

# IRF8788PbF

HEXFET® Power MOSFET

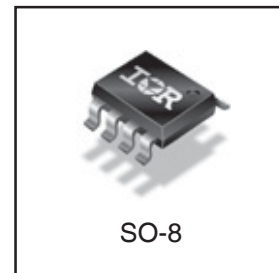
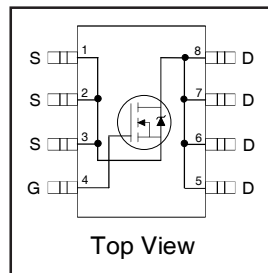
## Applications

- Synchronous MOSFET for Notebook Processor Power
- Synchronous Rectifier MOSFET for Isolated DC-DC Converters

$V_{DSS}$	$R_{DS(on)}$ max	Qg
30V	2.8mΩ @ $V_{GS} = 10V$	44nC

## Benefits

- Very Low Gate Charge
- Very Low  $R_{DS(on)}$  at 4.5V  $V_{GS}$
- Ultra-Low Gate Impedance
- Fully Characterized Avalanche Voltage and Current
- 20V  $V_{GS}$  Max. Gate Rating
- 100% tested for Rg
- Lead-Free



## Description

The IRF8788PbF incorporates the latest HEXFET Power MOSFET Silicon Technology into the industry standard SO-8 package. The IRF8788PbF 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.

## 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	24	A
$I_D$ @ $T_A = 70^\circ C$	Continuous Drain Current, $V_{GS}$ @ 10V	19	
$I_{DM}$	Pulsed Drain Current ①	190	
$P_D$ @ $T_A = 25^\circ C$	Power Dissipation	2.5	W
$P_D$ @ $T_A = 70^\circ C$	Power Dissipation	1.6	
	Linear Derating Factor	0.02	W/°C
$T_J$	Operating Junction and	-55 to + 150	°C
$T_{STG}$	Storage Temperature Range		

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JL}$	Junction-to-Drain Lead ⑤	—	20	°C/W
$R_{\theta JA}$	Junction-to-Ambient ④⑤	—	50	

Notes ① through ⑤ are on page 9

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International  
IR Rectifier

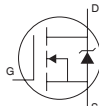
Static @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)

	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	—	0.024	—	$V/^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	2.3	2.8	m $\Omega$	$V_{GS} = 10V, I_D = 24A$ ③
		—	3.04	3.8		$V_{GS} = 4.5V, I_D = 19A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	1.35	1.80	2.35	V	$V_{DS} = V_{GS}, I_D = 100\mu A$
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient	—	-6.59	—	$\text{mV}/^\circ\text{C}$	
$I_{DSS}$	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	95	—	—	S	$V_{DS} = 15V, I_D = 19A$
$Q_g$	Total Gate Charge	—	44	66	nC	$V_{DS} = 15V$ $V_{GS} = 4.5V$ $I_D = 19A$ See Figs. 17a & 17b
$Q_{gs1}$	Pre-V <sub>th</sub> Gate-to-Source Charge	—	12	—		
$Q_{gs2}$	Post-V <sub>th</sub> Gate-to-Source Charge	—	4.7	—		
$Q_{gd}$	Gate-to-Drain Charge	—	14	—		
$Q_{godr}$	Gate Charge Overdrive	—	13.3	—		
$Q_{sw}$	Switch Charge ( $Q_{gs2} + Q_{gd}$ )	—	18.7	—		
$Q_{oss}$	Output Charge	—	22	—	nC	$V_{DS} = 16V, V_{GS} = 0V$
$R_g$	Gate Resistance	—	0.54	1.09	$\Omega$	
$t_{d(on)}$	Turn-On Delay Time	—	23	—	ns	$V_{DD} = 15V, V_{GS} = 4.5V$ $I_D = 19A$ $R_G = 1.8\Omega$ See Fig. 15a & 15b
$t_r$	Rise Time	—	24	—		
$t_{d(off)}$	Turn-Off Delay Time	—	23	—		
$t_f$	Fall Time	—	11	—		
$C_{iss}$	Input Capacitance	—	5720	—	pF	$V_{GS} = 0V$ $V_{DS} = 15V$ $f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	980	—		
$C_{rss}$	Reverse Transfer Capacitance	—	450	—		

