

# Power MOSFET

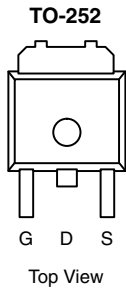
| PRODUCT SUMMARY          |                         |     |
|--------------------------|-------------------------|-----|
| V <sub>DS</sub> (V)      | -200                    |     |
| R <sub>DS(on)</sub> (Ω)  | V <sub>GS</sub> = -10 V | 1.0 |
| Q <sub>g</sub> max. (nC) | 29                      |     |
| Q <sub>gs</sub> (nC)     | 5.4                     |     |
| Q <sub>gd</sub> (nC)     | 15                      |     |
| Configuration            | Single                  |     |

## FEATURES

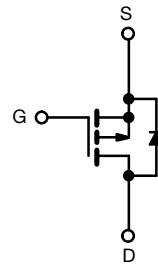
- Surface mount
- Available in tape and reel
- Dynamic dV/dt rating
- Repetitive avalanche rated
- P-channel
- Fast switching
- Ease of paralleling



**RoHS\***  
Available  
**HALOGEN**  
**FREE**  
Available



Drain Connected to Tab



P-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  | -3.6 | A |
|   |                                   | T <sub>C</sub> = 100 °C | -2.5 |   |
| Pulsed Drain Current <sup>a</sup>   | I <sub>DM</sub>                   | -15                     | W/°C |   |
| Linear Derating Factor  |                                   | 0.59                    |      |   |
| Linear Derating Factor (PCB mount) <sup>e</sup>                           |                                   | 0.025                   |      |   |
| Single Pulse Avalanche Energy <sup>b</sup>                                | E <sub>AS</sub>                   | 500                     | mJ   |   |
| Avalanche Current <sup>a</sup>  | I <sub>AR</sub>                   | -6.4                    | A    |   |
| Repetitive Avalanche Energy <sup>a</sup>                                  | E <sub>AR</sub>                   | 7.4                     | mJ   |   |
| Maximum Power Dissipation   | P <sub>D</sub>                    | T <sub>C</sub> = 25 °C  | 74   | W |
|   |                                   | T <sub>A</sub> = 25 °C  | 3.0  |   |
| 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                     |      |   |

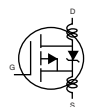

### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- V<sub>DD</sub> = -50 V, starting T<sub>J</sub> = 25 °C, L = 17 mH, R<sub>g</sub> = 25 Ω, I<sub>AS</sub> = -6.5 A (see fig. 12).
- I<sub>SD</sub> ≤ -6.5 A, di/dt ≤ 120 A/μs, V<sub>DD</sub> ≤ V<sub>DS</sub>, T<sub>J</sub> ≤ 150 °C.
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

| THERMAL RESISTANCE RATINGS                           |            |      |      |      |
|--|------------|------|------|------|
| PARAMETER  | SYMBOL     | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient                          | $R_{thJA}$ | -    | 62   | °C/W |
| Maximum Junction-to-Ambient (PCB mount) <sup>a</sup> | $R_{thJA}$ | -    | 40   |      |
| Maximum Junction-to-Case (Drain)                     | $R_{thJC}$ | -    | 1.7  |      |

**Note**

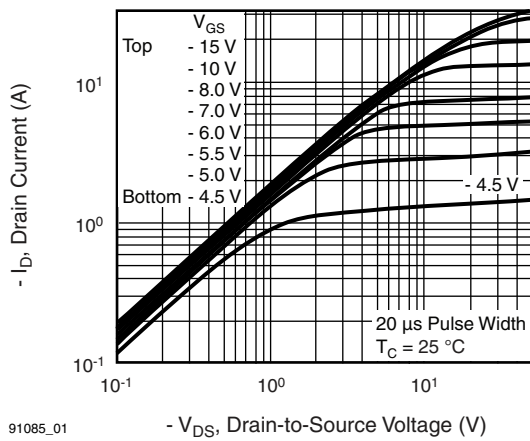
a. When mounted on 1" square PCB (FR-4 or G-10 material).

| SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                     |   |      |       |           |               |
|---|---------------------|---|------|-------|-----------|---------------|
| PARAMETER   | SYMBOL              | TEST CONDITIONS   | MIN. | TYP.  | MAX.      | UNIT          |
| <b>Static</b>   |                     |   |      |       |           |               |
| Drain-Source Breakdown Voltage  | $V_{DS}$            | $V_{GS} = 0, I_D = -250\ \mu\text{A}$   | -200 | -     | -         | V             |
| $V_{DS}$ Temperature Coefficient  | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$ , $I_D = -1\ \text{mA}$   | -    | -0.24 | -         | V/°C          |
| Gate-Source Threshold Voltage   | $V_{GS(th)}$        | $V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$  | -2.0 | -     | -4.0      | V             |
| Gate-Source Leakage   | $I_{GSS}$           | $V_{GS} = \pm 20\ \text{V}$   | -    | -     | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current   | $I_{DSS}$           | $V_{DS} = -200\ \text{V}, V_{GS} = 0\ \text{V}$   | -    | -     | -100      | $\mu\text{A}$ |
|   |                     | $V_{DS} = -160\ \text{V}, V_{GS} = 0\ \text{V}, T_J = 125\text{ }^\circ\text{C}$  | -    | -     | -500      |               |
| Drain-Source On-State Resistance  | $R_{DS(on)}$        | $V_{GS} = -10\ \text{V}, I_D = -3.0\ \text{A}^b$  | -    | 1.00  | -         | $\Omega$      |
| Forward Transconductance  | $g_{fs}$            | $V_{DS} = -50\ \text{V}, I_D = -3.0\ \text{A}^b$  | 2.8  | -     | -         | S             |
| <b>Dynamic</b>  |                     |   |      |       |           |               |
| Input Capacitance   | $C_{iss}$           | $V_{GS} = 0\ \text{V}, V_{DS} = -25\ \text{V}, f = 1.0\ \text{MHz}$ , see fig. 5  | -    | 700   | -         | $\mu\text{F}$ |
| Output Capacitance  | $C_{oss}$           |   | -    | 200   | -         |               |
| Reverse Transfer Capacitance  | $C_{rss}$           |   | -    | 40    | -         |               |
| Total Gate Charge   | $Q_g$               | $V_{GS} = -10\ \text{V}, I_D = -3.5\ \text{A}, V_{DS} = -160\ \text{V}$ , see fig. 6 and 13 <sup>b</sup>  | -    | -     | 29        | nC            |
| Gate-Source Charge  | $Q_{gs}$            |   | -    | -     | 5.4       |               |
| Gate-Drain Charge   | $Q_{gd}$            |   | -    | -     | 15        |               |
| Turn-On Delay Time  | $t_{d(on)}$         | $V_{DD} = -100\ \text{V}, I_D = -3.5\ \text{A}, R_g = 12\ \Omega, R_D = 15\ \Omega$ , see fig. 10 <sup>b</sup>  | -    | 12    | -         | ns            |
| Rise Time   | $t_r$               |   | -    | 27    | -         |               |
| Turn-Off Delay Time   | $t_{d(off)}$        |   | -    | 28    | -         |               |
| Fall Time   | $t_f$               |   | -    | 24    | -         |               |
| Internal Drain Inductance   | $L_D$               | Between lead, 6 mm (0.25") from package and center of die contact  | -    | 4.5   | -         | nH            |
| Internal Source Inductance  | $L_S$               |   | -    | 7.5   | -         |               |
| Gate Input Resistance   | $R_g$               | $f = 1\ \text{MHz}$ , open drain  | 0.6  | -     | 3.7       | $\Omega$      |
| <b>Drain-Source Body Diode Characteristics</b>                              |                     |   |      |       |           |               |
| Continuous Source-Drain Diode Current                                       | $I_S$               | MOSFET symbol showing the integral reverse p - n junction diode    | -    | -     | -6.5      | A             |
| Pulsed Diode Forward Current <sup>a</sup>                                   | $I_{SM}$            |   | -    | -     | -26       |               |
| Body Diode Voltage  | $V_{SD}$            | $T_J = 25\text{ }^\circ\text{C}, I_S = -3.5\ \text{A}, V_{GS} = 0\ \text{V}^b$  | -    | -     | -6.5      | V             |
| Body Diode Reverse Recovery Time  | $t_{rr}$            | $T_J = 25\text{ }^\circ\text{C}, I_F = -3.5\ \text{A}, dI/dt = 100\ \text{A}/\mu\text{s}^b$   | -    | 200   | 300       | ns            |
| Body Diode Reverse Recovery Charge  | $Q_{rr}$            |   | -    | 1.9   | 2.9       | $\mu\text{C}$ |
| Forward Turn-On Time  | $t_{on}$            | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )   |      |       |           |               |

