# International IΩR Rectifier

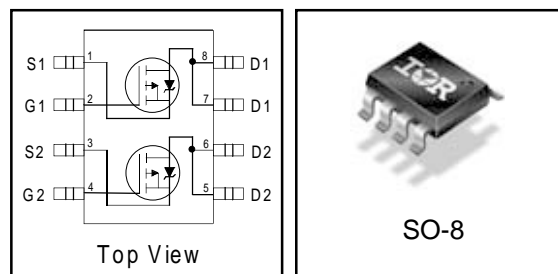# IRF7314Q

### HEXFET® Power MOSFET

### Typical Applications
- Anti-lock Braking Systems (ABS)
- Electronic Fuel Injection
- Air bag

### Benefits
- Advanced Process Technology
- Dual P-Channel MOSFET
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Repetitive Avalanche Allowed up to Tjmax
- Automotive [Q101] Qualified

| $V_{DSS}$ | $R_{DS(on)}$ max | $I_D$ |
|---|---|---|
| **-20V** | $0.058@V_{GS} = -4.5V$ | -5.2A |
| | $0.098@V_{GS} = -2.7V$ | -4.42A |



S1 1    8 D1
G1 2    7 D1
S2 3    6 D2
G2 4    5 D2

Top View

SO-8

### Description

Specifically designed for Automotive applications, these HEXFET ® Power MOSFET's in a Dual SO-8 package utilize the lastest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of these Automotive qualified HEXFET Power MOSFET's are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These benefits combine to make this design an extremely efficient and reliable device for use in Automotive applications and a wide variety of other applications.

The 175°C rating for the SO-8 package provides improved thermal performance with increased safe operating area and dual MOSFET die capability make it ideal in a variety of power applications. This dual, surface mount SO-8 can dramatically reduce board space and is also available in Tape & Reel.

### Absolute Maximum Ratings

|  | Parameter | Max. | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | -20 | V |
| $I_D$ @ $T_A = 25°C$ | Continuous Drain Current, $V_{GS}$ @ 10V | -5.2 | |
| $I_D$ @ $T_A = 70°C$ | Continuous Drain Current, $V_{GS}$ @ 10V | -4.3 | A |
| $I_{DM}$ | Pulsed Drain Current① | -43 | |
| $P_D$ @$T_A = 25°C$ | Maximum Power Dissipation③ | 2.4 | W |
| $P_D$ @$T_A = 70°C$ | Maximum Power Dissipation③ | 1.7 | W |
| | Linear Derating Factor | 16 | mW/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 12 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy② | 610 | mJ |
| $I_{AR}$ | Avalanche Current① | -5.2 | A |
| $E_{AR}$ | Repetitive Avalanche Energy | See Fig.14, 15, 16 | mJ |
| $T_J$ , $T_{STG}$ | Junction and Storage Temperature Range | -55 to + 175 | °C |

### Thermal Resistance

|  | Parameter | Max. | Units |  |
|---|---|---|---|---|
| $R_{\theta JA}$ | Maximum Junction-to-Ambient ③ | | 62.5 | °C/W |

