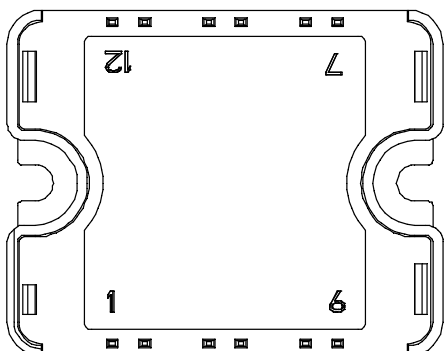
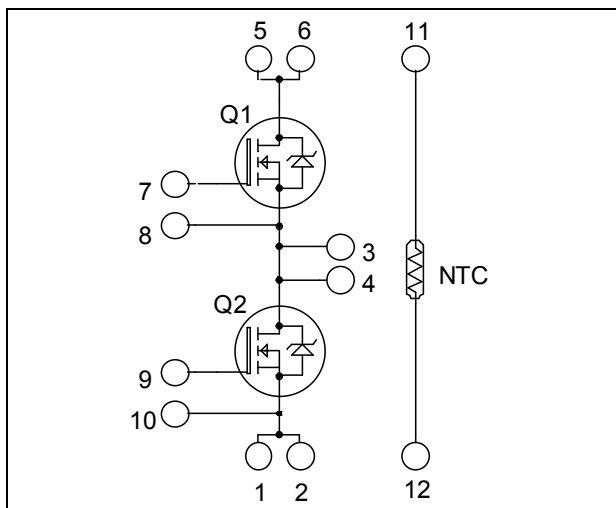


## Phase leg Super Junction MOSFET Power Module

$$V_{DSS} = 600V$$

$$R_{DSon} = 45m\Omega \text{ max @ } T_j = 25^\circ C$$

$$I_D = 49A \text{ @ } T_c = 25^\circ C$$



Pins 1/2 ; 3/4 ; 5/6 must be shorted together

### Application

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

### Features

- **COOLMOS** Power Semiconductors
  - Ultra low  $R_{DSon}$
  - Low Miller capacitance
  - Ultra low gate charge
  - Avalanche energy rated
  - Very rugged
- 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
- RoHS Compliant

### Absolute maximum ratings

| Symbol     | Parameter                                         | Max ratings                                          | Unit       |
|------------|---------------------------------------------------|------------------------------------------------------|------------|
| $V_{DSS}$  | Drain - Source Breakdown Voltage                  | 600                                                  | V          |
| $I_D$      | Continuous Drain Current                          | $T_c = 25^\circ C$<br>49<br>$T_c = 80^\circ C$<br>38 | A          |
| $I_{DM}$   | Pulsed Drain current                              | 130                                                  |            |
| $V_{GS}$   | Gate - Source Voltage                             | $\pm 20$                                             | V          |
| $R_{DSon}$ | Drain - Source ON Resistance                      | 45                                                   | m $\Omega$ |
| $P_D$      | Maximum Power Dissipation                         | $T_c = 25^\circ C$<br>250                            | W          |
| $I_{AR}$   | Avalanche current (repetitive and non repetitive) | 15                                                   | A          |
| $E_{AR}$   | Repetitive Avalanche Energy                       | 3                                                    | mJ         |
| $E_{AS}$   | Single Pulse Avalanche Energy                     | 1900                                                 |            |

**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 | $V_{GS} = 0V, V_{DS} = 600V$ $T_j = 25^\circ\text{C}$  |     |     | 250 | $\mu\text{A}$    |
|              |                                 | $V_{GS} = 0V, V_{DS} = 600V$ $T_j = 125^\circ\text{C}$ |     |     | 500 |                  |
| $R_{DS(on)}$ | Drain – Source on Resistance    | $V_{GS} = 10V, I_D = 24.5A$                            |     | 40  | 45  | $\text{m}\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage          | $V_{GS} = V_{DS}, I_D = 3\text{mA}$                    | 2.1 | 3   | 3.9 | V                |
| $I_{GSS}$    | Gate – Source Leakage Current   | $V_{GS} = \pm 20V, V_{DS} = 0V$                        |     |     | 100 | nA               |

