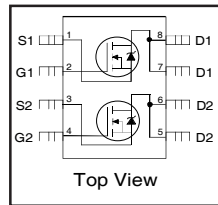


AUIRF7103Q

HEXFET® Power MOSFET

Features

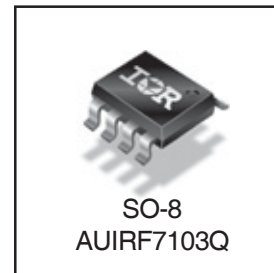
- Advanced Planar Technology
- Dual N Channel MOSFET
- Low On-Resistance
- Dynamic dV/dT Rating
- 175°C Operating Temperature
- Fast Switching
- Lead-Free, RoHS Compliant
- Automotive Qualified*



| | |
|-------------------|--------------|
| $V_{(BR)DSS}$ | 50V |
| $R_{DS(on)}$ max. | 130mΩ |
| I_D | 3.0A |

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, $V_{GS} @ 4.5\text{V}$ | 3.0 | A |
| $I_D @ T_A = 70^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 4.5\text{V}$ | 2.5 | |
| I_{DM} | Pulsed Drain Current ① | 25 | |
| $P_D @ T_A = 25^\circ\text{C}$ | Power Dissipation ② | 2.4 | W |
| | Linear Derating Factor | 16 | W/°C |
| V_{GS} | Gate-to-Source Voltage | ± 20 | V |
| E_{AS} | Single Pulse Avalanche Energy (Thermally Limited)④ | 22 | mJ |
| I_{AR} | Avalanche Current ① | See Fig. 16c, 16d, 19, 20 | A |
| E_{AR} | Repetitive Avalanche Energy ⑥ | | mJ |
| dv/dt | Peak Diode Recovery dv/dt ⑤ | 12 | V/ns |
| T_J T_{STG} | Operating Junction and Storage Temperature Range | -55 to + 175 | °C |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|-----------------|-------------------------|------|------|-------|
| $R_{\theta JL}$ | Junction-to-Drain Lead | — | 20 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient ③ ⑦ | — | 62.5 | |

HEXFET® is a registered trademark of International Rectifier.

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

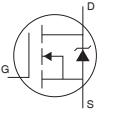
Static Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---------------------------------|--------------------------------------|------|-------|------|-------|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 50 | — | — | V | $V_{GS} = 0V, I_D = 250\mu A$ |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.057 | — | V/°C | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 130 | mΩ | $V_{GS} = 10V, I_D = 3.0A$ ② |
| | | — | — | 200 | | $V_{GS} = 4.5V, I_D = 1.5A$ ② |
| $V_{GS(th)}$ | Gate Threshold Voltage | 1.0 | — | 3.0 | V | $V_{DS} = V_{GS}, I_D = 250\mu A$ |
| gfs | Forward Transconductance | 3.4 | — | — | S | $V_{DS} = 15V, I_D = 3.0A$ |
| I_{DSS} | Drain-to-Source Leakage Current | — | — | 2.0 | μA | $V_{DS} = 40V, V_{GS} = 0V$ |
| | | — | — | 25 | | $V_{DS} = 40V, V_{GS} = 0V, T_J = 55^\circ\text{C}$ |
| 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 | — | 10 | 15 | nC | $I_D = 2.0A$ |
| Q_{gs} | Gate-to-Source Charge | — | 1.2 | — | | $V_{DS} = 40V$ |
| Q_{gd} | Gate-to-Drain ("Miller") Charge | — | 2.8 | — | | $V_{GS} = 10V$ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 5.1 | — | ns | $V_{DD} = 25V$ |
| t_r | Rise Time | — | 1.7 | — | | $I_D = 1.0A$ |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 15 | — | | $R_G = 6.0\Omega$ |
| t_f | Fall Time | — | 2.3 | — | | $R_D = 25\Omega$ ② |
| C_{iss} | Input Capacitance | — | 255 | — | pF | $V_{GS} = 0V$ |
| C_{oss} | Output Capacitance | — | 69 | — | | $V_{DS} = 25V$ |
| C_{rss} | Reverse Transfer Capacitance | — | 29 | — | | $f = 1.0\text{MHz}$ |

