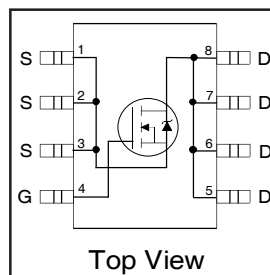


# AUIRF7478Q

## HEXFET® Power MOSFET

### Features

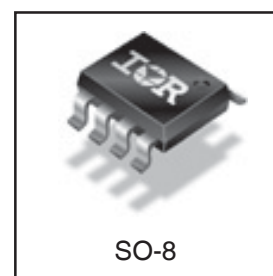
- Advanced Planar Technology
- Low On-Resistance
- Dynamic dV/dT Rating
- 150°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified \*



$V_{(BR)DSS}$		<b>60V</b>
$R_{DS(on)}$	typ.	<b>20mΩ</b>
	max.	<b>26mΩ</b>
$I_D$		<b>7.0A</b>

### 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.



<b>G</b>	<b>D</b>	<b>S</b>
Gate	Drain	Source

### 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
$V_{DS}$	Drain-Source Voltage	60	V
$I_D @ T_A = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	7.0	A
$I_D @ T_A = 70^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	5.6	
$I_{DM}$	Pulsed Drain Current ①	56	
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation ④	2.5	W
	Linear Derating Factor	0.02	W/°C
$V_{GS}$	Gate-to-Source Voltage	± 20	V
$E_{AS}$	Single Pulse Avalanche Energy ②	140	mJ
$I_{AR}$	Avalanche Current ①	4.2	A
dv/dt	Peak Diode Recovery dv/dt ③	3.7	V/ns
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

### Thermal Resistance

	Parameter	Max.	Units
$R_{\theta JL}$	Junction-to-Drain Lead	20	°C/W
$R_{\theta JA}$	Junction-to-Ambient ④	50	

HEXFET® is a registered trademark of International Rectifier.

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

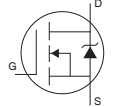
### Static Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	60	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.065	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	20	26	mΩ	$V_{GS} = 10V, I_D = 4.2A$ ③
		—	23	30		$V_{GS} = 4.5V, I_D = 3.5A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	3.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	17	—	—	S	$V_{DS} = 50V, I_D = 4.2A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 48V, V_{GS} = 0V$
		—	—	100		$V_{DS} = 48V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	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	—	21	31	nC	$I_D = 4.2A$
$Q_{gs}$	Gate-to-Source Charge	—	4.3	—		$V_{DS} = 48V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	9.6	—		$V_{GS} = 4.5V$
$t_{d(on)}$	Turn-On Delay Time	—	7.7	—	ns	$V_{DD} = 30V$
$t_r$	Rise Time	—	2.6	—		$I_D = 4.2A$
$t_{d(off)}$	Turn-Off Delay Time	—	44	—		$R_G = 6.2\Omega$
$t_f$	Fall Time	—	13	—		$V_{GS} = 10V$ ③
$C_{iss}$	Input Capacitance	—	1740	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	300	—		$V_{DS} = 25V$
$C_{riss}$	Reverse Transfer Capacitance	—	37	—		$f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	1590	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	220	—		$V_{GS} = 0V, V_{DS} = 48V, f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	410	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 48V$ ⑤

### Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	2.3	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	56		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 4.2A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	52	78	ns	$T_J = 25^\circ\text{C}, I_F = 4.2A$
$Q_{rr}$	Reverse Recovery Charge	—	100	150	nC	$di/dt = 100A/\mu s$ ③

#### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}, L = 16\text{mH}$   
 $R_G = 25\Omega, I_{AS} = 4.2A$ .
- ③ Pulse width  $\leq 400\mu s$ ; duty cycle  $\leq 2\%$ .
- ④ When mounted on 1 inch square copper board
- ⑤  $C_{oss}$  eff. is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$
- ⑥  $I_{SD} \leq 4.2A, di/dt \leq 160A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 150^\circ\text{C}$

