

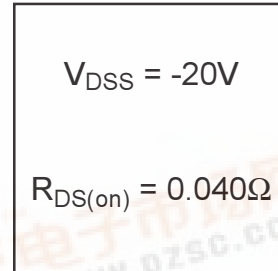
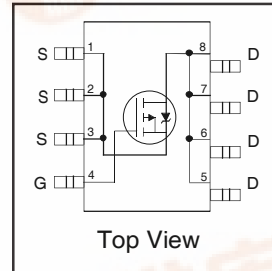
# International IR Rectifier

PD - 96127

## IRF7404QPbF

HEXFET® Power MOSFET

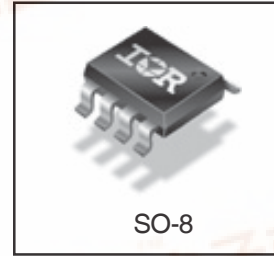
- Advanced Process Technology
- Ultra Low On-Resistance
- P Channel MOSFET
- Surface Mount
- Available in Tape & Reel
- 150°C Operating Temperature
- Automotive [Q101] Qualified
- Lead-Free



### Description

Specifically designed for Automotive applications, these HEXFET® Power MOSFET's in package utilize the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of these Automotive qualified 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 Automotive applications and a wide variety of other 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.



### Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_A = 25^\circ C$	10 Sec. Pulsed Drain Current, $V_{GS} @ -4.5V$	-7.7	A
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V$	-6.7	
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V$	-5.4	
$I_{DM}$	Pulsed Drain Current ①	-27	
$P_D @ T_A = 25^\circ C$	Power Dissipation	2.5	W
	Linear Derating Factor	0.02	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 12$	V
$dv/dt$	Peak Diode Recovery $dv/dt$ ②	-5.0	V/ns
$T_J, T_{STG}$	Junction and Storage Temperature Range	-55 to + 150	°C

### Thermal Resistance Ratings

	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Maximum Junction-to-Ambient ③	---	50	°C/W

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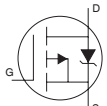
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## Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

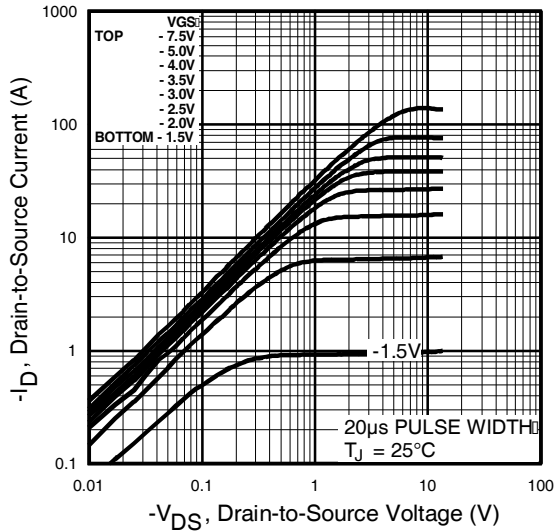
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	-20	—	—	V	$V_{GS} = 0V, I_D = -250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	-0.012	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = -1\text{mA}$
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	—	—	0.040	$\Omega$	$V_{GS} = -4.5V, I_D = -3.2A$ ③
		—	—	0.060		$V_{GS} = -2.7V, I_D = -2.7A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	-0.70	—	—	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
$g_{fs}$	Forward Transconductance	6.8	—	—	S	$V_{DS} = -15V, I_D = -3.2A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	-1.0	$\mu A$	$V_{DS} = -16V, V_{GS} = 0V$
		—	—	-25		$V_{DS} = -16V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	-100	nA	$V_{GS} = -12V$
	Gate-to-Source Reverse Leakage	—	—	100		$V_{GS} = 12V$
$Q_g$	Total Gate Charge	—	—	50	nC	$I_D = -3.2A$
$Q_{gs}$	Gate-to-Source Charge	—	—	5.5		$V_{DS} = -16V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	21		$V_{GS} = -4.5V$ , See Fig. 6 and 12 ③
$t_{d(on)}$	Turn-On Delay Time	—	14	—		$V_{DD} = -10V$
$t_r$	Rise Time	—	32	—	ns	$I_D = -3.2A$
$t_{d(off)}$	Turn-Off Delay Time	—	100	—		$R_G = 6.0\Omega$
$t_f$	Fall Time	—	65	—		$R_D = 3.1\Omega$ , See Fig. 10 ③
$L_D$	Internal Drain Inductance	—	2.5	—		nH
$L_S$	Internal Source Inductance	—	4.0	—		
$C_{iss}$	Input Capacitance	—	1500	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	730	—		$V_{DS} = -15V$
$C_{rss}$	Reverse Transfer Capacitance	—	340	—		$f = 1.0\text{MHz}$ , See Fig. 5

