

**SMPS MOSFET**

**IRFIB6N60A**

HEXFET® Power MOSFET

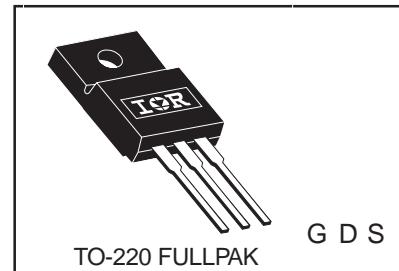
**Applications**

- Switch Mode Power Supply ( SMPS )
- Uninterruptable Power Supply
- High speed power switching
- High Voltage Isolation = 2.5KVRMS⑥

**Benefits**

- Low Gate Charge Qg results in Simple Drive Requirement
- Improved Gate, Avalanche and dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current

V <sub>DSS</sub>	R <sub>d(on)</sub> max	I <sub>D</sub>
600V	0.75Ω	5.5A



**Absolute Maximum Ratings**

	Parameter	Max.	Units
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

Notes ① through ⑥ are on page 8  
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Static @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{DSS}}$	Drain-to-Source Breakdown Voltage	600	—	—	V	$V_{GS} = 0V, I_D = 250\mu\text{A}$
$R_{DS(\text{on})}$	Static Drain-to-Source On-Resistance	—	—	0.75	$\Omega$	$V_{GS} = 10V, I_D = 3.3\text{A}$ ④
$V_{GS(\text{th})}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu\text{A}$	$V_{DS} = 600V, V_{GS} = 0V$
		—	—	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	$V_{DS} = 25V, I_D = 5.5\text{A}$
$Q_g$	Total Gate Charge	—	—	49	—	$I_D = 9.2\text{A}$
$Q_{gs}$	Gate-to-Source Charge	—	—	13	nC	$V_{DS} = 400V$
$Q_{gd}$	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	—		$I_D = 9.2\text{A}$
$t_{d(off)}$	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	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	7.1	—		$f = 1.0\text{MHz, See Fig. 5}$
$C_{oss}$	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

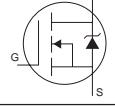
## Avalanche Characteristics

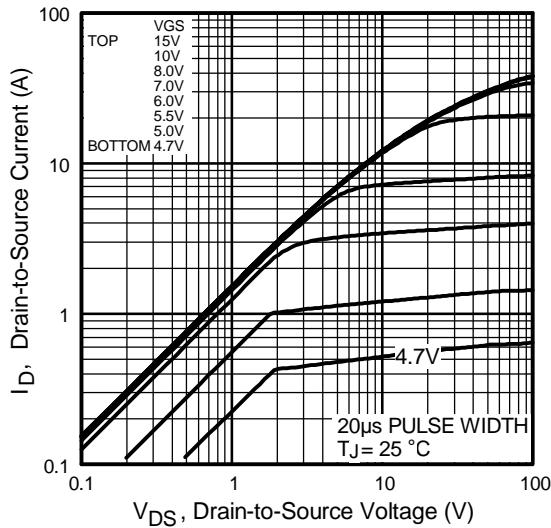
	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	290	mJ
$I_{AR}$	Avalanche Current ①	—	9.2	A
$E_{AR}$	Repetitive Avalanche Energy ①	—	6.0	mJ

## Thermal Resistance

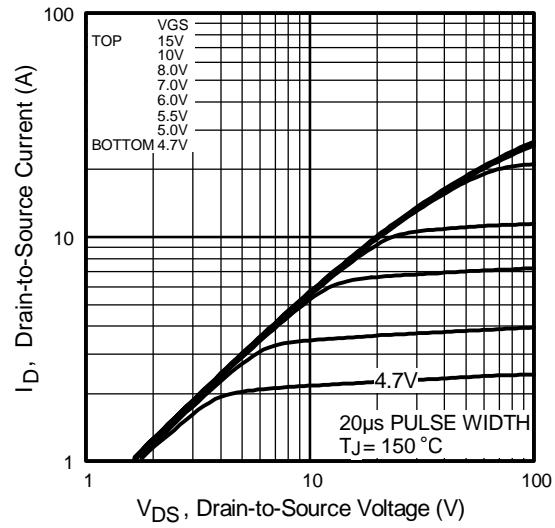
	Parameter	Typ.	Max.	Units
$R_{\theta\text{JC}}$	Junction-to-Case	—	2.1	°C/W
$R_{\theta\text{JA}}$	Junction-to-Ambient	—	65	

