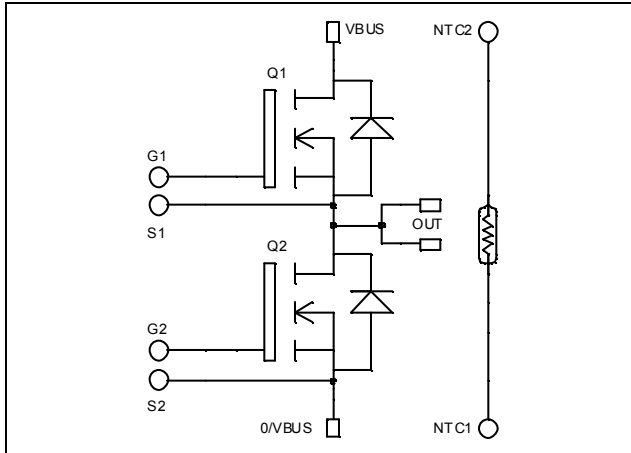


## Phase leg MOSFET Power Module

$V_{DSS} = 200V$   
 $R_{DSon} = 10m\Omega \text{ typ @ } T_j = 25^\circ C$   
 $I_D = 175A \text{ @ } T_c = 25^\circ C$

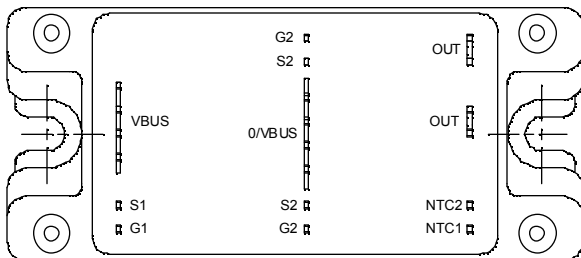


### Application

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

### 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                  | 200                | V         |     |
| $I_D$      | Continuous Drain Current                          | $T_c = 25^\circ C$ | A         |     |
|            |   | $T_c = 80^\circ C$ |           | 131 |
| $I_{DM}$   | Pulsed Drain current                              | 700                |           |     |
| $V_{GS}$   | Gate - Source Voltage                             | $\pm 30$           | V         |     |
| $R_{DSon}$ | Drain - Source ON Resistance                      | 12                 | $m\Omega$ |     |
| $P_D$      | Maximum Power Dissipation                         | $T_c = 25^\circ C$ | 694       | W   |
| $I_{AR}$   | Avalanche current (repetitive and non repetitive) | 89                 | A         |     |
| $E_{AR}$   | Repetitive Avalanche Energy                       | 50                 | mJ        |     |
| $E_{AS}$   | Single Pulse Avalanche Energy                     | 2500               |           |     |


**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 | $V_{GS} = 0\text{V}, V_{DS} = 200\text{V}$    |     |     | 200       | $\mu\text{A}$    |
|              |                                 | $V_{GS} = 0\text{V}, V_{DS} = 160\text{V}$    |     |     | 1000      |                  |
| $R_{DS(on)}$ | Drain – Source on Resistance    | $V_{GS} = 10\text{V}, I_D = 87.5\text{A}$     |     | 10  | 12        | $\text{m}\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage          | $V_{GS} = V_{DS}, I_D = 5\text{mA}$           | 3   |     | 5         | V                |
| $I_{GSS}$    | Gate – Source Leakage Current   | $V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$ |     |     | $\pm 150$ | nA               |

