

# IRF7484

HEXFET<sup>®</sup> Power MOSFET

## Typical Applications

- Relay replacement
- Anti-lock Braking System
- Air Bag

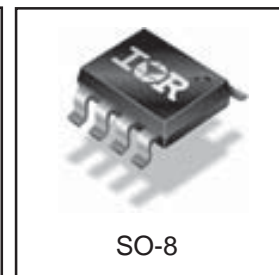
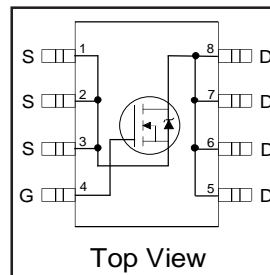
## Benefits

- Advanced Process Technology
- Ultra Low On-Resistance
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax

| V <sub>DSS</sub> | R <sub>DS(on)</sub> max (mΩ) | I <sub>D</sub> |
|------------------|------------------------------|----------------|
| 40V              | 10@V <sub>GS</sub> = 7.0V    | 14A            |

## Description

Specifically designed for Automotive applications, this Stripe Planar design of HEXFET<sup>®</sup> Power MOSFETs utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this HEXFET power MOSFET are a 150°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.



## Absolute Maximum Ratings

|  | Parameter                                       | Max.                     | Units |
|--|---|--------------------------|-------|
| I <sub>D</sub> @ T <sub>A</sub> = 25°C | Continuous Drain Current, V <sub>GS</sub> @ 10V | 14                       | A     |
| I <sub>D</sub> @ T <sub>A</sub> = 70°C | Continuous Drain Current, V <sub>GS</sub> @ 10V | 11                       |       |
| I <sub>DM</sub>                        | Pulsed Drain Current ①                          | 110                      | A     |
| P <sub>D</sub> @ T <sub>A</sub> = 25°C | Power Dissipation③                              | 2.5                      | W     |
|  | Linear Derating Factor                          | 0.02                     | W/°C  |
| V <sub>GS</sub>                        | Gate-to-Source Voltage                          | ± 8.0                    | V     |
| E <sub>AS</sub>                        | Single Pulse Avalanche Energy④                  | 230                      | mJ    |
| I <sub>AR</sub>                        | Avalanche Current①                              | See Fig.16c, 16d, 19, 20 | A     |
| E <sub>AR</sub>                        | Repetitive Avalanche Energy④                    |                          | mJ    |
| T <sub>J</sub> , T <sub>STG</sub>      | Junction and Storage Temperature Range          | -55 to + 150             | °C    |

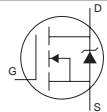
## Thermal Resistance

| Symbol           | Parameter              | Typ. | Max. | Units |
|------------------|------------------------|------|------|-------|
| R <sub>θJL</sub> | Junction-to-Drain Lead | —    | 20   | °C/W  |
| R <sub>θJA</sub> | Junction-to-Ambient ③  | —    | 50   |       |

## 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    | 40   | —     | —    | V          | $V_{GS} = 0V, I_D = 250\mu A$                        |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.040 | —    | V/°C       | Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$ |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —     | 10   | m $\Omega$ | $V_{GS} = 7.0V, I_D = 14A$ ②                         |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 1.0  | —     | 2.0  | V          | $V_{DS} = V_{GS}, I_D = 250\mu A$                    |
| $g_{fs}$                        | Forward Transconductance             | 40   | —     | —    | S          | $V_{DS} = 10V, I_D = 14A$                            |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —     | 20   | $\mu A$    | $V_{DS} = 40V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —     | 250  |            | $V_{DS} = 32V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —     | 200  | nA         | $V_{GS} = 8.0V$                                      |
|                                 | Gate-to-Source Reverse Leakage       | —    | —     | -200 |            | $V_{GS} = -8.0V$                                     |
| $Q_g$                           | Total Gate Charge                    | —    | 69    | 100  | nC         | $I_D = 14A$  |
| $Q_{gs}$                        | Gate-to-Source Charge                | —    | 9.0   | —    |            | $V_{DS} = 32V$                                       |
| $Q_{gd}$                        | Gate-to-Drain ("Miller") Charge      | —    | 16    | —    |            | $V_{GS} = 7.0V$                                      |
| $t_{d(on)}$                     | Turn-On Delay Time                   | —    | 9.3   | —    | ns         | $V_{DD} = 20V$ ②                                     |
| $t_r$                           | Rise Time                            | —    | 5.0   | —    |            | $I_D = 1.0A$   |
| $t_{d(off)}$                    | Turn-Off Delay Time                  | —    | 180   | —    |            | $R_G = 6.2\Omega$                                    |
| $t_f$                           | Fall Time                            | —    | 58    | —    |            | $V_{GS} = 7.0V$                                      |
| $C_{iss}$                       | Input Capacitance                    | —    | 3520  | —    | pF         | $V_{GS} = 0V$  |
| $C_{oss}$                       | Output Capacitance                   | —    | 660   | —    |            | $V_{DS} = 25V$                                       |
| $C_{riss}$                      | Reverse Transfer Capacitance         | —    | 76    | —    |            | $f = 1.0\text{MHz}$                                  |

