

International  
**IR** Rectifier

PD - 97145

**IRF8313PbF**

HEXFET® Power MOSFET

### Applications

- Load Switch
- DC/DC Conversion

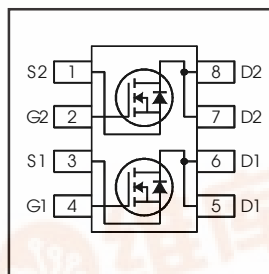
### Benefits

- Low Gate Charge and Low  $R_{DS(on)}$
- Fully Characterized Avalanche Voltage and Current
- 20V  $V_{GS}$  Max. Gate Rating
- 100% Tested for  $R_G$
- Lead-Free (Qualified to 260°C Reflow)
- RoHS Compliant (Halogen Free)

### Description

The IRF8313PbF incorporates the latest HEXFET Power MOSFET Silicon Technology into the industry standard SO-8 package. The IRF8313PbF has been optimized for parameters that are critical in synchronous buck operation including  $R_{ds(on)}$  and gate charge to reduce both conduction and switching losses. The reduced total losses make this product ideal for high efficiency DC-DC converters that power the latest generation of processors for notebook and Netcom applications.

| $V_{DSS}$ | $R_{DS(on)}$ max        | Qg    |
|-----------|-------------------------|-------|
| 30V       | 15.5mΩ @ $V_{GS} = 10V$ | 6.0nC |



### Absolute Maximum Ratings

|                            | Parameter                                           | Max.         | Units |
|----------------------------|-----------------------------------------------------|--------------|-------|
| $V_{DS}$                   | Drain-to-Source Voltage                             | 30           | V     |
| $V_{GS}$                   | Gate-to-Source Voltage                              | ±20          |       |
| $I_D$ @ $T_A = 25^\circ C$ | Continuous Drain Current, $V_{GS}$ @ 10V            | 9.7          | A     |
| $I_D$ @ $T_A = 70^\circ C$ | Continuous Drain Current, $V_{GS}$ @ 10V            | 8.1          |       |
| $I_{DM}$                   | Pulsed Drain Current ①                              | 81           |       |
| $P_D$ @ $T_A = 25^\circ C$ | Power Dissipation                                   | 2.0          | W     |
| $P_D$ @ $T_A = 70^\circ C$ | Power Dissipation                                   | 1.3          |       |
|                            | Linear Derating Factor                              | 0.016        | W/°C  |
| $T_J$<br>$T_{STG}$         | Operating Junction and<br>Storage Temperature Range | -55 to + 175 | °C    |

### Thermal Resistance

|                 | Parameter                | Typ. | Max. | Units |
|-----------------|--------------------------|------|------|-------|
| $R_{\theta JL}$ | Junction-to-Drain Lead ⑤ | —    | 42   | °C/W  |
| $R_{\theta JA}$ | Junction-to-Ambient ④ ⑤  | —    | 62.5 |       |

Notes ① through ⑤ are on page 9

### ORDERING INFORMATION:

See detailed ordering and shipping information on the last page of this data sheet.

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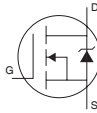
**Static @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

