

## N-Channel 200 V (D-S) MOSFET

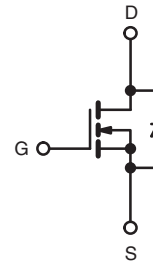
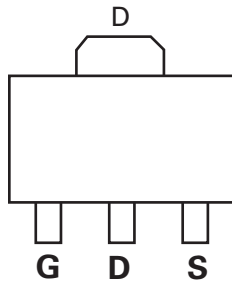
| PRODUCT SUMMARY           |                        |     |
|---------------------------|------------------------|-----|
| $V_{DS}$ (V)              | 200                    |     |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 1.6 |
| $Q_g$ (Max.) (nC)         | 8.2                    |     |
| $Q_{gs}$ (nC)             | 1.8                    |     |
| $Q_{gd}$ (nC)             | 4.5                    |     |
| Configuration             | Single                 |     |

### FEATURES

- Available in tape and reel
- Dynamic dV/dt rating
- Repetitive avalanche rated
- Fast switching
- Ease of paralleling
- Simple drive requirements



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available



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>                   | 200         | 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>                    | 1.0         | A    |
|                                                                           |                         | T <sub>C</sub> = 100 °C |                                   | 0.6         |      |
| Pulsed Drain Current <sup>a</sup>                                         |                         |                         | I <sub>DM</sub>                   | 3.7         | W/°C |
| Linear Derating Factor                                                    |                         |                         |                                   | 0.025       |      |
| Linear Derating Factor (PCB Mount) <sup>e</sup>                           |                         |                         |                                   | 0.017       |      |
| Single Pulse Avalanche Energy <sup>b</sup>                                |                         |                         | E <sub>AS</sub>                   | 50          | mJ   |
| Repetitive Avalanche Current <sup>a</sup>                                 |                         |                         | I <sub>AR</sub>                   | 0.96        | A    |
| Repetitive Avalanche Energy <sup>a</sup>                                  |                         |                         | E <sub>AR</sub>                   | 0.31        | mJ   |
| Maximum Power Dissipation                                                 | T <sub>C</sub> = 25 °C  |                         | P <sub>D</sub>                    | 3.1         | W    |
| Maximum Power Dissipation (PCB Mount) <sup>e</sup>                        | T <sub>A</sub> = 25 °C  |                         |                                   | 2.0         |      |
| Peak Diode Recovery dV/dt <sup>c</sup>                                    |                         |                         | dV/dt                             | 5.0         | 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         |      |

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 81\text{ mH}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AS} = 0.96\text{ A}$  (see fig. 12).
- $I_{SD} \leq 3.3\text{ A}$ ,  $dI/dt \leq 70\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

**THERMAL RESISTANCE RATINGS**

| PARAMETER                                            | SYMBOL     | MIN. | TYP. | MAX. | UNIT |
|------------------------------------------------------|------------|------|------|------|------|
| Maximum Junction-to-Ambient (PCB Mount) <sup>a</sup> | $R_{thJA}$ | -    | -    | 40   | °C/W |
| Maximum Junction-to-Case (Drain)                     | $R_{thJC}$ | -    | -    | 60   |      |

**Note**

a. When mounted on 1" square PCB (FR-4 or G-10 material).

