

**Applications**

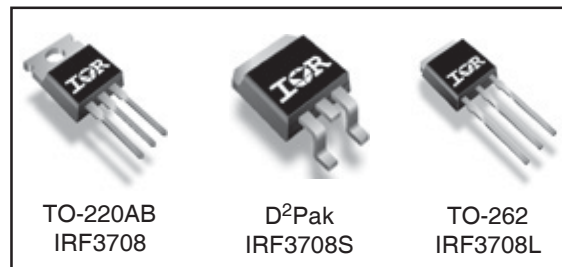
- High Frequency DC-DC Isolated Converters with Synchronous Rectification for Telecom and Industrial Use
- High Frequency Buck Converters for Computer Processor Power
- Lead-Free

**Benefits**

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

HEXFET® Power MOSFET

|           |                  |       |
|-----------|------------------|-------|
| $V_{DSS}$ | $R_{DS(on)}$ max | $I_D$ |
| 30V       | 12mΩ             | 62A   |



**Absolute Maximum Ratings**

| Symbol                   | Parameter                                | Max.         | Units |
|--------------------------|--|--------------|-------|
| $V_{DS}$                 | Drain-Source Voltage                     | 30           | V     |
| $V_{GS}$                 | Gate-to-Source Voltage                   | ±12          | V     |
| $I_D @ T_C = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 62           | A     |
| $I_D @ T_C = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 52           |       |
| $I_{DM}$                 | Pulsed Drain Current <sup>①</sup>        | 248          |       |
| $P_D @ T_C = 25^\circ C$ | Maximum Power Dissipation <sup>③</sup>   | 87           | W     |
| $P_D @ T_C = 70^\circ C$ | Maximum Power Dissipation <sup>③</sup>   | 61           | W     |
|                          | Linear Derating Factor                   | 0.58         | W/°C  |
| $T_J, T_{STG}$           | Junction and Storage Temperature Range   | -55 to + 175 | °C    |

**Thermal Resistance**

|                 | Parameter  | Typ. | Max. | Units |
|-----------------|--|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case                                 | —    | 1.73 | °C/W  |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface <sup>④</sup> | 0.50 | —    |       |
| $R_{\theta JA}$ | Junction-to-Ambient <sup>④</sup>                 | —    | 62   |       |
| $R_{\theta JA}$ | Junction-to-Ambient (PCB mount)*                 | —    | 40   |       |

\* When mounted on 1" square PCB (FR-4 or G-10 Material) .  
For recommended footprint and soldering techniques refer to application note #AN-994

Notes ① through ④ are on page 10

# IRF3708/S/LPbF

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    | 30   | —     | —    | V                   | $V_{GS} = 0V, I_D = 250\mu A$                        |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.028 | —    | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$    |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | 8     | 12.0 | m $\Omega$          | $V_{GS} = 10V, I_D = 15A$ ③                          |
|                                 |                                      | —    | 9.5   | 13.5 |                     | $V_{GS} = 4.5V, I_D = 12A$ ③                         |
|                                 |                                      | —    | 14.5  | 29   |                     | $V_{GS} = 2.8V, I_D = 7.5A$ ③                        |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 0.6  | —     | 2.0  | V                   | $V_{DS} = V_{GS}, I_D = 250\mu A$                    |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —     | 20   | $\mu A$             | $V_{DS} = 24V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —     | 100  |                     | $V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —     | 200  | nA                  | $V_{GS} = 12V$                                       |
|                                 | Gate-to-Source Reverse Leakage       | —    | —     | -200 |                     | $V_{GS} = -12V$                                      |

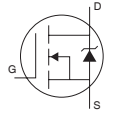
## Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

