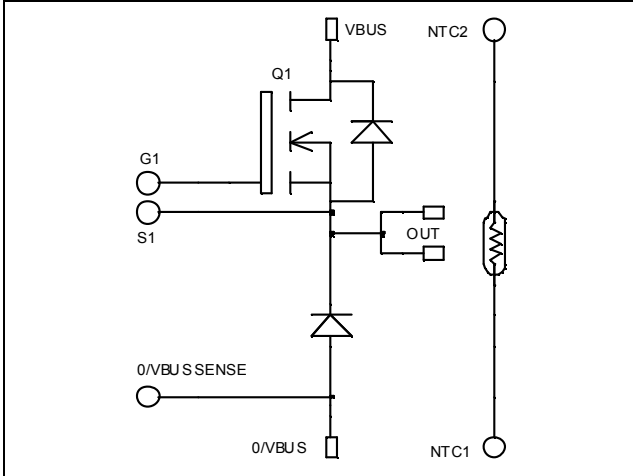


## Buck chopper MOSFET Power Module

$V_{DSS} = 500V$   
 $R_{DSon} = 38m\Omega \text{ typ @ } T_j = 25^\circ C$   
 $I_D = 90A \text{ @ } T_c = 25^\circ C$

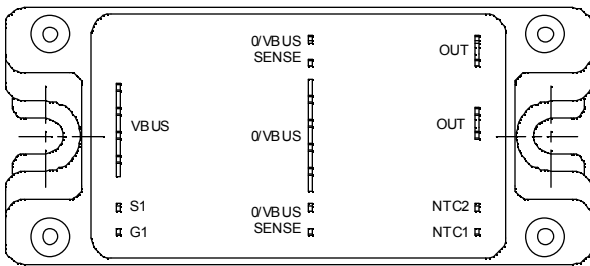


### Application

- AC and DC motor control
- Switched Mode Power Supplies

### Features

- Power MOS 7<sup>®</sup> MOSFETs
  - Low  $R_{DSon}$
  - Low input and Miller capacitance
  - Low gate charge
  - 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                  | 500                | V         |
| $I_D$      | Continuous Drain Current                          | $T_c = 25^\circ C$ | 90        |
|            |   | $T_c = 80^\circ C$ | 67        |
| $I_{DM}$   | Pulsed Drain current                              | 360                |           |
| $V_{GS}$   | Gate - Source Voltage                             | $\pm 30$           | V         |
| $R_{DSon}$ | Drain - Source ON Resistance                      | 45                 | $m\Omega$ |
| $P_D$      | Maximum Power Dissipation                         | $T_c = 25^\circ C$ | 694       |
| $I_{AR}$   | Avalanche current (repetitive and non repetitive) | 46                 | 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 | $V_{GS} = 0V, V_{DS} = 500V$        |     |     | 200       | $\mu\text{A}$    |
|              |                                 | $V_{GS} = 0V, V_{DS} = 400V$        |     |     | 1000      |                  |
| $R_{DS(on)}$ | Drain – Source on Resistance    | $V_{GS} = 10V, I_D = 45A$           |     | 38  | 45        | $\text{m}\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage          | $V_{GS} = V_{DS}, I_D = 5\text{mA}$ | 3   |     | 5         | V                |
| $I_{GSS}$    | Gate – Source Leakage Current   | $V_{GS} = \pm 30V, V_{DS} = 0V$     |     |     | $\pm 150$ | nA               |

