

## Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

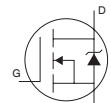
|                                | Parameter                                  | Min. | Typ. | Max. | Units                | Conditions                                                               |
|--------------------------------|--------------------------------------------|------|------|------|----------------------|--------------------------------------------------------------------------|
| $BV_{DSS}$                     | Drain-to-Source Breakdown Voltage          | 20   | —    | —    | V                    | $V_{GS} = 0V, I_D = 1.0mA$                                               |
| $\Delta BV_{DSS}/\Delta T_J$   | Breakdown Voltage Temp. Coefficient        | —    | 12   | —    | mV/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}$ , $I_D = 10mA$                           |
| $R_{DS(on)}$                   | Static Drain-to-Source On-Resistance       | —    | 1.8  | 2.5  | $m\Omega$            | $V_{GS} = 4.5V, I_D = 12A$ ③                                             |
|                                |                                            | —    | 1.2  | 1.8  |                      | $V_{GS} = 10V, I_D = 15A$ ③                                              |
| $V_{GS(th)}$                   | Gate Threshold Voltage                     | 1.6  | —    | 2.5  | V                    | $V_{DS} = V_{GS}, I_D = 250\mu A$                                        |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate Threshold Voltage Coefficient         | —    | -4.1 | —    | mV/ $^\circ\text{C}$ | $I_D = 10mA$ , reference to $25^\circ\text{C}$                           |
| $I_{DSS}$                      | Drain-to-Source Leakage Current            | —    | —    | 1.4  | mA                   | $V_{DS} = 20V, V_{GS} = 0V$                                              |
|                                |                                            | —    | —    | 500  | $\mu A$              | $V_{DS} = 16V, V_{GS} = 0V$                                              |
|                                |                                            | —    | —    | 5    | mA                   | $V_{DS} = 16V, V_{GS} = 0V, T_J = 125^\circ\text{C}$                     |
| $I_{GSS}$                      | Gate-to-Source Forward Leakage             | —    | —    | 100  | nA                   | $V_{GS} = 12V$                                                           |
|                                | Gate-to-Source Reverse Leakage             | —    | —    | -100 |                      | $V_{GS} = -12V$                                                          |
| $g_{fs}$                       | Forward Transconductance                   | 110  | —    | —    | S                    | $V_{DS} = 10V, I_D = 26A$                                                |
| $Q_g$                          | Total Gate Charge                          | —    | 47   | 71   | nC                   | $V_{DS} = 10V$<br>$V_{GS} = 4.5V$<br>$I_D = 17A$<br>See Fig. 17          |
| $Q_{gs1}$                      | Pre-V <sub>th</sub> Gate-to-Source Charge  | —    | 14   | —    |                      |                                                                          |
| $Q_{gs2}$                      | Post-V <sub>th</sub> Gate-to-Source Charge | —    | 4.4  | —    |                      |                                                                          |
| $Q_{gd}$                       | Gate-to-Drain Charge                       | —    | 15   | —    |                      |                                                                          |
| $Q_{godr}$                     | Gate Charge Overdrive                      | —    | 14   | —    |                      |                                                                          |
| $Q_{sw}$                       | Switch Charge ( $Q_{gs2} + Q_{gd}$ )       | —    | 19   | —    |                      |                                                                          |
| $Q_{oss}$                      | Output Charge                              | —    | 30   | —    | nC                   | $V_{DS} = 10V, V_{GS} = 0V$                                              |
| $R_G$                          | Gate Resistance                            | —    | 0.60 | 1.5  | $\Omega$             |                                                                          |
| $t_{d(on)}$                    | Turn-On Delay Time                         | —    | 23   | —    | ns                   | $V_{DD} = 16V, V_{GS} = 4.5V$ ③<br>$I_D = 26A$<br>Clamped Inductive Load |
| $t_r$                          | Rise Time                                  | —    | 95   | —    |                      |                                                                          |
| $t_{d(off)}$                   | Turn-Off Delay Time                        | —    | 25   | —    |                      |                                                                          |
| $t_f$                          | Fall Time                                  | —    | 10   | —    |                      |                                                                          |
| $C_{iss}$                      | Input Capacitance                          | —    | 6580 | —    | pF                   | $V_{GS} = 0V$<br>$V_{DS} = 10V$<br>$f = 1.0MHz$                          |
| $C_{oss}$                      | Output Capacitance                         | —    | 2070 | —    |                      |                                                                          |
| $C_{rss}$                      | Reverse Transfer Capacitance               | —    | 840  | —    |                      |                                                                          |

