

# IRF8313PbF

HEXFET® Power MOSFET

## Applications

- Load Switch
- DC/DC Conversion

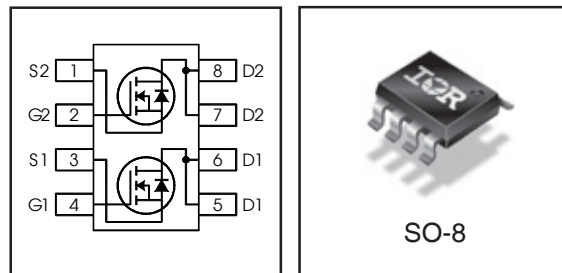
## Benefits

- 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
$T_J$	Operating Junction and	-55 to + 175	°C
$T_{STG}$	Storage Temperature Range		

## 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.

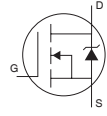
## Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

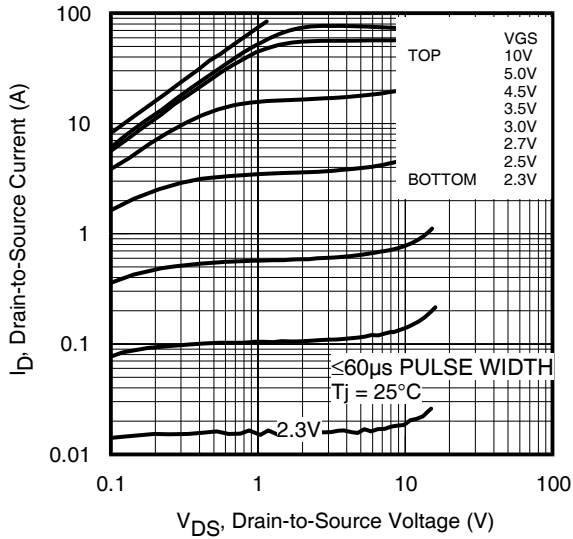
	Parameter	Min.	Typ.	Max.	Units	Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.021	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	12.5	15.5	mΩ	$V_{GS} = 10V, I_D = 9.7A$ 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/°C	
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	1.0	μA	$V_{DS} = 24V, V_{GS} = 0V$
		—	—	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	$V_{DS} = 15V$ $V_{GS} = 4.5V$ $I_D = 8.0A$ See Figs. 17a & 17b
$Q_{gs1}$	Pre-Vth Gate-to-Source Charge	—	1.5	—		
$Q_{gs2}$	Post-Vth 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	Ω	
$t_{d(on)}$	Turn-On Delay Time	—	8.3	—	ns	$V_{DD} = 15V, V_{GS} = 4.5V$ $I_D = 8.0A$ $R_G = 1.8\Omega$ 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	$V_{GS} = 0V$ $V_{DS} = 15V$ $f = 1.0MHz$
$C_{oss}$	Output Capacitance	—	172	—		
$C_{rss}$	Reverse Transfer Capacitance	—	87	—		

## Avalanche Characteristics

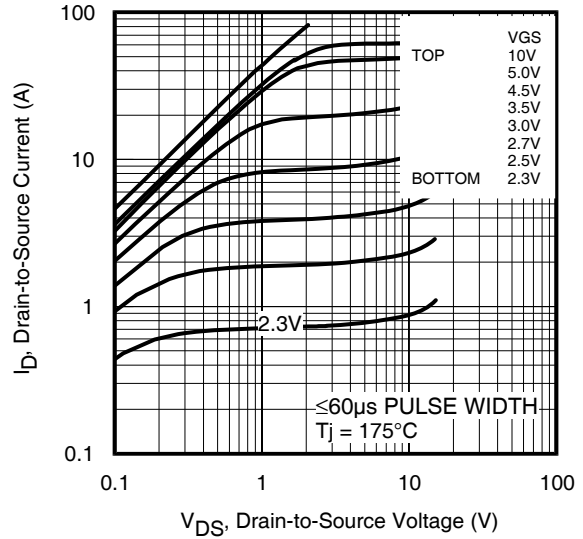
	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	46	mJ
$I_{AR}$	Avalanche Current ①	—	8.0	A