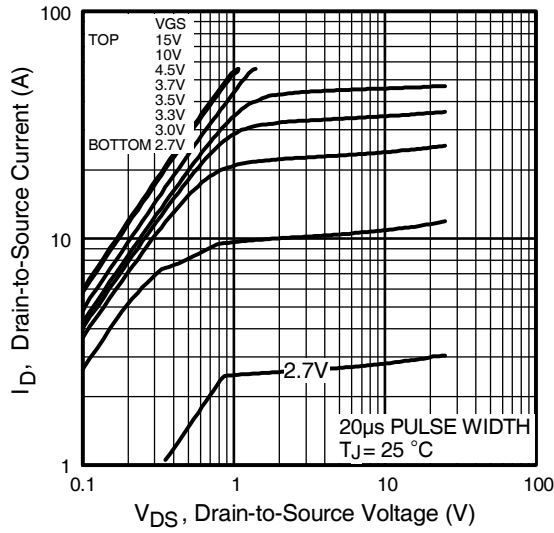
**Qualification Information<sup>†</sup>**

<b>Qualification Level</b>		Automotive (per AEC-Q101) <sup>††</sup>	
		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
<b>Moisture Sensitivity Level</b>		SO-8	MSL1
<b>ESD</b>	Machine Model	Class M3(+/- 300V) <sup>†††</sup> (per AEC-Q101-002)	
	Human Body Model	Class H1C(+/- 2000V) <sup>†††</sup> (per AEC-Q101-001)	
	Charged Device Model	Class C5(+/- 2000V) <sup>†††</sup> (per AEC-Q101-005)	
<b>RoHS Compliant</b>		Yes	

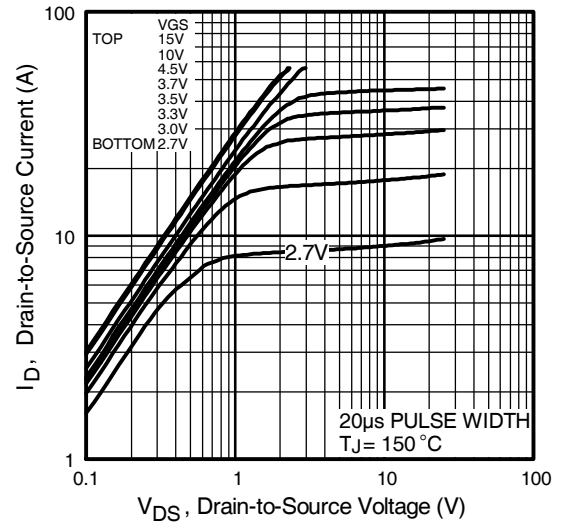
† Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/>

†† Exceptions (if any) to AEC-Q101 requirements are noted in the qualification report.

