International
IOR Rectifier

AUTOMOTIVE GRADE

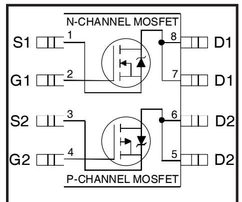
PD - 97647

AUIRF9952Q

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
- Full Avalanche Rated
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified*

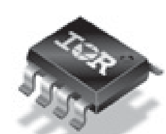


Top View

	N-CH	P-CH
$V_{(BR)DSS}$	30V	-30V
$R_{DS(on)}$ max.	0.10Ω	0.25Ω
I_D	3.5A	-2.3A

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
AUIRF9952Q

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	3.5	-2.3	A
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 10V	2.8	-1.8	
I_{DM}	Pulsed Drain Current ①	16	-10	
P_D @T_A = 25°C	Power Dissipation	2.0		W
P_D @T_A = 70°C	Power Dissipation	1.3		
	Linear Derating Factor	0.016		W/°C
V_{GS}	Gate-to-Source Voltage	± 20		V
E_{AS}	Single Pulse Avalanche Energy ③	44	57	mJ
I_{AR}	Avalanche Current ①	2.0	-1.3	A
E_{AR}	Repetitive Avalanche Energy ①	0.25		mJ
dv/dt	Peak Diode Recovery dv/dt ②	5.0	-5.0	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)⑤	–––	62.5	°C/W

*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	——	0.015	——	V/°C	Reference to 25°C, I_D = 1mA
		P-Ch	——	0.015	——		Reference to 25°C, I_D = -1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	N-Ch	——	0.08	0.10	Ω	V_{GS} = 10V, I_D = 2.2A ④
			——	0.12	0.15		V_{GS} = 4.5V, I_D = 1.0A ④
		P-Ch	——	0.165	0.250		V_{GS} = -10V, I_D = -1.0A ④
			——	0.290	0.400		V_{GS} = -4.5V, I_D = -0.5A ④
$V_{GS(th)}$	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	——	12	——	S	V_{DS} = 15V, I_D = 3.5A
		P-Ch	——	2.4	——		V_{DS} = -15V, I_D = -2.3A
I_{DSS}	Drain-to-Source Leakage Current	N-Ch	——	——	2.0	μA	V_{DS} = 24V, V_{GS} = 0V
		P-Ch	——	——	-2.0		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	——	6.9	14	nC	N-Channel
		P-Ch	——	6.1	12		I_D = 1.8A, V_{DS} = 10V, V_{GS} = 10V
Q_{gs}	Gate-to-Source Charge	N-Ch	——	1.0	2.0		④
		P-Ch	——	1.7	3.4		P-Channel
Q_{gd}	Gate-to-Drain ("Miller") Charge	N-Ch	——	1.8	3.5		I_D =-2.3A, V_{DS} =-10V, V_{GS} =-10V
		N-Ch	——	1.1	2.2		
$t_{d(on)}$	Turn-On Delay Time	P-Ch	——	6.2	12	ns	N-Channel
		N-Ch	——	9.7	19		V_{DD}= 10V, I_D = 1.0A R_G = 6.0Ω
t_r	Rise Time	P-Ch	——	8.8	18		R_D = 10Ω
		N-Ch	——	14	28		
$t_{d(off)}$	Turn-Off Delay Time	N-Ch	——	13	26		P-Channel
		P-Ch	——	20	40		V_{DD}=-10V, I_D =-1.0A R_G = 6.0Ω
t_f	Fall Time	N-Ch	——	3.0	6.0		R_D = 10Ω
		P-Ch	——	6.9	14		
C_{iss}	Input Capacitance	N-Ch	——	190	——	pF	N-Channel
		P-Ch	——	190	——		V_{GS} = 0V, V_{DS} = 15V, ƒ = 1.0MHz
C_{oss}	Output Capacitance	N-Ch	——	120	——		④
		P-Ch	——	110	——		P-Channel
C_{rss}	Reverse Transfer Capacitance	N-Ch	——	61	——		V_{GS} = 0V, V_{DS} = -15V, ƒ = 1.0MHz
		P-Ch	——	54	——		

Diode Characteristics

	Parameter		Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	N-Ch	——	——	1.7	A	
		P-Ch	——	——	-1.3		
I_{SM}	Pulsed Source Current (Body Diode) ①	N-Ch	——	——	16		
		P-Ch	——	——	16		
V_{SD}	Diode Forward Voltage	N-Ch	——	0.82	1.2	V	T_J = 25°C, I_S = 1.25A, V_{GS} = 0V ③
		P-Ch	——	-0.82	-1.2		T_J = 25°C, I_S = -1.25A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	N-Ch	——	27	53	ns	N-Channel
		P-Ch	——	27	54		T_J = 25°C,I_F =1.25A, di/dt = 100A/μs
Q_{rr}	Reverse Recovery Charge	N-Ch	——	28	57	nC	P-Channel ④
		P-Ch	——	31	62		T_J = 25°C,I_F =-1.25A, 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 $I_{SD} \leq 2.0A$, di/dt ≤ 100A/μs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150°C$.
P-Channel $I_{SD} \leq -1.3A$, di/dt ≤ 84A/μs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150°C$.