## Diode Characteristics

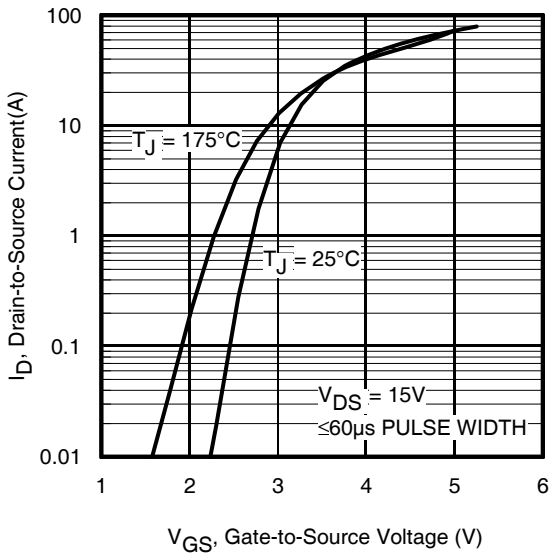
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	3.1	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	82	A	
$V_{SD}$	Diode Forward Voltage	—	—	1.0	V	$T_J = 25^\circ\text{C}, I_S = 8.0A, V_{GS} = 0V$ 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)				



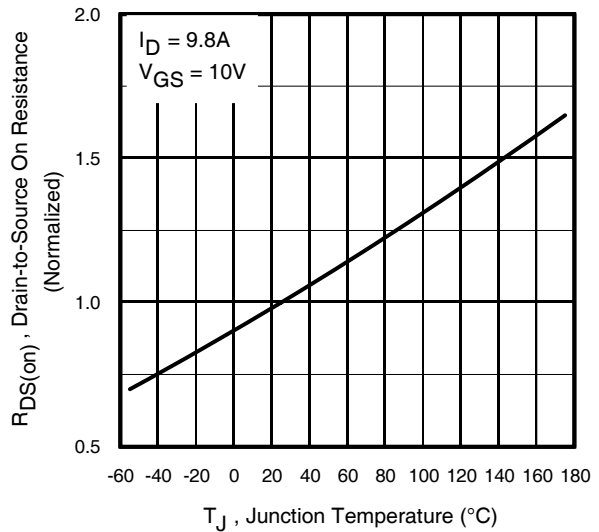
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics

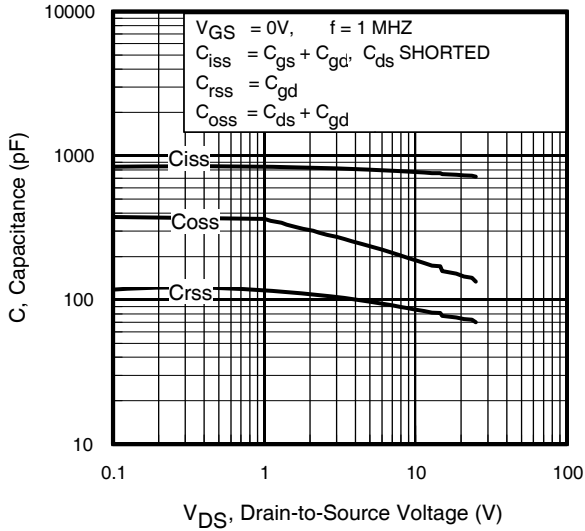


**Fig 3.** Typical Transfer Characteristics

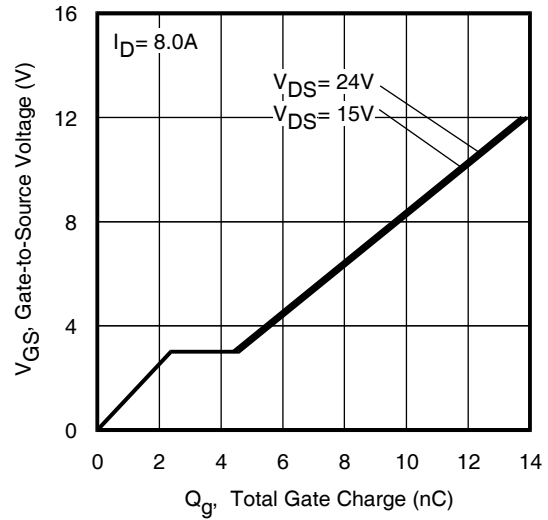


**Fig 4.** Normalized On-Resistance vs. Temperature

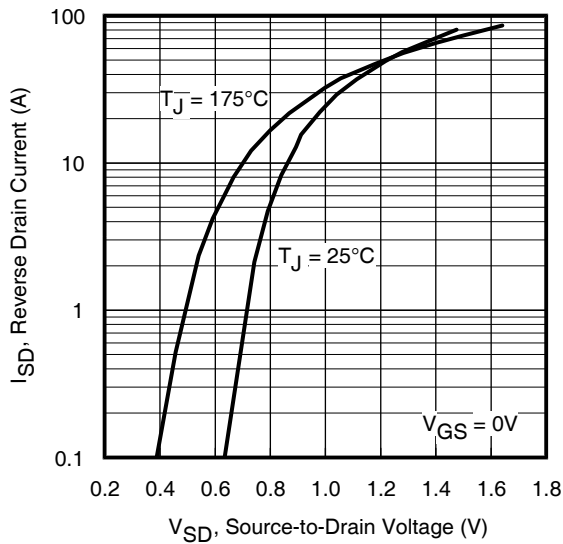
# IRF8313PbF



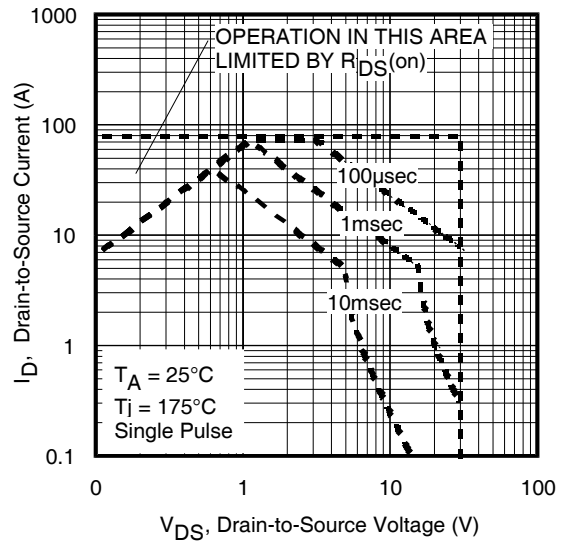
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