## Diode Characteristics

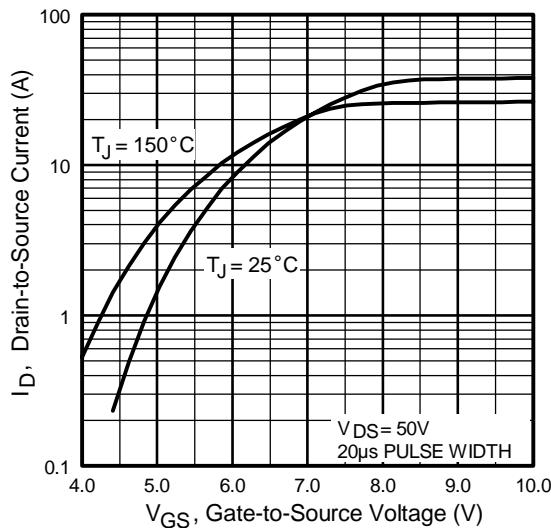
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	5.5	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	37		
$V_{SD}$	Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}, I_S = 9.2\text{A}, V_{GS}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



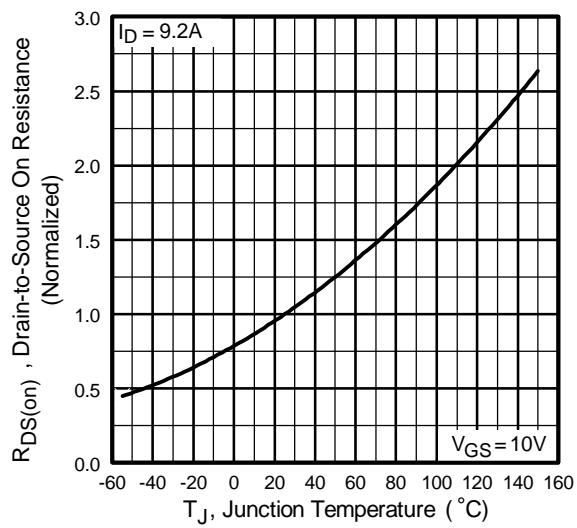
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



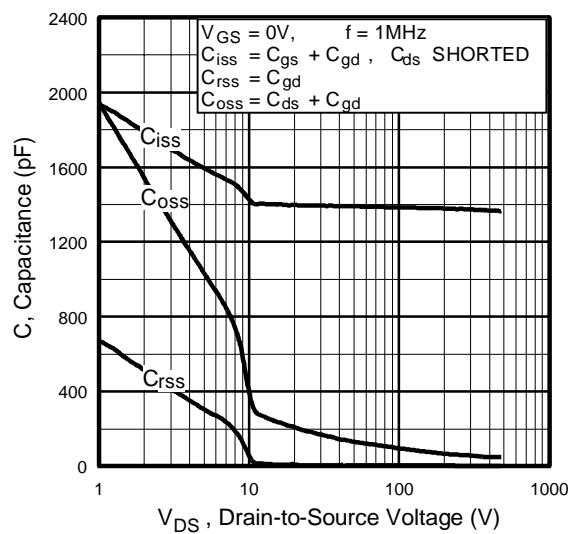
**Fig 3.** Typical Transfer Characteristics



