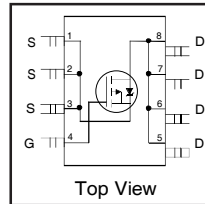


AUIRF7416Q

HEXFET® Power MOSFET

Features

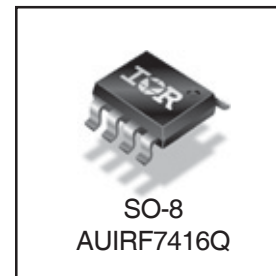
- Advanced Process Technology
- Low On-Resistance
- P-Channel MOSFET
- Dynamic dV/dT Rating
- 150°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Lead-Free, RoHS Compliant
- Automotive Qualified*



$V_{(BR)DSS}$	-30V
$R_{DS(on)}$ max.	0.02Ω
I_D	-10A

Description

Specifically designed for Automotive applications, this cellular design of HEXFET® Power MOSFETs utilizes the latest processing techniques to achieve 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 Automotive and a wide variety of other applications.



Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature (T_A) is 25°C, unless otherwise specified.

	Parameter	Max.	Units
$I_D @ T_A = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10\text{V}$	-10	A
$I_D @ T_A = 70^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10\text{V}$	-7.1	
I_{DM}	Pulsed Drain Current ①	-45	
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation	2.5	W
	Linear Derating Factor	0.02	mW/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ②	370	mJ
dv/dt	Peak Diode Recovery dv/dt ③	-5.0	V/ns
T_J	Operating Junction and	-55 to + 150	°C
T_{STG}	Storage Temperature Range		

Thermal Resistance

	Parameter	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient ④	50	°C/W

HEXFET® is a registered trademark of International Rectifier.

*Qualification standards can be found at <http://www.irf.com/>

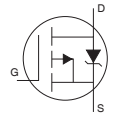
Static Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	-30	—	—	V	$V_{GS} = 0V, I_D = -250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	-0.024	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = -1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.020	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	—	-2.04	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
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		$V_{DS} = -24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	-100	nA	$V_{GS} = -20V$
	Gate-to-Source Reverse Leakage	—	—	100		$V_{GS} = 20V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
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 & 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	—		$R_G = 6.2\Omega$
t_f	Fall Time	—	60	—		$R_D = 2.7\Omega$, 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	—		$f = 1.0\text{MHz}$, See Fig. 5

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	—	—	-45		
V_{SD}	Diode Forward Voltage	—	—	-1.0	V	$T_J = 25^\circ\text{C}, I_S = -5.6A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	56	85	ns	$T_J = 25^\circ\text{C}, I_F = -5.6A$
Q_{rr}	Reverse Recovery Charge	—	99	150	nC	$di/dt = 100A/\mu s$ ③

Notes:

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

② Starting $T_J = 25^\circ\text{C}$, $L = 25\text{mH}$
 $R_G = 25\Omega, I_{AS} = -5.6A$. (See Figure 12)

③ $I_{SD} \leq -5.6A, di/dt \leq 100A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 150^\circ\text{C}$.

④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.

⑤ Surface mounted on FR-4 board, $t \leq 10\text{sec}$.

Qualification Information†

Qualification Level		Automotive (per AEC-Q101) ††	
		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
Moisture Sensitivity Level		SO-8	MSL1
ESD	Machine Model	Class M4 (+/- 425V) ††† AEC-Q101-002	
	Human Body Model	Class H1B (+/- 1000V) ††† AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 1125V) ††† AEC-Q101-005	
RoHS Compliant		Yes	

† Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/>

†† Exceptions to AEC-Q101 requirements are noted in the qualification report.

††† Highest passing voltage.