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | -20 | —— | —— | V | $V_{GS}$ = 0V, $I_D$ = -250µA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | —— | 0.009 | —— | V/°C | Reference to 25°C, $I_D$ = -1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | —— | 0.049 | 0.058 | Ω | $V_{GS}$ = -4.5V, $I_D$ = -5.2A ② |
| | | —— | 0.082 | 0.098 | | $V_{GS}$ = -2.7V, $I_D$ = -4.42A ② |
| $V_{GS(th)}$ | Gate Threshold Voltage | -0.7 | —— | —— | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| $g_{fs}$ | Forward Transconductance | 6.8 | —— | —— | S | $V_{DS}$ = 10V, $I_D$ = -5.2A |
| $I_{DSS}$ | Drain-to-Source Leakage Current | —— | —— | -1.0 | µA | $V_{DS}$ = -16V, $V_{GS}$ = 0V |
| | | —— | —— | -25 | | $V_{DS}$ = -16V, $V_{GS}$ = 0V, $T_J$ = 150°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | —— | —— | -100 | nA | $V_{GS}$ = -12V |
| | Gate-to-Source Reverse Leakage | —— | —— | 100 | | $V_{GS}$ = 12V |
| $Q_g$ | Total Gate Charge | —— | 19 | 29 | | $I_D$ = -5.2A |
| $Q_{gs}$ | Gate-to-Source Charge | —— | 2.1 | 3.2 | nC | $V_{DS}$ = -16V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | —— | 9.3 | 14 | | $V_{GS}$ = -4.5V |
| $t_{d(on)}$ | Turn-On Delay Time | —— | 18 | —— | | $V_{DD}$ = -10V |
| $t_r$ | Rise Time | —— | 26 | —— | ns | $I_D$ = -1.0A |
| $t_{d(off)}$ | Turn-Off Delay Time | —— | 41 | —— | | $R_G$ = 6.0Ω |
| $t_f$ | Fall Time | —— | 38 | —— | | $V_{GS}$ = -4.5V ② |
| $C_{iss}$ | Input Capacitance | —— | 913 | —— | | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | —— | 512 | —— | pF | $V_{DS}$ = -15V |
| $C_{rss}$ | Reverse Transfer Capacitance | —— | 260 | —— | | $f$ = 1.0MHz |

## Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | —— | —— | -3.0 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | —— | —— | -43 | | |
| $V_{SD}$ | Diode Forward Voltage | —— | —— | -1.0 | V | $T_J$ = 25°C, $I_S$ = -3.0A, $V_{GS}$ = 0V ② |
| $t_{rr}$ | Reverse Recovery Time | —— | 44 | 66 | ns | $T_J$ = 25°C, $I_F$ = -3.0A |
| $Q_{rr}$ | Reverse Recovery Charge | —— | 54 | 81 | nC | di/dt = -100A/µs ② |

**Notes:**

① Repetitive rating; pulse width limited by max. junction temperature.

② Starting $T_J$ = 25°C, L = 45mH
$R_G$ = 25Ω, $I_{AS}$ = -5.2A.

③ Surface mounted on FR-4 board, t ≤ 10sec.