## Avalanche Characteristics

	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	230	mJ
$I_{AR}$	Avalanche Current ①	—	19	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	—	—	190	A	
$V_{SD}$	Diode Forward Voltage	—	—	1.0	V	$T_J = 25^\circ\text{C}, I_S = 19A, V_{GS} = 0V$ ③
		—	—	0.75	V	$T_J = 25^\circ\text{C}, I_S = 2.2A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	24	36	ns	$T_J = 25^\circ\text{C}, I_F = 19A, V_{DD} = 15V$
$Q_{rr}$	Reverse Recovery Charge	—	33	50	nC	$di/dt = 230A/\mu s$ ③
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

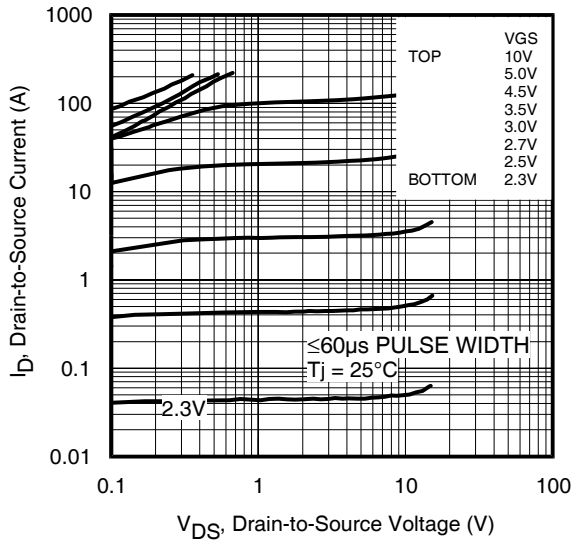


Fig 1. Typical Output Characteristics

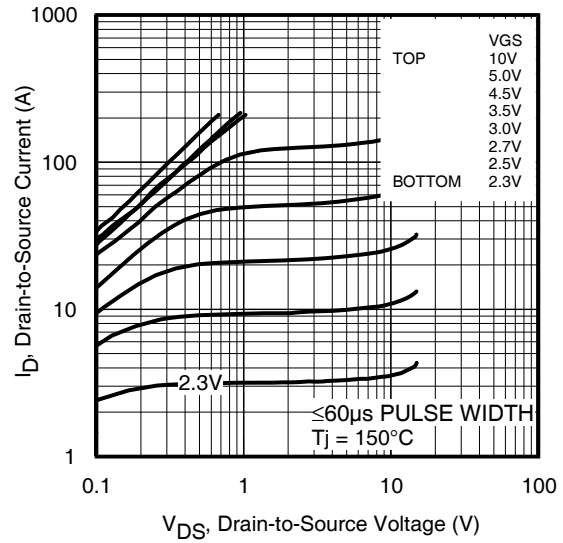


Fig 2. Typical Output Characteristics

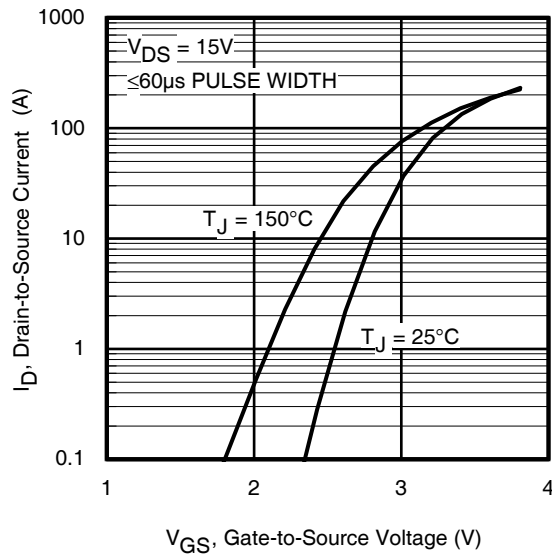


Fig 3. Typical Transfer Characteristics

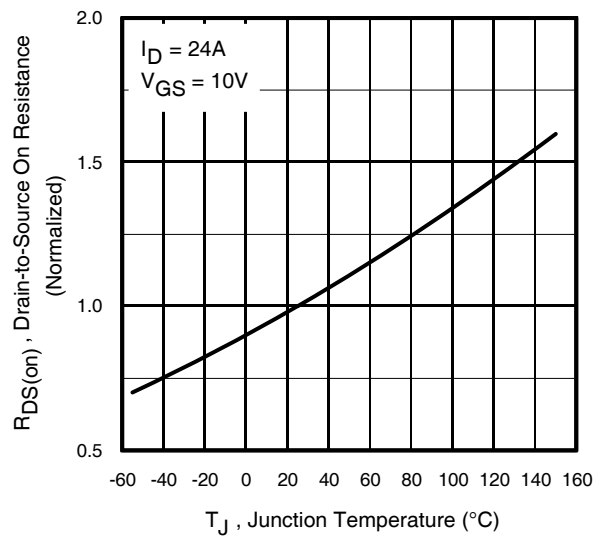
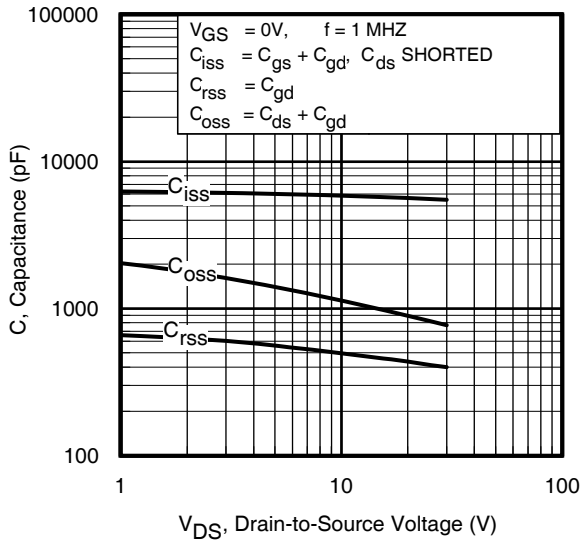


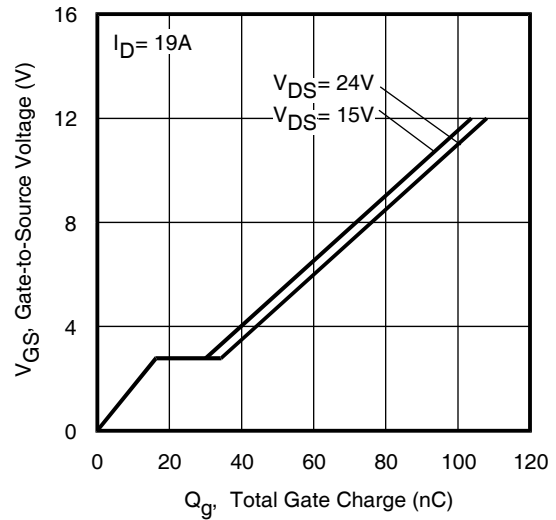
Fig 4. Normalized On-Resistance vs. Temperature

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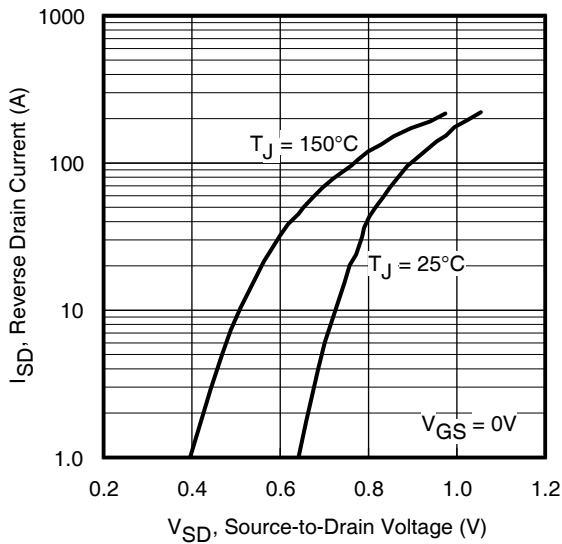
International  
**IR** Rectifier