**Dynamic Characteristics**

| Symbol       | Characteristic               | Test Conditions   | Min | Typ  | Max | Unit          |
|--------------|------------------------------|---|-----|------|-----|---------------|
| $C_{iss}$    | Input Capacitance            | $V_{GS} = 0V$   |     | 11.2 |     | nF            |
| $C_{oss}$    | Output Capacitance           | $V_{DS} = 25V$  |     | 2.4  |     |               |
| $C_{rss}$    | Reverse Transfer Capacitance | $f = 1\text{MHz}$   |     | 0.18 |     |               |
| $Q_g$        | Total gate Charge            | $V_{GS} = 10V$  |     | 246  |     | nC            |
| $Q_{gs}$     | Gate – Source Charge         | $V_{Bus} = 250V$  |     | 66   |     |               |
| $Q_{gd}$     | Gate – Drain Charge          | $I_D = 90A$   |     | 130  |     |               |
| $T_{d(on)}$  | Turn-on Delay Time           | <b>Inductive switching @ <math>125^\circ\text{C}</math></b><br>$V_{GS} = 15V$<br>$V_{Bus} = 333V$<br>$I_D = 90A$<br>$R_G = 2\Omega$ |     | 18   |     | ns            |
| $T_r$        | Rise Time                    |   |     | 35   |     |               |
| $T_{d(off)}$ | Turn-off Delay Time          |   |     | 87   |     |               |
| $T_f$        | Fall Time                    |   |     | 77   |     |               |
| $E_{on}$     | Turn-on Switching Energy     | <b>Inductive switching @ <math>25^\circ\text{C}</math></b><br>$V_{GS} = 15V, V_{Bus} = 333V$<br>$I_D = 90A, R_G = 2\Omega$          |     | 1510 |     | $\mu\text{J}$ |
| $E_{off}$    | Turn-off Switching Energy    |   |     | 1452 |     |               |
| $E_{on}$     | Turn-on Switching Energy     | <b>Inductive switching @ <math>125^\circ\text{C}</math></b><br>$V_{GS} = 15V, V_{Bus} = 333V$<br>$I_D = 90A, R_G = 2\Omega$         |     | 2482 |     | $\mu\text{J}$ |
| $E_{off}$    | Turn-off Switching Energy    |   |     | 1692 |     |               |

**Chopper diode ratings and characteristics**

| Symbol    | Characteristic                          | Test Conditions             | Min                       | Typ | Max | Unit          |
|-----------|---|-----------------------------|---------------------------|-----|-----|---------------|
| $V_{RRM}$ | Maximum Peak Repetitive Reverse Voltage |                             | 600                       |     |     | V             |
| $I_{RM}$  | Maximum Reverse Leakage Current         | $V_R = 600V$                | $T_j = 25^\circ\text{C}$  |     | 250 | $\mu\text{A}$ |
|           |   |                             | $T_j = 125^\circ\text{C}$ |     | 500 |               |
| $I_F$     | DC Forward Current                      |                             |                           | 60  |     | A             |
| $V_F$     | Diode Forward Voltage                   | $I_F = 60A$                 |                           | 1.6 | 1.8 | V             |
|           |   | $I_F = 120A$                |                           | 1.9 |     |               |
|           |   | $I_F = 60A$                 | $T_j = 125^\circ\text{C}$ |     | 1.4 |               |
| $t_{rr}$  | Reverse Recovery Time                   | $I_F = 60A$<br>$V_R = 400V$ | $T_j = 25^\circ\text{C}$  |     | 130 | ns            |
|           |   |                             | $T_j = 125^\circ\text{C}$ |     | 170 |               |
| $Q_{rr}$  | Reverse Recovery Charge                 | $di/dt = 200A/\mu\text{s}$  | $T_j = 25^\circ\text{C}$  |     | 220 | nC            |
|           |   |                             | $T_j = 125^\circ\text{C}$ |     | 920 |               |

## Thermal and package characteristics

*Symbol Characteristic*

|                   |  | <i>Min</i>  | <i>Typ</i> | <i>Max</i> | <i>Unit</i> |     |
|-------------------|--|-------------|------------|------------|-------------|-----|
| R <sub>thJC</sub> | Junction to Case Thermal Resistance  | Transistor  |            | 0.18       | °C/W        |     |
|                   |  | Diode       |            | 0.9        |             |     |
| 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).