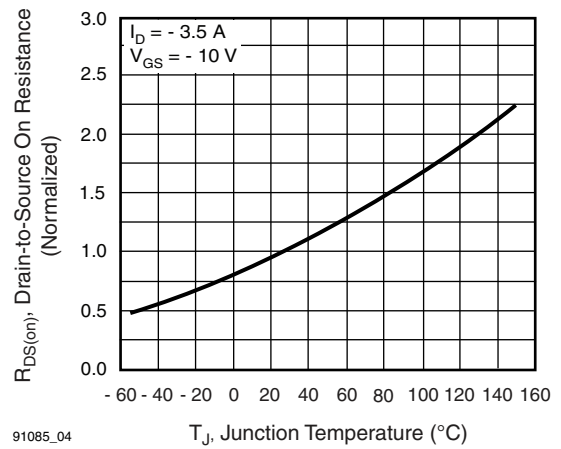
**Notes**

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

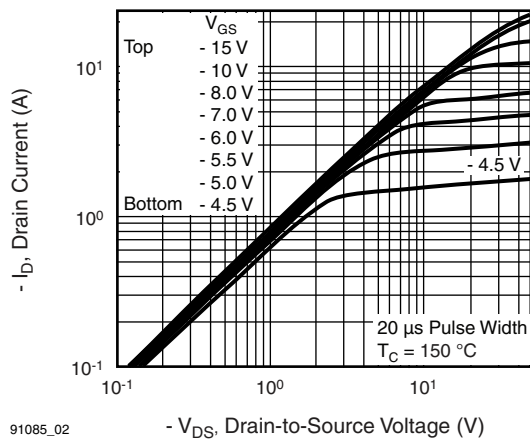
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



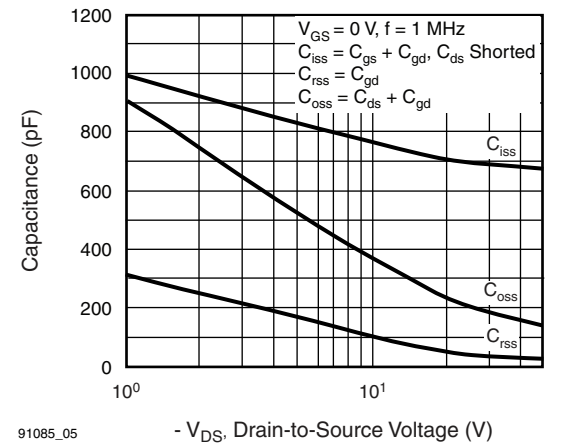
**Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^\circ\text{C}$**



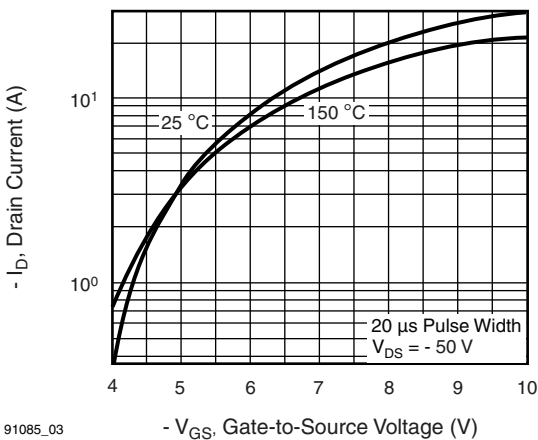
**Fig. 4 - Normalized On-Resistance vs. Temperature**