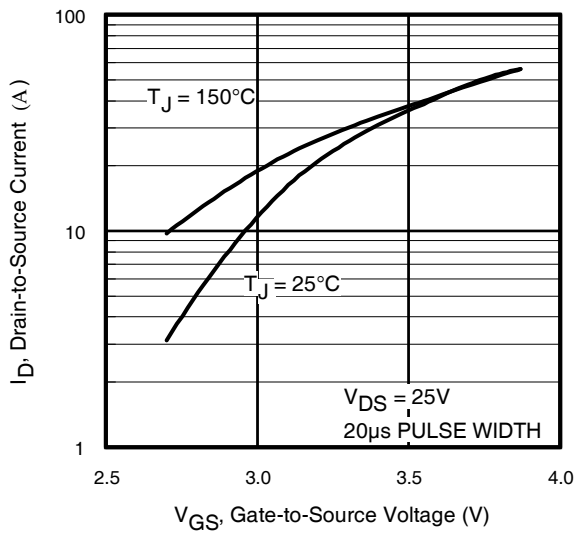
††† Highest passing voltage



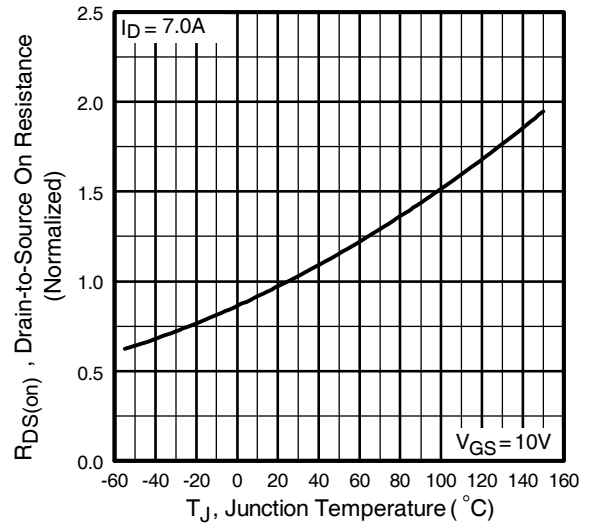
**Fig 1.** Typical Output Characteristics



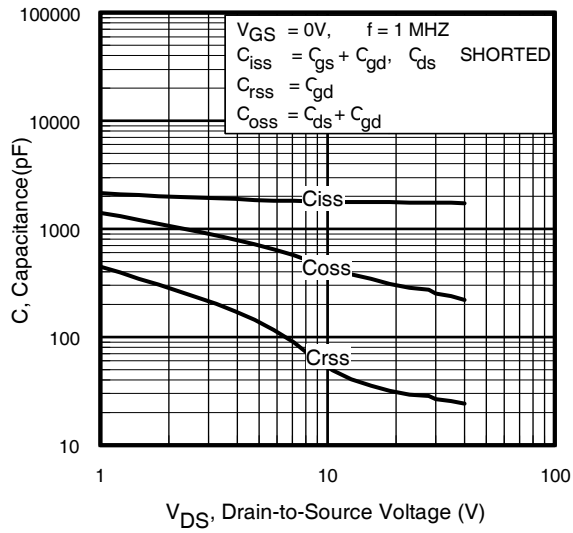
**Fig 2.** Typical Output Characteristics



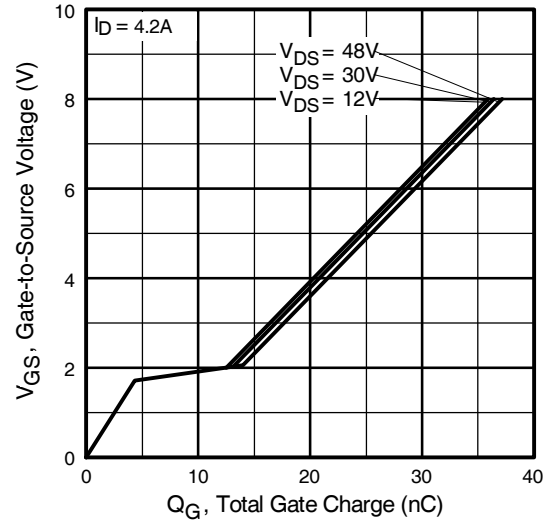
**Fig 3.** Typical Transfer Characteristics



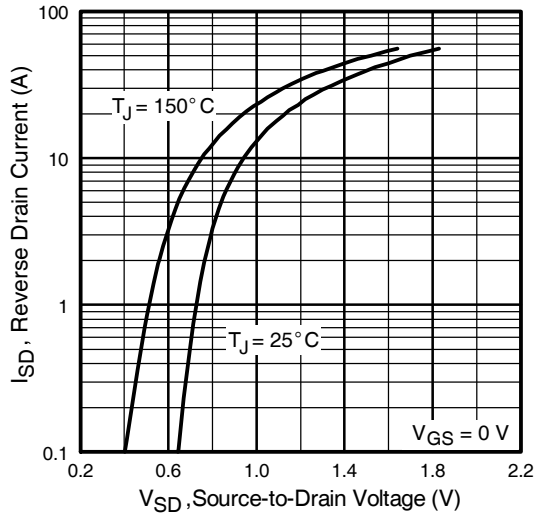
**Fig 4.** Normalized On-Resistance Vs. Temperature