**Dynamic Characteristics**

| Symbol       | Characteristic               | Test Conditions   | Min | Typ  | Max | Unit          |
|--------------|------------------------------|---|-----|------|-----|---------------|
| $C_{iss}$    | Input Capacitance            | $V_{GS} = 0\text{V}$<br>$V_{DS} = 25\text{V}$<br>$f = 1\text{MHz}$  |     | 13.7 |     | nF            |
| $C_{oss}$    | Output Capacitance           |   |     | 4.36 |     |               |
| $C_{rss}$    | Reverse Transfer Capacitance |   |     | 0.19 |     |               |
| $Q_g$        | Total gate Charge            | $V_{GS} = 10\text{V}$<br>$V_{Bus} = 100\text{V}$<br>$I_D = 150\text{A}$   |     | 224  |     | nC            |
| $Q_{gs}$     | Gate – Source Charge         |   |     | 86   |     |               |
| $Q_{gd}$     | Gate – Drain Charge          |   |     | 94   |     |               |
| $T_{d(on)}$  | Turn-on Delay Time           | <b>Inductive switching @ <math>125^\circ\text{C}</math></b><br>$V_{GS} = 15\text{V}$<br>$V_{Bus} = 133\text{V}$<br>$I_D = 150\text{A}$<br>$R_G = 2.5\Omega$ |     | 28   |     | ns            |
| $T_r$        | Rise Time                    |   |     | 56   |     |               |
| $T_{d(off)}$ | Turn-off Delay Time          |   |     | 81   |     |               |
| $T_f$        | Fall Time                    |   |     | 99   |     |               |
| $E_{on}$     | Turn-on Switching Energy     | <b>Inductive switching @ <math>25^\circ\text{C}</math></b><br>$V_{GS} = 15\text{V}, V_{Bus} = 133\text{V}$<br>$I_D = 150\text{A}, R_G = 2.5\Omega$          |     | 926  |     | $\mu\text{J}$ |
| $E_{off}$    | Turn-off Switching Energy    |   |     | 910  |     |               |
| $E_{on}$     | Turn-on Switching Energy     | <b>Inductive switching @ <math>125^\circ\text{C}</math></b><br>$V_{GS} = 15\text{V}, V_{Bus} = 133\text{V}$<br>$I_D = 150\text{A}, R_G = 2.5\Omega$         |     | 1216 |     | $\mu\text{J}$ |
| $E_{off}$    | Turn-off Switching Energy    |   |     | 1062 |     |               |

**Source - Drain diode ratings and characteristics**

| Symbol   | Characteristic                         | Test Conditions                             | Min                       | Typ  | Max | Unit          |
|----------|--|---|---------------------------|------|-----|---------------|
| $I_S$    | Continuous Source current (Body diode) |   | $T_c = 25^\circ\text{C}$  |      | 175 | A             |
|          |  |   | $T_c = 80^\circ\text{C}$  |      | 131 |               |
| $V_{SD}$ | Diode Forward Voltage                  | $V_{GS} = 0\text{V}, I_S = -150\text{A}$    |                           |      | 1.3 | V             |
| $dv/dt$  | Peak Diode Recovery ①                  |   |                           |      | 8   | V/ns          |
| $t_{rr}$ | Reverse Recovery Time                  | $I_S = -150\text{A}$<br>$V_R = 133\text{V}$ | $T_j = 25^\circ\text{C}$  |      | 220 | ns            |
|          |  |   | $T_j = 125^\circ\text{C}$ |      | 420 |               |
| $Q_{rr}$ | Reverse Recovery Charge                | $di/dt = 200\text{A}/\mu\text{s}$           | $T_j = 25^\circ\text{C}$  | 2.14 |     | $\mu\text{C}$ |
|          |  |   | $T_j = 125^\circ\text{C}$ | 5.8  |     |               |

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

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

## Thermal and package characteristics

| Symbol            | Characteristic   | Min         | Typ | Max  | Unit |     |
|-------------------|--|-------------|-----|------|------|-----|
| R <sub>thJC</sub> | Junction to Case Thermal Resistance  |             |     | 0.18 | °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 | M5  | 2.5  | 4.7  | N.m |
| Wt                | Package Weight   |             |     |      | 160  | g   |

