

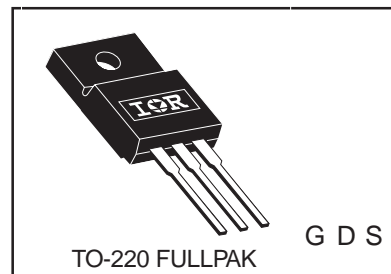
**Applications**

- Switch Mode Power Supply ( SMPS )
- Uninterruptable Power Supply
- High speed power switching
- High Voltage Isolation = 2.5KVRMSⓄ

|                        |                               |                      |
|------------------------|-------------------------------|----------------------|
| <b>V<sub>DSS</sub></b> | <b>R<sub>ds(on)</sub> max</b> | <b>I<sub>D</sub></b> |
| <b>600V</b>            | <b>0.75Ω</b>                  | <b>5.5A</b>          |

**Benefits**

- Low Gate Charge Q<sub>g</sub> results in Simple Drive Requirement
- Improved Gate, Avalanche and dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current



**Absolute Maximum Ratings**

|   | <b>Parameter</b>                                | <b>Max.</b>            | <b>Units</b> |
|---|---|------------------------|--------------|
| I <sub>D</sub> @ T <sub>C</sub> = 25°C  | Continuous Drain Current, V <sub>GS</sub> @ 10V | 5.5                    | A            |
| I <sub>D</sub> @ T <sub>C</sub> = 100°C | Continuous Drain Current, V <sub>GS</sub> @ 10V | 3.5                    |              |
| I <sub>DM</sub>                         | Pulsed Drain Current ①                          | 37                     |              |
| P <sub>D</sub> @ T <sub>C</sub> = 25°C  | Power Dissipation                               | 60                     | W            |
|   | Linear Derating Factor                          | 0.48                   | W/°C         |
| V <sub>GS</sub>                         | Gate-to-Source Voltage                          | ± 30                   | V            |
| dv/dt                                   | Peak Diode Recovery dv/dt ③                     | 5.0                    | V/ns         |
| T <sub>J</sub>                          | Operating Junction and                          | -55 to + 150           | °C           |
| T <sub>STG</sub>                        | Storage Temperature Range                       |                        |              |
|   | Soldering Temperature, for 10 seconds           | 300 (1.6mm from case ) |              |
|   | Mounting torque, 6-32 or M3 screw               | 10 lbf•in (1.1N•m)     |              |

**Typical SMPS Topologies:**

- Single Transistor Forward
- Active Clamped Forward

# IRFIB6N60A

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    | 600  | —    | —    | V        | $V_{GS} = 0V, I_D = 250\mu A$                         |
| $R_{DS(on)}$  | Static Drain-to-Source On-Resistance | —    | —    | 0.75 | $\Omega$ | $V_{GS} = 10V, I_D = 3.3A$ ④                          |
| $V_{GS(th)}$  | Gate Threshold Voltage               | 2.0  | —    | 4.0  | V        | $V_{DS} = V_{GS}, I_D = 250\mu A$                     |
| $I_{DSS}$     | Drain-to-Source Leakage Current      | —    | —    | 25   | $\mu A$  | $V_{DS} = 600V, V_{GS} = 0V$                          |
|               |                                      | —    | —    | 250  |          | $V_{DS} = 480V, V_{GS} = 0V, T_J = 150^\circ\text{C}$ |
| $I_{GSS}$     | Gate-to-Source Forward Leakage       | —    | —    | 100  | nA       | $V_{GS} = 30V$  |
|               | Gate-to-Source Reverse Leakage       | —    | —    | -100 |          | $V_{GS} = -30V$                                       |