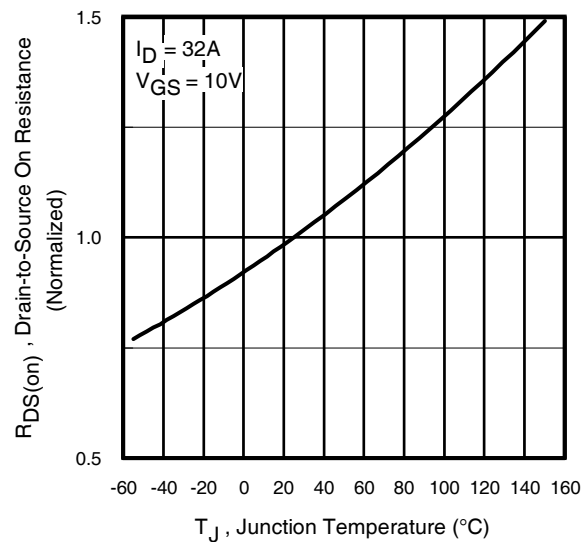
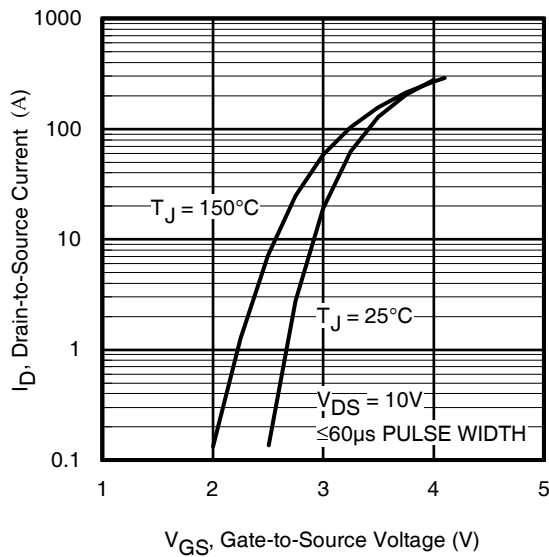
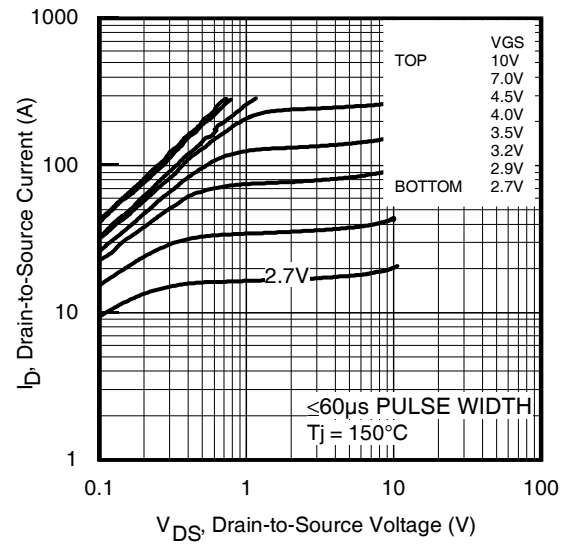
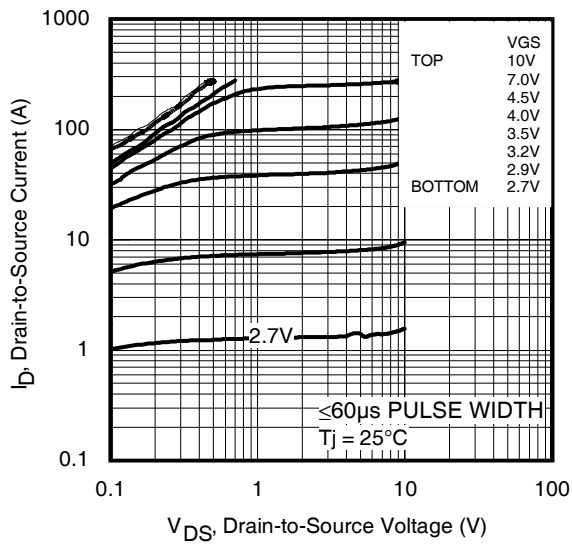
## Avalanche Characteristics

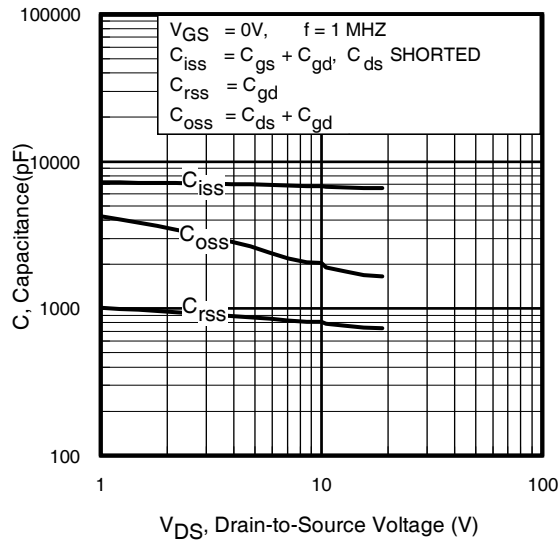
|          | Parameter                      | Typ. | Max. | Units |
|----------|--------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy② | —    | 230  | mJ    |
| $I_{AR}$ | Avalanche Current ①            | —    | 26   | A     |