③ N-Channel Starting T_J = 25°C, L = 22mH R_G = 25Ω, I_{AS} = 2.0A. (See Figure 12)
P-Channel Starting T_J = 25°C, L = 67mH R_G = 25Ω, I_{AS} = -1.3A.

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

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

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 Q1(N) = M1A (+/- 50V)††† , Q2(P) = M1A (+/- 50V)††† AEC-Q101-002	
	Human Body Model	Class Q1(N) = H0 (+/- 150V)††† , Q2(P) = H0 (+/- 150V)††† AEC-Q101-001	
	Charged Device Model	Class Q1(N) = C4 (+/- 1000V)††† , Q2(P) = C4 (+/- 1000V)††† 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

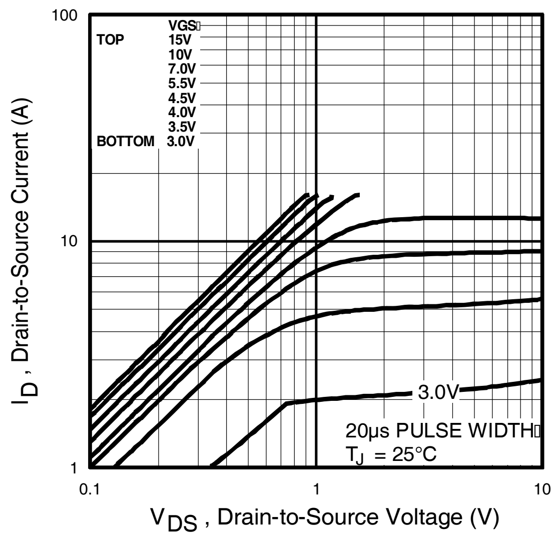


Fig 1. Typical Output Characteristics

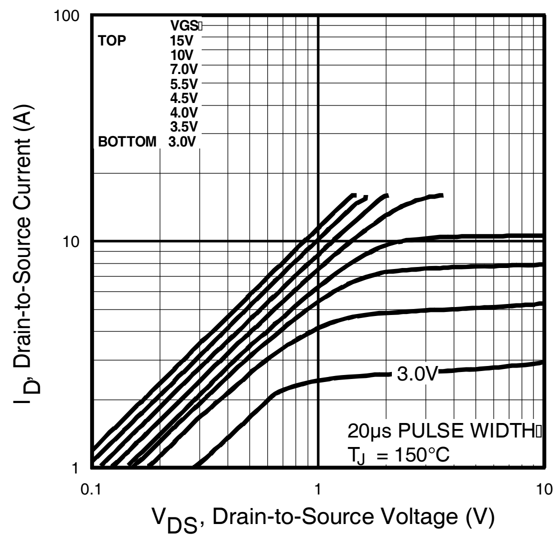


Fig 2. Typical Output Characteristics

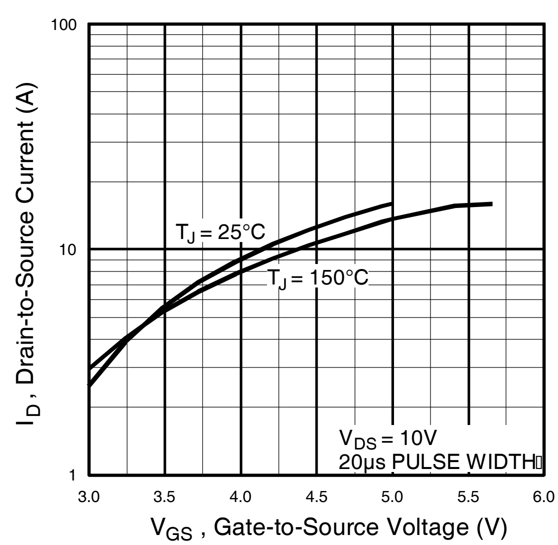


Fig 3. Typical Transfer Characteristics

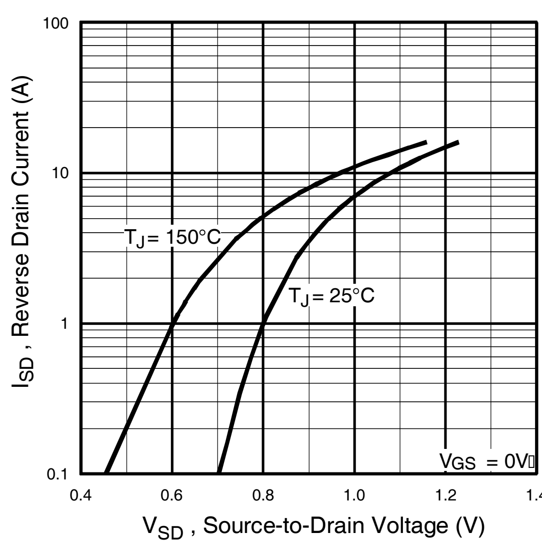


Fig 4. Typical Source-Drain Diode Forward Voltage

N-Channel

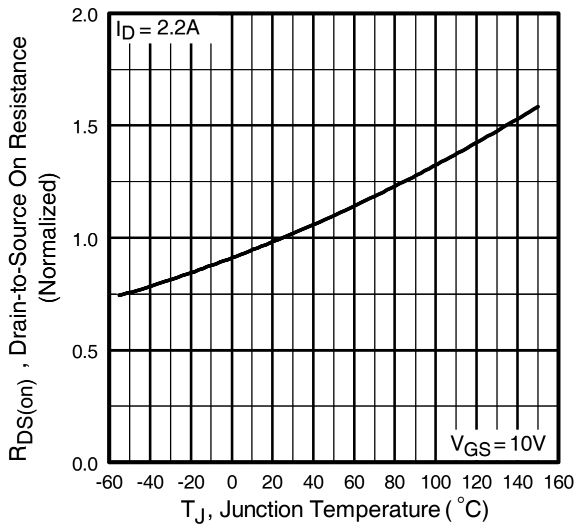


Fig 5. Normalized On-Resistance Vs. Temperature