|                              | Parameter                                  | Min. | Typ.  | Max. | Units                | Conditions                                                                               |
|------------------------------|--------------------------------------------|------|-------|------|----------------------|------------------------------------------------------------------------------------------|
| $BV_{DSS}$                   | Drain-to-Source Breakdown Voltage          | 30   | —     | —    | V                    | $V_{GS} = 0V, I_D = 250\mu A$                                                            |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient        | —    | 0.021 | —    | V/ $^\circ\text{C}$  | Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$                                     |
| $R_{DS(on)}$                 | Static Drain-to-Source On-Resistance       | —    | 12.5  | 15.5 | $m\Omega$            | $V_{GS} = 10V, I_D = 9.7A$ ③                                                             |
|                              |                                            | —    | 18.6  | 21.6 |                      | $V_{GS} = 4.5V, I_D = 8.0A$ ③                                                            |
| $V_{GS(th)}$                 | Gate Threshold Voltage                     | 1.35 | 1.80  | 2.35 | V                    | $V_{DS} = V_{GS}, I_D = 25\mu A$                                                         |
| $\Delta V_{GS(th)}$          | Gate Threshold Voltage Coefficient         | —    | -6.0  | —    | mV/ $^\circ\text{C}$ |                                                                                          |
| $I_{DSS}$                    | Drain-to-Source Leakage Current            | —    | —     | 1.0  | $\mu A$              | $V_{DS} = 24V, V_{GS} = 0V$                                                              |
|                              |                                            | —    | —     | 150  |                      | $V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$                                     |
| $I_{GSS}$                    | Gate-to-Source Forward Leakage             | —    | —     | 100  | nA                   | $V_{GS} = 20V$                                                                           |
|                              | Gate-to-Source Reverse Leakage             | —    | —     | -100 |                      | $V_{GS} = -20V$                                                                          |
| $g_{fs}$                     | Forward Transconductance                   | 23   | —     | —    | S                    | $V_{DS} = 15V, I_D = 8.0A$                                                               |
| $Q_g$                        | Total Gate Charge                          | —    | 6.0   | 9.0  | nC                   | $V_{DS} = 15V$<br>$V_{GS} = 4.5V$<br>$I_D = 8.0A$<br>See Figs. 17a & 17b                 |
| $Q_{gs1}$                    | Pre-V <sub>th</sub> Gate-to-Source Charge  | —    | 1.5   | —    |                      |                                                                                          |
| $Q_{gs2}$                    | Post-V <sub>th</sub> Gate-to-Source Charge | —    | 0.9   | —    |                      |                                                                                          |
| $Q_{gd}$                     | Gate-to-Drain Charge                       | —    | 2.2   | —    |                      |                                                                                          |
| $Q_{godr}$                   | Gate Charge Overdrive                      | —    | 1.4   | —    |                      |                                                                                          |
| $Q_{sw}$                     | Switch Charge ( $Q_{gs2} + Q_{gd}$ )       | —    | 2.9   | —    |                      |                                                                                          |
| $Q_{oss}$                    | Output Charge                              | —    | 3.8   | —    | nC                   | $V_{DS} = 16V, V_{GS} = 0V$                                                              |
| $R_g$                        | Gate Resistance                            | —    | 2.2   | 3.6  | $\Omega$             |                                                                                          |
| $t_{d(on)}$                  | Turn-On Delay Time                         | —    | 8.3   | —    | ns                   | $V_{DD} = 15V, V_{GS} = 4.5V$<br>$I_D = 8.0A$<br>$R_G = 1.8\Omega$<br>See Fig. 15a & 15b |
| $t_r$                        | Rise Time                                  | —    | 9.9   | —    |                      |                                                                                          |
| $t_{d(off)}$                 | Turn-Off Delay Time                        | —    | 8.5   | —    |                      |                                                                                          |
| $t_f$                        | Fall Time                                  | —    | 4.2   | —    |                      |                                                                                          |
| $C_{iss}$                    | Input Capacitance                          | —    | 760   | —    | pF                   | $V_{GS} = 0V$<br>$V_{DS} = 15V$<br>$f = 1.0\text{MHz}$                                   |
| $C_{oss}$                    | Output Capacitance                         | —    | 172   | —    |                      |                                                                                          |
| $C_{rss}$                    | Reverse Transfer Capacitance               | —    | 87    | —    |                      |                                                                                          |

## Avalanche Characteristics

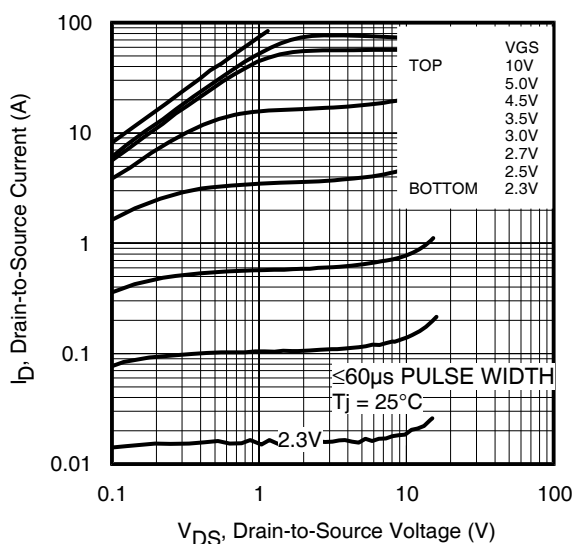
|          | Parameter                       | Typ. | Max. | Units |
|----------|---------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy ② | —    | 46   | mJ    |
| $I_{AR}$ | Avalanche Current ①             | —    | 8.0  | A     |