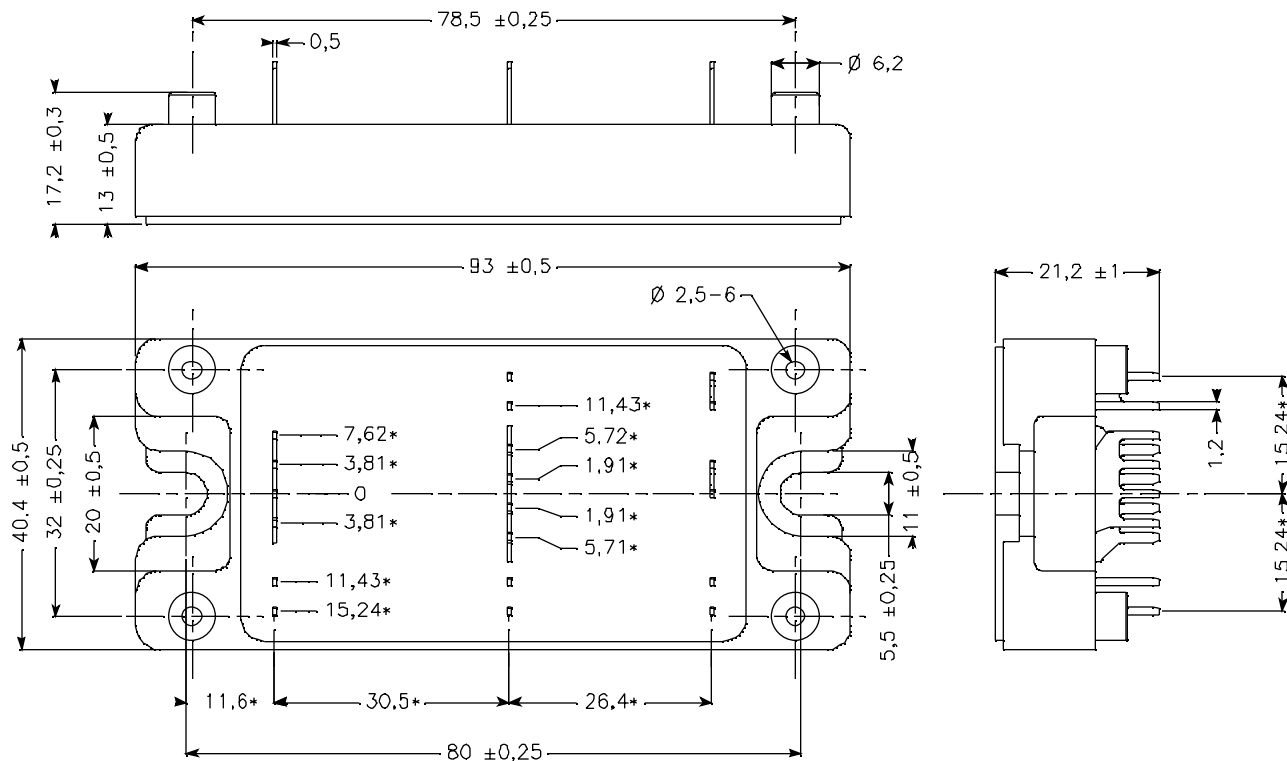
## Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