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

|                        | Parameter                       | Min. | Typ. | Max. | Units | Conditions                                      |
|------------------------|---------------------------------|------|------|------|-------|---|
| $g_{fs}$               | Forward Transconductance        | 5.5  | —    | —    | S     | $V_{DS} = 25V, I_D = 5.5A$                      |
| $Q_g$                  | Total Gate Charge               | —    | —    | 49   | nC    | $I_D = 9.2A$                                    |
| $Q_{gs}$               | Gate-to-Source Charge           | —    | —    | 13   |       | $V_{DS} = 400V$                                 |
| $Q_{gd}$               | Gate-to-Drain ("Miller") Charge | —    | —    | 20   |       | $V_{GS} = 10V, \text{See Fig. 6 and 13}$ ④      |
| $t_{d(on)}$            | Turn-On Delay Time              | —    | 13   | —    | ns    | $V_{DD} = 300V$                                 |
| $t_r$                  | Rise Time                       | —    | 25   | —    |       | $I_D = 9.2A$                                    |
| $t_{d(off)}$           | Turn-Off Delay Time             | —    | 30   | —    |       | $R_G = 9.1\Omega$                               |
| $t_f$                  | Fall Time                       | —    | 22   | —    |       | $R_D = 35.5\Omega, \text{See Fig. 10}$ ④        |
| $C_{iss}$              | Input Capacitance               | —    | 1400 | —    | pF    | $V_{GS} = 0V$                                   |
| $C_{oss}$              | Output Capacitance              | —    | 180  | —    |       | $V_{DS} = 25V$                                  |
| $C_{riss}$             | Reverse Transfer Capacitance    | —    | 7.1  | —    |       | $f = 1.0\text{MHz}, \text{See Fig. 5}$          |
| $C_{oss}$              | Output Capacitance              | —    | 1957 | —    |       | $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$ |
| $C_{oss}$              | Output Capacitance              | —    | 49   | —    |       | $V_{GS} = 0V, V_{DS} = 480V, f = 1.0\text{MHz}$ |
| $C_{oss \text{ eff.}}$ | Effective Output Capacitance    | —    | 96   | —    |       | $V_{GS} = 0V, V_{DS} = 0V \text{ to } 480V$ ⑤   |

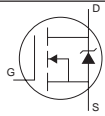
## Avalanche Characteristics

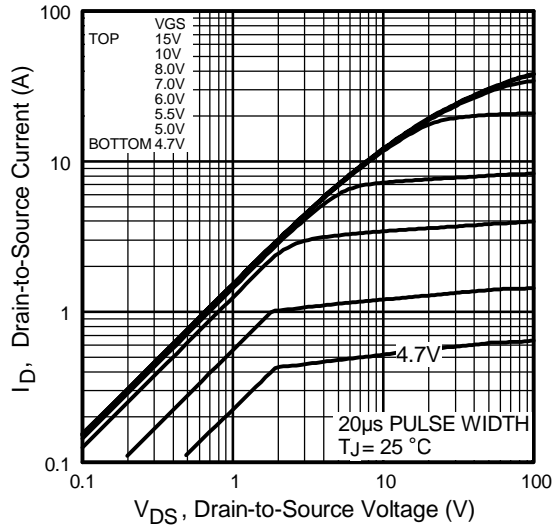
|          | Parameter                       | Typ. | Max. | Units |
|----------|---------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy ② | —    | 290  | mJ    |
| $I_{AR}$ | Avalanche Current ①             | —    | 9.2  | A     |
| $E_{AR}$ | Repetitive Avalanche Energy ①   | —    | 6.0  | mJ    |

## Thermal Resistance

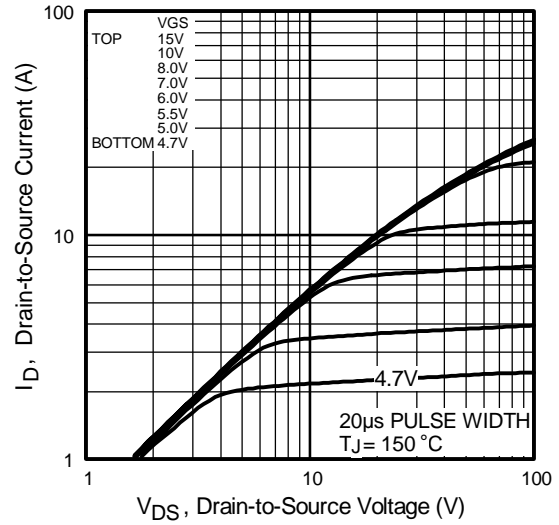
|                 | Parameter           | Typ. | Max. | Units              |
|-----------------|---------------------|------|------|--------------------|
| $R_{\theta JC}$ | Junction-to-Case    | —    | 2.1  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Junction-to-Ambient | —    | 65   |                    |

