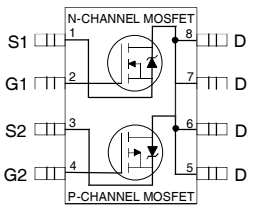
International
IOR Rectifier

PD - 95462

# IRF7389PbF

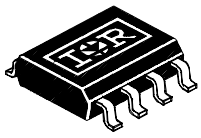
HEXFET® Power MOSFET

- Generation V Technology
- Ultra Low On-Resistance
- Complimentary Half Bridge
- Surface Mount
- Fully Avalanche Rated
- Lead-Free



Top View

| | N-Ch | P-Ch |
|---|---|---|
| $V_{DSS}$ | 30V | -30V |
| $R_{DS(on)}$ | 0.029Ω | 0.058Ω |


SO-8

## Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The SO-8 has been modified through a customized leadframe for enhanced thermal characteristics and multiple-die capability making it ideal in a variety of power applications. With these improvements, multiple devices can be used in an application with dramatically reduced board space. The package is designed for vapor phase, infra red, or wave soldering techniques.

## Absolute Maximum Ratings ( $T_A$ = 25°C Unless Otherwise Noted)

| | | Symbol | Maximum | | Units |
|---|---|---|---|---|---|
| | | | N-Channel | P-Channel | |
| Drain-Source Voltage | | $V_{DS}$ | 30 | -30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | | |
| Continuous Drain Current⑤ | $T_A$ = 25°C | $I_D$ | 7.3 | -5.3 | A |
| | $T_A$ = 70°C | | 5.9 | -4.2 | |
| Pulsed Drain Current | | $I_{DM}$ | 30 | -30 | |
| Continuous Source Current (Diode Conduction) | | $I_S$ | 2.5 | -2.5 | |
| Maximum Power Dissipation ⑤ | $T_A$ = 25°C | $P_D$ | 2.5 | | W |
| | $T_A$ = 70°C | | 1.6 | | |
| Single Pulse Avalanche Energy | | $E_{AS}$ | 82 | 140 | mJ |
| Avalanche Current | | $I_{AR}$ | 4.0 | -2.8 | A |
| Repetitive Avalanche Energy | | $E_{AR}$ | 0.20 | | mJ |
| Peak Diode Recovery dv/dt ② | | dv/dt | 3.8 | -2.2 | V/ ns |
| Junction and Storage Temperature Range | | $T_J, T_{STG}$ | -55 to + 150 °C | | |

## Thermal Resistance Ratings

| Parameter | Symbol | Limit | Units |
|---|---|---|---|
| Maximum Junction-to-Ambient ⑤ | $R_{\theta JA}$ | 50 | °C/W |