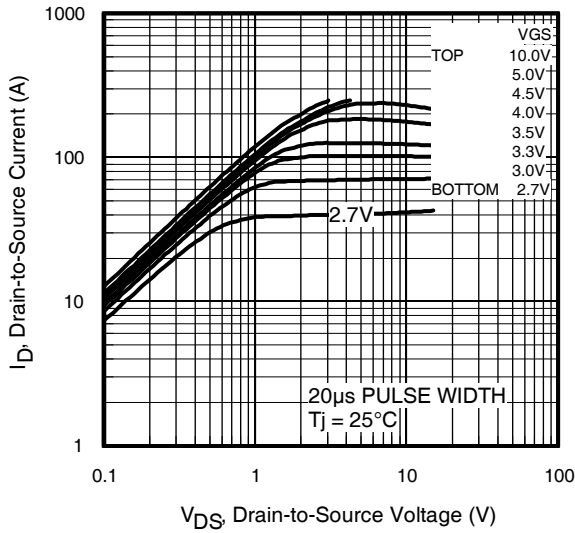
| Symbol       | Parameter                       | Min. | Typ. | Max. | Units | Conditions                               |
|--------------|---------------------------------|------|------|------|-------|--|
| $g_{fs}$     | Forward Transconductance        | 49   | —    | —    | S     | $V_{DS} = 15V, I_D = 50A$                |
| $Q_g$        | Total Gate Charge               | —    | 24   | —    | nC    | $I_D = 24.8A$                            |
| $Q_{gs}$     | Gate-to-Source Charge           | —    | 6.7  | —    |       | $V_{DS} = 15V$                           |
| $Q_{gd}$     | Gate-to-Drain ("Miller") Charge | —    | 5.8  | —    |       | $V_{GS} = 4.5V$ ③                        |
| $Q_{oss}$    | Output Gate Charge              | —    | 14   | 21   |       | $V_{GS} = 0V, I_D = 24.8A, V_{DS} = 15V$ |
| $t_{d(on)}$  | Turn-On Delay Time              | —    | 7.2  | —    | ns    | $V_{DD} = 15V$                           |
| $t_r$        | Rise Time                       | —    | 50   | —    |       | $I_D = 24.8A$                            |
| $t_{d(off)}$ | Turn-Off Delay Time             | —    | 17.6 | —    |       | $R_G = 0.6\Omega$                        |
| $t_f$        | Fall Time                       | —    | 3.7  | —    |       | $V_{GS} = 4.5V$ ③                        |
| $C_{iss}$    | Input Capacitance               | —    | 2417 | —    | pF    | $V_{GS} = 0V$                            |
| $C_{oss}$    | Output Capacitance              | —    | 707  | —    |       | $V_{DS} = 15V$                           |
| $C_{rss}$    | Reverse Transfer Capacitance    | —    | 52   | —    |       | $f = 1.0\text{MHz}$                      |

## Avalanche Characteristics

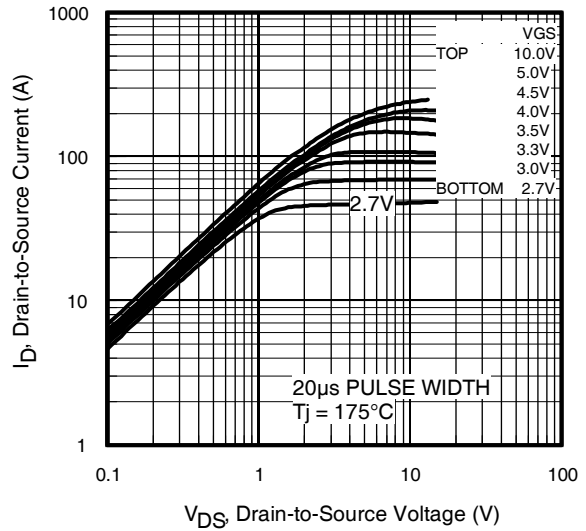
| Symbol   | Parameter                      | Typ. | Max. | Units |
|----------|--------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy② | —    | 213  | mJ    |
| $I_{AR}$ | Avalanche Current①             | —    | 62   | A     |