Diode 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 | — | — | 12 | | |
| V_{SD} | Diode Forward Voltage | — | — | 1.2 | V | $T_J = 25^\circ\text{C}, I_S = 1.5A, V_{GS} = 0V$ ② |
| t_{rr} | Reverse Recovery Time | — | 35 | 53 | ns | $T_J = 25^\circ\text{C}, I_F = 1.5A$ |
| Q_{rr} | Reverse Recovery Charge | — | 45 | 67 | nC | $di/dt = 100A/\mu s$ ② |
| t_{on} | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.
- ③ Surface mounted on 1 in square Cu board.
- ④ Starting $T_J = 25^\circ\text{C}$, $L = 4.9\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 3.0A$. (See Figure 12).
- ⑤ $I_{SD} \leq 2.0A$, $di/dt \leq 155A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 175^\circ\text{C}$.
- ⑥ Limited by T_{Jmax} , see Fig.16c, 16d, 19, 20 for typical repetitive avalanche performance.

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 M1A (+/- 50V) ^{†††} AEC-Q101-002 | |
| | Human Body Model | Class H0 (+/- 250V) ^{†††} 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.

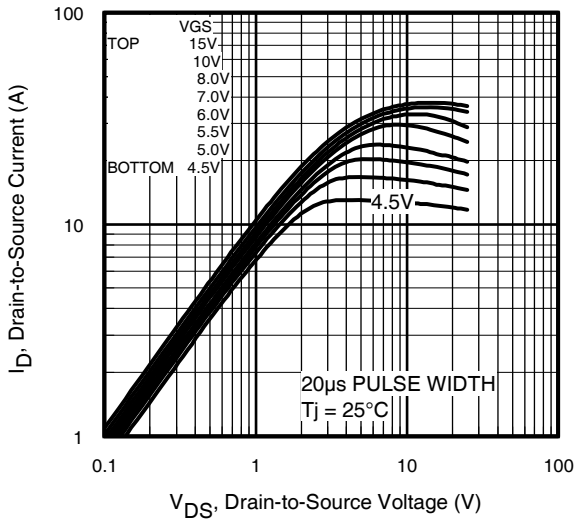


Fig 1. Typical Output Characteristics