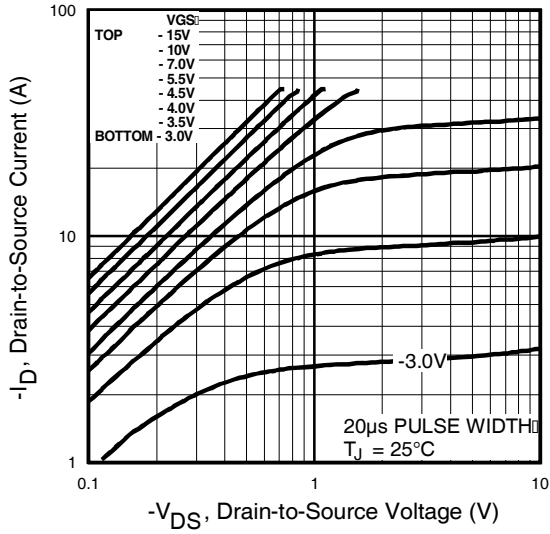


Fig 1. Typical Output Characteristics

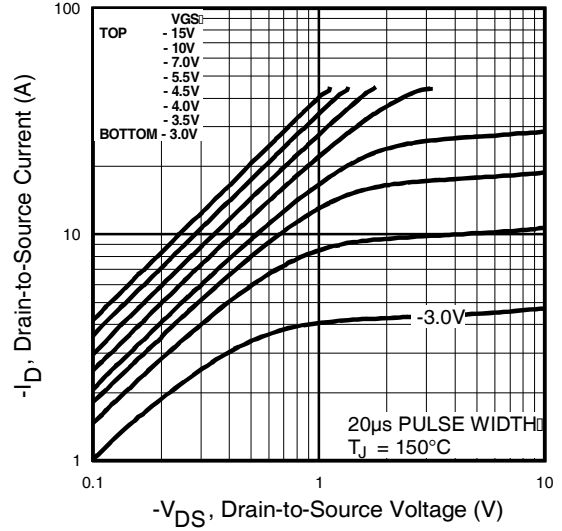


Fig 2. Typical Output Characteristics

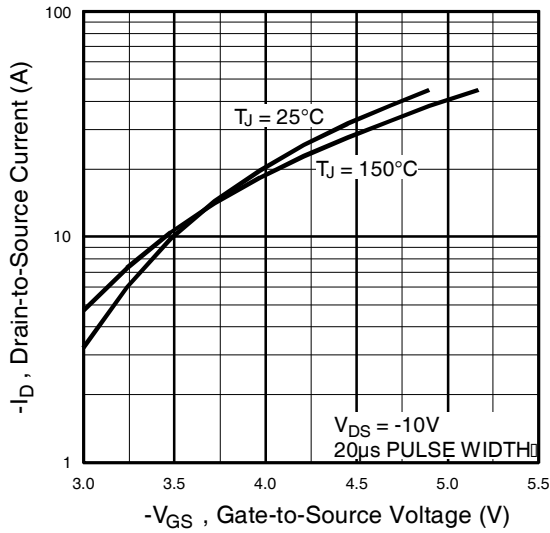


Fig 3. Typical Transfer Characteristics

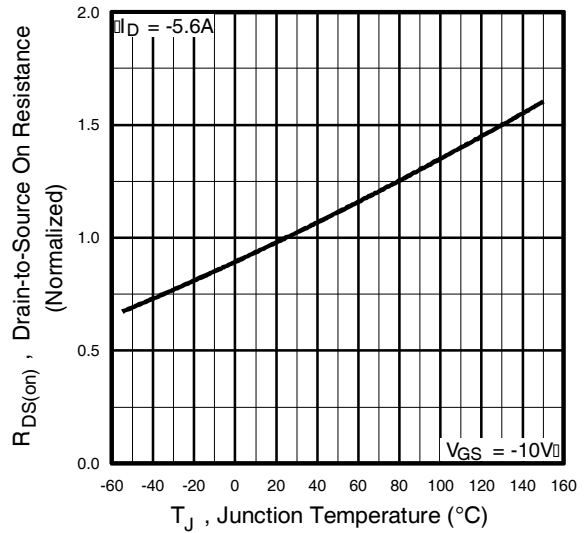


Fig 4. Normalized On-Resistance Vs. Temperature

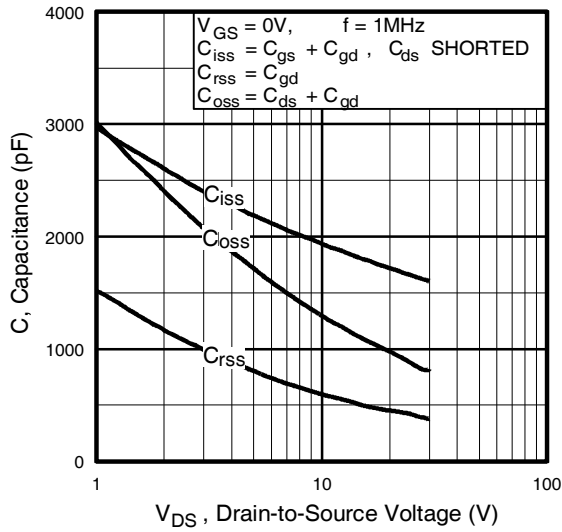


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

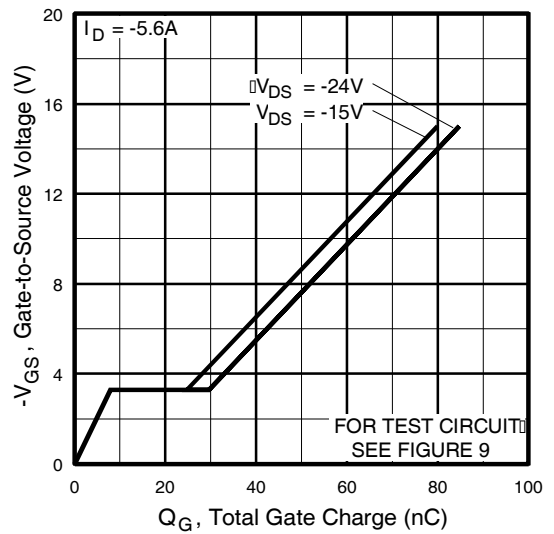