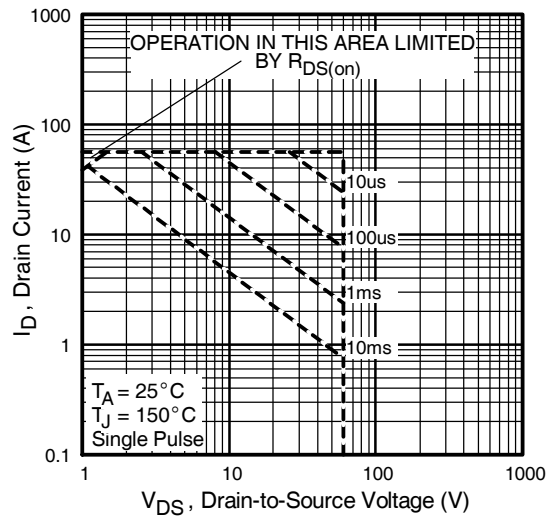
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



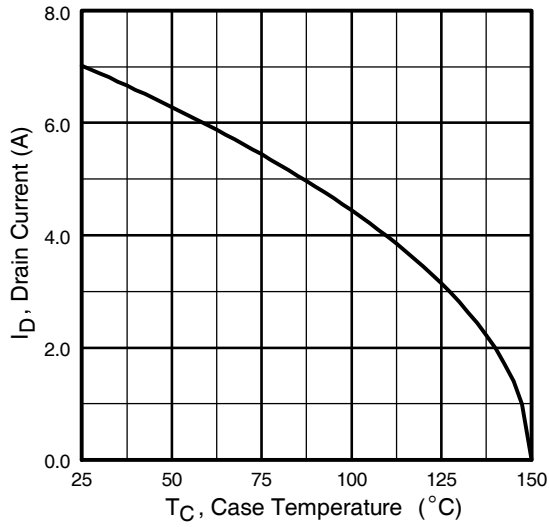
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



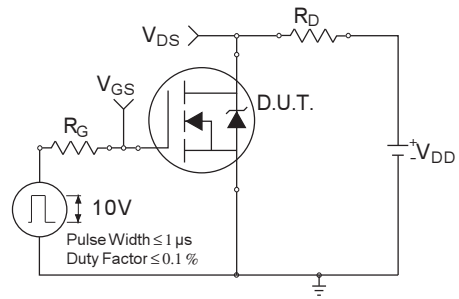
**Fig 7.** Typical Source-Drain Diode Forward Voltage