| 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

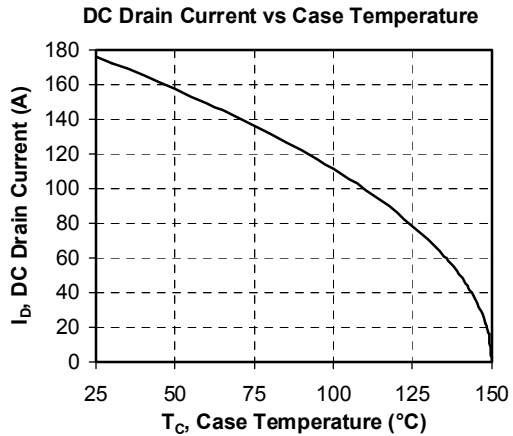
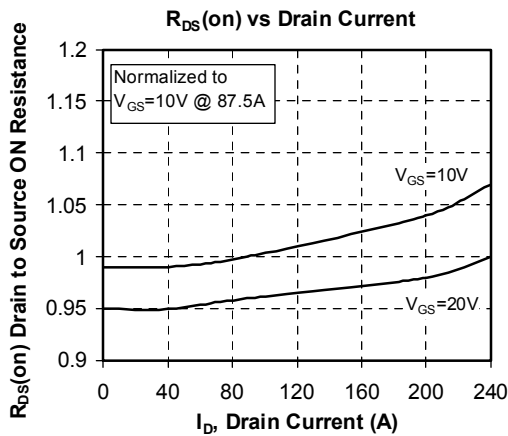
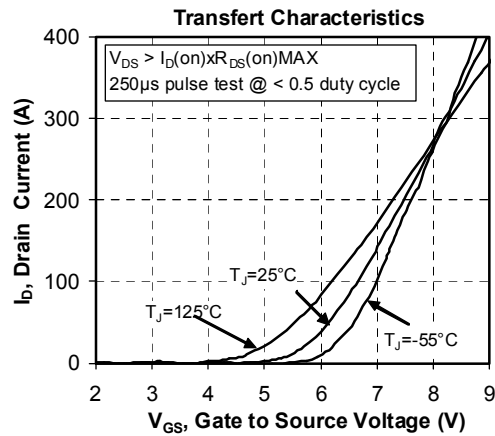
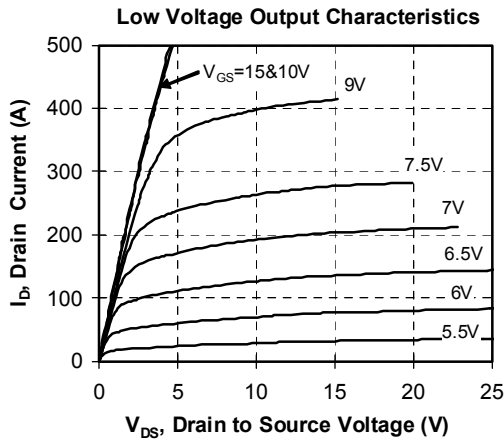
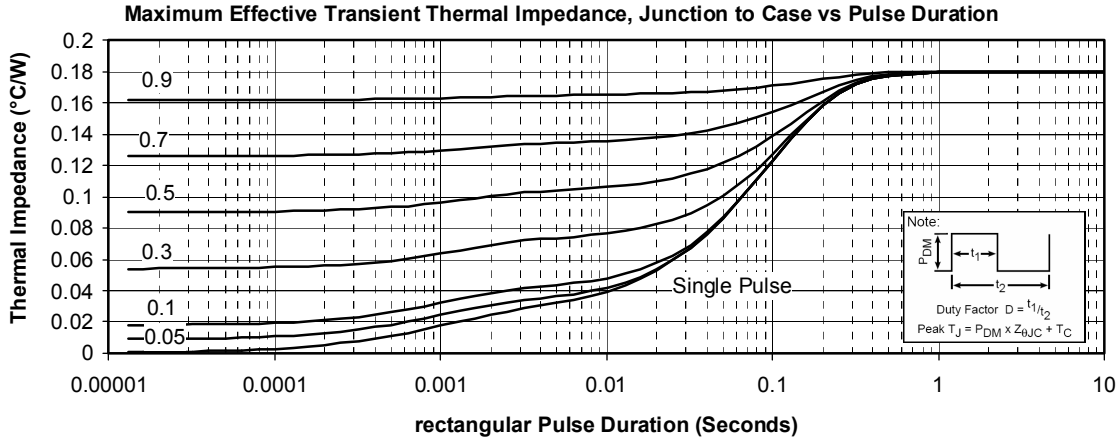
## SP4 Package outline (dimensions in mm)

