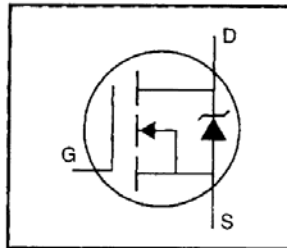


# IRFBG20PbF

- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead-Free

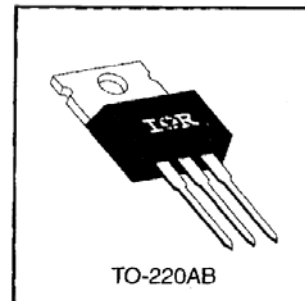


$V_{DSS} = 1000V$
$R_{DS(on)} = 11\Omega$
$I_D = 1.4A$

## Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.




## Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10 V$	1.4	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10 V$	0.86	
$I_{DM}$	Pulsed Drain Current ①	5.6	
$P_D @ T_C = 25^\circ C$	Power Dissipation	54	W
	Linear Derating Factor	0.43	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy ②	200	mJ
$I_{AR}$	Avalanche Current ①	1.4	A
$E_{AR}$	Repetitive Avalanche Energy ①	5.4	mJ
dv/dt	Peak Diode Recovery dv/dt ③	1.0	V/ns
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.1 N•m)	

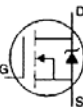
## Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	2.3	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	—	62	

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

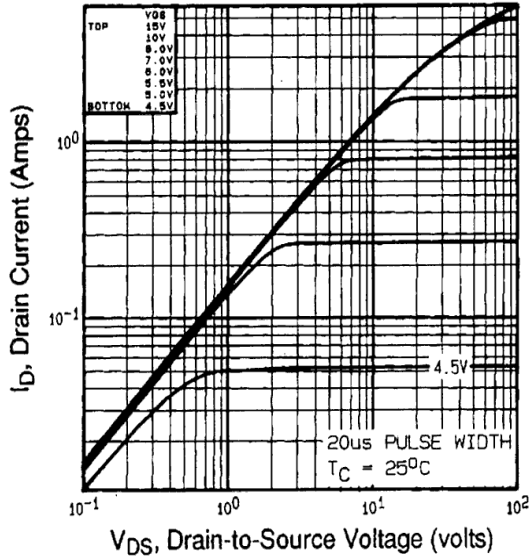
	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	1000	—	—	V	$V_{GS}=0V, I_D=250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	1.2	—	V/°C	Reference to $25^\circ\text{C}, I_D=1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	11	$\Omega$	$V_{GS}=10V, I_D=0.84A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
$g_{fs}$	Forward Transconductance	1.0	—	—	S	$V_{DS}=50V, I_D=0.84A$ ④
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	100	$\mu A$	$V_{DS}=1000V, V_{GS}=0V$
		—	—	500		$V_{DS}=800V, V_{GS}=0V, T_J=125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS}=20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS}=-20V$
$Q_g$	Total Gate Charge	—	—	38	nC	$I_D=1.4A$
$Q_{gs}$	Gate-to-Source Charge	—	—	4.9		$V_{DS}=400V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	22		$V_{GS}=10V$ See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	9.4	—	ns	$V_{DD}=500V$
$t_r$	Rise Time	—	17	—		$I_D=1.4A$
$t_{d(off)}$	Turn-Off Delay Time	—	58	—		$R_G=18\Omega$
$t_f$	Fall Time	—	31	—		$R_D=370\Omega$ See Figure 10 ④
$L_D$	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6 mm (0.25in.) from package and center of die contact 
$L_S$	Internal Source Inductance	—	7.5	—		
$C_{iss}$	Input Capacitance	—	500	—	pF	$V_{GS}=0V$
$C_{oss}$	Output Capacitance	—	52	—		$V_{DS}=25V$
$C_{rss}$	Reverse Transfer Capacitance	—	17	—		$f=1.0\text{MHz}$ See Figure 5

