

**Applications**

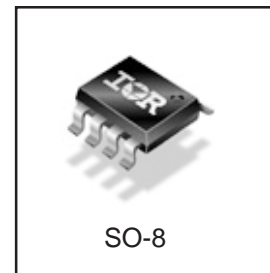
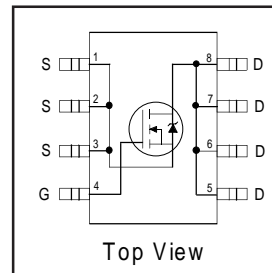
- High Frequency DC-DC Converters with Synchronous Rectification

HEXFET® Power MOSFET

| $V_{DSS}$ | $R_{DS(on)}$ max | $I_D$ |
|-----------|------------------|-------|
| 40V       | 13mΩ             | 10A   |

**Benefits**

- Ultra-Low Gate Impedance
- Very Low  $R_{DS(on)}$  at 4.5V  $V_{GS}$
- Fully Characterized Avalanche Voltage and Current



**Absolute Maximum Ratings**

| Symbol                         | Parameter                                       | Max.         | Units |
|--------------------------------|---|--------------|-------|
| $V_{DS}$                       | Drain-Source Voltage                            | 40           | V     |
| $V_{GS}$                       | Gate-to-Source Voltage                          | ± 12         | V     |
| $I_D @ T_A = 25^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10\text{V}$ | 10           | A     |
| $I_D @ T_A = 70^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10\text{V}$ | 8.5          |       |
| $I_{DM}$                       | Pulsed Drain Current <sup>①</sup>               | 85           |       |
| $P_D @ T_A = 25^\circ\text{C}$ | Maximum Power Dissipation <sup>③</sup>          | 2.5          | W     |
| $P_D @ T_A = 70^\circ\text{C}$ | Maximum Power Dissipation <sup>③</sup>          | 1.6          | W     |
|                                | Linear Derating Factor                          | 0.02         | mW/°C |
| $T_J, T_{STG}$                 | Junction and Storage Temperature Range          | -55 to + 150 | °C    |

**Thermal Resistance**

| Symbol          | Parameter                        | Typ. | Max. | Units |
|-----------------|----------------------------------|------|------|-------|
| $R_{\theta JL}$ | Junction-to-Drain Lead           | —    | 20   | °C/W  |
| $R_{\theta JA}$ | Junction-to-Ambient <sup>④</sup> | —    | 50   |       |

Notes ① through ④ are on page 8  
[www.irf.com](http://www.irf.com)

# IRF7470

International  
**IR** Rectifier

## Static @ $T_J = 25^\circ\text{C}$ (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  | —    | 0.04 | —    | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$ |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | 9.0  | 13   | m $\Omega$          | $V_{GS} = 10V, I_D = 10A$ ④                          |
|                                 |                                      | —    | 10   | 15   |                     | $V_{GS} = 4.5V, I_D = 8.0A$ ④                        |
|                                 |                                      | —    | 14.5 | 30   |                     | $V_{GS} = 2.8V, I_D = 5.0A$ ④                        |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 0.8  | —    | 2.0  | V                   | $V_{DS} = V_{GS}, I_D = 250\mu A$                    |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —    | 20   | $\mu A$             | $V_{DS} = 32V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —    | 100  |                     | $V_{DS} = 32V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —    | 200  | nA                  | $V_{GS} = 12V$                                       |
|                                 | Gate-to-Source Reverse Leakage       | —    | —    | -200 |                     | $V_{GS} = -12V$                                      |

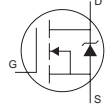
## Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

| Symbol       | Parameter                       | Min. | Typ. | Max. | Units | Conditions                  |
|--------------|---------------------------------|------|------|------|-------|-----------------------------|
| $g_{fs}$     | Forward Transconductance        | 27   | —    | —    | S     | $V_{DS} = 20V, I_D = 8.0A$  |
| $Q_g$        | Total Gate Charge               | —    | 29   | 44   | nC    | $I_D = 8.0A$                |
| $Q_{gs}$     | Gate-to-Source Charge           | —    | 7.9  | 12   |       | $V_{DS} = 20V$              |
| $Q_{gd}$     | Gate-to-Drain ("Miller") Charge | —    | 8.0  | 12   |       | $V_{GS} = 4.5V$ ③           |
| $Q_{oss}$    | Output Gate Charge              | —    | 23   | 35   |       | $V_{GS} = 0V, V_{DS} = 16V$ |
| $t_{d(on)}$  | Turn-On Delay Time              | —    | 10   | —    | ns    | $V_{DD} = 20V$              |
| $t_r$        | Rise Time                       | —    | 1.9  | —    |       | $I_D = 8.0A$                |
| $t_{d(off)}$ | Turn-Off Delay Time             | —    | 21   | —    |       | $R_G = 1.8\Omega$           |
| $t_f$        | Fall Time                       | —    | 3.2  | —    |       | $V_{GS} = 4.5V$ ③           |
| $C_{iss}$    | Input Capacitance               | —    | 3430 | —    |       | $V_{GS} = 0V$               |
| $C_{oss}$    | Output Capacitance              | —    | 690  | —    | pF    | $V_{DS} = 20V$              |
| $C_{rss}$    | Reverse Transfer Capacitance    | —    | 41   | —    |       | $f = 1.0\text{MHz}$         |