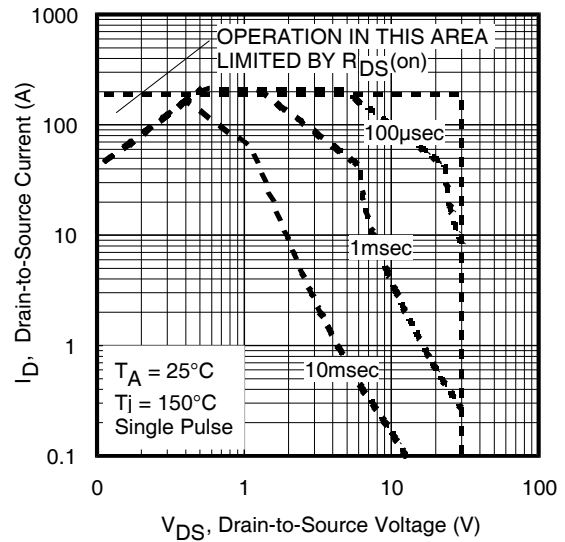
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



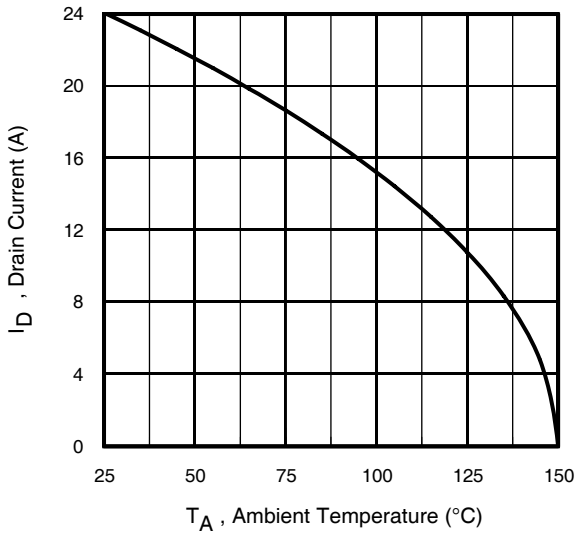
**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage



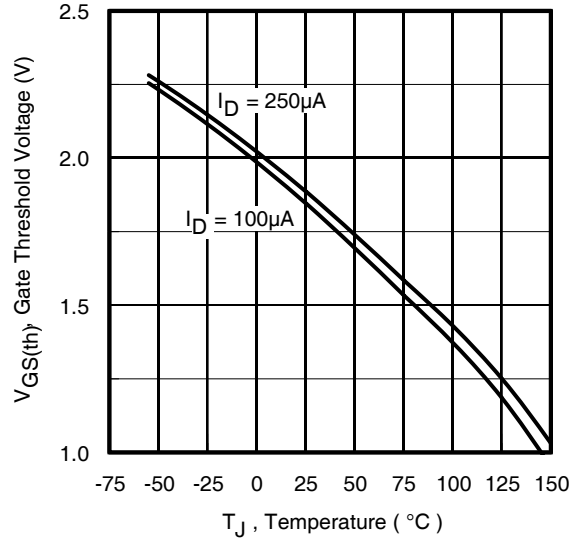
**Fig 7.** Typical Source-Drain Diode Forward Voltage