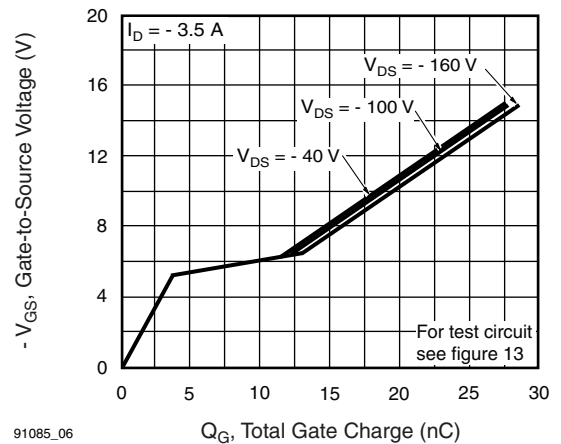
**Fig. 2 - Typical Output Characteristics,  $T_C = 150\text{ }^\circ\text{C}$**



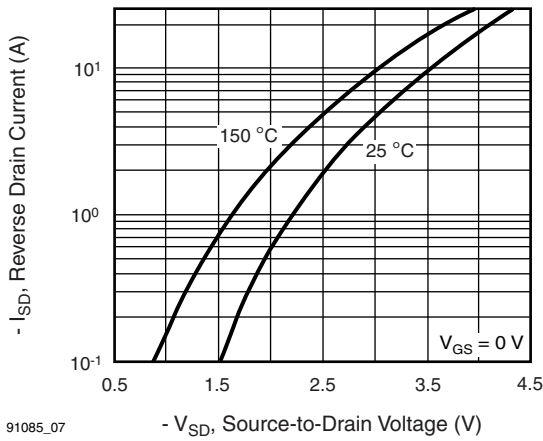
**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**



**Fig. 3 - Typical Transfer Characteristics**

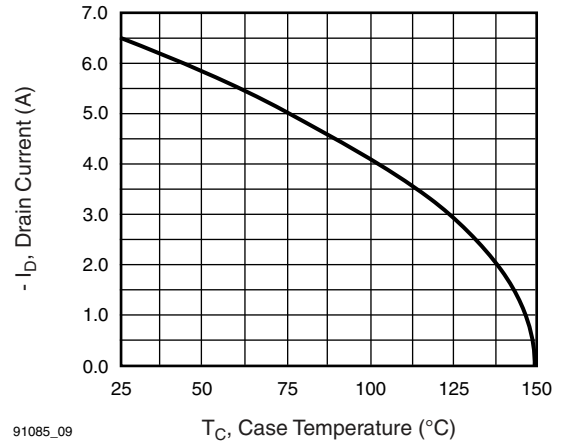


**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**



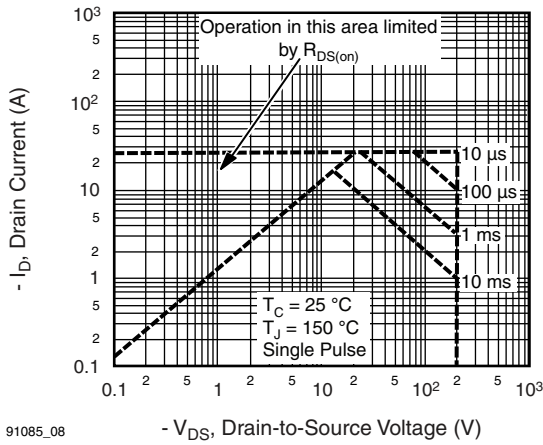
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**Fig. 7 - Typical Source-Drain Diode Forward Voltage**



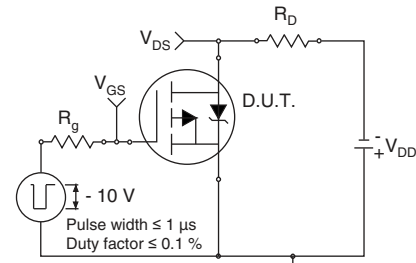
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**Fig. 9 - Maximum Drain Current vs. Case Temperature**