## Avalanche Characteristics

| Symbol   | Parameter                      | Typ. | Max. | Units |
|----------|--------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy② | —    | 300  | mJ    |
| $I_{AR}$ | Avalanche Current①             | —    | 8.0  | A     |

## Diode Characteristics

| Symbol   | 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   | —    | —    | 85   |       |  |
| $V_{SD}$ | Diode Forward Voltage                  | —    | 0.80 | 1.3  | V     | $T_J = 25^\circ\text{C}, I_S = 8.0A, V_{GS} = 0V$ ③  |
|          |  | —    | 0.65 | —    |       | $T_J = 125^\circ\text{C}, I_S = 8.0A, V_{GS} = 0V$   |
| $t_{rr}$ | Reverse Recovery Time                  | —    | 72   | 110  | ns    | $T_J = 25^\circ\text{C}, I_F = 8.0A, V_R = 20V$  |
| $Q_{rr}$ | Reverse Recovery Charge                | —    | 130  | 200  | nC    | $di/dt = 100A/\mu s$ ③   |
| $t_{rr}$ | Reverse Recovery Time                  | —    | 76   | 110  | ns    | $T_J = 125^\circ\text{C}, I_F = 8.0A, V_R = 20V$   |
| $Q_{rr}$ | Reverse Recovery Charge                | —    | 150  | 230  | nC    | $di/dt = 100A/\mu s$ ③   |