## Source-Drain Ratings and 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   | —    | —    | 110  |       |  |
| $V_{SD}$ | Diode Forward Voltage                  | —    | —    | 1.3  | V     | $T_J = 25^\circ\text{C}, I_S = 2.3A, V_{GS} = 0V$ ②  |
| $t_{rr}$ | Reverse Recovery Time                  | —    | 59   | 89   | ns    | $T_J = 25^\circ\text{C}, I_F = 2.3A$   |
| $Q_{rr}$ | Reverse Recovery Charge                | —    | 110  | 170  | nC    | $di/dt = 100A/\mu s$ ②   |

### 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  $T_J = 25^\circ\text{C}$ ,  $L = 2.3\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 14A$ . (See Figure 12).
- ⑤  $I_{SD} \leq 14A$ ,  $di/dt \leq 140A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ\text{C}$ .
- ⑥ Limited by  $T_{Jmax}$ , see Fig.16c, 16d, 19, 20 for typical repetitive avalanche performance.

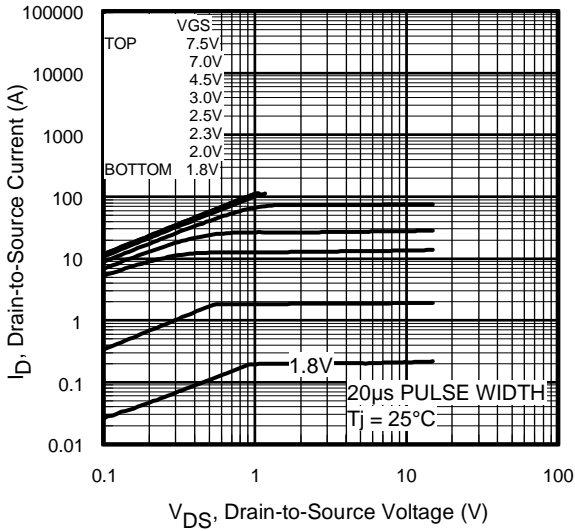


Fig 1. Typical Output Characteristics

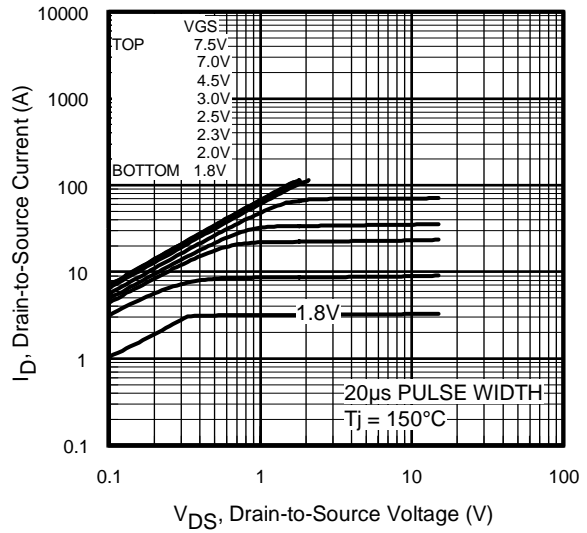


Fig 2. Typical Output Characteristics

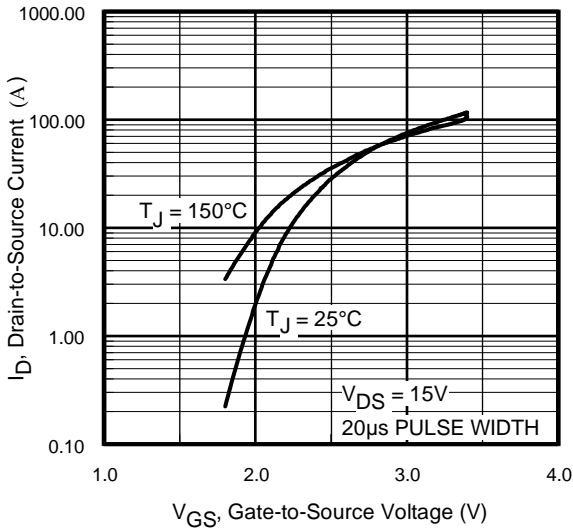


Fig 3. Typical Transfer Characteristics

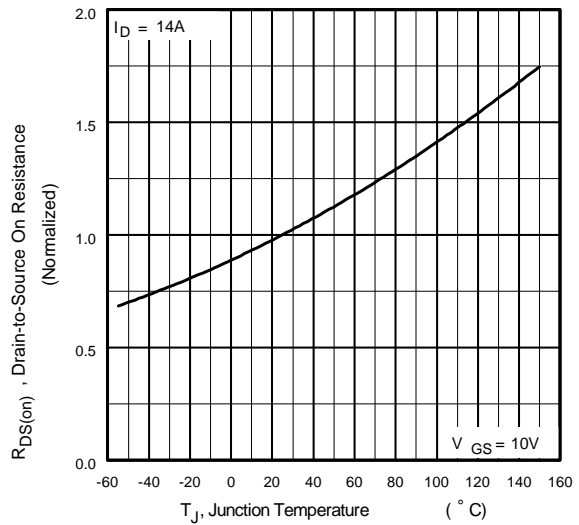
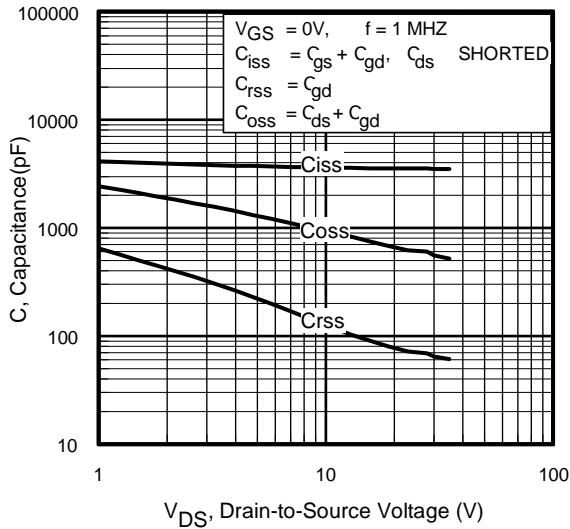
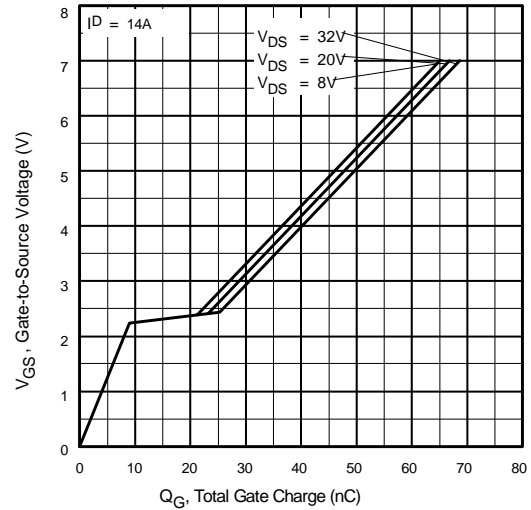


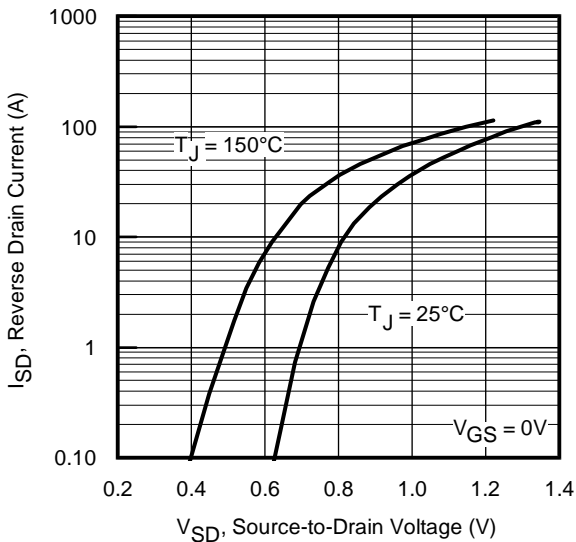
Fig 4. Normalized On-Resistance Vs. Temperature



