

# IRLB8721PbF

## Applications

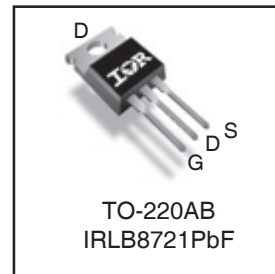
- Optimized for UPS/Inverter Applications
- High Frequency Synchronous Buck Converters for Computer Processor Power
- High Frequency Isolated DC-DC Converters with Synchronous Rectification for Telecom and Industrial Use

## Benefits

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

HEXFET® Power MOSFET

$V_{DSS}$	$R_{DS(on)}$ max	Qg (typ.)
30V	8.7m $\Omega$ @ $V_{GS} = 10V$	7.6nC



G	D	S
Gate	Drain	Source

## Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{DS}$	Drain-to-Source Voltage	30	V
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	
$I_D$ @ $T_C = 25^\circ C$	Continuous Drain Current, $V_{GS}$ @ 10V	62	A
$I_D$ @ $T_C = 100^\circ C$	Continuous Drain Current, $V_{GS}$ @ 10V	44	
$I_{DM}$	Pulsed Drain Current ①	250	
$P_D$ @ $T_C = 25^\circ C$	Maximum Power Dissipation ⑤	65	W
$P_D$ @ $T_C = 100^\circ C$	Maximum Power Dissipation ⑤	33	
	Linear Derating Factor	0.43	W/ $^\circ C$
$T_J$	Operating Junction and	-55 to + 175	$^\circ C$
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw	10lb·in (1.1N·m)	

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑤	—	2.3	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink, Flat Greased Surface	0.5	—	
$R_{\theta JA}$	Junction-to-Ambient ④	—	62	

Notes ① through ⑤ are on page 9

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

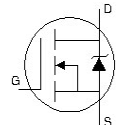
	Parameter	Min.	Typ.	Max.	Units	Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	21	—	mV/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	6.5	8.7	$m\Omega$	$V_{GS} = 10V, I_D = 31A$ ③
		—	13.1	16		$V_{GS} = 4.5V, I_D = 25A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	1.35	1.80	2.35	V	$V_{DS} = V_{GS}, I_D = 25\mu A$
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-7.0	—	mV/ $^\circ\text{C}$	
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	1.0	$\mu A$	$V_{DS} = 24V, V_{GS} = 0V$
		—	—	150		$V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
$g_{fs}$	Forward Transconductance	35	—	—	S	$V_{DS} = 15V, I_D = 25A$
$Q_g$	Total Gate Charge	—	7.6	13	nC	$V_{DS} = 15V$ $V_{GS} = 4.5V$ $I_D = 25A$ See Fig. 16
$Q_{gs1}$	Pre-V <sub>th</sub> Gate-to-Source Charge	—	1.9	—		
$Q_{gs2}$	Post-V <sub>th</sub> Gate-to-Source Charge	—	1.2	—		
$Q_{gd}$	Gate-to-Drain Charge	—	3.4	—		
$Q_{gdr}$	Gate Charge Overdrive	—	2.0	—		
$Q_{sw}$	Switch Charge ( $Q_{gs2} + Q_{gd}$ )	—	4.6	—		
$Q_{oss}$	Output Charge	—	7.9	—	nC	$V_{DS} = 15V, V_{GS} = 0V$
$R_G$	Gate Resistance	—	2.3	3.8	$\Omega$	
$t_{d(on)}$	Turn-On Delay Time	—	9.1	—	ns	$V_{DD} = 15V, V_{GS} = 4.5V$ ③ $I_D = 25A$ $R_G = 1.8\Omega$ See Fig. 14
$t_r$	Rise Time	—	93	—		
$t_{d(off)}$	Turn-Off Delay Time	—	9.0	—		
$t_f$	Fall Time	—	17	—		
$C_{iss}$	Input Capacitance	—	1077	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	360	—		$V_{DS} = 15V$
$C_{rss}$	Reverse Transfer Capacitance	—	110	—		$f = 1.0\text{MHz}$