## Diode Characteristics

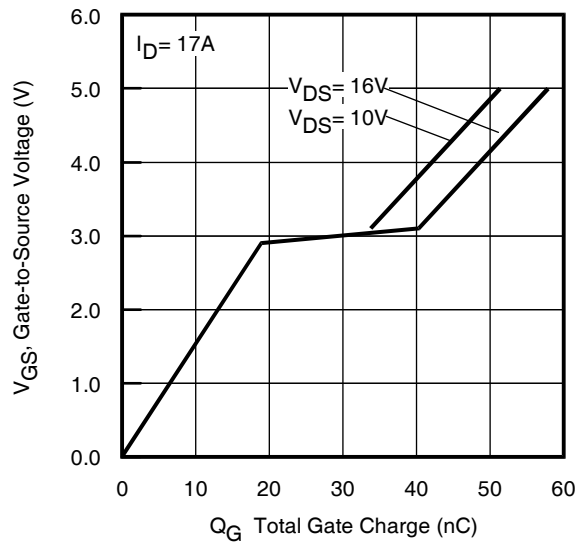
|          | Parameter                                 | Min. | Typ. | Max. | Units | Conditions                                                              |
|----------|-------------------------------------------|------|------|------|-------|-------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current<br>(Body Diode) | —    | —    | 200  | A     | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current<br>(Body Diode) ①   | —    | —    | 260  |       |                                                                         |
| $V_{SD}$ | Diode Forward Voltage                     | —    | —    | 0.65 | V     | $T_J = 25^\circ\text{C}, I_S = 25A, V_{GS} = 0V$ ③                      |
| $t_{rr}$ | Reverse Recovery Time                     | —    | 32   | 48   | ns    | $T_J = 25^\circ\text{C}, I_F = 25A$                                     |
| $Q_{rr}$ | Reverse Recovery Charge                   | —    | 26   | 39   | nC    | $di/dt = 100A/\mu s$ ③                                                  |



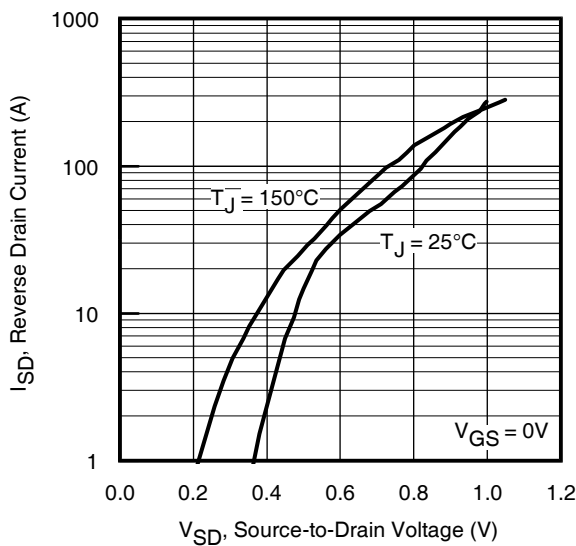




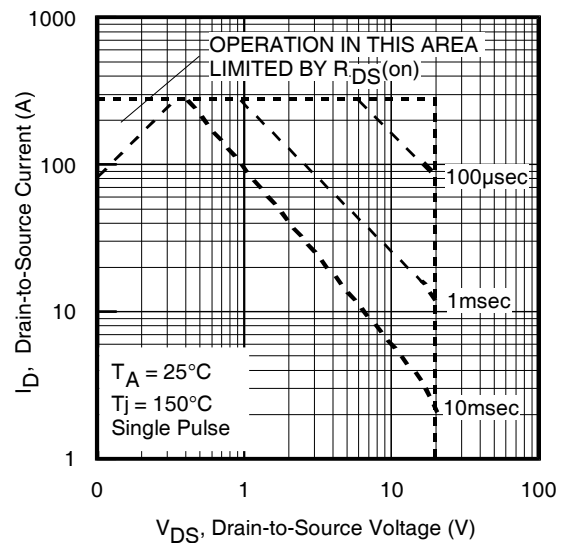
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



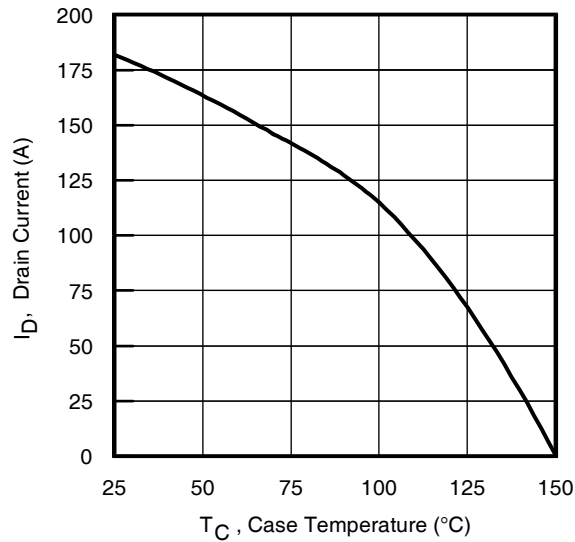
**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage



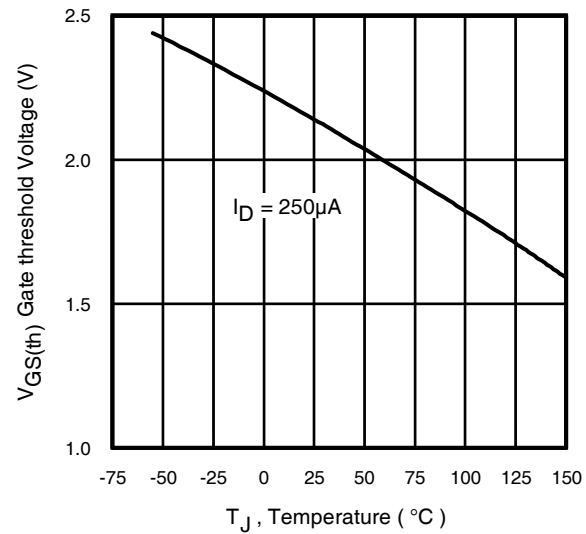
**Fig 7.** Typical Source-Drain Diode Forward Voltage



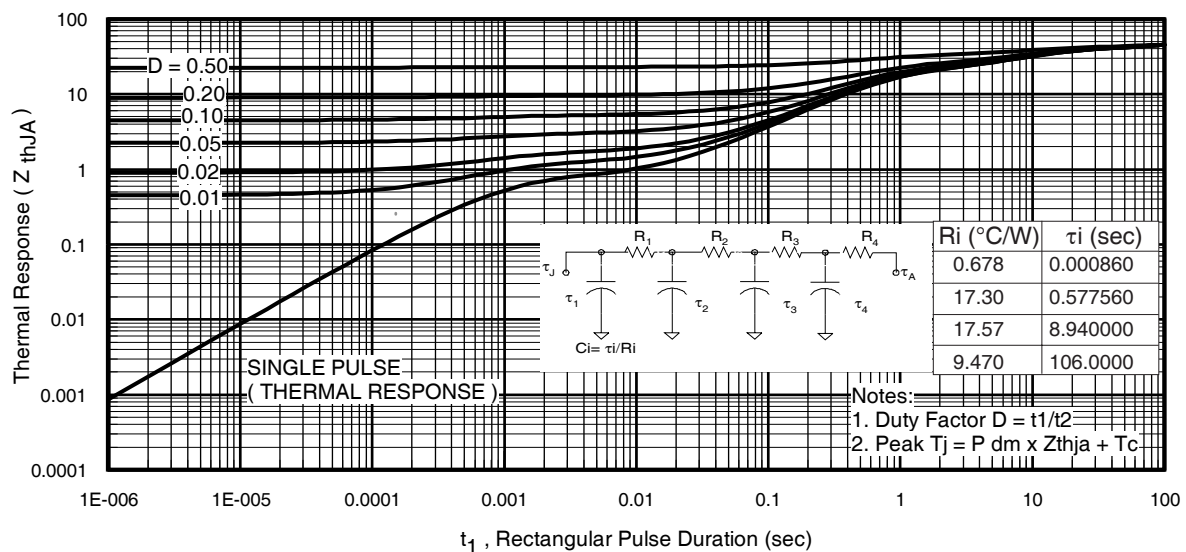
**Fig 8.** Maximum Safe Operating Area



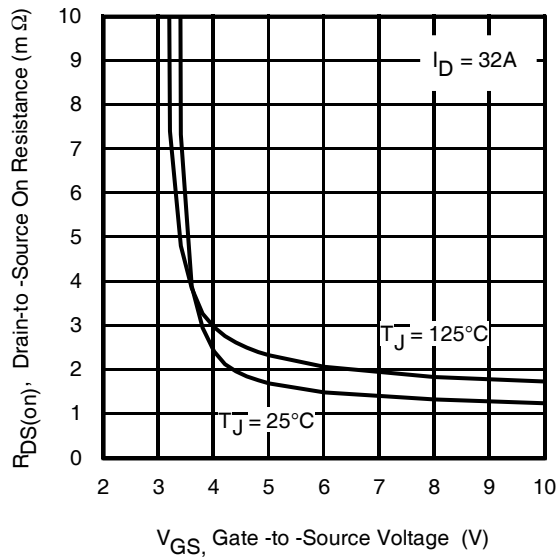
**Fig 9.** Maximum Drain Current vs. Case Temperature



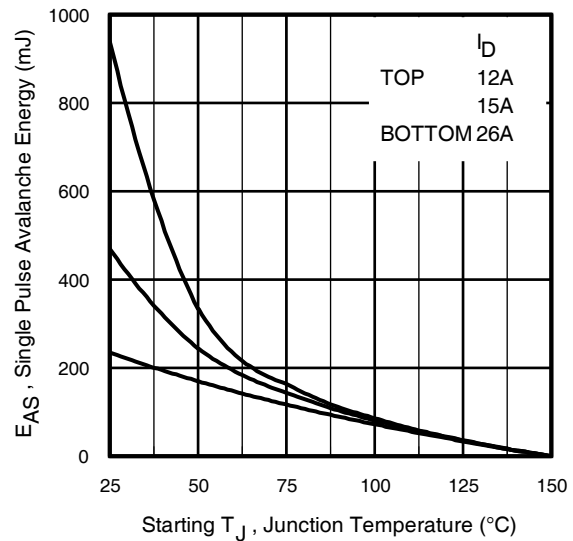
**Fig 10.** Threshold Voltage vs. Temperature



