International
IOR Rectifier

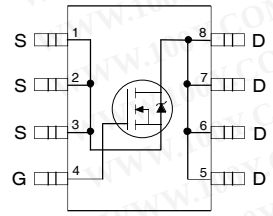


PD - 96112A

# IRF7413QPbF

HEXFET® Power MOSFET

- Advanced Process Technology
- Ultra Low On-Resistance
- N Channel MOSFET
- Surface Mount
- Available in Tape & Reel
- 150°C Operating Temperature
- Lead-Free



Top View

$V_{DSS}$ = 30V

$R_{DS(on)}$ = 0.011Ω

## Description

These HEXFET® Power MOSFET's in SO-8 package utilize the lastest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of these HEXFET Power MOSFET's are a 150°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These benefits combine to make this design an extremely efficient and reliable device for use in a wide variety of applications.
The efficient SO-8 package provides enhanced thermal characteristics making it ideal in a variety of power applications. This surface mount SO-8 can dramatically reduce board space and is also available in Tape & Reel.


SO-8

## Absolute Maximum Ratings

| Symbol | 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 | 13 | A |
| $I_D$ @ $T_A$ = 70°C | Continuous Drain Current, $V_{GS}$ @ 10V | 9.2 | |
| $I_{DM}$ | Pulsed Drain Current ① | 58 | |
| $P_D$ @$T_A$ = 25°C | Power Dissipation | 2.5 | W |
| | Linear Derating Factor | 0.02 | mW/°C |
| $E_{AS}$ | Single Pulse Avalanche Energy ② | 260 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ③ | 5.0 | V/ns |
| $T_J$, $T_{STG}$ | Junction and Storage Temperature Range | -55 to +150 | °C |

## Thermal Resistance Ratings

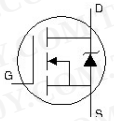
| Symbol | Parameter | Typ | Max | Units |
|---|---|---|---|---|
| $R_{\theta JL}$ | Junction-to-Drain Lead ⑥ | — | 20 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient ⑤⑥ | — | 50 | |

## Electrical Characteristics @ TJ = 25°C (unless otherwise specified)

| Symbol | Parameter | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 30 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250µA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.034 | — | V/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 0.011 | Ω | $V_{GS}$ = 10V, $I_D$ = 7.3A ④ |
| | | — | — | 0.018 | | $V_{GS}$ = 4.5V, $I_D$ = 3.7A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 1.0 | — | 3.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| $g_{fs}$ | Forward Transconductance | 10 | — | — | S | $V_{DS}$ = 10V, $I_D$ = 3.7A |
| $I_{DSS}$ | Drain-to-Source Leakage Current | — | — | 12 | µA | $V_{DS}$ = 30V, $V_{GS}$ = 0V |
| | | — | — | 25 | | $V_{DS}$ = 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 |
| $Q_g$ | Total Gate Charge | — | 52 | 79 | nC | $I_D$ = 7.3A |
| $Q_{gs}$ | Gate-to-Source Charge | — | 6.1 | 9.2 | | $V_{DS}$ = 24V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | — | 16 | 23 | | $V_{GS}$ = 10V, See Fig. 6 and 9 ④ |
| $R_G$ | Gate Resistance | 1.2 | — | 3.7 | | |
| $t_{d(on)}$ | Turn-On Delay Time | — | 8.6 | — | ns | $V_{DD}$ = 15V |
| $t_r$ | Rise Time | — | 50 | — | | $I_D$ = 7.3A |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 52 | — | | $R_G$ = 6.2 Ω |
| $t_f$ | Fall Time | — | 46 | — | | $R_G$ = 2.0Ω, See Fig. 10 ④ |
| $C_{iss}$ | Input Capacitance | — | 1800 | — | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | — | 680 | — | | $V_{DS}$ = 25V |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 240 | — | | $f$ = 1.0MHz, See Fig. 5 |