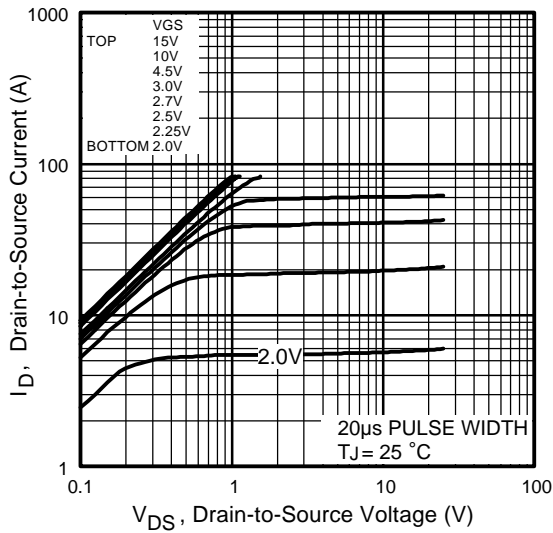


Fig 1. Typical Output Characteristics

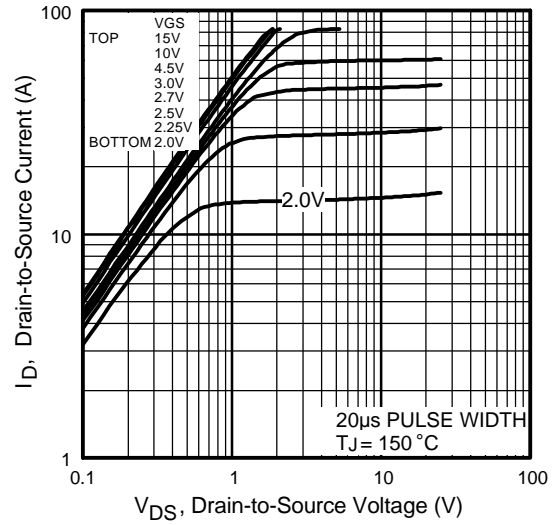


Fig 2. Typical Output Characteristics

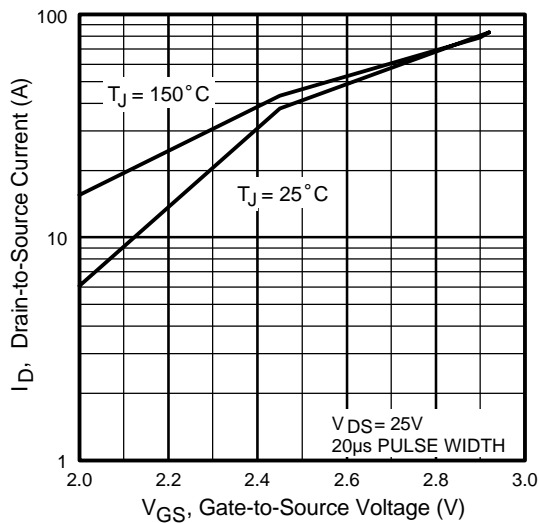


Fig 3. Typical Transfer Characteristics

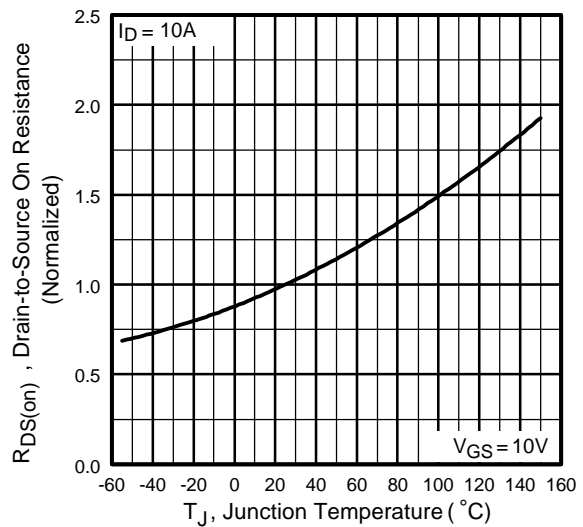
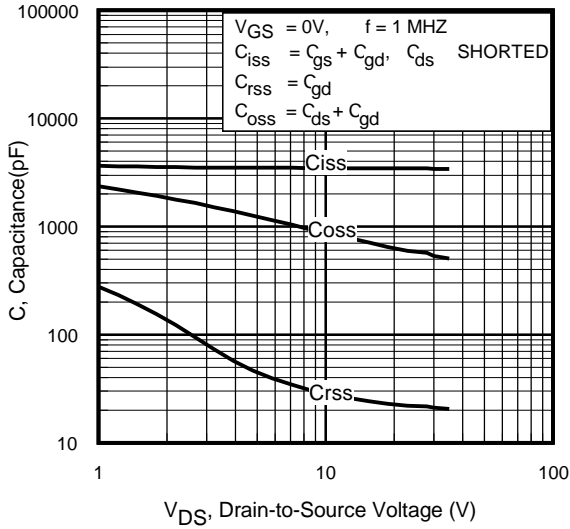
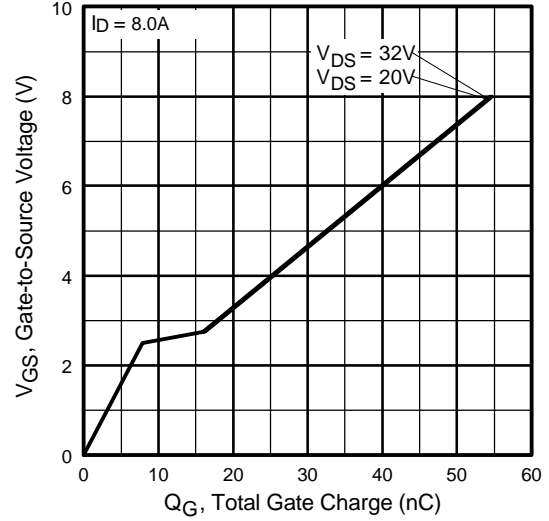


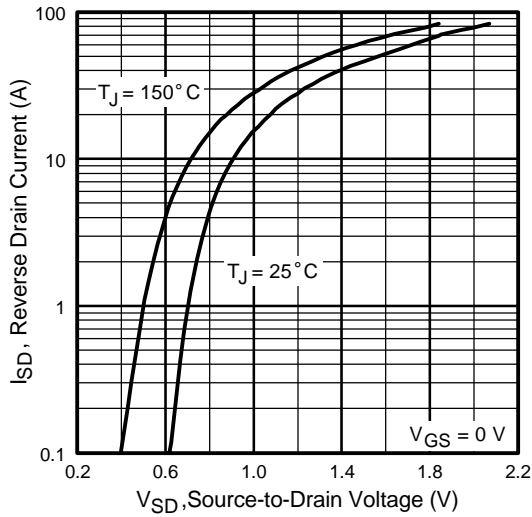
Fig 4. Normalized On-Resistance  
Vs. Temperature



