

## IRF9630STRR-VB Datasheet

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

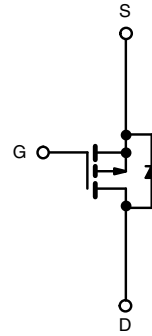
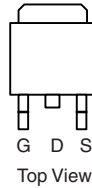
| PRODUCT SUMMARY           |                  |      |
|---------------------------|------------------|------|
| $V_{DS}$ (V)              | -200             |      |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = -10$ V | 0.50 |
| $Q_g$ max. (nC)           | 44               |      |
| $Q_{gs}$ (nC)             | 7.1              |      |
| $Q_{gd}$ (nC)             | 27               |      |
| Configuration             | Single           |      |

#### FEATURES

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



TO-263



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        | V        |
| Continuous Drain Current  | V <sub>GS</sub> at -10 V | T <sub>C</sub> = 25 °C  | I <sub>D</sub>                    | -11         | A        |
|   |                          | T <sub>C</sub> = 100 °C |                                   | -6.8        |          |
| Pulsed Drain Current <sup>a</sup>   |                          |                         | I <sub>DM</sub>                   | -44         |          |
| Linear Derating Factor  |                          |                         |                                   | 1.0         | W/°C     |
| Single Pulse Avalanche Energy <sup>b</sup>                                |                          |                         | E <sub>AS</sub>                   | 700         | mJ       |
| Repetitive Avalanche Current <sup>a</sup>                                 |                          |                         | I <sub>AR</sub>                   | -11         | 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                             | -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         |          |
| Mounting Torque   | 6-32 or M3 screw         |                         |                                   | 10          | lbf · in |
|   |                          |                         |                                   | 1.1         | N · m    |

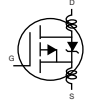

#### Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).  
 b.  $V_{DD} = -50$  V, starting  $T_J = 25^\circ\text{C}$ ,  $L = 8.7$  mH,  $R_G = 25 \Omega$ ,  $I_{AS} = -11$  A (see fig. 12).  
 c.  $I_{SD} \leq -11$  A,  $dI/dt \leq 150$  A/ $\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150^\circ\text{C}$ .  
 d. 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  |      |