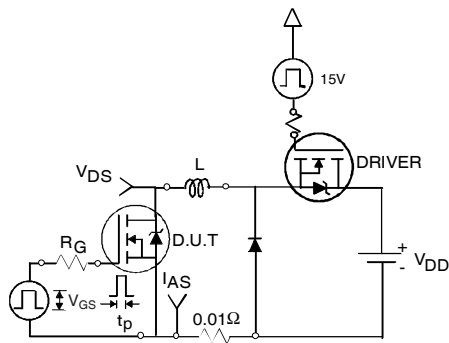
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



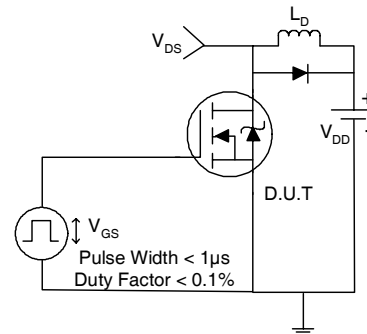
**Fig 12.** On-Resistance vs. Gate Voltage



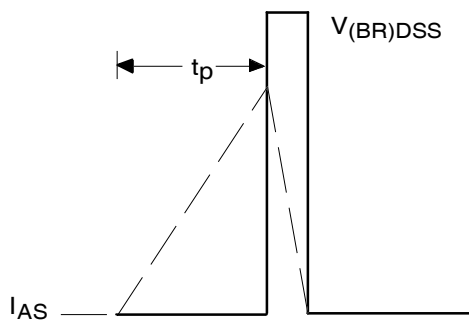
**Fig 13.** Maximum Avalanche Energy vs. Drain Current



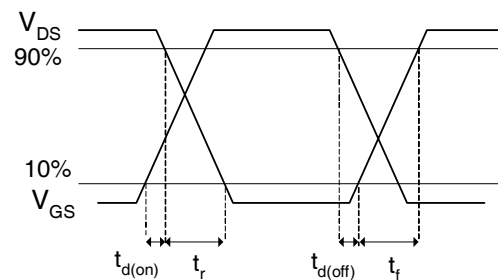
**Fig 14a.** Unclamped Inductive Test Circuit



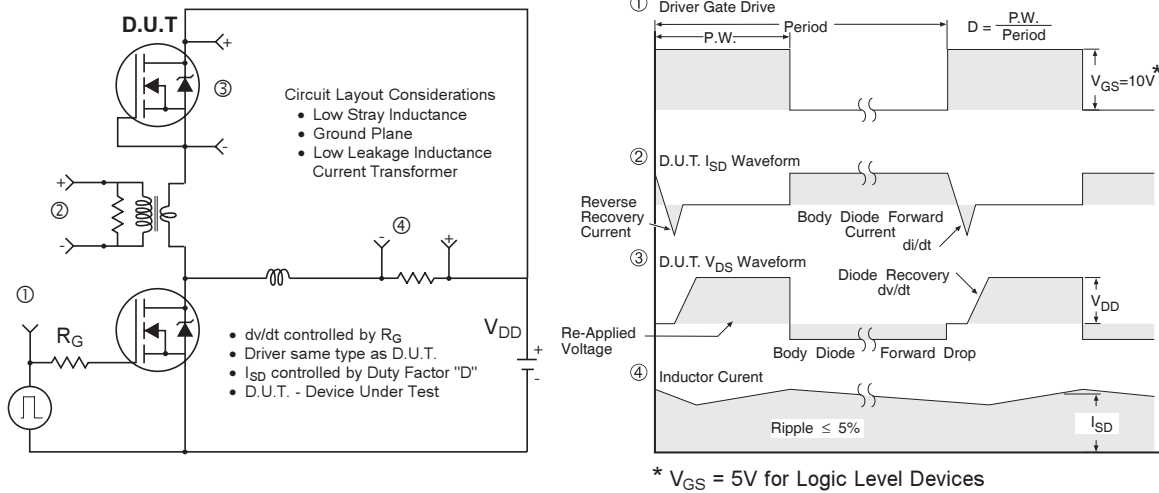
**Fig 15a.** Switching Time Test Circuit



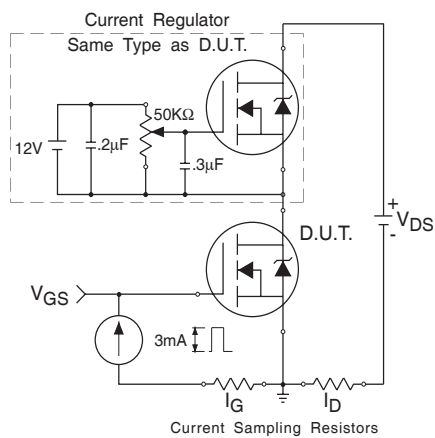
**Fig 14b.** Unclamped Inductive Waveforms