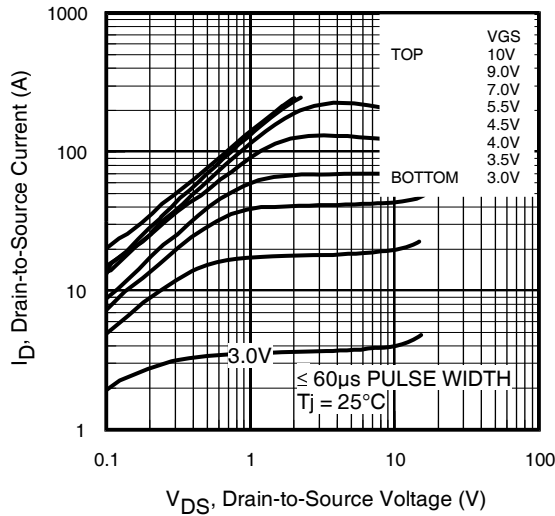
## Avalanche Characteristics

	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy ②	—	98	mJ
$I_{AR}$	Avalanche Current ①	—	25	A

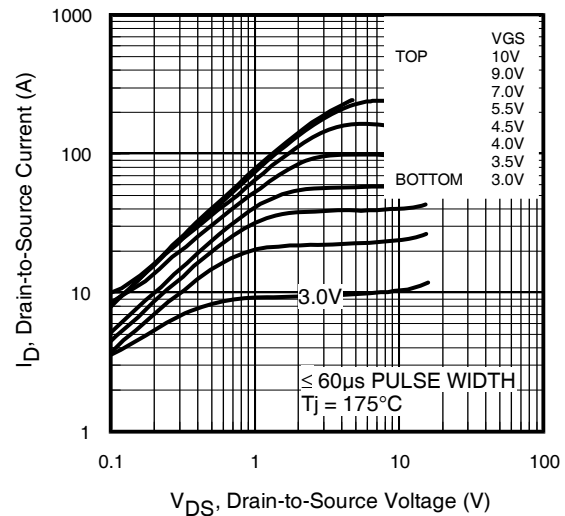
## Diode Characteristics

	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	—	—	250		
$V_{SD}$	Diode Forward Voltage	—	—	1.0	V	$T_J = 25^\circ\text{C}, I_S = 25A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	16	24	ns	$T_J = 25^\circ\text{C}, I_F = 25A, V_{DD} = 15V$
$Q_{rr}$	Reverse Recovery Charge	—	14	21	nC	$di/dt = 200A/\mu s$ ③

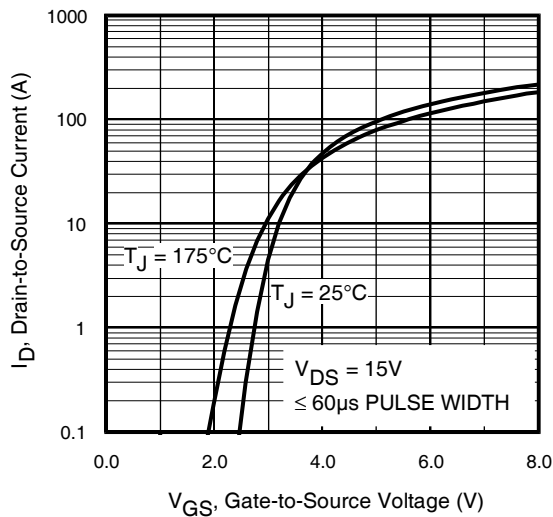




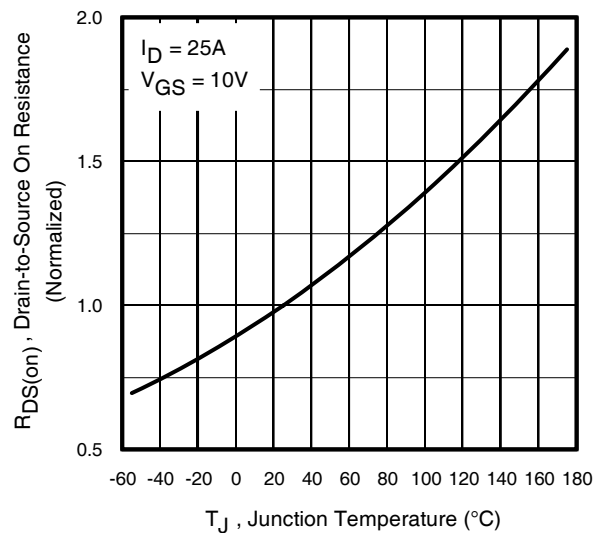
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



