International
IOR Rectifier

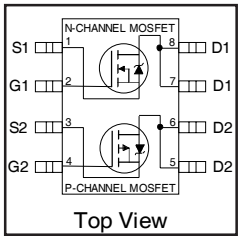
AUTOMOTIVE GRADE

AUIRF7309Q

HEXFET® Power MOSFET

Features

- Advanced Planar Technology
- Low On-Resistance
- Dual N and P Channel MOSFET
- Dynamic dV/dT Rating
- 150°C Operating Temperature
- Fast Switching
- Lead-Free, RoHS Compliant
- Automotive Qualified*



Top View

	N-CH	P-CH
$V_{(BR)DSS}$	30V	-30V
$R_{DS(on)}$ max.	0.05Ω	0.10Ω
I_D	4.7A	-3.5A

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.


SO-8
AUIRF7309Q

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
		N-Channel	P-Channel	
I_D @ T_A = 25°C	10 Sec. Pulsed Drain Current, V_{GS} @ 10V	4.7	-3.5	A
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 10V	4	-3.0	
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 10V	3.2	-2.4	
I_{DM}	Pulsed Drain Current ①	16	-12	
P_D @T_A = 25°C	Power Dissipation ④	1.4		W
	Linear Derating Factor ④	0.011		W/°C
V_{GS}	Gate-to-Source Voltage	± 20		V
dv/dt	Peak Diode Recovery dv/dt ②	6.9	-6.0	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150		°C

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, steady state) ④	——	90	°C/W

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

Static 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	—	0.032	—	V/°C	Reference to 25°C, I_D = 1mA
		P-Ch	—	-0.037	—		Reference to 25°C, I_D = -1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	N-Ch	—	—	0.050	Ω	V_{GS} = 10V, I_D = 2.4A ③
			—	—	0.080		V_{GS} = 4.5V, I_D = 2.0A ③
		P-Ch	—	—	0.10		V_{GS} = -10V, I_D = 1.8A ③
			—	—	0.16		V_{GS} = -4.5V, I_D = 1.5A ③
$V_{GS(th)}$	Gate Threshold Voltage	N-Ch	1.0	—	3.0	V	V_{DS} = V_{GS}, I_D = 250µA
		P-Ch	-1.0	—	-3.0		V_{DS} = V_{GS}, I_D = -250µA
gfs	Forward Transconductance	N-Ch	5.2	—	—	S	V_{DS} = 15V, I_D = 2.4A
		P-Ch	2.5	—	—		V_{DS} = -24V, I_D = -1.8A
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 = 125°C
		P-Ch	—	—	-25		V_{DS} = -24V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	N-P	—	—	-100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage	N-P	—	—	100		V_{GS} = -20V

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

	Parameter		Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge	N-Ch	—	—	25	nC	N-Channel
		P-Ch	—	—	25		I_D = 2.6A, V_{DS} = 16V, V_{GS} = 4.5V ③
Q_{gs}	Gate-to-Source Charge	N-Ch	—	—	2.9		
		P-Ch	—	—	2.9		P-Channel
Q_{gd}	Gate-to-Drain ("Miller") Charge	N-Ch	—	—	7.9		I_D =-2.2A, V_{DS} =-16V, V_{GS} =-4.5V
		N-Ch	—	—	9.0		
$t_{d(on)}$	Turn-On Delay Time	P-Ch	—	6.8	—	ns	N-Channel
		N-Ch	—	11	—		V_{DD}= 10V, I_D = 2.6A R_G = 6.0Ω
t_r	Rise Time	P-Ch	—	21	—		R_D = 3.8Ω
		N-Ch	—	17	—		
$t_{d(off)}$	Turn-Off Delay Time	N-Ch	—	22	—		P-Channel
		P-Ch	—	25	—		V_{DD}=-10V, I_D =-2.2A R_G = 6.0Ω
t_f	Fall Time	N-Ch	—	7.7	—		R_D = 4.5Ω
		P-Ch	—	18	—		
L_D	Internal Drain Inductance	N-P	—	4.0	—	nH	Between lead,
L_S	Internal Source Inductance	N-P	—	6.0	—		6mm (0.25in.) from package and center of die contact
C_{iss}	Input Capacitance	N-Ch	—	520	—	pF	N-Channel
		P-Ch	—	440	—		V_{GS} = 0V, V_{DS} = 15V, f = 1.0MHz ③
C_{oss}	Output Capacitance	N-Ch	—	180	—		
		P-Ch	—	200	—		P-Channel
C_{rss}	Reverse Transfer Capacitance	N-Ch	—	72	—		V_{GS} = 0V, V_{DS} = -15V, f = 1.0MHz
		P-Ch	—	93	—		

Diode Characteristics

	Parameter		Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	N-Ch	—	—	1.8	A	
		P-Ch	—	—	-1.8		
I_{SM}	Pulsed Source Current (Body Diode) ①	N-Ch	—	—	16		
		P-Ch	—	—	-12		
V_{SD}	Diode Forward Voltage	N-Ch	—	—	1.0	V	T_J = 25°C, I_S = 1.8A, V_{GS} = 0V ③
		P-Ch	—	—	-1.0		T_J = 25°C, I_S = -1.8A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	N-Ch	—	47	71	ns	N-Channel
		P-Ch	—	53	80		T_J = 25°C,I_F =2.6A, di/dt = 100A/µs
Q_{rr}	Reverse Recovery Charge	N-Ch	—	56	84	nC	P-Channel ③
		P-Ch	—	66	99		T_J = 25°C,I_F =-2.2A, di/dt = 100A/µs
t_{on}	Forward Turn-On Time	N-P	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 23)

② N-Channel I_{SD} ≤ 2.4A, di/dt ≤ 73A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 150°C.
P-Channel I_{SD} ≤ -1.8A, di/dt ≤ 90A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 150°C.