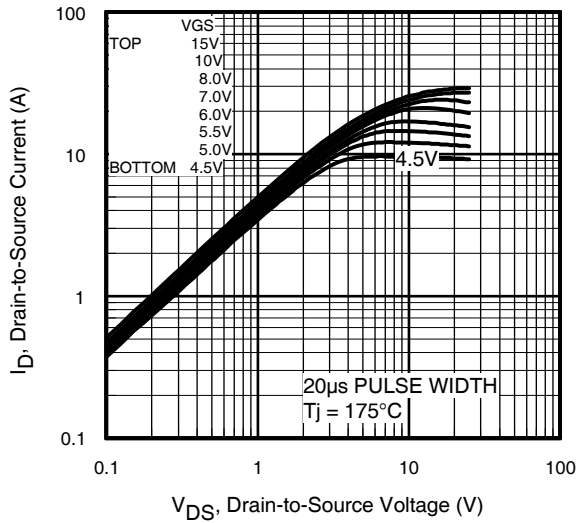


Fig 2. Typical Output Characteristics

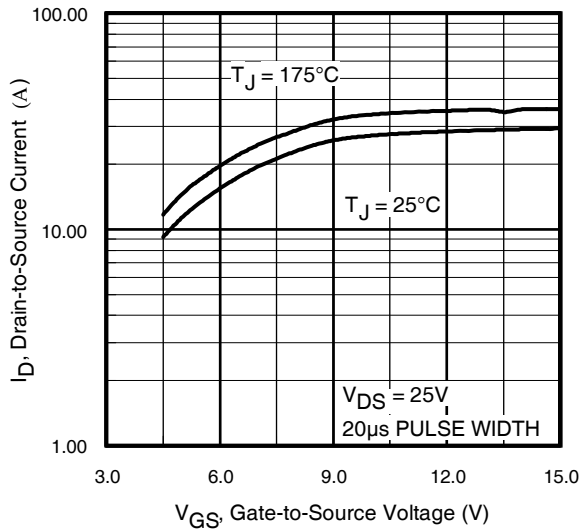


Fig 3. Typical Transfer Characteristics

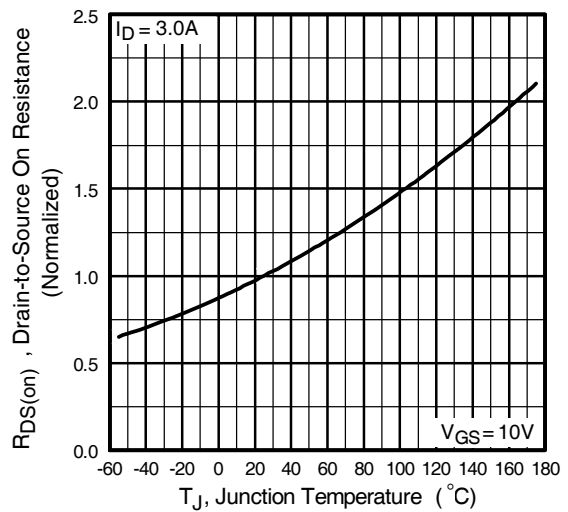


Fig 4. Normalized On-Resistance Vs. Temperature

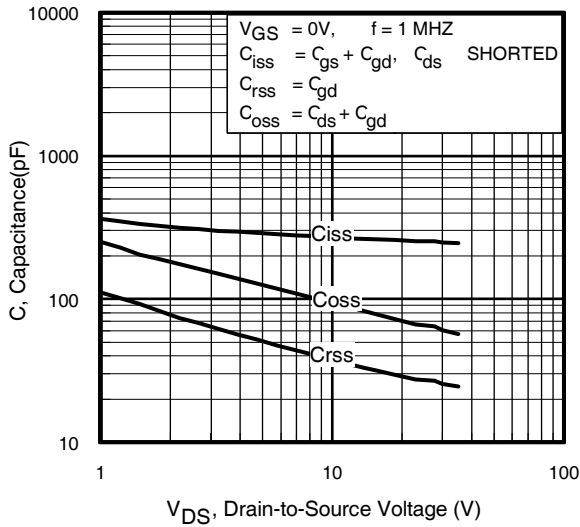


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

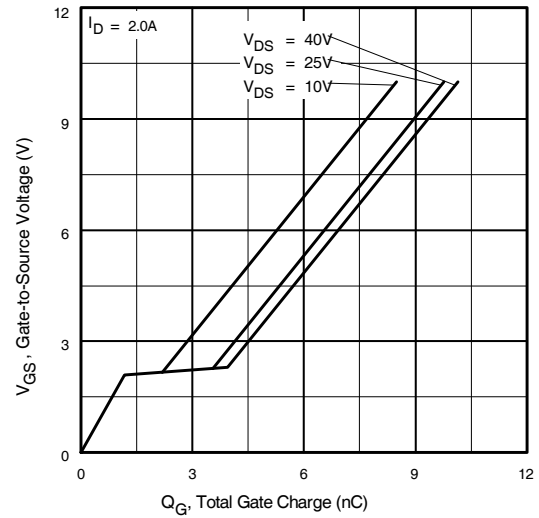


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

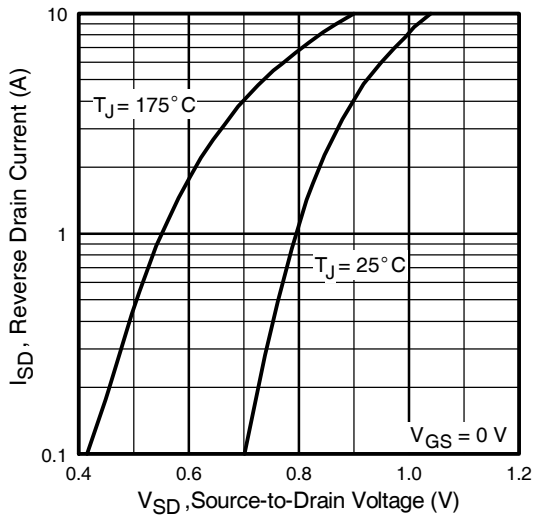


Fig 7. Typical Source-Drain Diode Forward Voltage

