PD - 97137A

International
IOR Rectifier

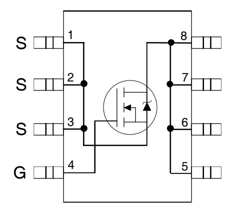
# IRF8788PbF

HEXFET® Power MOSFET

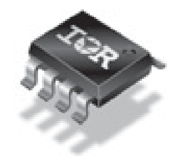
| $V_{DSS}$ | $R_{DS(on)}$ max | Qg |
|---|---|---|
| 30V | 2.8m$\Omega$@$V_{GS}$ = 10V | 44nC |

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

## 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



Top View


SO-8

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

## 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



8/18/08

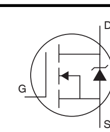
## Static @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | 30 | ––– | ––– | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | ––– | 0.024 | ––– | V/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | ––– | 2.3 | 2.8 | mΩ | $V_{GS}$ = 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 | $V_{DS} = V_{GS}$, $I_D$ = 100μA |
| $\Delta V_{GS(th)}$ | Gate Threshold Voltage Coefficient | ––– | -6.59 | ––– | 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°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | ––– | ––– | 100 | nA | $V_{GS}$ = 20V |
| | Gate-to-Source Reverse Leakage | ––– | ––– | -100 | | $V_{GS}$ = -20V |
| gfs | Forward Transconductance | 95 | ––– | ––– | S | $V_{DS}$ = 15V, $I_D$ = 19A |
| $Q_g$ | Total Gate Charge | ––– | 44 | 66 | nC | |
| $Q_{gs1}$ | Pre-Vth Gate-to-Source Charge | ––– | 12 | ––– | | $V_{DS}$ = 15V |
| $Q_{gs2}$ | Post-Vth Gate-to-Source Charge | ––– | 4.7 | ––– | | $V_{GS}$ = 4.5V |
| $Q_{gd}$ | Gate-to-Drain Charge | ––– | 14 | ––– | | $I_D$ = 19A |
| $Q_{godr}$ | Gate Charge Overdrive | ––– | 13.3 | ––– | | See Figs. 17a & 17b |
| $Q_{sw}$ | 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 | Ω | |
| $t_{d(on)}$ | Turn-On Delay Time | ––– | 23 | ––– | ns | $V_{DD}$ = 15V, $V_{GS}$ = 4.5V |
| $t_r$ | Rise Time | ––– | 24 | ––– | | $I_D$ = 19A |
| $t_{d(off)}$ | Turn-Off Delay Time | ––– | 23 | ––– | | $R_G$ = 1.8Ω |
| $t_f$ | Fall Time | ––– | 11 | ––– | | See Fig. 15a & 15b |
| $C_{iss}$ | Input Capacitance | ––– | 5720 | ––– | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | ––– | 980 | ––– | | $V_{DS}$ = 15V |
| $C_{rss}$ | Reverse Transfer Capacitance | ––– | 450 | ––– | | $f$ = 1.0MHz |

## 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°C, $I_S$ = 19A, $V_{GS}$ = 0V ③ |
| | | ––– | ––– | 0.75 | V | $T_J$ = 25°C, $I_S$ = 2.2A, $V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | ––– | 24 | 36 | ns | $T_J$ = 25°C, $I_F$ = 19A, $V_{DD}$ = 15V |
| $Q_{rr}$ | Reverse Recovery Charge | ––– | 33 | 50 | nC | di/dt = 230A/μs ③ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