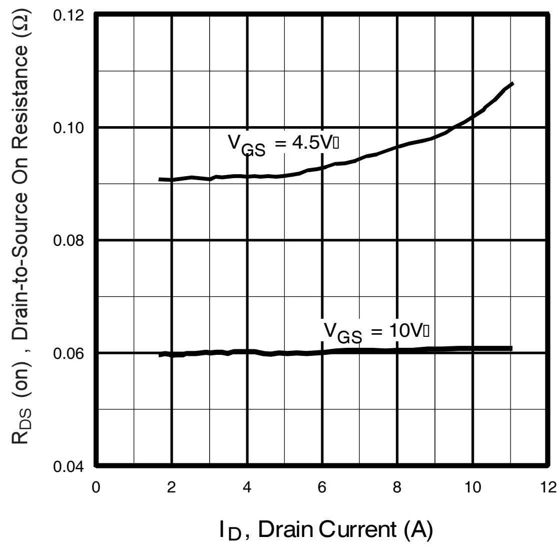


Fig 6. Typical On-Resistance Vs. Drain Current

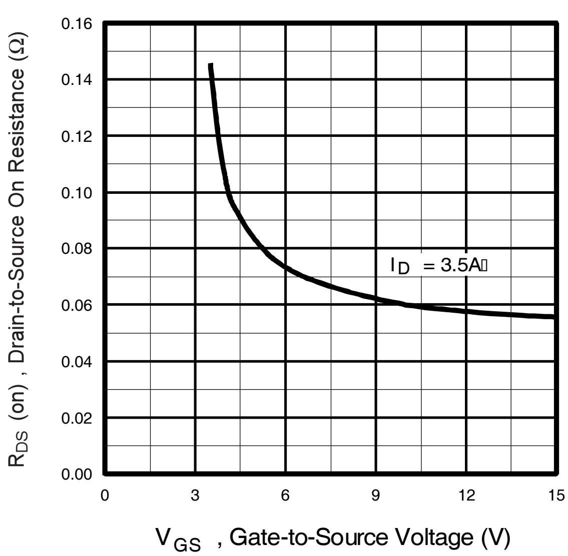


Fig 7. Typical On-Resistance Vs. Gate Voltage

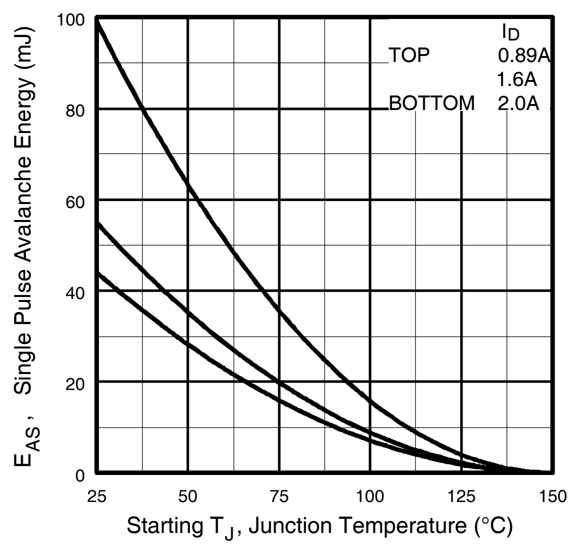


Fig 8. Maximum Avalanche Energy Vs. Drain Current

N-Channel

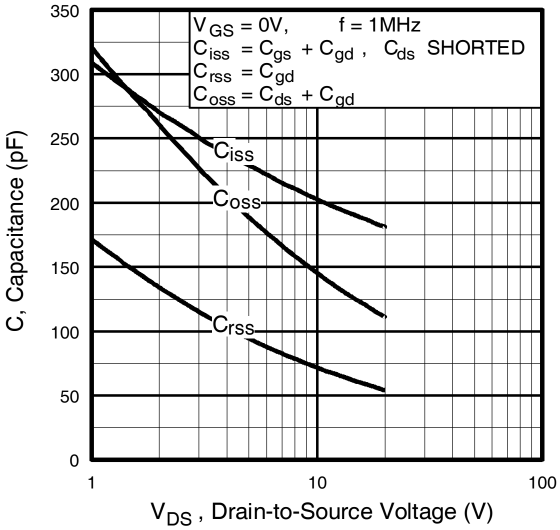


Fig 9. Typical Capacitance Vs. Drain-to-Source Voltage

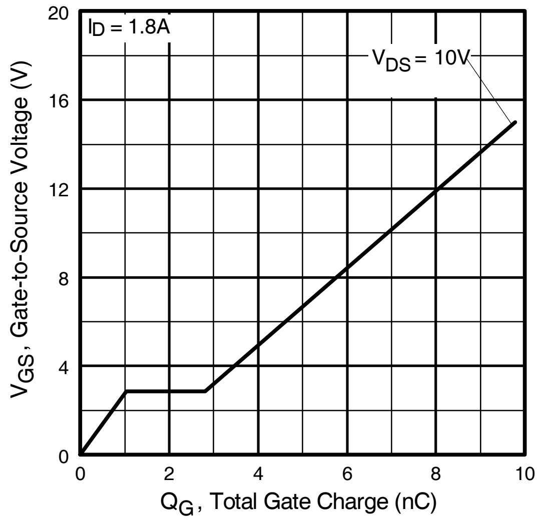


Fig 10. Typical Gate Charge Vs. Gate-to-Source Voltage

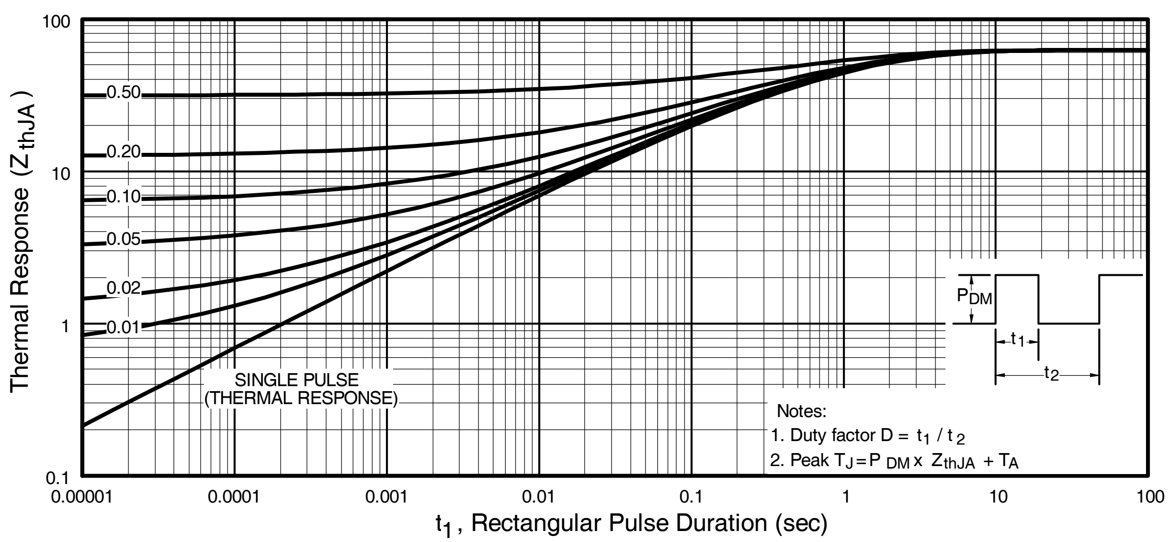