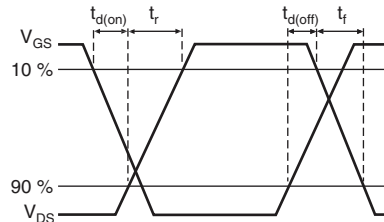


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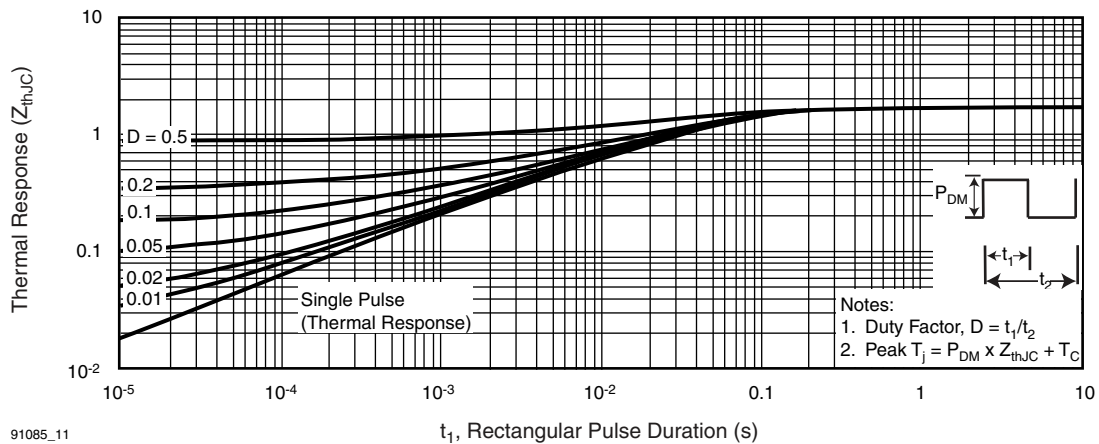
**Fig. 8 - Maximum Safe Operating Area**