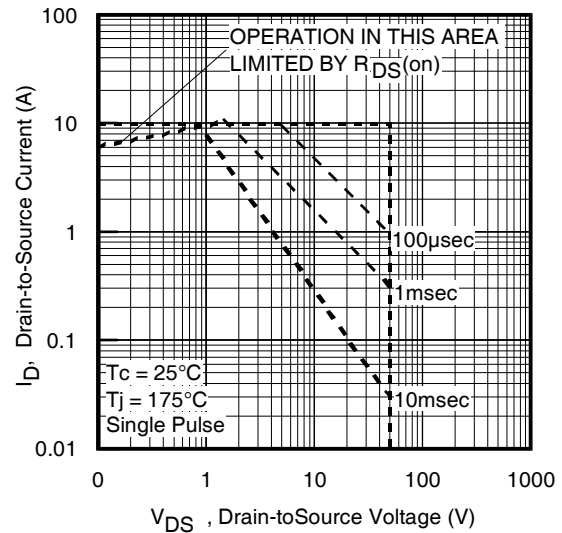


Fig 8. Maximum Safe Operating Area

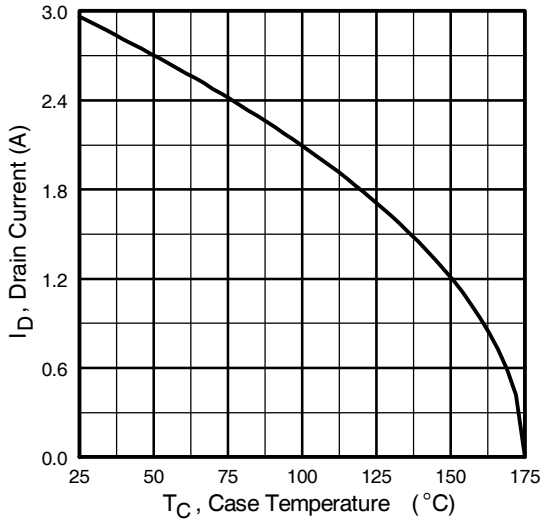


Fig 9. Maximum Drain Current Vs. Case Temperature

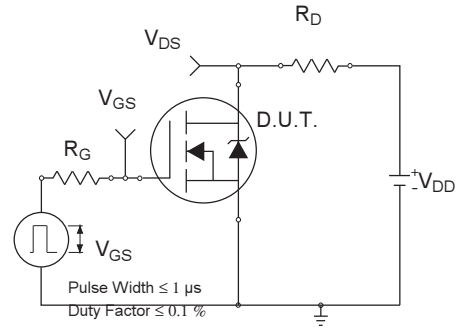


Fig 10a. Switching Time Test Circuit

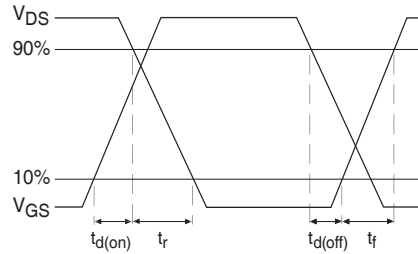


Fig 10b. Switching Time Waveforms

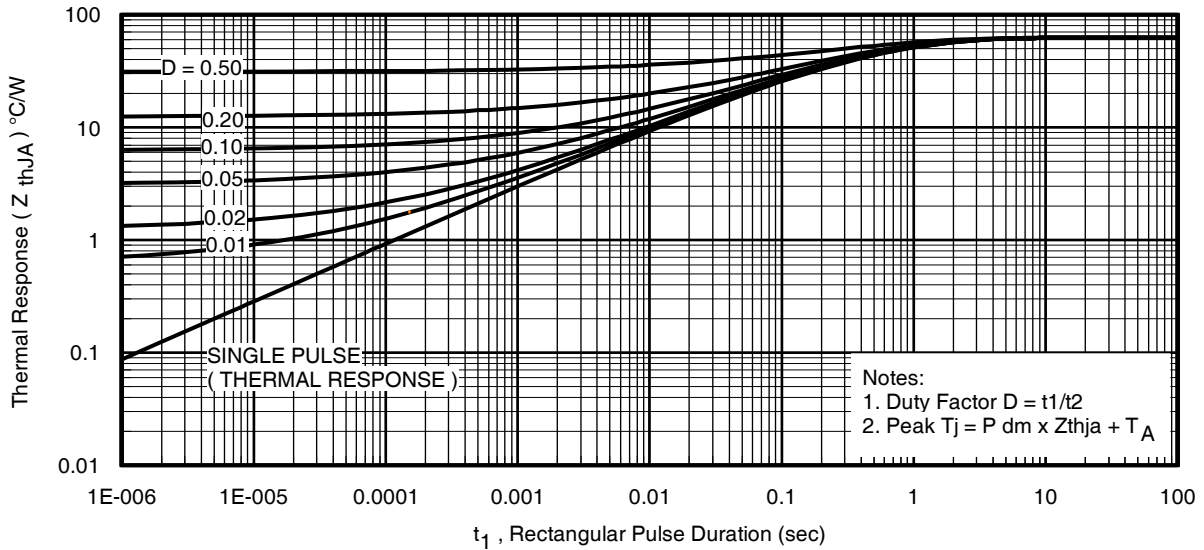


Fig 11. Typical Effective Transient Thermal Impedance, Junction-to-Ambient

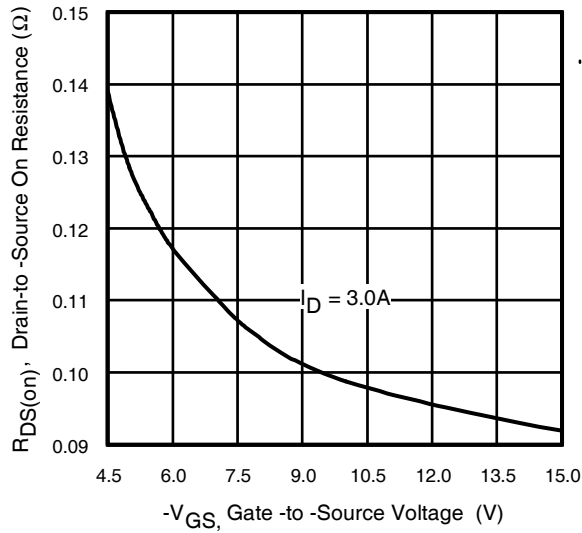


Fig 12. Typical On-Resistance Vs. Gate Voltage