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



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



**Fig 8.** Maximum Safe Operating Area

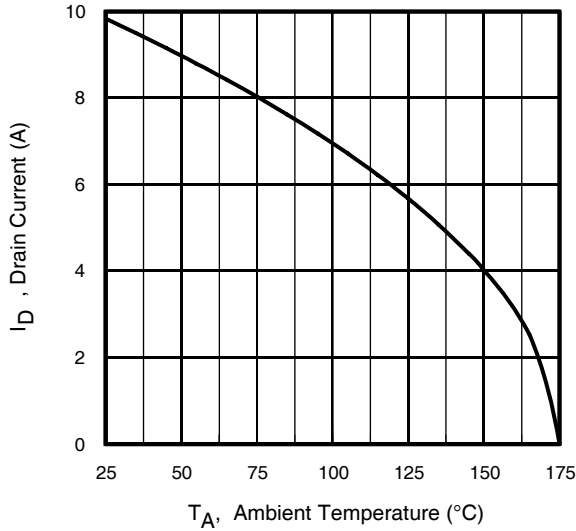


Fig 9. Maximum Drain Current vs. Ambient Temperature

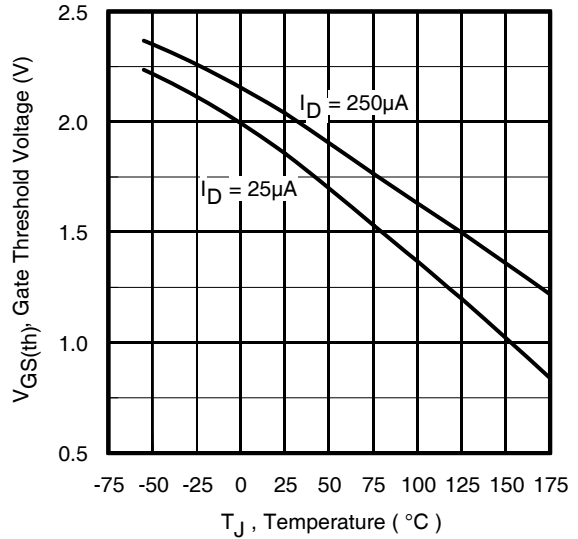


Fig 10. Threshold Voltage vs. Temperature

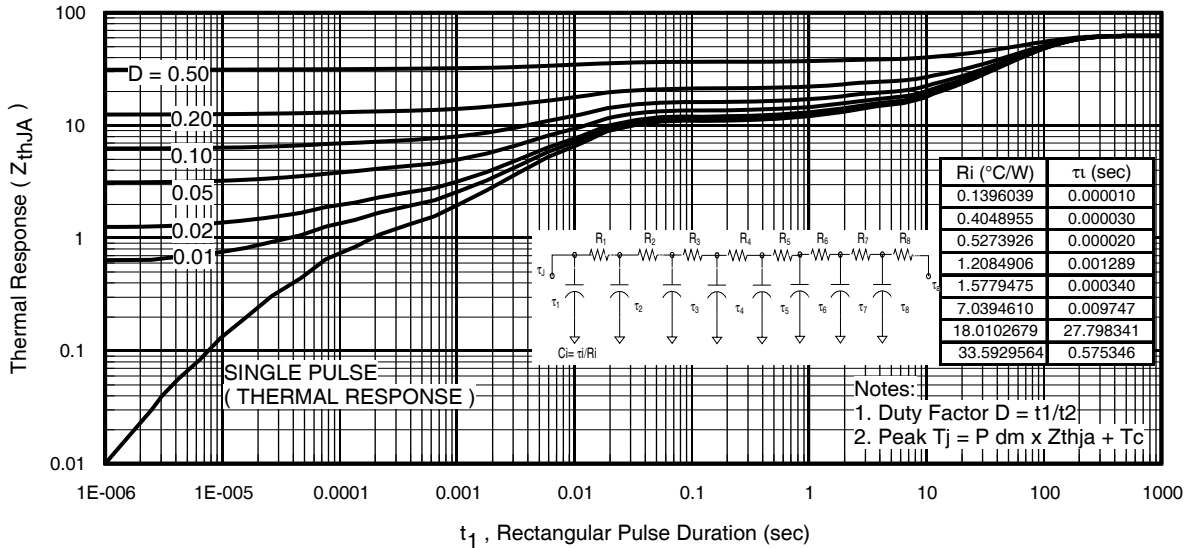


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

# IRF8313PbF

International  
**IR** Rectifier

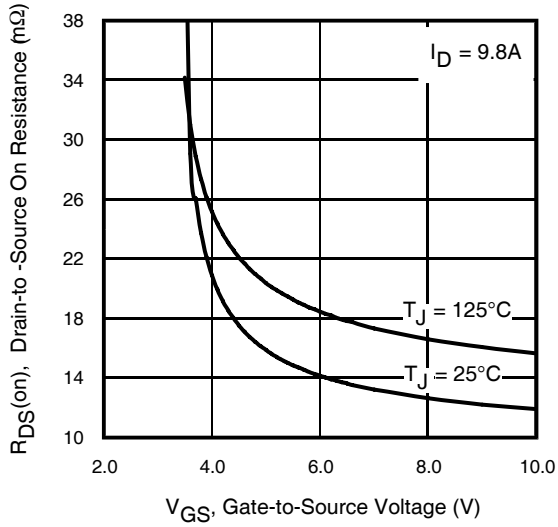


Fig 12. On-Resistance vs. Gate Voltage

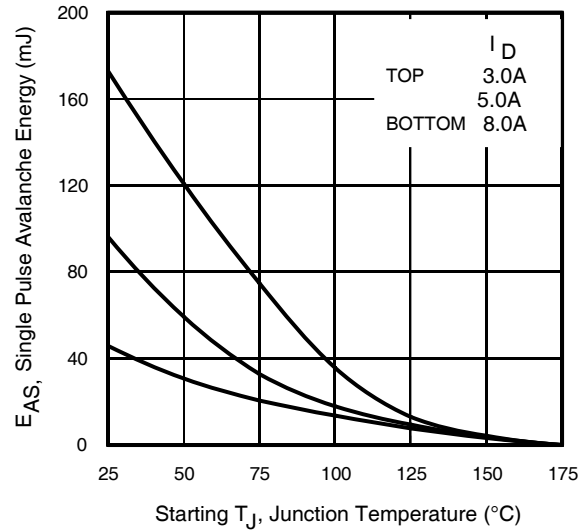