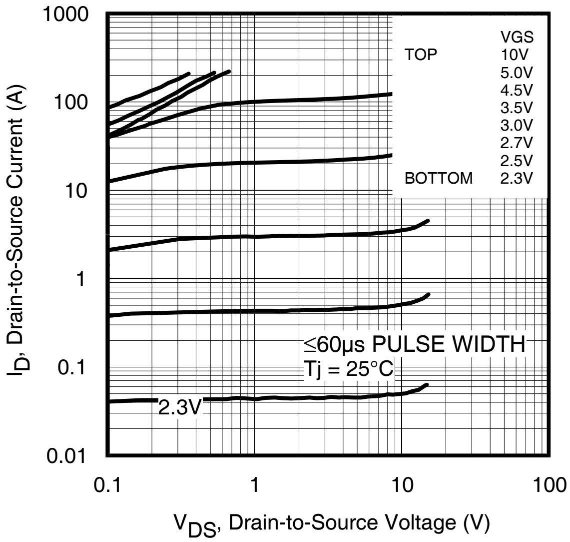



**Fig 1.** Typical Output Characteristics

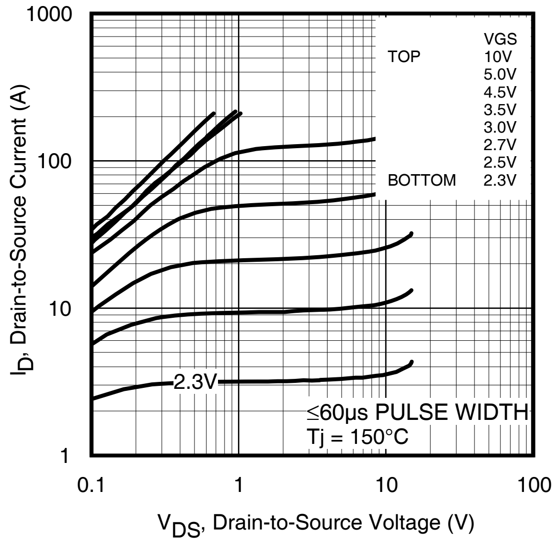



**Fig 2.** Typical Output Characteristics

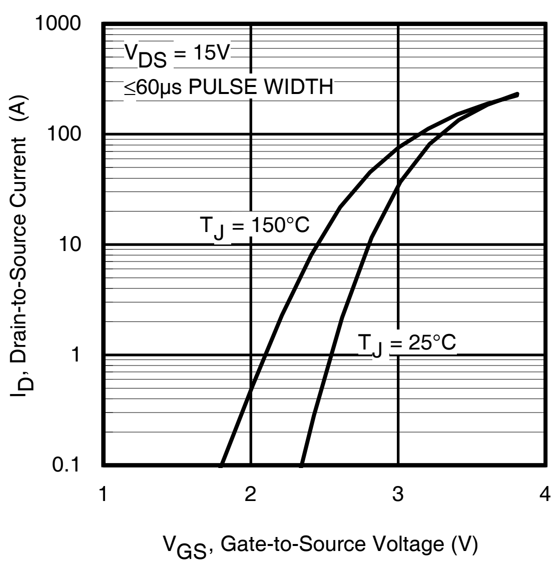



**Fig 3.** Typical Transfer Characteristics

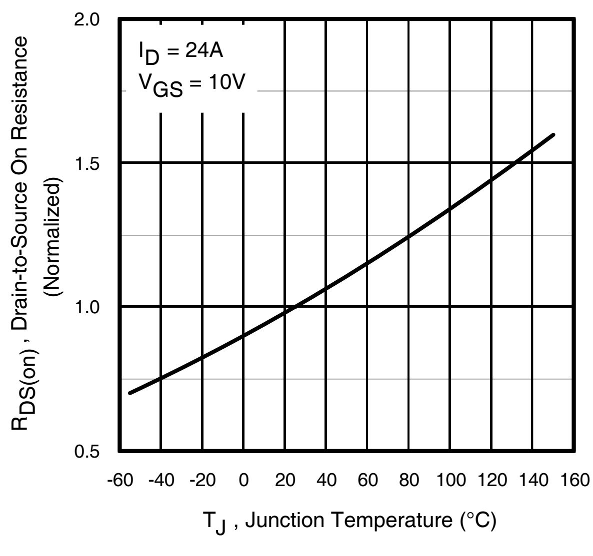



**Fig 4.** Normalized On-Resistance vs. Temperature

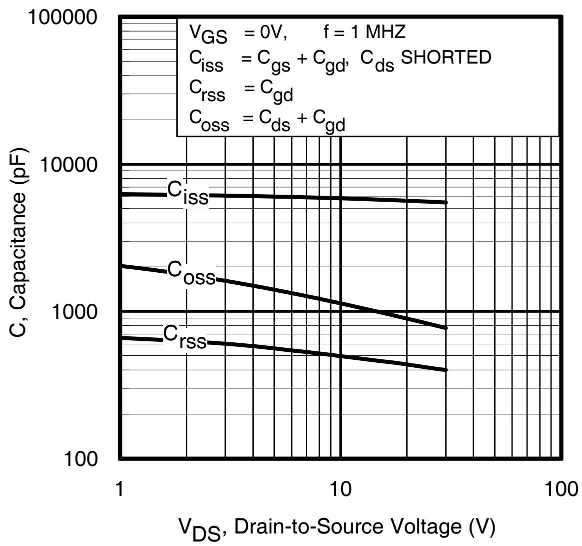