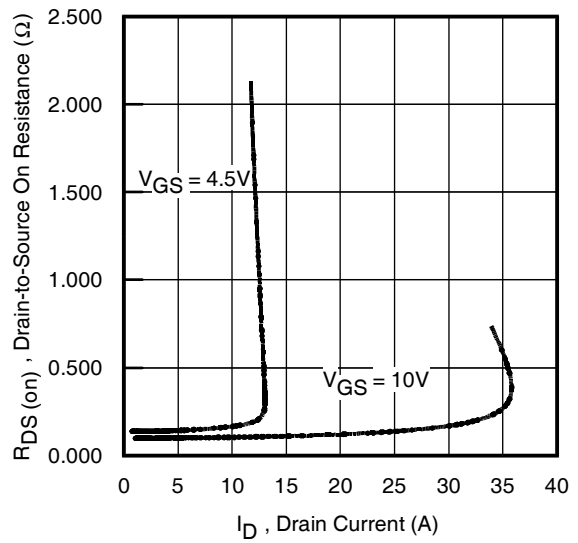


Fig 13. Typical On-Resistance Vs. Drain Current

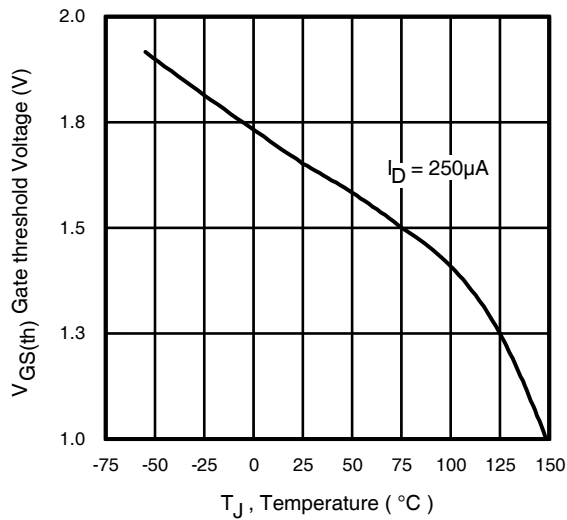


Fig 14. Typical Threshold Voltage Vs. Junction Temperature

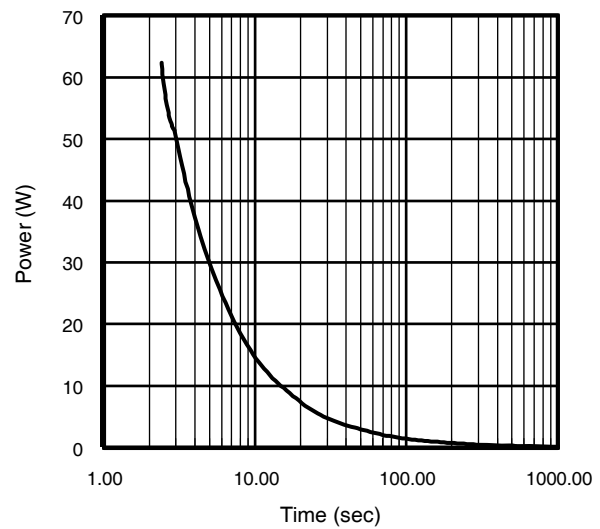


Fig 15. Typical Power Vs. Time

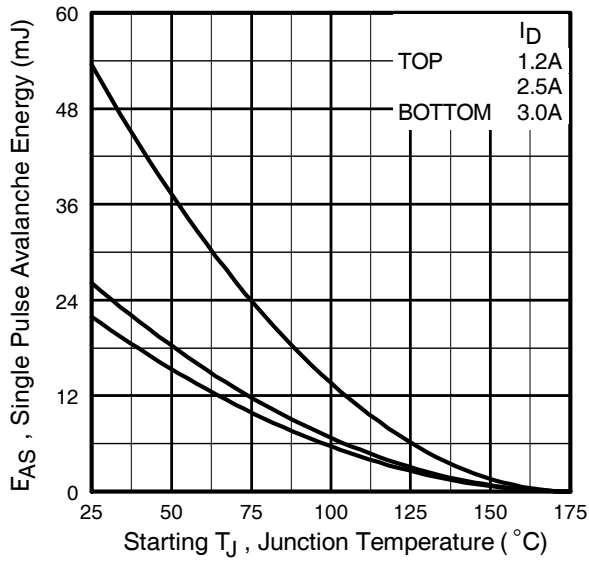


Fig 16a. Maximum Avalanche Energy Vs. Drain Current

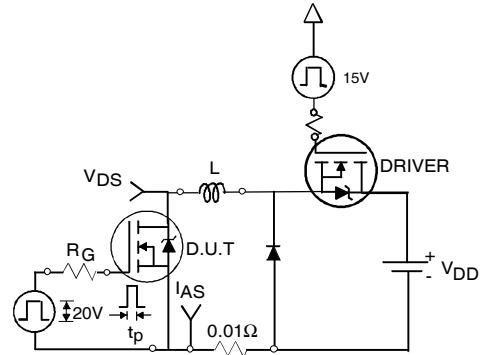


Fig 16c. Unclamped Inductive Test Circuit

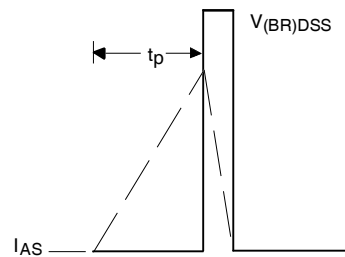


Fig 16d. Unclamped Inductive Waveforms

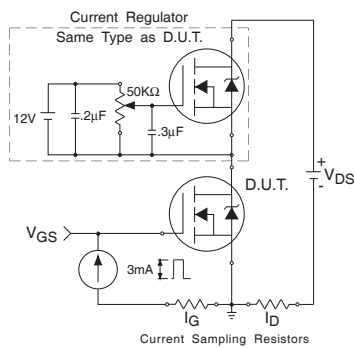