6/29/04

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

| | Parameter | | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | N-Ch | 30 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250µA |
| | | P-Ch | -30 | — | — | | $V_{GS}$ = 0V, $I_D$ = -250µA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | N-Ch | — | 0.022 | — | V/°C | Reference to 25°C, $I_D$ = 1mA |
| | | P-Ch | — | 0.022 | — | | Reference to 25°C, $I_D$ = -1mA |
| $R_{DS(ON)}$ | Static Drain-to-Source On-Resistance | N-Ch | — | 0.023 | 0.029 | Ω | $V_{GS}$ = 10V, $I_D$ = 5.8A ④ |
| | | | — | 0.032 | 0.046 | | $V_{GS}$ = 4.5V, $I_D$ = 4.7A ④ |
| | | P-Ch | — | 0.042 | 0.058 | | $V_{GS}$ = -10V, $I_D$ = -4.9A ④ |
| | | | — | 0.076 | 0.098 | | $V_{GS}$ = -4.5V, $I_D$ = -3.6A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | N-Ch | 1.0 | — | — | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| | | P-Ch | -1.0 | — | — | | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| $g_{fs}$ | Forward Transconductance | N-Ch | — | 14 | — | S | $V_{DS}$ = 15V, $I_D$ = 5.8A ④ |
| | | P-Ch | — | 7.7 | — | | $V_{DS}$ = -15V, $I_D$ = -4.9A ④ |
| $I_{DSS}$ | Drain-to-Source Leakage Current | N-Ch | — | — | 1.0 | µA | $V_{DS}$ = 24V, $V_{GS}$ = 0V |
| | | P-Ch | — | — | -1.0 | | $V_{DS}$ = -24V, $V_{GS}$ = 0V |
| | | N-Ch | — | — | 25 | | $V_{DS}$ = 24V, $V_{GS}$ = 0V, $T_J$ = 55°C |
| | | P-Ch | — | — | -25 | | $V_{DS}$ = -24V, $V_{GS}$ = 0V, $T_J$ = 55°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | N-P | — | — | ±100 | nA | $V_{GS}$ = ±20V |
| $Q_g$ | Total Gate Charge | N-Ch | — | 22 | 33 | nC | N-Channel<br>$I_D$ = 5.8A, $V_{DS}$ = 15V, $V_{GS}$ = 10V ④<br>P-Channel<br>$I_D$ = -4.9A, $V_{DS}$ = -15V, $V_{GS}$ = -10V |
| | | P-Ch | — | 23 | 34 | | |
| $Q_{gs}$ | Gate-to-Source Charge | N-Ch | — | 2.6 | 3.9 | | |
| | | P-Ch | — | 3.8 | 5.7 | | |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | N-Ch | — | 6.4 | 9.6 | | |
| | | P-Ch | — | 5.9 | 8.9 | | |
| $t_{d(on)}$ | Turn-On Delay Time | N-Ch | — | 8.1 | 12 | ns | N-Channel<br>$V_{DD}$ = 15V, $I_D$ = 1.0A, $R_G$ = 6.0Ω, $R_D$ = 15Ω ④<br>P-Channel<br>$V_{DD}$ = -15V, $I_D$ = -1.0A, $R_G$ = 6.0Ω, $R_D$ = 15Ω |
| | | P-Ch | — | 13 | 19 | | |
| $t_r$ | Rise Time | N-Ch | — | 8.9 | 13 | | |
| | | P-Ch | — | 13 | 20 | | |
| $t_{d(off)}$ | Turn-Off Delay Time | N-Ch | — | 26 | 39 | | |
| | | P-Ch | — | 34 | 51 | | |
| $t_f$ | Fall Time | N-Ch | — | 17 | 26 | | |
| | | P-Ch | — | 32 | 48 | | |
| $C_{iss}$ | Input Capacitance | N-Ch | — | 650 | — | pF | N-Channel<br>$V_{GS}$ = 0V, $V_{DS}$ = 25V, $f$ = 1.0MHz<br>P-Channel<br>$V_{GS}$ = 0V, $V_{DS}$ = -25V, $f$ = 1.0MHz |
| | | P-Ch | — | 710 | — | | |
| $C_{oss}$ | Output Capacitance | N-Ch | — | 320 | — | | |
| | | P-Ch | — | 380 | — | | |
| $C_{rss}$ | Reverse Transfer Capacitance | N-Ch | — | 130 | — | | |
| | | P-Ch | — | 180 | — | | |

## Source-Drain Ratings and Characteristics

| | Parameter | | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | N-Ch | — | — | 2.5 | A | |
| | | P-Ch | — | — | -2.5 | | |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | N-Ch | — | — | 30 | | |
| | | P-Ch | — | — | -30 | | |
| $V_{SD}$ | Diode Forward Voltage | N-Ch | — | 0.78 | 1.0 | V | $T_J$ = 25°C, $I_S$ = 1.7A, $V_{GS}$ = 0V ③ |
| | | P-Ch | — | -0.78 | -1.0 | | $T_J$ = 25°C, $I_S$ = -1.7A, $V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | N-Ch | — | 45 | 68 | ns | N-Channel<br>$T_J$ = 25°C, $I_F$ =1.7A, di/dt = 100A/µs<br>P-Channel ④<br>$T_J$ = 25°C, $I_F$ = -1.7A, di/dt = 100A/µs |
| | | P-Ch | — | 44 | 66 | | |
| $Q_{rr}$ | Reverse Recovery Charge | N-Ch | — | 58 | 87 | nC | |
| | | P-Ch | — | 42 | 63 | | |

**Notes:**

① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 22 )

② N-Channel $I_{SD}$ ≤ 4.0A, di/dt ≤ 74A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_J$ ≤ 150°C
P-Channel $I_{SD}$ ≤ -2.8A, di/dt ≤ 150A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_J$ ≤ 150°C

③ N-Channel Starting $T_J$ = 25°C, L = 10mH $R_G$ = 25Ω, $I_{AS}$ = 4.0A. (See Figure 12)
P-Channel Starting $T_J$ = 25°C, L = 35mH $R_G$ = 25Ω, $I_{AS}$ = -2.8A.

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

⑤ Surface mounted on FR-4 board, t ≤ 10sec.