## Diode Characteristics

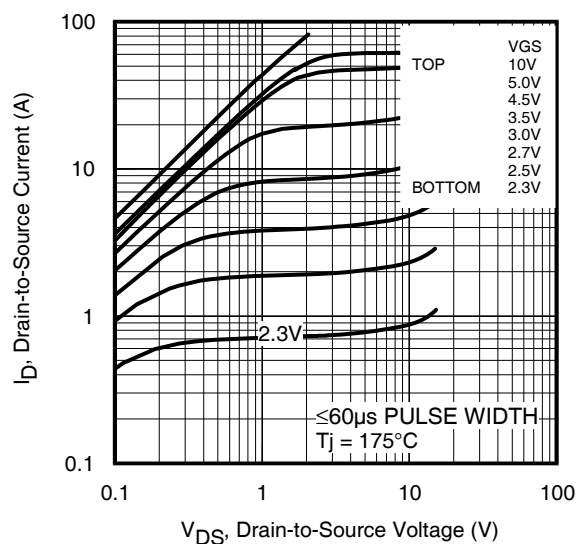
|          | Parameter                                 | Min.                                                                 | Typ. | Max. | Units | Conditions                                                                                                                                                       |
|----------|-------------------------------------------|----------------------------------------------------------------------|------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current<br>(Body Diode) | —                                                                    | —    | 3.1  | A     | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode.<br> |
| $I_{SM}$ | Pulsed Source Current<br>(Body Diode) ①   | —                                                                    | —    | 82   | A     |                                                                                                                                                                  |
| $V_{SD}$ | Diode Forward Voltage                     | —                                                                    | —    | 1.0  | V     | $T_J = 25^\circ\text{C}, I_S = 8.0A, V_{GS} = 0V$ ③                                                                                                              |
| $t_{rr}$ | Reverse Recovery Time                     | —                                                                    | 20   | 30   | ns    | $T_J = 25^\circ\text{C}, I_F = 8.0A, V_{DD} = 15V$                                                                                                               |
| $Q_{rr}$ | Reverse Recovery Charge                   | —                                                                    | 10   | 15   | nC    | $di/dt = 100A/\mu s$ ③                                                                                                                                           |
| $t_{on}$ | Forward Turn-On Time                      | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) |      |      |       |                                                                                                                                                                  |

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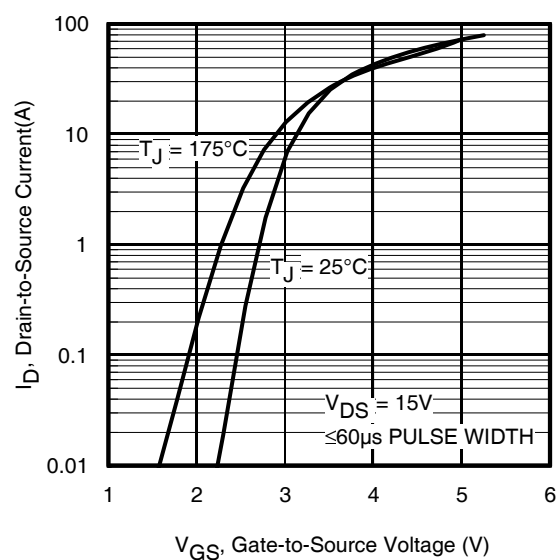
## IRF8313PbF



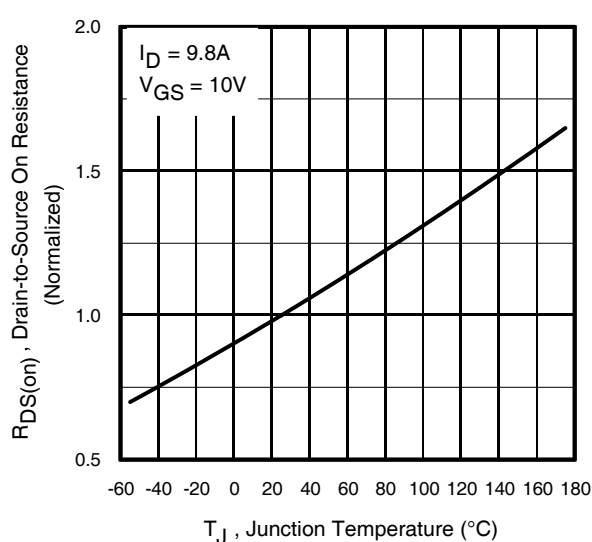
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