## Diode Characteristics

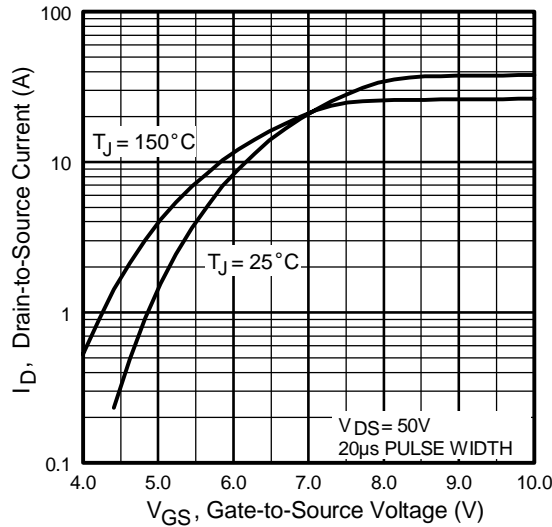
|          | Parameter                              | Min.  | Typ. | Max. | Units         | Conditions   |
|----------|--|---|------|------|---------------|--|
| $I_S$    | Continuous Source Current (Body Diode) | —   | —    | 5.5  | A             | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —   | —    | 37   |               |  |
| $V_{SD}$ | Diode Forward Voltage                  | —   | —    | 1.5  | V             | $T_J = 25^\circ\text{C}, I_S = 9.2A, V_{GS} = 0V$ ④  |
| $t_{rr}$ | Reverse Recovery Time                  | —   | 530  | 800  | ns            | $T_J = 25^\circ\text{C}, I_F = 9.2A$   |
| $Q_{rr}$ | Reverse Recovery Charge                | —   | 3.0  | 4.4  | $\mu\text{C}$ | $di/dt = 100A/\mu\text{s}$ ④   |
| $t_{on}$ | Forward Turn-On Time                   | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ ) |      |      |               |  |



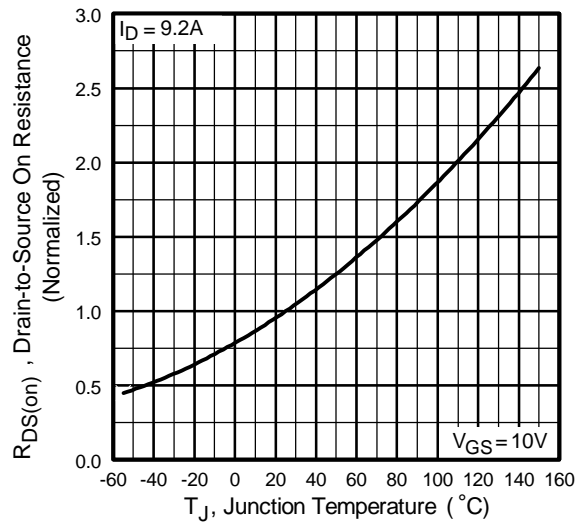
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics

