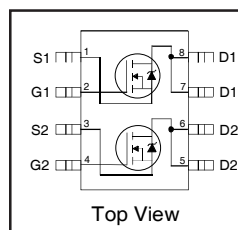


# AUIRF7313Q

HEXFET® Power MOSFET

## Features

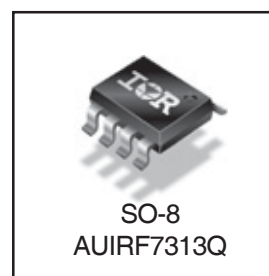
- Advanced Planar Technology
- Dual N Channel MOSFET
- Low On-Resistance
- Dynamic dV/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Lead-Free, RoHS Compliant
- Automotive Qualified\*



|                          |             |
|--------------------------|-------------|
| $V_{(BR)DSS}$            | <b>30V</b>  |
| $R_{DS(on)}$ <b>typ.</b> | <b>23mΩ</b> |
| <b>max.</b>              | <b>29mΩ</b> |
| $I_D$                    | <b>6.9A</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.



## 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                                | 30           | V     |
| $I_D$ @ $T_A = 25^\circ\text{C}$ | Continuous Drain Current, $V_{GS}$ @ 10V            | 6.9          | A     |
| $I_D$ @ $T_A = 70^\circ\text{C}$ | Continuous Drain Current, $V_{GS}$ @ 10V            | 5.8          |       |
| $I_{DM}$                         | Pulsed Drain Current ①                              | 58           |       |
| $P_D$ @ $T_A = 25^\circ\text{C}$ | Power Dissipation                                   | 2.4          | W     |
|                                  | Linear Derating Factor                              | 0.02         | W/°C  |
| $V_{GS}$                         | Gate-to-Source Voltage                              | ± 20         | V     |
| $E_{AS}$                         | Single Pulse Avalanche Energy②                      | 450          | mJ    |
| dv/dt                            | Peak Diode Recovery dv/dt ③                         | 3.6          | V/ns  |
| $T_J$<br>$T_{STG}$               | Operating Junction and<br>Storage Temperature Range | -55 to + 175 | °C    |

## Thermal Resistance

|                 | Parameter               | Max. | Units |
|-----------------|-------------------------|------|-------|
| $R_{\theta JL}$ | Junction-to-Drain Lead  | 20   | °C/W  |
| $R_{\theta JA}$ | Junction-to-Ambient ⑤ ⑥ | 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    | 30   | —    | —    | V       | $V_{GS} = 0V, I_D = 250\mu A$                        |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.03 | —    | V/°C    | Reference to $25^\circ\text{C}$ , $I_D = 1mA$        |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | 23   | 29   | mΩ      | $V_{GS} = 10V, I_D = 6.9A$ ④                         |
|                                 |                                      | —    | 32   | 46   |         | $V_{GS} = 4.5V, I_D = 5.5A$ ④                        |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 1.0  | —    | 3.0  | V       | $V_{DS} = V_{GS}, I_D = 250\mu A$                    |
| $g_{fs}$                        | Forward Transconductance             | 7.5  | —    | —    | S       | $V_{DS} = 15V, I_D = 3.5A$                           |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —    | 1.0  | $\mu A$ | $V_{DS} = 24V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —    | 25   |         | $V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | 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               | —    | 22   | 33   | nC    | $I_D = 3.5A$      |
| $Q_{gs}$     | Gate-to-Source Charge           | —    | 2.6  | 3.9  |       | $V_{DS} = 15V$    |
| $Q_{gd}$     | Gate-to-Drain ("Miller") Charge | —    | 6.8  | 10   |       | $V_{GS} = 10V$ ④  |
| $t_{d(on)}$  | Turn-On Delay Time              | —    | 3.7  | —    | ns    | $V_{DD} = 15V$    |
| $t_r$        | Rise Time                       | —    | 7.3  | —    |       | $I_D = 3.5A$      |
| $t_{d(off)}$ | Turn-Off Delay Time             | —    | 21   | —    |       | $R_G = 6.8\Omega$ |
| $t_f$        | Fall Time                       | —    | 11   | —    |       | $V_{GS} = 10V$ ④  |
| $C_{iss}$    | Input Capacitance               | —    | 755  | —    | pF    | $V_{GS} = 0V$     |
| $C_{oss}$    | Output Capacitance              | —    | 310  | —    |       | $V_{DS} = 25V$    |
| $C_{rss}$    | Reverse Transfer Capacitance    | —    | 120  | —    |       | $f = 1.0MHz$      |