## Source-Drain Ratings and Characteristics

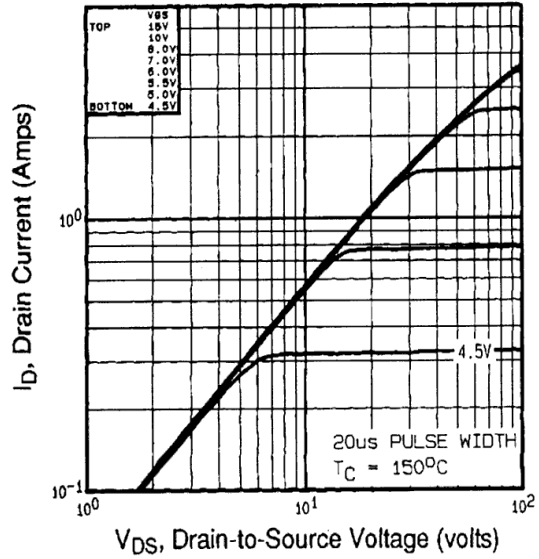
	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	1.4	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	5.6		
$V_{SD}$	Diode Forward Voltage	—	—	1.5	V	$T_J=25^\circ\text{C}, I_S=1.4A, V_{GS}=0V$ ③
$t_{rr}$	Reverse Recovery Time	—	130	190	ns	$T_J=25^\circ\text{C}, I_F=1.4A$
$Q_{rr}$	Reverse Recovery Charge	—	0.46	0.69	$\mu C$	$di/dt=100A/\mu s$ ④
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )				

### Notes:

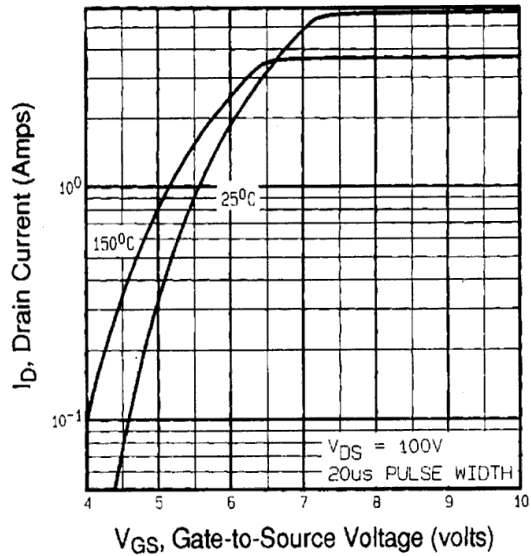
- ① Repetitive rating; pulse width limited by max. junction temperature (See Figure 11)
- ②  $V_{DD}=50V$ , starting  $T_J=25^\circ\text{C}$ ,  $L=193\text{mH}$ ,  $R_G=25\Omega$ ,  $I_{AS}=1.4A$  (See Figure 12)
- ③  $I_{SD}\leq 1.4A$ ,  $di/dt\leq 60A/\mu s$ ,  $V_{DD}\leq 600$ ,  $T_J\leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .



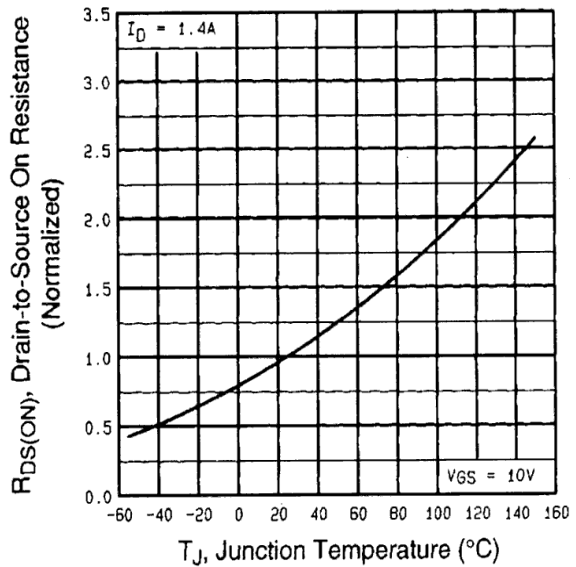
**Fig 1.** Typical Output Characteristics,  
 $T_C=25^\circ\text{C}$