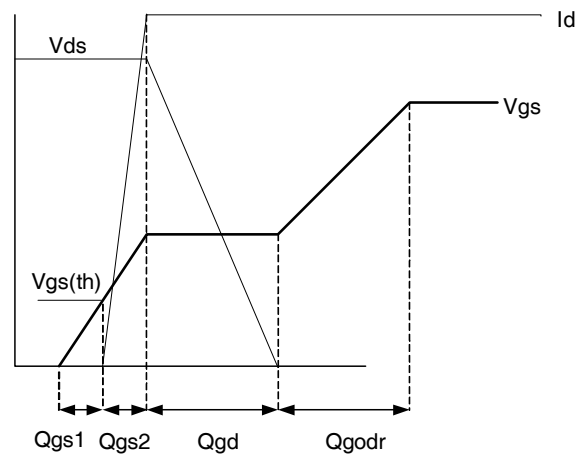
**Fig 15b.** Switching Time Waveforms



**Fig 16. Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs**



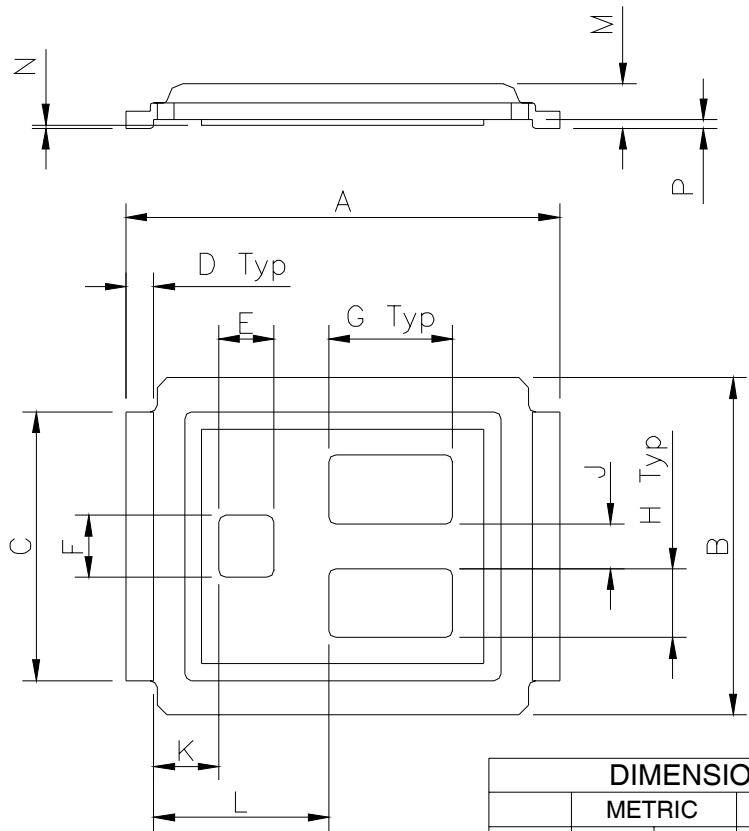
**Fig 17. Gate Charge Test Circuit**



**Fig 18. Gate Charge Waveform**

DirectFET™ Outline Dimension, MT Outline  
(Medium Size Can, T-Designation).

Please see DirectFET application note AN-1035 for all details regarding the assembly of DirectFET. This includes all recommendations for stencil and substrate designs.

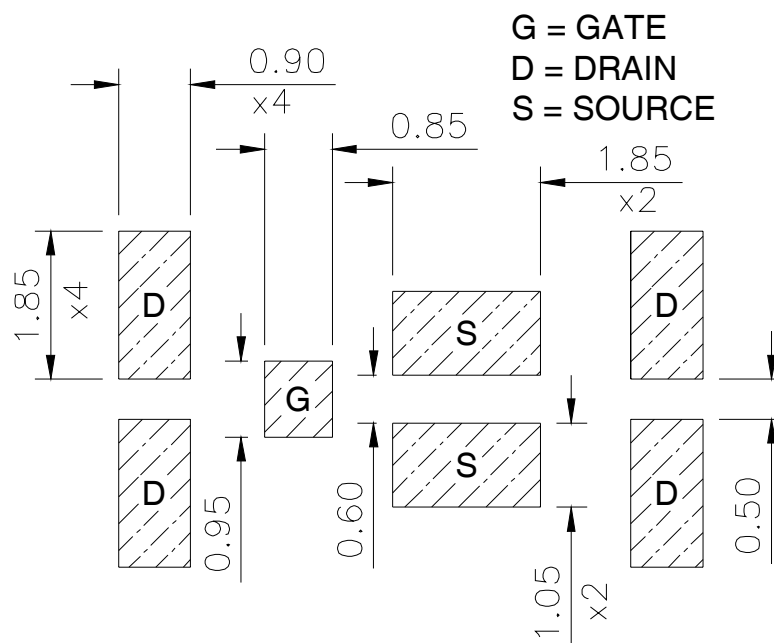
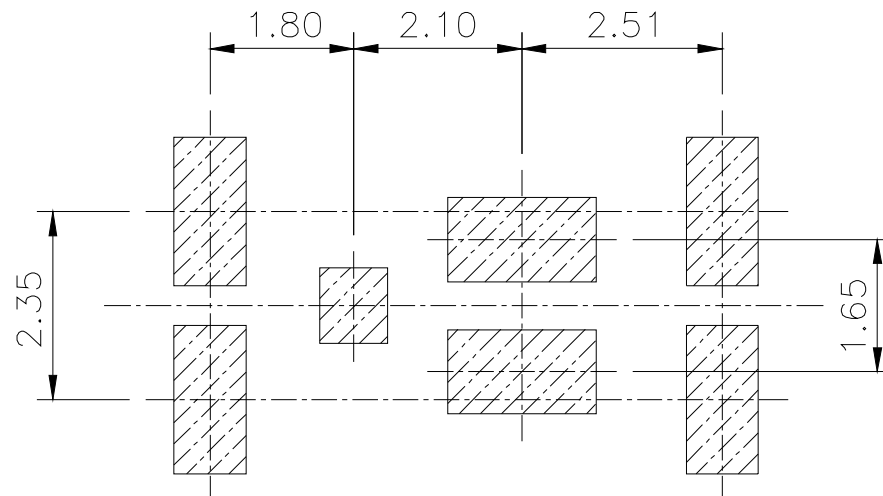