## Source-Drain Ratings and Characteristics

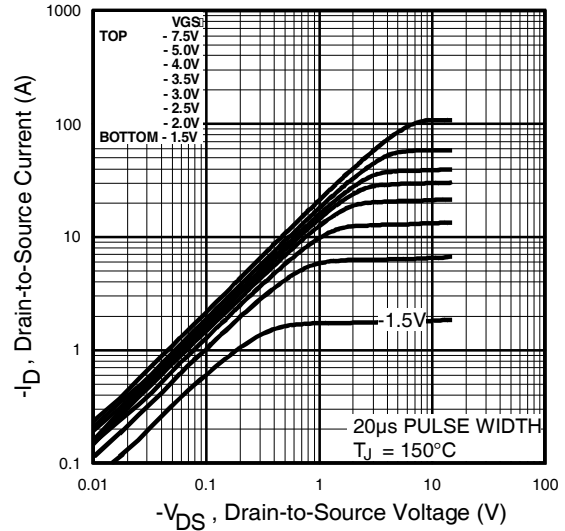
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	-3.1	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	-27		
$V_{SD}$	Diode Forward Voltage	—	—	-1.0	V	$T_J = 25^\circ\text{C}, I_S = -2.0A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	69	100	ns	$T_J = 25^\circ\text{C}, I_F = -3.2A$
$Q_{rr}$	Reverse Recovery Charge	—	71	110	$\mu\text{C}$	$di/dt = 100A/\mu\text{s}$ ③
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ )				

### Notes:

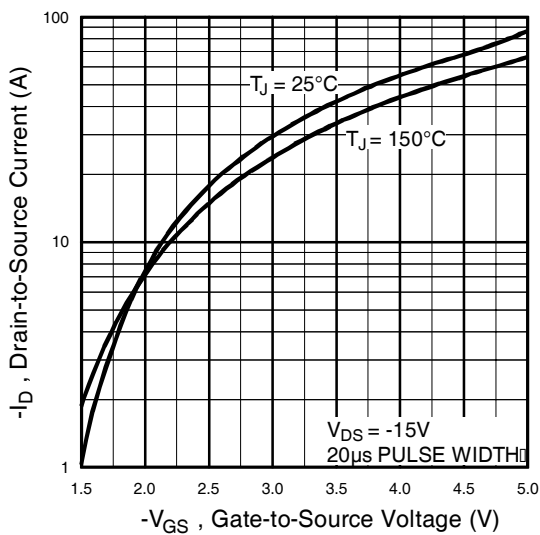
- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
- ②  $I_{SD} \leq -3.2A, di/dt \leq -65A/\mu\text{s}, V_{DD} \leq V_{(BR)DSS}, T_J \leq 150^\circ\text{C}$
- ③ Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ Surface mounted on FR-4 board,  $t \leq 10\text{sec}$ .



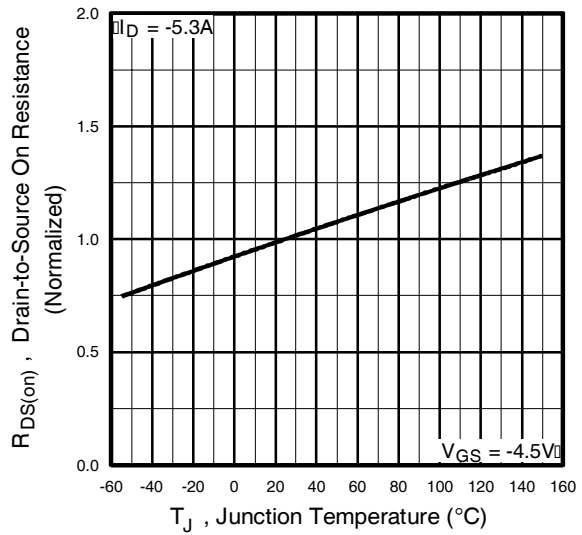
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