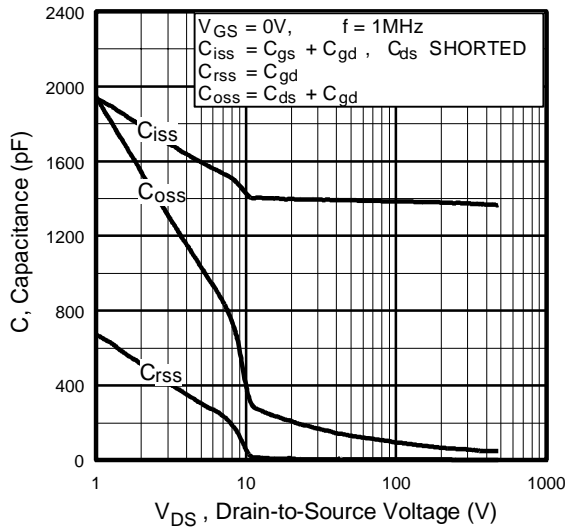


**Fig 3.** Typical Transfer Characteristics

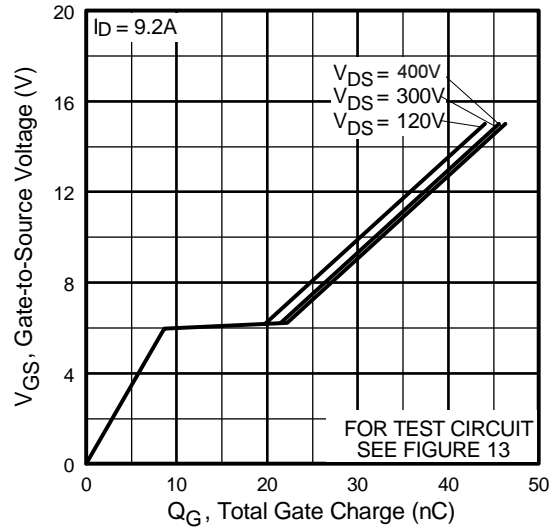


**Fig 4.** Normalized On-Resistance Vs. Temperature

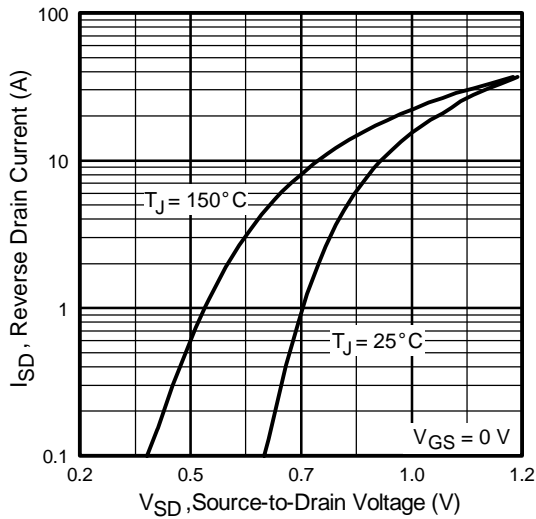
# IRFIB6N60A



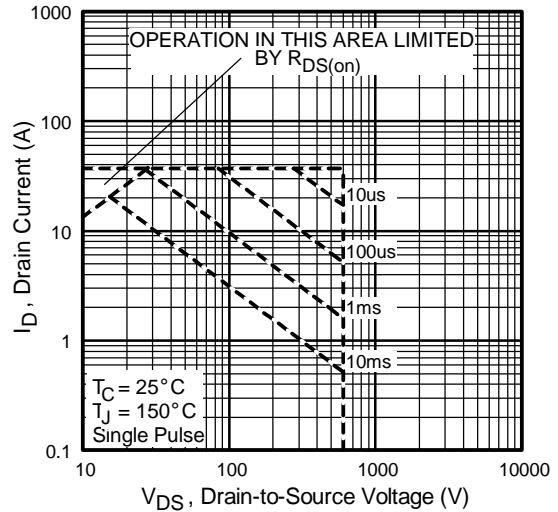
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



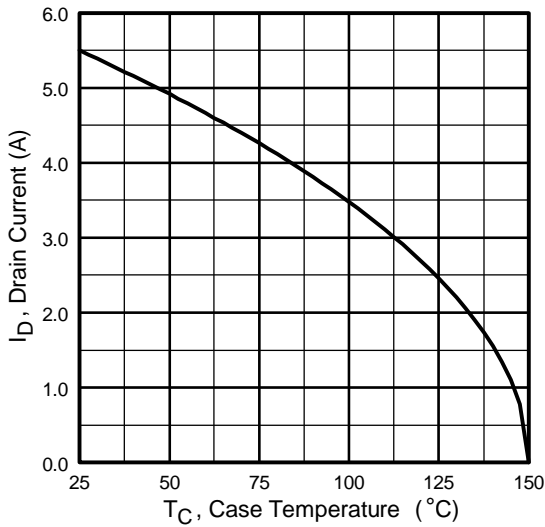
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