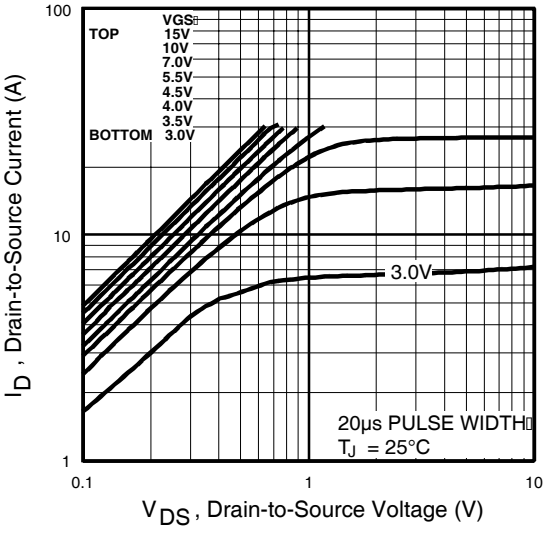



**Fig 1.** Typical Output Characteristics

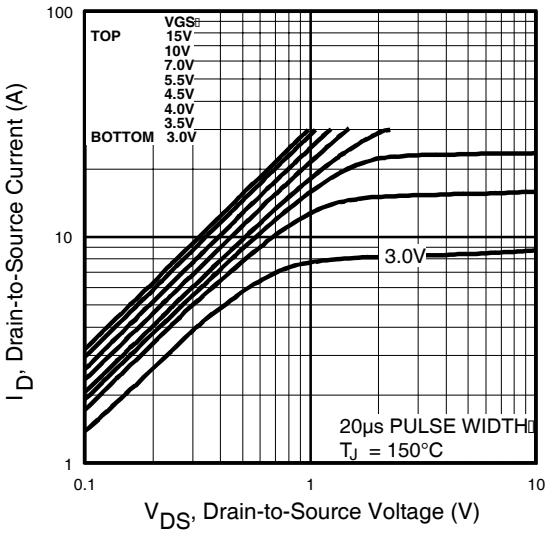



**Fig 2.** Typical Output Characteristics

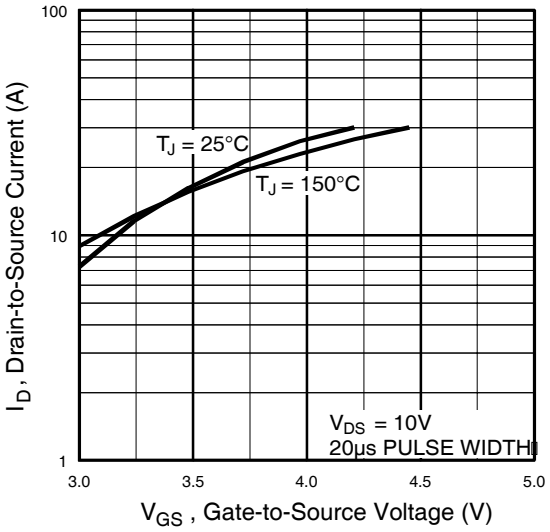



**Fig 3.** Typical Transfer Characteristics

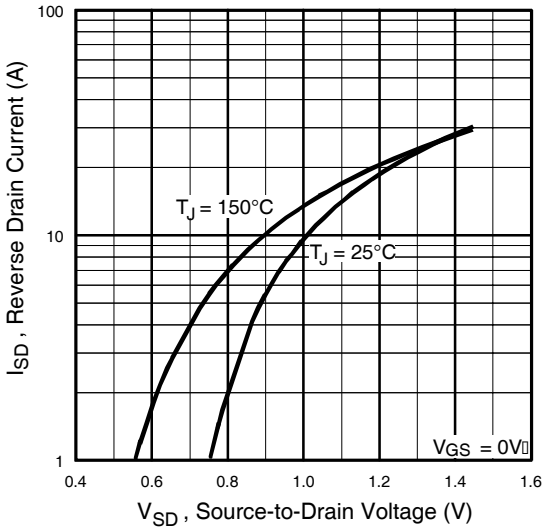



**Fig 4.** Typical Source-Drain Diode Forward Voltage

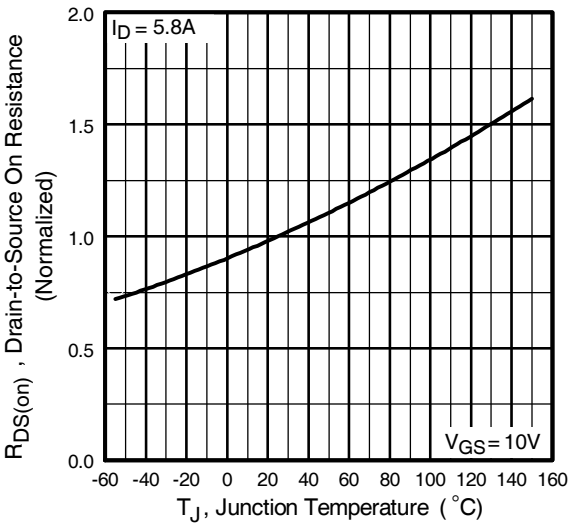



**Fig 5.** Normalized On-Resistance Vs. Temperature

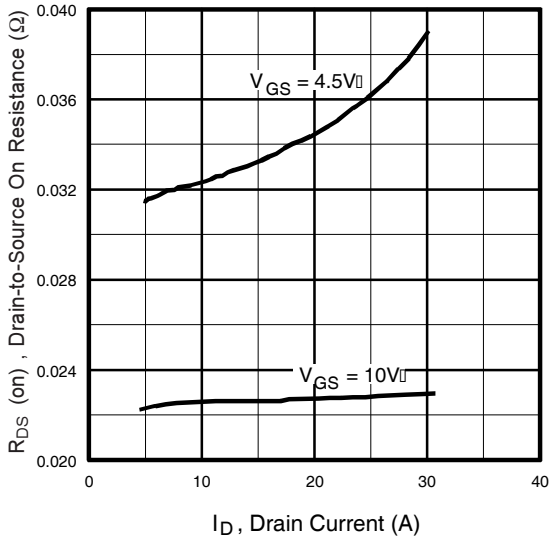