### Dynamic Characteristics

| Symbol       | Characteristic            | Test Conditions                                                                                                                     | Min | Typ  | Max | Unit          |
|--------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|---------------|
| $C_{iss}$    | Input Capacitance         | $V_{GS} = 0V ; V_{DS} = 25V$<br>$f = 1\text{MHz}$                                                                                   |     | 7.2  |     | nF            |
| $C_{oss}$    | Output Capacitance        |                                                                                                                                     |     | 8.5  |     |               |
| $Q_g$        | Total gate Charge         | $V_{GS} = 10V$<br>$V_{Bus} = 300V$<br>$I_D = 49A$                                                                                   |     | 150  |     | nC            |
| $Q_{gs}$     | Gate – Source Charge      |                                                                                                                                     |     | 34   |     |               |
| $Q_{gd}$     | Gate – Drain Charge       |                                                                                                                                     |     | 51   |     |               |
| $T_{d(on)}$  | Turn-on Delay Time        | <b>Inductive Switching (<math>125^\circ\text{C}</math>)</b><br>$V_{GS} = 10V$<br>$V_{Bus} = 400V$<br>$I_D = 49A$<br>$R_G = 5\Omega$ |     | 21   |     | ns            |
| $T_r$        | Rise Time                 |                                                                                                                                     |     | 30   |     |               |
| $T_{d(off)}$ | Turn-off Delay Time       |                                                                                                                                     |     | 100  |     |               |
| $T_f$        | Fall Time                 |                                                                                                                                     |     | 45   |     |               |
| $E_{on}$     | Turn-on Switching Energy  | <b>Inductive switching @ <math>25^\circ\text{C}</math></b><br>$V_{GS} = 10V ; V_{Bus} = 400V$<br>$I_D = 49A ; R_G = 5\Omega$        |     | 675  |     | $\mu\text{J}$ |
| $E_{off}$    | Turn-off Switching Energy |                                                                                                                                     |     | 520  |     |               |
| $E_{on}$     | Turn-on Switching Energy  | <b>Inductive switching @ <math>125^\circ\text{C}</math></b><br>$V_{GS} = 10V ; V_{Bus} = 400V$<br>$I_D = 49A ; R_G = 5\Omega$       |     | 1100 |     | $\mu\text{J}$ |
| $E_{off}$    | Turn-off Switching Energy |                                                                                                                                     |     | 635  |     |               |

### Source - Drain diode ratings and characteristics

| Symbol   | Characteristic                            | Test Conditions                                            | Min                      | Typ | Max | Unit          |
|----------|-------------------------------------------|------------------------------------------------------------|--------------------------|-----|-----|---------------|
| $I_S$    | Continuous Source current<br>(Body diode) | $T_c = 25^\circ\text{C}$                                   |                          | 49  |     | A             |
|          |                                           | $T_c = 80^\circ\text{C}$                                   |                          | 38  |     |               |
| $V_{SD}$ | Diode Forward Voltage                     | $V_{GS} = 0V, I_S = -49A$                                  |                          |     | 1.2 | V             |
| $dv/dt$  | Peak Diode Recovery ❶                     |                                                            |                          |     | 4   | V/ns          |
| $t_{rr}$ | Reverse Recovery Time                     | $I_S = -49A$<br>$V_R = 350V$<br>$di/dt = 100A/\mu\text{s}$ | $T_j = 25^\circ\text{C}$ | 600 |     | ns            |
| $Q_{rr}$ | Reverse Recovery Charge                   | $di/dt = 100A/\mu\text{s}$                                 | $T_j = 25^\circ\text{C}$ | 17  |     | $\mu\text{C}$ |

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

$I_S \leq -49A$      $di/dt \leq 100A/\mu\text{s}$      $V_R \leq V_{DSS}$      $T_j \leq 150^\circ\text{C}$