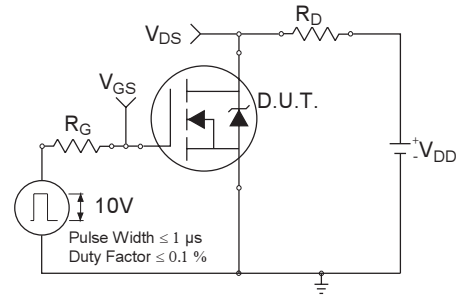
**Fig 7.** Typical Source-Drain Diode Forward Voltage



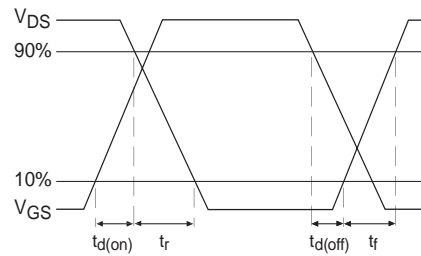
**Fig 8.** Maximum Safe Operating Area



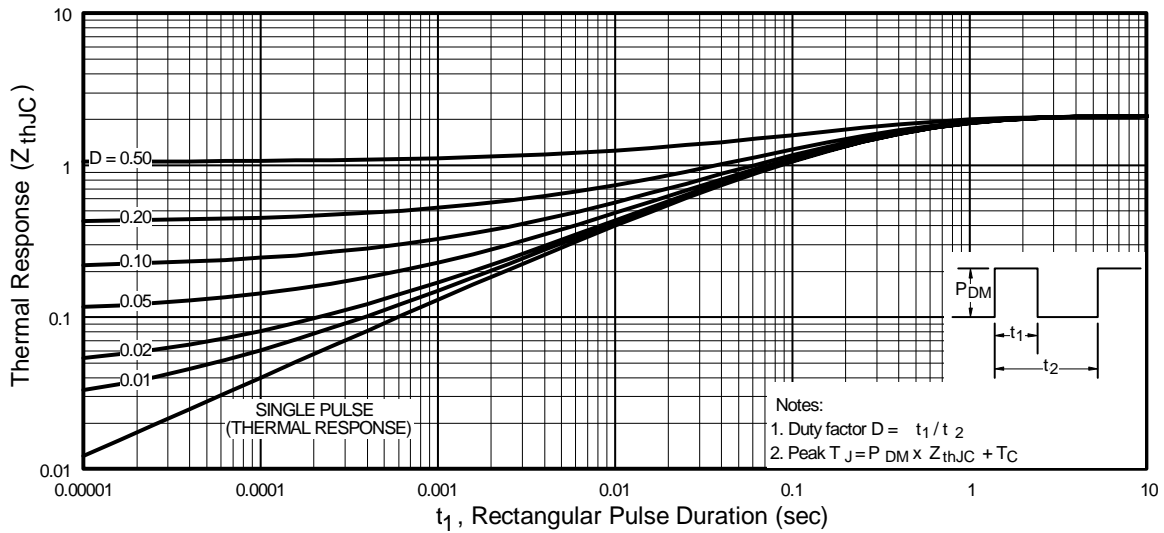
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



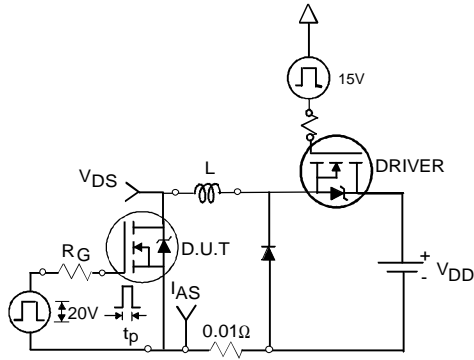
**Fig 10b.** Switching Time Waveforms



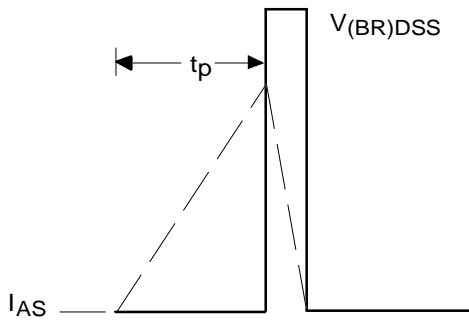
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