Fig 13. Maximum Avalanche Energy vs. Drain Current

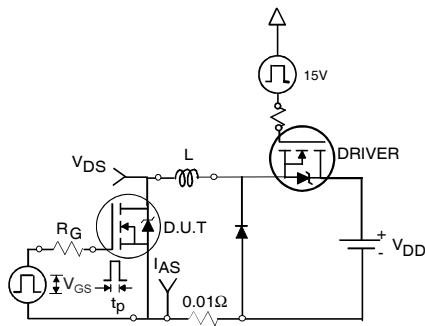


Fig 14a. Unclamped Inductive Test Circuit

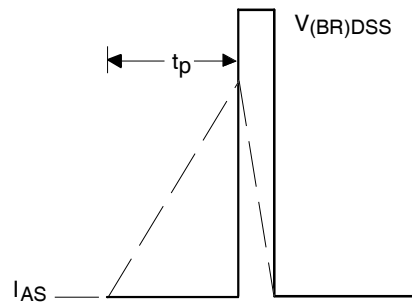


Fig 14b. Unclamped Inductive Waveforms

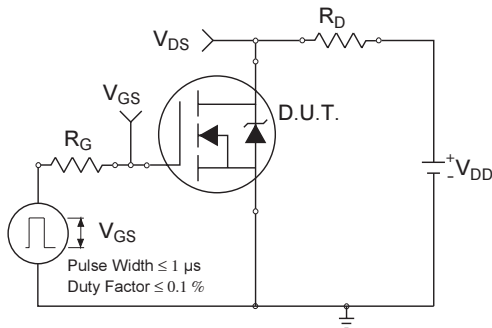


Fig 15a. Switching Time Test Circuit

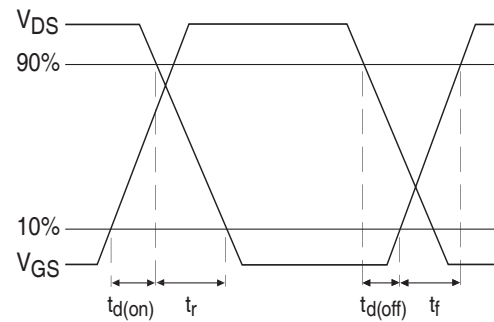
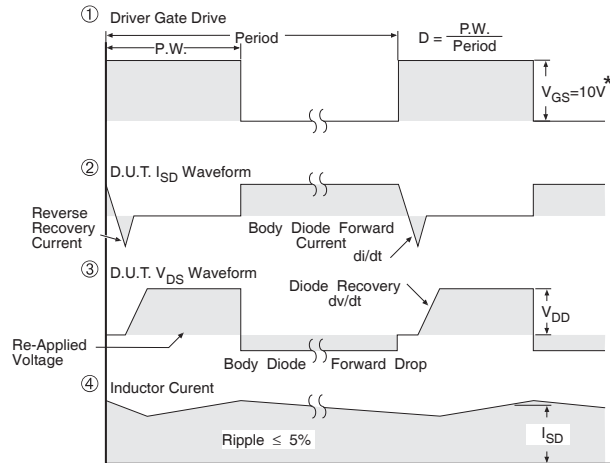
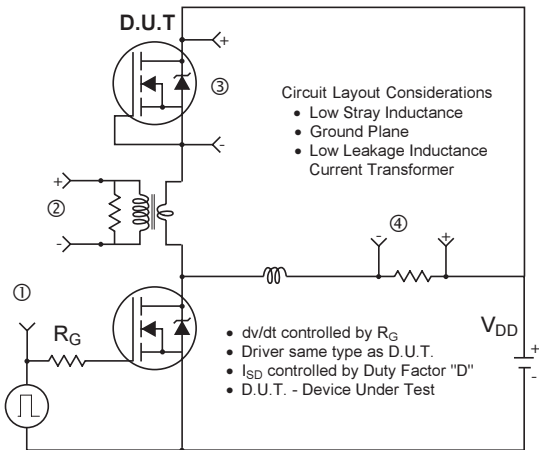


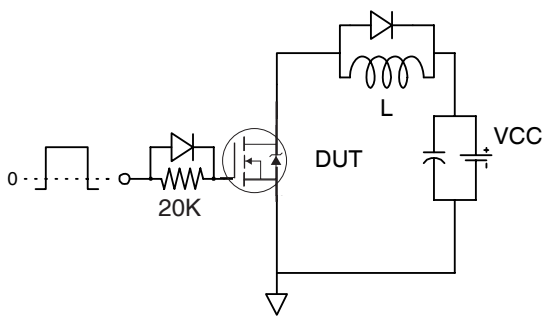
Fig 15b. Switching Time Waveforms

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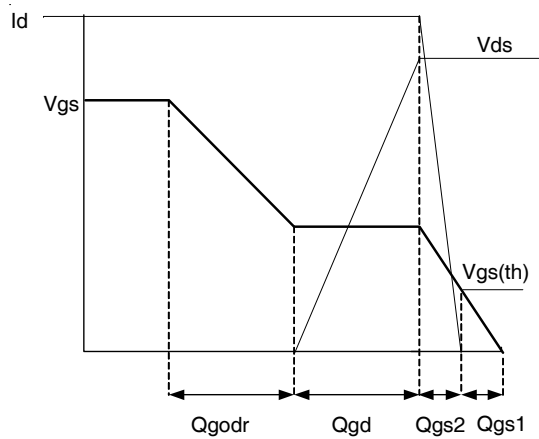