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

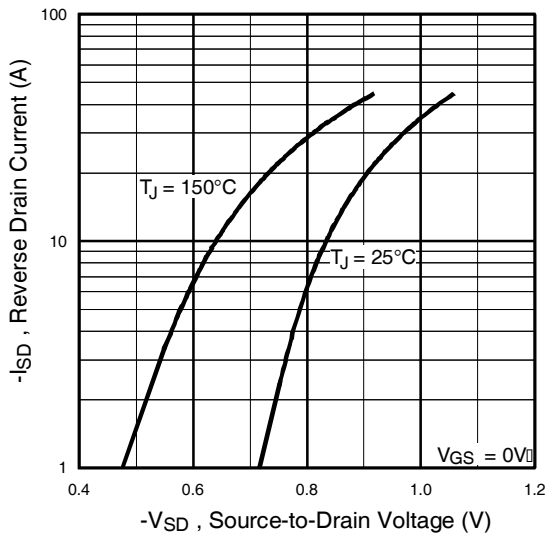


Fig 7. Typical Source-Drain Diode Forward Voltage

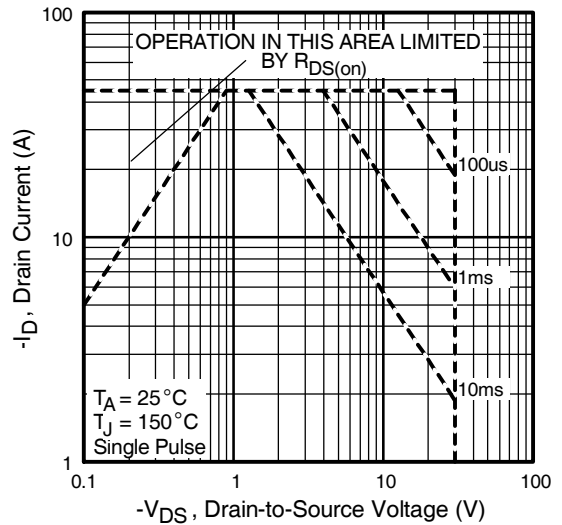


Fig 8. Maximum Safe Operating Area

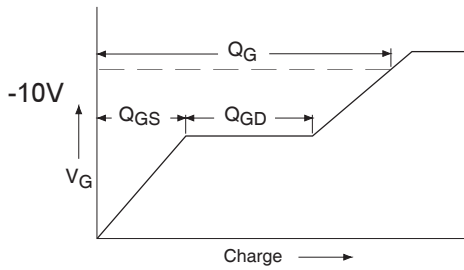


Fig 9a. Basic Gate Charge Waveform

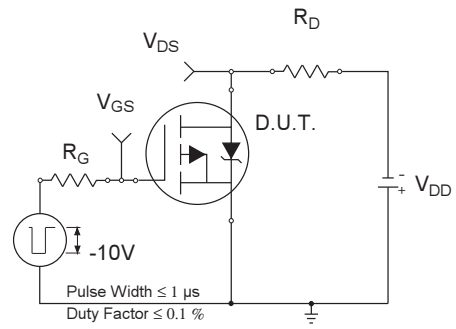


Fig 10a. Switching Time Test Circuit

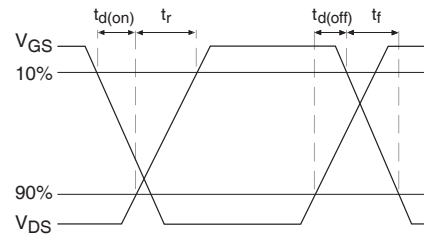
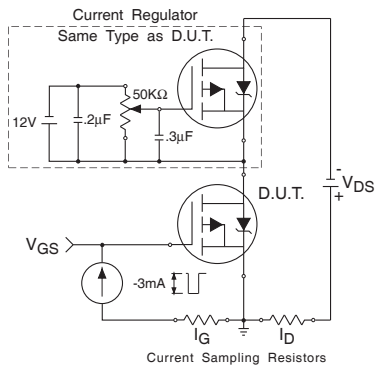