③ Pulse width ≤ 300µs; duty cycle ≤ 2%.

④ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

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	N-CH: Class M2 (+/- 150V)††† P-CH: Class M2 (+/- 150V)††† AEC-Q101-002	
	Human Body Model	N-CH: Class H1A (+/- 500V)††† P-CH: Class H0 (+/- 250V)††† AEC-Q101-001	
	Charged Device Model	N-CH: Class C5 (+/- 2000V)††† P-CH: Class C5 (+/- 2000V)††† 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.

N-Channel

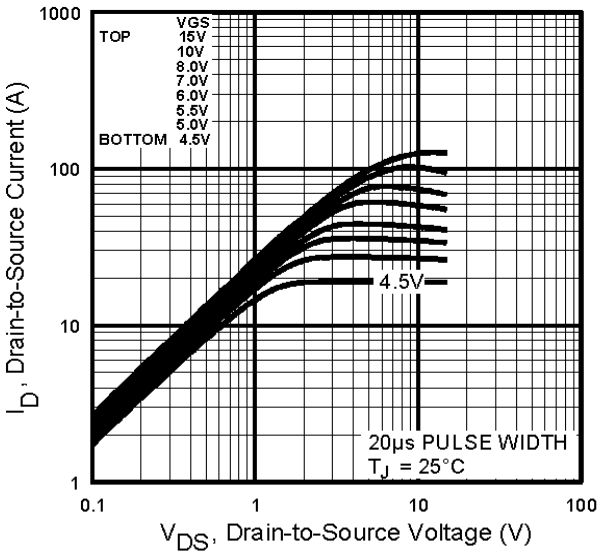


Fig 1. Typical Output Characteristics, T_J = 25ºC

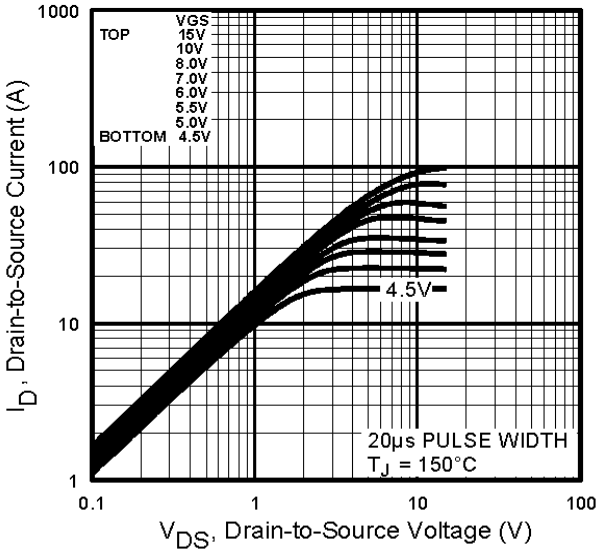


Fig 2. Typical Output Characteristics, T_J = 150ºC