Fig 17. Gate Charge Test Circuit

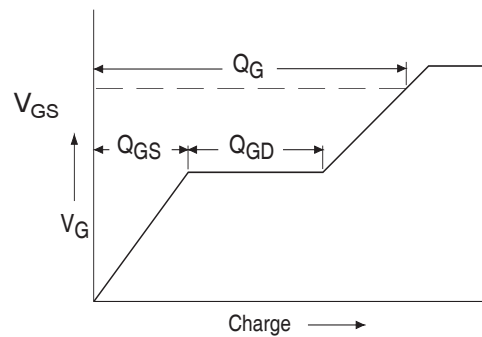


Fig 18. Basic Gate Charge Waveform

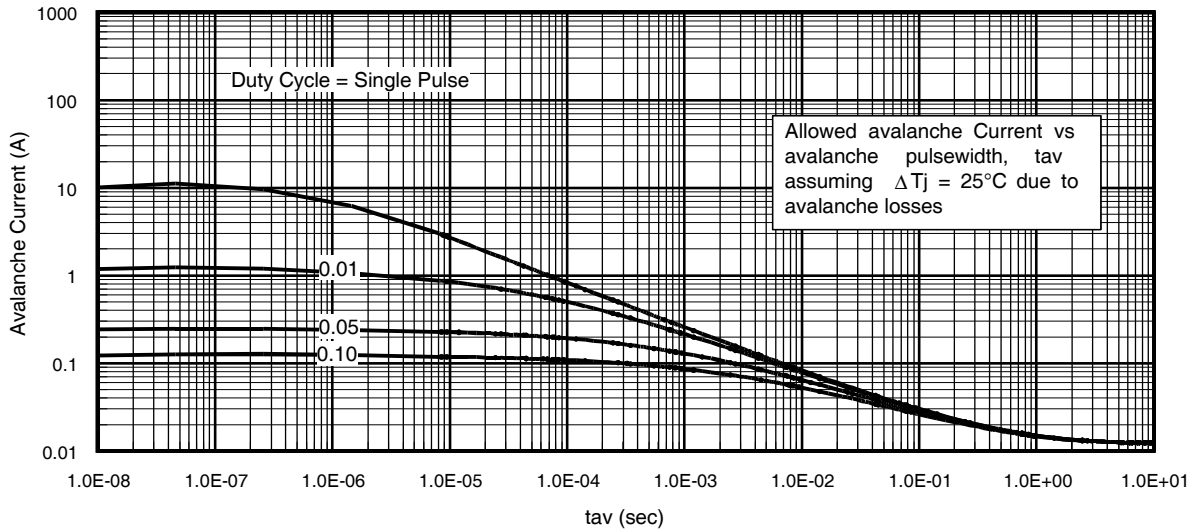


Fig 19. Typical Avalanche Current Vs. Pulsewidth

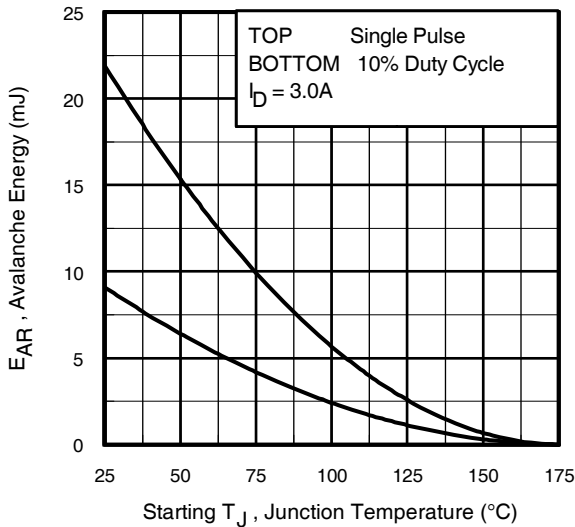


Fig 20. Maximum Avalanche Energy Vs. Temperature

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. ΔT = 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)

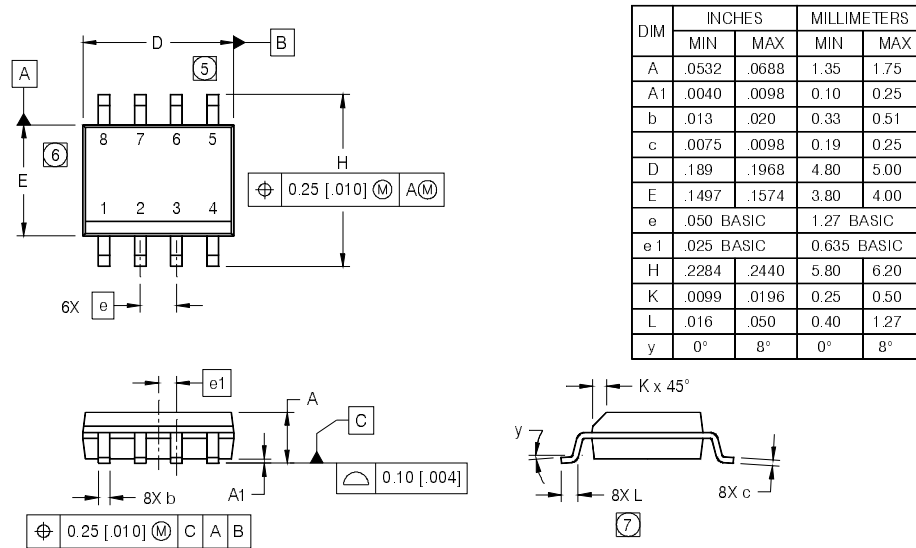
$$P_{D(ave)} = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$