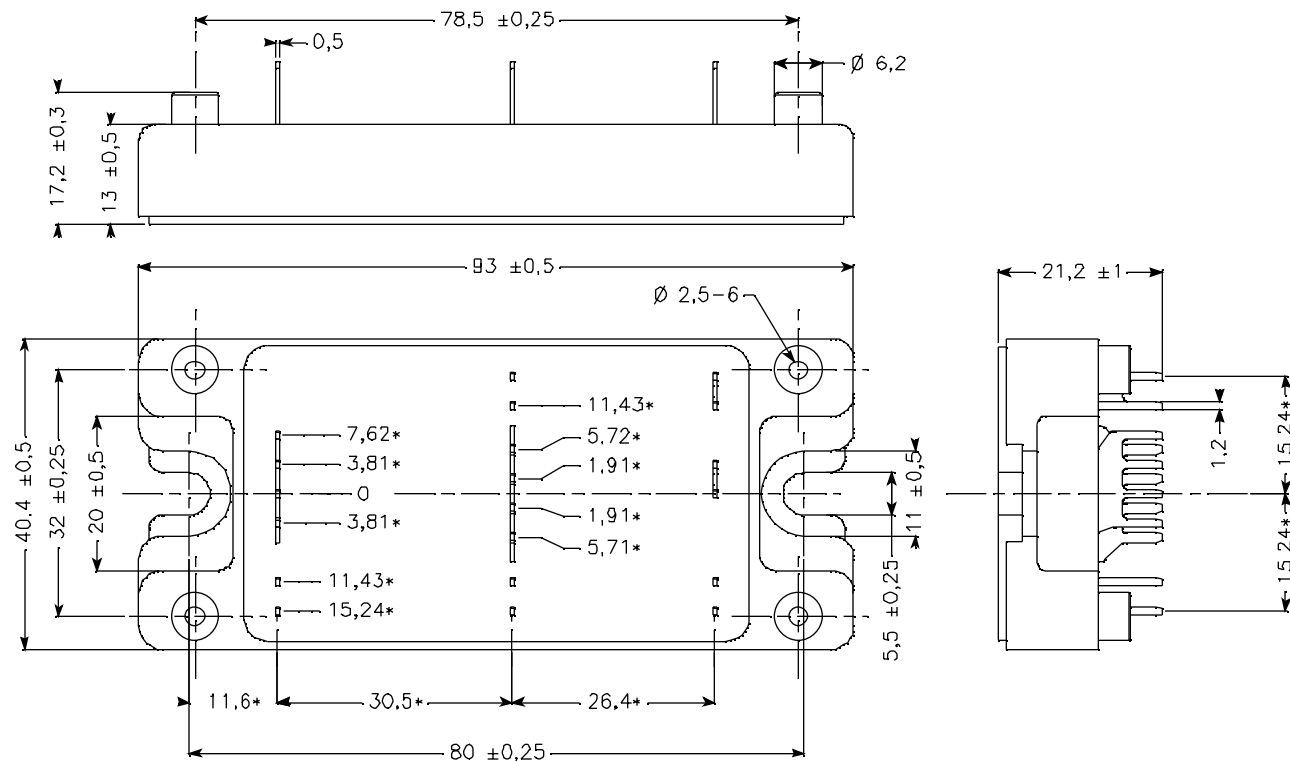
*Symbol Characteristic*

|                    |                            | <i>Min</i> | <i>Typ</i> | <i>Max</i> | <i>Unit</i> |
|--------------------|----------------------------|------------|------------|------------|-------------|
| 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