**NOTE: CONTROLLING  
DIMENSIONS ARE IN MM**

| DIMENSIONS |        |      |          |       |
|------------|--------|------|----------|-------|
| CODE       | METRIC |      | IMPERIAL |       |
|            | MIN    | MAX  | MIN      | MAX   |
| A          | 6.25   | 6.35 | 0.246    | 0.250 |
| B          | 4.80   | 5.05 | 0.189    | 0.199 |
| C          | 3.85   | 3.95 | 0.152    | 0.156 |
| D          | 0.35   | 0.45 | 0.014    | 0.018 |
| E          | 0.78   | 0.82 | 0.031    | 0.032 |
| F          | 0.88   | 0.92 | 0.035    | 0.036 |
| G          | 1.78   | 1.82 | 0.070    | 0.072 |
| H          | 0.98   | 1.02 | 0.039    | 0.040 |
| J          | 0.63   | 0.67 | 0.025    | 0.026 |
| K          | 0.88   | 1.01 | 0.035    | 0.039 |
| L          | 2.46   | 2.63 | 0.097    | 0.104 |
| M          | 0.59   | 0.70 | 0.023    | 0.028 |
| N          | 0.03   | 0.08 | 0.001    | 0.003 |
| P          | 0.08   | 0.17 | 0.003    | 0.007 |

# **DirectFET™ Board Footprint, MT Outline (Medium Size Can, T-Designation).**

Please see DirectFET application note AN-1035 for all details regarding the assembly of DirectFET.  
This includes all recommendations for stencil and substrate designs.

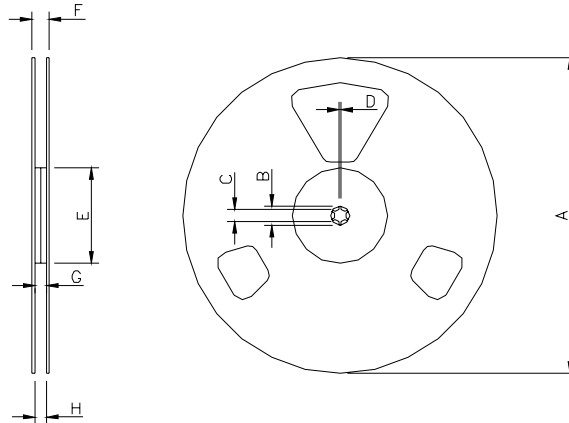




# IRF6691

## DirectFET™ Tape & Reel Dimension (Showing component orientation).

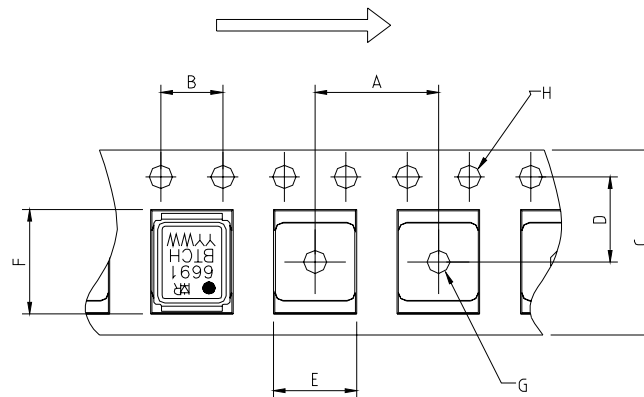
International  
**IOR** Rectifier



NOTE: Controlling dimensions in mm  
Std reel quantity is 4800 parts. (ordered as IRF6691). For 1000 parts on 7" reel,  
order IRF6691TR1