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

P-Channel

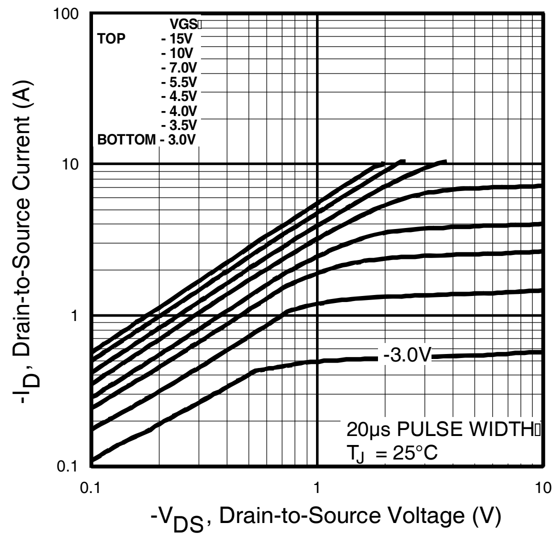


Fig 12. Typical Output Characteristics

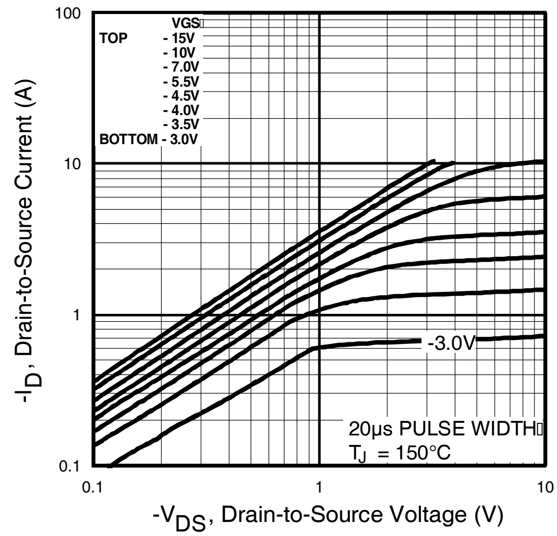


Fig 13. Typical Output Characteristics

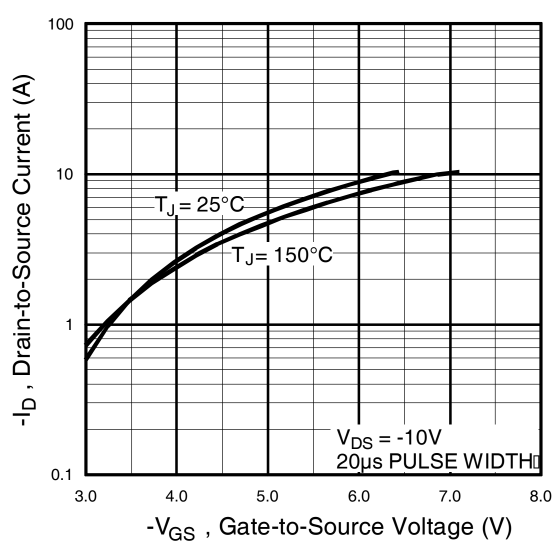


Fig 14. Typical Transfer Characteristics

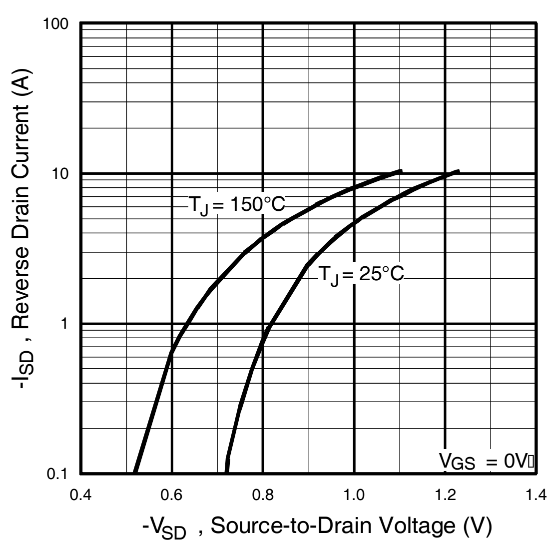


Fig 15. Typical Source-Drain Diode Forward Voltage

P-Channel

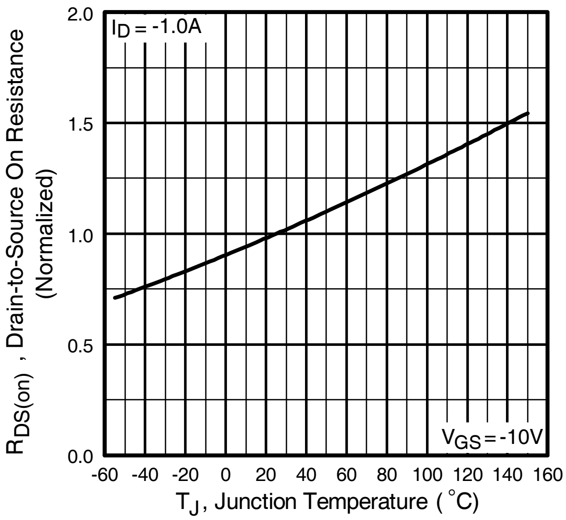


Fig 16. Normalized On-Resistance Vs. Temperature