**Thermal and package characteristics**

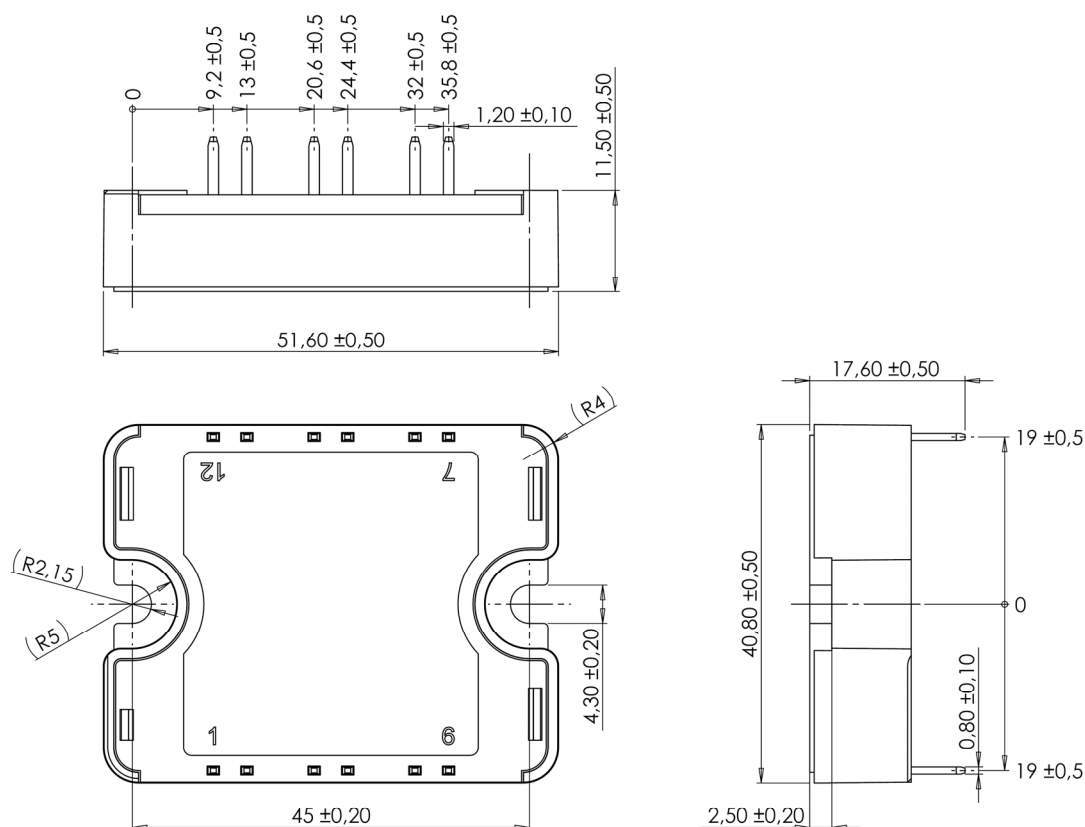
| Symbol            | Characteristic                                               | Min         | Typ | Max | Unit |
|-------------------|--------------------------------------------------------------|-------------|-----|-----|------|
| R <sub>thJC</sub> | Junction to Case Thermal Resistance                          |             |     | 0.5 | °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 | M4  | 2   | N.m  |
| Wt                | Package Weight                                               |             |     | 80  | 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    |