| REEL DIMENSIONS            |        |      |          |       |                       |       |          |      |
|----------------------------|--------|------|----------|-------|-----------------------|-------|----------|------|
| STANDARD OPTION (QTY 4800) |        |      |          |       | TR1 OPTION (QTY 1000) |       |          |      |
|                            | METRIC |      | IMPERIAL |       | METRIC                |       | IMPERIAL |      |
| CODE                       | MIN    | MAX  | MIN      | MAX   | MIN                   | MAX   | MIN      | MAX  |
| A                          | 330.0  | N.C  | 12.992   | N.C   | 177.77                | N.C   | 6.9      | N.C  |
| B                          | 20.2   | N.C  | 0.795    | N.C   | 19.06                 | N.C   | 0.75     | N.C  |
| C                          | 12.8   | 13.2 | 0.504    | 0.520 | 13.5                  | 12.8  | 0.53     | 0.50 |
| D                          | 1.5    | N.C  | 0.059    | N.C   | 1.5                   | N.C   | 0.059    | N.C  |
| E                          | 100.0  | N.C  | 3.937    | N.C   | 58.72                 | N.C   | 2.31     | N.C  |
| F                          | N.C    | 18.4 | N.C      | 0.724 | N.C                   | 13.50 | N.C      | 0.53 |
| G                          | 12.4   | 14.4 | 0.488    | 0.567 | 11.9                  | 12.01 | 0.47     | N.C  |
| H                          | 11.9   | 15.4 | 0.469    | 0.606 | 11.9                  | 12.01 | 0.47     | N.C  |

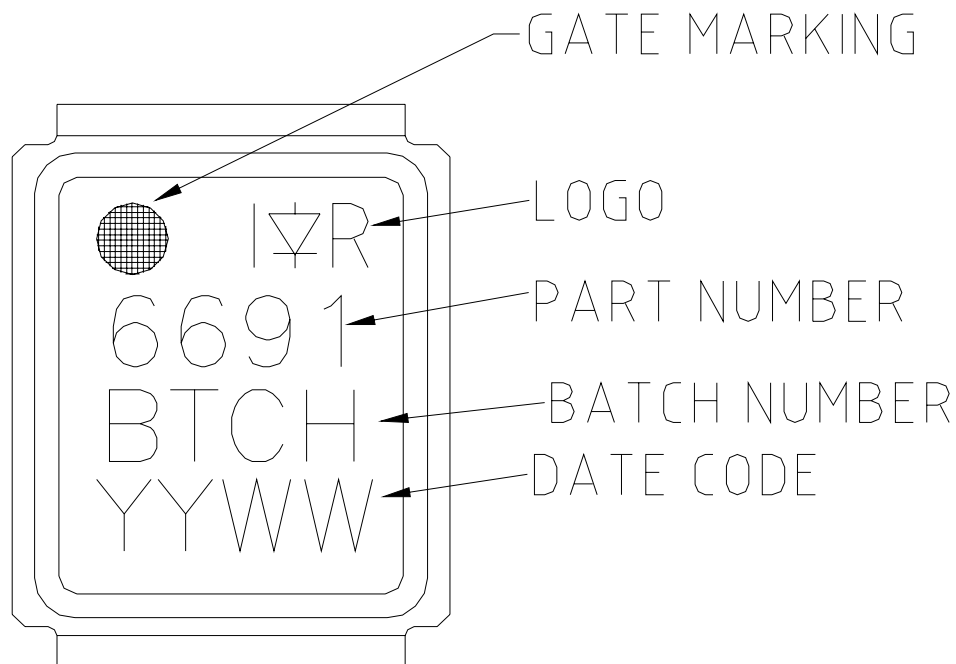
LOADED TAPE FEED DIRECTION



NOTE: CONTROLLING  
DIMENSIONS IN MM

| DIMENSIONS |        |       |          |       |
|------------|--------|-------|----------|-------|
|            | METRIC |       | IMPERIAL |       |
| CODE       | MIN    | MAX   | MIN      | MAX   |
| A          | 7.90   | 8.10  | 0.311    | 0.319 |
| B          | 3.90   | 4.10  | 0.154    | 0.161 |
| C          | 11.90  | 12.30 | 0.469    | 0.484 |
| D          | 5.45   | 5.55  | 0.215    | 0.219 |
| E          | 5.10   | 5.30  | 0.201    | 0.209 |
| F          | 6.50   | 6.70  | 0.256    | 0.264 |
| G          | 1.50   | N.C   | 0.059    | N.C   |
| H          | 1.50   | 1.60  | 0.059    | 0.063 |

## DirectFET™ Part Marking



### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.72\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 26\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ Surface mounted on 1 in. square Cu board.
- ⑤ Used double sided cooling, mounting pad.
- ⑥ Mounted on minimum footprint full size board with metalized back and with small clip heatsink.
- ⑦  $T_C$  measured with thermal couple mounted to top (Drain) of part.
- ⑧  $R_\theta$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .

Data and specifications subject to change without notice.  
This product has been designed and qualified for the Industrial market.  
Qualification Standards can be found on IR's Web site.

International  
**IR** Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
TAC Fax: (310) 252-7903

Visit us at [www.irf.com](http://www.irf.com) for sales contact information. 11/05

Note: For the most current drawings please refer to the IR website at:  
<http://www.irf.com/package/>