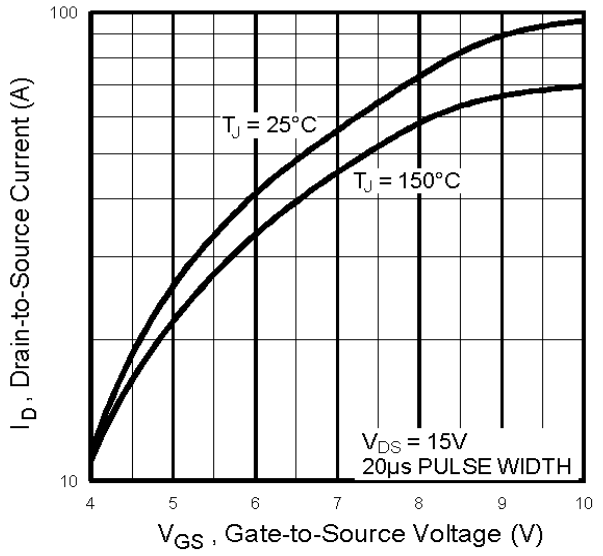


Fig 3. Typical Transfer Characteristics

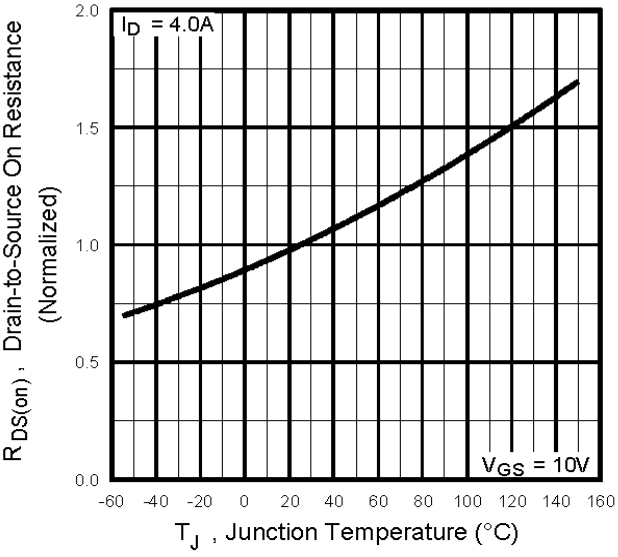


Fig 4. Normalized On-Resistance Vs. Temperature

N-Channel

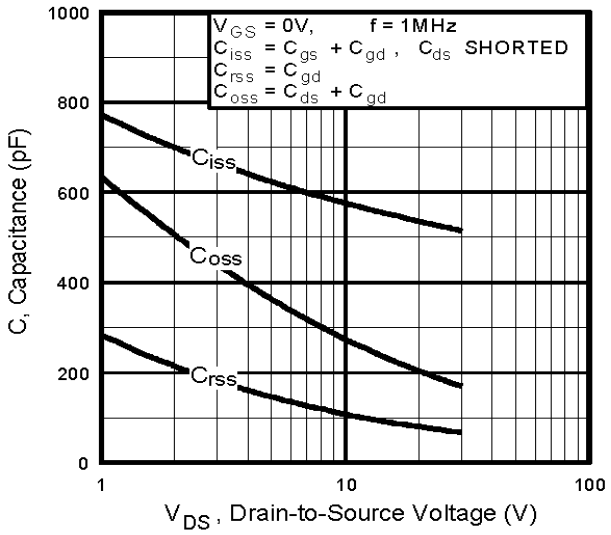


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

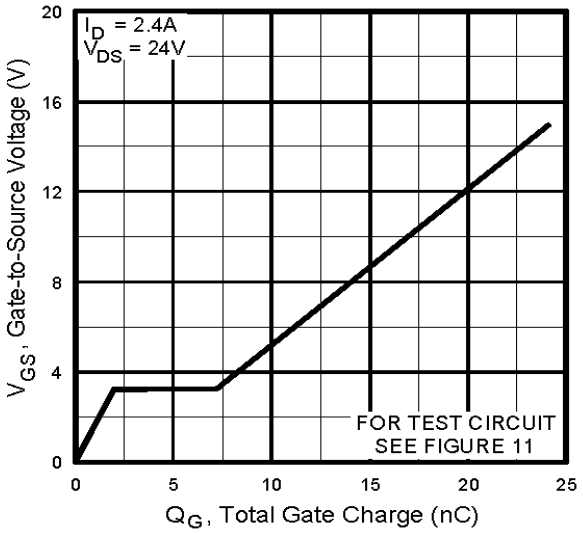


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

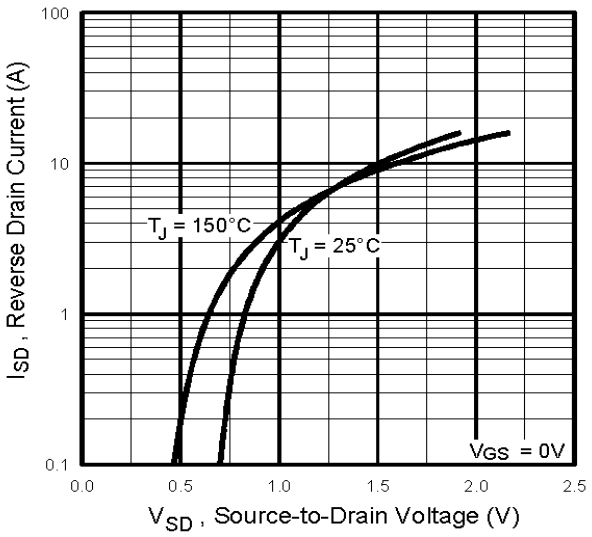


Fig 7. Typical Source-Drain Diode Forward Voltage

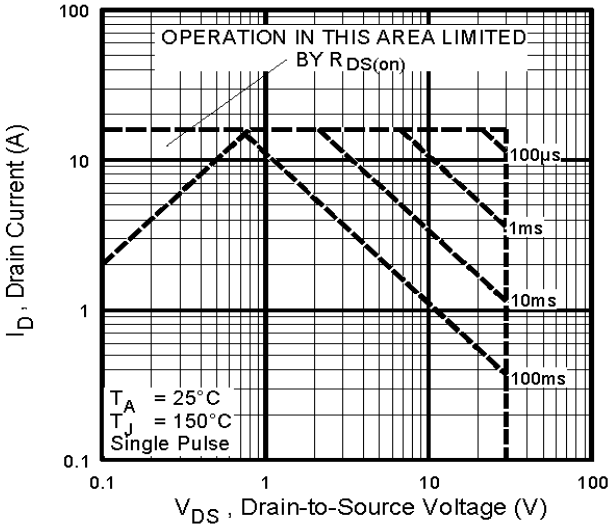


Fig 8. Maximum Safe Operating Area

N-Channel

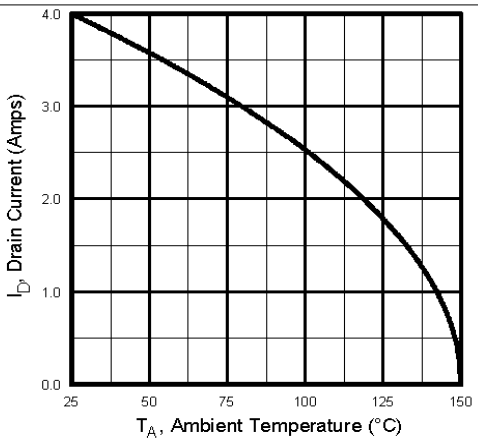


Fig 9. Max. Drain Current Vs. Ambient Temp.

