International
IOR Rectifier

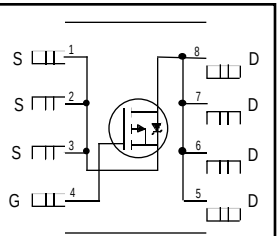
PD - 9.1356C

PRELIMINARY

IRF7416

HEXFET® Power MOSFET

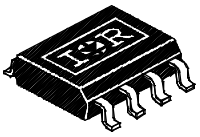
- Generation V Technology
- Ultra Low On-Resistance
- P-Channel Mosfet
- Surface Mount
- Available in Tape & Reel
- Dynamic dv/dt Rating
- Fast Switching



Top View

V_{DSS} = -30V

$R_{DS(on)}$ = 0.02Ω


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. Power dissipation of greater than 0.8W is possible in a typical PCB mount application.

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 10V**	-8.8	A
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 10V*	-5.6	
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 10V*	-4.5	
I_{DM}	Pulsed Drain Current ①	-45	
P_D @T_A = 25°C	Power Dissipation (PCB Mount)**	2.5	W
P_D @T_A = 25°C	Power Dissipation (PCB Mount)*	1.0	
	Linear Derating Factor (PCB Mount)*	8.0	mW/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②	370	mJ
dv/dt	Peak Diode Recovery dv/dt ③	-1.8	V/ns
T_J, T_{STG}	Junction and Storage Temperature Range	-55 to + 150	°C

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Amb. (PCB Mount, steady state)*	100	125	°C/W
$R_{\theta JA}$	Junction-to-Amb. (PCB Mount, steady state)**	40	50	

* When mounted on FR-4 board using minimum recommended footprint.

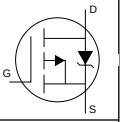
** When mounted on 1 inch square copper board, for comparison with other SMD devices.

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

	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	——	-0.024	——	V/°C	Reference to 25°C, I_D = -1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	——	0.020	Ω	V_{GS} = -10V, I_D = -5.6A ④
		——	——	0.035		V_{GS} = -4.5V, I_D = -2.8A ④
$V_{GS(th)}$	Gate Threshold Voltage	-1.0	——	——	V	V_{DS} = V_{GS}, I_D = -250µA
g_{fs}	Forward Transconductance	5.6	——	——	S	V_{DS} = -10V, I_D = -2.8A
I_{DSS}	Drain-to-Source Leakage Current	——	——	-1.0	µA	V_{DS} = -24V, 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	——	61	92	nC	I_D = -5.6A
Q_{gs}	Gate-to-Source Charge	——	8.0	12		V_{DS} = -24V
Q_{gd}	Gate-to-Drain ("Miller") Charge	——	22	32		V_{GS} = -10V, See Fig. 6 and 9 ④
$t_{d(on)}$	Turn-On Delay Time	——	18	——	ns	V_{DD} = -15V
t_r	Rise Time	——	49	——		I_D = -5.6A
$t_{d(off)}$	Turn-Off Delay Time	——	59	——		R_G = 6.2Ω
t_f	Fall Time	——	60	——		R_D = 2.7Ω, See Fig. 10 ④
C_{iss}	Input Capacitance	——	1700	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	890	——		V_{DS} = -25V
C_{rss}	Reverse Transfer Capacitance	——	410	——		f = 1.0MHz, See Fig. 5

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	-1.3	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	——	——	-45		
V_{SD}	Diode Forward Voltage	——	——	-1.0	V	T_J = 25°C, I_S = -5.6A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	——	56	85	ns	T_J = 25°C, I_F = -5.6A
Q_{rr}	Reverse RecoveryCharge	——	99	150	nC	di/dt = 100A/µs ③



Specification changes

Rev. #	Parameters	Old spec.	New spec.	Comments	Revision Date
1	$V_{GS(th)}$ (Max.)	-2.5 v	No spec.	Removed $V_{GS(th)}$ (Max). Specification	10/21/96