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

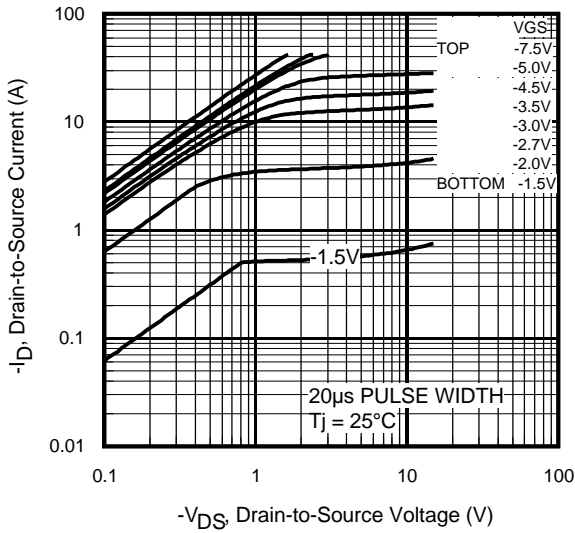International **IGR** Rectifier

# IRF7314Q



**Fig 1.** Typical Output Characteristics
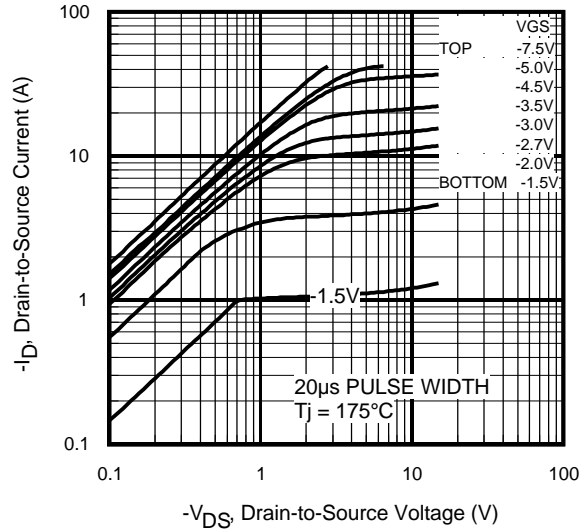


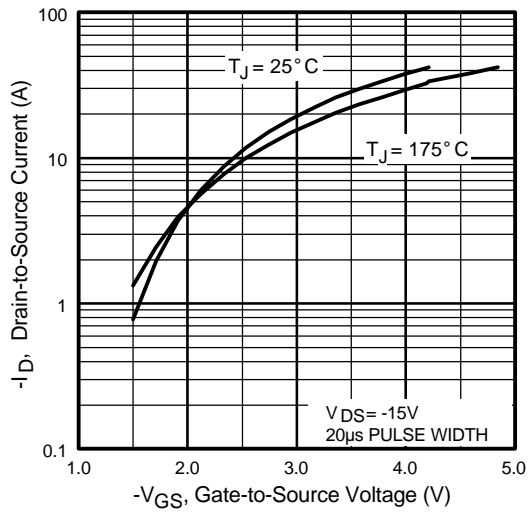**Fig 2.** Typical Output Characteristics