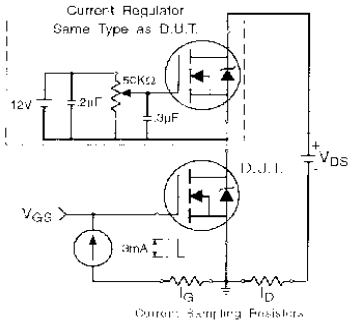


Fig 11a. Gate Charge Test Circuit

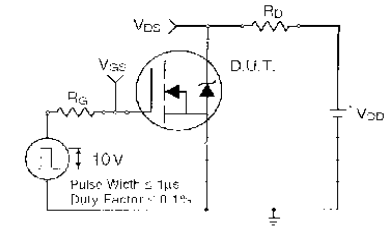


Fig 10a. Switching Time Test Circuit

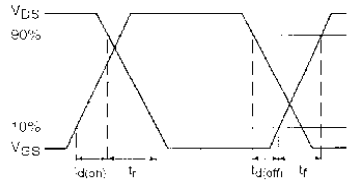


Fig 10b. Switching Time Waveforms

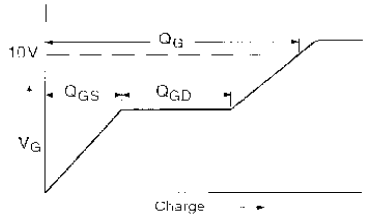


Fig 11b. Basic Gate Charge Waveform

P-Channel

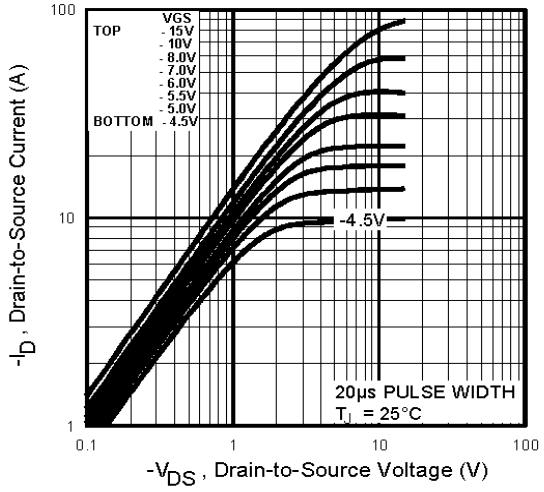


Fig 12. Typical Output Characteristics, T_J = 25ºC

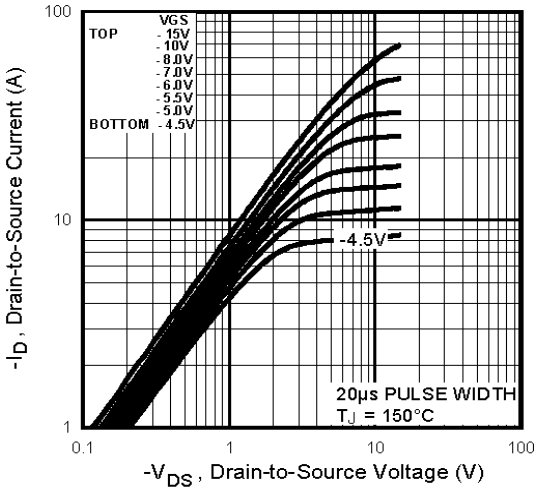


Fig 13. Typical Output Characteristics, T_J = 150ºC

P-Channel

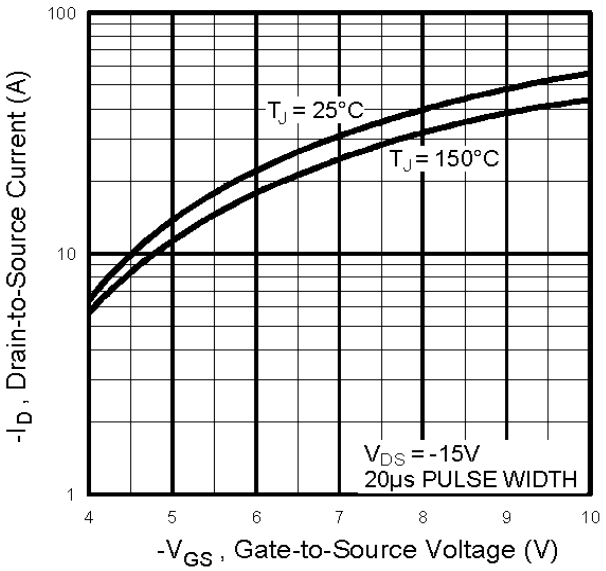


