

## N-Channel 250 V (D-S) 175 °C MOSFET

| PRODUCT SUMMARY           |                        |       |
|---------------------------|------------------------|-------|
| $V_{DS}$ (V)              | 250                    |       |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 0.176 |
| $Q_g$ max. (nC)           | 68                     |       |
| $Q_{gs}$ (nC)             | 11                     |       |
| $Q_{gd}$ (nC)             | 35                     |       |
| Configuration             | Single                 |       |

### FEATURES

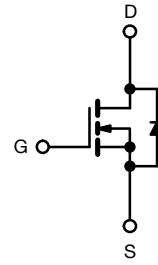
- Dynamic dV/dt rating
- Repetitive avalanche rated
- Fast switching
- Ease of paralleling
- Simple drive requirements



TO-252



Top View



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted) |                         |                         |                                   |             |          |
|---------------------------------------------------------------------------|-------------------------|-------------------------|-----------------------------------|-------------|----------|
| PARAMETER                                                                 |                         |                         | SYMBOL                            | LIMIT       | UNIT     |
| Drain-Source Voltage                                                      |                         |                         | V <sub>DS</sub>                   | 250         | V        |
| Gate-Source Voltage                                                       |                         |                         | V <sub>GS</sub>                   | ± 20        |          |
| Continuous Drain Current                                                  | V <sub>GS</sub> at 10 V | T <sub>C</sub> = 25 °C  | I <sub>D</sub>                    | 17          | A        |
|                                                                           |                         | T <sub>C</sub> = 100 °C |                                   | 11          |          |
| Pulsed Drain Current <sup>a</sup>                                         |                         |                         | I <sub>DM</sub>                   | 56          |          |
| Linear Derating Factor                                                    |                         |                         |                                   | 1.0         | W/°C     |
| Single Pulse Avalanche Energy <sup>b</sup>                                |                         |                         | E <sub>AS</sub>                   | 550         | mJ       |
| Repetitive Avalanche Current <sup>a</sup>                                 |                         |                         | I <sub>AR</sub>                   | 17          | A        |
| Repetitive Avalanche Energy <sup>a</sup>                                  |                         |                         | E <sub>AR</sub>                   | 13          | mJ       |
| Maximum Power Dissipation                                                 | T <sub>C</sub> = 25 °C  |                         | P <sub>D</sub>                    | 125         | W        |
| Peak Diode Recovery dV/dt <sup>c</sup>                                    |                         |                         | dV/dt                             | 4.8         | V/ns     |
| Operating Junction and Storage Temperature Range                          |                         |                         | T <sub>J</sub> , T <sub>stg</sub> | -55 to +150 | °C       |
| Soldering Recommendations (Peak temperature) <sup>d</sup>                 |                         | for 10 s                |                                   | 300         |          |
| Mounting Torque                                                           | 6-32 or M3 screw        |                         |                                   | 10          | lbf · in |
|                                                                           |                         |                         |                                   | 1.1         | N · m    |

### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DS} = 50\text{ V}$ , starting  $T_J = 25\text{ }^{\circ}\text{C}$ ,  $L = 4.5\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 14\text{ A}$  (see fig. 12).
- $I_{SD} \leq 14\text{ A}$ ,  $dI/dt \leq 150\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^{\circ}\text{C}$ .
- 1.6 mm from case.