Notes:

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

② Starting T_J = 25°C, L = 25mH
R_G = 25Ω, I_{AS} = -5.6A. (See Figure 12)

③ I_{SD} ≤ -5.6A, di/dt ≤ 100A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 150°C

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

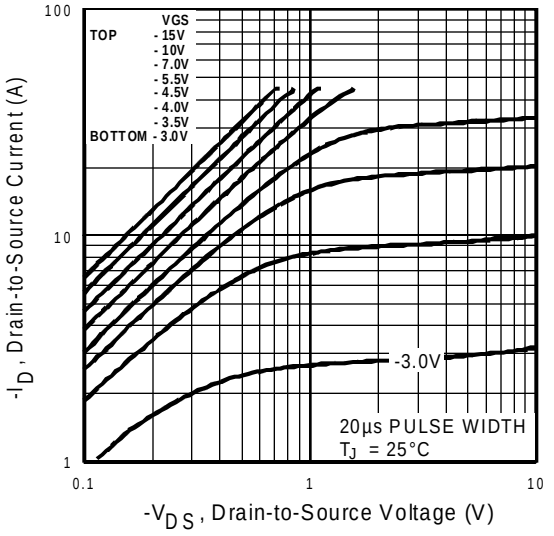


Fig 1. Typical Output Characteristics