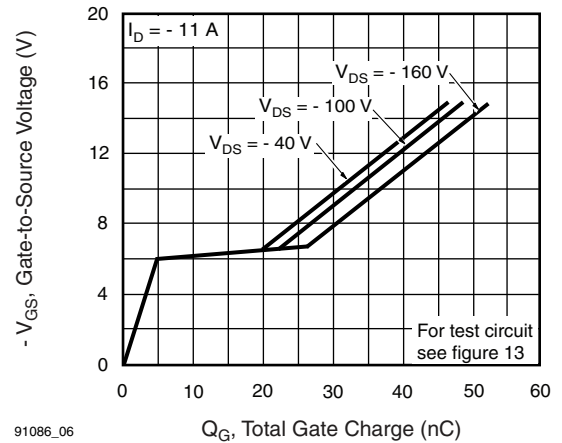
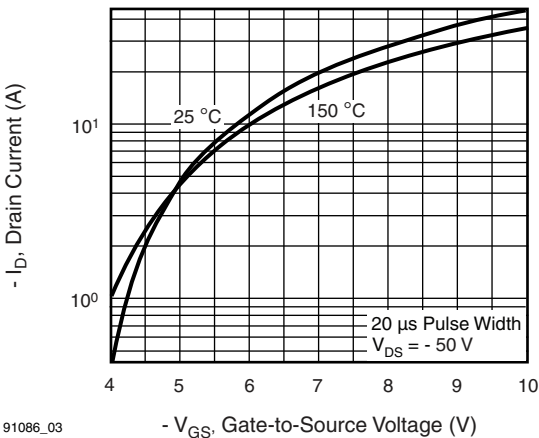
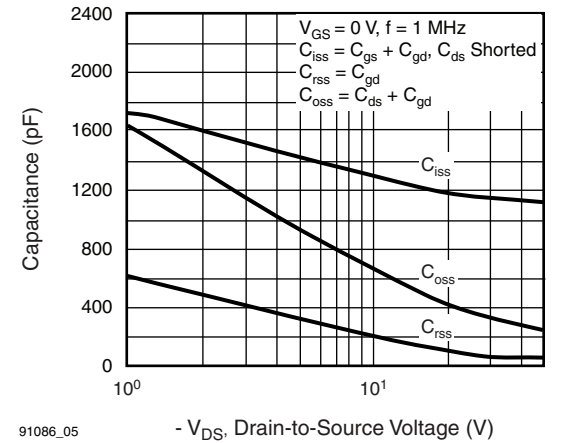
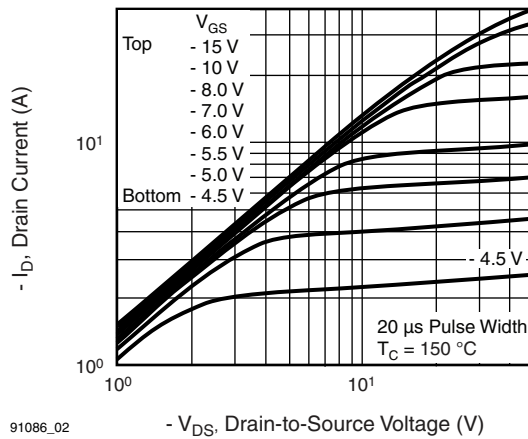
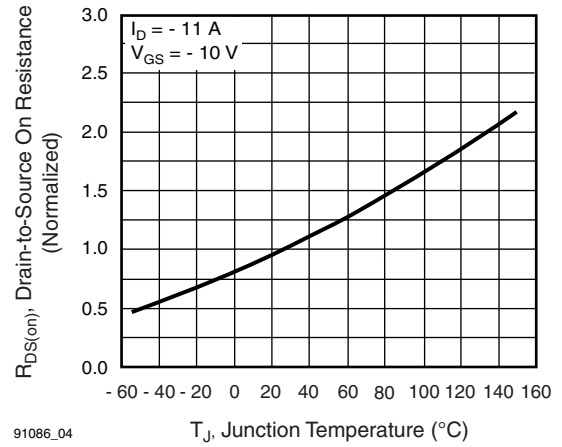
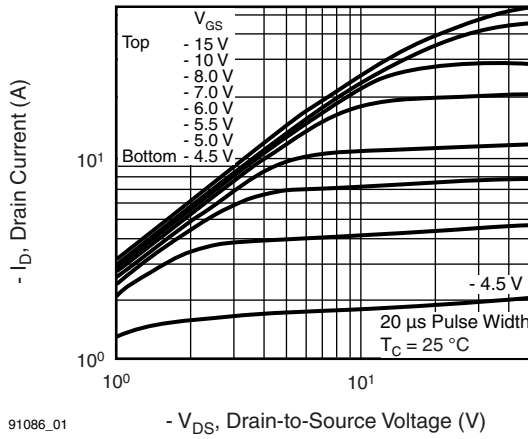
**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