**THERMAL RESISTANCE RATINGS**

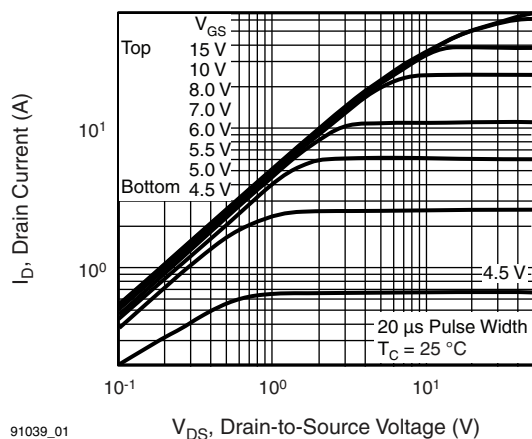
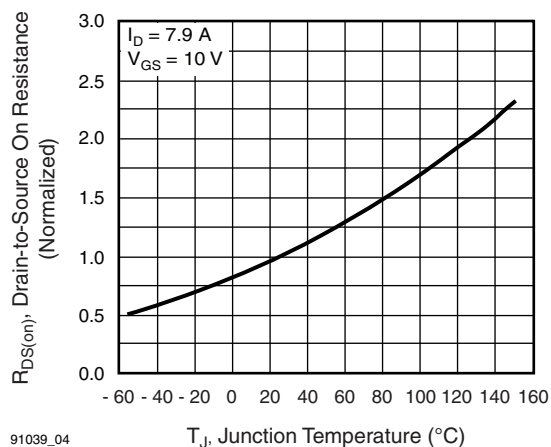
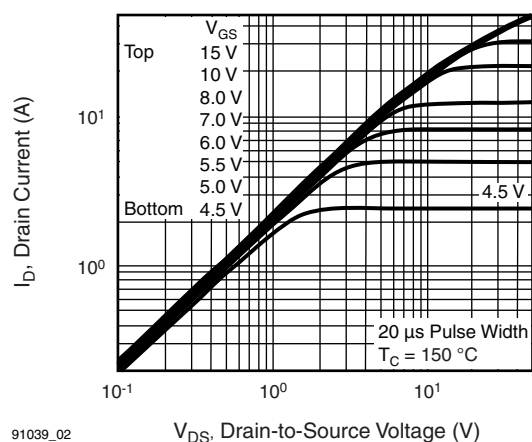
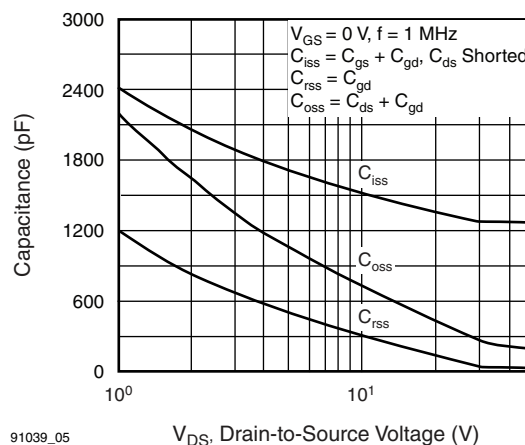
| PARAMETER                           | SYMBOL     | TYP. | MAX. | UNIT |
|-------------------------------------|------------|------|------|------|
| Maximum Junction-to-Ambient         | $R_{thJA}$ | -    | 62   | °C/W |
| Case-to-Sink, Flat, Greased Surface | $R_{thCS}$ | 0.50 | -    |      |
| Maximum Junction-to-Case (Drain)    | $R_{thJC}$ | -    | 1.0  |      |