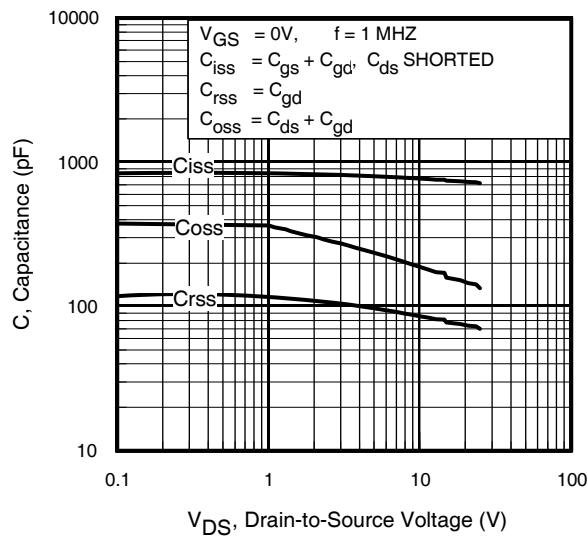
**Fig 3.** Typical Transfer Characteristics



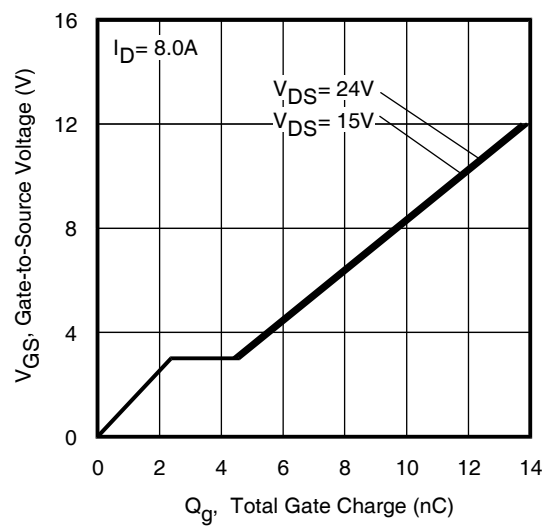
**Fig 4.** Normalized On-Resistance  
vs. Temperature

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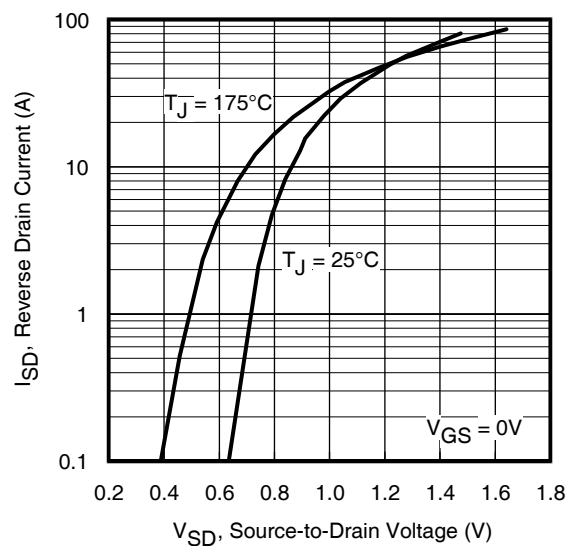
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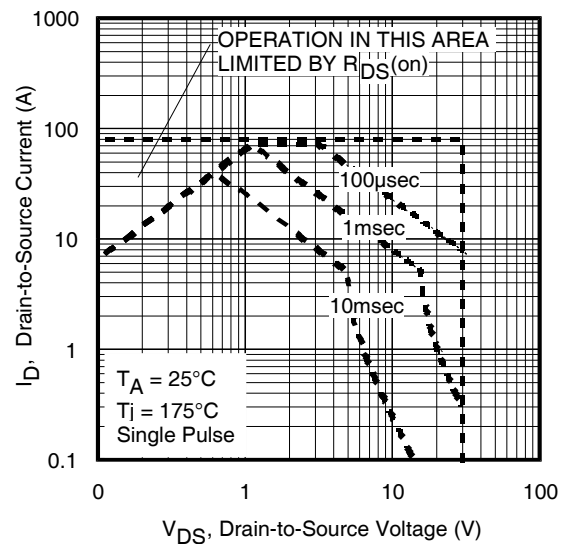
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



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



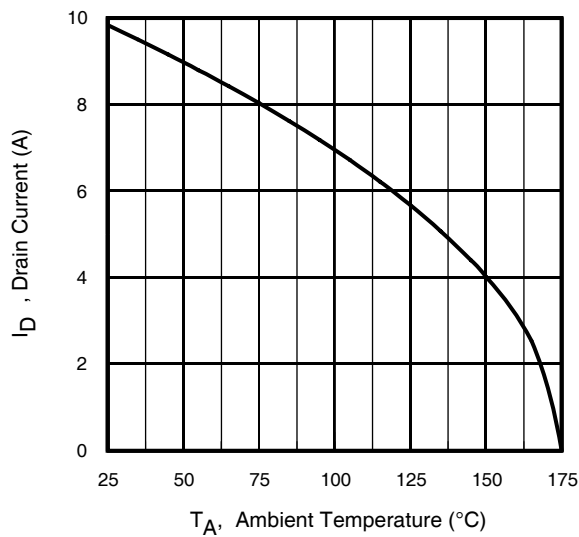
**Fig 7.** Typical Source-Drain Diode Forward Voltage