Fig 10b. Switching Time Waveforms

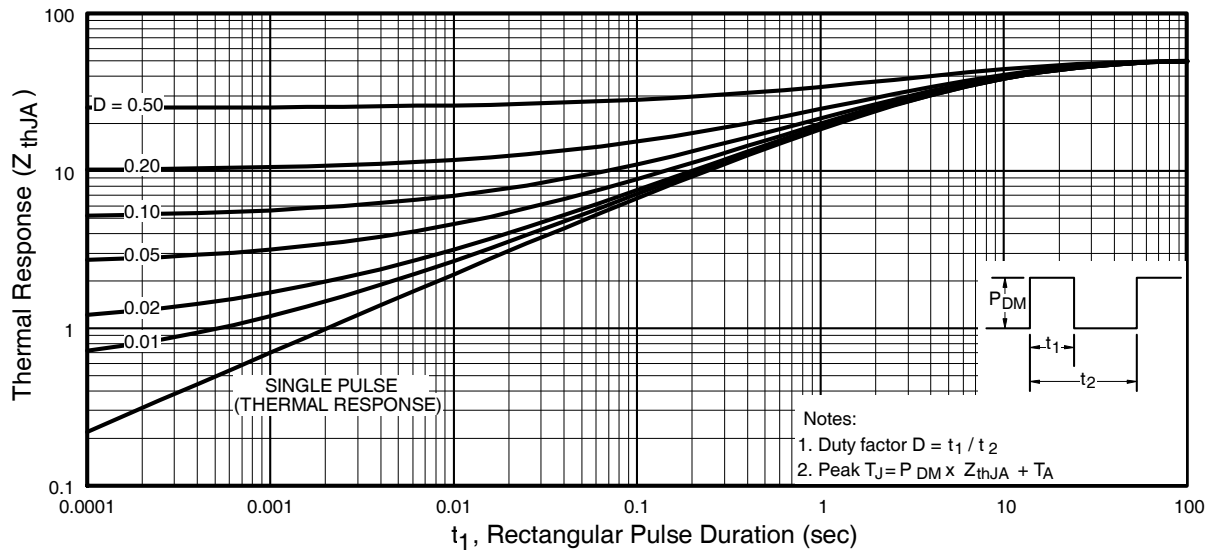


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

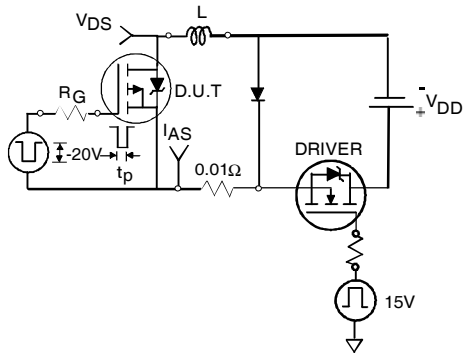


Fig 12a. Unclamped Inductive Test Circuit