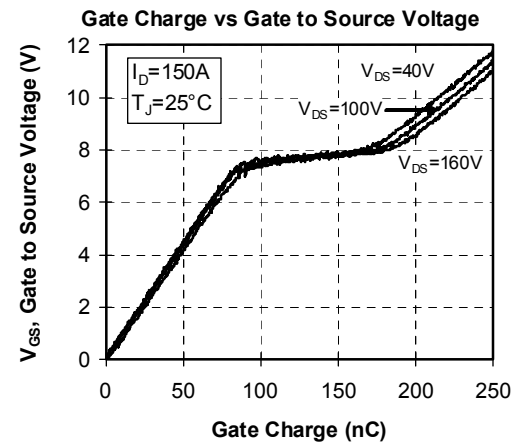
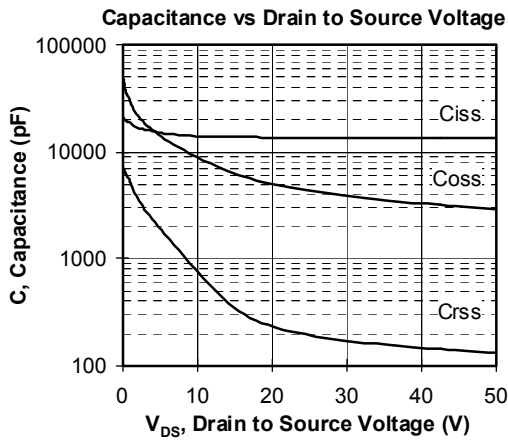
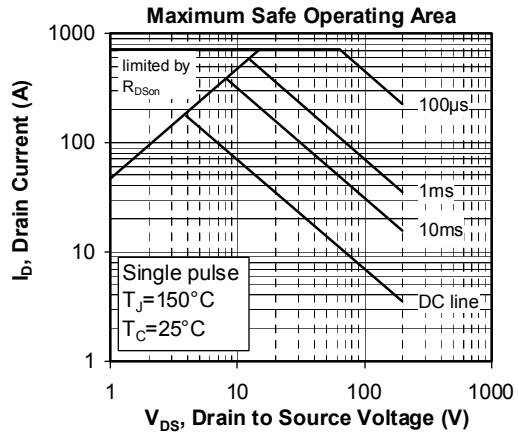
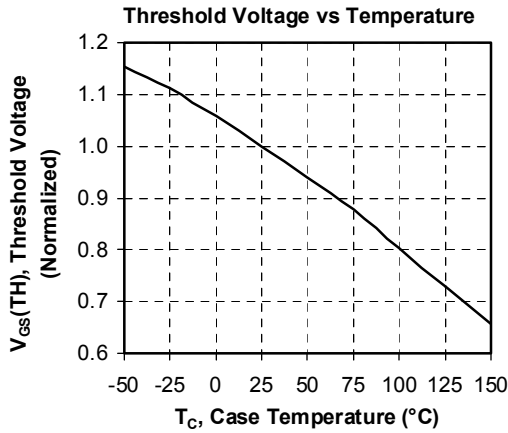
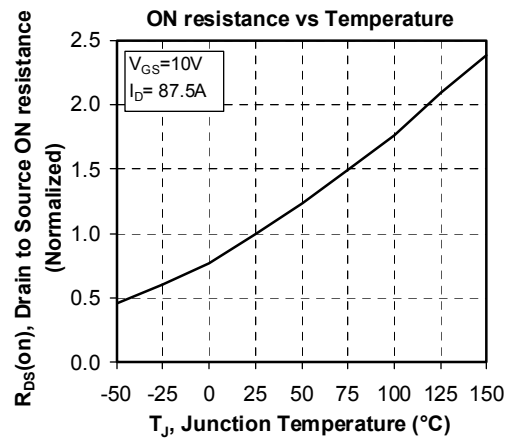
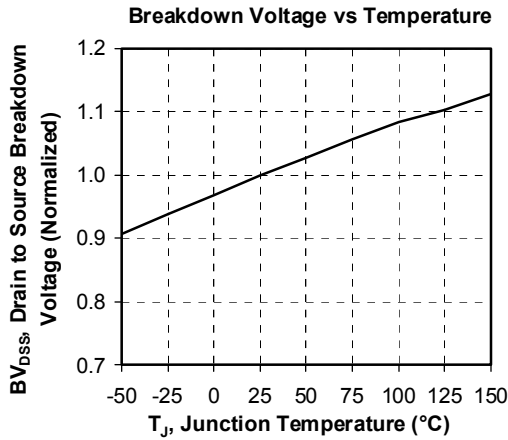


ALL DIMENSIONS MARKED "\*" ARE TOLERANCED AS:  $\boxed{\oplus \ominus 0.1}$

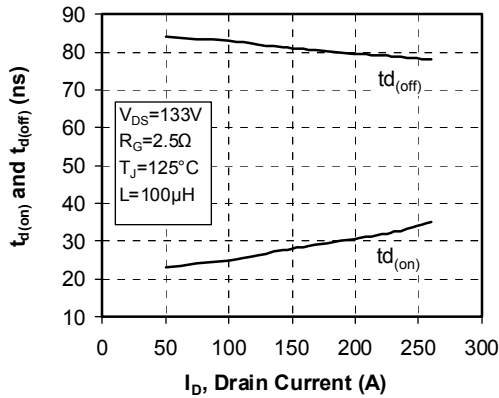
See application note APT0501 - Mounting Instructions for SP4 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical Performance Curve