| PARAMETER                                      | SYMBOL              | TEST CONDITIONS   | MIN. | TYP. | MAX.      | UNIT          |
|--|---------------------|---|------|------|-----------|---------------|
| <b>Static</b>                                  |                     |   |      |      |           |               |
| Drain-Source Breakdown Voltage                 | $V_{DS}$            | $V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$   | -200 | -    | -         | V             |
| $V_{DS}$ Temperature Coefficient               | $\Delta V_{DS}/T_J$ | Reference to $25\text{ °C}$ , $I_D = -1\text{ mA}$  | -    | -0.2 | -         | V/°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                | $I_{DSS}$           | $V_{DS} = -200\text{ V}$ , $V_{GS} = 0\text{ V}$  | -    | -    | -100      | $\mu\text{A}$ |
|  |                     | $V_{DS} = -160\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ °C}$  | -    | -    | -500      |               |
| Drain-Source On-State Resistance               | $R_{DS(on)}$        | $V_{GS} = -10\text{ V}$ , $I_D = -6.6\text{ A}^b$   | -    | 0.50 | -         | $\Omega$      |
| Forward Transconductance                       | $g_{fs}$            | $V_{DS} = -50\text{ V}$ , $I_D = -6.6\text{ A}^b$   | 4.1  | -    | -         | 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   | -    | 1200 | -         | pF            |
| Output Capacitance                             | $C_{oss}$           |   | -    | 370  | -         |               |
| Reverse Transfer Capacitance                   | $C_{rss}$           |   | -    | 81   | -         |               |
| Total Gate Charge                              | $Q_g$               | $V_{GS} = -10\text{ V}$ , $I_D = -11\text{ A}$ , $V_{DS} = -160\text{ V}$ ,<br>see fig. 6 and 13 <sup>b</sup>   | -    | -    | 44        | nC            |
| Gate-Source Charge                             | $Q_{gs}$            |   | -    | -    | 7.1       |               |
| Gate-Drain Charge                              | $Q_{gd}$            |   | -    | -    | 27        |               |
| Turn-On Delay Time                             | $t_{d(on)}$         | $V_{DD} = -100\text{ V}$ , $I_D = -11\text{ A}$<br>$R_g = 9.1\text{ }\Omega$ , $R_D = 8.6\text{ }\Omega$ , see fig. 10 <sup>b</sup>                                 | -    | 14   | -         | ns            |
| Rise Time                                      | $t_r$               |   | -    | 43   | -         |               |
| Turn-Off Delay Time                            | $t_{d(off)}$        |   | -    | 39   | -         |               |
| Fall Time                                      | $t_f$               |   | -    | 38   | -         |               |
| 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  | -    | 1.7       | $\Omega$      |
| <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>     | -    | -    | -11       | A             |
| Pulsed Diode Forward Current <sup>a</sup>      | $I_{SM}$            |   | -    | -    | -44       |               |
| Body Diode Voltage                             | $V_{SD}$            | $T_J = 25\text{ °C}$ , $I_S = -11\text{ A}$ , $V_{GS} = 0\text{ V}^b$   | -    | -    | -5        | V             |
| Body Diode Reverse Recovery Time               | $t_{rr}$            | $T_J = 25\text{ °C}$ , $I_F = -11\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}^b$  | -    | 250  | 300       | ns            |
| Body Diode Reverse Recovery Charge             | $Q_{rr}$            |   | -    | 2.9  | 3.6       | $\mu\text{C}$ |
| 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)