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



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



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

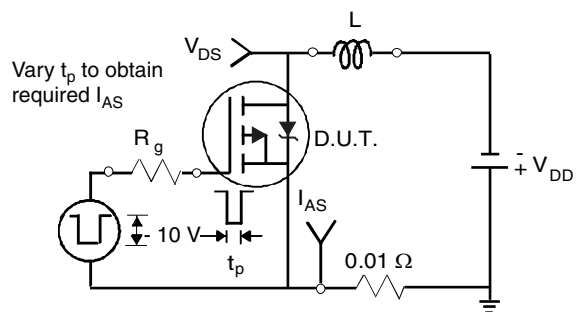


Fig. 12a - Unclamped Inductive Test Circuit

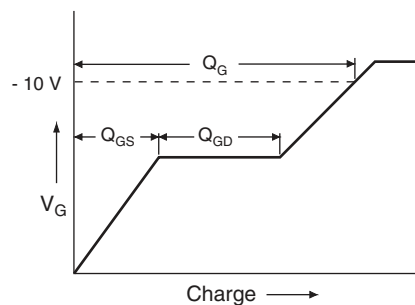


Fig. 13a - Basic Gate Charge Waveform

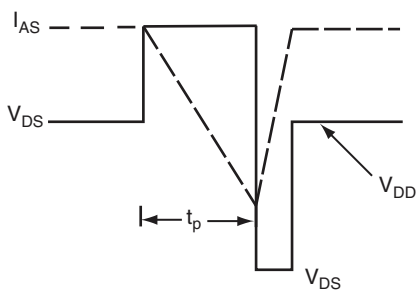


Fig. 12b - Unclamped Inductive Waveforms

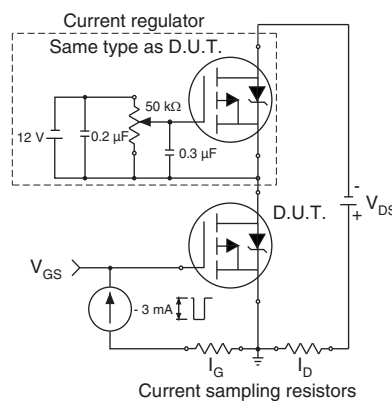


Fig. 13b - Gate Charge Test Circuit

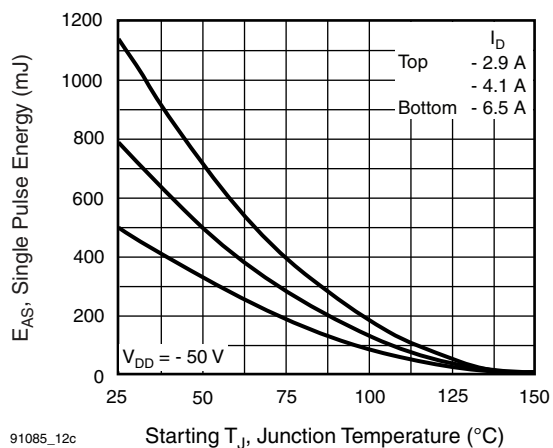
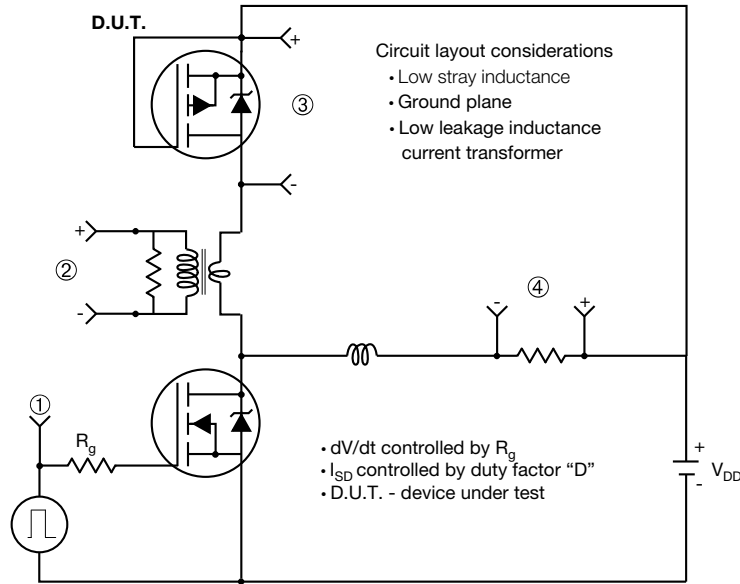
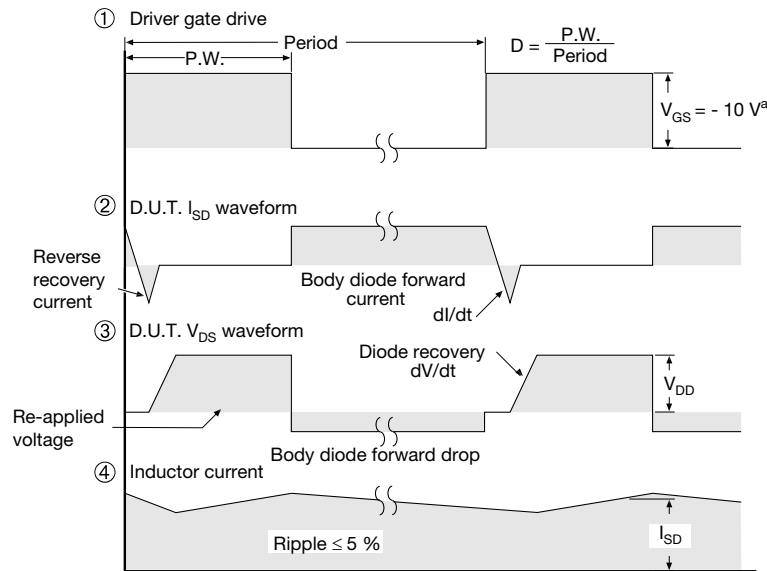