## Diode Characteristics

|          | Parameter                                 | Min. | Typ. | Max. | Units | Conditions                                                              |
|----------|-------------------------------------------|------|------|------|-------|-------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current<br>(Body Diode) | —    | —    | 3.0  | A     | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current<br>(Body Diode) ①   | —    | —    | 58   |       |                                                                         |
| $V_{SD}$ | Diode Forward Voltage                     | —    | —    | 1.0  | V     | $T_J = 25^\circ\text{C}, I_S = 3.5A, V_{GS} = 0V$ ④                     |
| $t_{rr}$ | Reverse Recovery Time                     | —    | 27   | 40   | ns    | $T_J = 25^\circ\text{C}, I_F = 3.5A$                                    |
| $Q_{rr}$ | Reverse Recovery Charge                   | —    | 43   | 65   | nC    | $di/dt = 100A/\mu s$ ④                                                  |

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Limited by  $T_{Jmax}$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 76mH$ ,  $R_G = 50\Omega$ ,  $I_{AS} = 3.5A$ ,  $V_{GS} = 10V$ . Part not recommended for use above this value.
- ③  $I_{SD} \leq 3.5A$ ,  $di/dt \leq 590A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 175^\circ\text{C}$ .
- ④ Pulse width  $\leq 400\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤ When mounted on 1 inch square copper board.
- ⑥  $R_{\theta}$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .

## Qualification Information<sup>†</sup>

|                                   |                      |                                                                                                                                                                         |      |
|-----------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Qualification Level</b>        |                      | Automotive<br>(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 M1B (+/- 100 V) <sup>†††</sup><br>AEC-Q101-002                                                                                                                    |      |
|                                   | Human Body Model     | Class H1A (+/- 500 V) <sup>†††</sup><br>AEC-Q101-001                                                                                                                    |      |
|                                   | Charged Device Model | Class C5 (+/- 2000 V) <sup>†††</sup><br>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

## Ordering Information

| Base part number | Package Type | Standard Pack |          | Complete Part Number |
|------------------|--------------|---------------|----------|----------------------|
|                  |              | Form          | Quantity |                      |
| AUIRF7313Q       | SO-8         | Tube          | 95       | AUIRF7313Q           |
|                  |              | Tape and Reel | 4000     | AUIRF7313QTR         |