**Fig 6.** Typical On-Resistance Vs. Drain Current

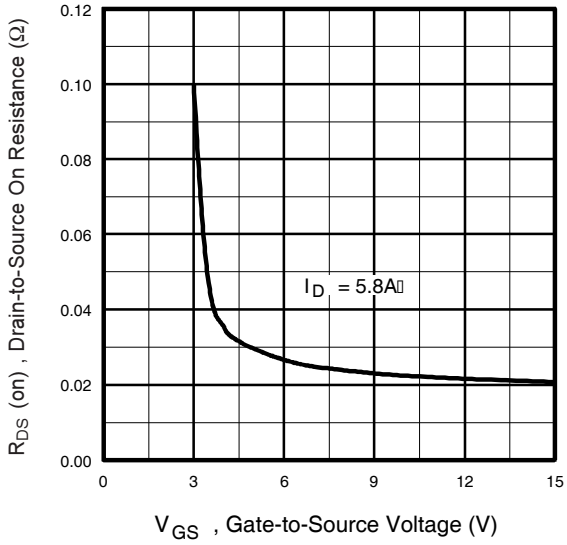



**Fig 7.** Typical On-Resistance Vs. Gate Voltage

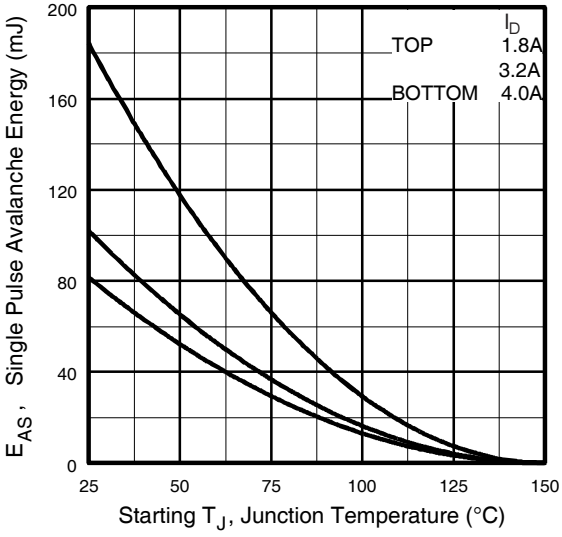



**Fig 8.** Maximum Avalanche Energy Vs. Drain Current

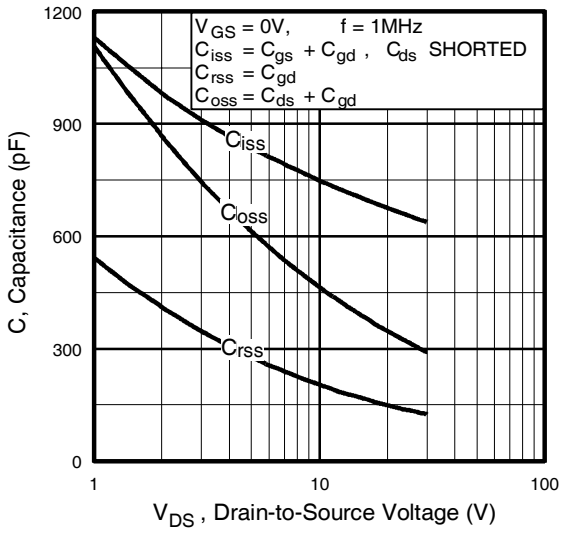



**Fig 9.** Typical Capacitance Vs. Drain-to-Source Voltage

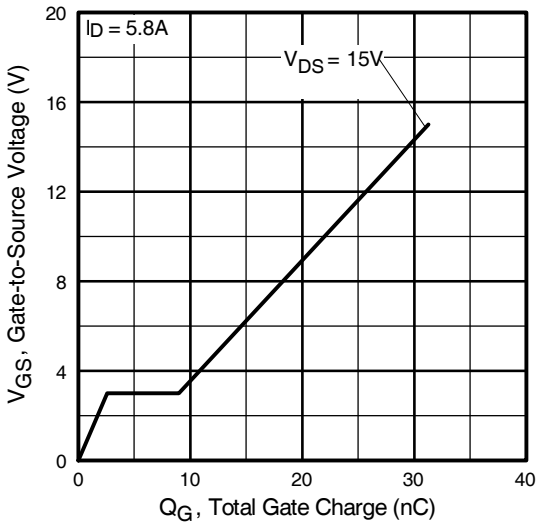



**Fig 10.** Typical Gate Charge Vs. Gate-to-Source Voltage

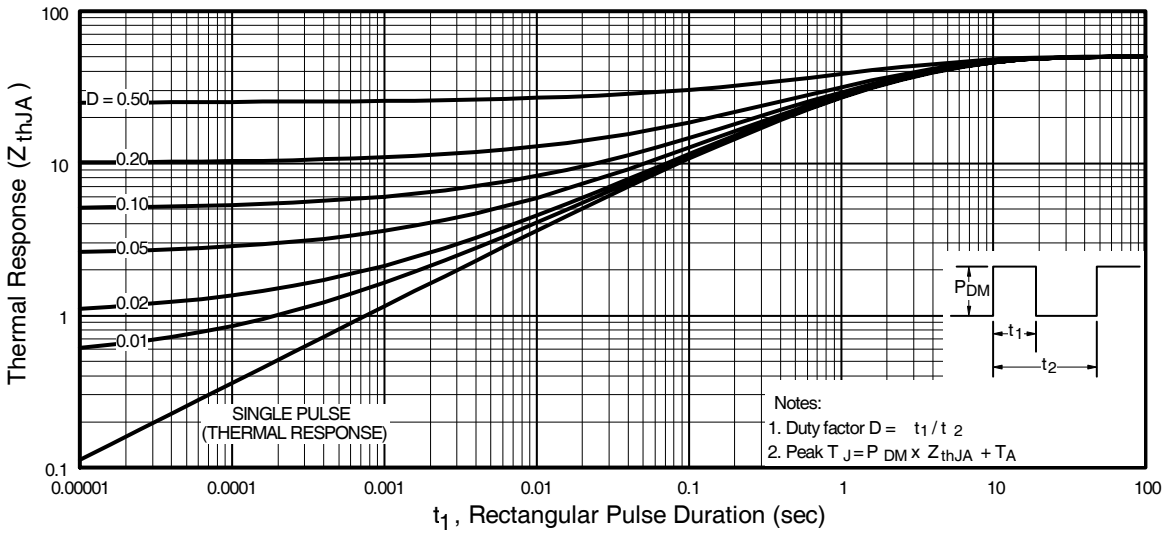