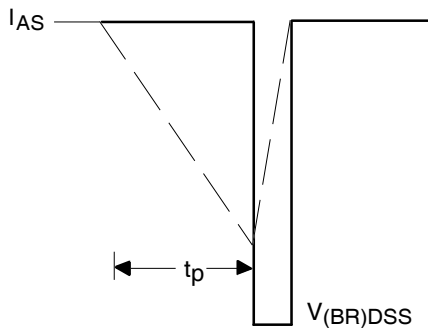


Fig 12b. Unclamped Inductive Waveforms

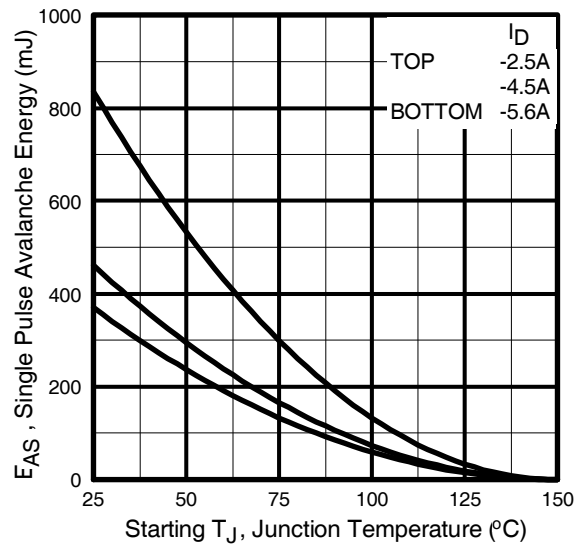
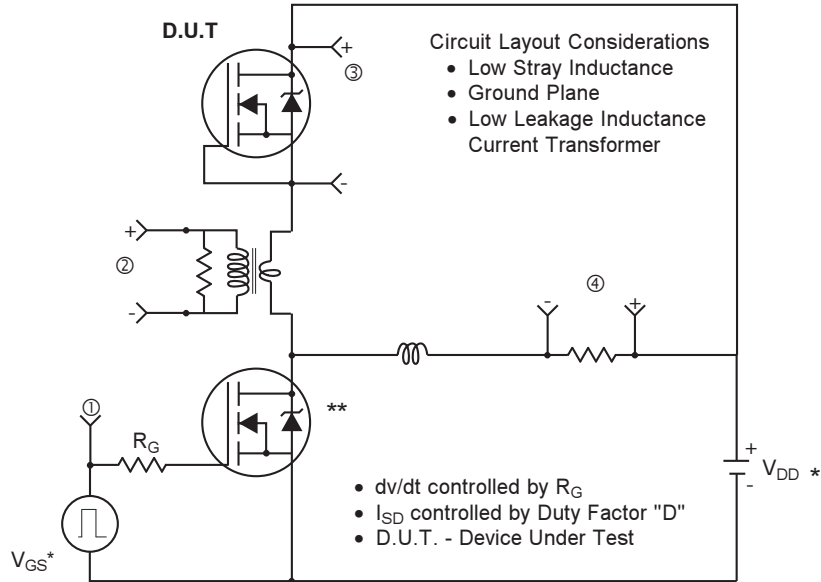
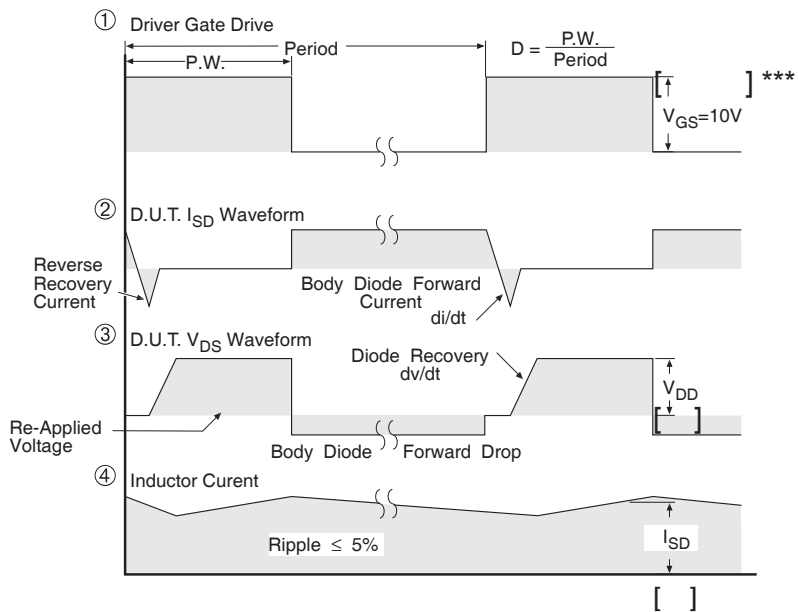