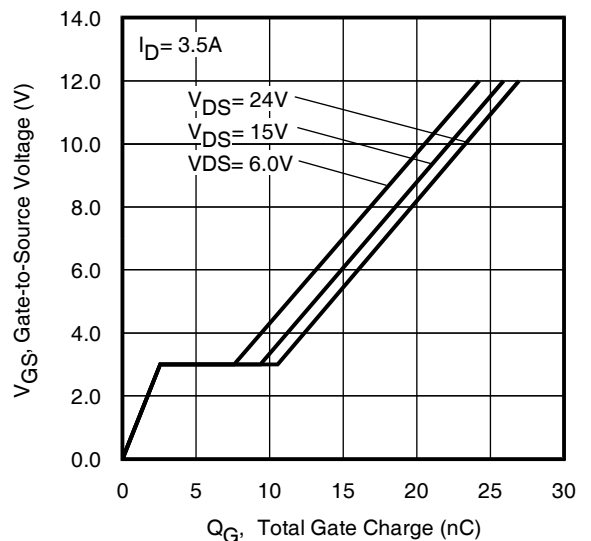
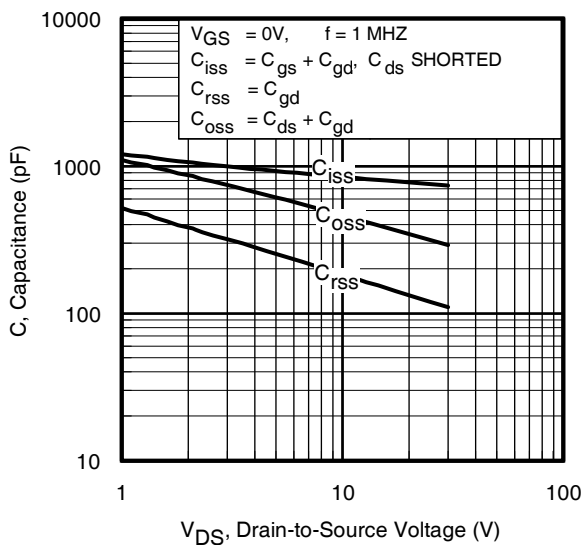
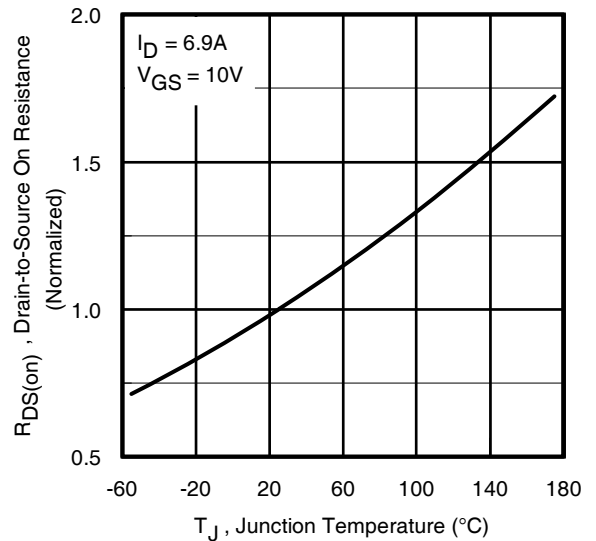
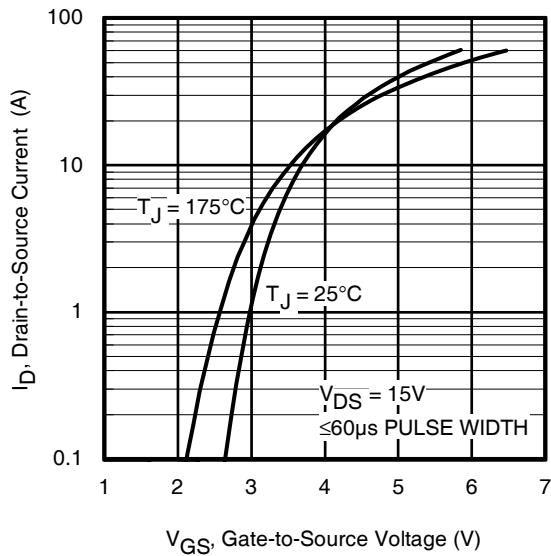
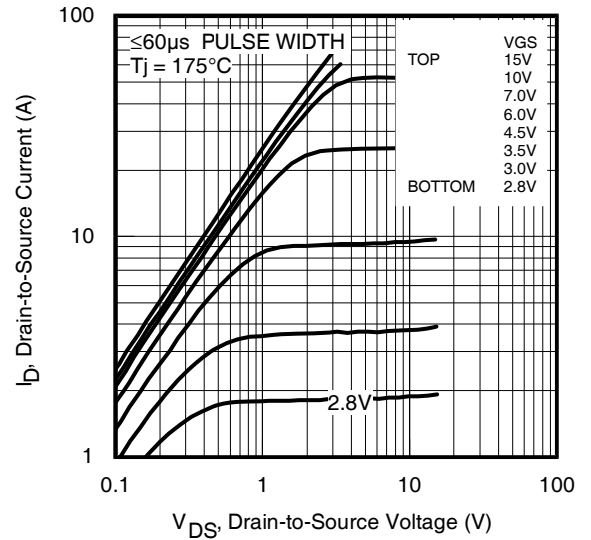
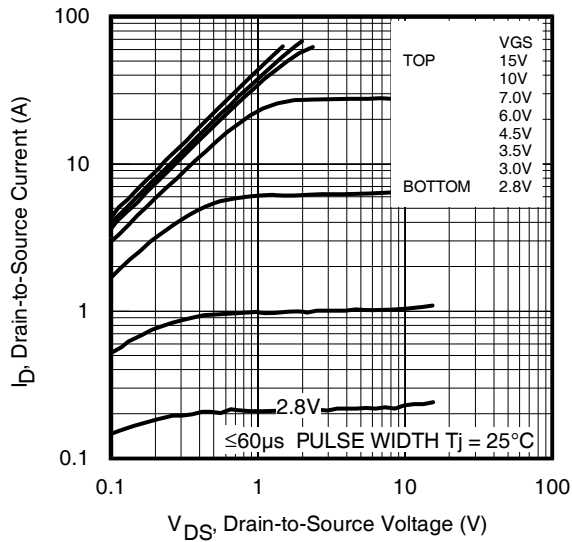