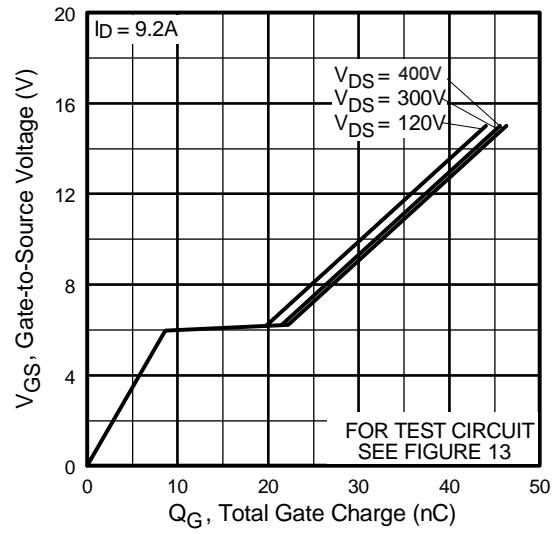
**Fig 4.** Normalized On-Resistance  
Vs. Temperature

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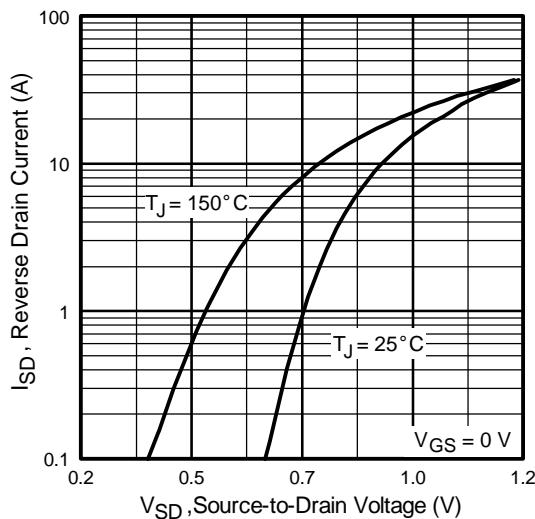
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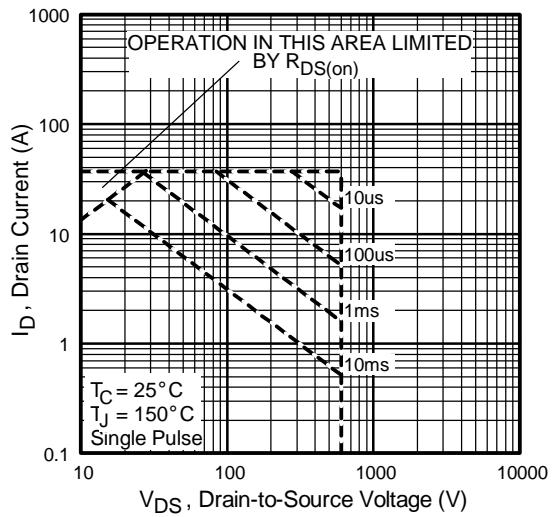
**Fig 5.** Typical Capacitance Vs.  
Drain-to-Source Voltage



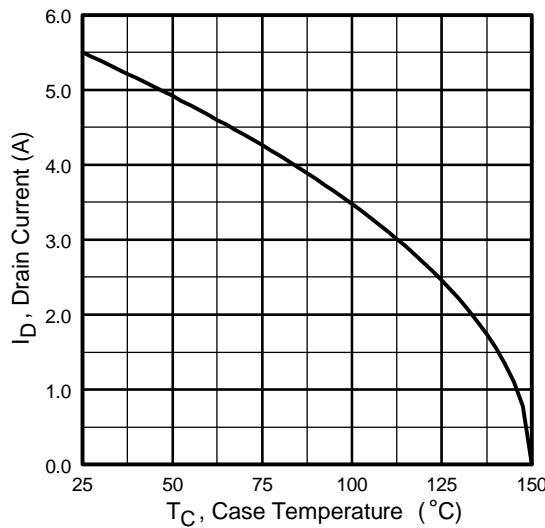
**Fig 6.** Typical Gate Charge Vs.  
Gate-to-Source Voltage