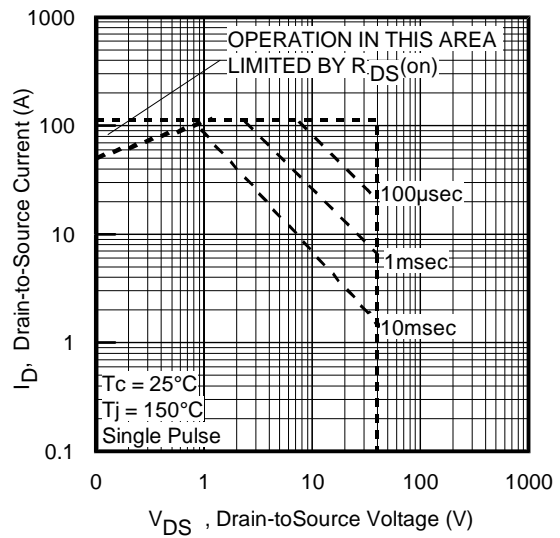
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



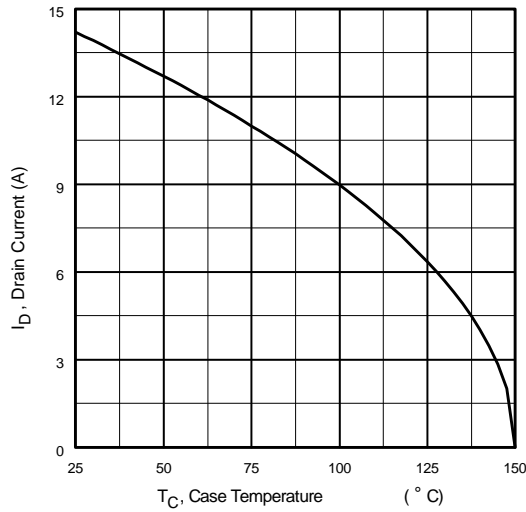
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



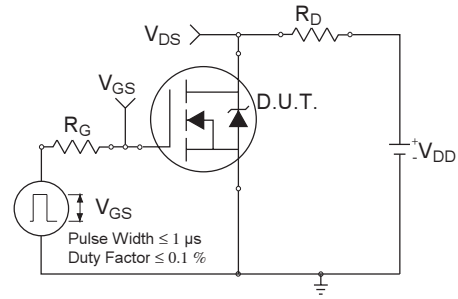
**Fig 7.** Typical Source-Drain Diode Forward Voltage