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

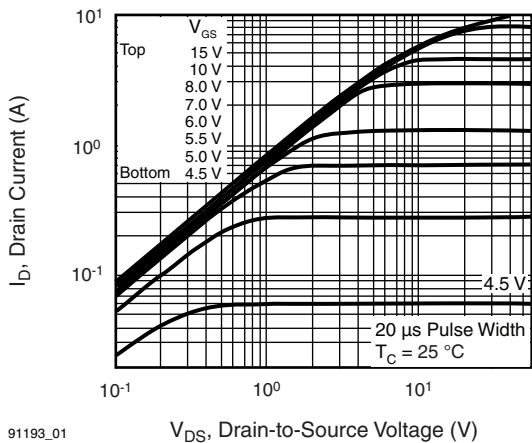
| PARAMETER                                 | SYMBOL              | TEST CONDITIONS                                                                                                                    |                                                                                    | MIN. | TYP. | MAX.      | UNIT                        |
|-------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------|------|-----------|-----------------------------|
| Static                                    |                     |                                                                                                                                    |                                                                                    |      |      |           |                             |
| Drain-Source Breakdown Voltage            | $V_{DS}$            | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                                             |                                                                                    | 200  | -    | -         | V                           |
| $V_{DS}$ Temperature Coefficient          | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^{\circ}\text{C}$ , $I_D = 1\text{ mA}$                                                                    |                                                                                    | -    | 0.30 | -         | $\text{V}/^{\circ}\text{C}$ |
| 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           | $I_{DSS}$           | $V_{DS} = 200\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                    |                                                                                    | -    | -    | 25        | $\mu\text{A}$               |
|                                           |                     | $V_{DS} = 160\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^{\circ}\text{C}$                                              |                                                                                    | -    | -    | 250       |                             |
| Drain-Source On-State Resistance          | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$                                                                                                             | $I_D = 0.58\text{ A}^b$                                                            | -    | 1.6  | -         | $\Omega$                    |
| Forward Transconductance                  | $g_{fs}$            | $V_{DS} = 50\text{ V}$ , $I_D = 0.58\text{ A}$                                                                                     |                                                                                    | 0.51 | -    | -         | S                           |
| Dynamic                                   |                     |                                                                                                                                    |                                                                                    |      |      |           |                             |
| Input Capacitance                         | $C_{iss}$           | $V_{GS} = 0\text{ V}$ ,<br>$V_{DS} = 25\text{ V}$ ,<br>$f = 1.0\text{ MHz}$ , see fig. 5                                           |                                                                                    | -    | 140  | -         | pF                          |
| Output Capacitance                        | $C_{oss}$           |                                                                                                                                    |                                                                                    | -    | 53   | -         |                             |
| Reverse Transfer Capacitance              | $C_{rss}$           |                                                                                                                                    |                                                                                    | -    | 15   | -         |                             |
| Total Gate Charge                         | $Q_g$               | $V_{GS} = 10\text{ V}$                                                                                                             | $I_D = 3.3\text{ A}$ , $V_{DS} = 160\text{ V}$ ,<br>see fig. 6 and 13 <sup>b</sup> | -    | -    | 8.2       | nC                          |
| Gate-Source Charge                        | $Q_{gs}$            |                                                                                                                                    |                                                                                    | -    | -    | 1.8       |                             |
| Gate-Drain Charge                         | $Q_{gd}$            |                                                                                                                                    |                                                                                    | -    | -    | 4.5       |                             |
| Turn-On Delay Time                        | $t_{d(on)}$         | $V_{DD} = 100\text{ V}$ , $I_D = 3.3\text{ A}$ ,<br>$R_g = 24\text{ }\Omega$ , $R_D = 30\text{ }\Omega$ , see fig. 10 <sup>b</sup> |                                                                                    | -    | 8.2  | -         | ns                          |
| Rise Time                                 | $t_r$               |                                                                                                                                    |                                                                                    | -    | 17   | -         |                             |
| Turn-Off Delay Time                       | $t_{d(off)}$        |                                                                                                                                    |                                                                                    | -    | 14   | -         |                             |
| Fall Time                                 | $t_f$               |                                                                                                                                    |                                                                                    | -    | 8.9  | -         |                             |
| Internal Drain Inductance                 | $L_D$               | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact                                                         |                                                                                    | -    | 4.0  | -         | nH                          |
| Internal Source Inductance                | $L_S$               |                                                                                                                                    |                                                                                    | -    | 6.0  | -         |                             |
| Drain-Source Body Diode Characteristics   |                     |                                                                                                                                    |                                                                                    |      |      |           |                             |
| Continuous Source-Drain Diode Current     | $I_S$               | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode                                                           |                                                                                    | -    | -    | 0.96      | A                           |
| Pulsed Diode Forward Current <sup>a</sup> | $I_{SM}$            |                                                                                                                                    |                                                                                    | -    | -    | 7.7       |                             |
| Body Diode Voltage                        | $V_{SD}$            | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_S = 0.96\text{ A}$ , $V_{GS} = 0\text{ V}^b$                                               |                                                                                    | -    | -    | 2.0       | V                           |
| Body Diode Reverse Recovery Time          | $t_{rr}$            | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_F = 3.3\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}^b$                                   |                                                                                    | -    | 150  | 310       | ns                          |
| Body Diode Reverse Recovery Charge        | $Q_{rr}$            |                                                                                                                                    |                                                                                    | -    | 0.60 | 1.4       | $\mu\text{C}$               |
| Forward Turn-On Time                      | $t_{on}$            | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )                                                    |                                                                                    |      |      |           |                             |