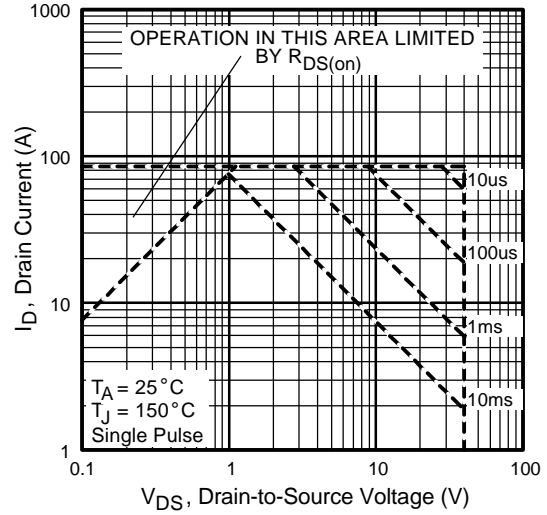
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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



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

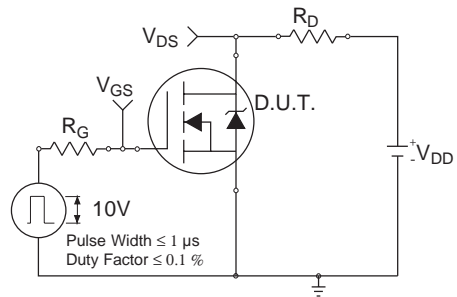
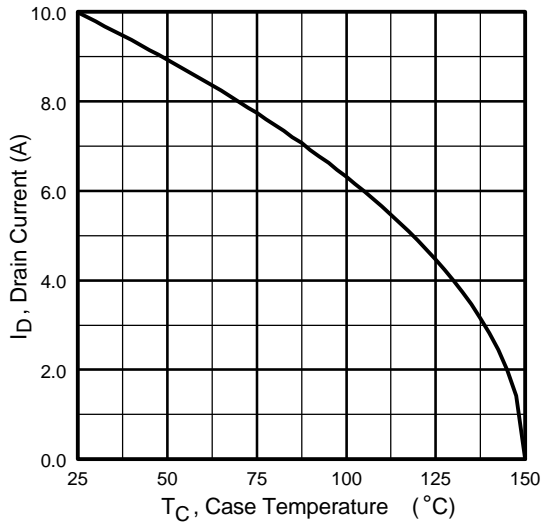


**Fig 8.** Maximum Safe Operating Area

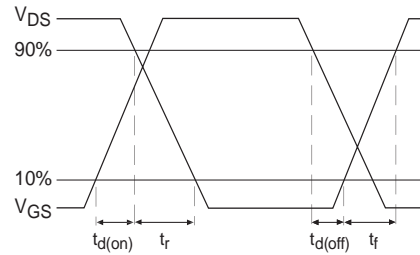
**Fig 6.** On-Resistance Vs. Drain Current