\*  $V_{GS} = 5V$  for Logic Level Devices

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



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



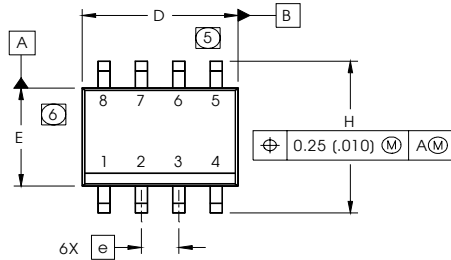
**Fig 17b. Gate Charge Waveform**

# IRF8313PbF

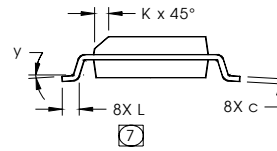
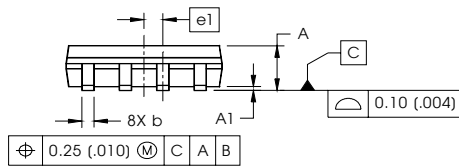
## SO-8 Package Outline

International  
**IR** Rectifier

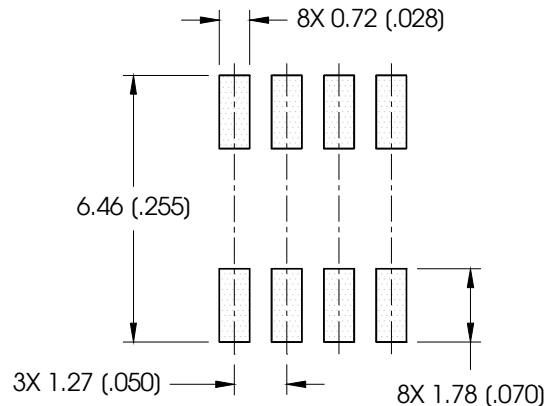
Dimensions are shown in millimeters (inches)



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

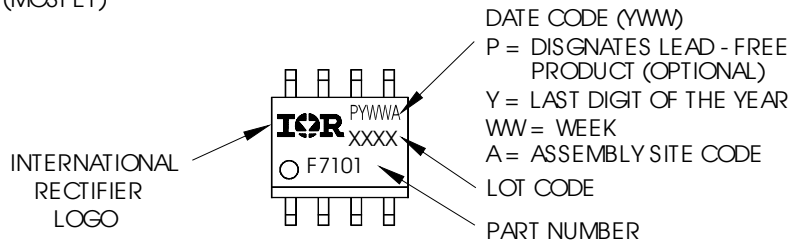


#### NOTES:

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)

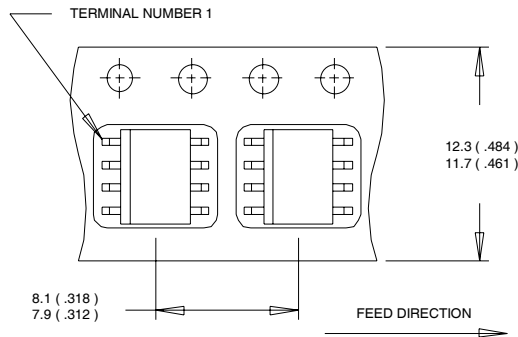


Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

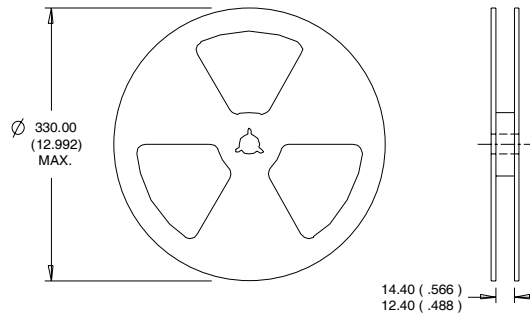


## SO-8 Tape and Reel

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/>

# IRF8313PbF

International  
 Rectifier

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> (per JEDEC JESD47F <sup>†††</sup> guidelines)		
Moisture Sensitivity Level	SO-8	MSL1 (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.

International  
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