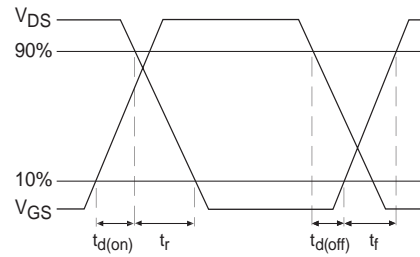
**Fig 8.** Maximum Safe Operating Area



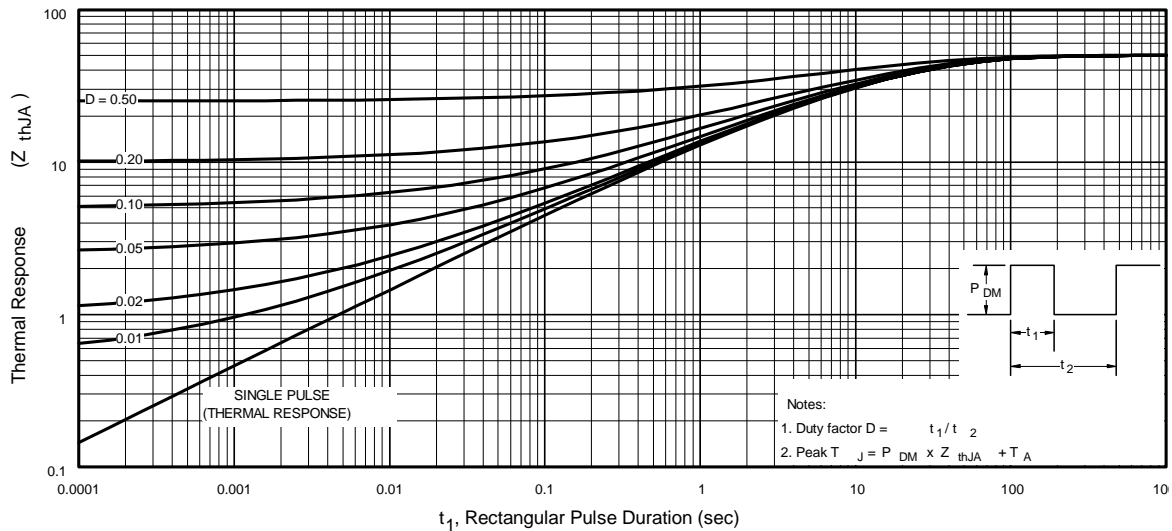
**Fig 9.** Maximum Drain Current Vs. Case Temperature



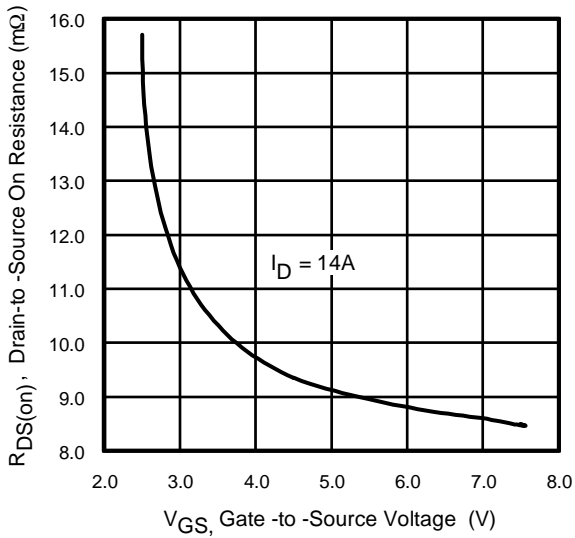
**Fig 10a.** Switching Time Test Circuit



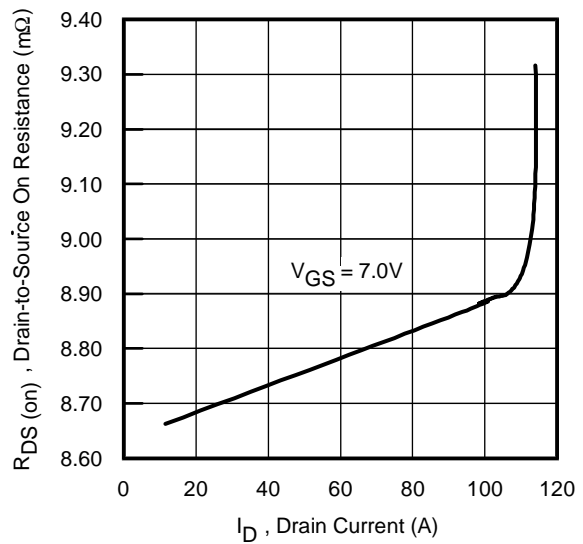
**Fig 10b.** Switching Time Waveforms



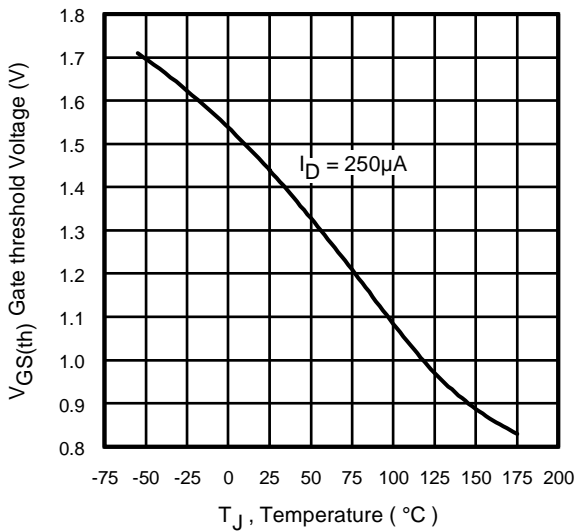
**Fig 11.** Typical Effective Transient Thermal Impedance, Junction-to-Ambient