## Source-Drain Ratings and Characteristics

| Symbol | 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 | — | — | 58 | | |
| $V_{SD}$ | Diode Forward Voltage | — | — | 1.0 | V | $T_J$ = 25°C, $I_S$ = 7.3A, $V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | — | 74 | 110 | ns | $T_J$ = 25°C, $I_F$ = 7.3A |
| $Q_{rr}$ | Reverse Recovery Charge | — | 200 | 300 | nC | di/dt = 100A/µs ③ |




**Notes:**

① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )

② Starting $T_J$ = 25°C, L =9.8mH $R_G$ = 25Ω, $I_{AS}$ =7.3A. (See Figure 12)

③ $I_{SD} \le 7.3A$, di/dt ≤ 100A/µs, $V_{DD} \le V_{(BR)DSS}$, $T_J \le 150°C$

④ Pulse width ≤ 300µs; duty cycle ≤ 2%.

⑤ Surface mounted on FR-4 board

⑥ $R_\theta$ is measured at $T_J$ approximately 90°C

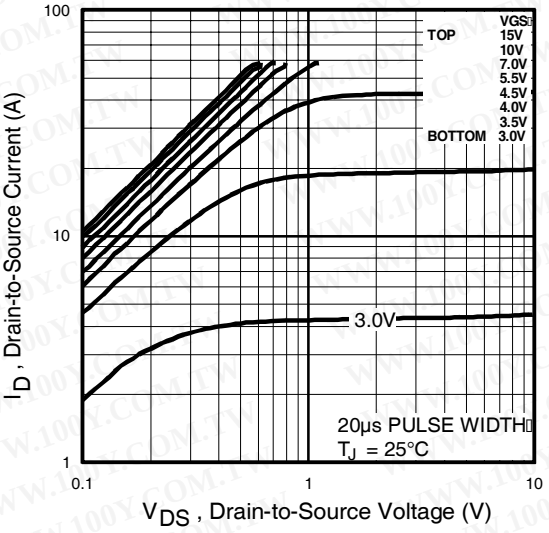



**Fig 1.** Typical Output Characteristics

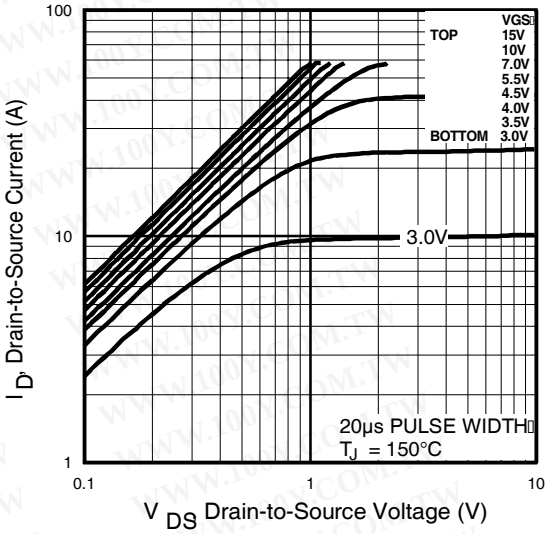



**Fig 2.** Typical Output Characteristics

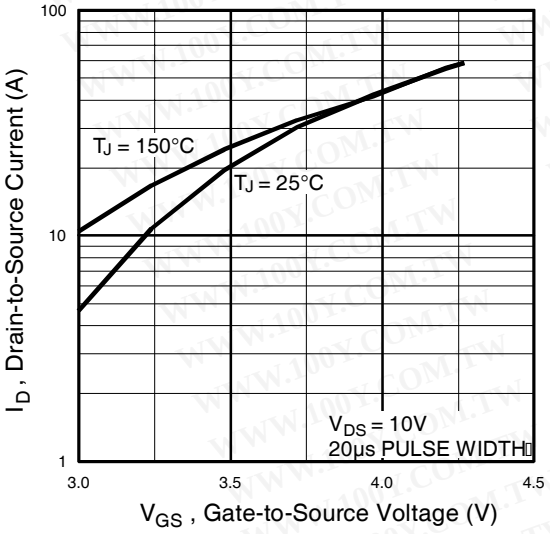