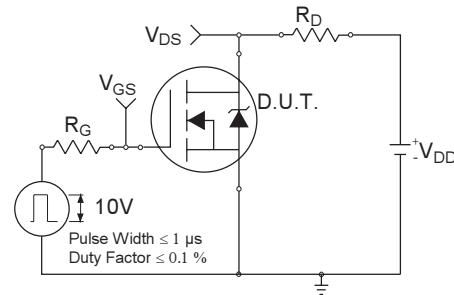
**Fig 7.** Typical Source-Drain Diode  
Forward Voltage



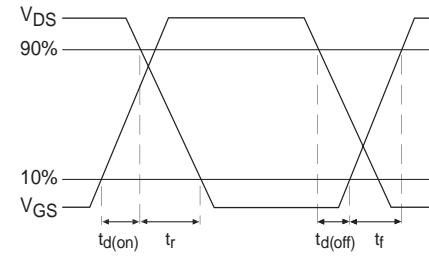
**Fig 8.** Maximum Safe Operating Area



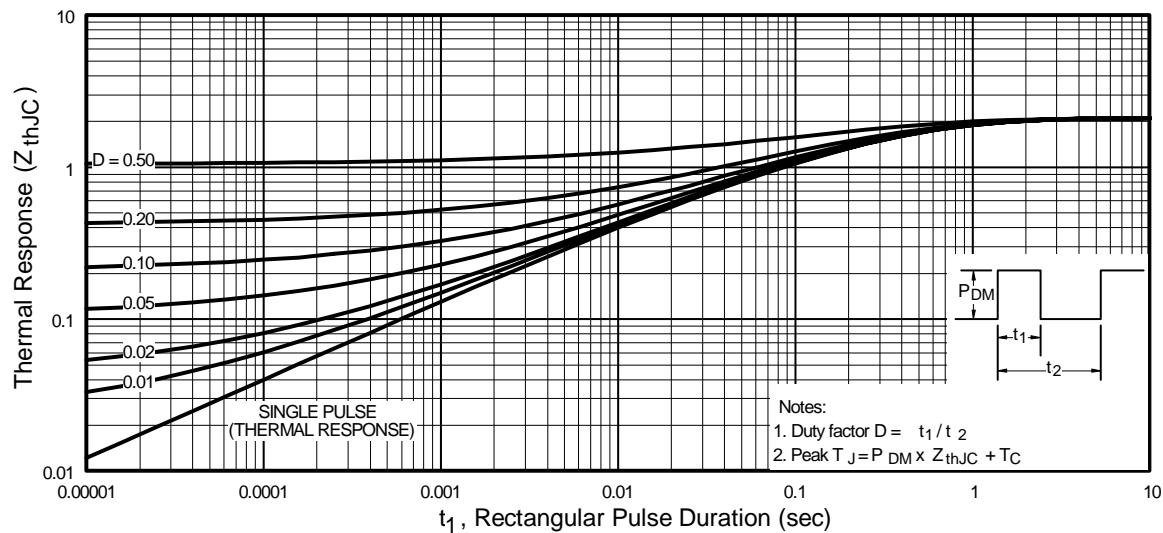
**Fig 9.** Maximum Drain Current Vs.  
Case Temperature



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



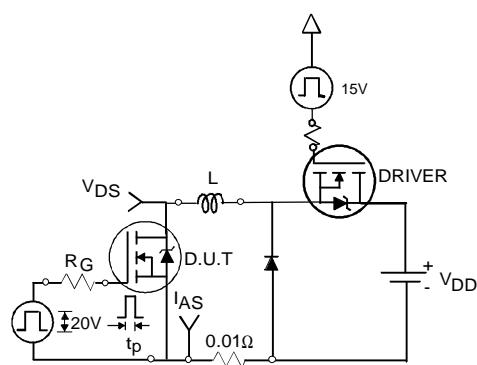
**Fig 10b.** Switching Time Waveforms



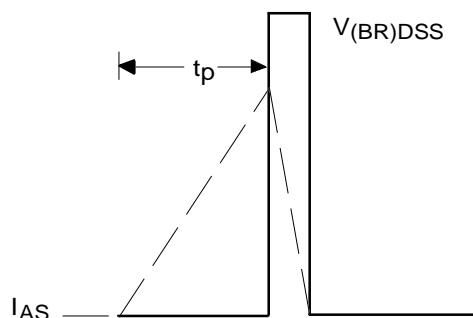
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