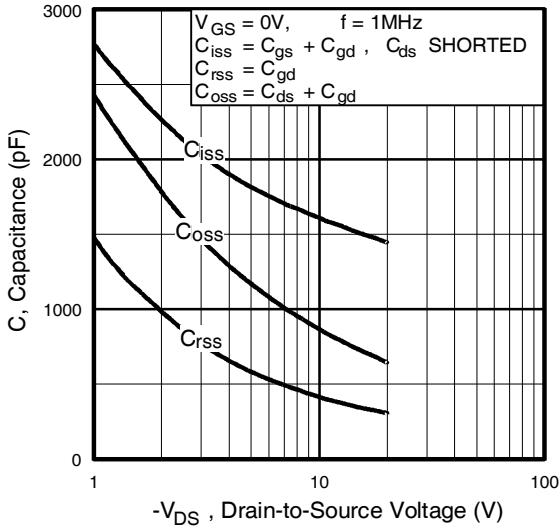
**Fig 3.** Typical Transfer Characteristics



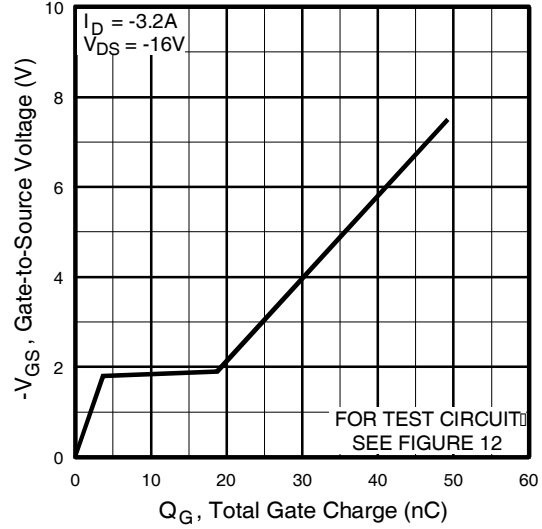
**Fig 4.** Normalized On-Resistance Vs. Temperature

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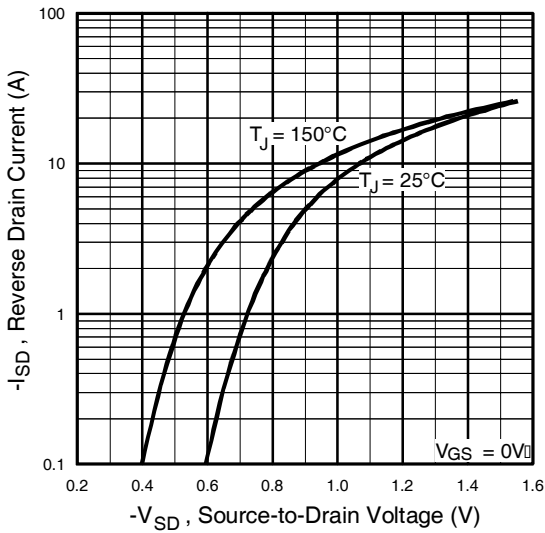
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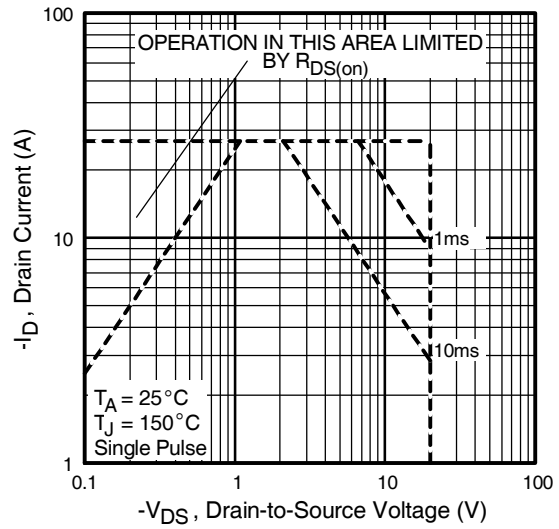
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