International  
IR Rectifier

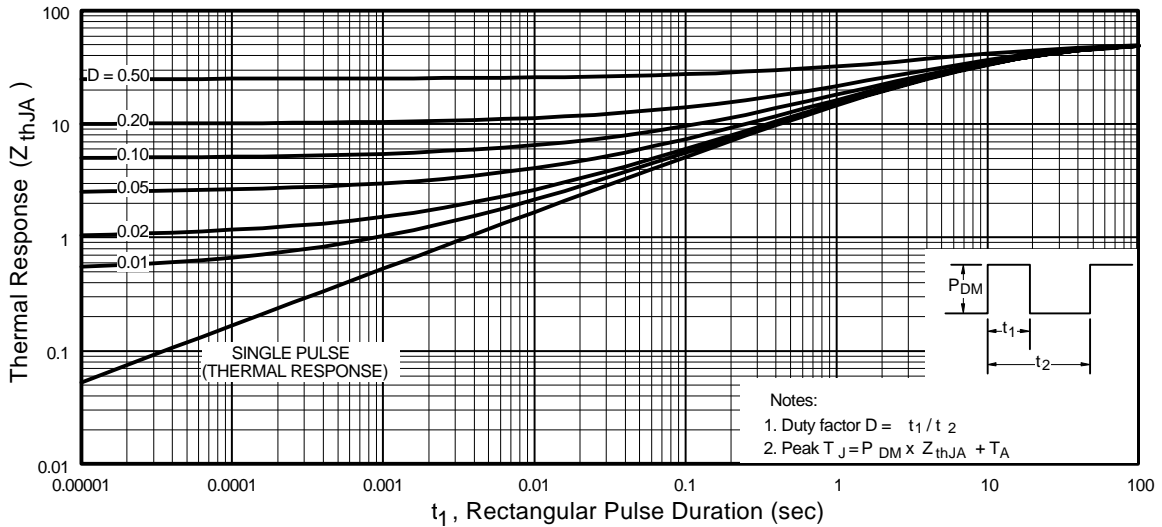
IRF7470



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



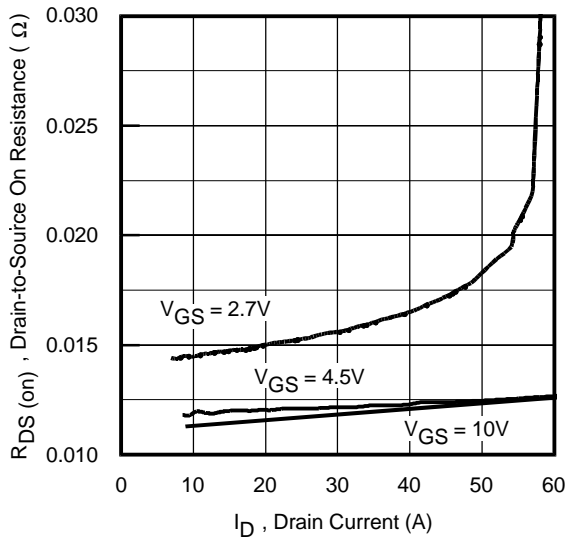
**Fig 10b.** Switching Time Waveforms



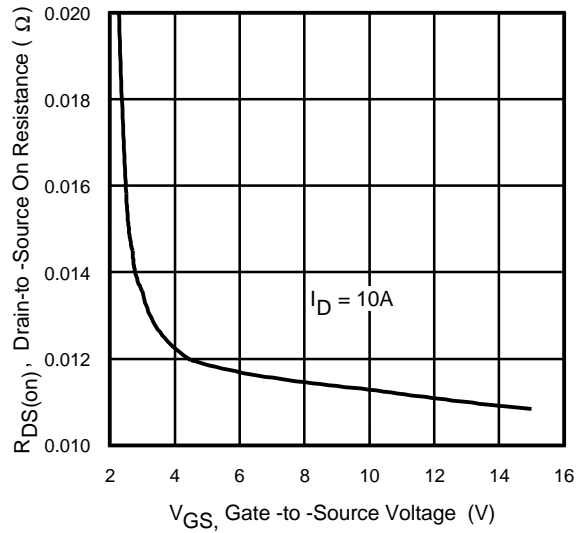
**Fig 10.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

# IRF7470

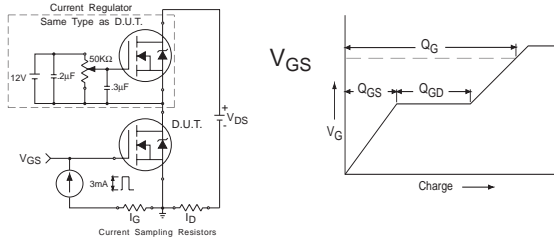
International  
**IR** Rectifier



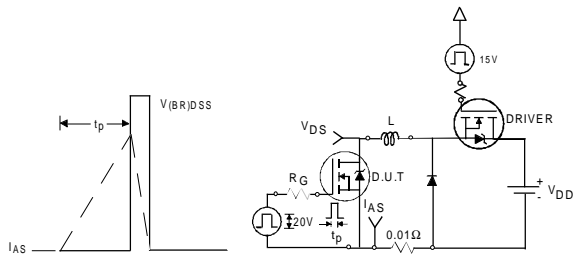
**Fig 12.** On-Resistance Vs. Drain Current