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

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

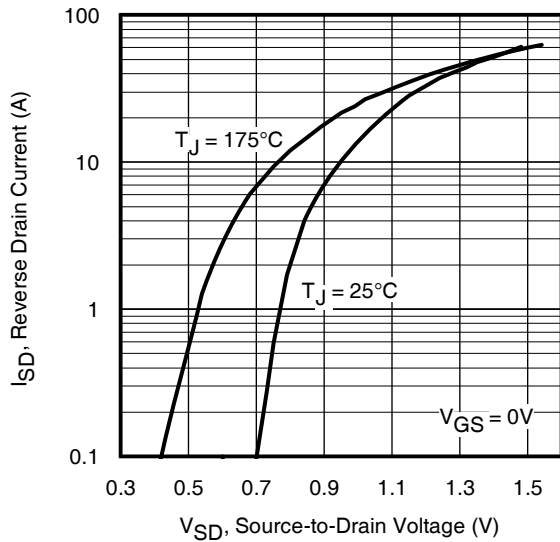


Fig 7. Typical Source-Drain Diode Forward Voltage

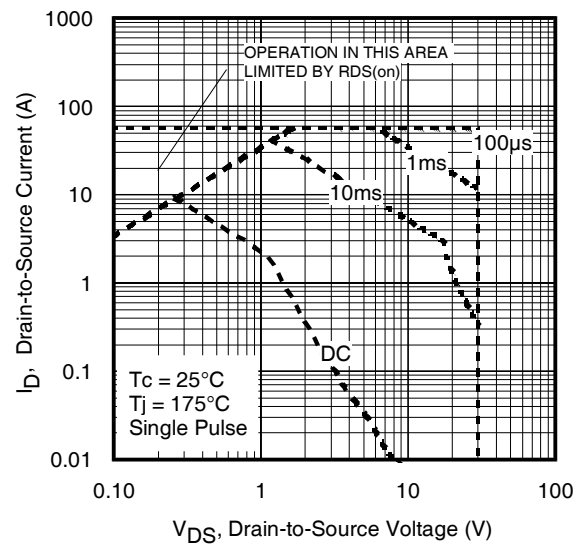


Fig 8. Maximum Safe Operating Area

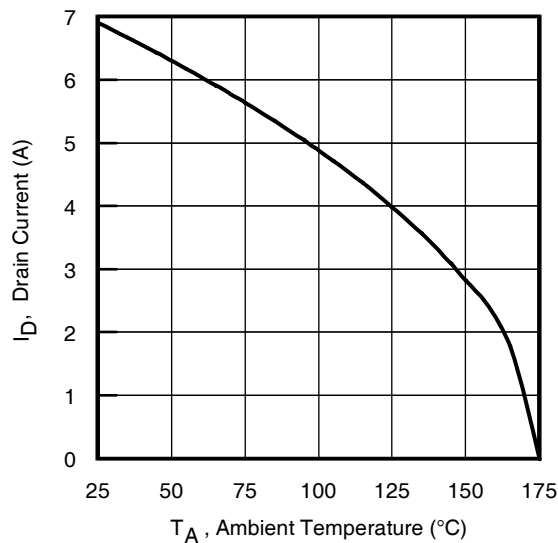