**Fig 3.** Typical Transfer Characteristics

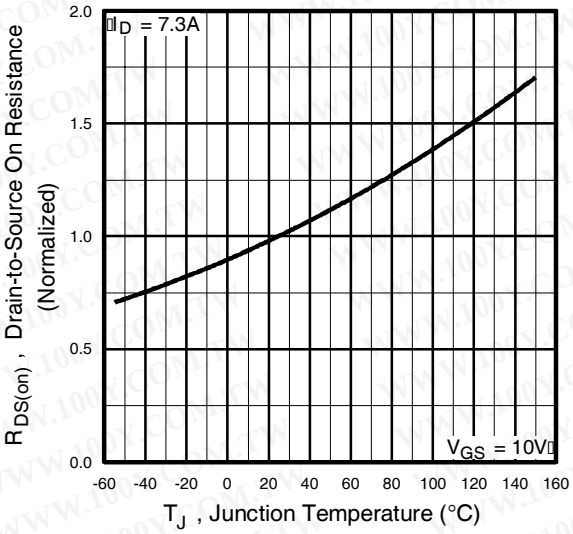



**Fig 4.** Normalized On-Resistance Vs. Temperature

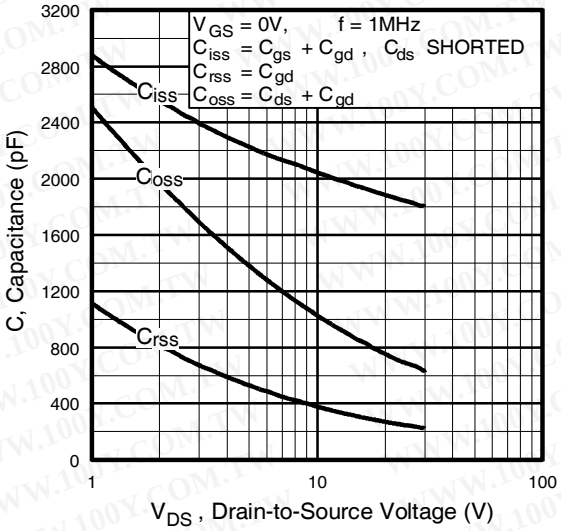



**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage

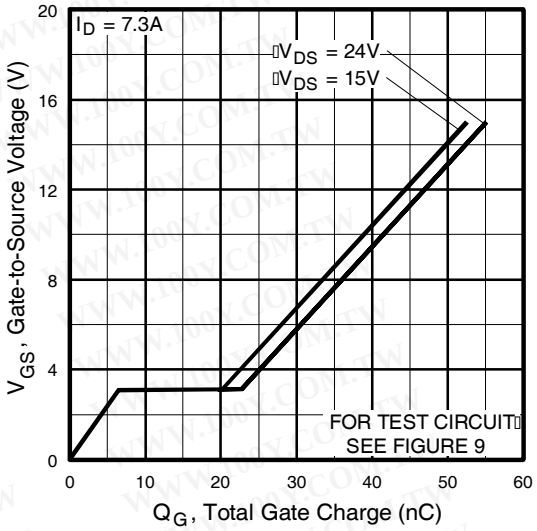



**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage

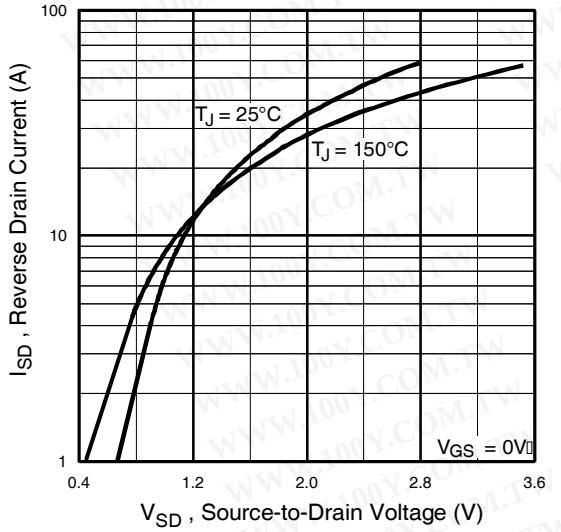



**Fig 7.** Typical Source-Drain Diode Forward Voltage

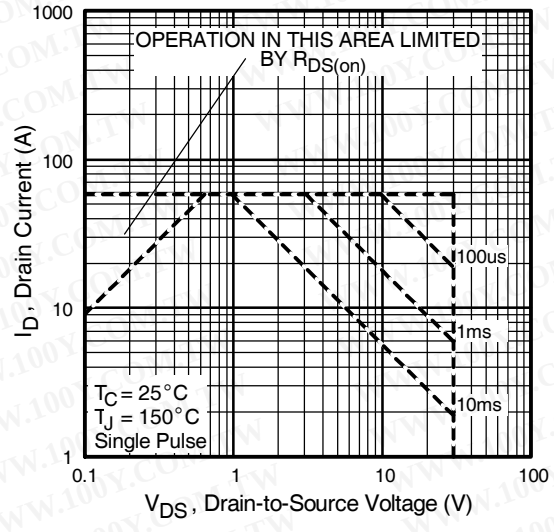