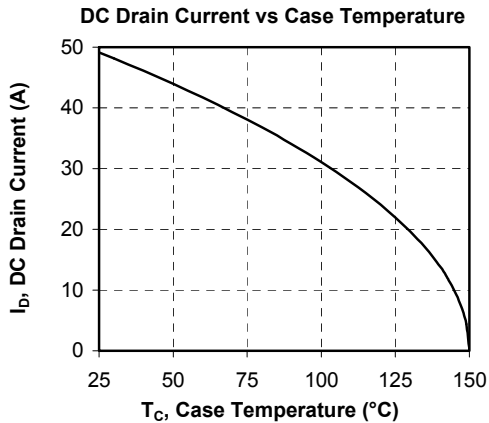
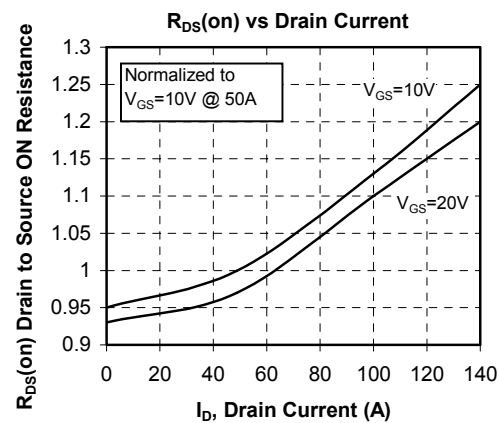
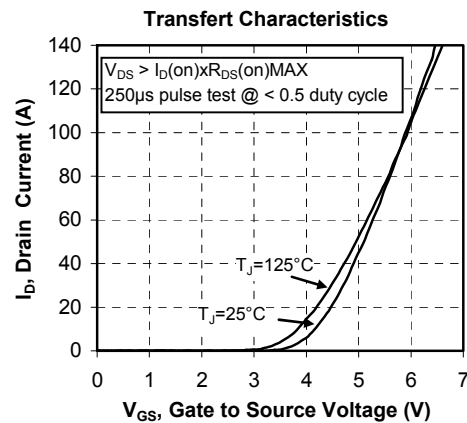
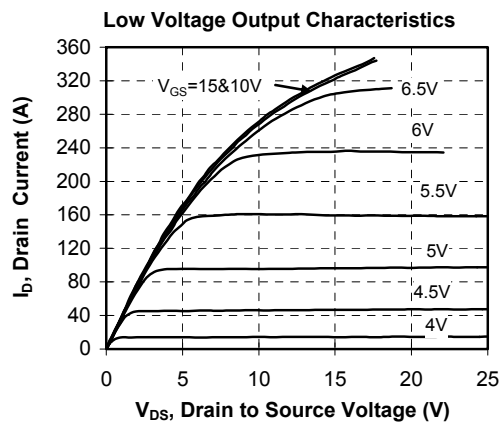
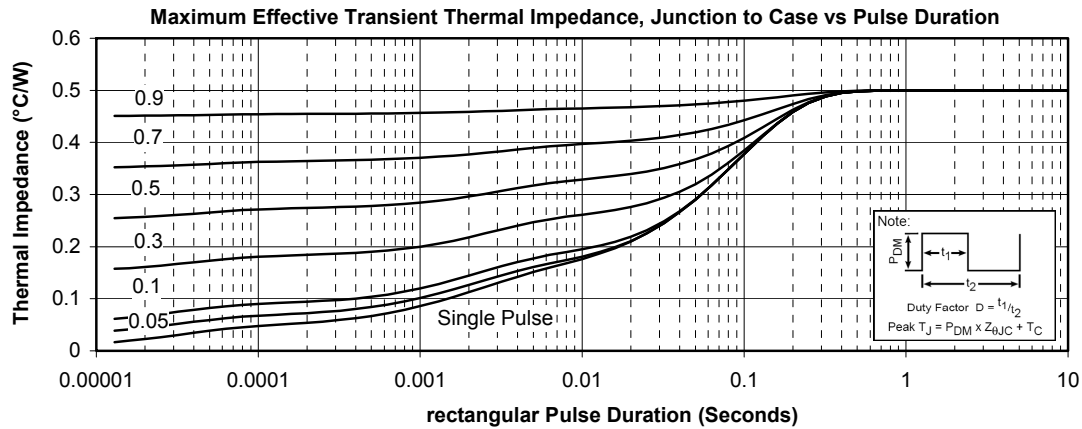
$$R_T = \frac{R_{25}}{\exp \left[ B_{25/85} \left( \frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