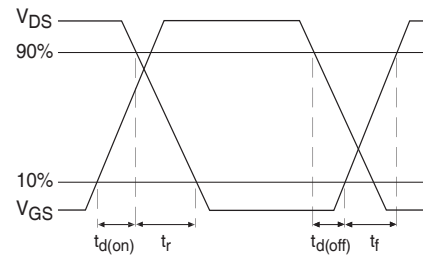
**Fig 8.** Maximum Safe Operating Area



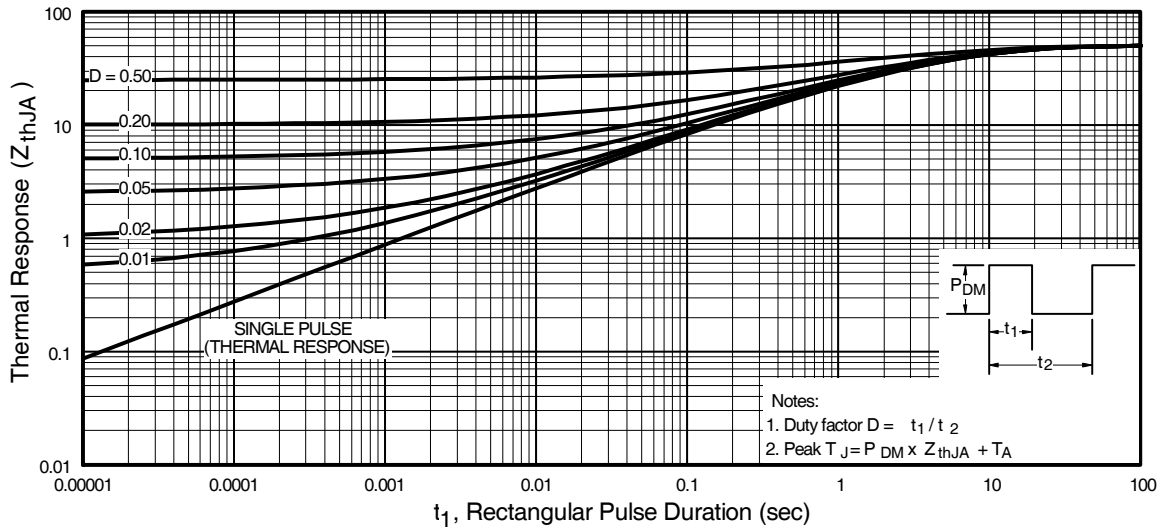
**Fig 9.** Maximum Drain Current Vs. Ambient Temperature