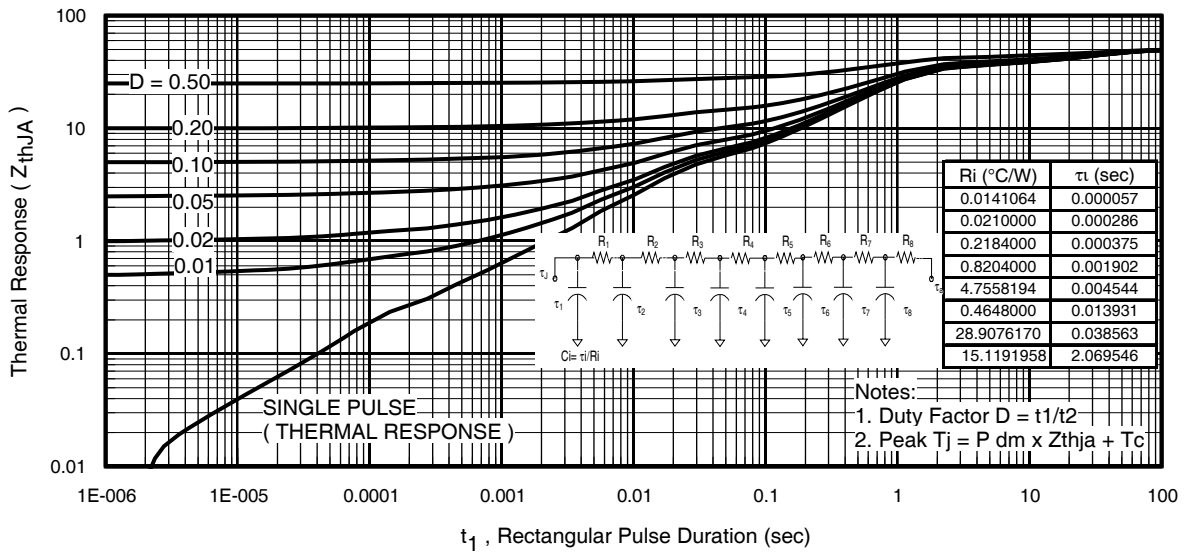
**Fig 8.** Maximum Safe Operating Area



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



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



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

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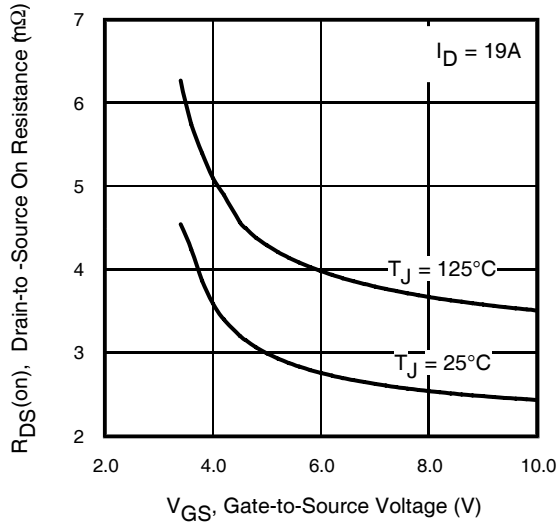