## Diode Characteristics

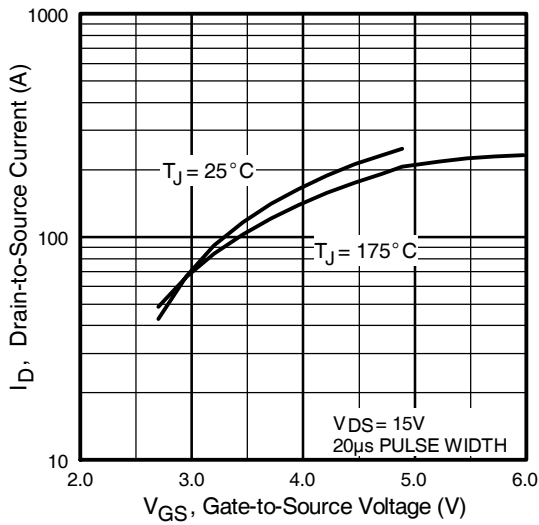
| Symbol   | Parameter                              | Min. | Typ. | Max. | Units | Conditions   |
|----------|--|------|------|------|-------|--|
| $I_S$    | Continuous Source Current (Body Diode) | —    | —    | 62   | A     | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —    | —    | 248  |       |  |
| $V_{SD}$ | Diode Forward Voltage                  | —    | 0.88 | 1.3  | V     | $T_J = 25^\circ\text{C}, I_S = 31A, V_{GS} = 0V$ ③   |
|          |  | —    | 0.80 | —    |       | $T_J = 125^\circ\text{C}, I_S = 31A, V_{GS} = 0V$ ③  |
| $t_{rr}$ | Reverse Recovery Time                  | —    | 41   | 62   | ns    | $T_J = 25^\circ\text{C}, I_F = 31A, V_R = 20V$   |
| $Q_{rr}$ | Reverse Recovery Charge                | —    | 64   | 96   | nC    | $di/dt = 100A/\mu s$ ③   |
| $t_{rr}$ | Reverse Recovery Time                  | —    | 43   | 65   | ns    | $T_J = 125^\circ\text{C}, I_F = 31A, V_R = 20V$  |
| $Q_{rr}$ | Reverse Recovery Charge                | —    | 70   | 105  | nC    | $di/dt = 100A/\mu s$ ③   |



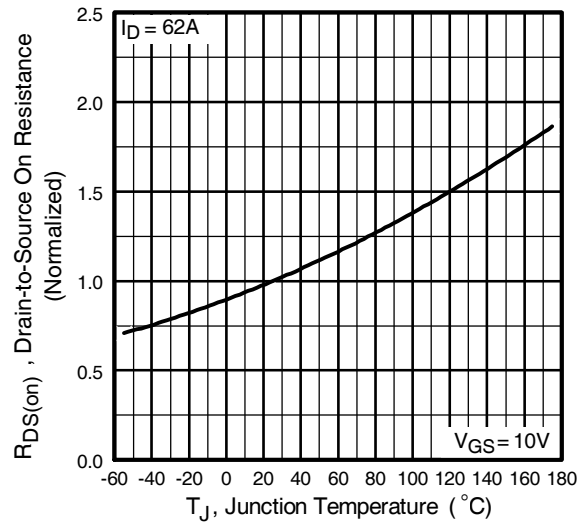
**Fig 1.** Typical Output Characteristics



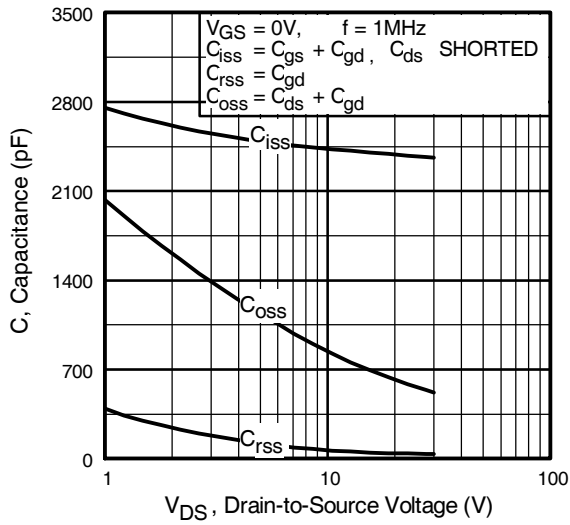
**Fig 2.** Typical Output Characteristics



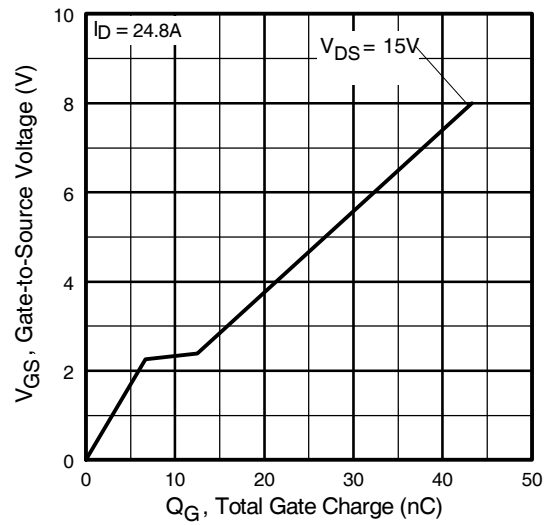
**Fig 3.** Typical Transfer Characteristics