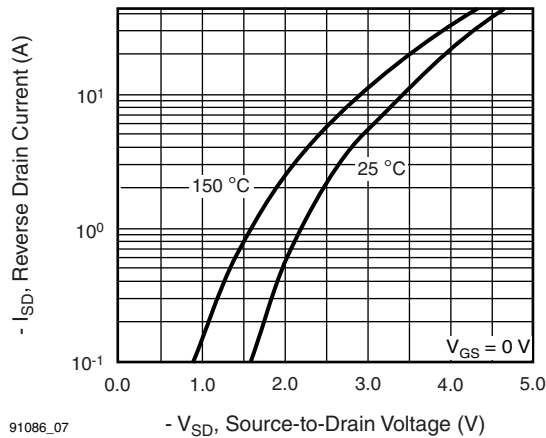


Fig. 7 - Typical Source-Drain Diode Forward Voltage

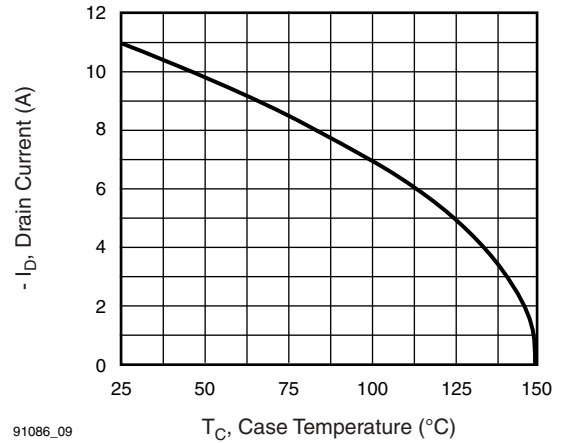


Fig. 9 - Maximum Drain Current vs. Case Temperature

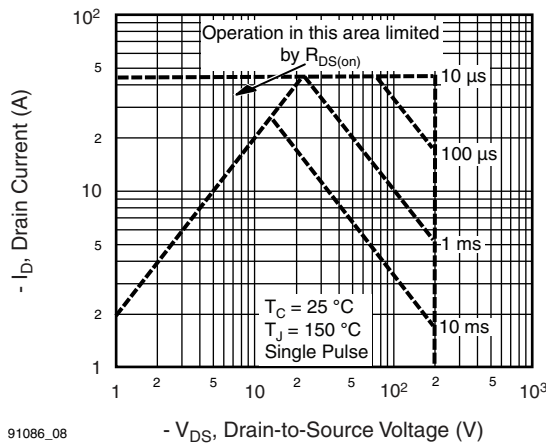


Fig. 8 - Maximum Safe Operating Area

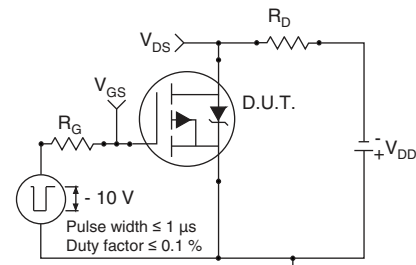


Fig. 10a - Switching Time Test Circuit

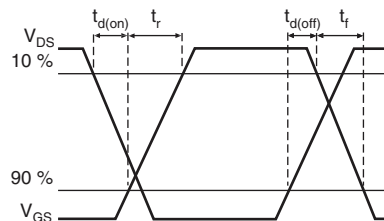


Fig. 10b - Switching Time Waveforms