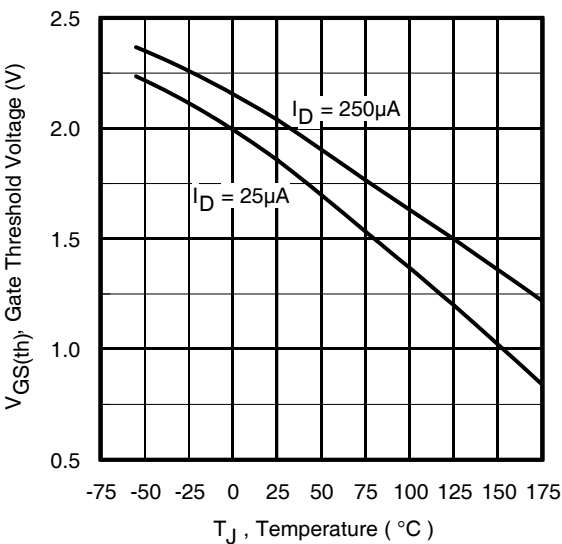
**Fig 8.** Maximum Safe Operating Area

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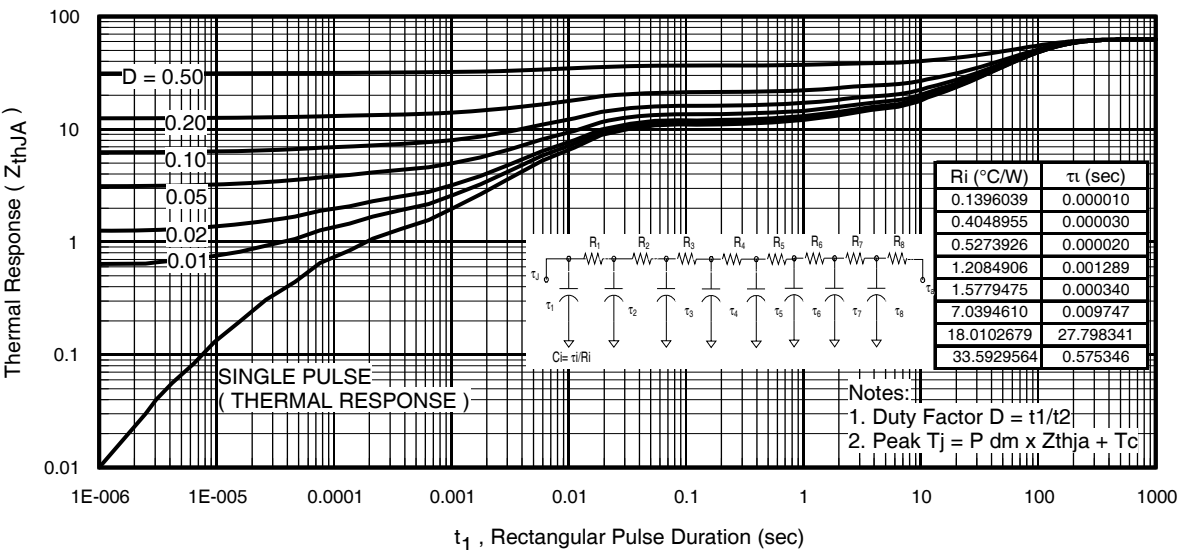
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**Fig 9.** Maximum Drain Current vs. Ambient Temperature



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



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

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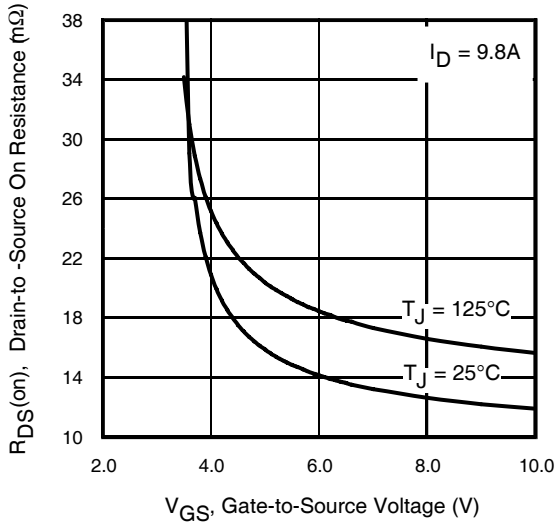