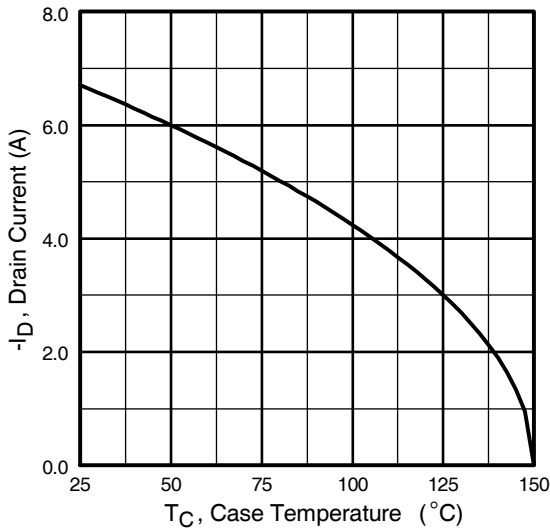
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



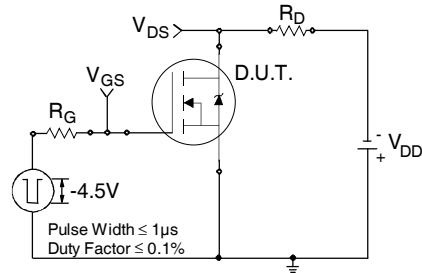
**Fig 7.** Typical Source-Drain Diode Forward Voltage



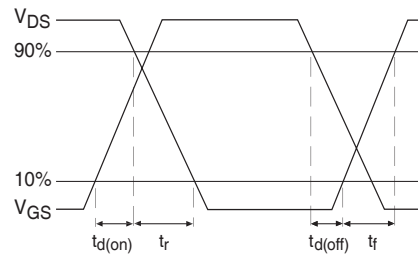
**Fig 8.** Maximum Safe Operating Area



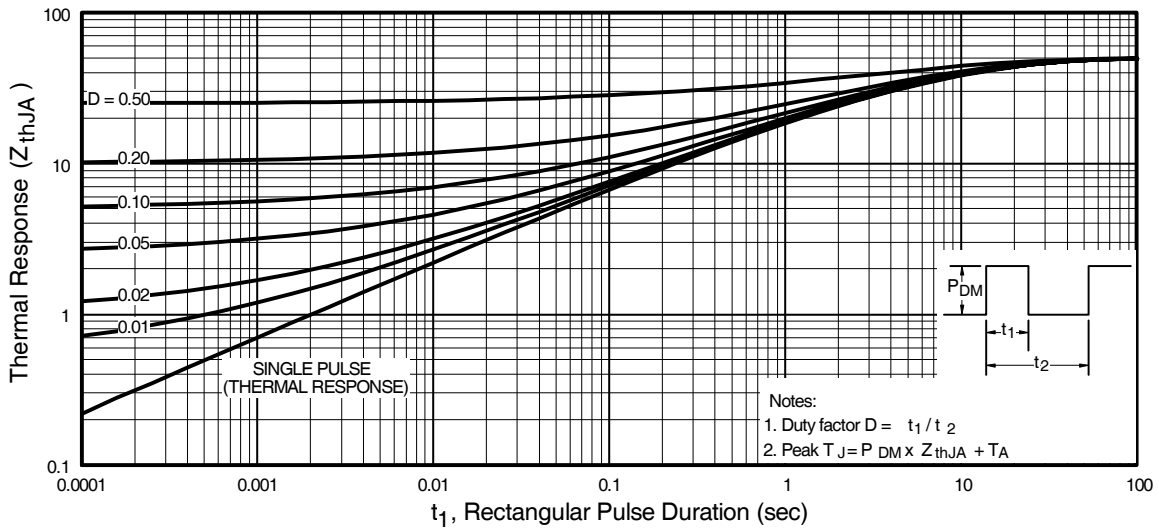
**Fig 9.** Maximum Drain Current Vs. Ambient Temperature



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



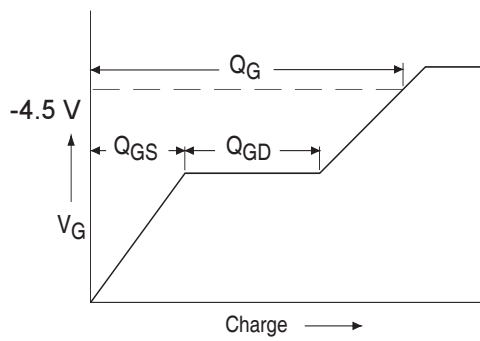
**Fig 10b.** Switching Time Waveforms



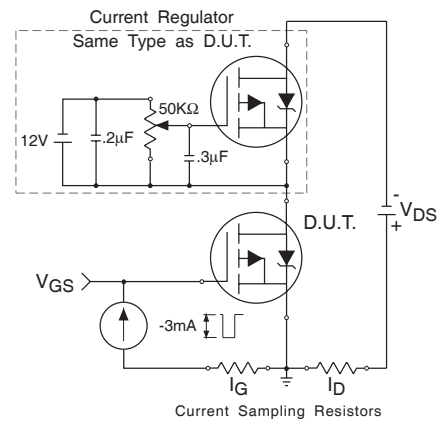
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