**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage

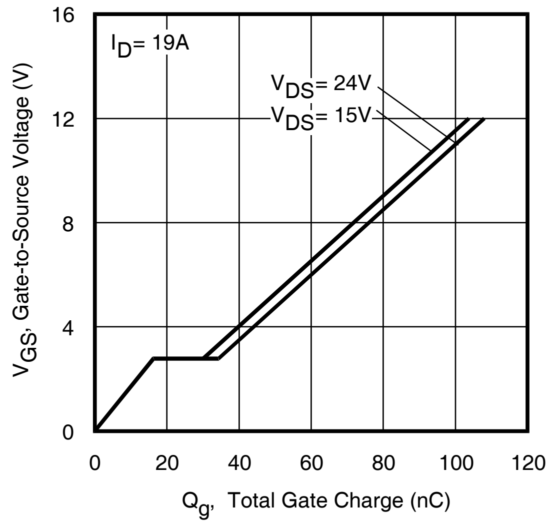



**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage

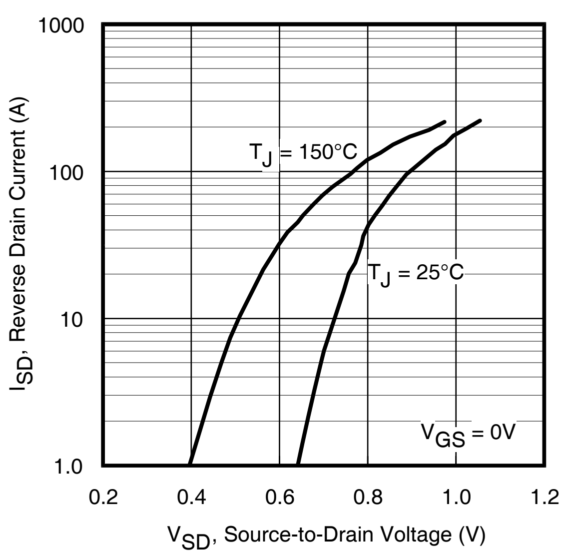



**Fig 7.** Typical Source-Drain Diode Forward Voltage

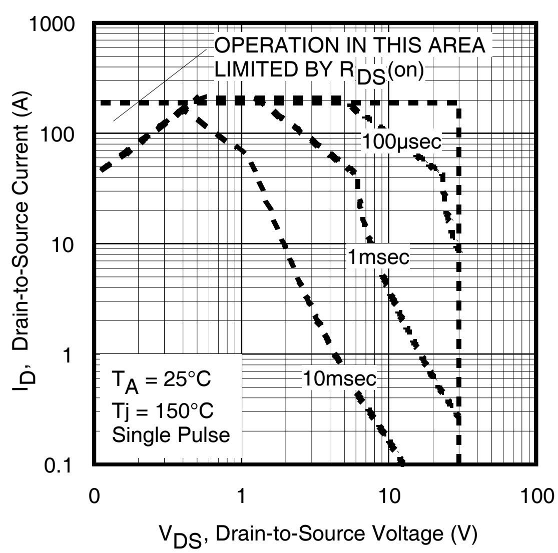



**Fig 8.** Maximum Safe Operating Area

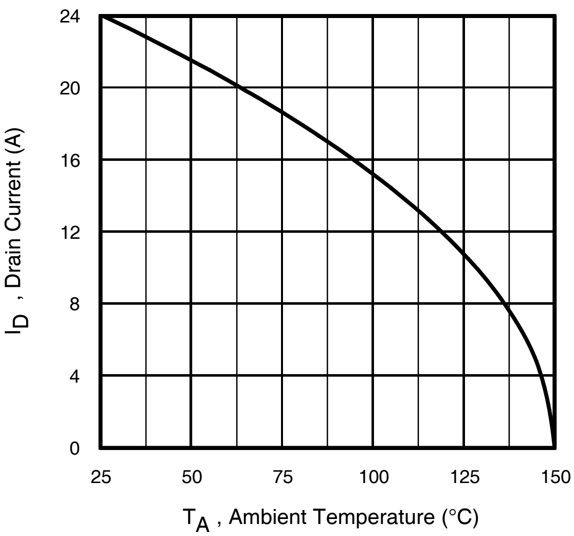