Fig 12. On-Resistance vs. Gate Voltage

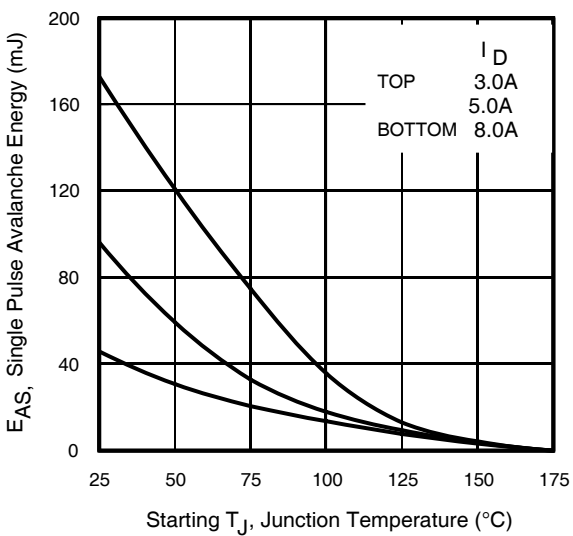


Fig 13. Maximum Avalanche Energy vs. Drain Current

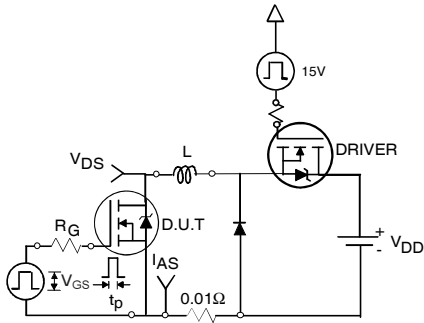


Fig 14a. Unclamped Inductive Test Circuit

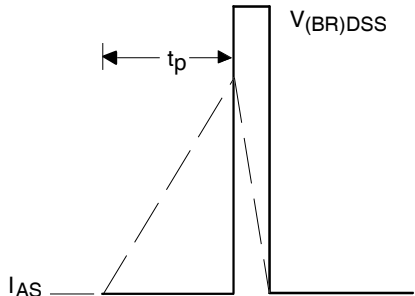


Fig 14b. Unclamped Inductive Waveforms

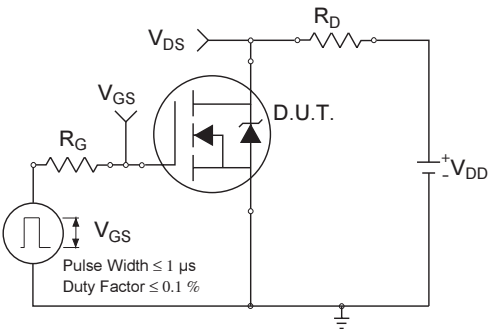


Fig 15a. Switching Time Test Circuit

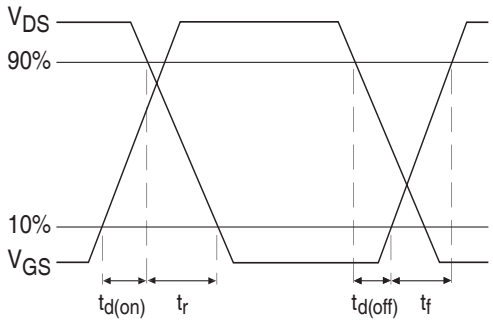
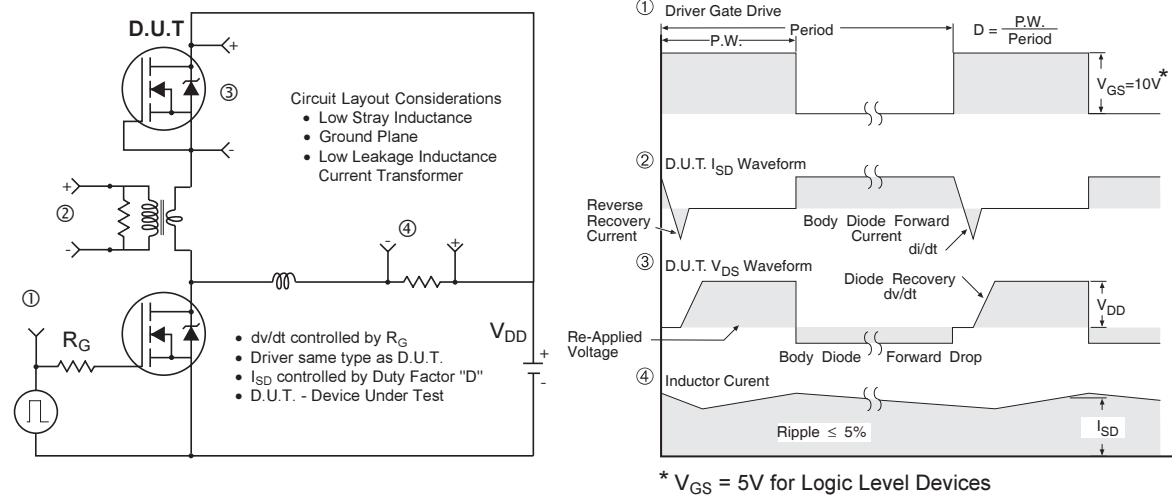