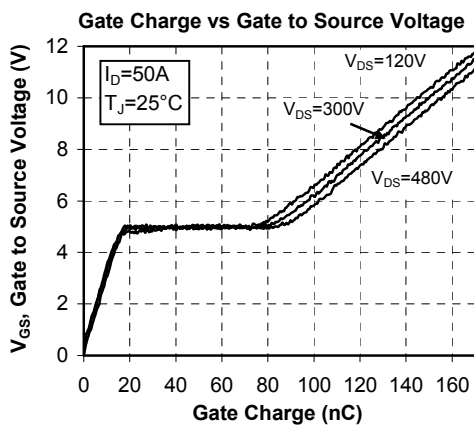
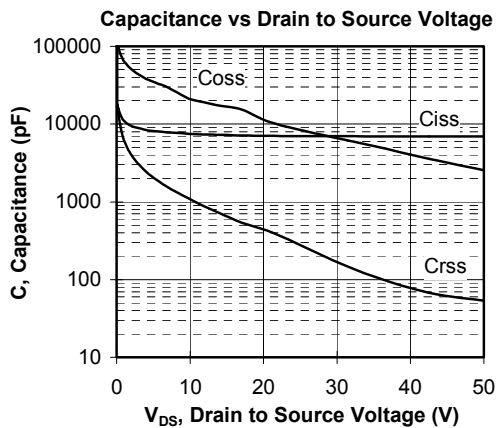
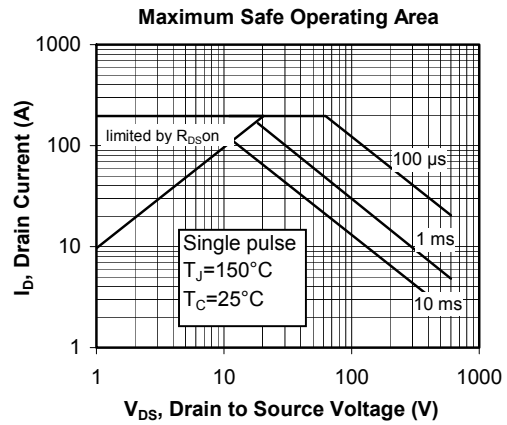
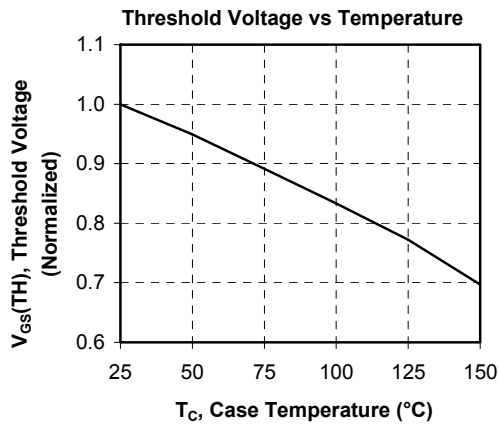
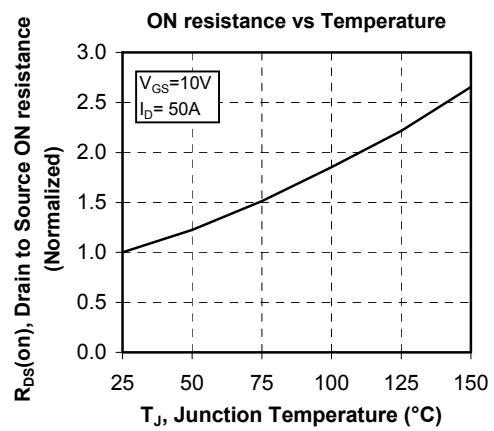
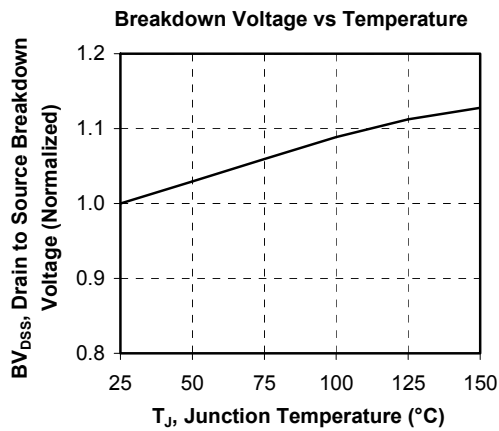
T: Thermistor temperature  
 R<sub>T</sub>: Thermistor value at T