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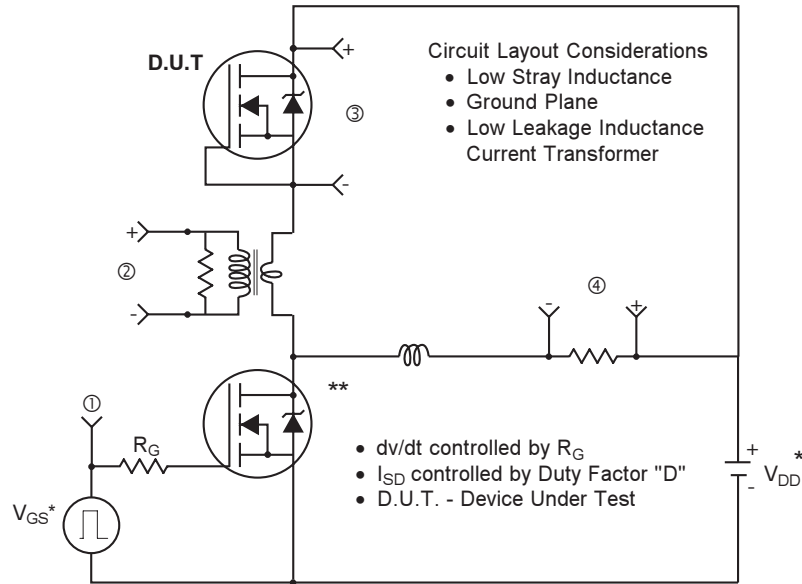


**Fig 12a.** Basic Gate Charge Waveform



**Fig 12b.** Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



\* Reverse Polarity for P-Channel

\*\* Use P-Channel Driver for P-Channel Measurements

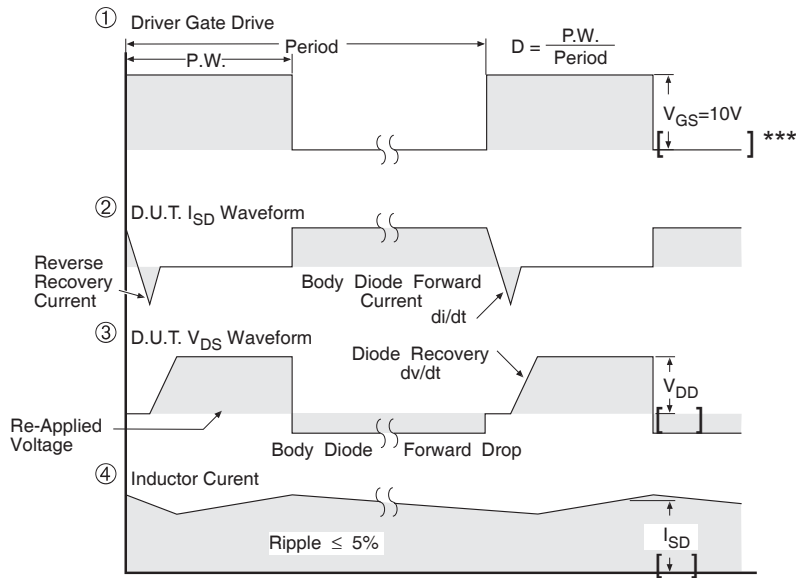


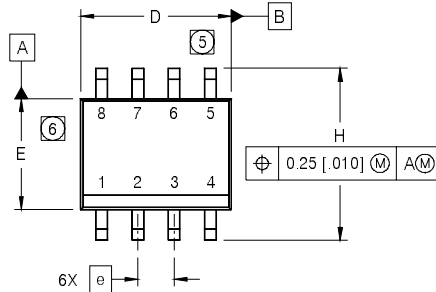
Fig 13. For P-Channel HEXFETS

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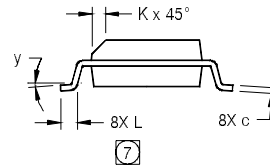
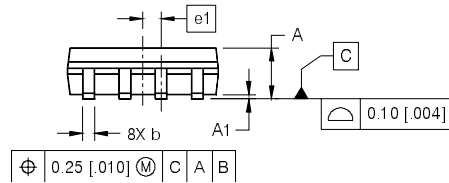
## SO-8 Package Outline