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

Peak Diode Recovery dv/dt Test Circuit



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

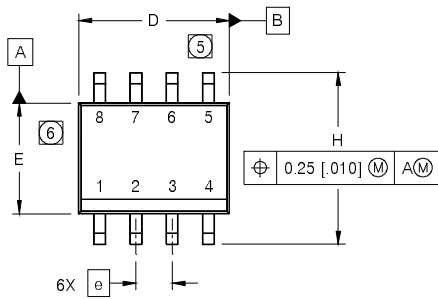


*** $V_{GS} = 5.0V$ for Logic Level and 3V Drive Devices

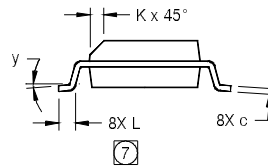
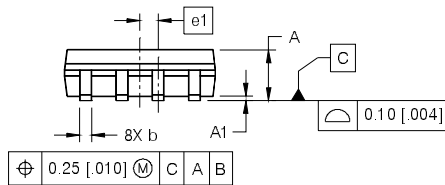
Fig 13. For P-Channel HEXFETS

SO-8 Package Outline

Dimensions are shown in millimeters (inches)



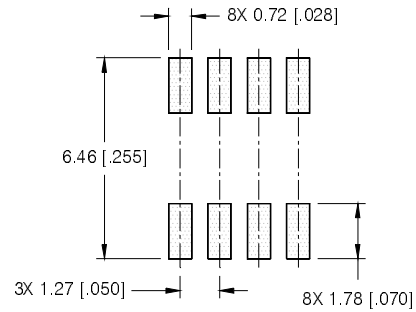
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
b	.013	.020	0.33	0.51
c	.0075	.0098	0.19	0.25
D	.189	.1968	4.80	5.00
E	.1497	.1574	3.80	4.00
e	.050 BASIC		1.27 BASIC	
e1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.0099	.0196	0.25	0.50
L	.016	.050	0.40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