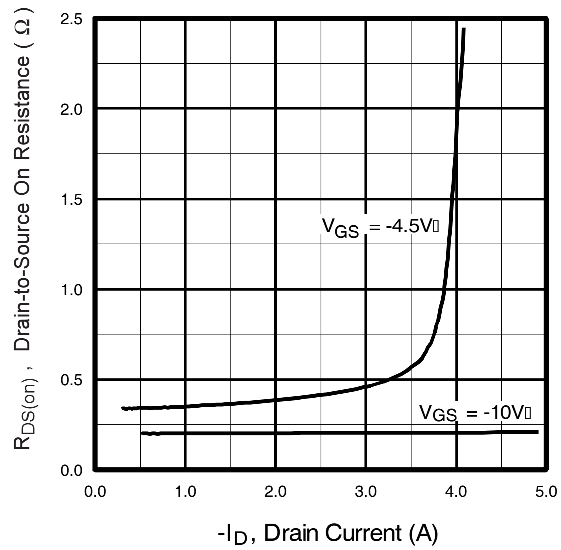


Fig 17. Typical On-Resistance Vs. Drain Current

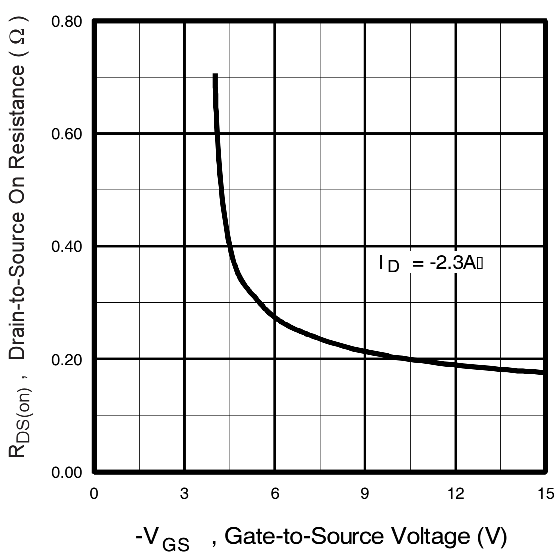


Fig 18. Typical On-Resistance Vs. Gate Voltage

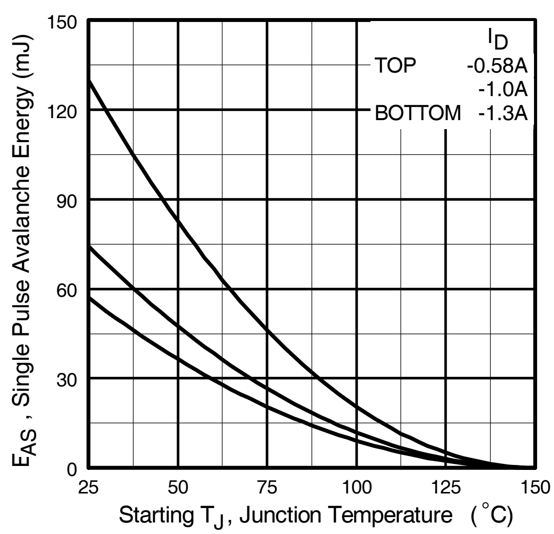


Fig 19. Maximum Avalanche Energy Vs. Drain Current

P-Channel

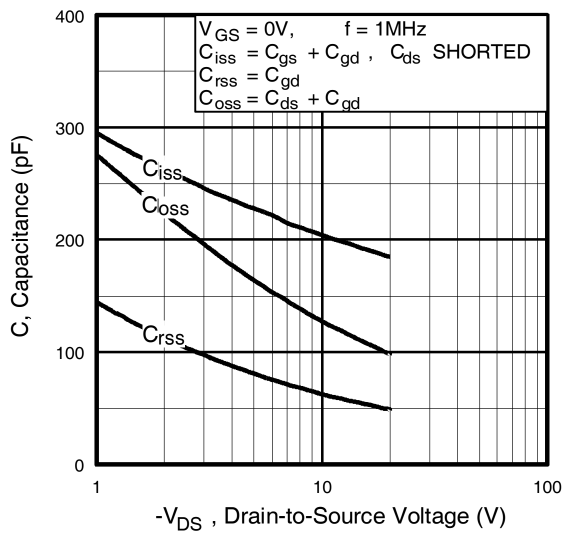


Fig 20. Typical Capacitance Vs. Drain-to-Source Voltage

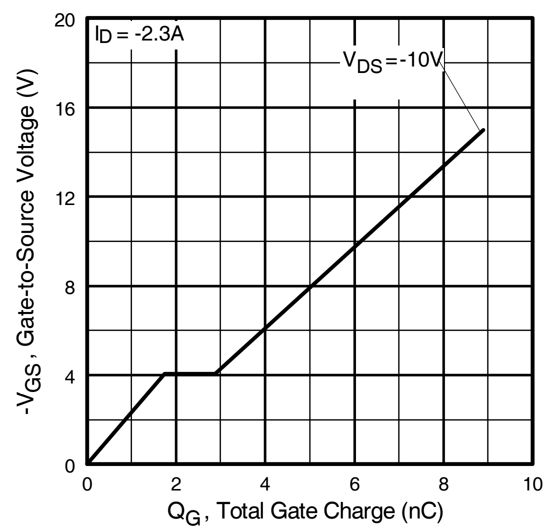


Fig 21. Typical Gate Charge Vs. Gate-to-Source Voltage

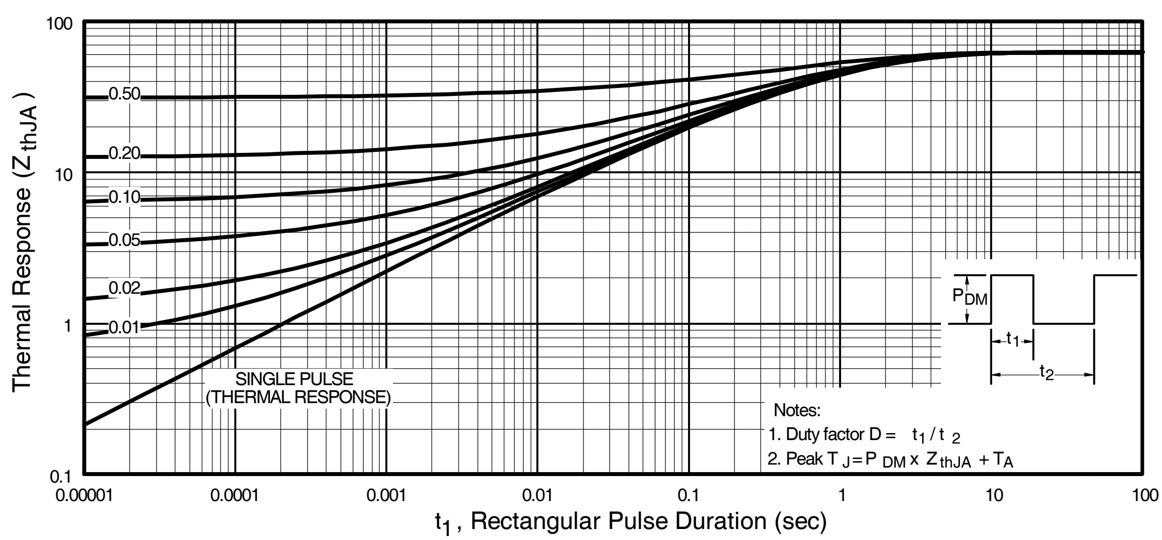