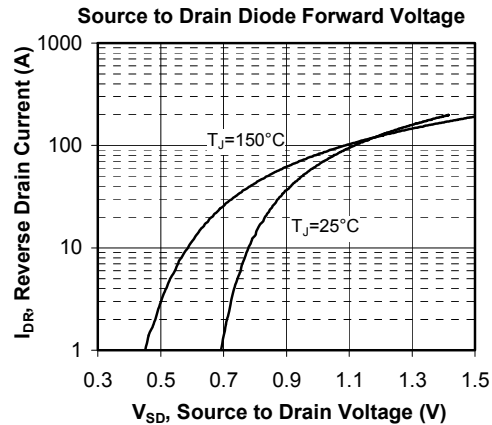
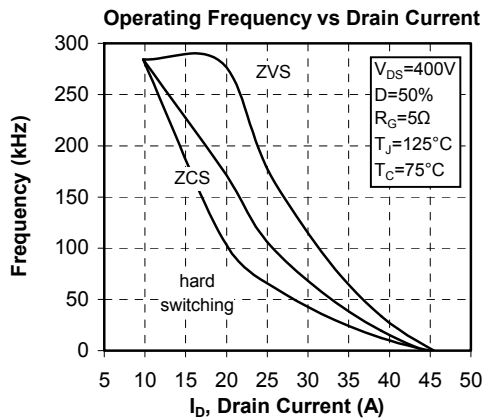
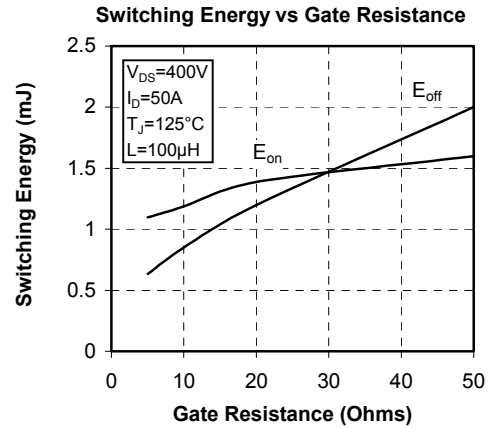
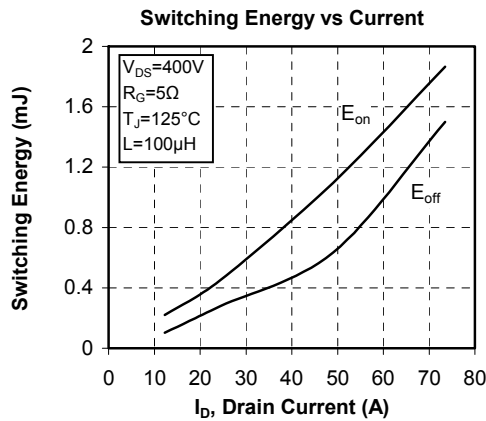
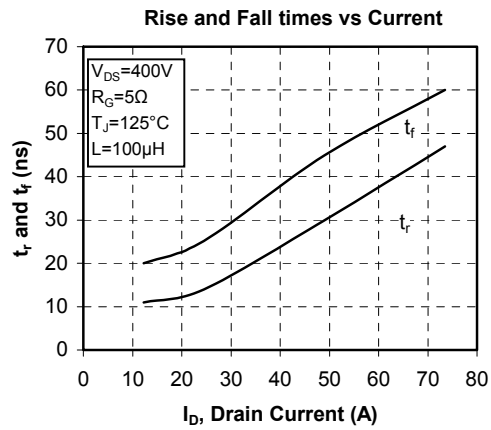
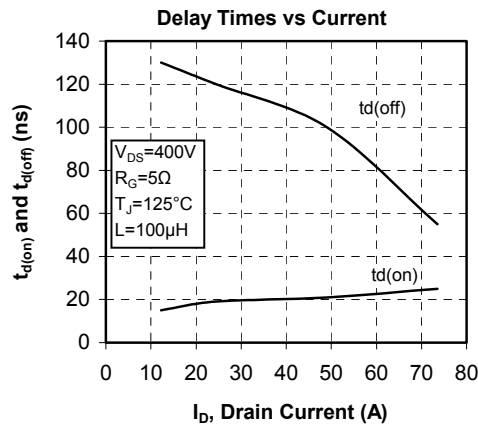
**SP1 Package outline** (dimensions in mm)


See application note 1904 - Mounting Instructions for SP1 Power Modules on [www.microsemi.com](http://www.microsemi.com)

## Typical Performance Curve







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