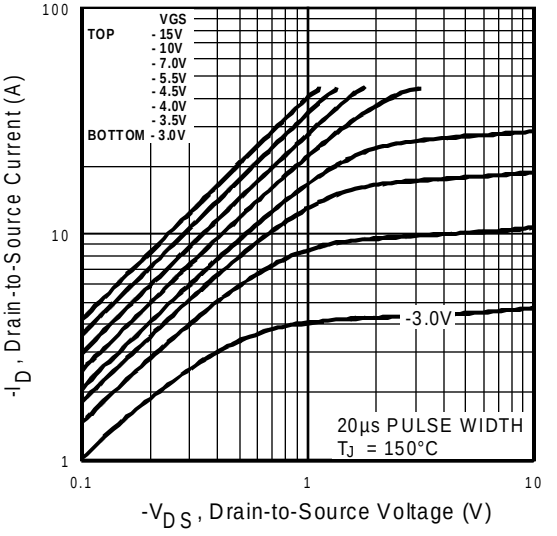


Fig 2. Typical Output Characteristics

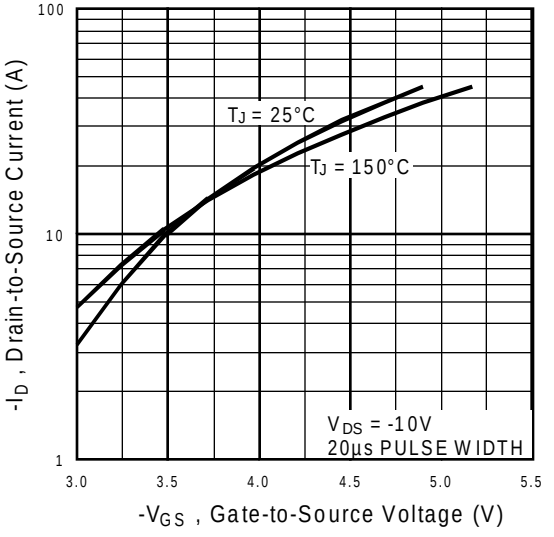


Fig 3. Typical Transfer Characteristics

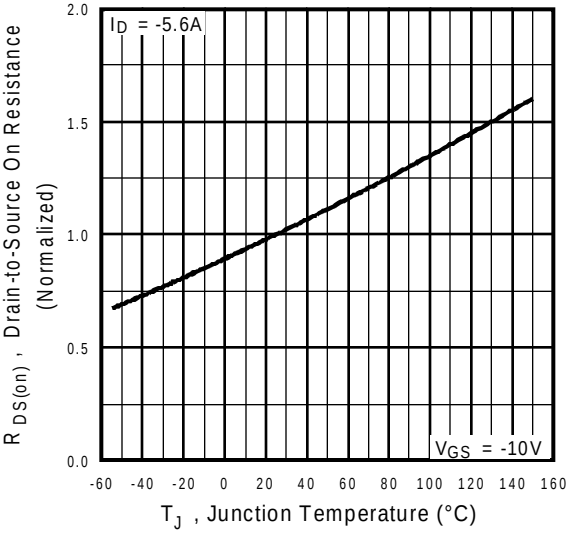


Fig 4. Normalized On-Resistance Vs. Temperature

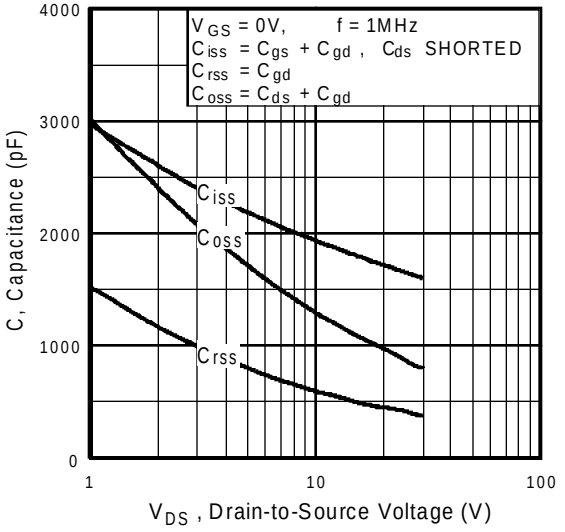


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

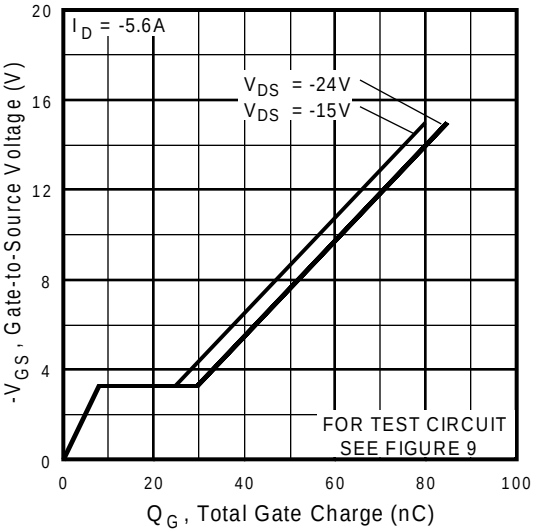