**Fig 9.** Maximum Drain Current vs. Ambient Temperature

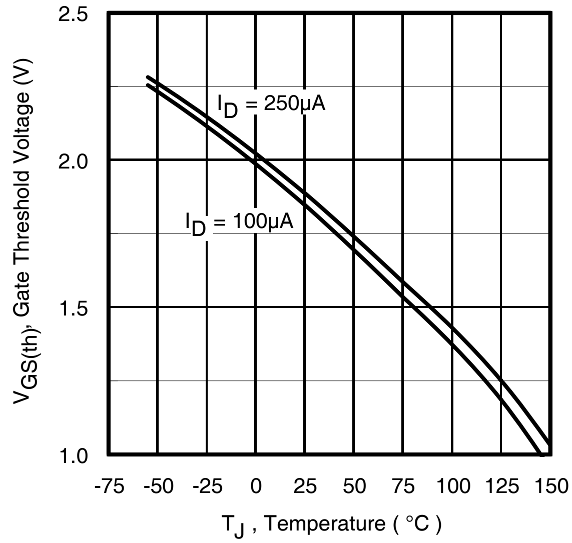
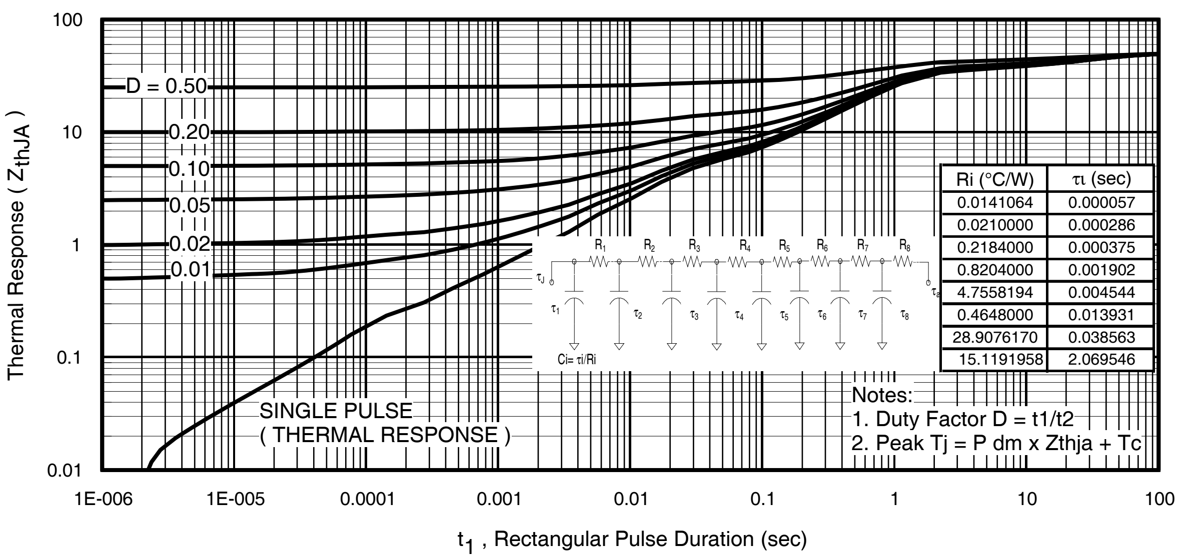



**Fig 10.** Threshold Voltage vs. Temperature




| Ri (°C/W) | τi (sec) |
|---|---|
| 0.0141064 | 0.000057 |
| 0.0210000 | 0.000286 |
| 0.2184000 | 0.000375 |
| 0.8204000 | 0.001902 |
| 4.7558194 | 0.004544 |
| 0.4648000 | 0.013931 |
| 28.9076170 | 0.038563 |
| 15.1191958 | 2.069546 |