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

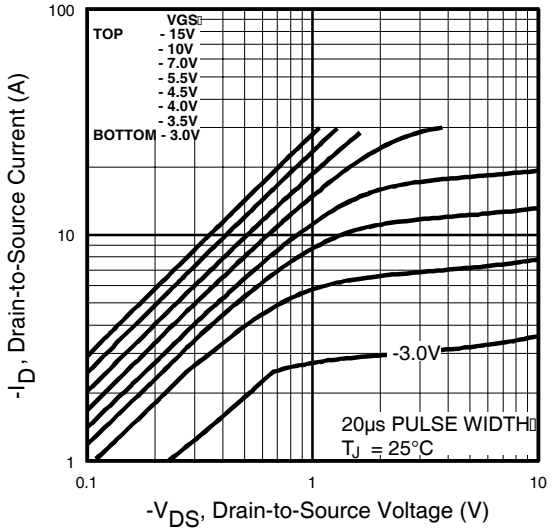



**Fig 12.** Typical Output Characteristics

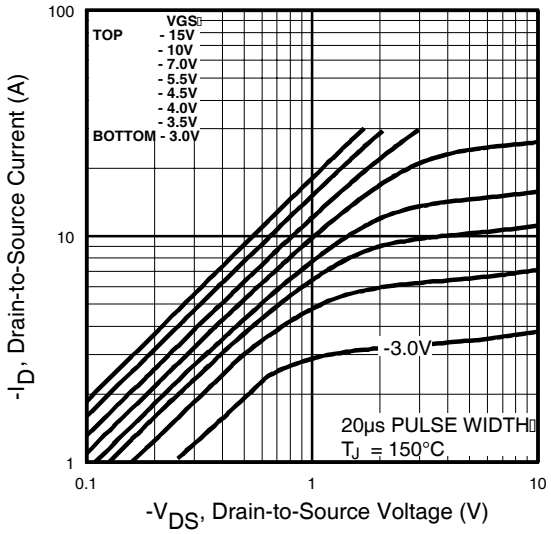



**Fig 13.** Typical Output Characteristics

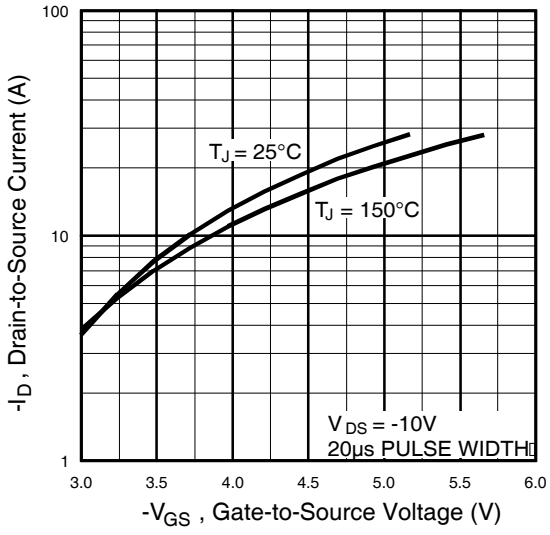



**Fig 14.** Typical Transfer Characteristics

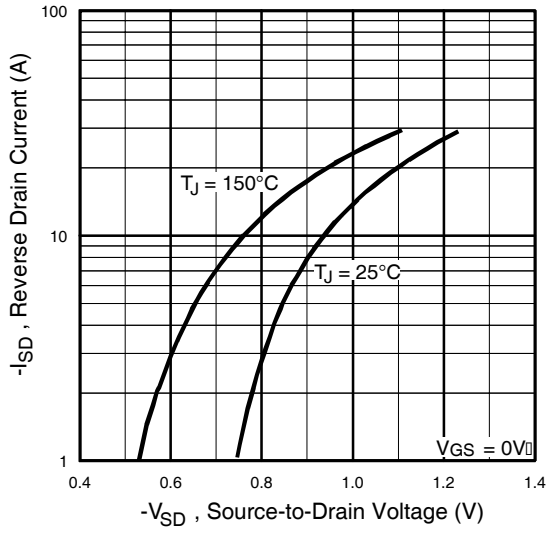



**Fig 15.** Typical Source-Drain Diode Forward Voltage

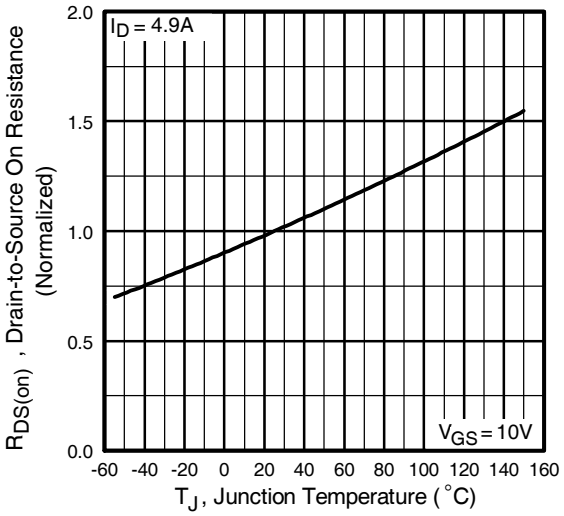



**Fig 16.** Normalized On-Resistance Vs. Temperature

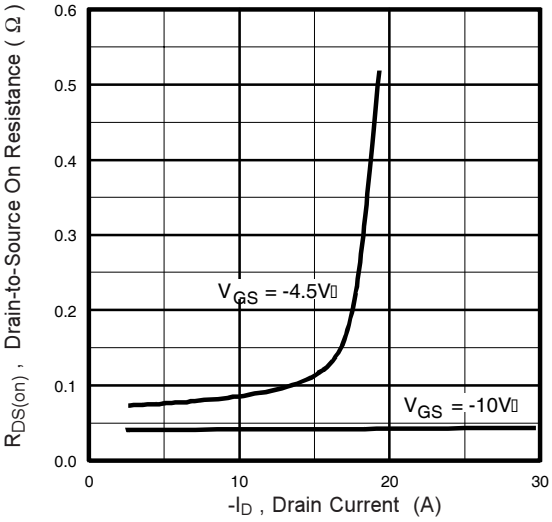