**Fig 3.** Typical Transfer Characteristics
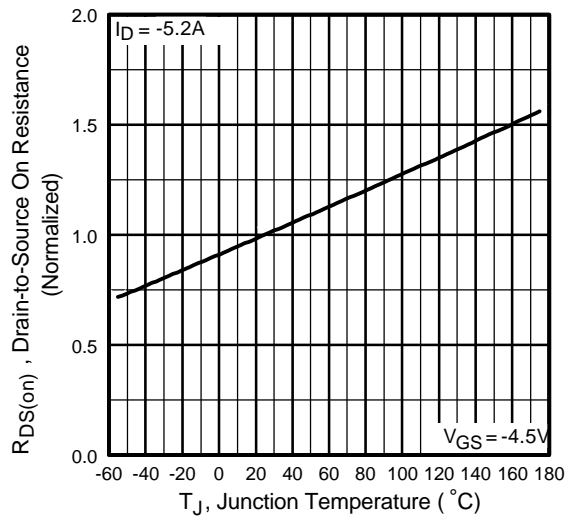


**Fig 4.** Normalized On-Resistance
Vs. Temperature

# IRF7314Q

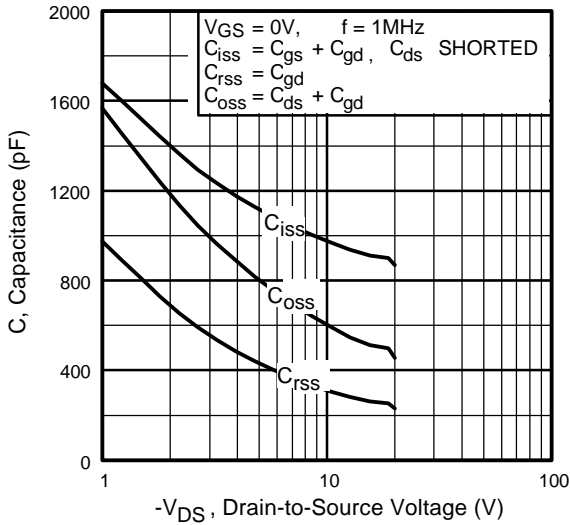International
**IƎR** Rectifier



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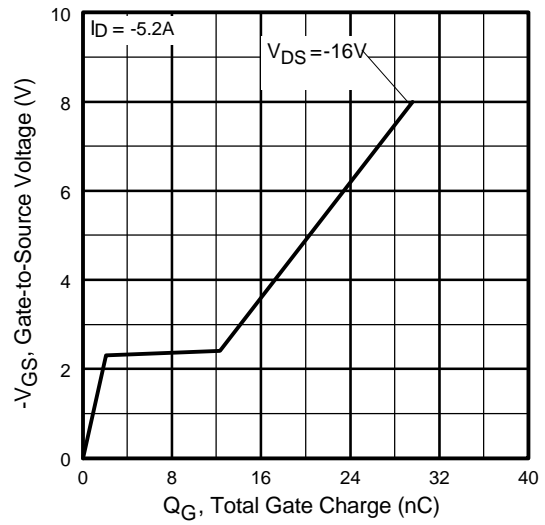Drain-to-Source Voltage
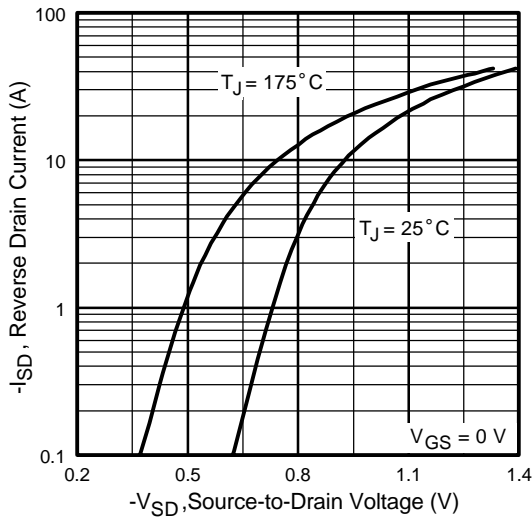


**Fig 6.** Typical Gate Charge Vs.
Gate-to-Source Voltage
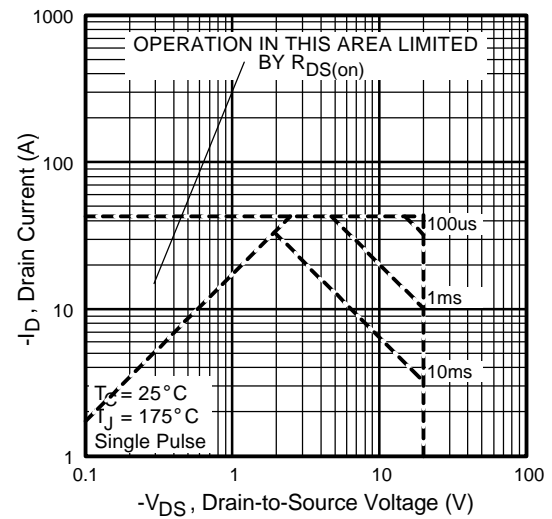


**Fig 7.** Typical Source-Drain Diode
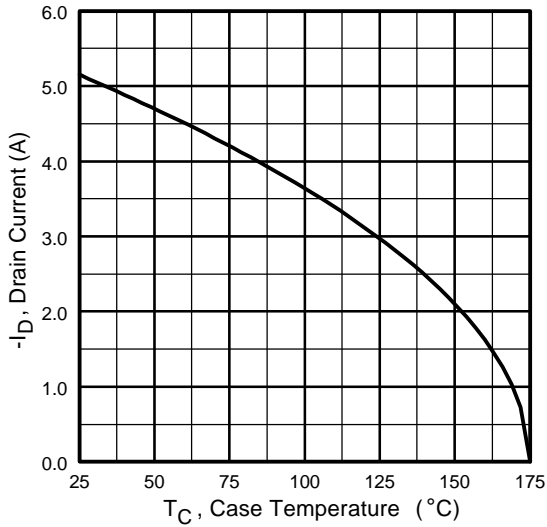Forward Voltage



**Fig 8.** Maximum Safe Operating Area

4                                                                          www.irf.com
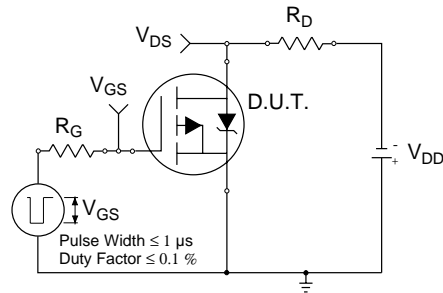
**Fig 9.** Maximum Drain Current Vs.
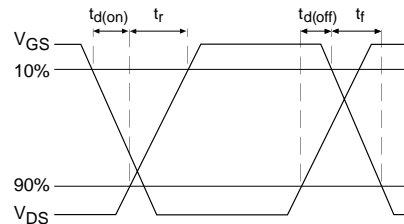Case Temperature