Fig 9. Maximum Drain Current Vs. Ambient Temperature

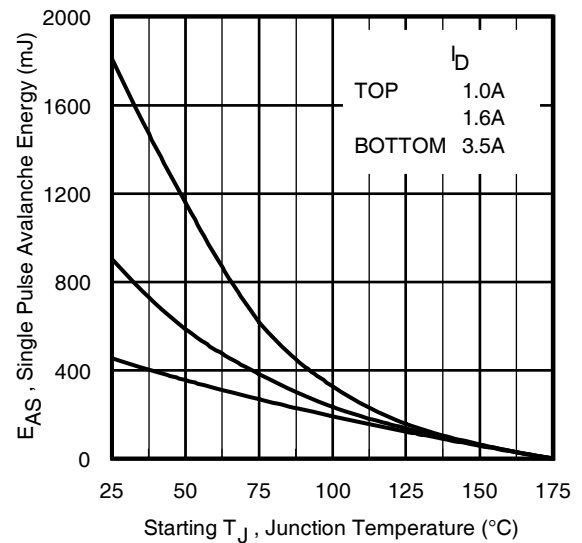


Fig 10. Maximum Avalanche Energy vs. Drain Current

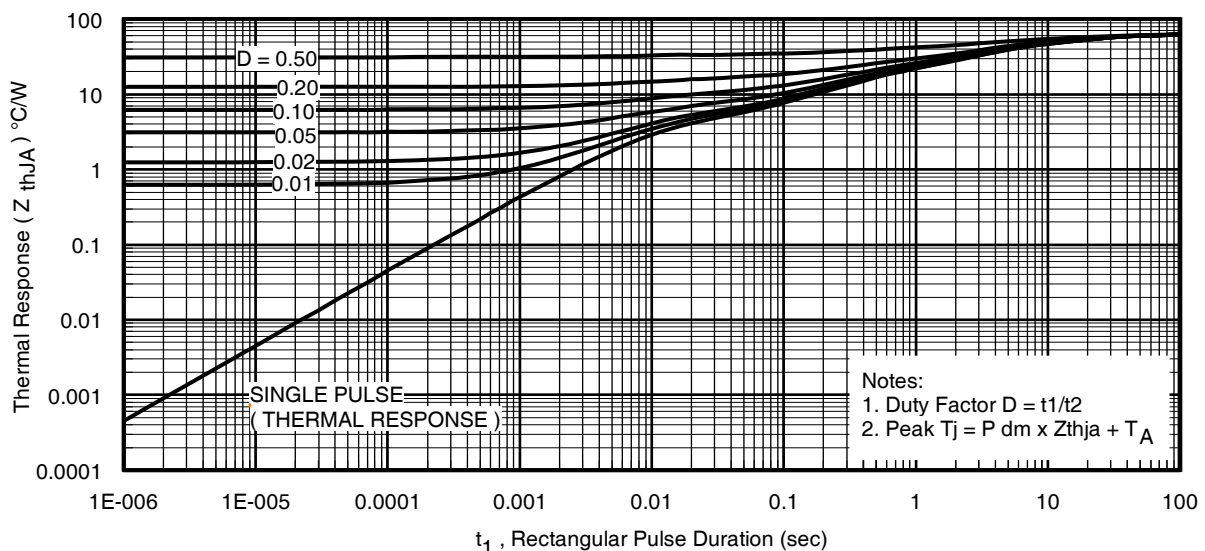


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

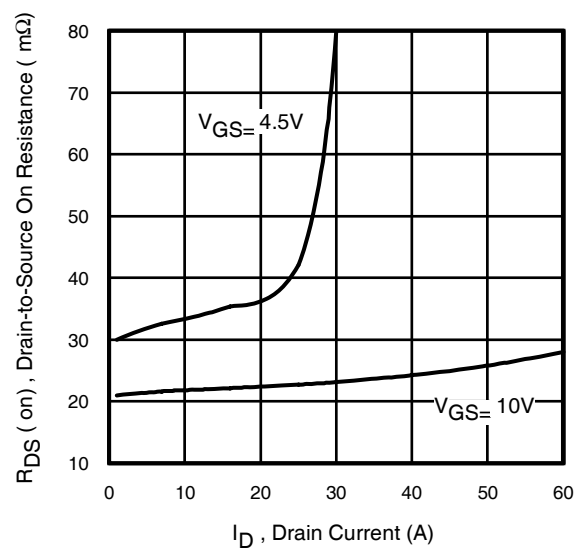


Fig 12. Typical On-Resistance Vs. Drain Current

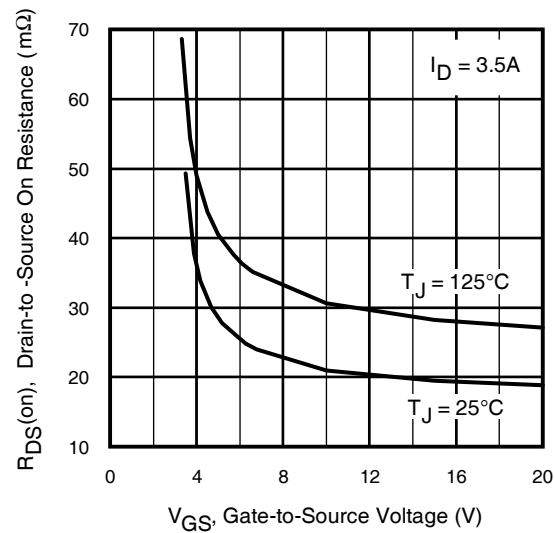