Fig 14. Typical Transfer Characteristics

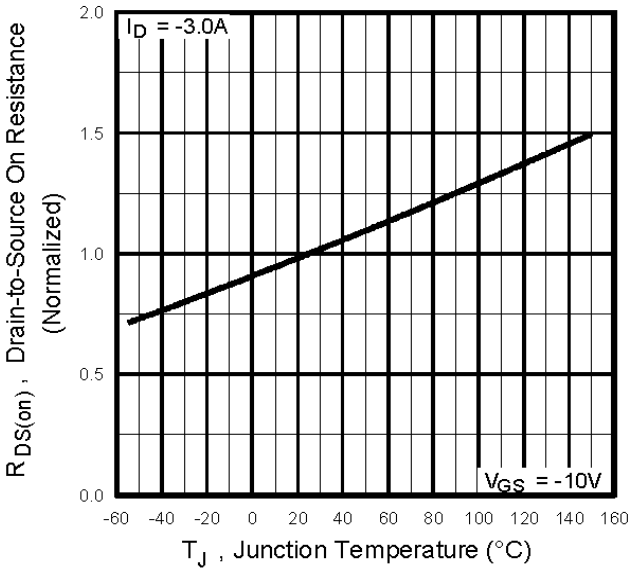


Fig 15. Normalized On-Resistance Vs. Temperature

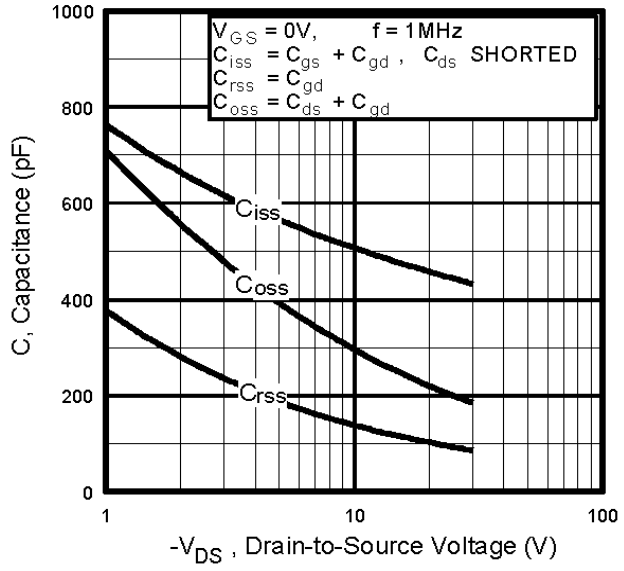


Fig 16. Typical Capacitance Vs. Drain-to-Source Voltage

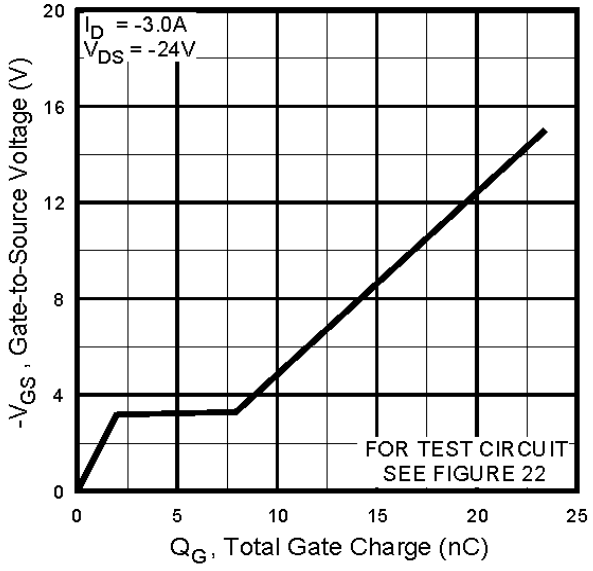


Fig 17. Typical Gate Charge Vs. Gate-to-Source Voltage

P-Channel

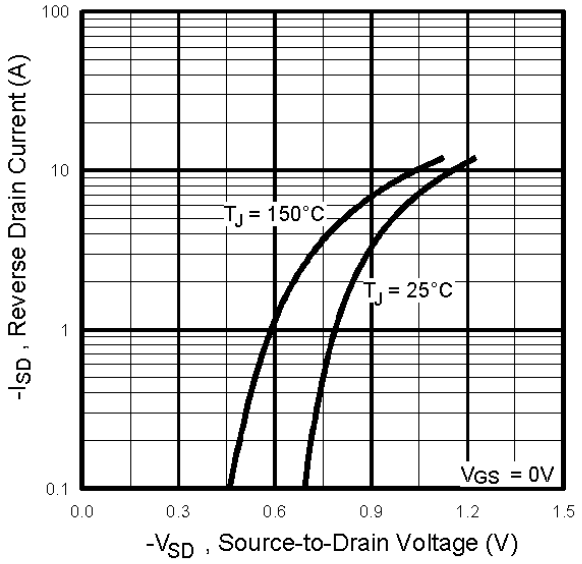


Fig 18. Typical Source-Drain Diode Forward Voltage

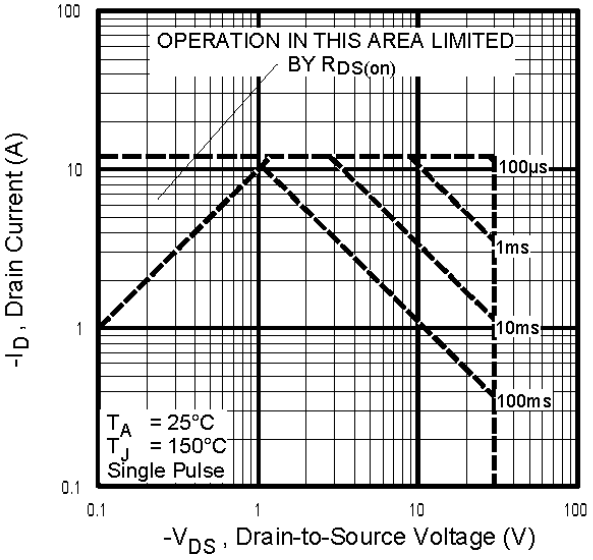


Fig 19. Maximum Safe Operating Area

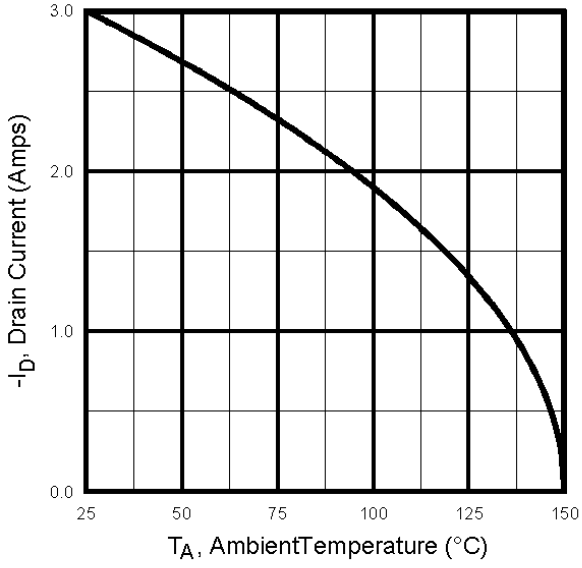


Fig 20. Max.Drain Current Vs. Ambient Temp.