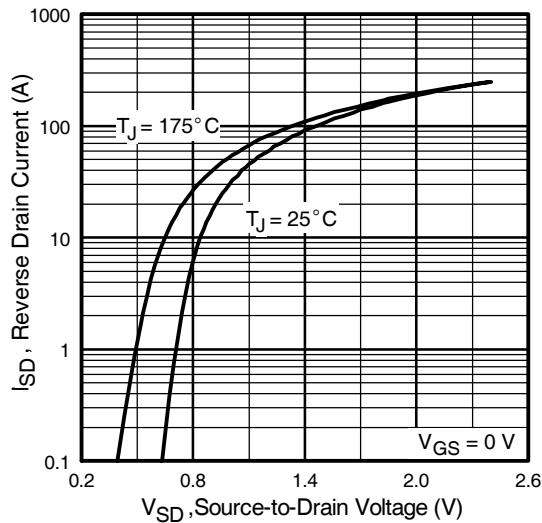
**Fig 4.** Normalized On-Resistance Vs. Temperature



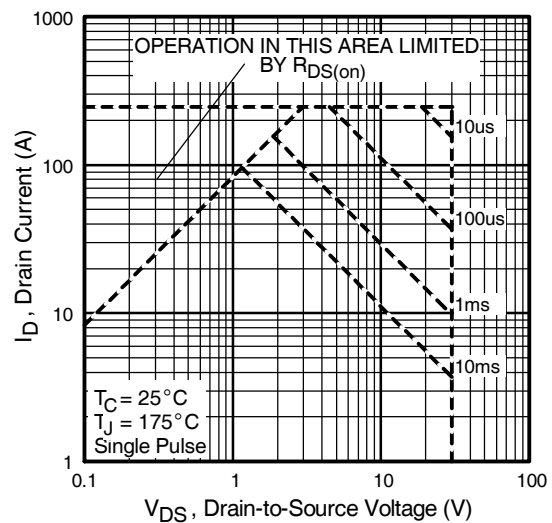
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



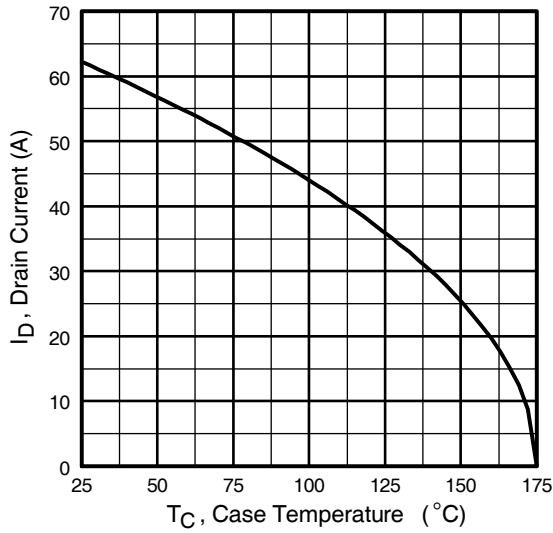
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



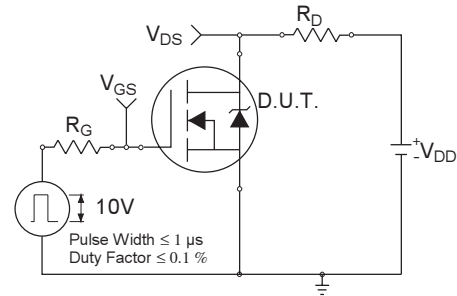
**Fig 7.** Typical Source-Drain Diode Forward Voltage