**Fig 8.** Maximum Safe Operating Area

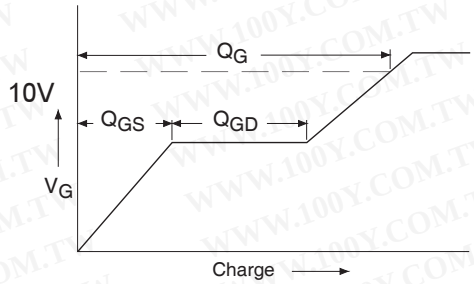



**Fig 9a.** Basic Gate Charge Waveform

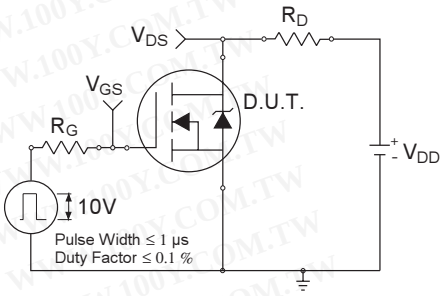



**Fig 10a.** Switching Time Test Circuit

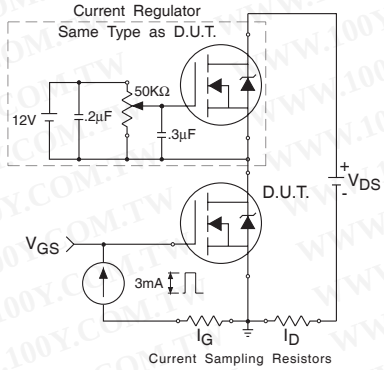



**Fig 9b.** Gate Charge Test Circuit

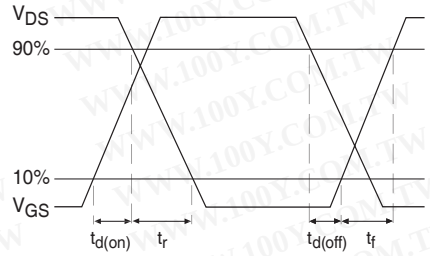



**Fig 10b.** Switching Time Waveforms

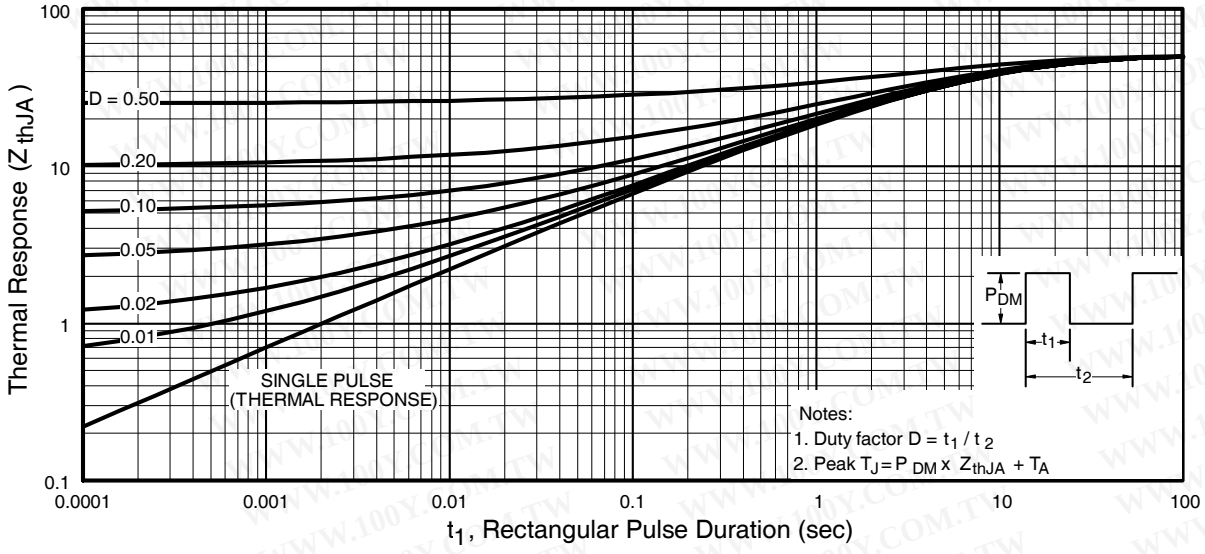



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