**Fig 17.** Typical On-Resistance Vs. Drain Current

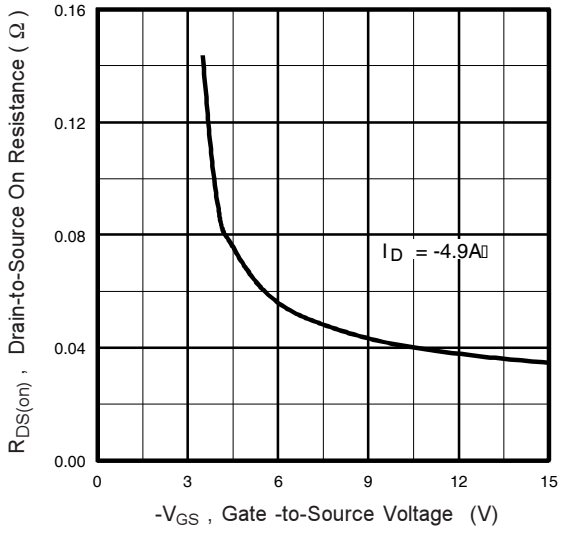



**Fig 18.** Typical On-Resistance Vs. Gate Voltage

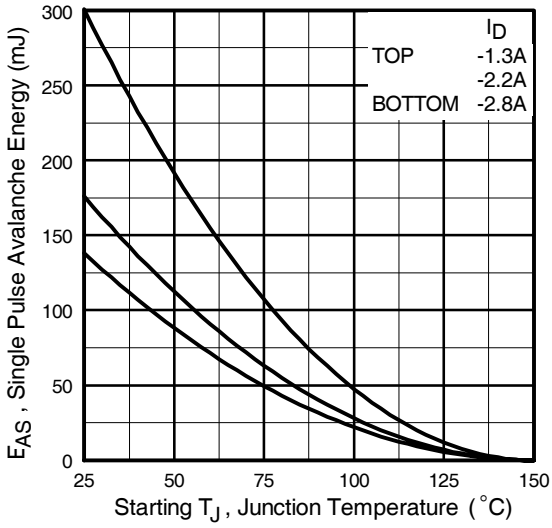



**Fig 19.** Maximum Avalanche Energy Vs. Drain Current

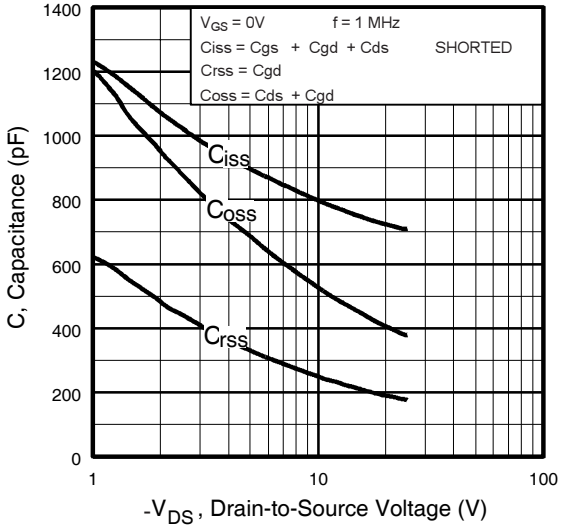



**Fig 20.** Typical Capacitance Vs. Drain-to-Source Voltage

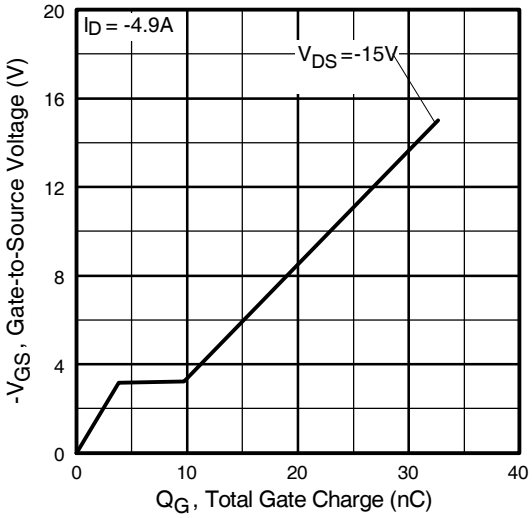



**Fig 21.** Typical Gate Charge Vs. Gate-to-Source Voltage

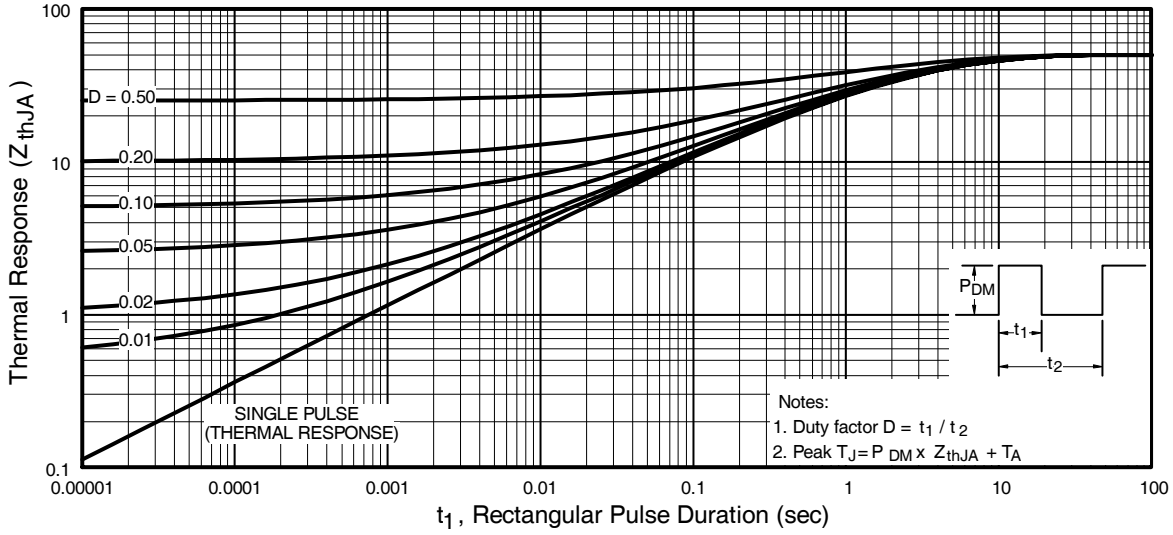