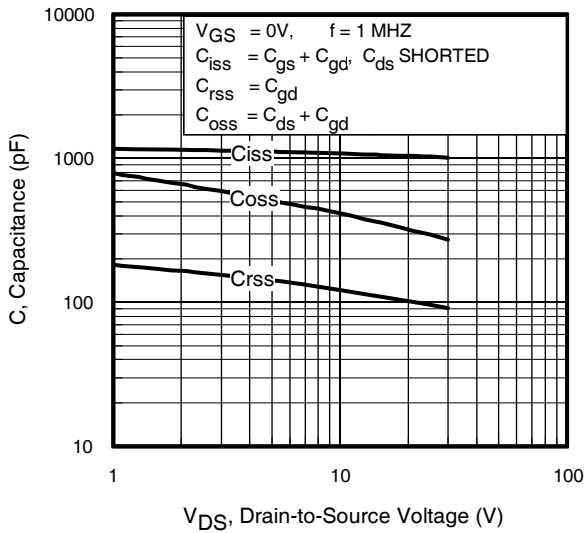
**Fig 3.** Typical Transfer Characteristics



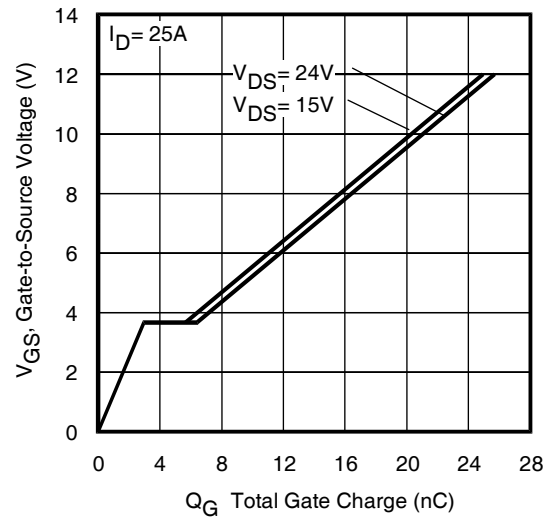
**Fig 4.** Normalized On-Resistance vs. Temperature

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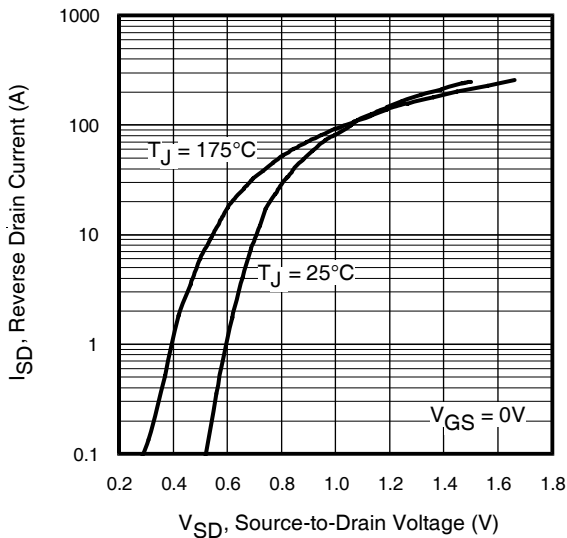
International  
**IR** Rectifier