# IRFIB6N60A

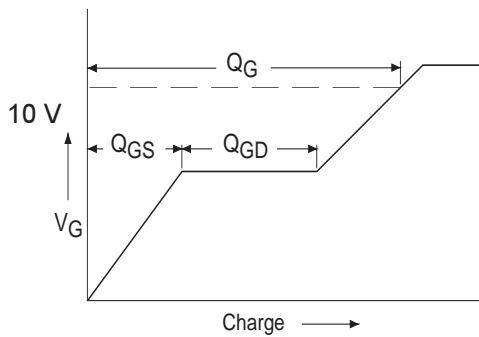
International  
**IR** Rectifier



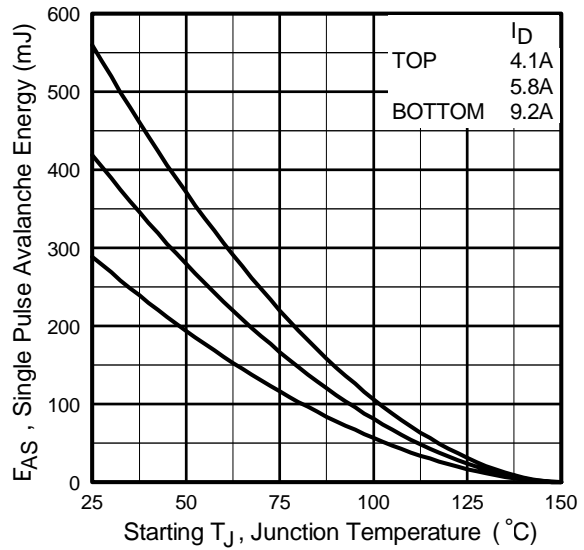
**Fig 12a.** Unclamped Inductive Test Circuit



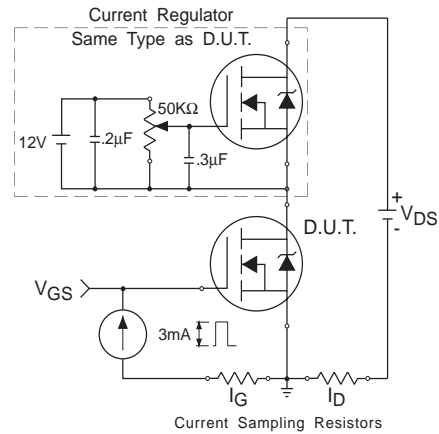
**Fig 12b.** Unclamped Inductive Waveforms



**Fig 13a.** Basic Gate Charge Waveform

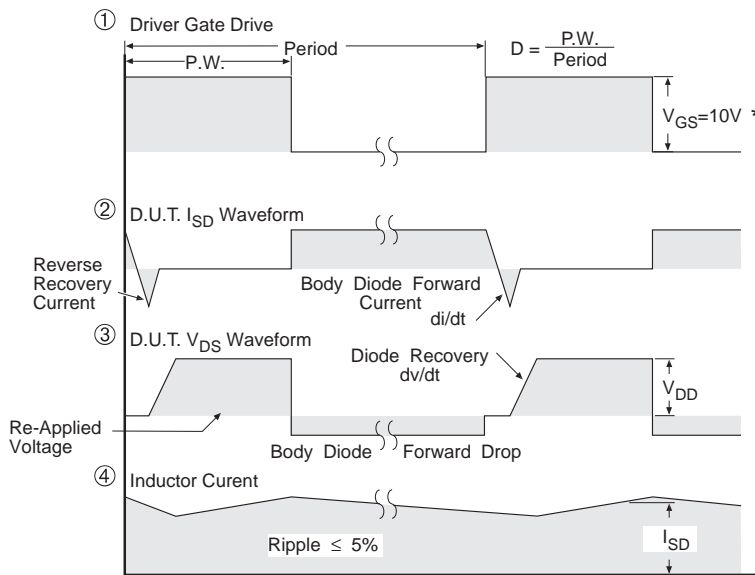
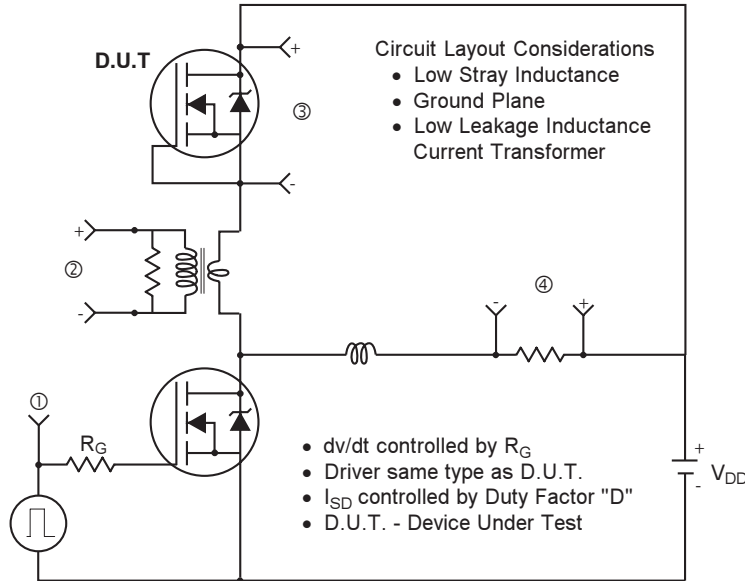