**SPECIFICATIONS** ( $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

| PARAMETER                                      | SYMBOL              | TEST CONDITIONS                                                                                                                                                     | MIN. | TYP.  | MAX.      | UNIT                  |
|------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-----------|-----------------------|
| <b>Static</b>                                  |                     |                                                                                                                                                                     |      |       |           |                       |
| Drain-Source Breakdown Voltage                 | $V_{DS}$            | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                                              | 250  | -     | -         | V                     |
| $V_{DS}$ Temperature Coefficient               | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^{\circ}\text{C}$ , $I_D = 1\text{ mA}$                                                                                                     | -    | 0.34  | -         | V/ $^{\circ}\text{C}$ |
| Gate-Source Threshold Voltage                  | $V_{GS(th)}$        | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                                                  | 2.0  | -     | 4.0       | V                     |
| Gate-Source Leakage                            | $I_{GSS}$           | $V_{GS} = \pm 20\text{ V}$                                                                                                                                          | -    | -     | $\pm 100$ | nA                    |
| Zero Gate Voltage Drain Current                | $I_{DSS}$           | $V_{DS} = 250\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                                                     | -    | -     | 25        | $\mu\text{A}$         |
|                                                |                     | $V_{DS} = 200\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^{\circ}\text{C}$                                                                               | -    | -     | 250       |                       |
| Drain-Source On-State Resistance               | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$ , $I_D = 8.4\text{ A}^b$                                                                                                                     | -    | 0.176 | -         | $\Omega$              |
| Forward Transconductance                       | $g_{fs}$            | $V_{DS} = 50\text{ V}$ , $I_D = 8.4\text{ A}^b$                                                                                                                     | 6.7  | -     | -         | S                     |
| <b>Dynamic</b>                                 |                     |                                                                                                                                                                     |      |       |           |                       |
| Input Capacitance                              | $C_{iss}$           | $V_{GS} = 0\text{ V}$ ,<br>$V_{DS} = 25\text{ V}$ ,<br>$f = 1.0\text{ MHz}$ , see fig. 5                                                                            | -    | 1300  | -         | pF                    |
| Output Capacitance                             | $C_{oss}$           |                                                                                                                                                                     | -    | 330   | -         |                       |
| Reverse Transfer Capacitance                   | $C_{rss}$           |                                                                                                                                                                     | -    | 85    | -         |                       |
| Total Gate Charge                              | $Q_g$               | $V_{GS} = 10\text{ V}$ , $I_D = 7.9\text{ A}$ , $V_{DS} = 200\text{ V}$ ,<br>see fig. 6 and 13 <sup>b</sup>                                                         | -    | -     | 68        | nC                    |
| Gate-Source Charge                             | $Q_{gs}$            |                                                                                                                                                                     | -    | -     | 11        |                       |
| Gate-Drain Charge                              | $Q_{gd}$            |                                                                                                                                                                     | -    | -     | 35        |                       |
| Turn-On Delay Time                             | $t_{d(on)}$         | $V_{DD} = 125\text{ V}$ , $I_D = 7.9\text{ A}$ ,<br>$R_g = 9.1\text{ }\Omega$ , $R_D = 8.7\text{ }\Omega$ , see fig. 10 <sup>b</sup>                                | -    | 11    | -         | ns                    |
| Rise Time                                      | $t_r$               |                                                                                                                                                                     | -    | 24    | -         |                       |
| Turn-Off Delay Time                            | $t_{d(off)}$        |                                                                                                                                                                     | -    | 53    | -         |                       |
| Fall Time                                      | $t_f$               |                                                                                                                                                                     | -    | 49    | -         |                       |
| Internal Drain Inductance                      | $L_D$               | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact<br> | -    | 4.5   | -         | nH                    |
| Internal Source Inductance                     | $L_S$               |                                                                                                                                                                     | -    | 7.5   | -         |                       |
| Gate Input Resistance                          | $R_g$               | $f = 1\text{ MHz}$ , open drain                                                                                                                                     | 0.3  | -     | 1.2       | $\Omega$              |
| <b>Drain-Source Body Diode Characteristics</b> |                     |                                                                                                                                                                     |      |       |           |                       |
| Continuous Source-Drain Diode Current          | $I_S$               | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode<br>   | -    | -     | 14        | A                     |
| Pulsed Diode Forward Current <sup>a</sup>      | $I_{SM}$            |                                                                                                                                                                     | -    | -     | 56        |                       |
| Body Diode Voltage                             | $V_{SD}$            | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_S = 14\text{ A}$ , $V_{GS} = 0\text{ V}^b$                                                                                  | -    | -     | 1.8       | V                     |
| Body Diode Reverse Recovery Time               | $t_{rr}$            | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_F = 7.9\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}^b$                                                                    | -    | 250   | 500       | ns                    |
| Body Diode Reverse Recovery Charge             | $Q_{rr}$            |                                                                                                                                                                     | -    | 2.3   | 4.6       | $\mu\text{C}$         |
| Forward Turn-On Time                           | $t_{on}$            | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )                                                                                     |      |       |           |                       |