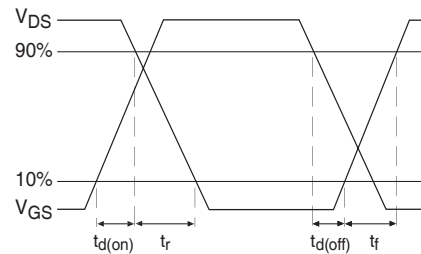
**Fig 8.** Maximum Safe Operating Area



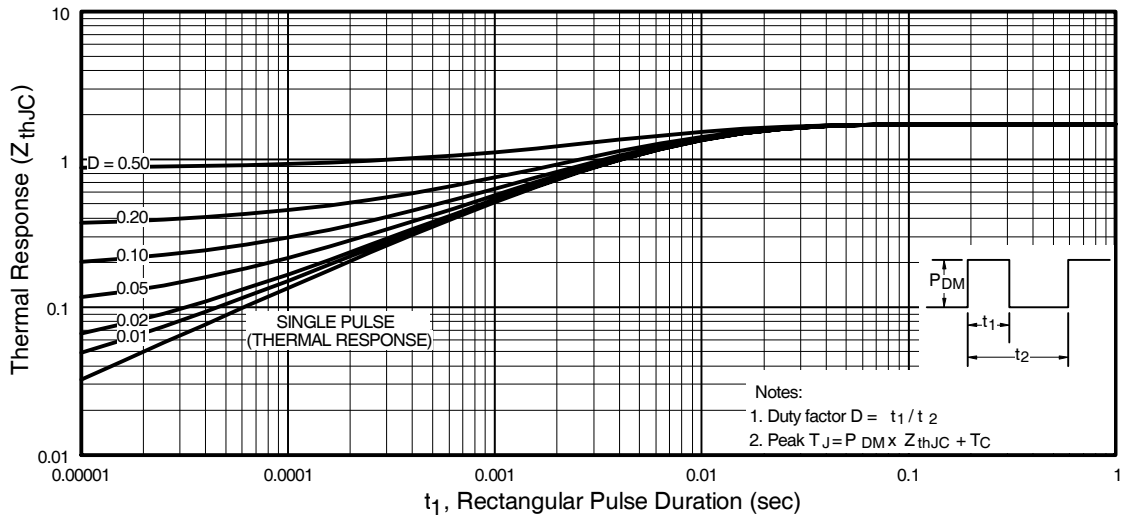
**Fig 9.** Maximum Drain Current Vs. Case Temperature



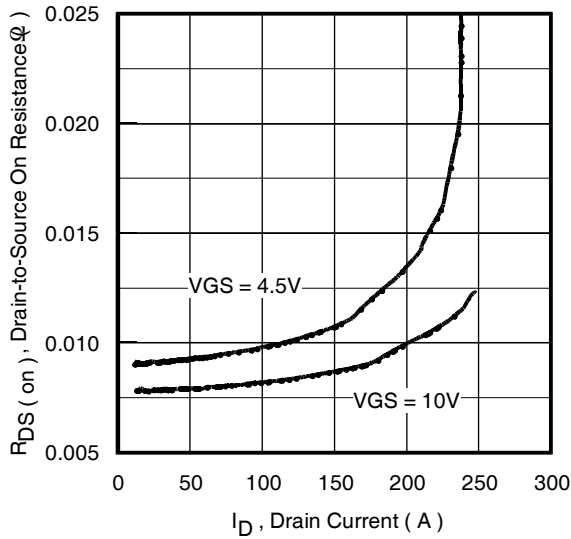
**Fig 10a.** Switching Time Test Circuit



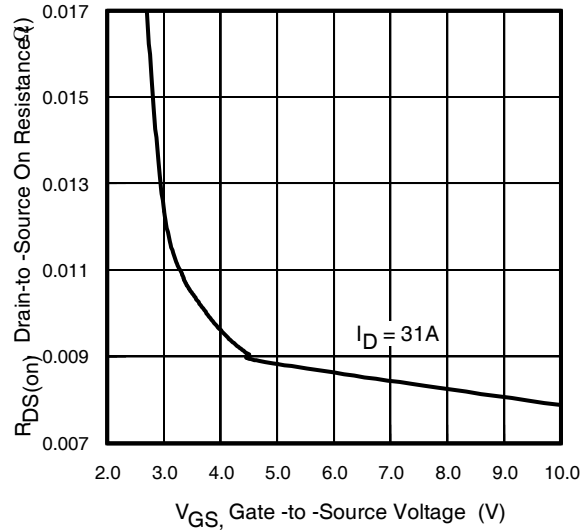
**Fig 10b.** Switching Time Waveforms



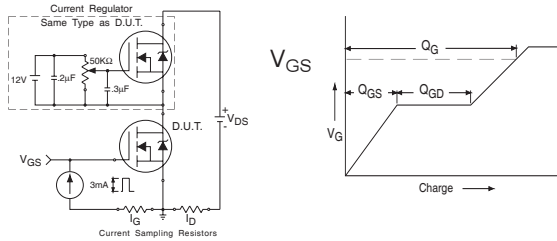
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