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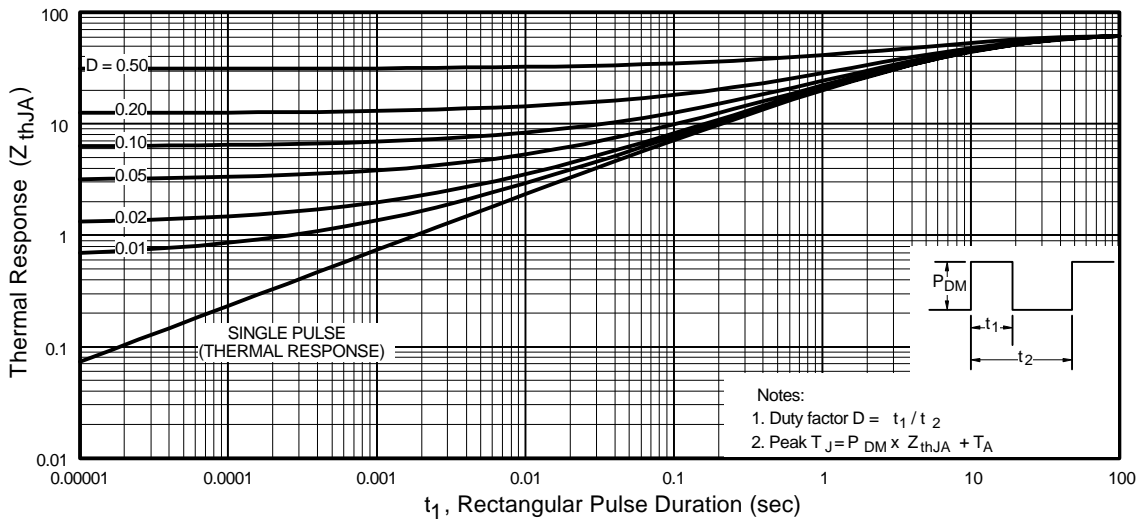


**Fig 10b.** Switching Time Waveforms



Notes:
1. Duty factor D = $t_1 / t_2$
2. Peak $T_J = P_{DM}$ x $Z_{thJA}$ + $T_A$