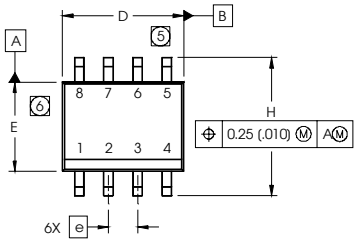
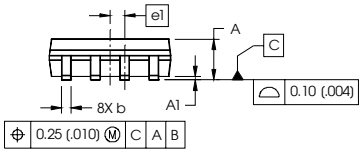


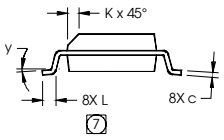

**Fig 22.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

## 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 | |
| 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° |

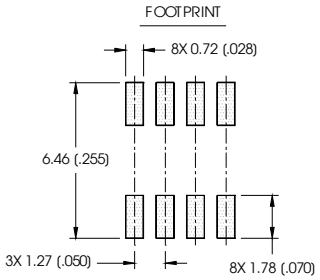
NOTES:

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).

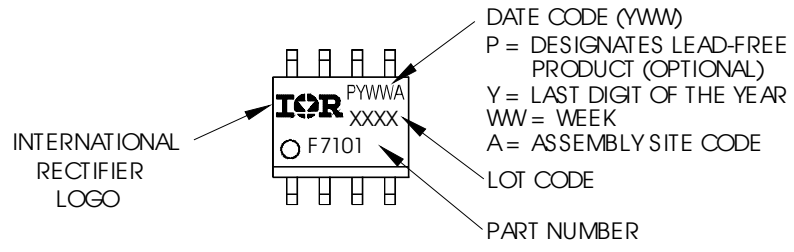
6 DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 (.010).