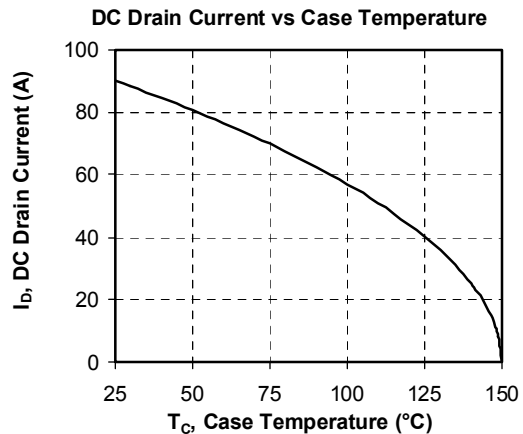
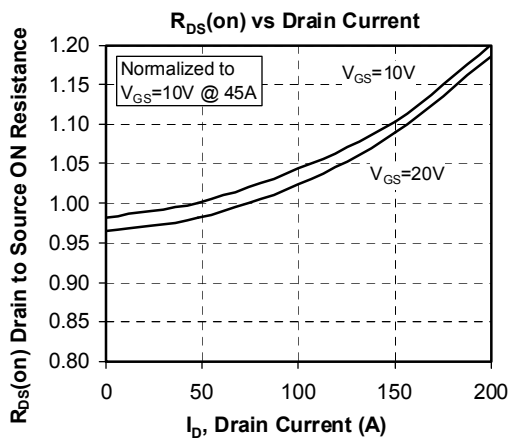
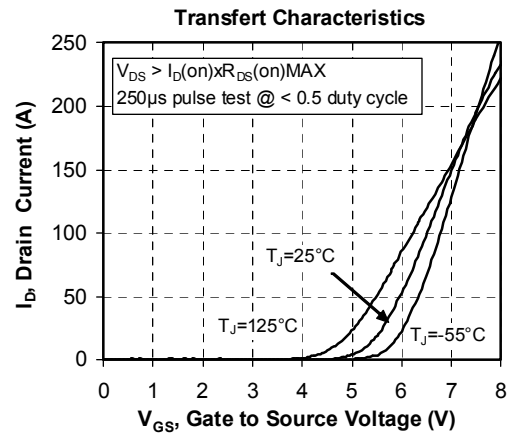
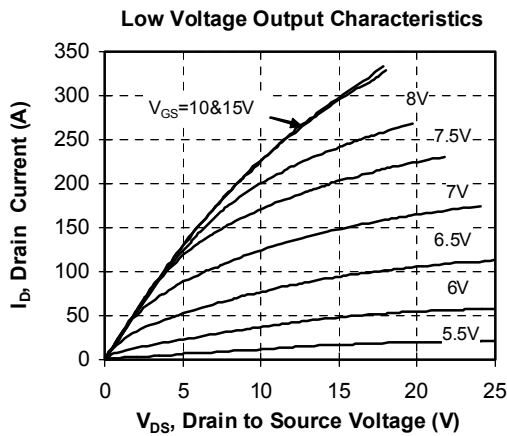
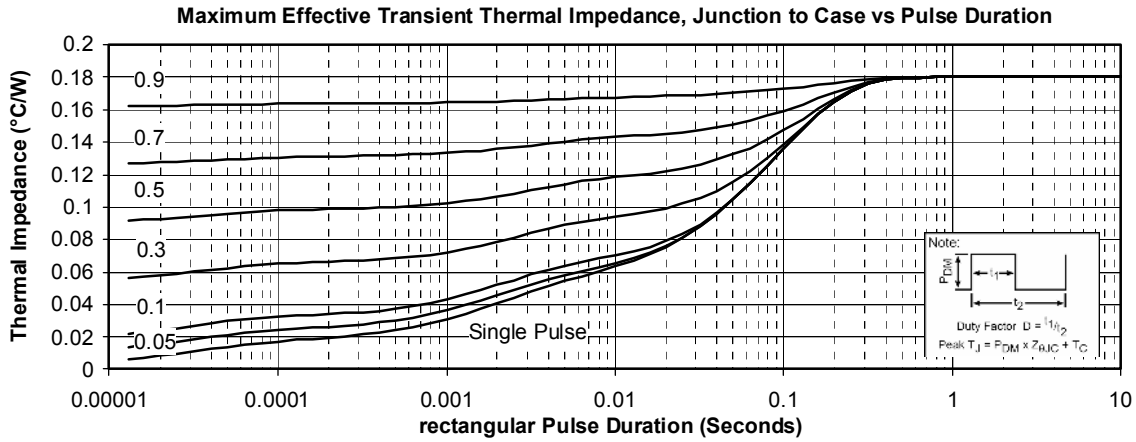
## SP4 Package outline (dimensions in mm)