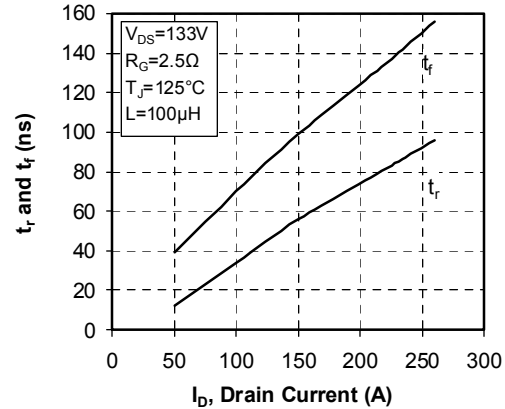




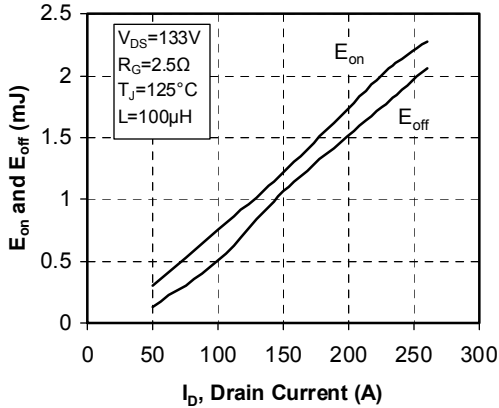
**Delay Times vs Current**



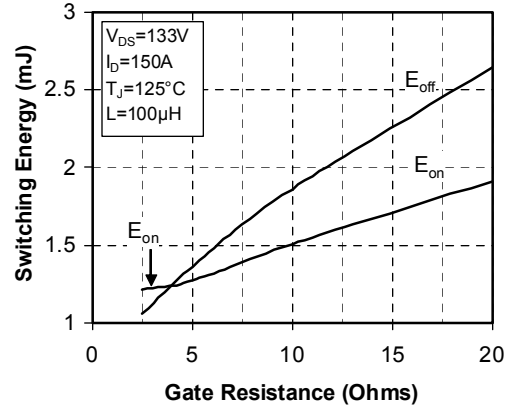
**Rise and Fall times vs Current**



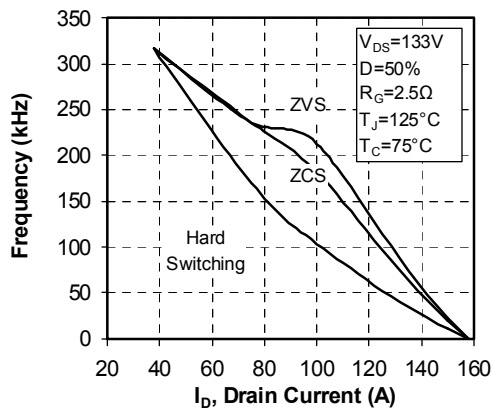
**Switching Energy vs Current**



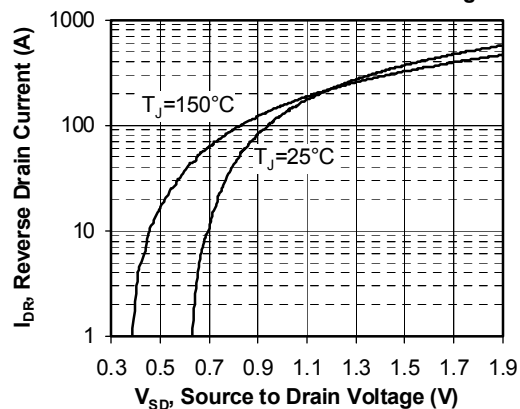
**Switching Energy vs Gate Resistance**



**Operating Frequency vs Drain Current**



**Source to Drain Diode Forward Voltage**



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