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



**Fig 10b.** Switching Time Waveforms



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

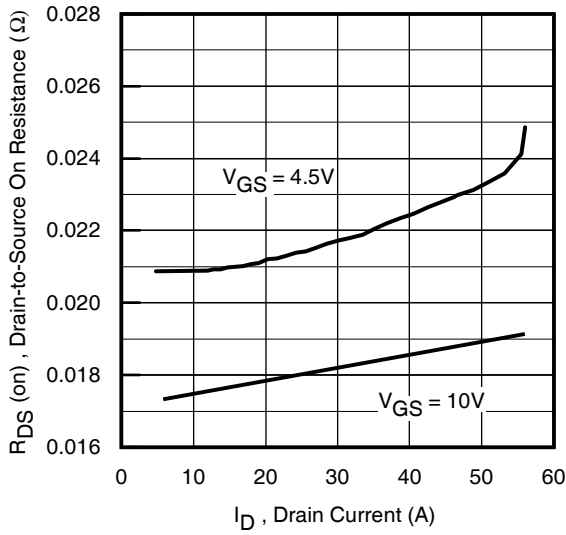


Fig 12. On-Resistance Vs. Drain Current

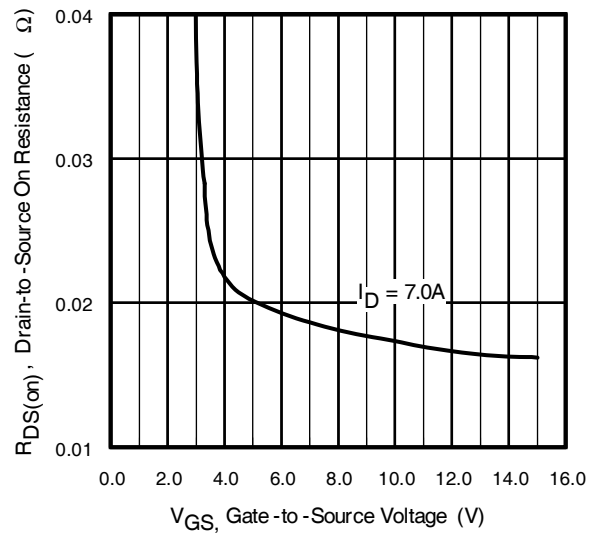


Fig 13. On-Resistance Vs. Gate Voltage

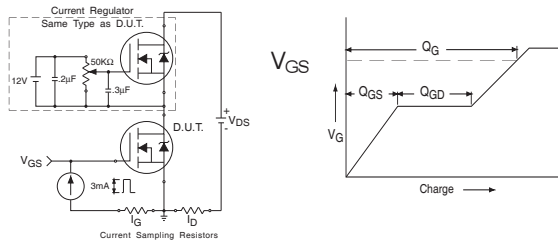


Fig 14a&b. Basic Gate Charge Test Circuit and Waveform

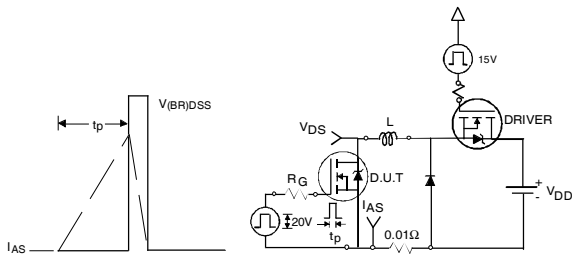


Fig 15a&b. Unclamped Inductive Test circuit and Waveforms

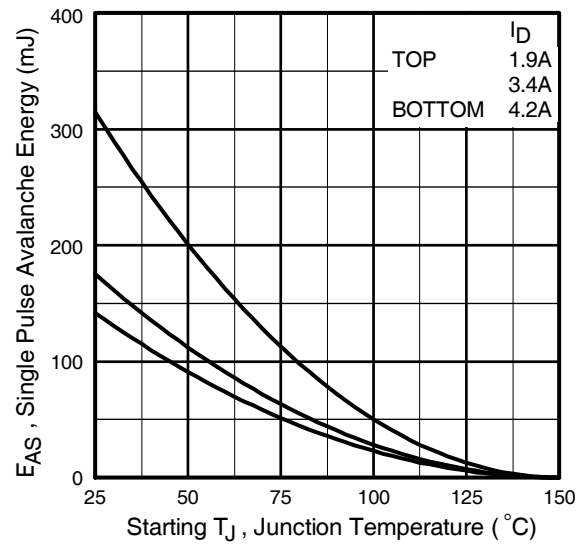
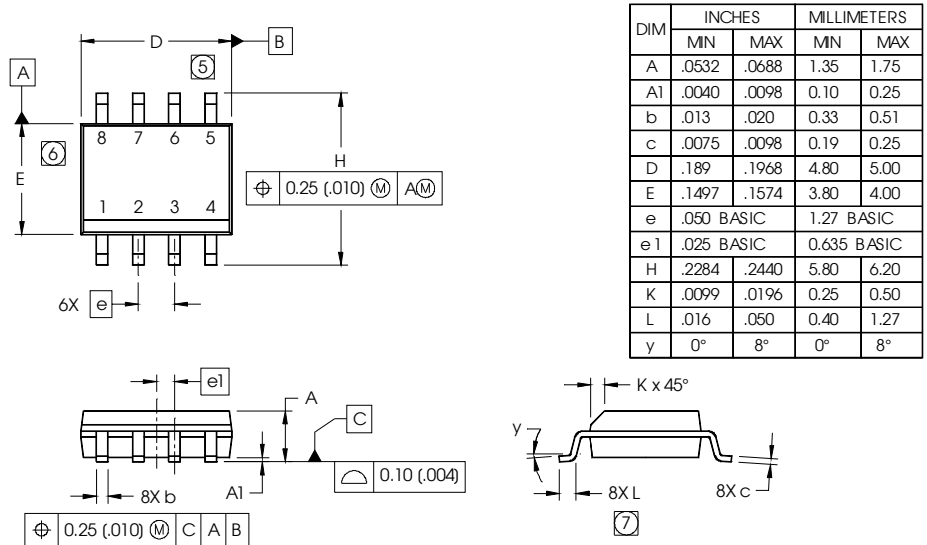


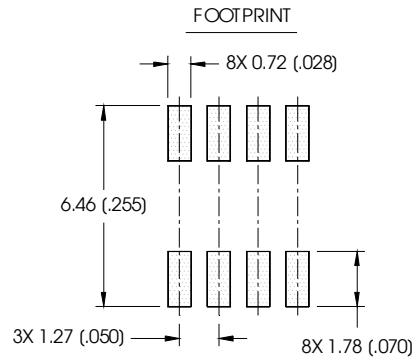
Fig 15c. Maximum Avalanche Energy Vs. Drain Current

