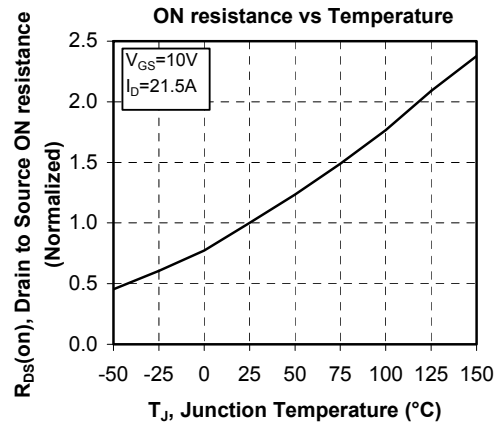
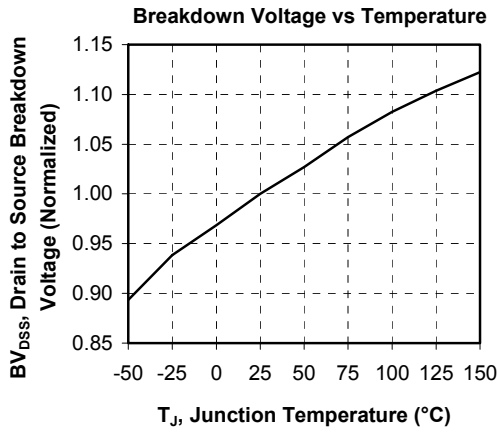
$$R_T = \frac{R_{25}}{\exp \left[ B_{25/85} \left( \frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

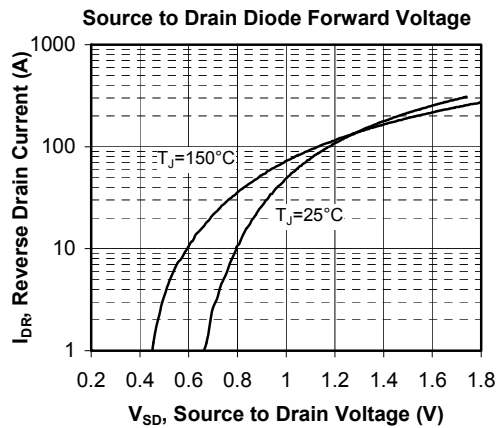
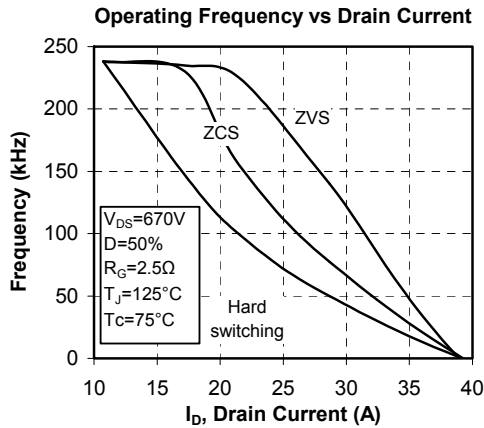
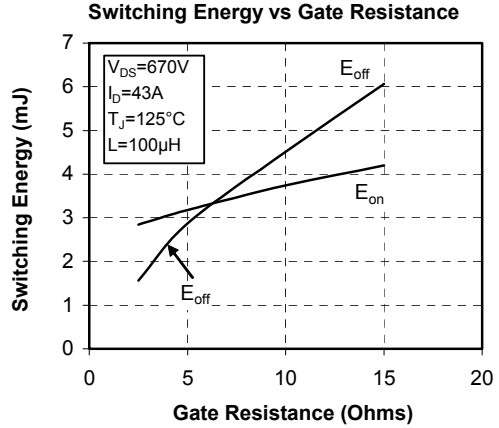
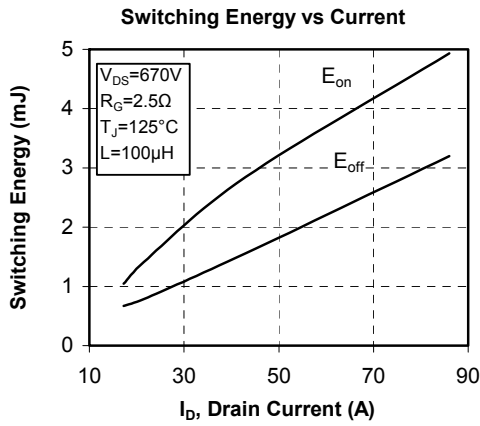
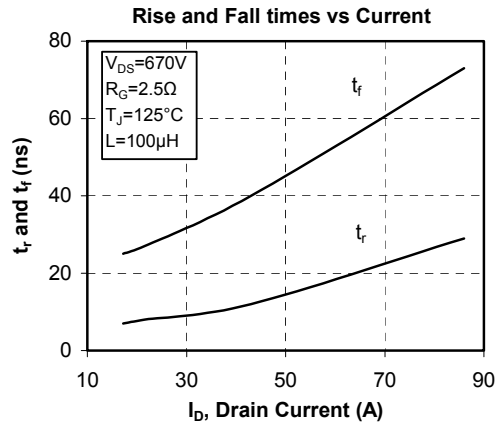
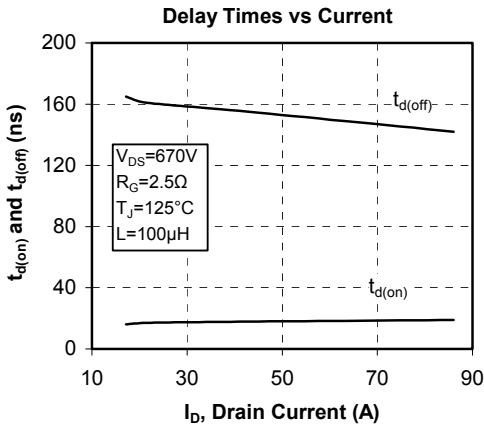
T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

**SP4 Package outline** (dimensions in mm)

 ALL DIMENSIONS MARKED "\*" ARE TOLERANCED AS:  $\pm \phi 1$ 

See application note APT0501 - Mounting Instructions for SP4 Power Modules on 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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