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

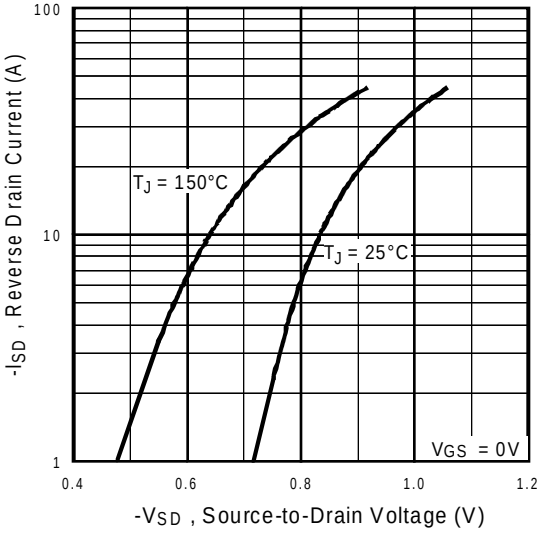


Fig 7. Typical Source-Drain Diode Forward Voltage

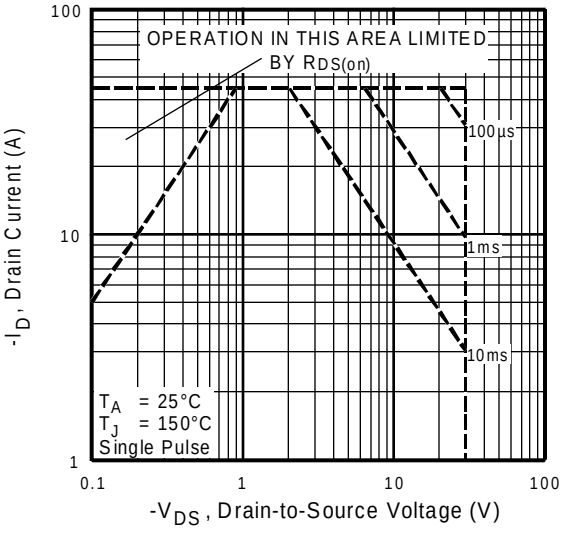


Fig 8. Maximum Safe Operating Area

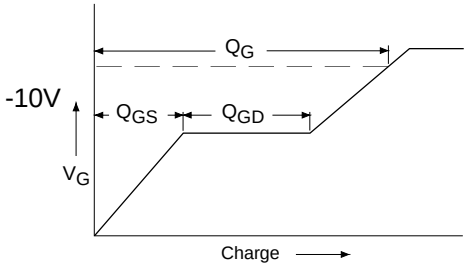


Fig 9a. Basic Gate Charge Waveform

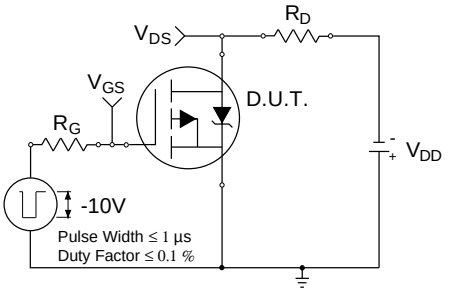