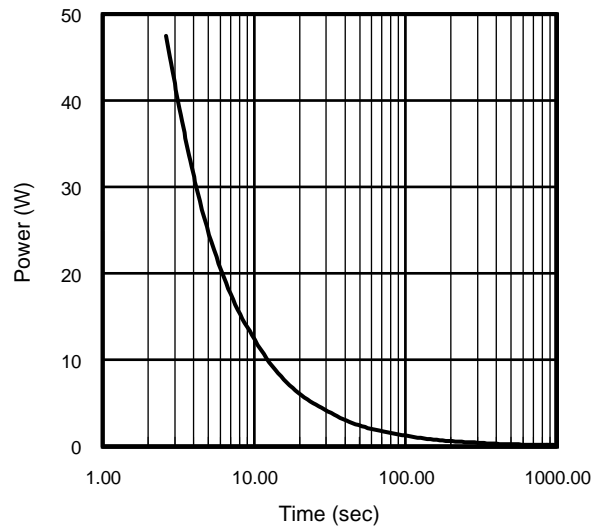
**Fig 12.** Typical On-Resistance Vs. Gate Voltage



**Fig 13.** Typical On-Resistance Vs. Drain Current



**Fig 14.** Typical Threshold Voltage Vs. Junction Temperature



**Fig 15.** Typical Power Vs. Time

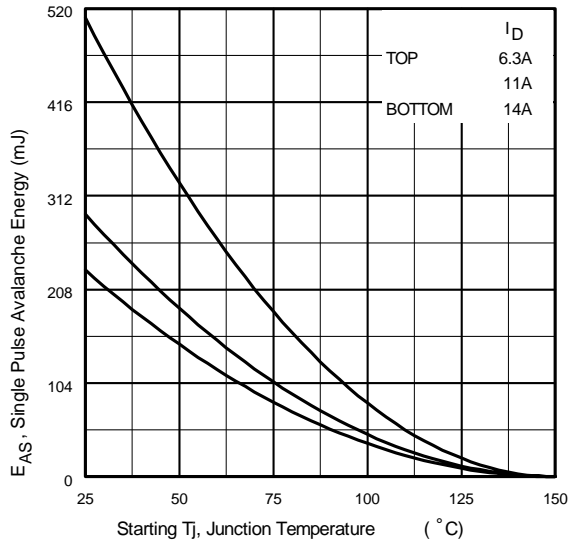


Fig 16a. Maximum Avalanche Energy Vs. Drain Current

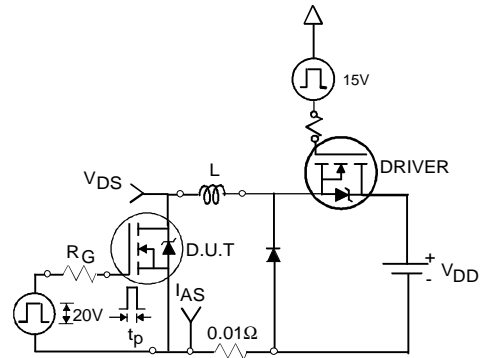


Fig 16c. Unclamped Inductive Test Circuit

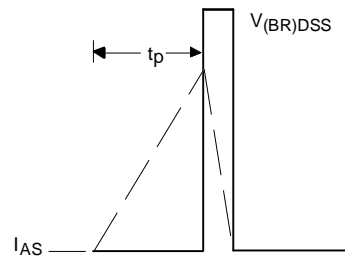


Fig 16d. Unclamped Inductive Waveforms

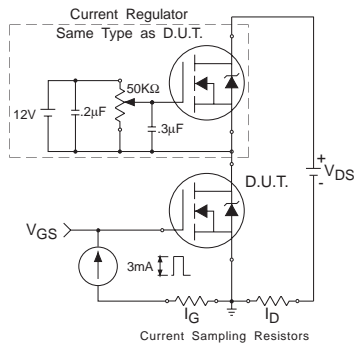


Fig 17. Gate Charge Test Circuit