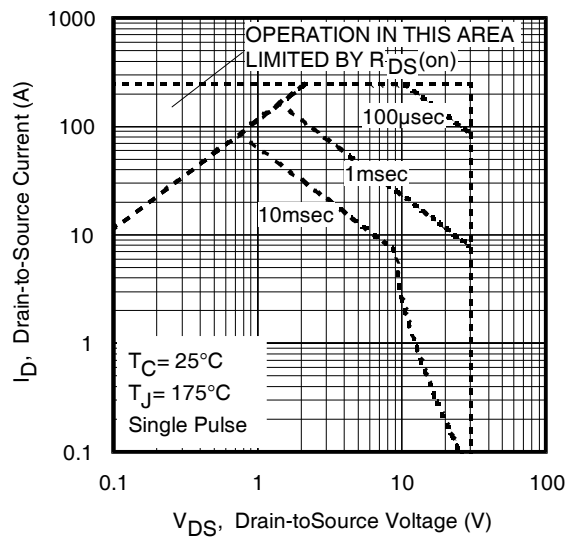
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



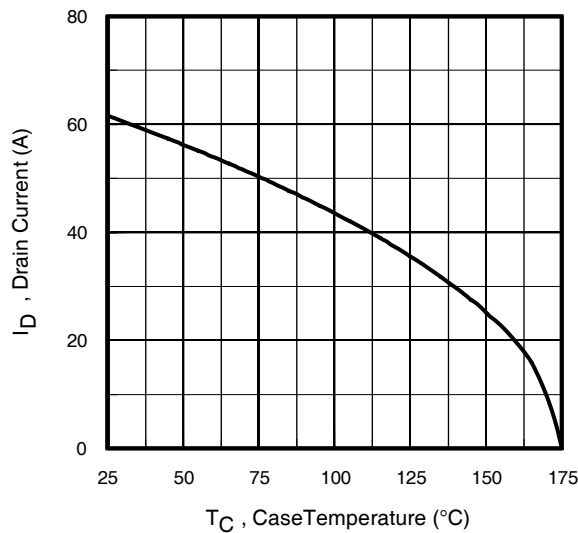
**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage



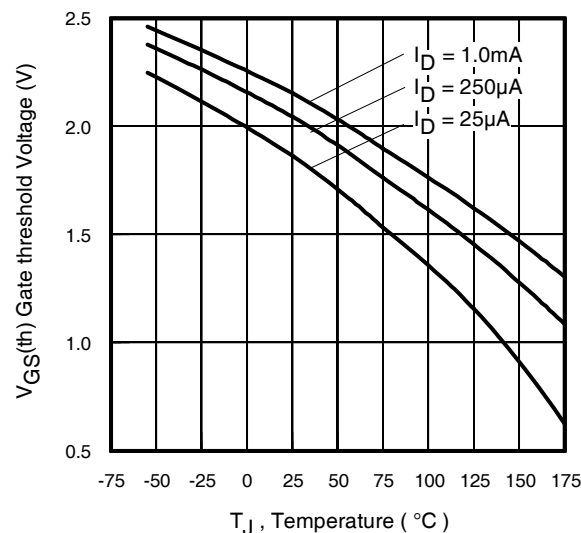
**Fig 7.** Typical Source-Drain Diode Forward Voltage