**Notes**

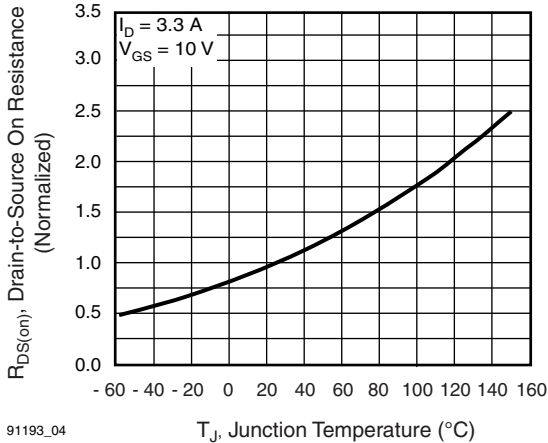
a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).

b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

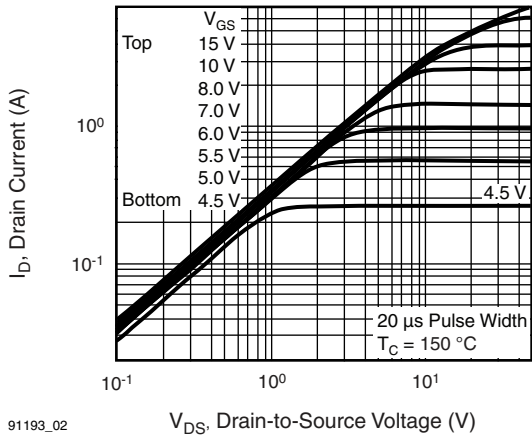
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



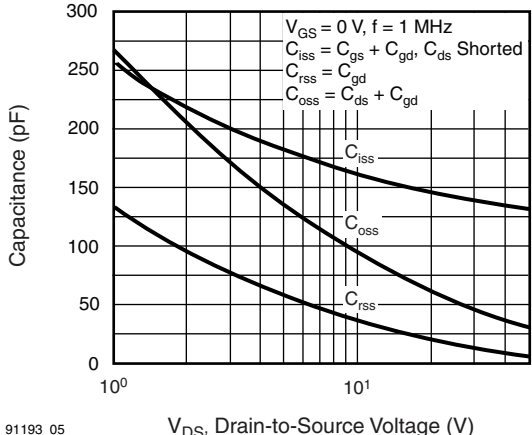
**Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^{\circ}\text{C}$**



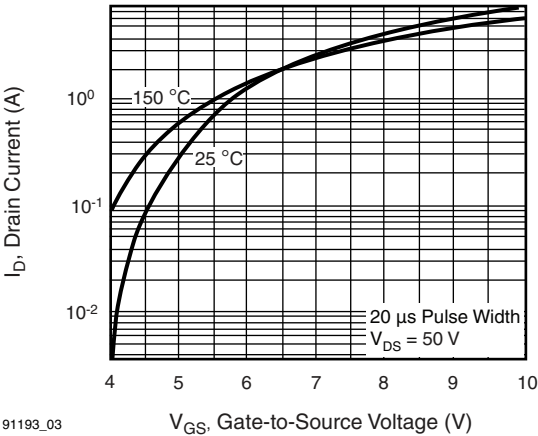
**Fig. 4 - Normalized On-Resistance vs. Temperature**



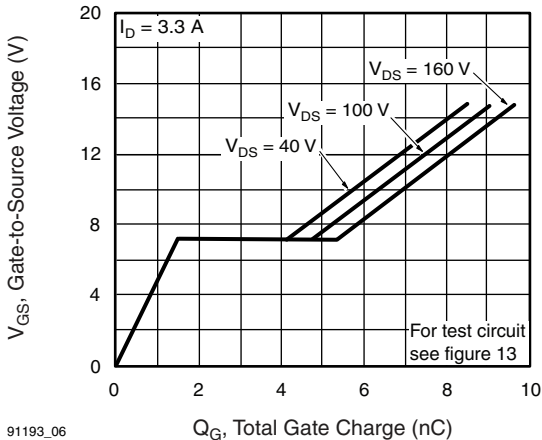
**Fig. 2 - Typical Output Characteristics,  $T_C = 150\text{ }^{\circ}\text{C}$**