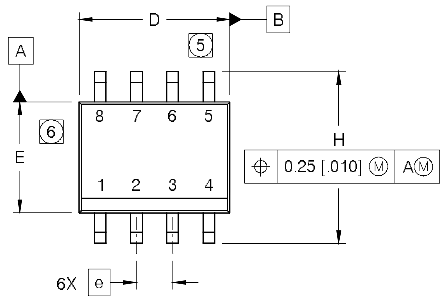


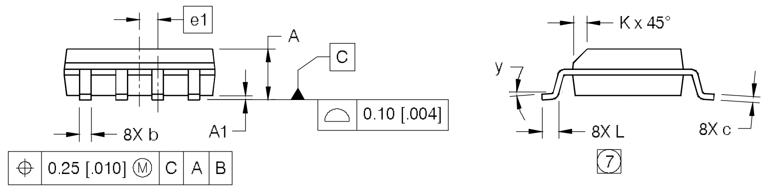
Fig 22. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

SO-8 Package Outline

Dimensions are shown in millimeters (inches)

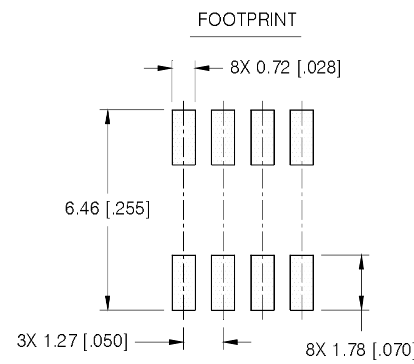


DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
b	.013	.020	0.33	0.51
c	.0075	.0098	0.19	0.25
D	.189	.1968	4.80	5.00
E	.1497	.1574	3.80	4.00
e	.050 BASIC		1.27 BASIC	
e 1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.0099	.0196	0.25	0.50
L	.016	.050	0.40	1.27
y	0°	8°	0°	8°