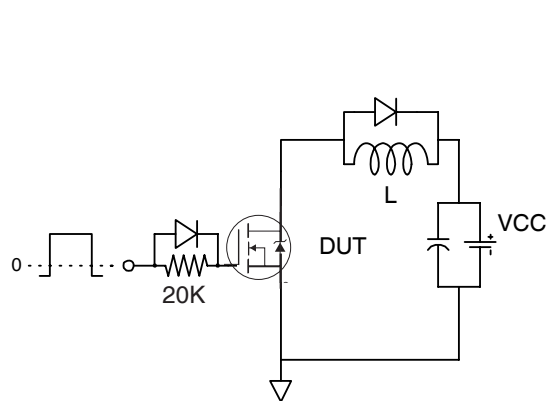
Fig 15b. Switching Time Waveforms  
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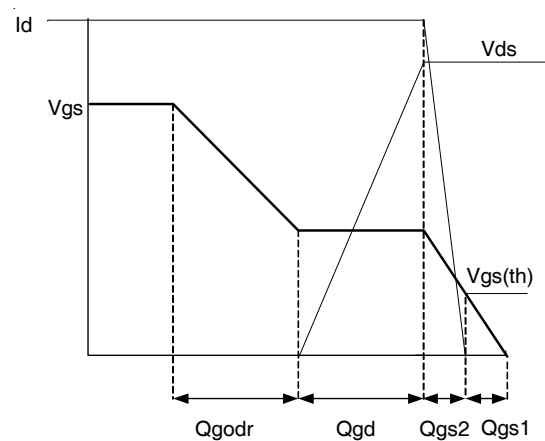
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**Fig 16. Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs**



**Fig 17a. Gate Charge Test Circuit**



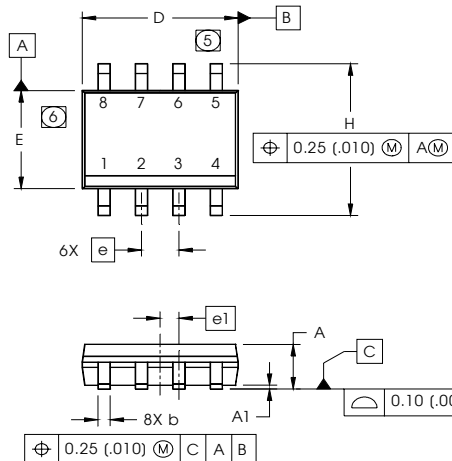
**Fig 17b. Gate Charge Waveform**

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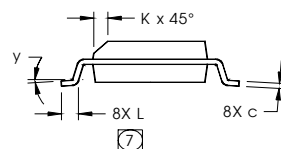
## SO-8 Package Outline

Dimensions are shown in millimeters (inches)

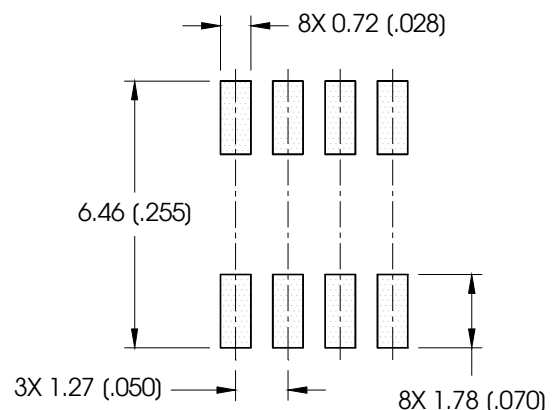
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| DIM | INCHES     |       | MILLIMETERS |      |
|-----|------------|-------|-------------|------|
|     | MIN        | MAX   | MIN         | MAX  |
| A   | .0532      | .0688 | 1.35        | 1.75 |
| A1  | .0040      | .0098 | 0.10        | 0.25 |
| b   | .013       | .020  | 0.33        | 0.51 |
| c   | .0075      | .0098 | 0.19        | 0.25 |
| D   | .189       | .1968 | 4.80        | 5.00 |
| E   | .1497      | .1574 | 3.80        | 4.00 |
| e   | .050 BASIC |       | 1.27 BASIC  |      |
| e1  | .025 BASIC |       | 0.635 BASIC |      |
| H   | .2284      | .2440 | 5.80        | 6.20 |
| K   | .0099      | .0196 | 0.25        | 0.50 |
| L   | .016       | .050  | 0.40        | 1.27 |
| y   | 0°         | 8°    | 0°          | 8°   |