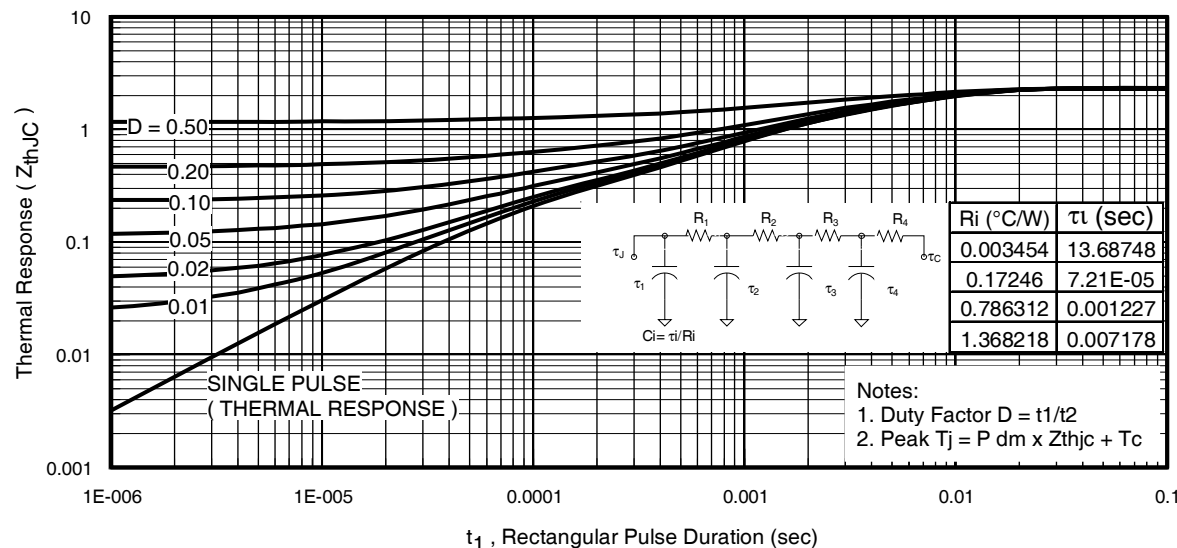
**Fig 8.** Maximum Safe Operating Area



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



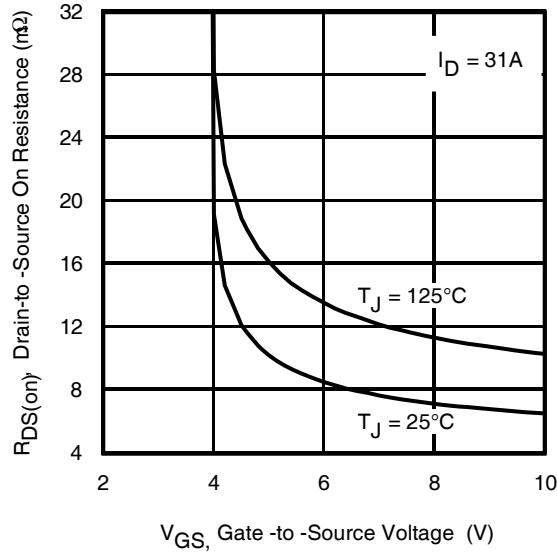
**Fig 10.** Threshold Voltage vs. Temperature



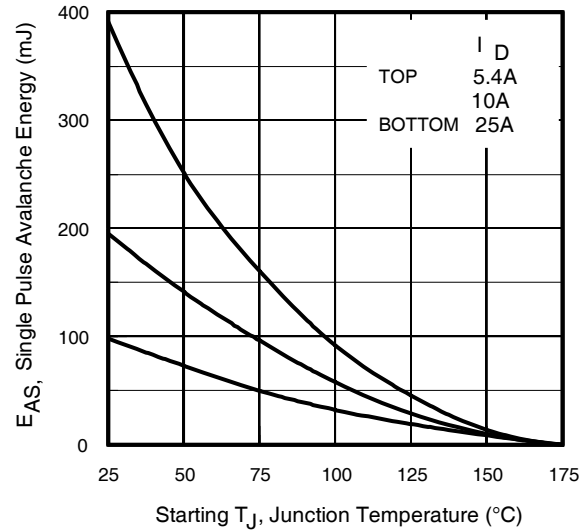
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

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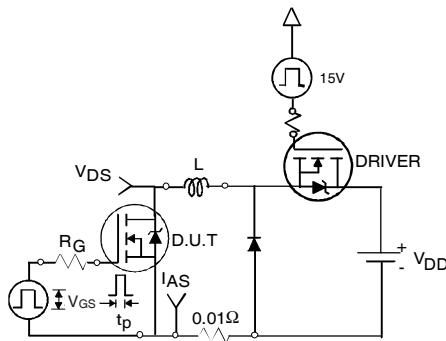
International  
**IR** Rectifier