**Fig 10.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient
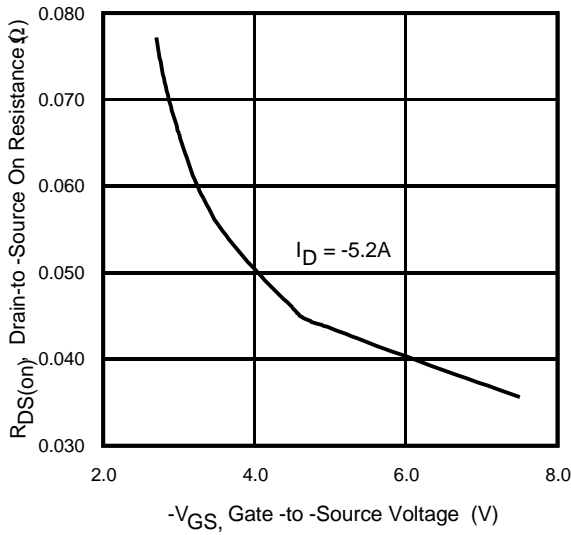
# IRF7314Q

**Fig 11.** Typical On-Resistance Vs. Gate Voltage
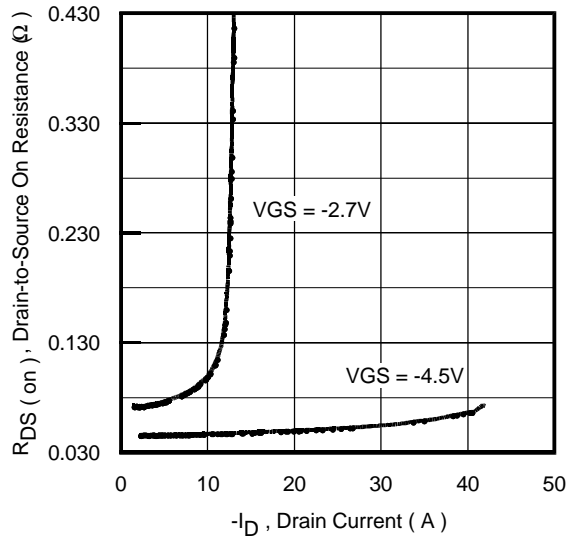


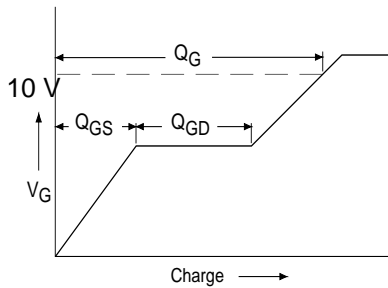**Fig 12.** Typical On-Resistance Vs. Drain Current
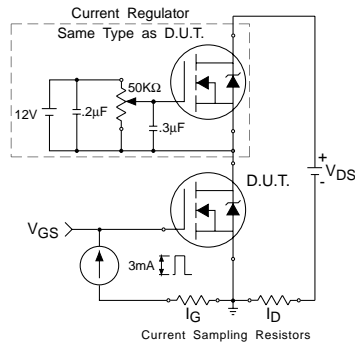


**Fig 13a.** Basic Gate Charge Waveform



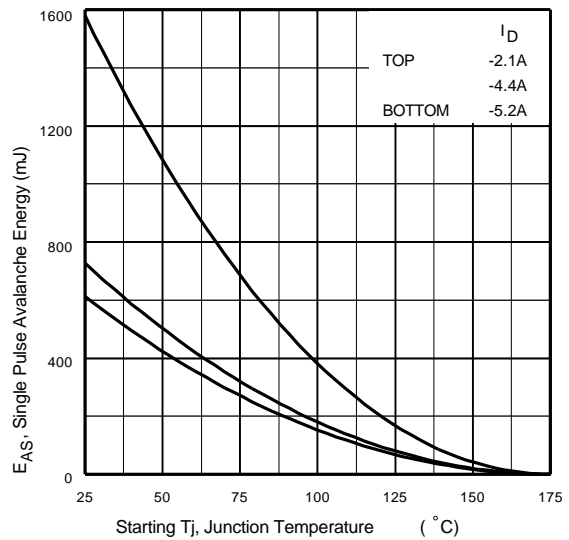**Fig 13b.** Gate Charge Test Circuit



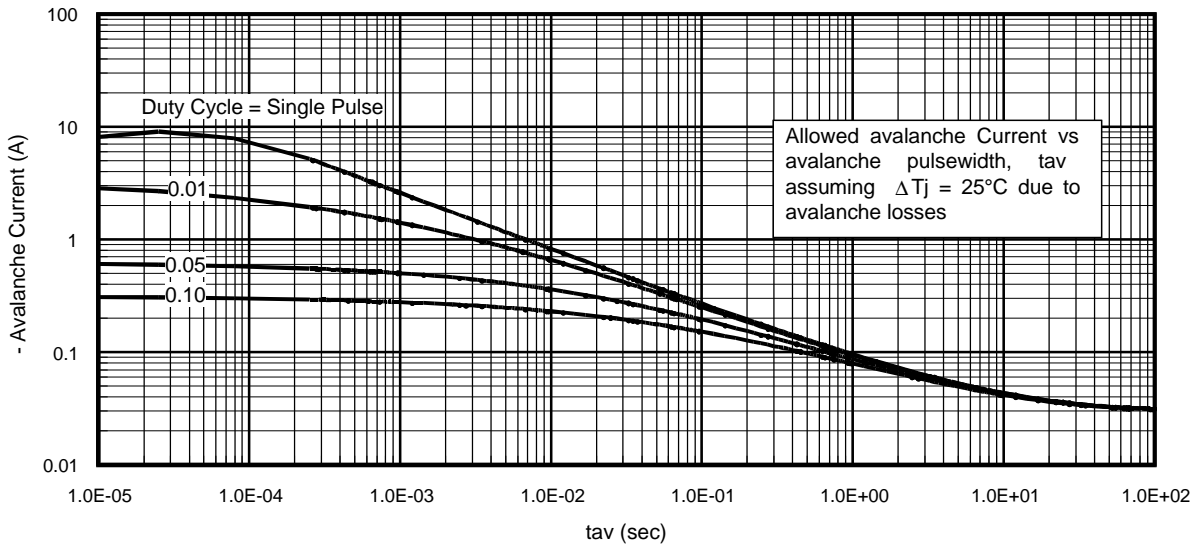**Fig 14.** Maximum Avalanche Energy Vs. Drain Current