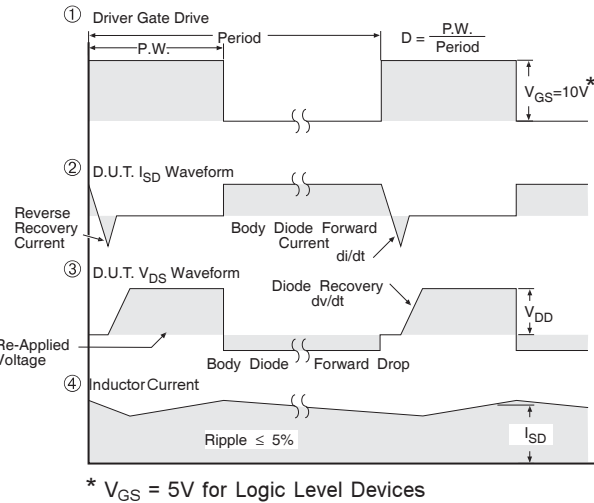
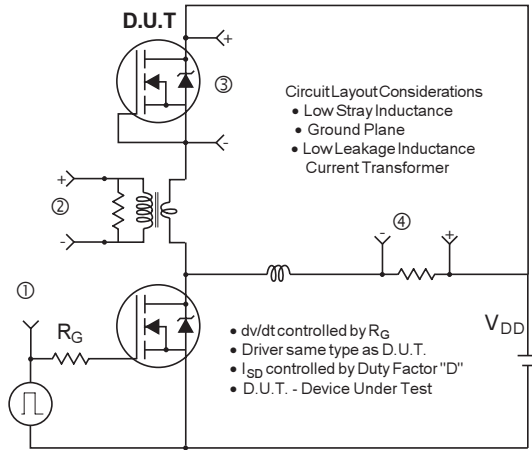
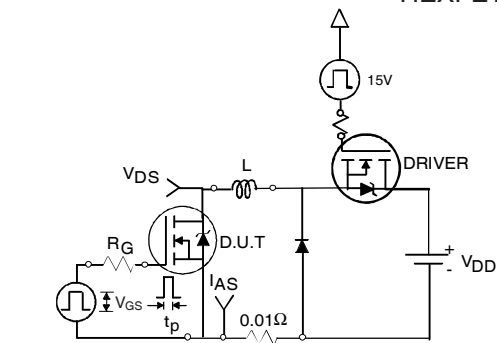


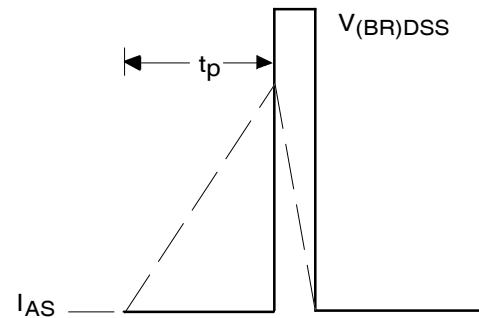
Fig 13. Typical On-Resistance Vs. Gate Voltage



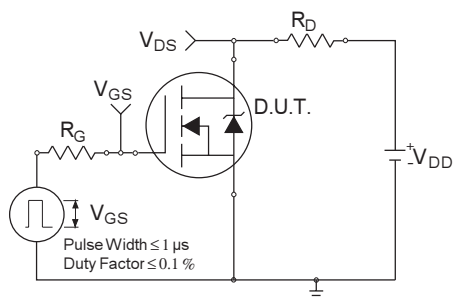
**Fig 14. Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs**