**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

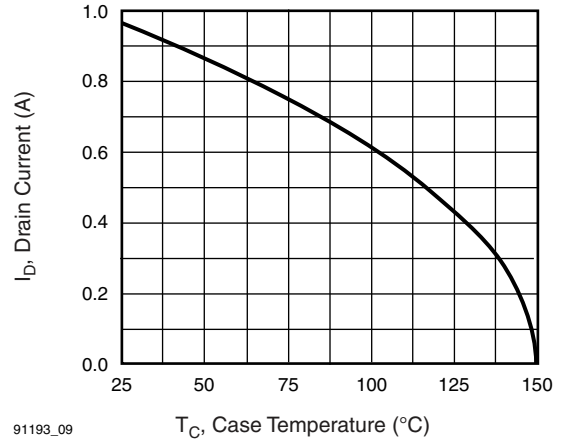


Fig. 9 - Maximum Drain Current vs. Case Temperature

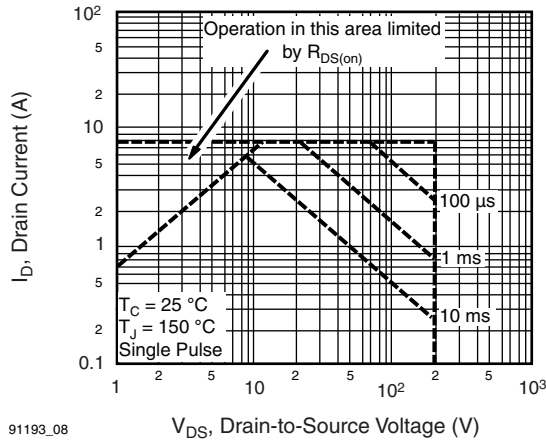


Fig. 8 - Maximum Safe Operating Area

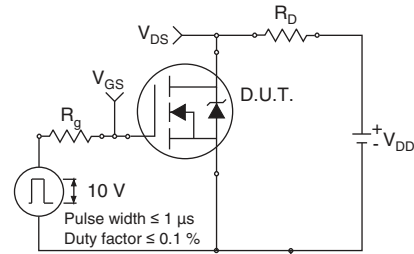


Fig. 10a - Switching Time Test Circuit

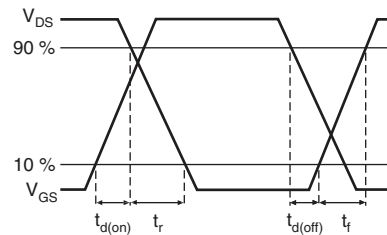


Fig. 10b - Switching Time Waveforms

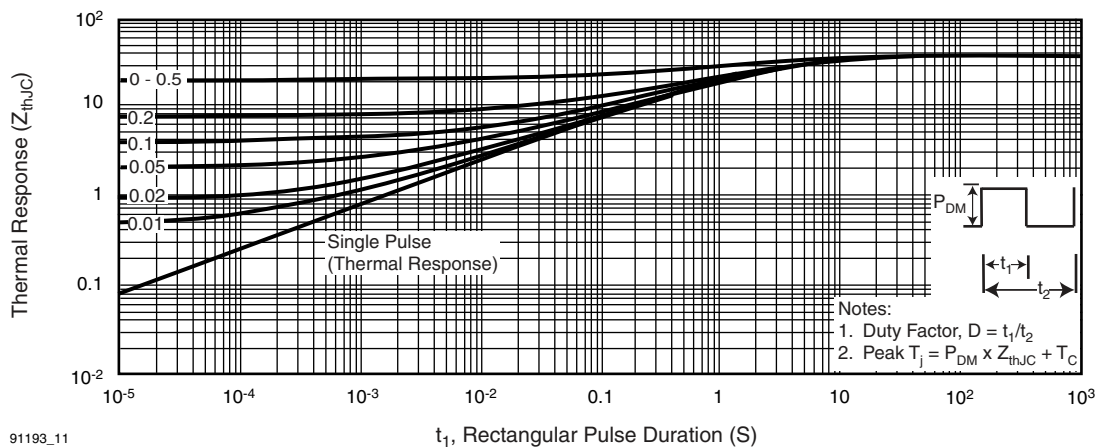


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