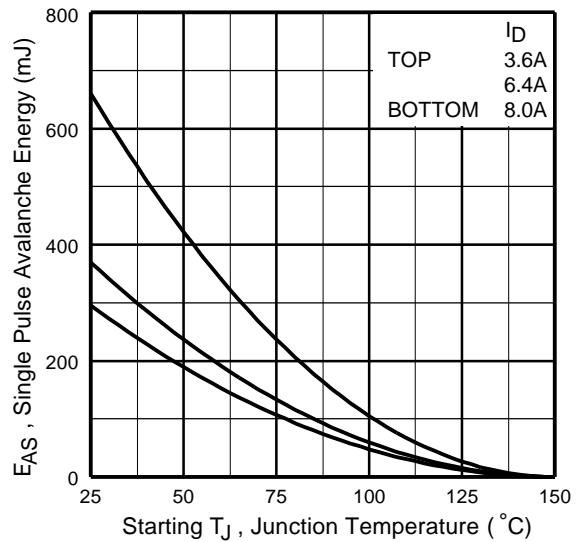
**Fig 13.** On-Resistance Vs. Gate Voltage



**Fig 13a&b.** Basic Gate Charge Test Circuit and Waveform

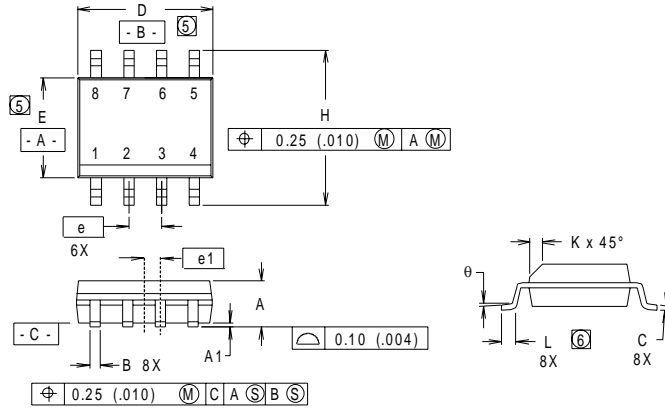


**Fig 14a&b.** Unclamped Inductive Test circuit and Waveforms



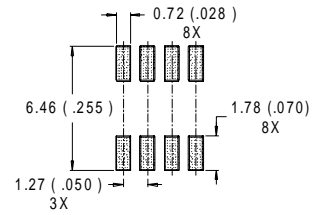
**Fig 14c.** Maximum Avalanche Energy Vs. Drain Current

## 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        | .014       | .018  | 0.36        | 0.46 |
| C        | .0075      | .0098 | 0.19        | 0.25 |
| D        | .189       | .196  | 4.80        | 4.98 |
| E        | .150       | .157  | 3.81        | 3.99 |
| e        | .050 BASIC |       | 1.27 BASIC  |      |
| e1       | .025 BASIC |       | 0.635 BASIC |      |
| H        | .2284      | .2440 | 5.80        | 6.20 |
| K        | .011       | .019  | 0.28        | 0.48 |
| L        | 0.16       | .050  | 0.41        | 1.27 |
| $\theta$ | 0°         | 8°    | 0°          | 8°   |

### RECOMMENDED FOOTPRINT



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1982.
2. CONTROLLING DIMENSION : INCH.
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 0.25 (.006).
- (6) DIMENSIONS IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE..

## SO-8 Part Marking

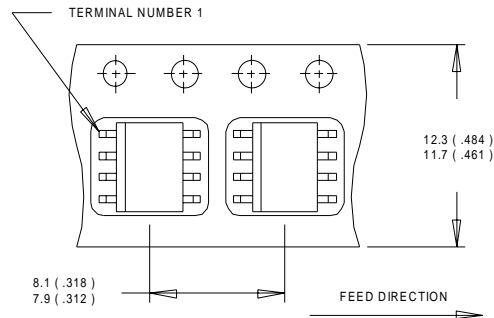
EXAMPLE: THIS IS AN IRF7101



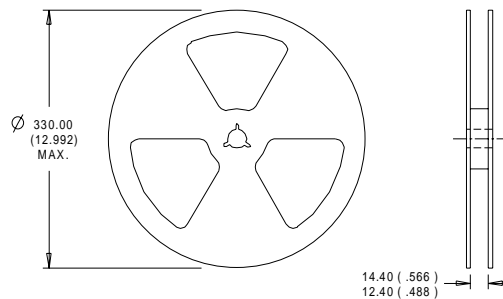
# IRF7470

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.

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 9.4\text{mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 8.0\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ When mounted on 1 inch square copper board,  $t < 10$  sec

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  
TAC Fax: (310) 252-7903

Visit us at [www.irf.com](http://www.irf.com) for sales contact information. 3/01

[www.irf.com](http://www.irf.com)