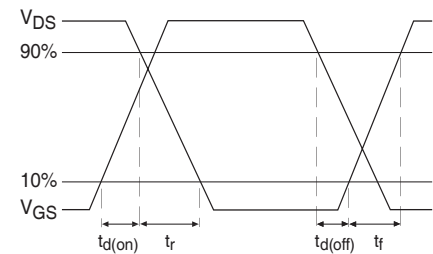
**Fig 15a. Unclamped Inductive Test Circuit**



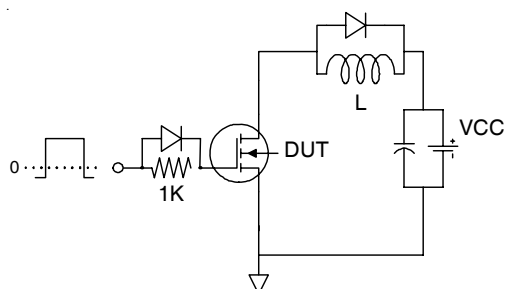
**Fig 15b. Unclamped Inductive Waveforms**



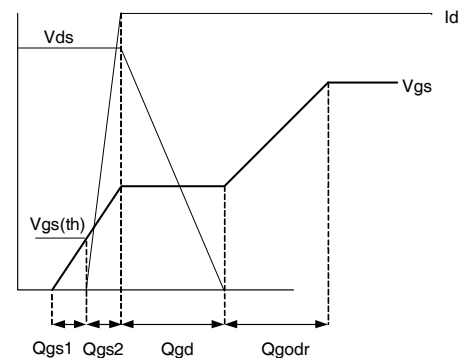
**Fig 16a. Switching Time Test Circuit**



**Fig 16b. Switching Time Waveforms**



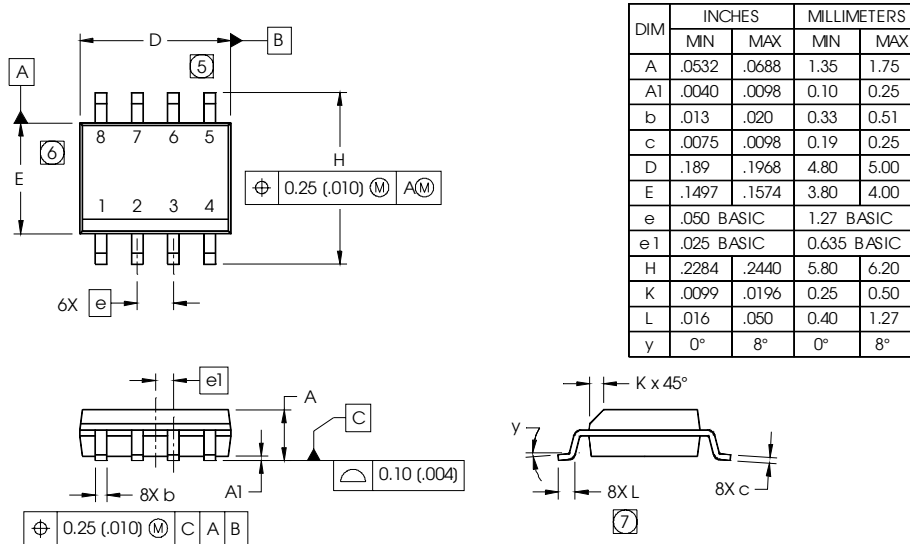
**Fig 17a. Gate Charge Test Circuit**



**Fig 17b. Gate Charge Waveform**

## SO-8 Package Outline

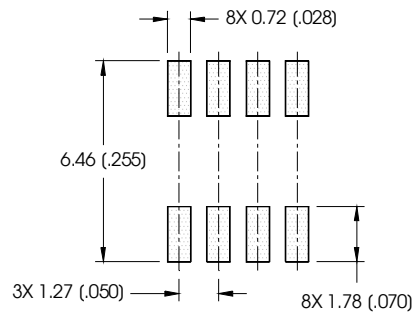
Dimensions are shown in millimeters (inches)