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

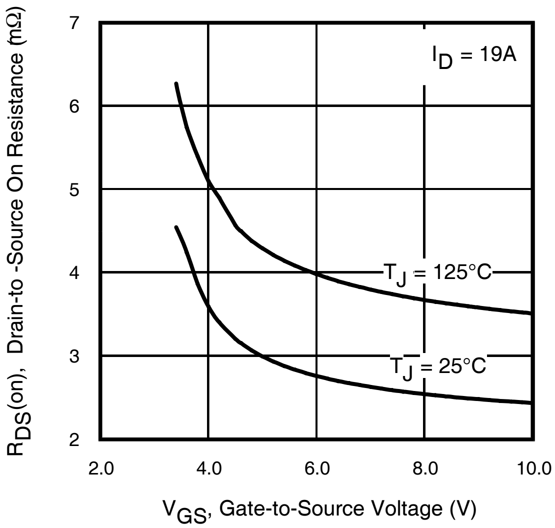



**Fig 12.** On-Resistance vs. Gate Voltage

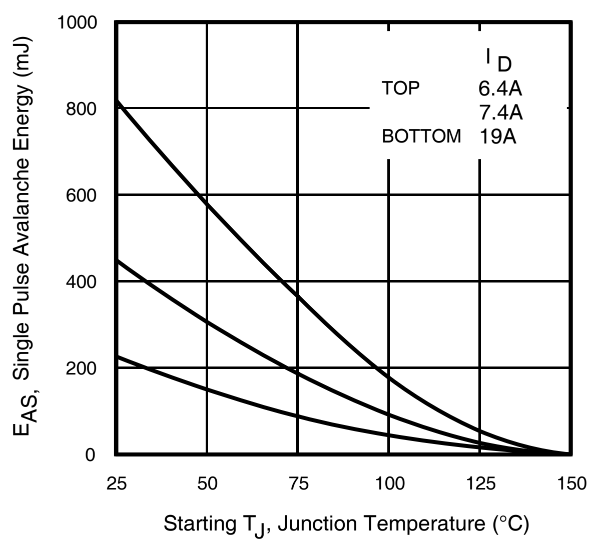



**Fig 13.** Maximum Avalanche Energy vs. Drain Current

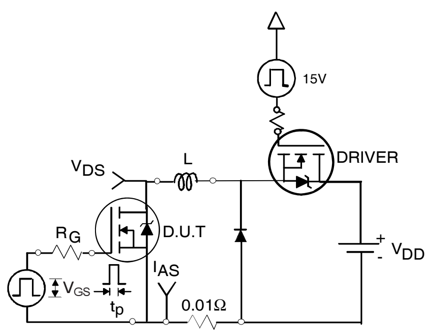



**Fig 14a.** Unclamped Inductive Test Circuit

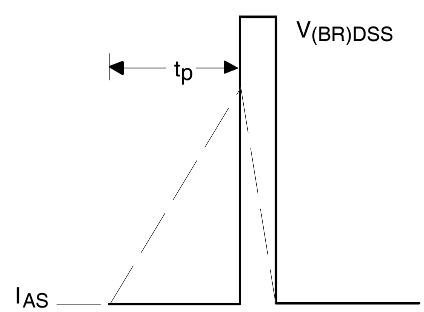



**Fig 14b.** Unclamped Inductive Waveforms

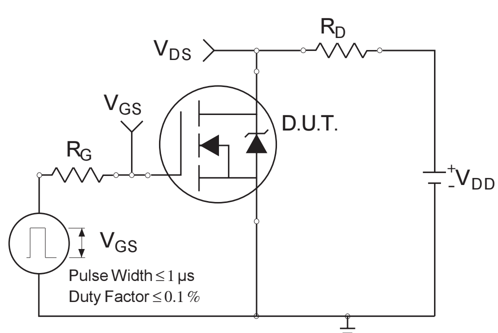