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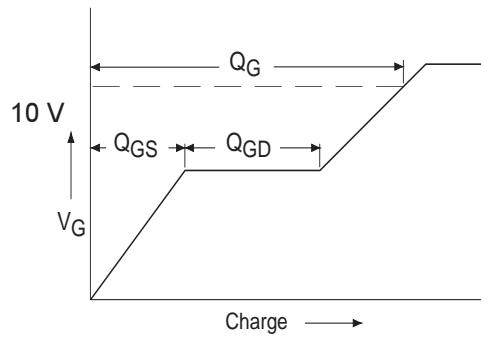
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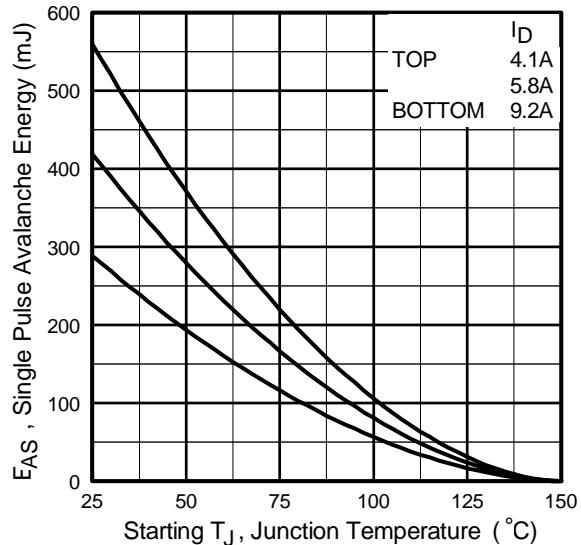
**Fig 12a.** Unclamped Inductive Test Circuit



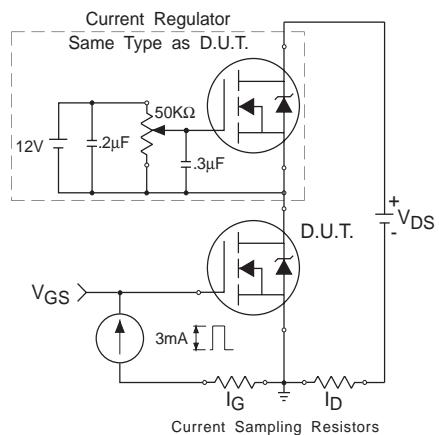
**Fig 12b.** Unclamped Inductive Waveforms