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

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

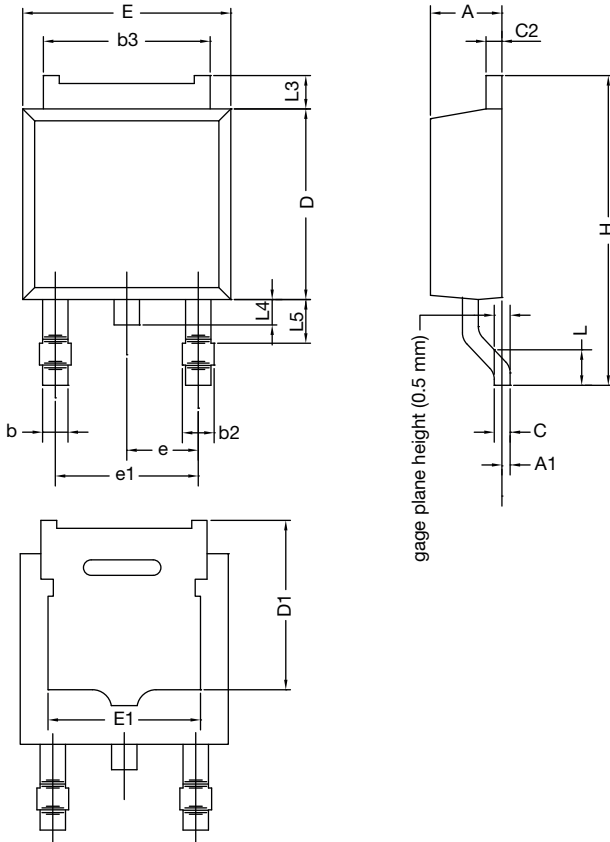


**Note**  
• Compliment N-Channel of D.U.T. for driver



**Fig. 14 - For P-Channel**

## TO-252AA CASE OUTLINE

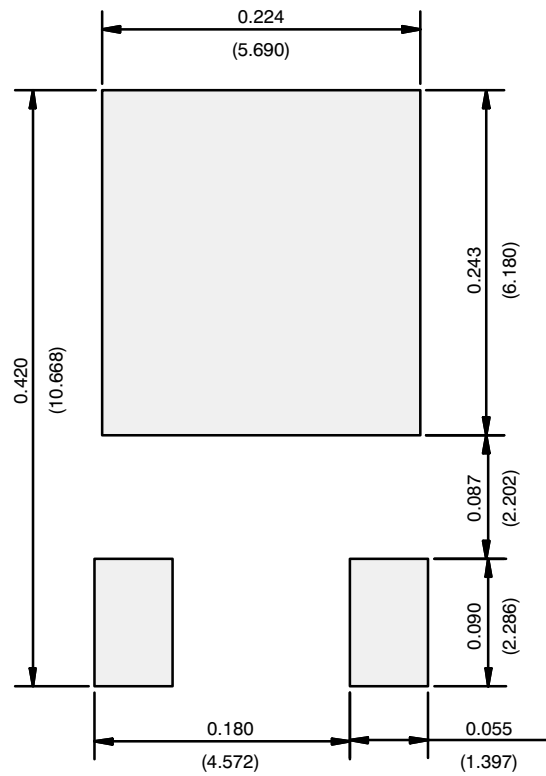


| DIM.   | MILLIMETERS |       | INCHES    |       |
|--|-------------|-------|-----------|-------|
|  | MIN.        | MAX.  | MIN.      | MAX.  |
| A  | 2.18        | 2.38  | 0.086     | 0.094 |
| A1   | -           | 0.127 | -         | 0.005 |
| b  | 0.64        | 0.88  | 0.025     | 0.035 |
| b2   | 0.76        | 1.14  | 0.030     | 0.045 |
| b3   | 4.95        | 5.46  | 0.195     | 0.215 |
| C  | 0.46        | 0.61  | 0.018     | 0.024 |
| C2   | 0.46        | 0.89  | 0.018     | 0.035 |
| D  | 5.97        | 6.22  | 0.235     | 0.245 |
| D1   | 5.21        | -     | 0.205     | -     |
| E  | 6.35        | 6.73  | 0.250     | 0.265 |
| E1   | 4.32        | -     | 0.170     | -     |
| H  | 9.40        | 10.41 | 0.370     | 0.410 |
| e  | 2.28 BSC    |       | 0.090 BSC |       |
| e1   | 4.56 BSC    |       | 0.180 BSC |       |
| L  | 1.40        | 1.78  | 0.055     | 0.070 |
| L3   | 0.89        | 1.27  | 0.035     | 0.050 |
| L4   | -           | 1.02  | -         | 0.040 |
| L5   | 1.14        | 1.52  | 0.045     | 0.060 |
| ECN: X12-0247-Rev. M, 24-Dec-12<br>DWG: 5347 |             |       |           |       |

**Note**

- Dimension L3 is for reference only.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads  
Dimensions in Inches/(mm)



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