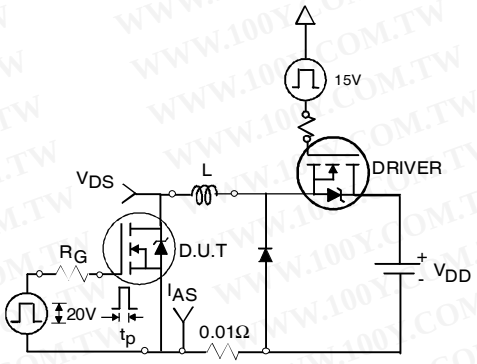



**Fig 12a.** Unclamped Inductive Test Circuit

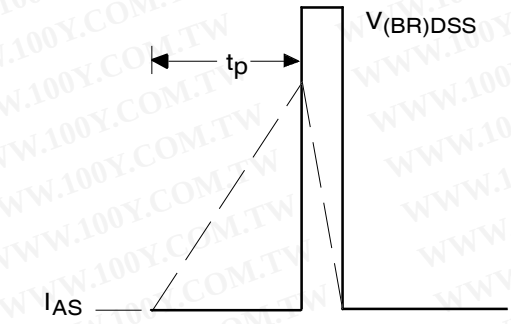



**Fig 12b.** Unclamped Inductive Waveforms

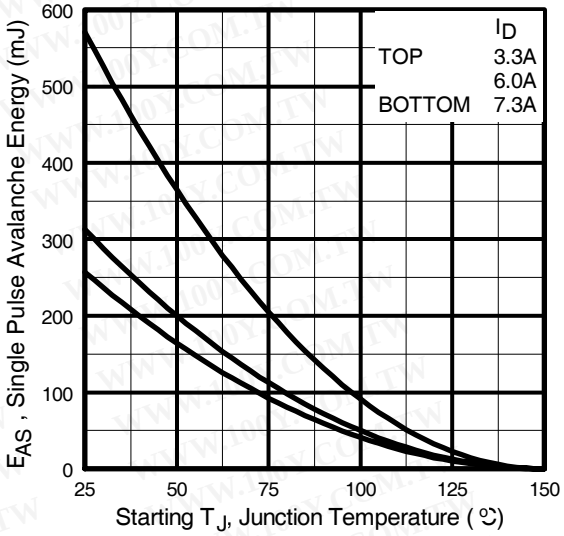
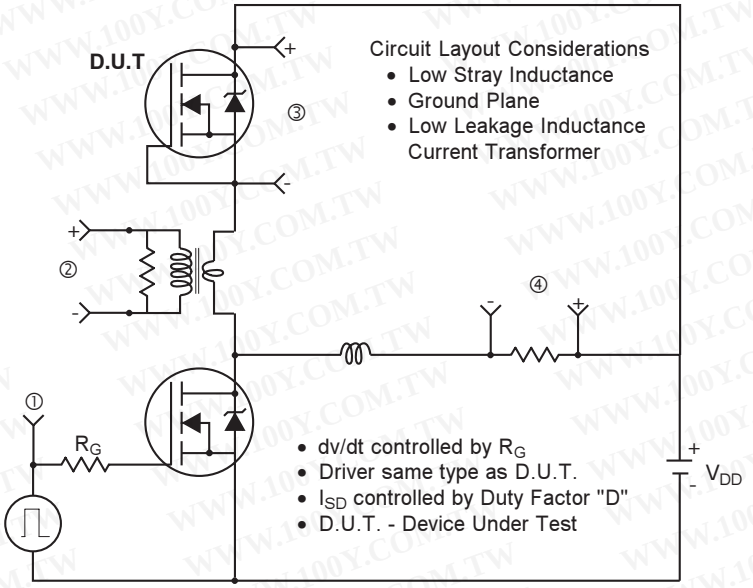



**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current

## Peak Diode Recovery dv/dt Test Circuit



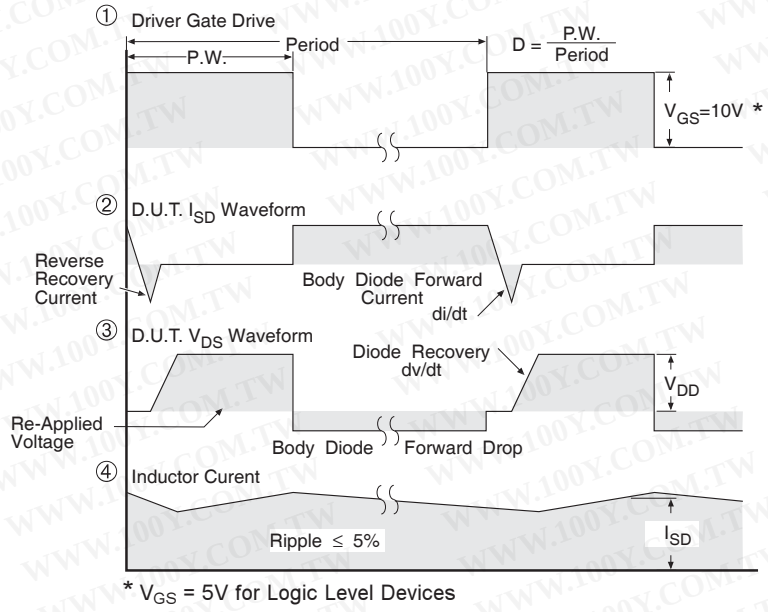
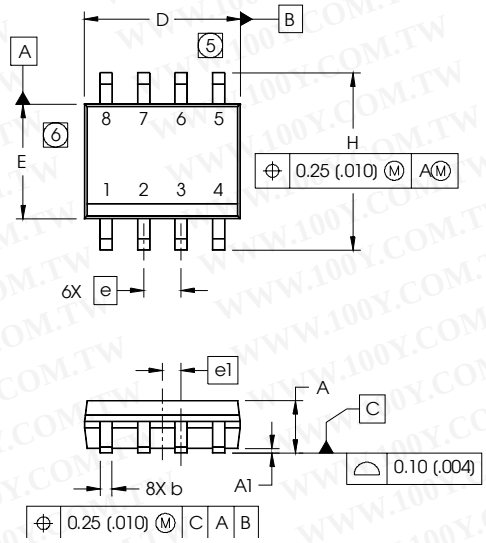