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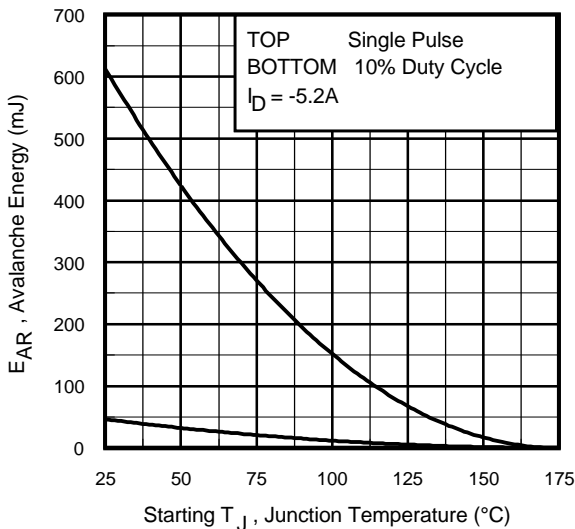**Fig 15.** Typical Avalanche Current Vs.Pulsewidth



**Fig 16.** Maximum Avalanche Energy Vs. Temperature

**Notes on Repetitive Avalanche Curves , Figures 15, 16:**
**(For further info, see AN-1005 at www.irf.com)**

1. Avalanche failures assumption:
   Purely a thermal phenomenon and failure occurs at a temperature far in excess of $T_{jmax}$. This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as $T_{jmax}$ is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
4. $P_{D\ (ave)}$ = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. $I_{av}$ = Allowable avalanche current.
7. $\Delta T$ = Allowable rise in junction temperature, not to exceed $T_{jmax}$ (assumed as 25°C in Figure 15, 16).
   $t_{av}$ = Average time in avalanche.
   D = Duty cycle in avalanche = $t_{av} \cdot f$
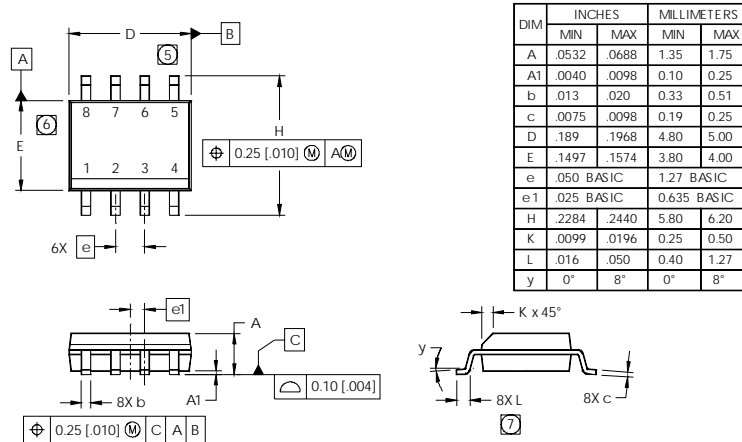   $Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see figure 11)

$$P_{D\ (ave)} = 1/2\ (\ 1.3 \cdot BV \cdot I_{av}) = \Delta T/ Z_{thJC}$$
$$I_{av} = 2\Delta T/ [1.3 \cdot BV \cdot Z_{th}]$$
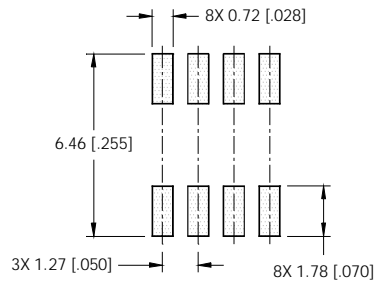$$E_{AS\ (AR)} = P_{D\ (ave)} \cdot t_{av}$$