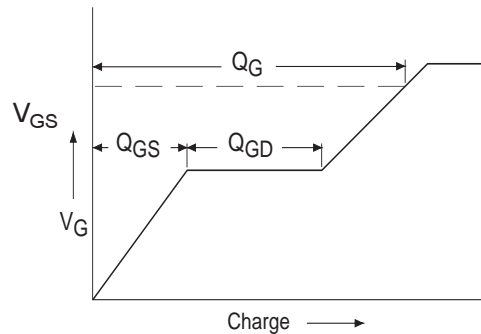
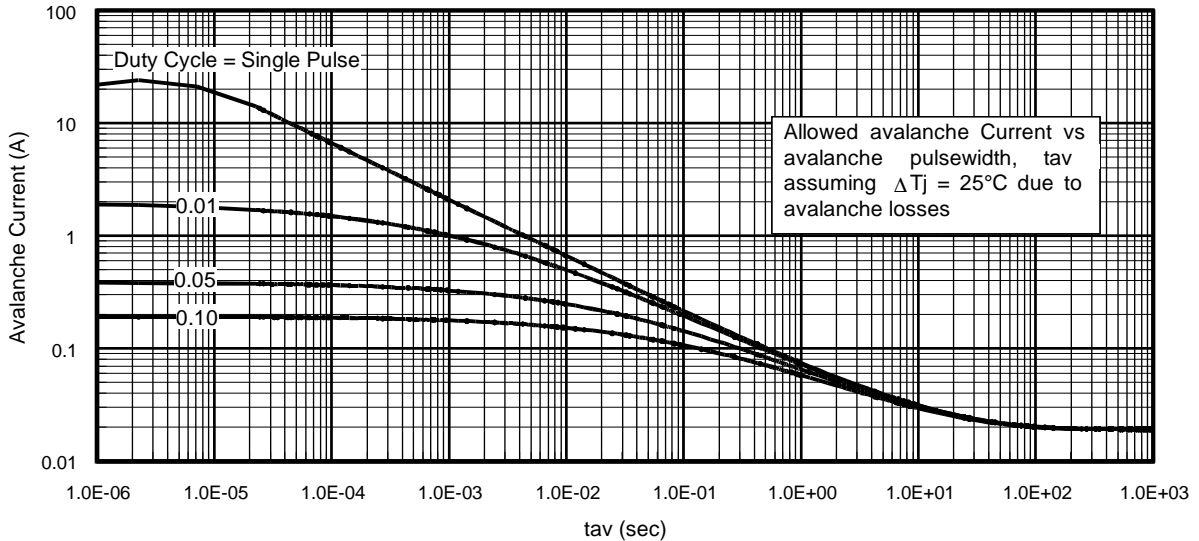
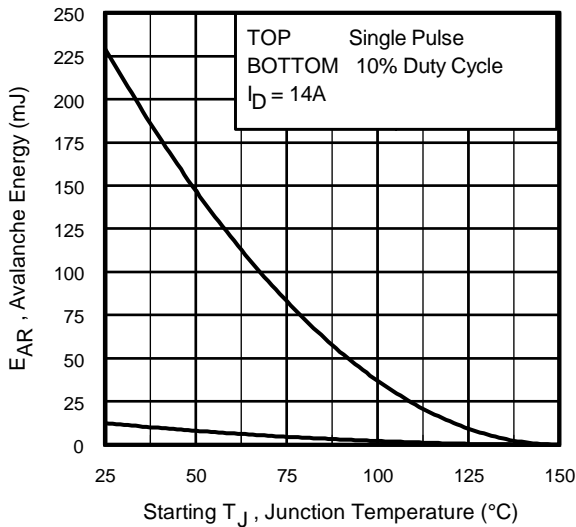


Fig 18. Basic Gate Charge Waveform



**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)**

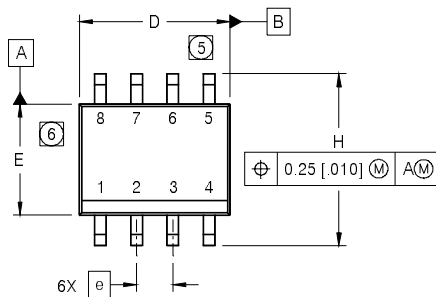
1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as  $T_{jmax}$  is not exceeded.
3. Equation below based on circuit and waveforms 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.  $\Delta T$  = Allowable rise in junction temperature, not to exceed  $T_{jmax}$  (assumed as  $25^\circ\text{C}$  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)