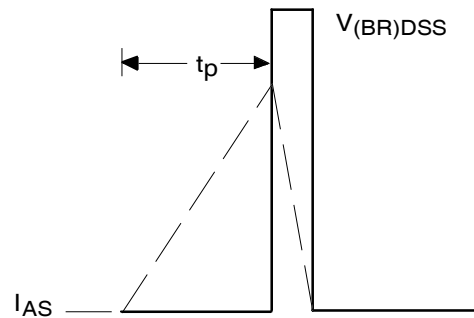
**Fig 12.** On-Resistance vs. Gate Voltage



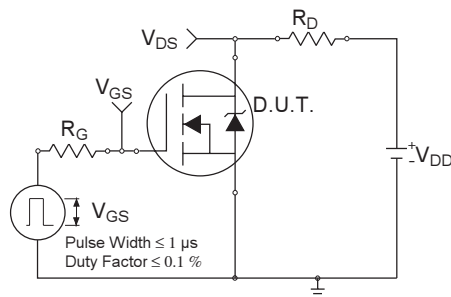
**Fig 13a.** Maximum Avalanche Energy vs. Drain Current



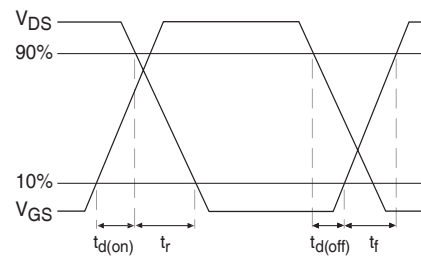
**Fig 13b.** Unclamped Inductive Test Circuit



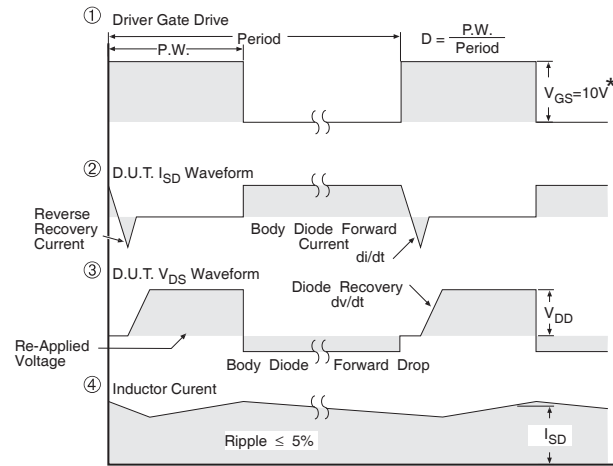
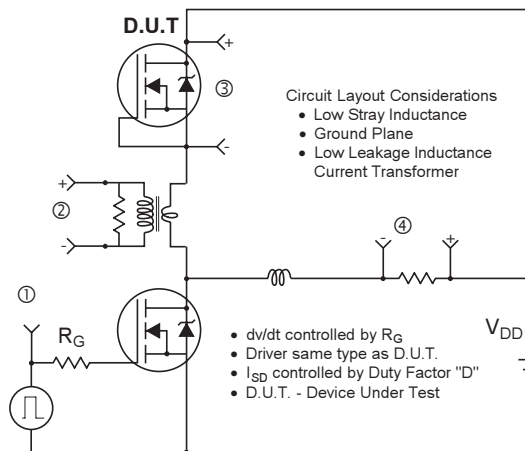
**Fig 13c.** Unclamped Inductive Waveforms



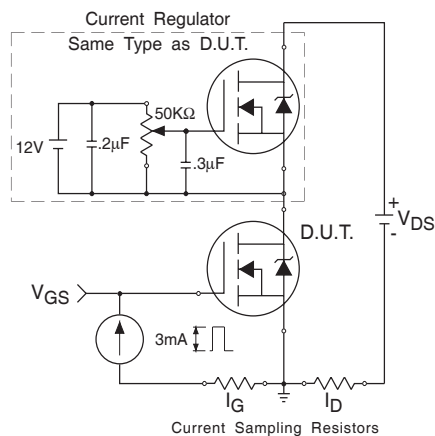
**Fig 14a.** Switching Time Test Circuit