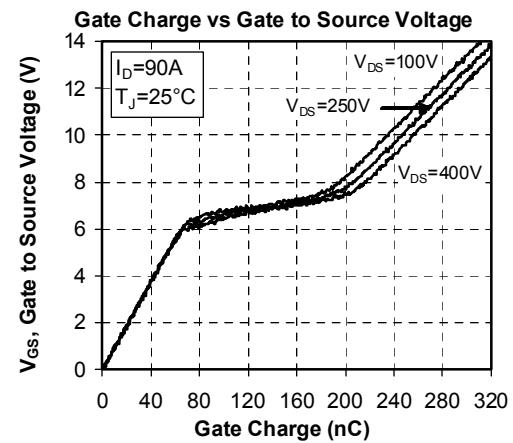
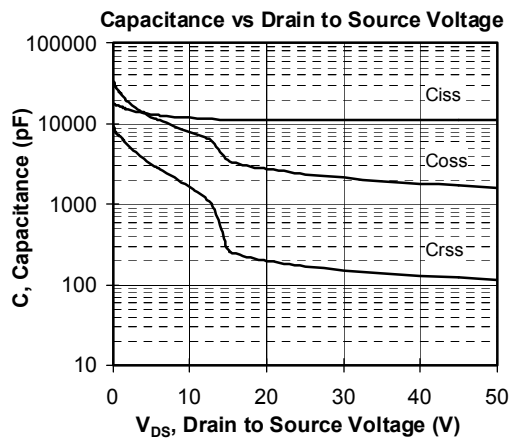
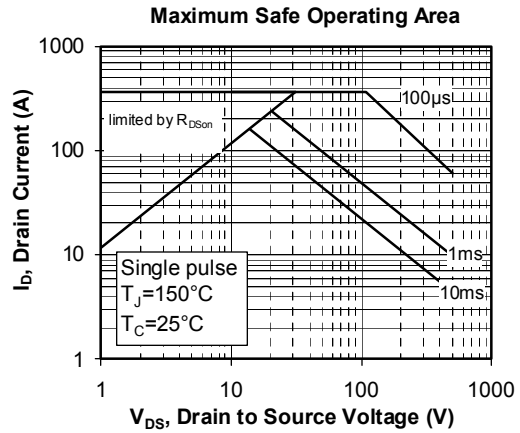
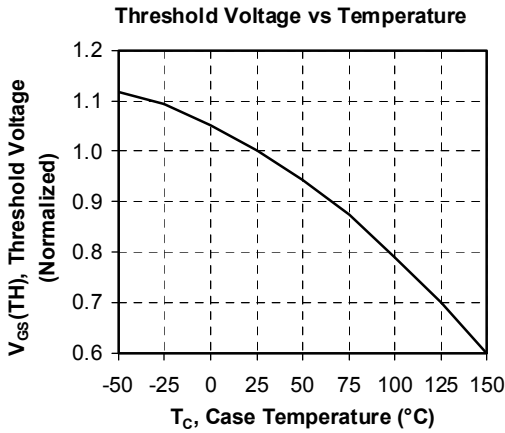
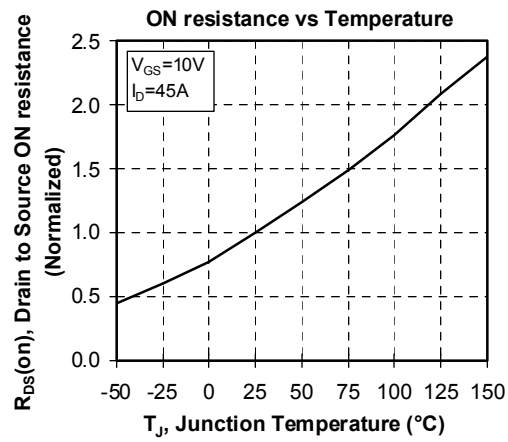
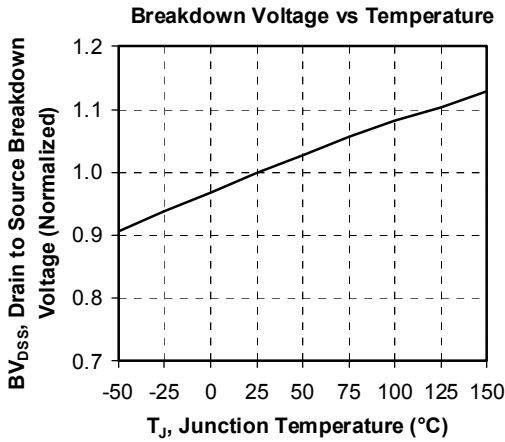