**Notes**

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).  
 b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

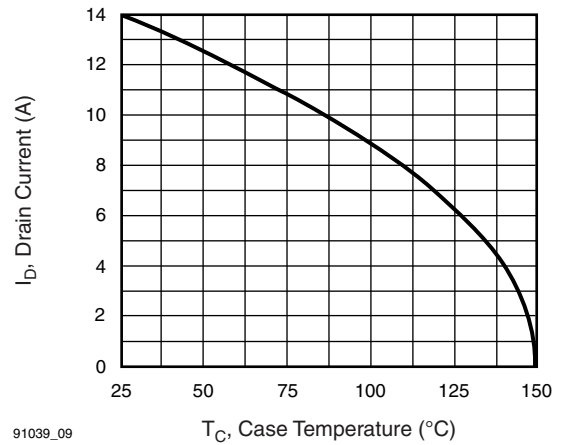
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Fig. 1 - Typical Output Characteristics,  $T_C = 25^\circ\text{C}$** 

**Fig. 4 - Normalized On-Resistance vs. Temperature**

**Fig. 2 - Typical Output Characteristics,  $T_C = 150^\circ\text{C}$** 

**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**

**Fig. 3 - Typical Transfer Characteristics**

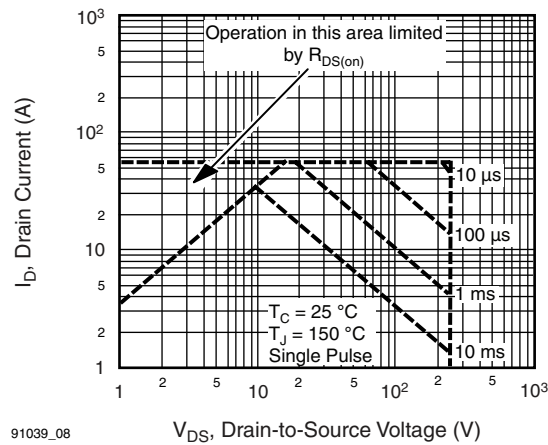
**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**



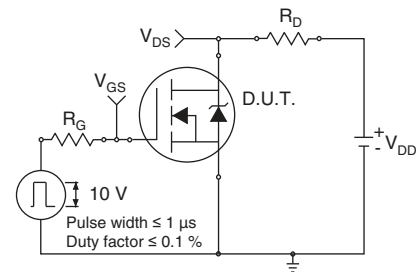
**Fig. 7 - Typical Source-Drain Diode Forward Voltage**



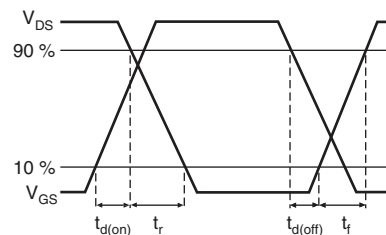
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