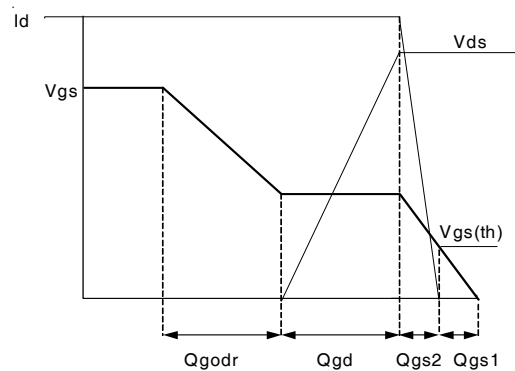
**Fig 14b.** Switching Time Waveforms



**Fig 15. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs**



**Fig 16a. Gate Charge Test Circuit**

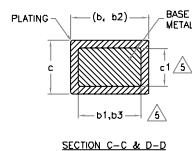
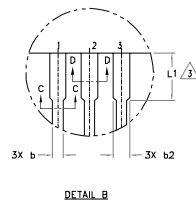
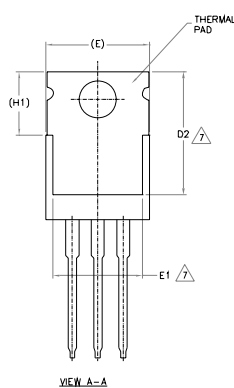
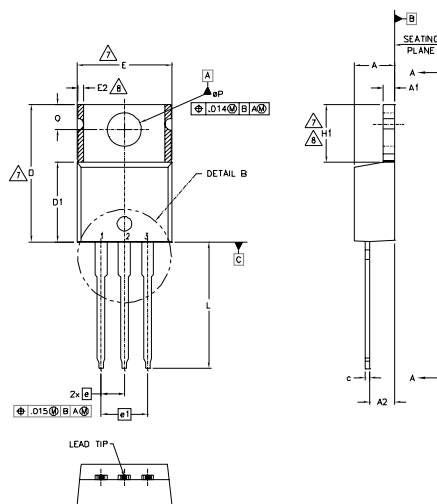


**Fig 16b. Gate Charge Waveform**

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International  
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## TO-220AB Package Outline (Dimensions are shown in millimeters (inches))



### NOTES:

- 1.- DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
- 2.- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
- 3.- LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4.- DIMENSION D, D1 & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- 5.- DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
- 6.- CONTROLLING DIMENSION : INCHES.
- 7.- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
- 8.- DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
- 9.- OUTLINE CONFORMS TO JEDEC TO-220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.83	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.03	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.97	.015	.038	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	11.68	12.88	.460	.507	7
E	9.65	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	—	0.76	—	.030	8
e	2.54 BSC		.100 BSC		
e1	5.08 BSC		.200 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	3.56	4.06	.140	.160	3
ØP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

### LEAD ASSIGNMENTS

#### HERFET

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE

#### IGBTs, GdPAKs

- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER

#### DIODES

- 1.- ANODE
- 2.- CATHODE
- 3.- ANODE

TO-220AB packages are not recommended for Surface Mount Application.

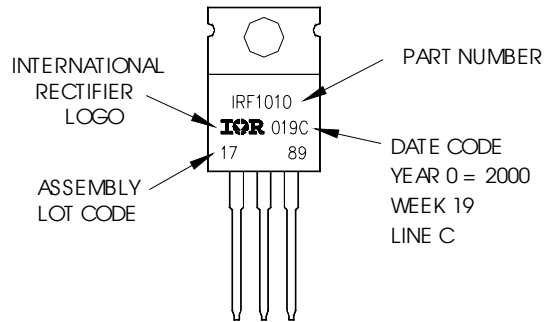
Note: For the most current drawing please refer to IR website at: <http://www.irf.com/package/>



## TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010  
LOT CODE 1789  
ASSEMBLED ON WW 19, 2000  
IN THE ASSEMBLY LINE "C"

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



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

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.32\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 25\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ When mounted on 1" square PCB (FR-4 or G-10 Material).  
For recommended footprint and soldering techniques refer to application note #AN-994.
- ⑤  $R_\theta$  is measured at  $T_J$  approximately  $90^\circ\text{C}$ .

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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