## SO-8 Package Outline

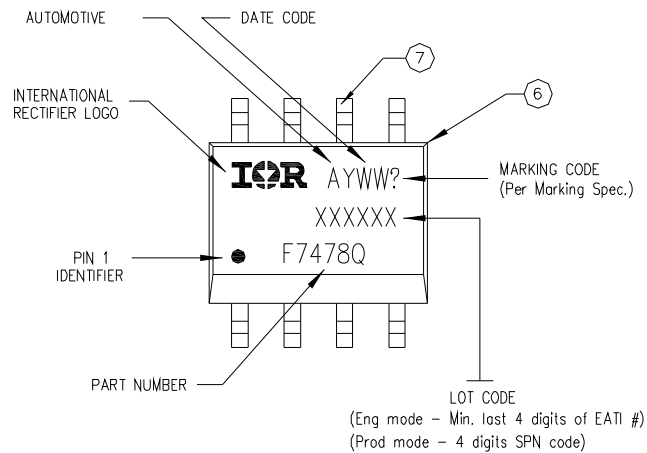
Dimensions are shown in millimeters (inches)



- 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

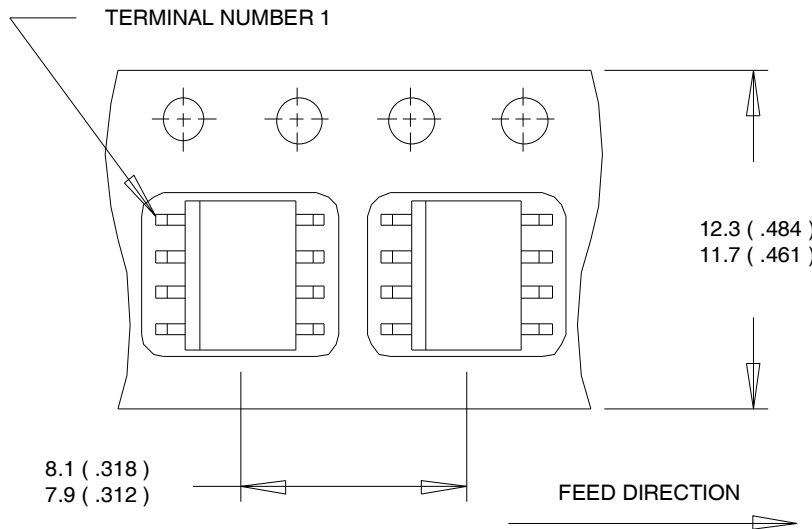


TOP MARKING (LASER)

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

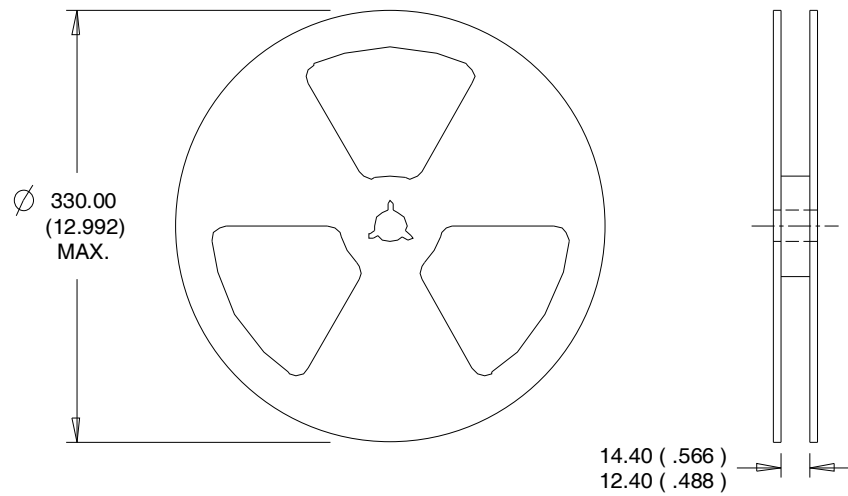
## SO-8 Tape and Reel

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	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRF7478Q	SO-8	Tube	95	AUIRF7478Q
		Tape and Reel	4000	AUIRF7478QTR

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