Fig 10a. Switching Time Test Circuit

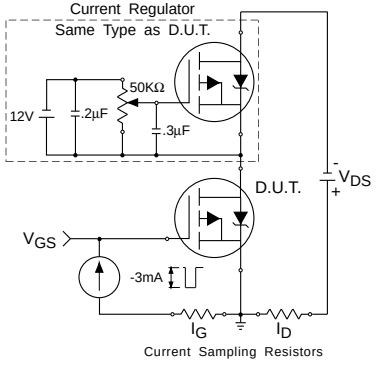


Fig 9b. Gate Charge Test Circuit

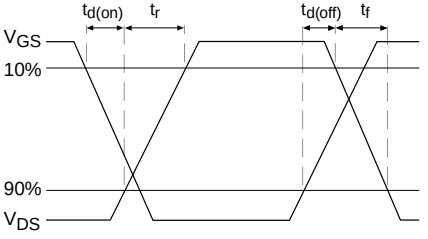


Fig 10b. Switching Time Waveforms

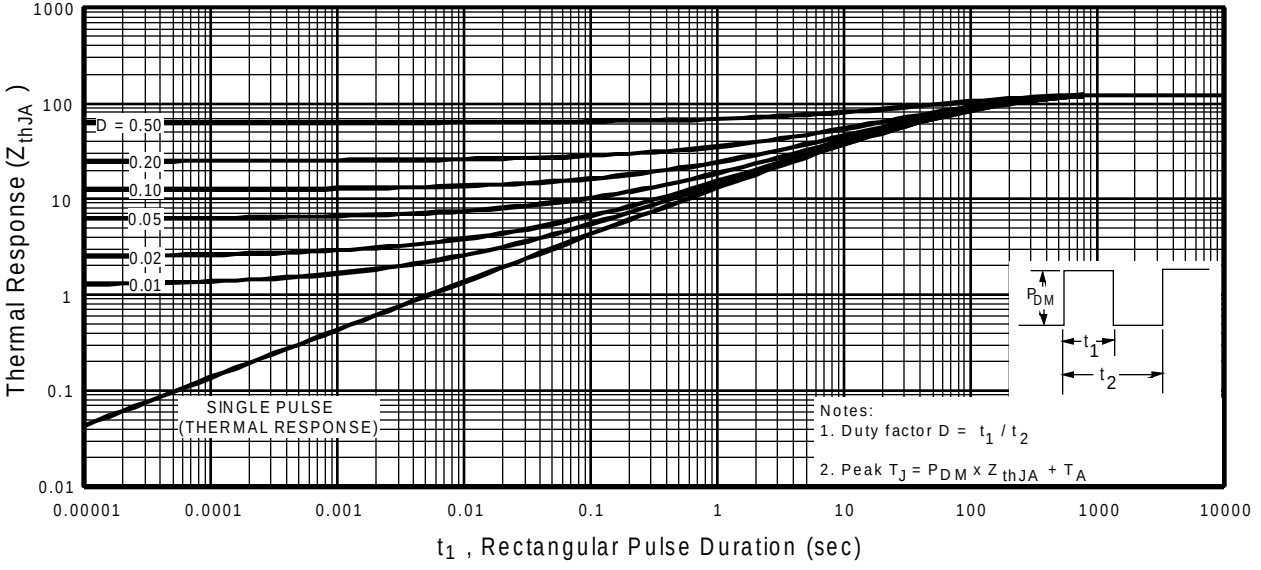


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

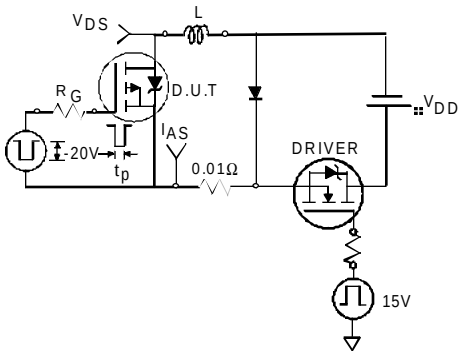


Fig 12a. Unclamped Inductive Test Circuit