7 DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.



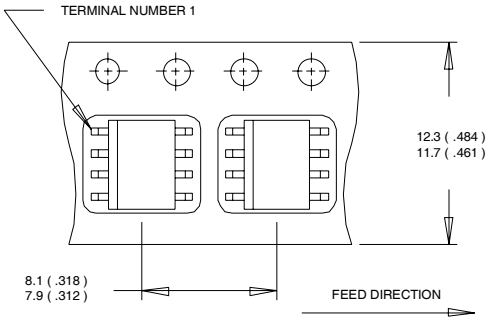

## SO-8 Part Marking Information (Lead-Free)

EXAMPLE: THIS IS AN IRF7101 (MOSFET)

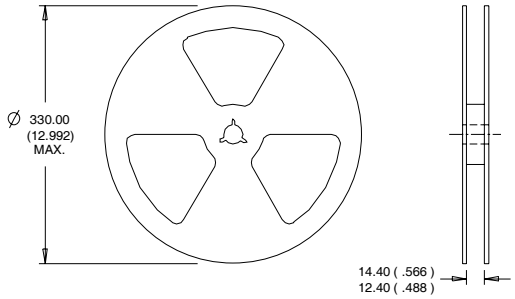


## SO-8 Tape and Reel

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.

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

International
IOR Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.06/04

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