Fig 12. On-Resistance vs. Gate Voltage

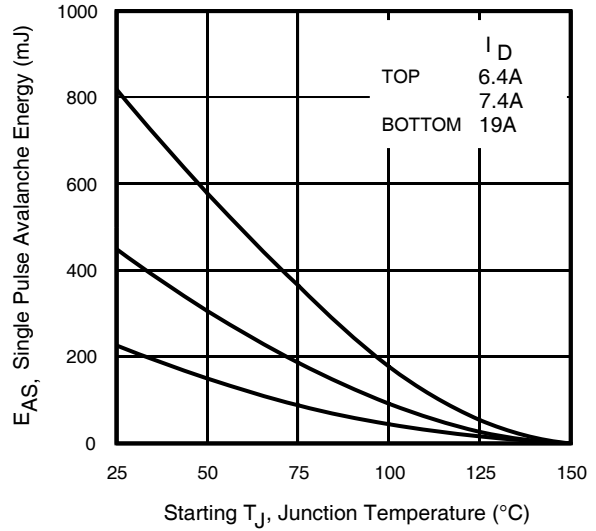


Fig 13. Maximum Avalanche Energy vs. Drain Current

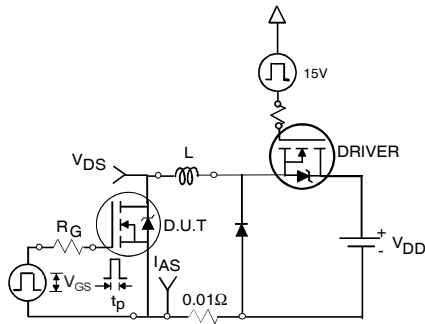


Fig 14a. Unclamped Inductive Test Circuit

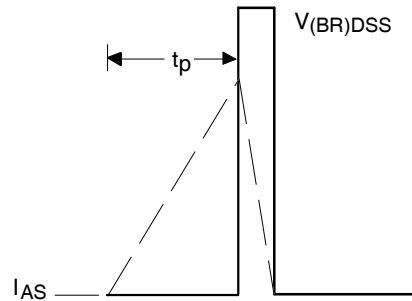


Fig 14b. Unclamped Inductive Waveforms

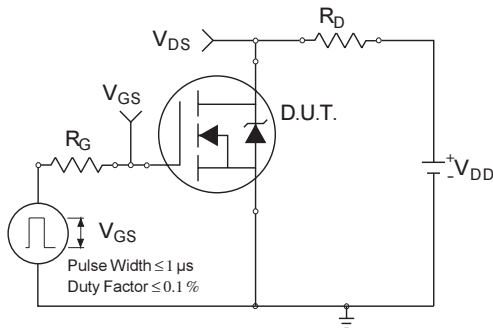


Fig 15a. Switching Time Test Circuit

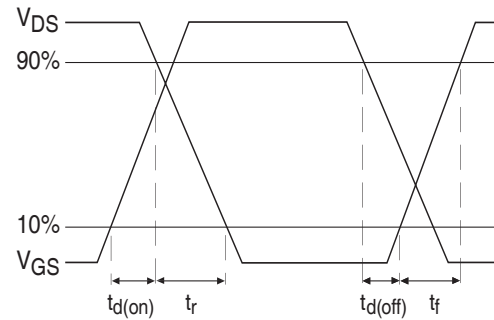
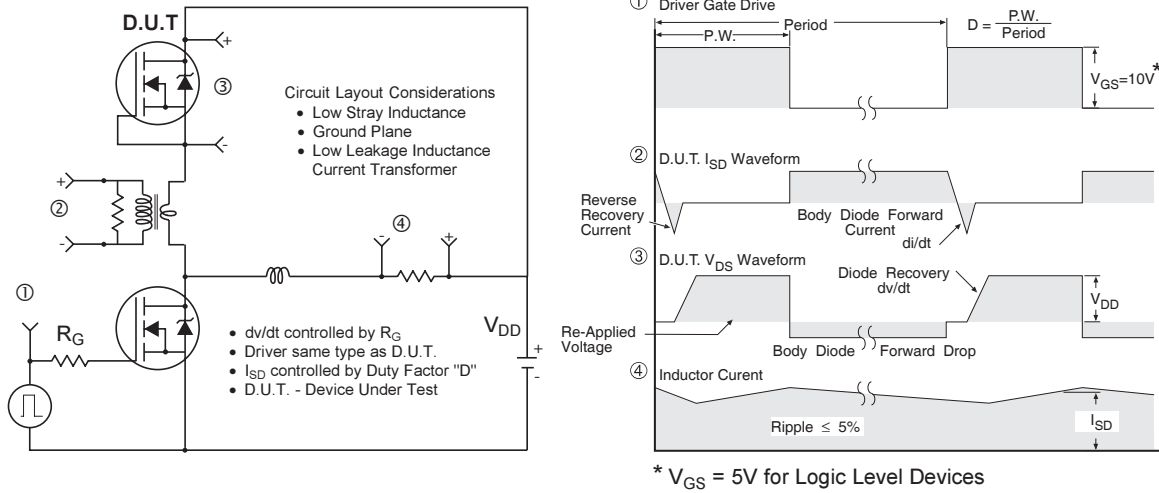
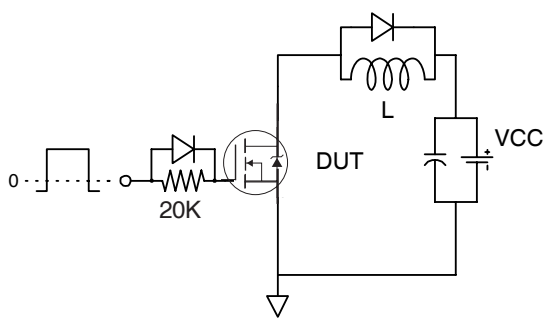


Fig 15b. Switching Time Waveforms

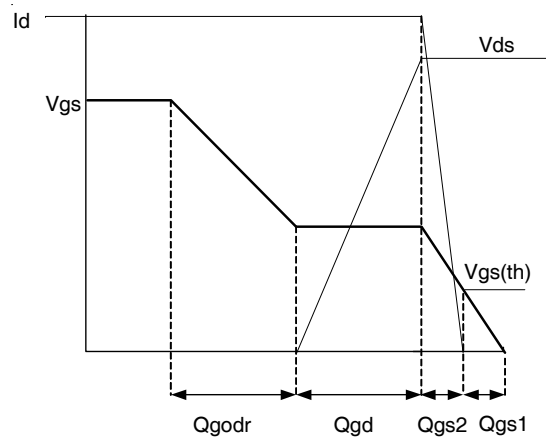
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**Fig 16.** Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs



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



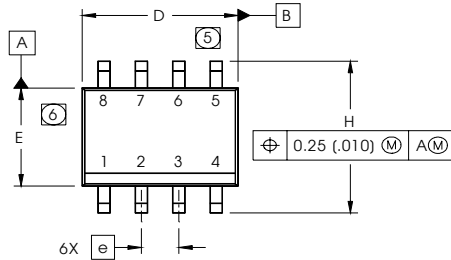
**Fig 17b.** Gate Charge Waveform

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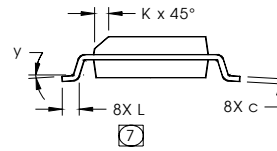
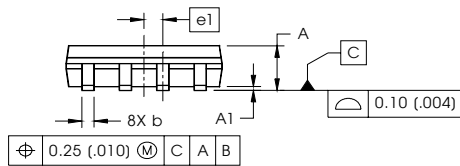
## SO-8 Package Outline

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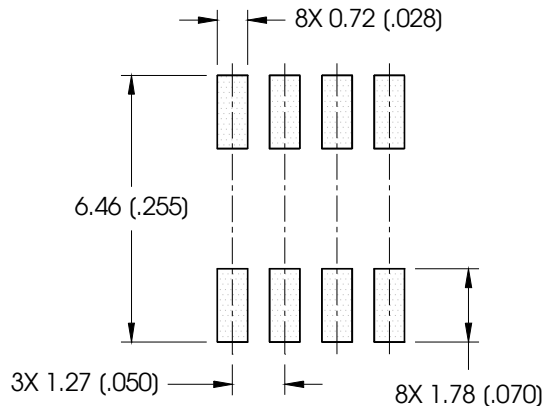
Dimensions are shown in millimeters (inches)



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

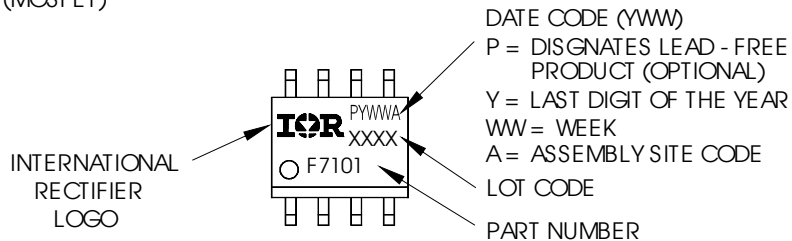


#### NOTES:

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)

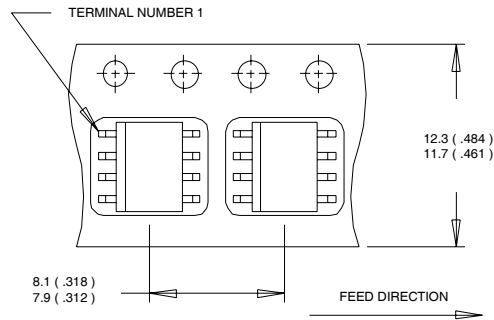


Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

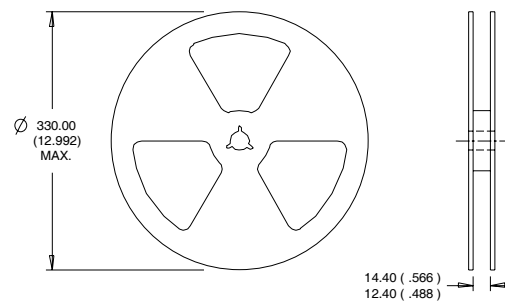


## SO-8 Tape and Reel

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  $T_J = 25^\circ\text{C}$ ,  $L = 1.25\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 19\text{A}$ .
- 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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 This product has been designed and qualified for the Consumer market.  
 Qualification Standards can be found on IR's Web site.

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