**Fig 15a.** Switching Time Test Circuit

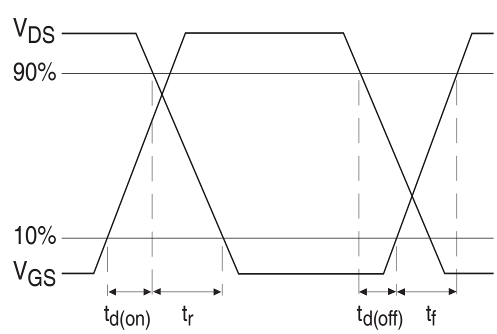



**Fig 15b.** Switching Time Waveforms

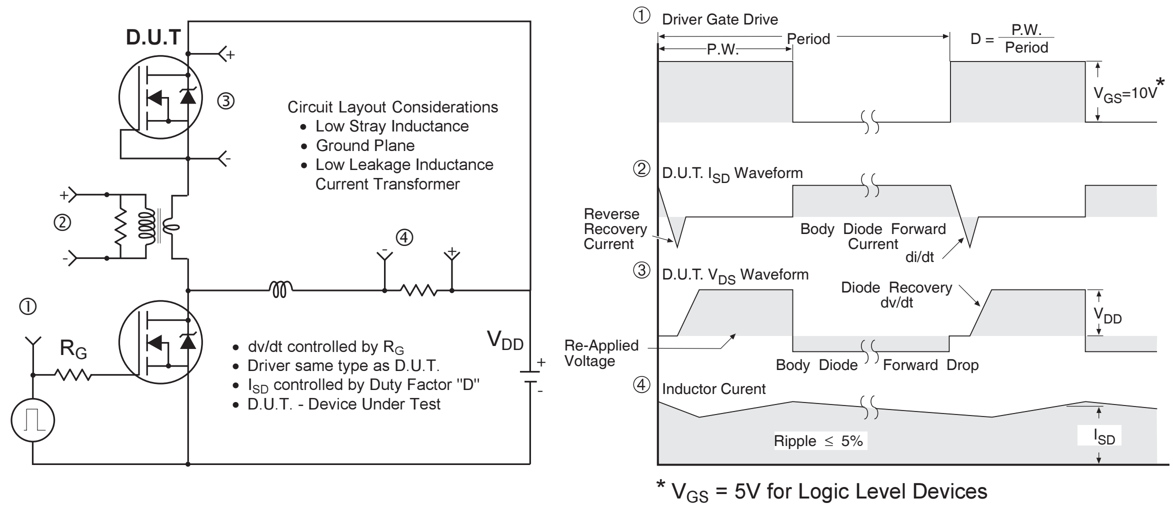



**Fig 16.** Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

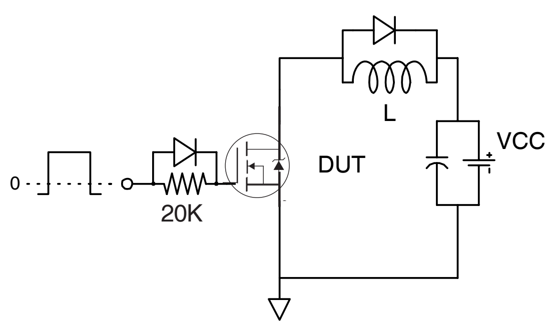



**Fig 17a.** Gate Charge Test Circuit

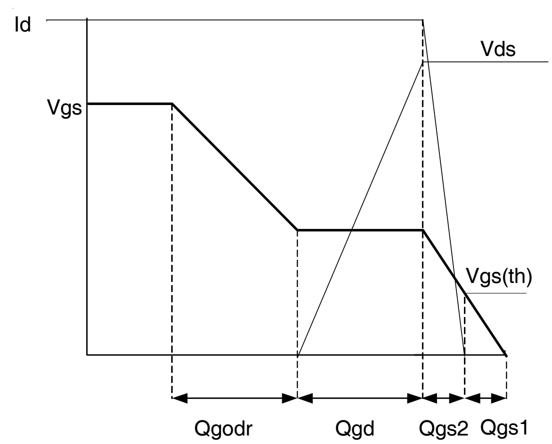
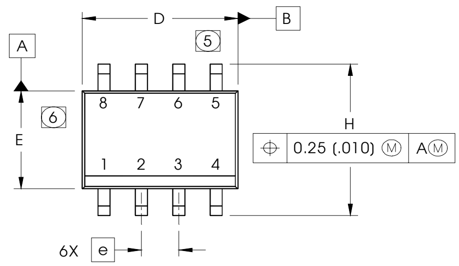