**Fig 13.** For N-Channel HEXFETS

## SO-8 Package Details

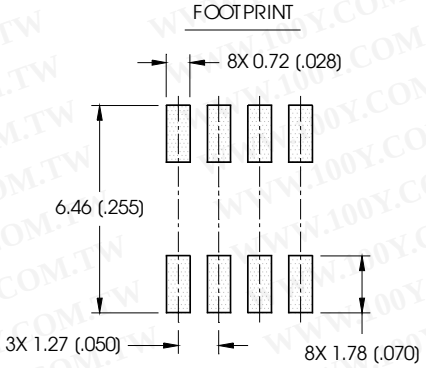
Dimensions are shown in milimeters (inches)




| 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 | |
| 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° |

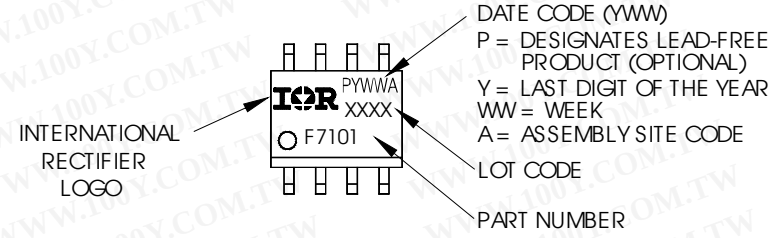
NOTES:

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

EXAMPLE: THIS IS AN IRF7101 (MOSFET)



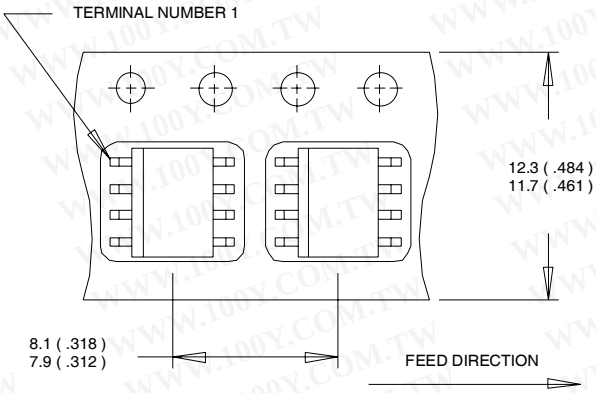

**Notes:**

**1. For an Automotive Qualified version of this part please see http://www.irf.com/product-info/auto/**

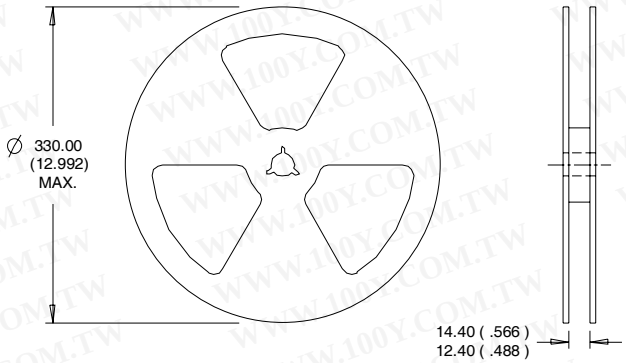
**2. For the most current drawing please refer to IR website at http://www.irf.com/package/**

## 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.

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.

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