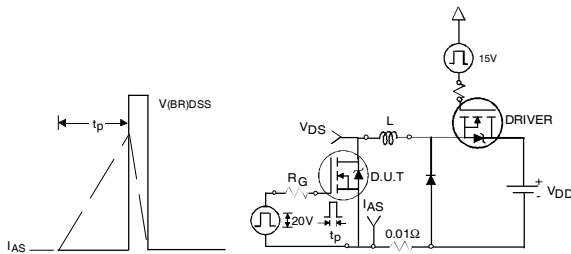
**Fig 12.** On-Resistance Vs. Drain Current



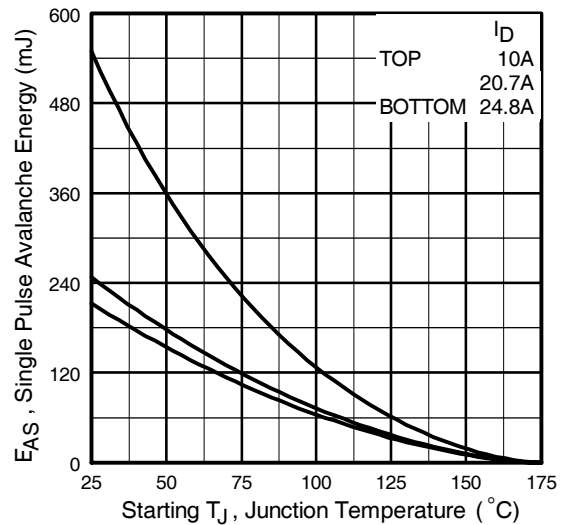
**Fig 13.** On-Resistance Vs. Gate Voltage



**Fig 14a&b.** Gate Charge Test Circuit and Waveform



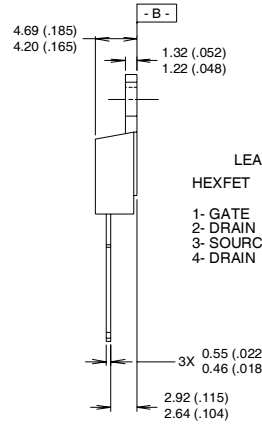
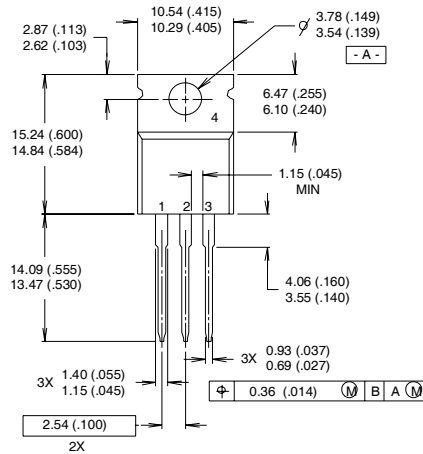
**Fig 15a&b.** Unclamped Inductive Test circuit and Waveforms



**Fig 15c.** Maximum Avalanche Energy Vs. Drain Current

## TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



LEAD ASSIGNMENTS

| HEXFET    | IGBTs, CoPACK |
|-----------|---------------|
| 1- GATE   | 1- GATE       |
| 2- DRAIN  | 2- COLLECTOR  |
| 3- SOURCE | 3- EMITTER    |
| 4- DRAIN  | 4- COLLECTOR  |

NOTES:

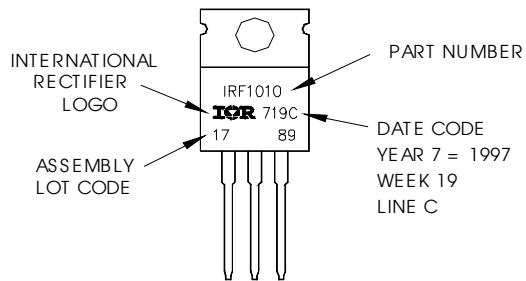
- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH

- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

## TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 1997  
 IN THE ASSEMBLY LINE "C"

**Note:** "P" in assembly line position indicates "Lead-Free"

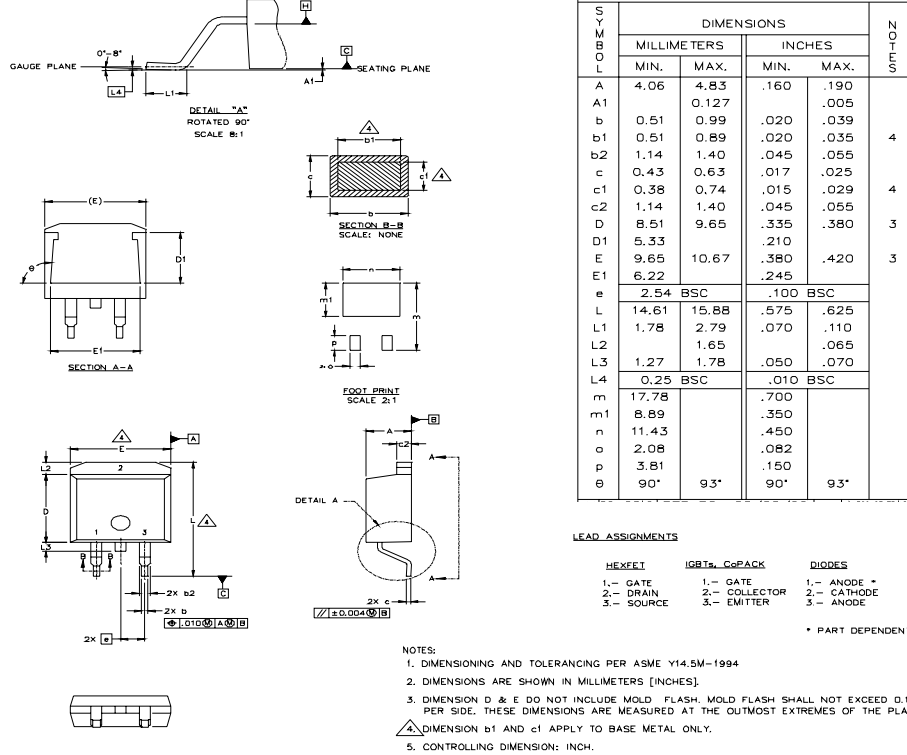


# IRF3708/S/LPbF

International  
**IR** Rectifier

## D<sup>2</sup>Pak Package Outline

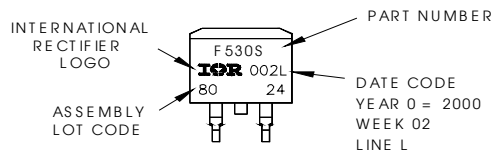
Dimensions are shown in millimeters (inches)



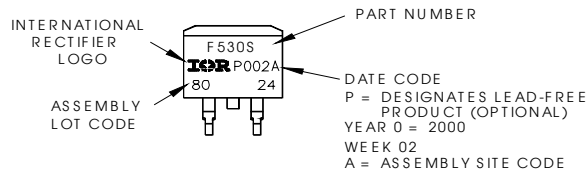
## D<sup>2</sup>Pak Part Marking Information (Lead-Free)

EXAMPLE: THIS IS AN IRF530S WITH  
LOT CODE 8024  
ASSEMBLED ON WW 02, 2000  
IN THE ASSEMBLY LINE "L"

Note: "P" in assembly line  
position indicates "Lead-Free"