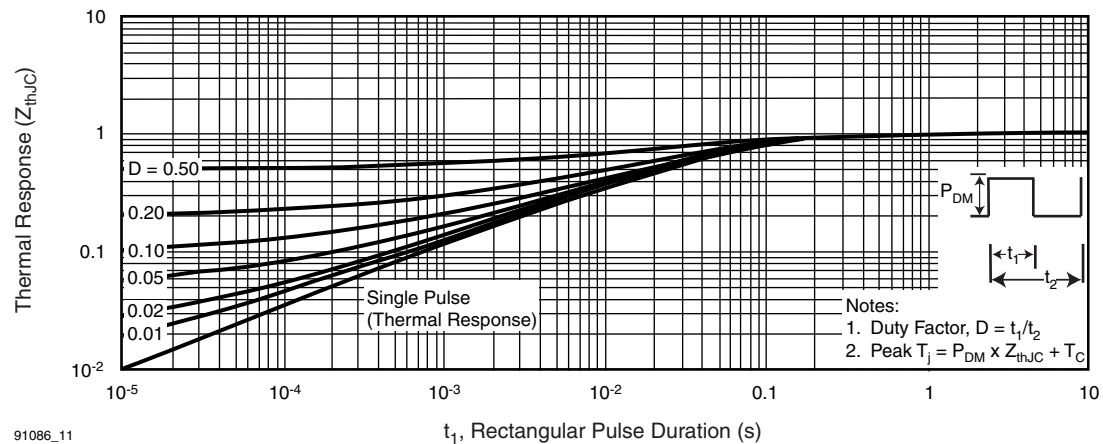


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

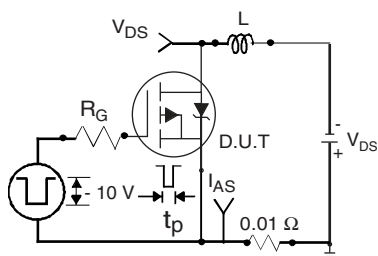


Fig. 12a - Unclamped Inductive Test Circuit

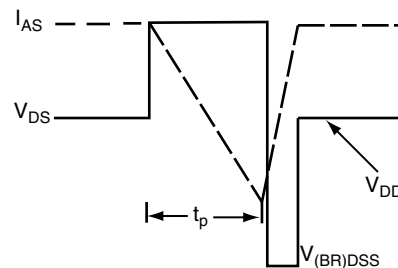


Fig. 12b - Unclamped Inductive Waveforms

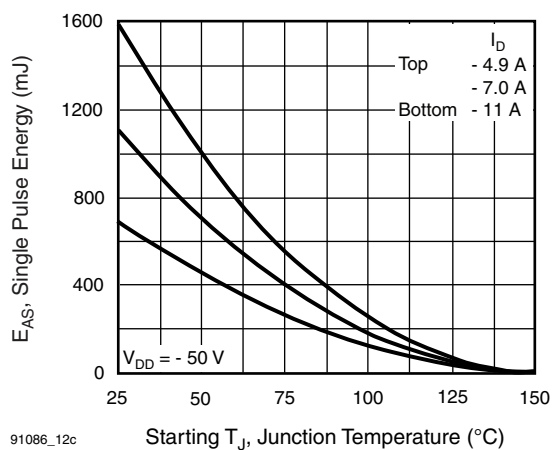


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

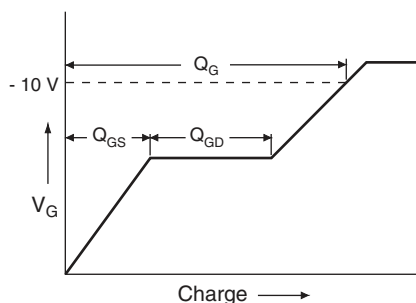


Fig. 13a - Basic Gate Charge Waveform