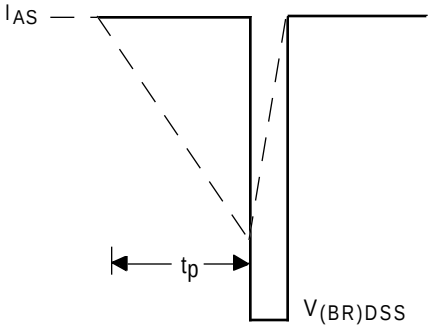


Fig 12b. Unclamped Inductive Waveforms

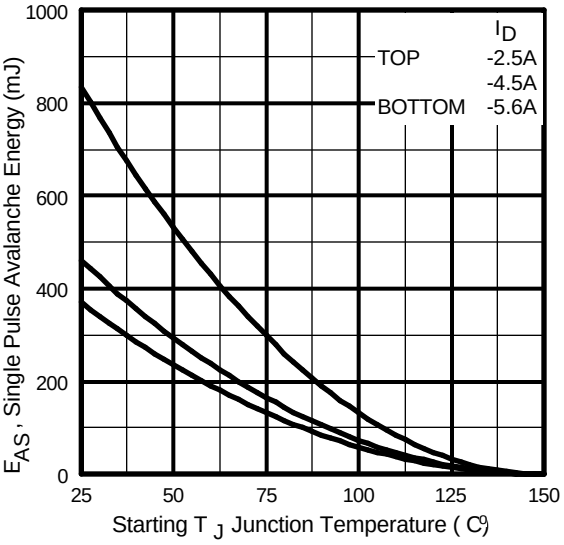
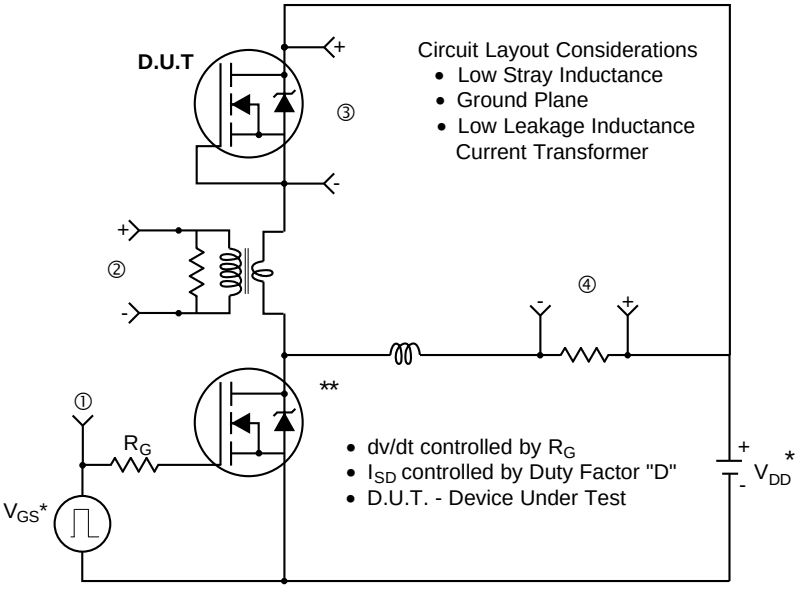
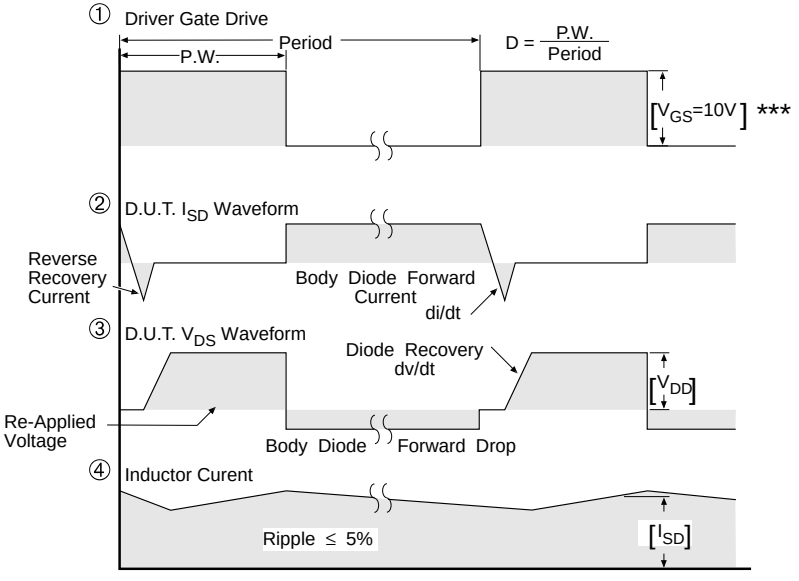


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

Peak Diode Recovery dv/dt Test Circuit



* Reverse Polarity for P-Channel
** Use P-Channel Driver for P-Channel Measurements