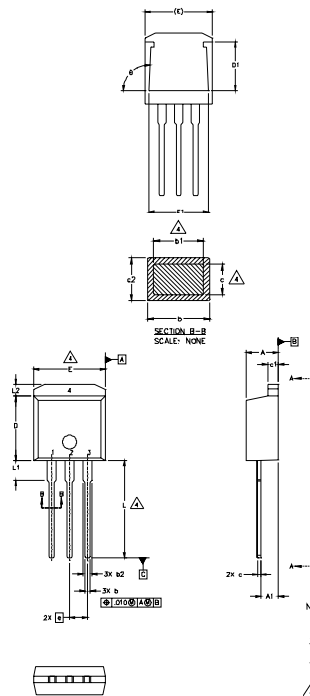


**OR**





## TO-262 Package Outline



| SYMBOL | DIMENSIONS  |       |          |      | NOTES |
|--------|-------------|-------|----------|------|-------|
|        | MILLIMETERS |       | INCHES   |      |       |
|        | MIN.        | MAX.  | MIN.     | MAX. |       |
| A      | 4.06        | 4.83  | .160     | .190 |       |
| A1     | 2.03        | 2.92  | .080     | .115 |       |
| b      | 0.51        | 0.99  | .020     | .039 |       |
| b1     | 0.51        | 0.89  | .020     | .035 | 4     |
| b2     | 1.14        | 1.40  | .045     | .055 |       |
| c      | 0.38        | 0.63  | .015     | .025 | 4     |
| c1     | 1.14        | 1.40  | .045     | .055 |       |
| c2     | 0.43        | .063  | .017     | .029 |       |
| D      | 8.51        | 9.65  | .335     | .380 | 3     |
| D1     | 5.33        |       | .210     |      |       |
| E      | 9.65        | 10.67 | .380     | .420 | 3     |
| E1     | 6.22        |       | .245     |      |       |
| e      | 2.54 BSC    |       | .100 BSC |      |       |
| L      | 13.46       | 14.09 | .530     | .555 |       |
| L1     | 3.56        | 3.71  | .140     | .146 |       |
| L2     |             | 1.65  |          | .065 |       |

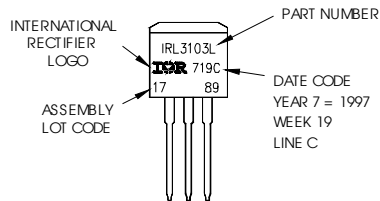
**LEAD ASSIGNMENTS**

|               |              |
|---------------|--------------|
|               | IGBT         |
| <b>HEXFET</b> | 1- GATE      |
| 1.- GATE      | 2- COLLECTOR |
| 2.- DRAIN     | 3- EMITTER   |
| 3.- SOURCE    |              |
| 4.- DRAIN     |              |

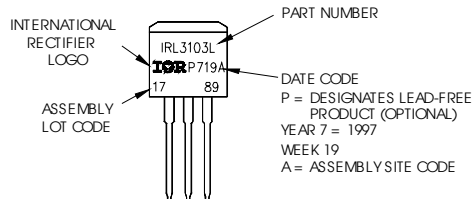
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
  2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
  3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
  4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
  5. CONTROLLING DIMENSION: INCH.

## TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 1997  
 IN THE ASSEMBLY LINE "C"  
 Note: "P" in assembly line  
 position indicates "Lead-Free"



**OR**

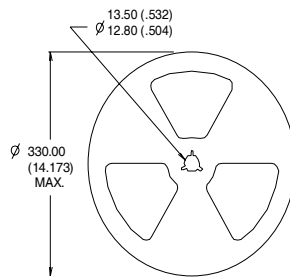
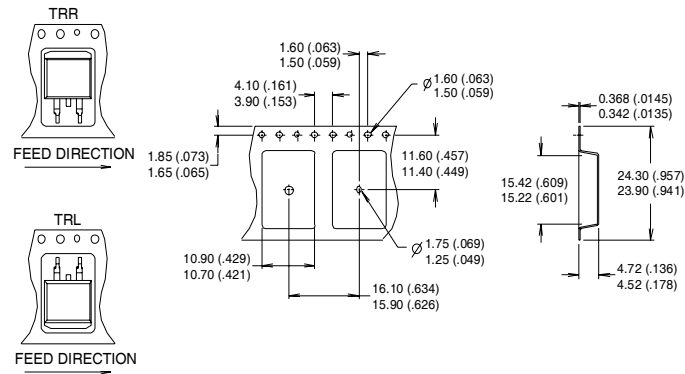


# IRF3708/S/LPbF

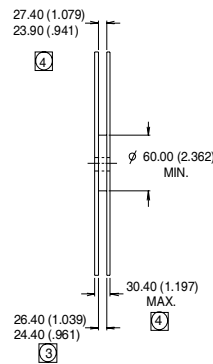
International  
**IR** Rectifier

## D<sup>2</sup>Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



- NOTES:
1. CONFORMS TO EIA-418.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION MEASURED @ HUB.
  4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.



### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.7 \text{ mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 24.8 \text{ A}$ .
- ③ Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ This is only applied to TO-220AB package

Data and specifications subject to change without notice.

International  
**IR** Rectifier

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TAC Fax: (310) 252-7903

Visit us at [www.irf.com](http://www.irf.com) for sales contact information.06/04

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