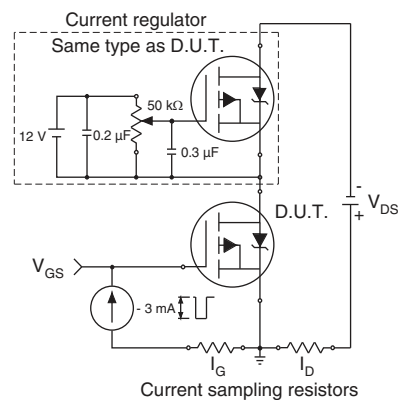
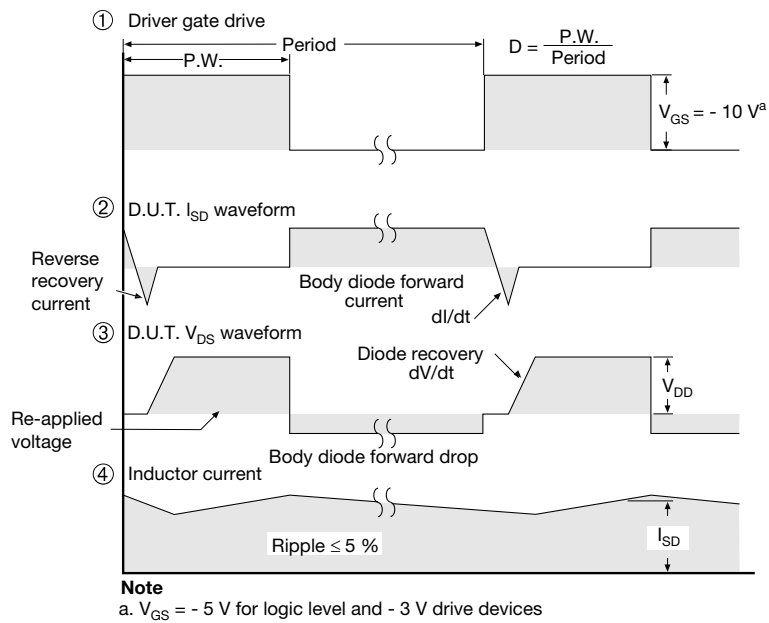
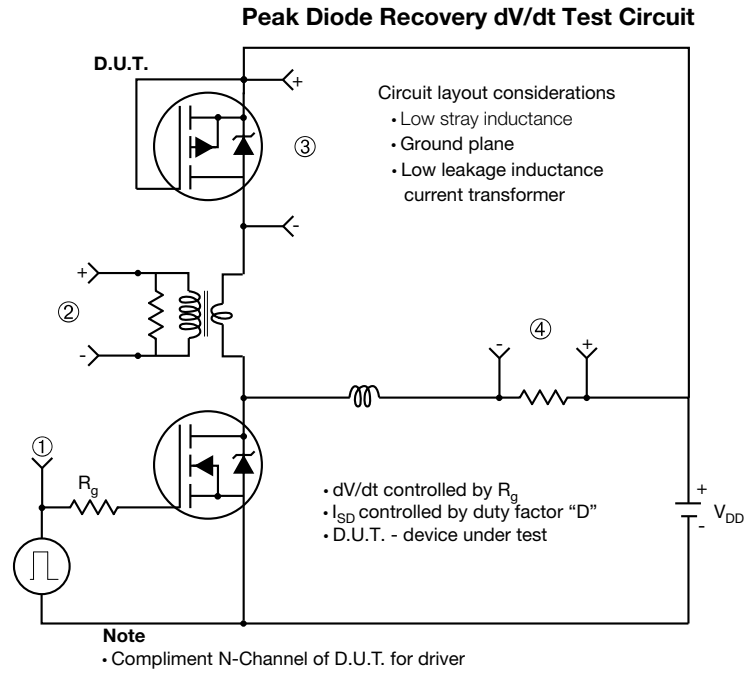
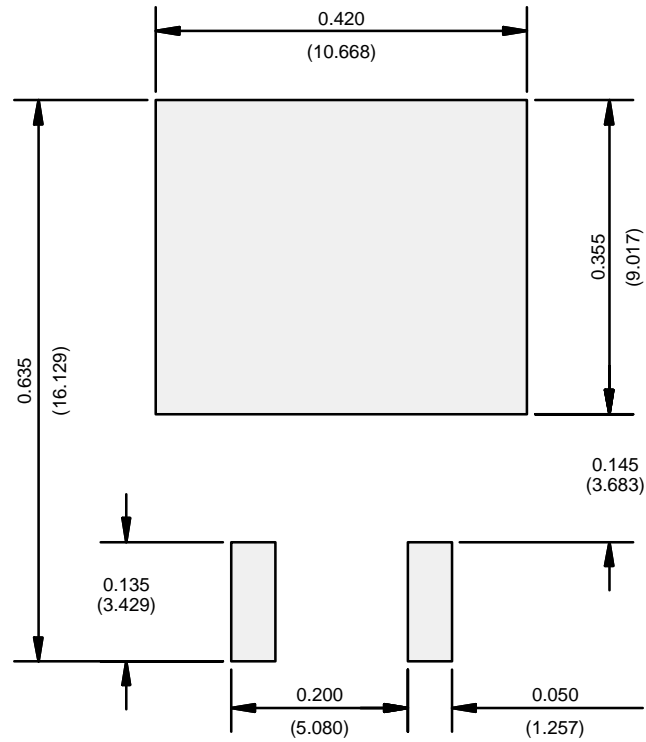


Fig. 13b - Gate Charge Test Circuit



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

**RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead**



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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