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Dimensions are shown in millimeters (inches)



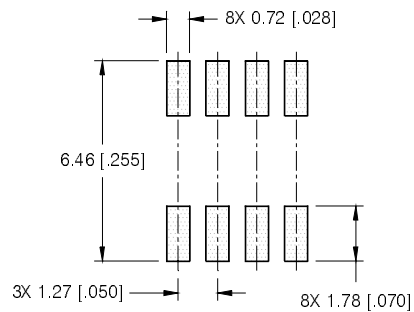
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
b	.013	.020	0.33	0.51
c	.0075	.0098	0.19	0.25
D	.189	.1968	4.80	5.00
E	.1497	.1574	3.80	4.00
e	.050 BASIC		1.27 BASIC	
e1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.0099	.0196	0.25	0.50
L	.016	.050	0.40	1.27
y	0°	8°	0°	8°



### NOTES:

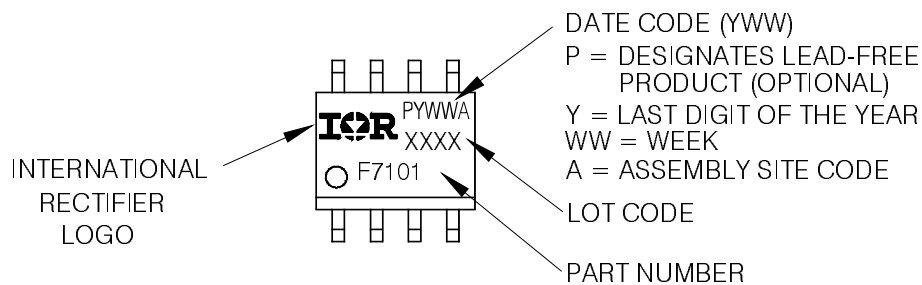
- DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
- CONTROLLING DIMENSION: MILLIMETER
- DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
- DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 [0.006].
- DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [0.010].
- DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

### FOOTPRINT



## SO-8 Part Marking

EXAMPLE: THIS IS AN IRF7101 (MOSFET)

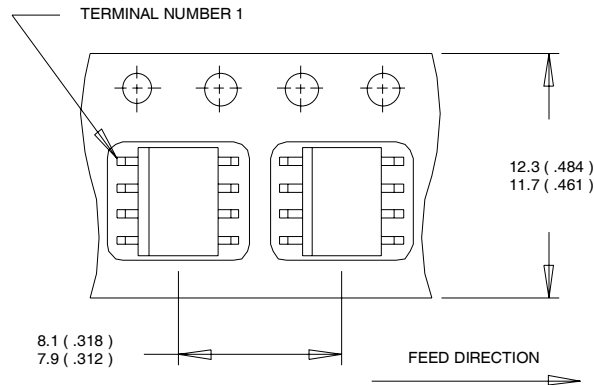


Note: For the most current drawing please refer to IR website at: <http://www.irf.com/package/>

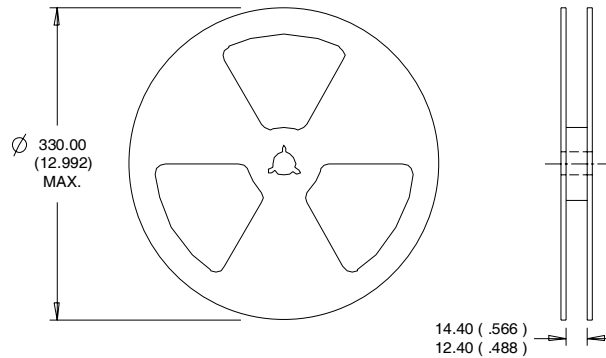


## SO-8 Tape and Reel

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.

**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 Automotive [Q101] market.  
 Qualification Standards can be found on IR's Web site.