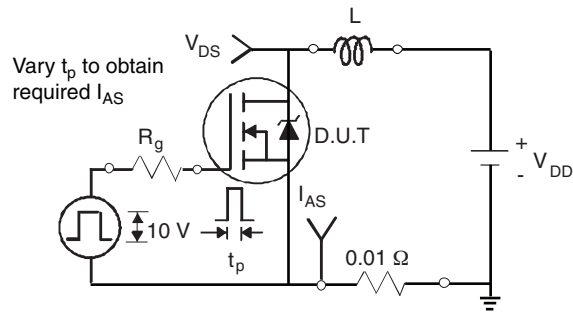


Fig. 12a - Unclamped Inductive Test Circuit

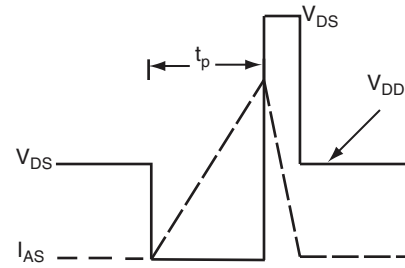


Fig. 12b - Unclamped Inductive Waveforms

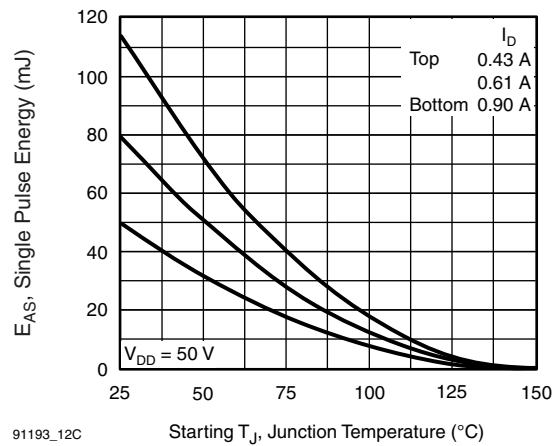


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

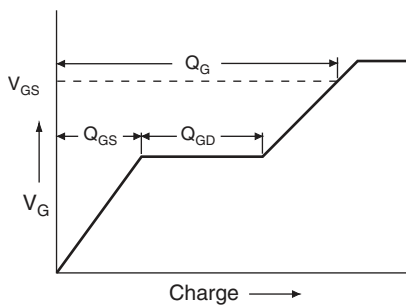


Fig. 13a - Basic Gate Charge Waveform

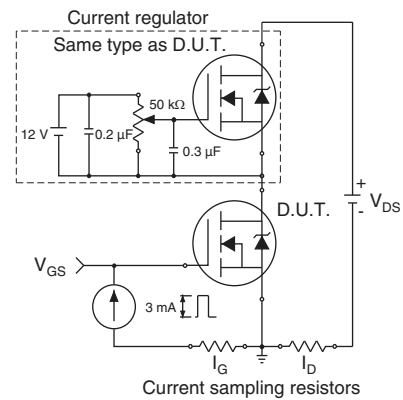
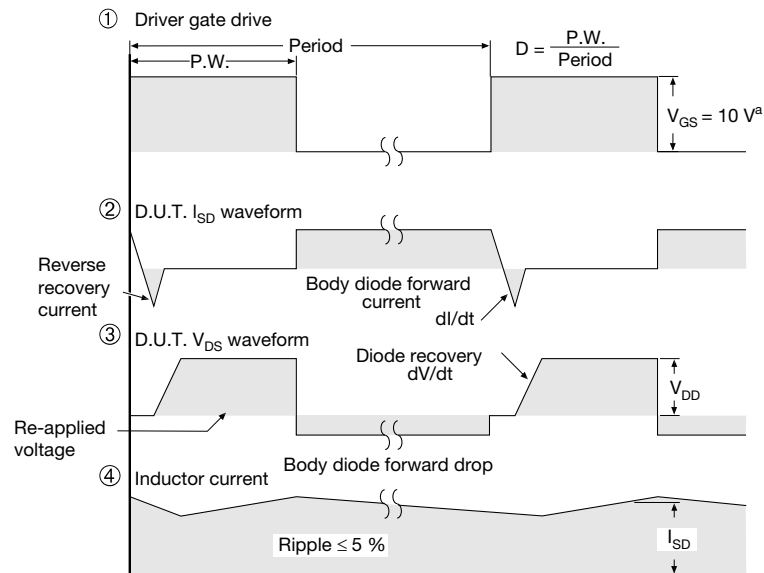
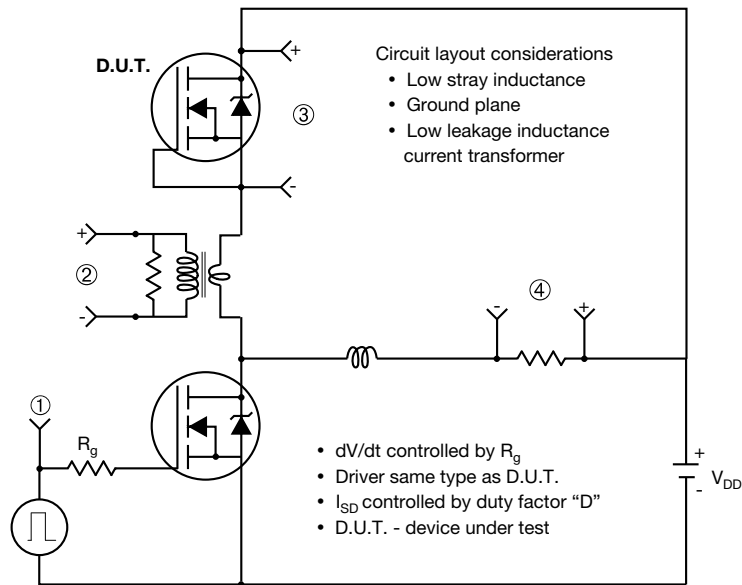