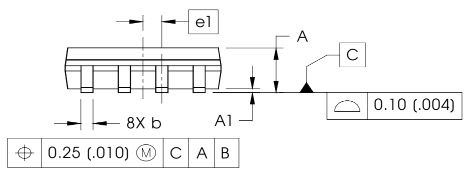

**Fig 17b.** Gate Charge Waveform

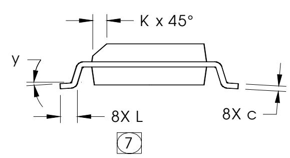
## SO-8 Package Outline

Dimensions are shown in milimeters (inches)



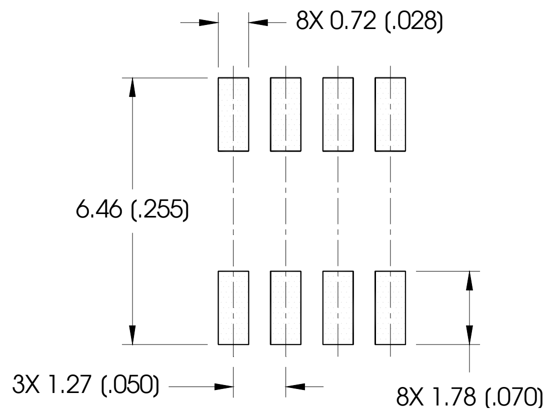

| DIM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | .0532 | .0688 | 1.35 | 1.75 |
| A1 | .0040 | .0098 | 0.10 | 0.25 |
| b | .013 | .020 | 0.33 | 0.51 |
| c | .0075 | .0098 | 0.19 | 0.25 |
| D | .189 | .1968 | 4.80 | 5.00 |
| E | .1497 | .1574 | 3.80 | 4.00 |
| e | .050 BASIC | | 1.27 BASIC | |
| e 1 | .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° |



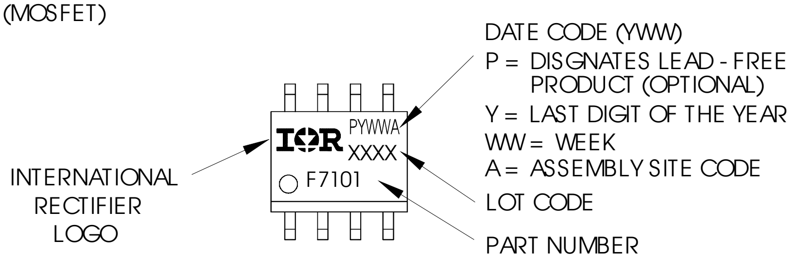

NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
5. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 [.006].
6. DIMENSION DOES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

FOOTPRINT




## SO-8 Part Marking Information

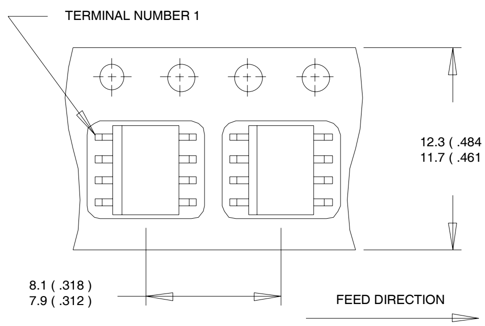
EXAMPLE: THIS IS AN IRF7101 (MOSFET)



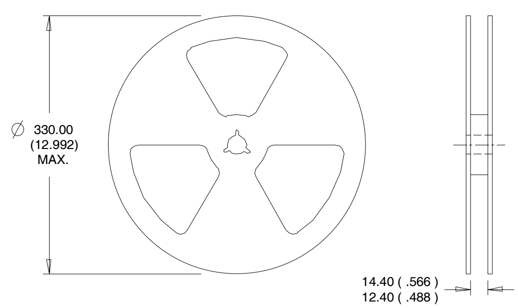

Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

## SO-8 Tape and Reel

Dimensions are shown in milimeters (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 $T_J = 25°C$, $L = 1.25mH$, $R_G = 25\Omega$, $I_{AS} = 19A$.

③ Pulse width $\leq$ 400µs; duty cycle $\leq$ 2%.

④ When mounted on 1 inch square copper board.

⑤ $R_\theta$ is measured at $T_J$ of approximately 90°C.

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

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

International
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