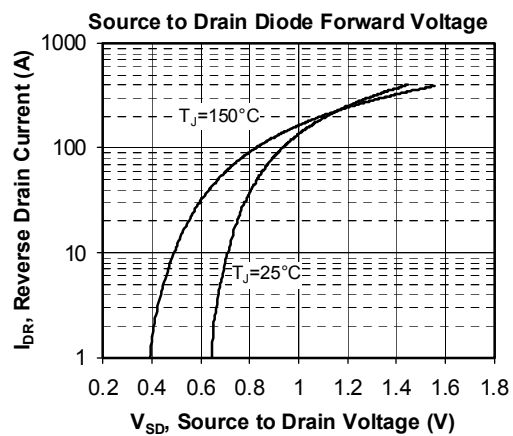
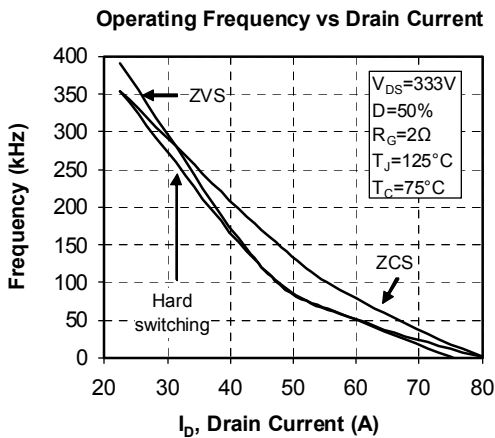
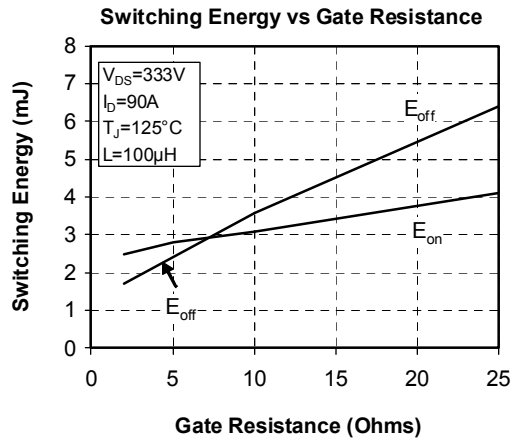
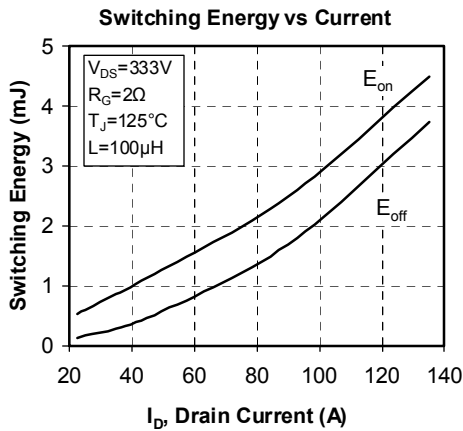
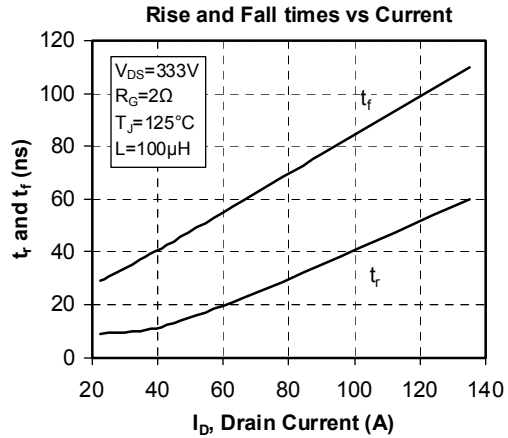
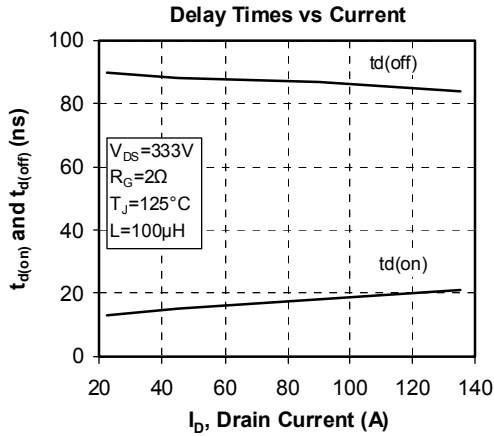
ALL DIMENSIONS MARKED "\*" ARE TOLERANCED AS:  $\boxed{\oplus \ominus 0.1}$

See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

## Typical Performance Curve







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