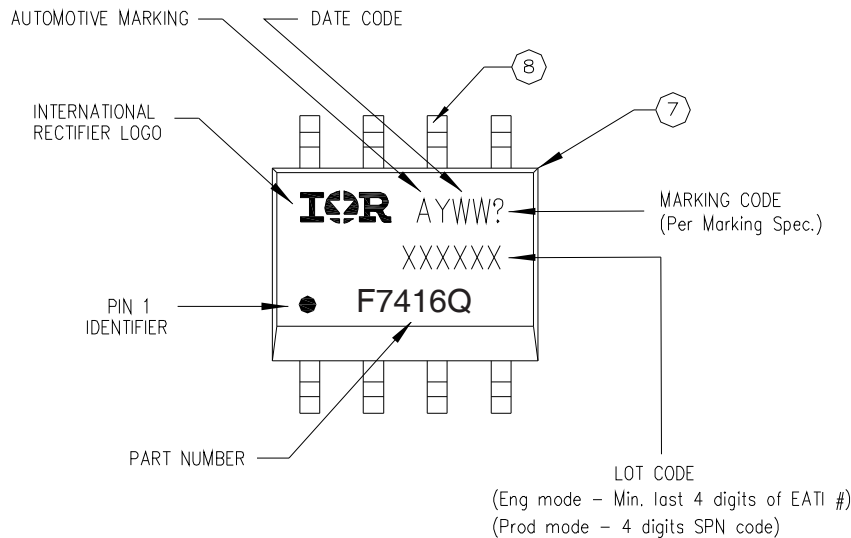
NOTES:

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 [0.006].
- ⑥ DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [0.010].
- ⑦ DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

FOOTPRINT



SO-8 Part Marking

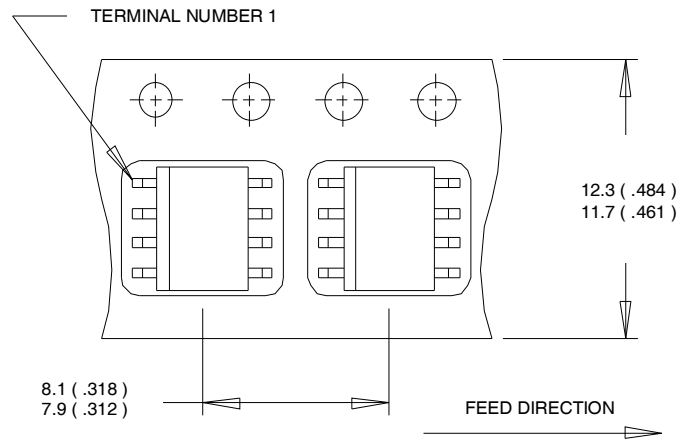


Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>
www.irf.com

AUIRF7416Q

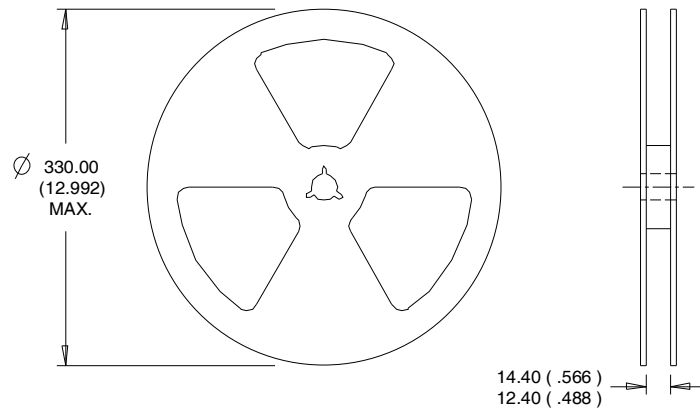
SO-8 Tape and Reel

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.

Ordering Information

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRF7416Q	SO-8	Tube	95	AUIRF7416Q
		Tape and Reel	2500	AUIRF7416QTR

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