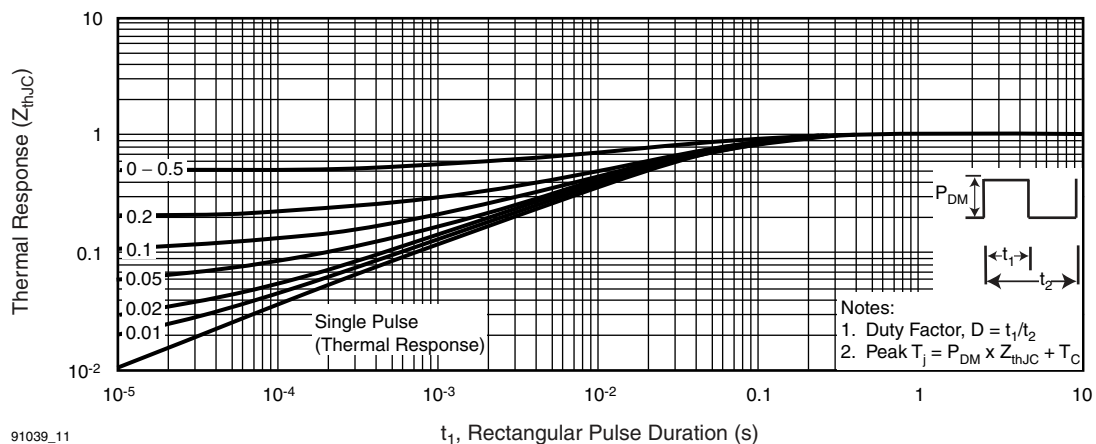
**Fig. 8 - Maximum Safe Operating Area**



**Fig. 10a - Switching Time Test Circuit**



**Fig. 10b - Switching Time Waveforms**



**Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**



Fig. 12a - Unclamped Inductive Test Circuit



Fig. 12b - Unclamped Inductive Waveforms

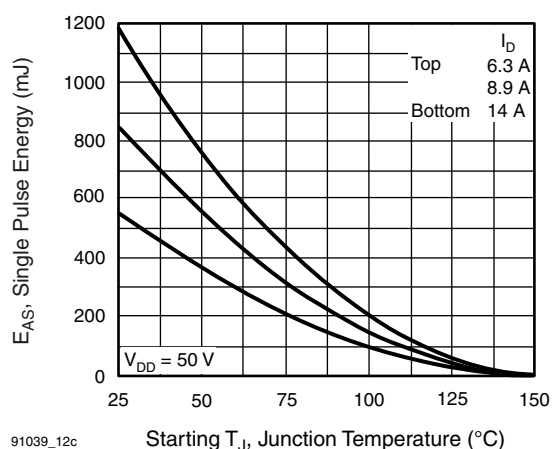


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

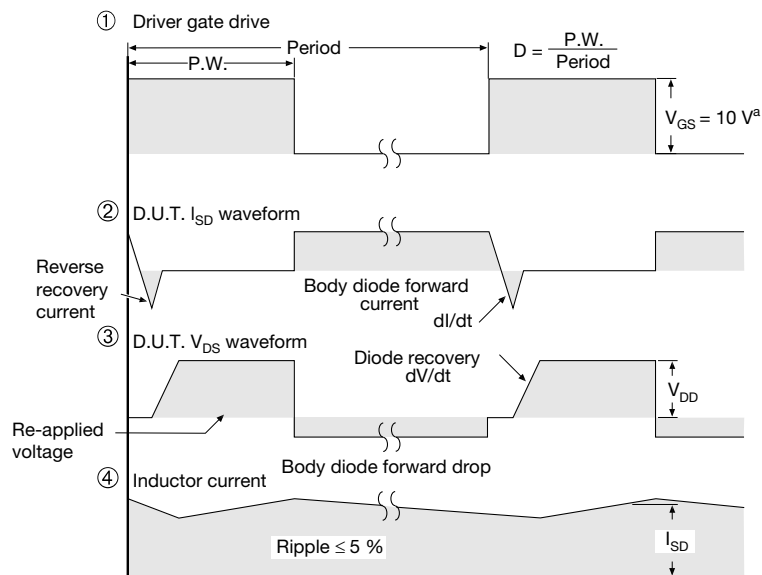


Fig. 13a - Basic Gate Charge Waveform



Fig. 13b - Gate Charge Test Circuit

### Peak Diode Recovery dV/dt Test Circuit



**Note**

a.  $V_{GS} = 5V$  for logic level devices

**Fig. 14 - For N-Channel**

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