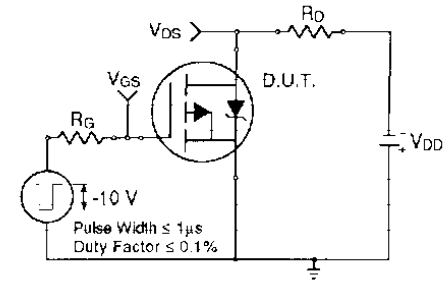


Fig 21a. Switching Time Test Circuit

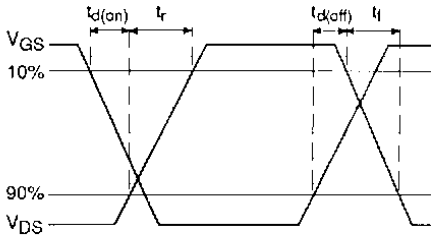


Fig 21b. Switching Time Waveforms

P-Channel

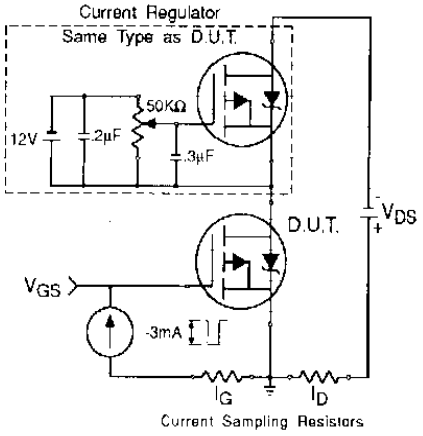


Fig 22b. Gate Charge Test Circuit

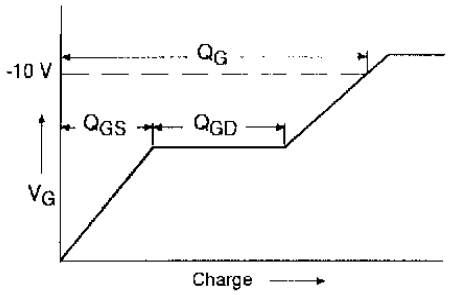


Fig 22b. Basic Gate Charge Waveform

N- and P-Channel

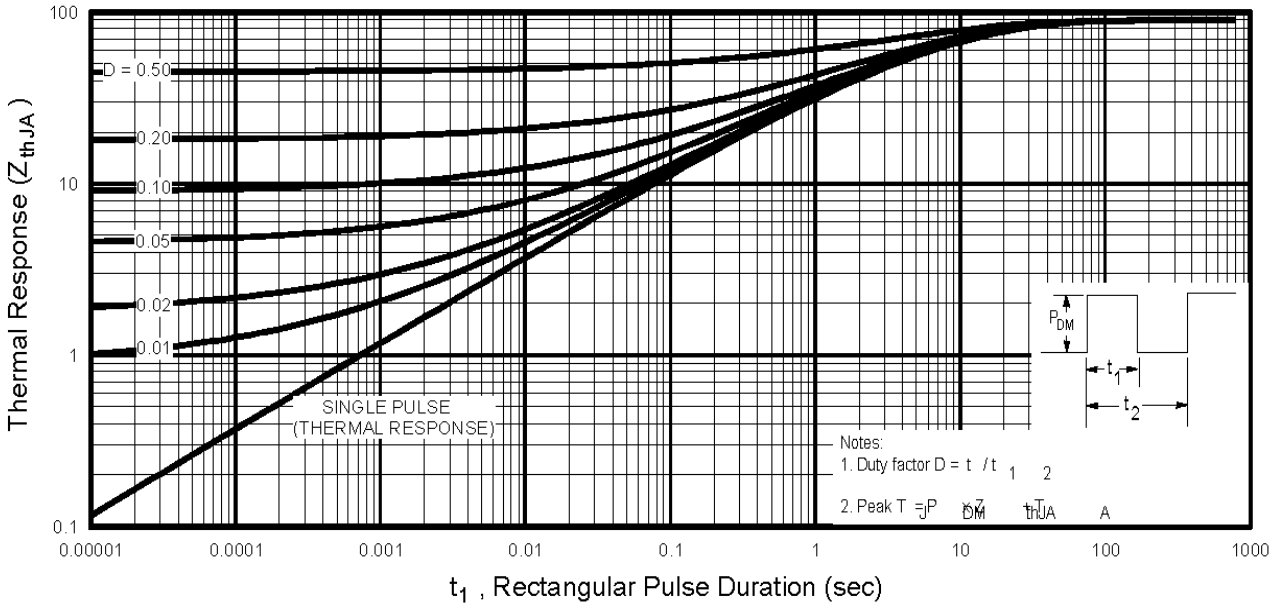
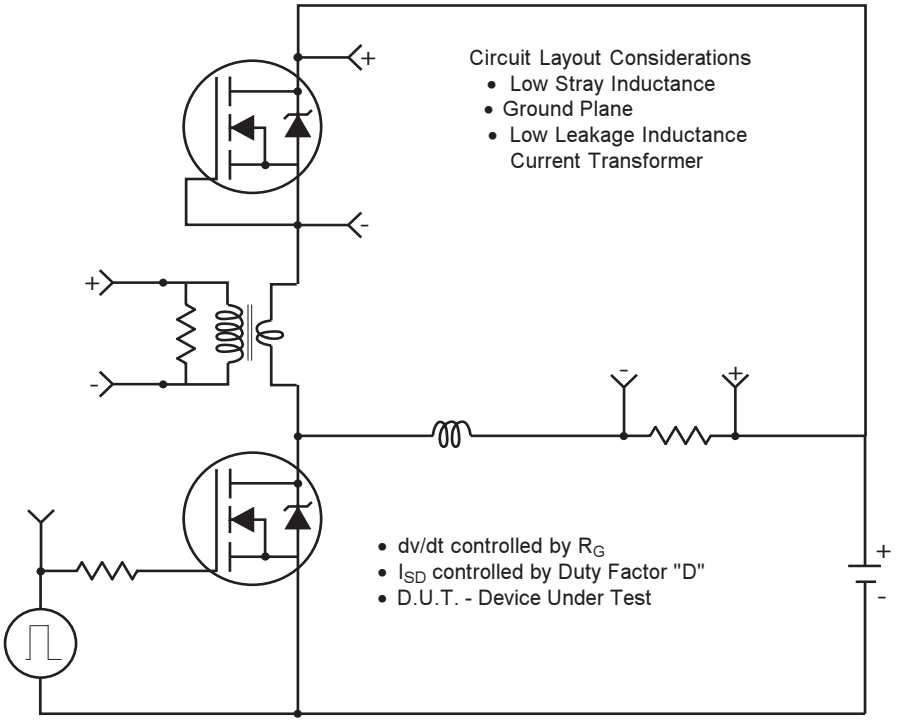
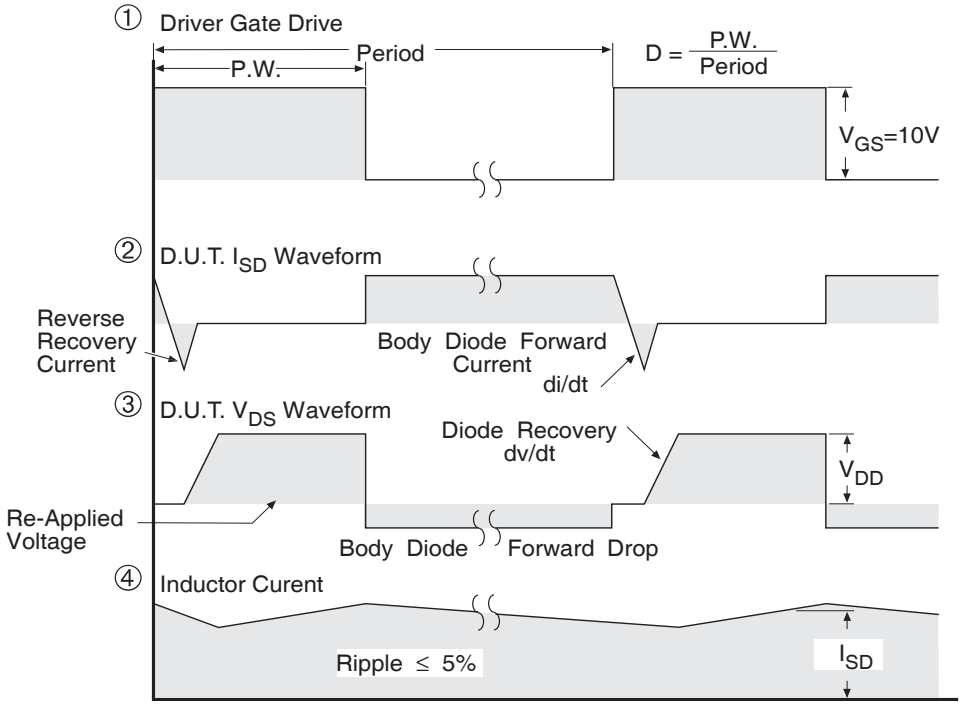


Fig 23. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

Peak Diode Recovery dv/dt Test Circuit



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

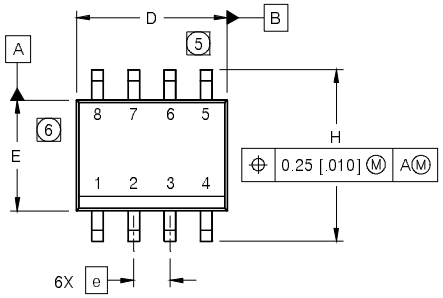


*** V_{GS} = 5.0V for Logic Level and 3V Drive Devices

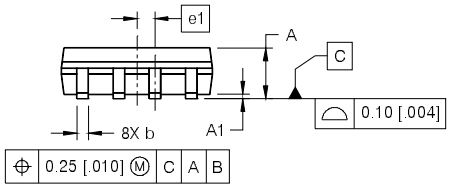
Fig 24. For N and P Channel HEXFETS

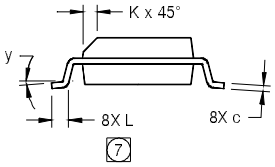
SO-8 Package Outline

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	
e 1	.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°