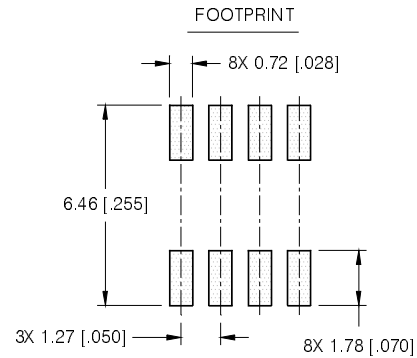
SO-8 Package Outline

Dimensions are shown in millimeters (inches)

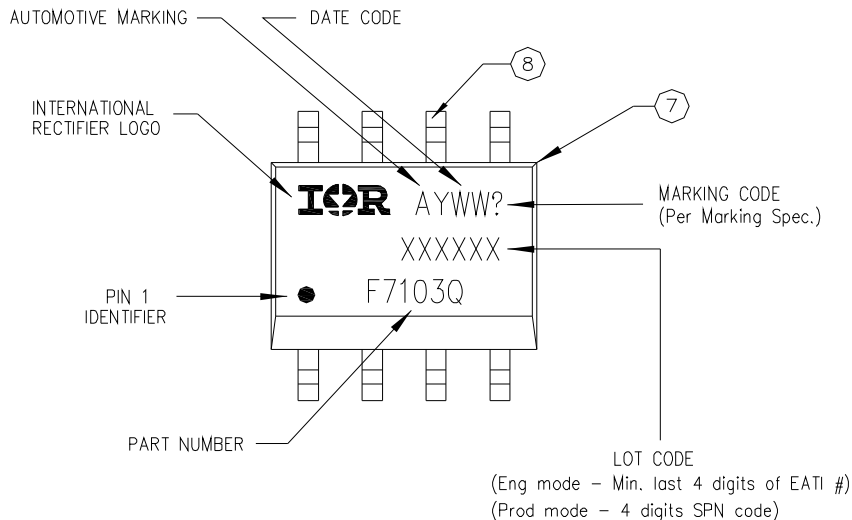


NOTES:

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 [0.006].
- ⑥ DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [0.10].
- ⑦ DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.



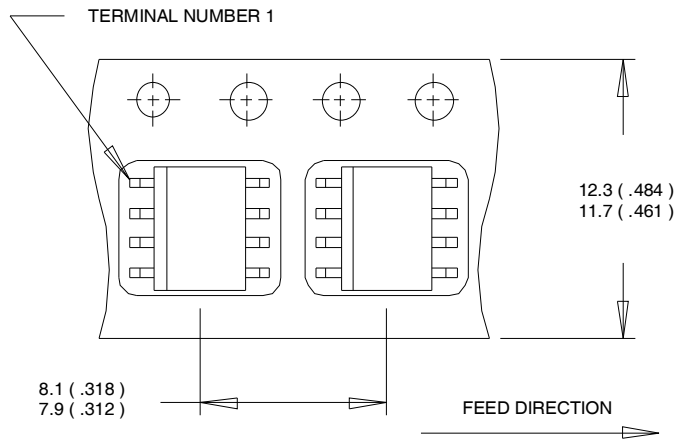
SO-8 Part Marking



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

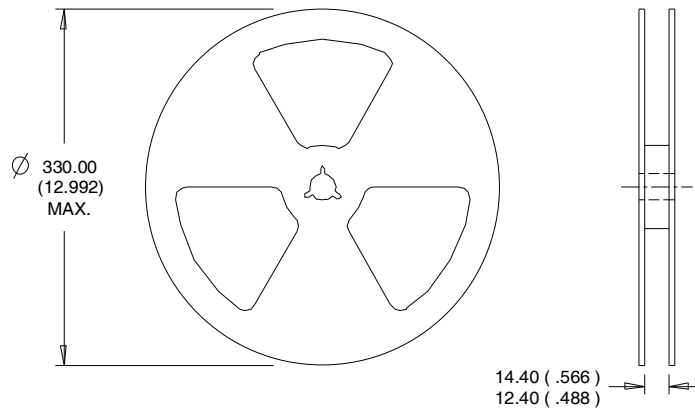
SO-8 Tape and Reel

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 | |
| AUIRF7103Q | SO-8 | Tube | 95 | AUIRF7103Q |
| | | Tape and Reel | 4000 | AUIRF7103QTR |

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