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



**Fig 13b.** Gate Charge Test Circuit

**Peak Diode Recovery dv/dt Test Circuit**



\*  $V_{GS} = 5V$  for Logic Level Devices

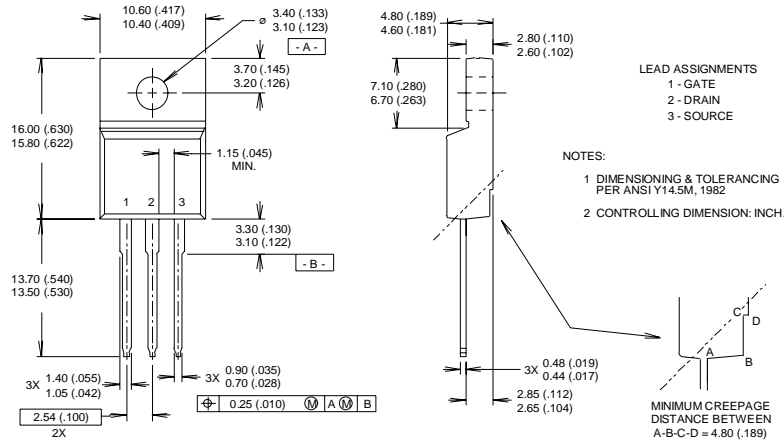
**Fig 14.** For N-Channel HEXFETS

# IRFIB6N60A

International  
**IR** Rectifier

## Package Outline TO-220 Fullpak Outline

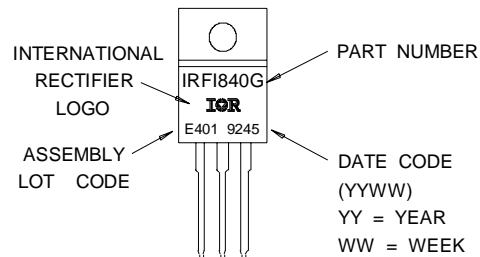
Dimensions are shown in millimeters (inches)



## Part Marking Information

### TO-220 Fullpak

EXAMPLE : THIS IS AN IRFI840G  
WITH ASSEMBLY  
LOT CODE E401



### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 6.8\text{mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 9.2\text{A}$ . (See Figure 12)
- ③  $I_{SD} \leq 9.2\text{A}$ ,  $di/dt \leq 50\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ⑤  $C_{oss}$  eff. is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$
- ⑥  $t = 60\text{s}$ ,  $f = 60\text{Hz}$

International  
**IR** Rectifier

**WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, Tel: (310) 322 3331

**IR GREAT BRITAIN:** Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020

**IR CANADA:** 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200

**IR GERMANY:** Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590

**IR ITALY:** Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111

**IR FAR EAST:** K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo Japan 171 Tel: 81 3 3983 0086

**IR SOUTHEAST ASIA:** 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 838 4630

**IR TAIWAN:** 16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673, Taiwan Tel: 886-2-2377-9936

<http://www.irf.com/> Data and specifications subject to change without notice. 5/99

This datasheet has been download from:

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

Datasheets for electronics components.