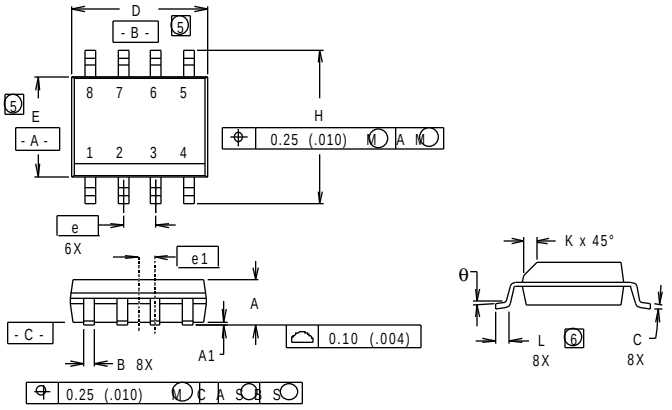


*** V_{GS} = 5.0V for Logic Level and 3V Drive Devices

Fig 13. For P-Channel HEXFETS

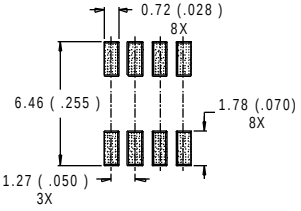
Package Outline

SO8 Outline



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
B	.014	.018	0.36	0.46
C	.0075	.0098	0.19	0.25
D	.189	.196	4.80	4.98
E	.150	.157	3.81	3.99
e	.050 BASIC		1.27 BASIC	
e1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.011	.019	0.28	0.48
L	0.16	.050	0.41	1.27
θ	0°	8°	0°	8°

RECOMMENDED FOOTPRINT



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1982.
2. CONTROLLING DIMENSION : INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.

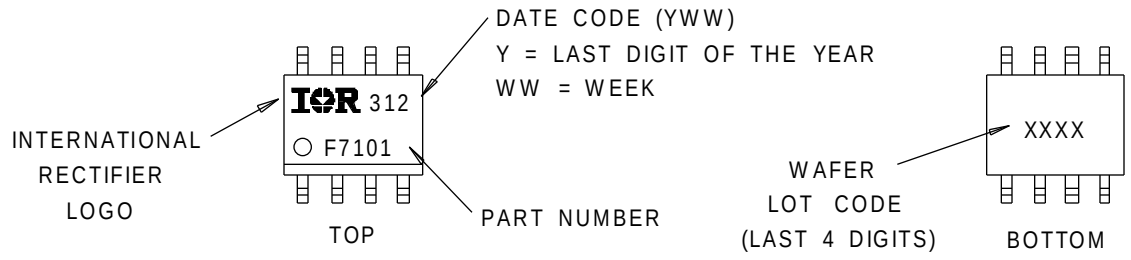
5 DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS
MOLD PROTRUSIONS NOT TO EXCEED 0.25 (.006).

6 DIMENSIONS IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE..

Part Marking Information

SO8

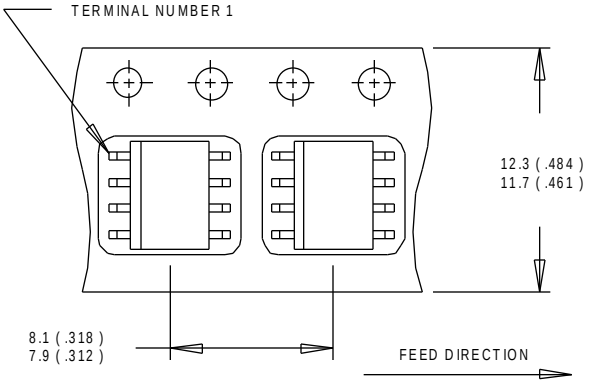
EXAMPLE : THIS IS AN IRF7101



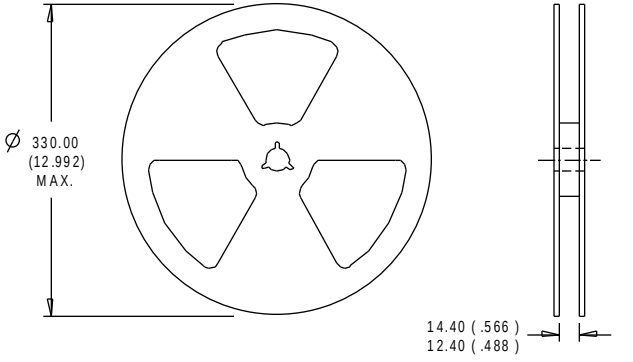
Tape & Reel Information

SO8

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.

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