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

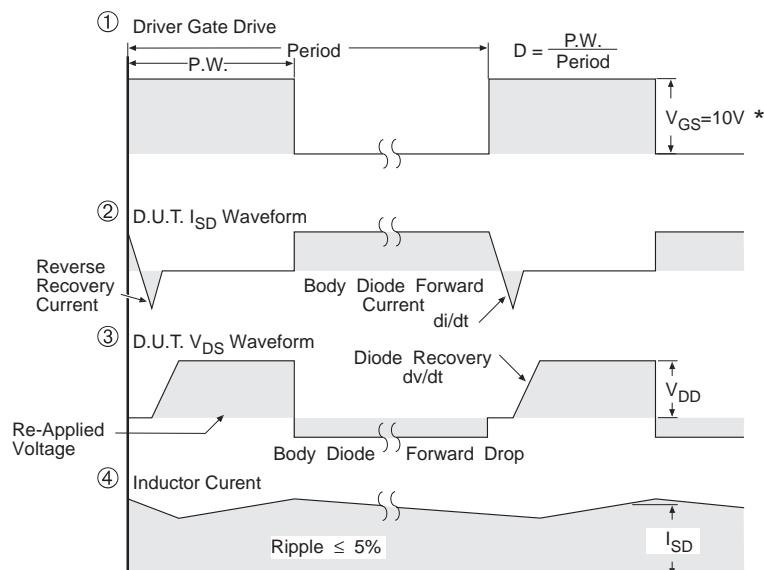
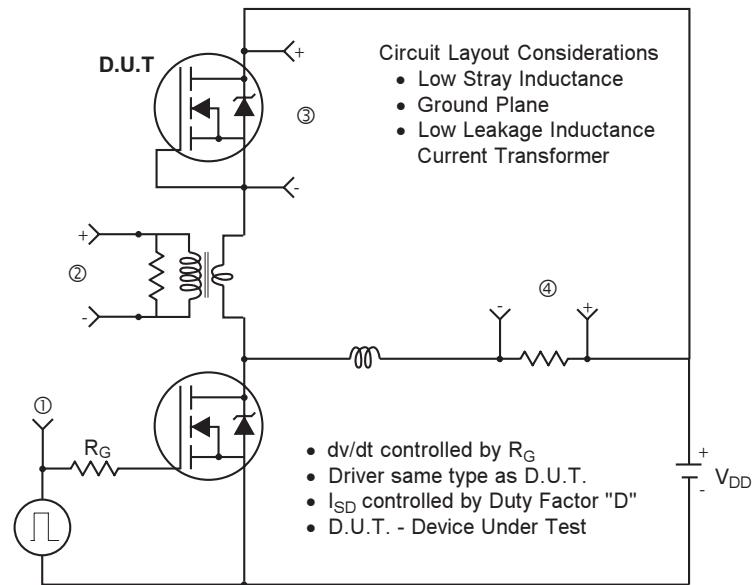


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



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

### Peak Diode Recovery dv/dt Test Circuit



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

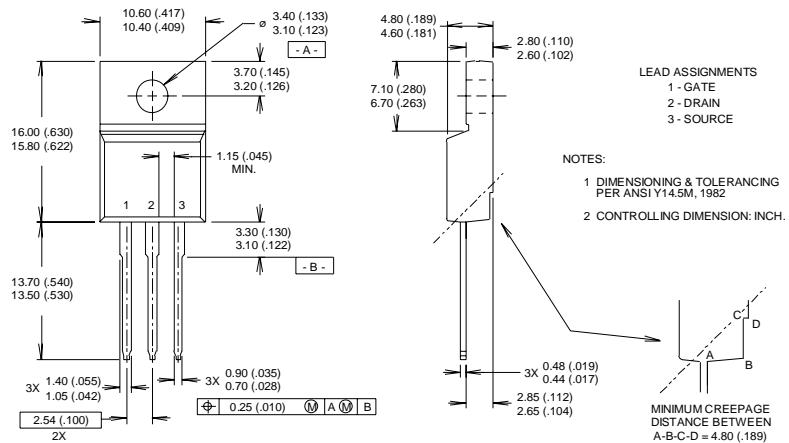
**Fig 14.** For N-Channel HEXFETs

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## Package Outline TO-220 Fullpak Outline

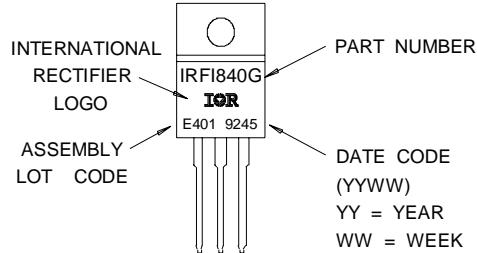
Dimensions are shown in millimeters (inches)



## 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  $I_{SD} \leq 9.2\text{A}$ ,  $\text{di/dt} \leq 50\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(\text{BR})DSS}$ ,  
 $T_J \leq 150^\circ\text{C}$
- 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  $t=60\text{s}$ ,  $f=60\text{Hz}$

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**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

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

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