FOOTPRINT

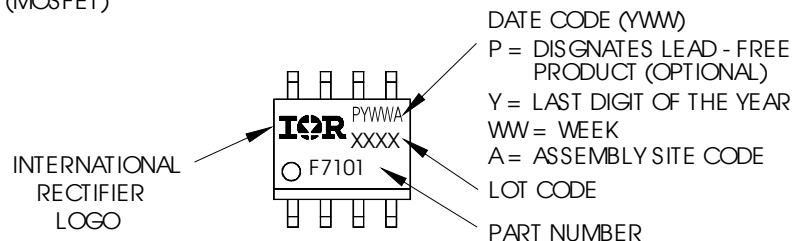


### NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
- ⑤ DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 (.006).
- ⑥ DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 (.010).
- ⑦ DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

## SO-8 Part Marking Information

EXAMPLE: THIS IS AN IRF7101 (MOSFET)



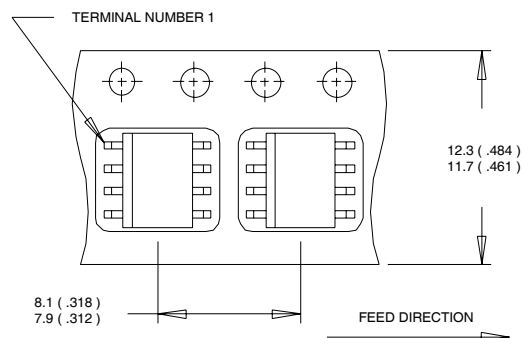
Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

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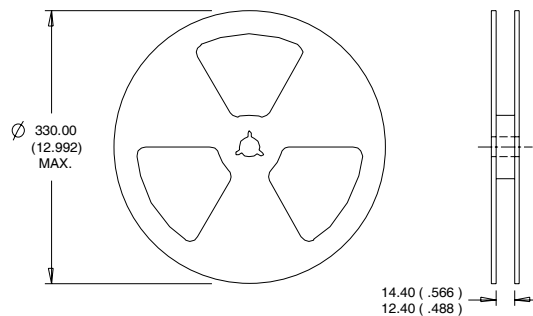
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## SO-8 Tape and Reel

Dimensions are shown in millimeters (inches)



- NOTES:
1. CONTROLLING DIMENSION : MILLIMETER.
  2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS(INCHES).
  3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



- NOTES:
1. CONTROLLING DIMENSION : MILLIMETER.
  2. OUTLINE CONFORMS TO EIA-481 & EIA-541.

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1.43\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 8.0\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ When mounted on 1 inch square copper board.
- ⑤  $R_\theta$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .

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

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| Orderable Part number | Package Type | Standard Pack |          | Note |
|-----------------------|--------------|---------------|----------|------|
|                       |              | Form          | Quantity |      |
| IRF8313PbF            | SO-8         | Tube/Bulk     | 95       |      |
| IRF8313TRPbF          | SO-8         | Tape and Reel | 4000     |      |

## Qualification Information<sup>†</sup>

|                            |                                                                         |                                                |
|----------------------------|-------------------------------------------------------------------------|------------------------------------------------|
| Qualification Level        | Consumer <sup>††</sup><br>(per JEDEC JESD47F <sup>†††</sup> guidelines) |                                                |
| Moisture Sensitivity Level | SO-8                                                                    | MSL1<br>(per JEDEC J-STD-020D <sup>†††</sup> ) |
| RoHS Compliant             | Yes                                                                     |                                                |

† Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/>

†† Higher qualification ratings may be available should the user have such requirements.

Please contact your International Rectifier sales representative for further information:

<http://www.irf.com/whoto-call/salesrep/>

††† Applicable version of JEDEC standard at the time of product release.

Data and specifications subject to change without notice.

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