Fig. 13b - Gate Charge Test Circuit

**Peak Diode Recovery dV/dt Test Circuit**

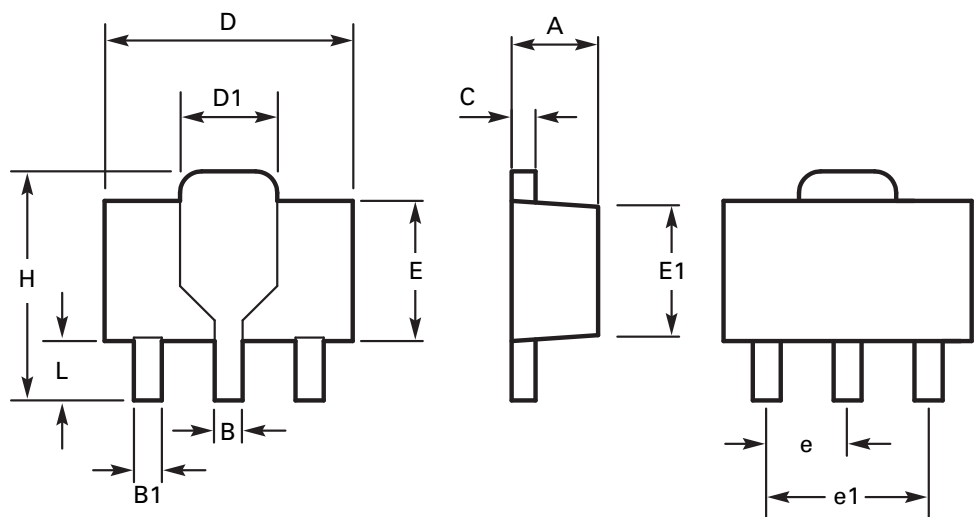


**Note**

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

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

Package outline - SOT89



| DIM | Millimeters |      | Inches |       | DIM | Millimeters |      | Inches    |       |
|-----|-------------|------|--------|-------|-----|-------------|------|-----------|-------|
|     | Min         | Max  | Min    | Max   |     | Min         | Max  | Min       | Max   |
| A   | 1.40        | 1.60 | 0.550  | 0.630 | E   | 2.29        | 2.60 | 0.090     | 0.102 |
| B   | 0.44        | 0.56 | 0.017  | 0.022 | E1  | 2.13        | 2.29 | 0.084     | 0.090 |
| B1  | 0.36        | 0.48 | 0.014  | 0.019 | e   | 1.50 BSC    |      | 0.059 BSC |       |
| C   | 0.35        | 0.44 | 0.014  | 0.017 | e1  | 3.00 BSC    |      | 0.118 BSC |       |
| D   | 4.40        | 4.60 | 0.173  | 0.181 | H   | 3.94        | 4.25 | 0.155     | 0.167 |
| D1  | 1.62        | 1.83 | 0.064  | 0.072 | L   | 0.89        | 1.20 | 0.035     | 0.047 |

**Note:** Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

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