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

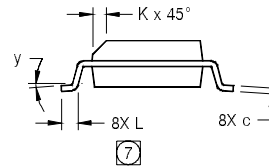
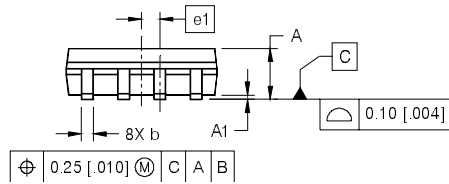
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

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

## SO-8 Package Details



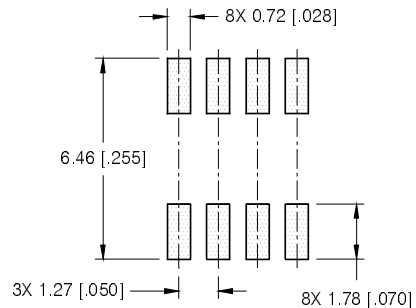
| DIM | INCHES     |       | MILLIMETERS |      |
|-----|------------|-------|-------------|------|
|     | MIN        | MAX   | MIN         | MAX  |
| A   | .0532      | .0688 | 1.35        | 1.75 |
| A1  | .0040      | .0098 | 0.10        | 0.25 |
| b   | .013       | .020  | 0.33        | 0.51 |
| 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:**

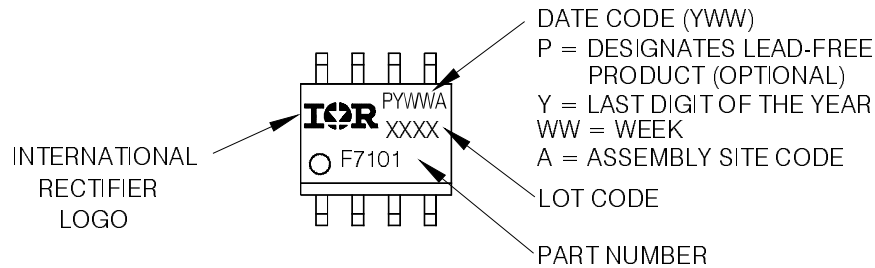
- DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
- CONTROLLING DIMENSION: MILLIMETER
- DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
- DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 [0.006].
- DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [0.010].
- DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

**FOOTPRINT**



## SO-8 Part Marking

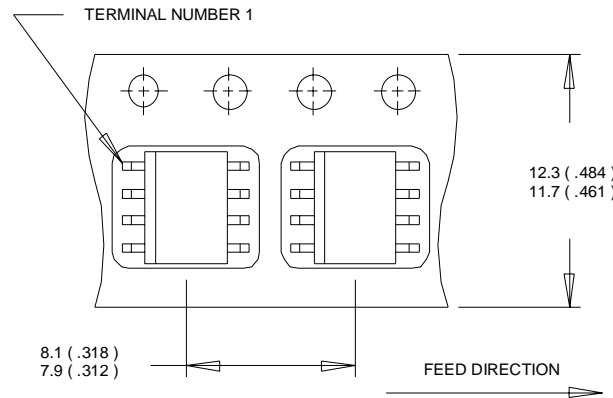
EXAMPLE: THIS IS AN IRF7101 (MOSFET)



# IRF7484

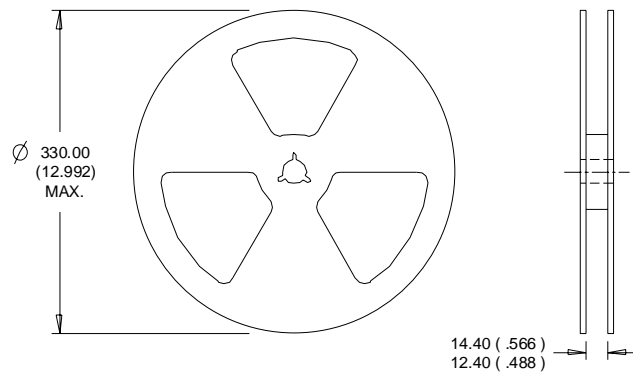
International  
**IR** Rectifier

## SO-8 Tape and Reel



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.

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

International  
**IR** Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
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