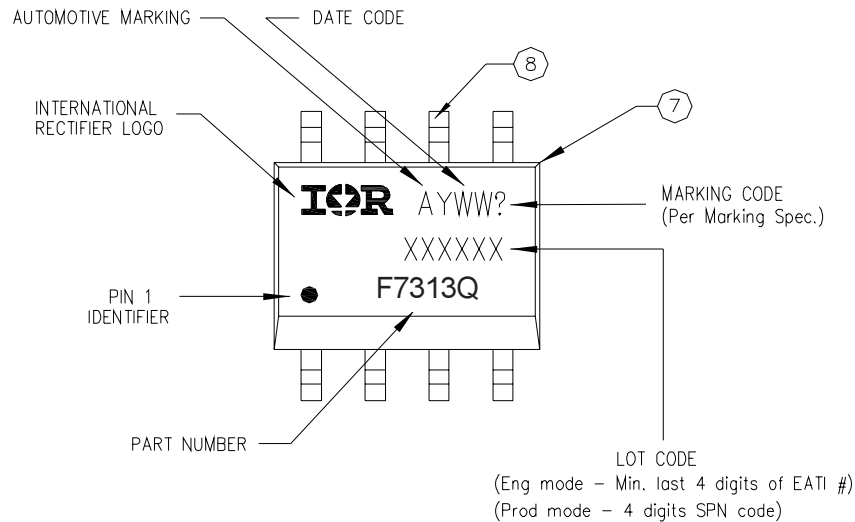
### NOTES:

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.

### FOOTPRINT



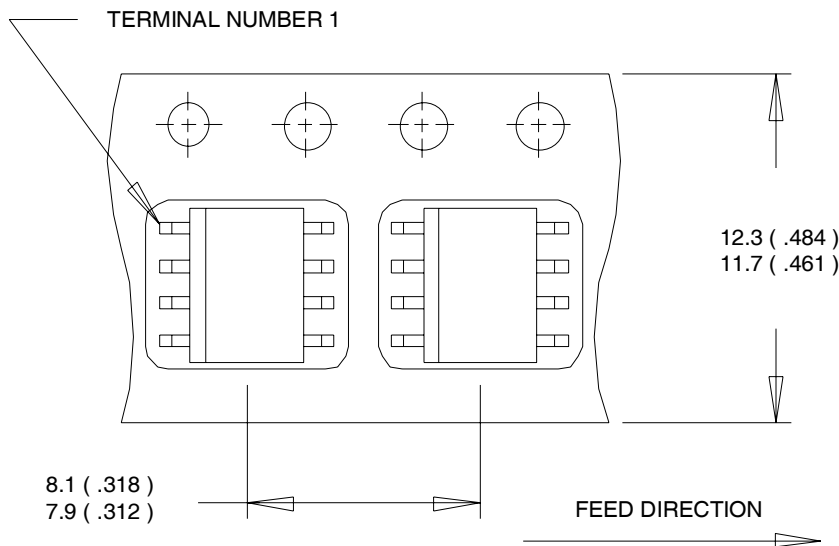
## SO-8 Part Marking



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

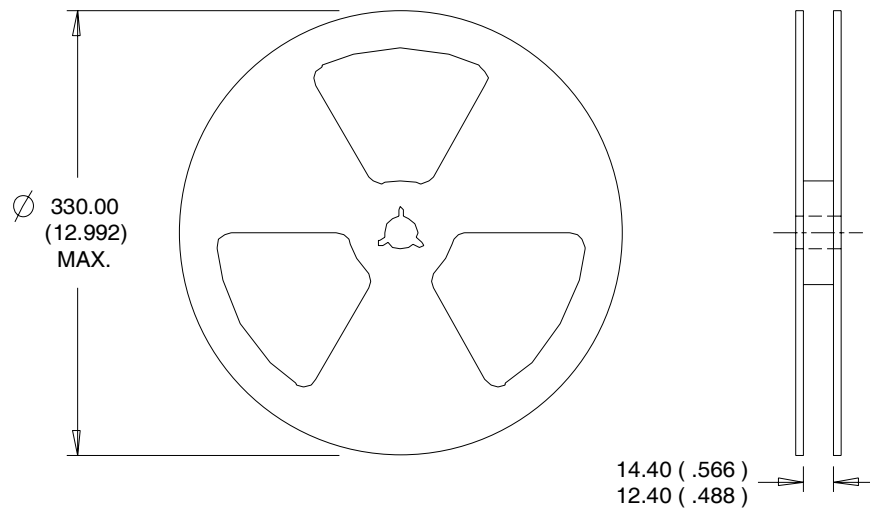
## SO-8 Tape and Reel

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.

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