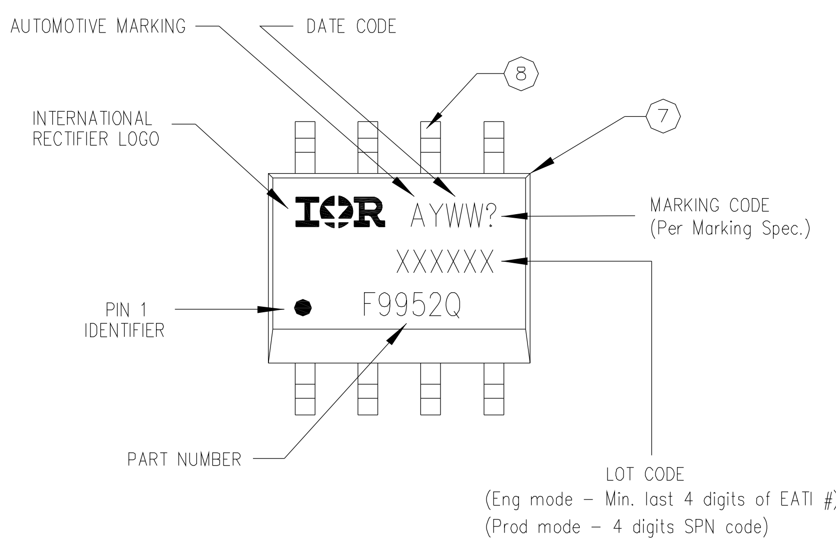


NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
5. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 [.006].
6. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [.010].
7. DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

FOOTPRINT



SO-8 Part Marking



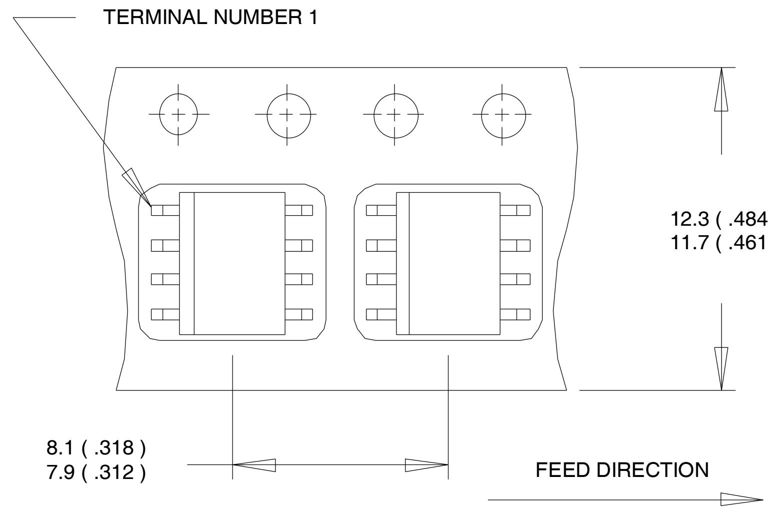
Notes:

1. For an Automotive Qualified version of this part please see http://www.irf.com/product-info/auto/

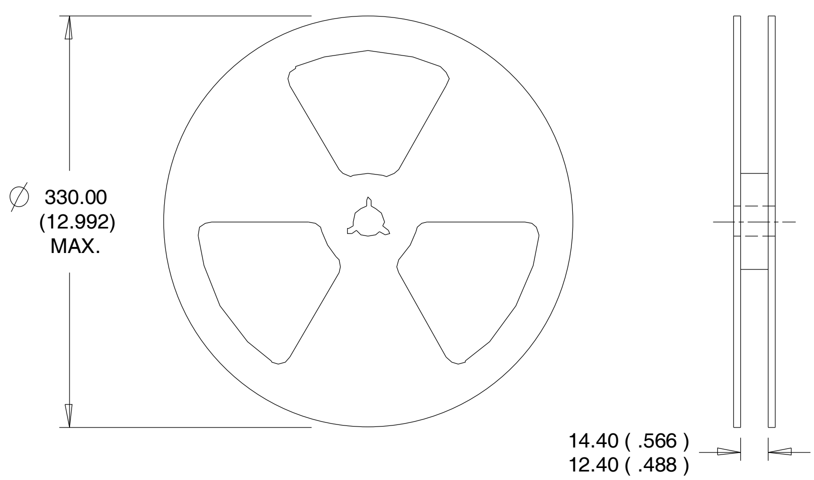
2. For the most current drawing please refer to IR website at http://www.irf.com/package/

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	
AUIRF9952Q	SO-8	Tube	95	AUIRF9952Q
		Tape and Reel	4000	AUIRF9952QTR

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For technical support, please contact IR's Technical Assistance Center
http://www.irf.com/technical-info/

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Tel: (310) 252-7105