## SO-8 Package Details

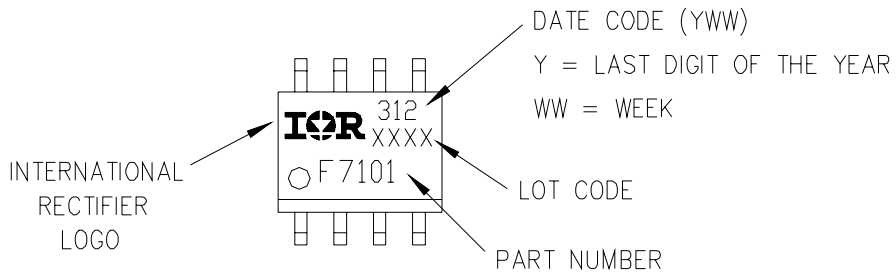| DIM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | .0532 | .0688 | 1.35 | 1.75 |
| A1 | .0040 | .0098 | 0.10 | 0.25 |
| b | .013 | .020 | 0.33 | 0.51 |
| c | .0075 | .0098 | 0.19 | 0.25 |
| D | .189 | .1968 | 4.80 | 5.00 |
| E | .1497 | .1574 | 3.80 | 4.00 |
| 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 [.006].
6 DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [.010].
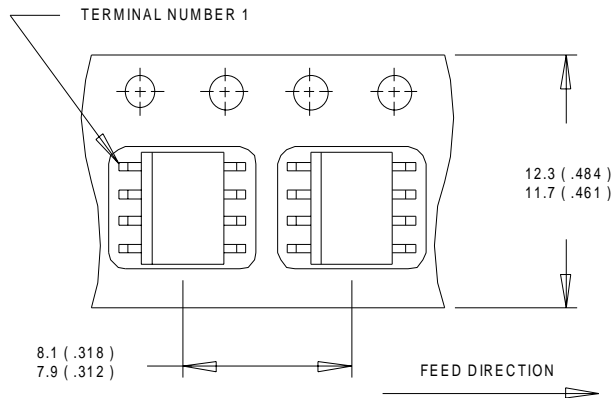7 DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

FOOTPRINT

8X 0.72 [.028]
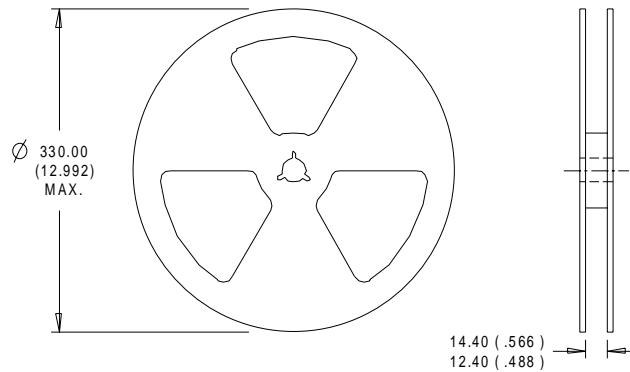
6.46 [.255]

3X 1.27 [.050]

8X 1.78 [.070]

## Part Marking

EXAMPLE: THIS IS AN IRF7101

DATE CODE (YWW)
Y = LAST DIGIT OF THE YEAR
WW = WEEK

312
XXXX
F 7101

INTERNATIONAL
RECTIFIER
LOGO

LOT CODE

PART NUMBER

## Tape and Reel

TERMINAL NUMBER 1

12.3 ( .484 )
11.7 ( .461 )

8.1 ( .318 )
7.9 ( .312 )

FEED DIRECTION

NOTES:
1. CONTROLLING DIMENSION : MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS(INCHES).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.

$\varnothing$ 330.00
(12.992)
MAX.

14.40 ( .566 )
12.40 ( .488 )

NOTES :
1. CONTROLLING DIMENSION : MILLIMETER.
2. OUTLINE CONFORMS TO EIA-481 & EIA-541.

Data and specifications subject to change without notice.
This product has been designed and qualified for the Automotive [Q101] market.
Qualification Standards can be found on IR's Web site.

International
**ICR** Rectifier