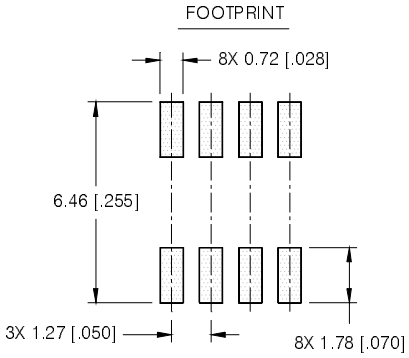
NOTES:

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.

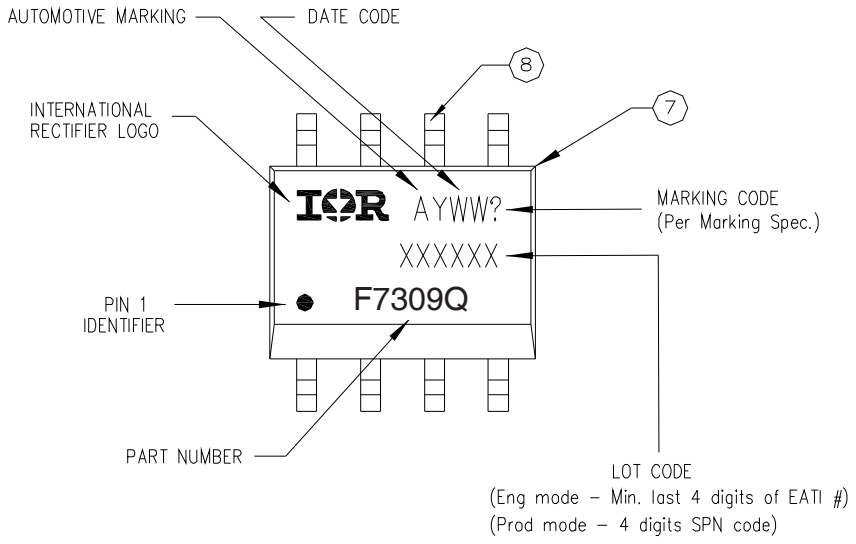
(5) DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 [.006].

(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.



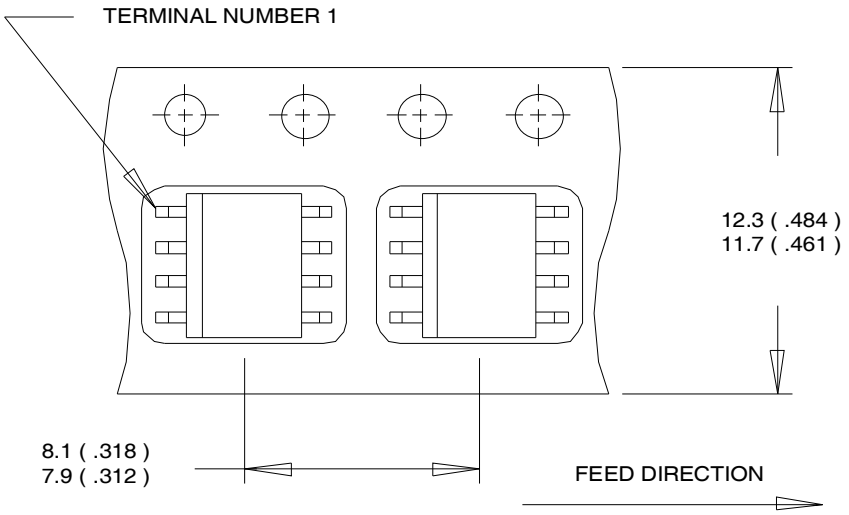
SO-8 Part Marking



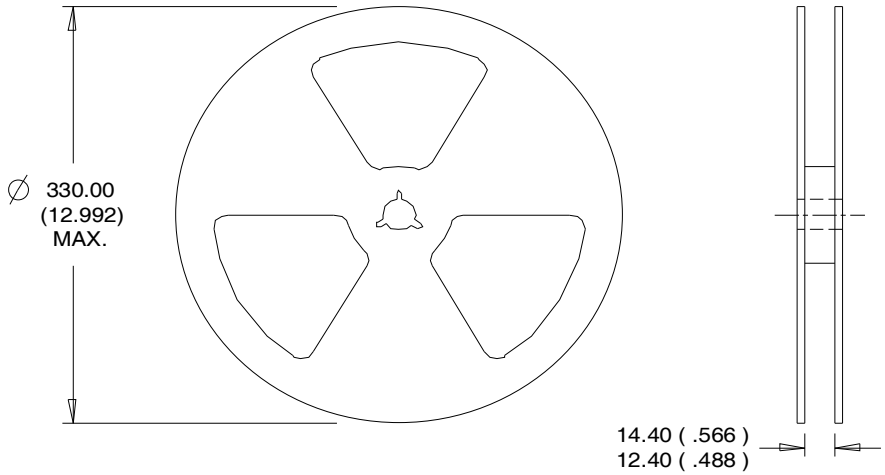
Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

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.

Ordering Information

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRF7309Q	SO-8	Tube	95	AUIRF7309Q
		Tape and Reel	4000	AUIRF7309QTR

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