**Fig 2.** Typical Output Characteristics,  
 $T_C=150^\circ\text{C}$



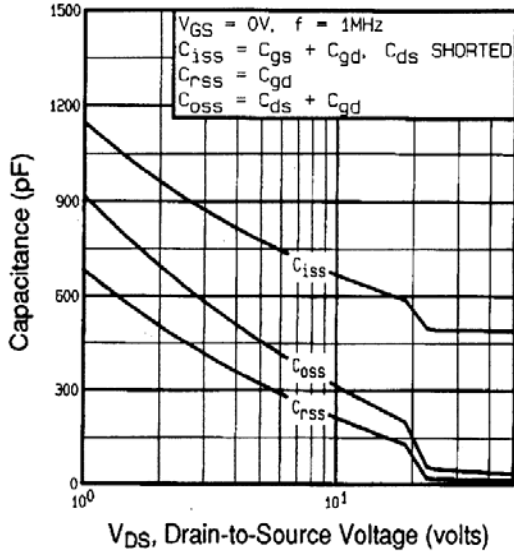
**Fig 3.** Typical Transfer Characteristics



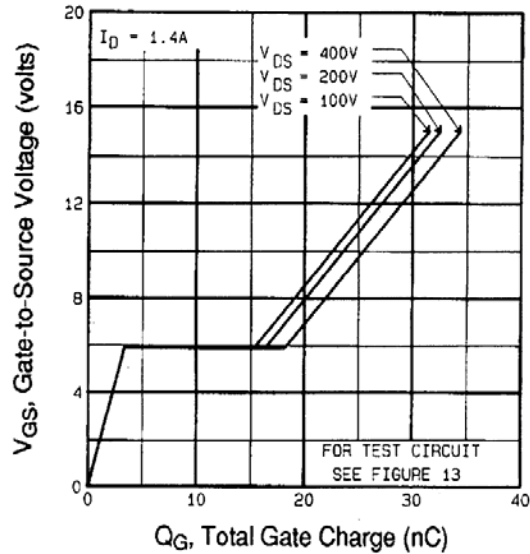
**Fig 4.** Normalized On-Resistance  
Vs. Temperature

# IRFBG20PbF

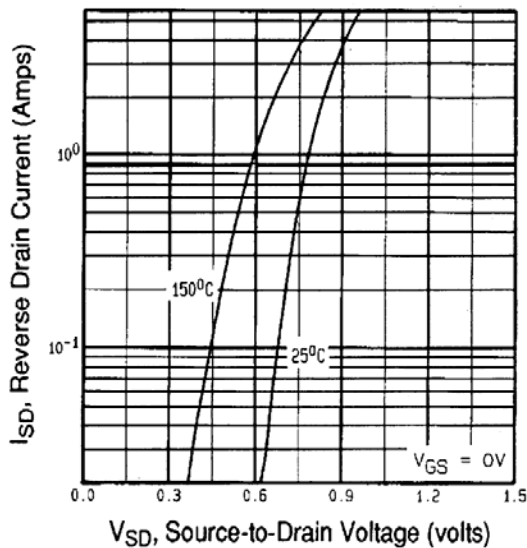
International  
**IR** Rectifier



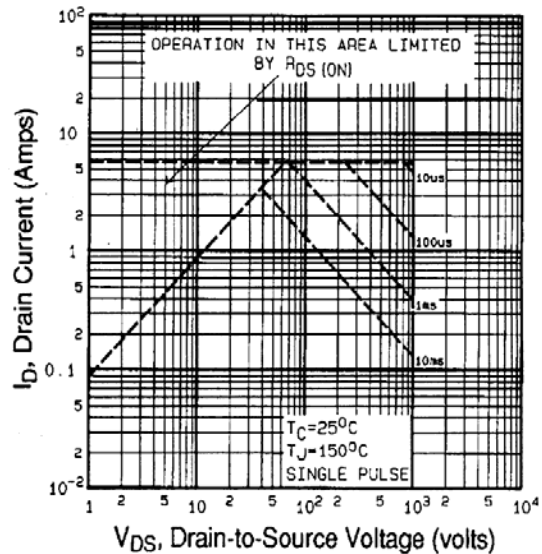
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



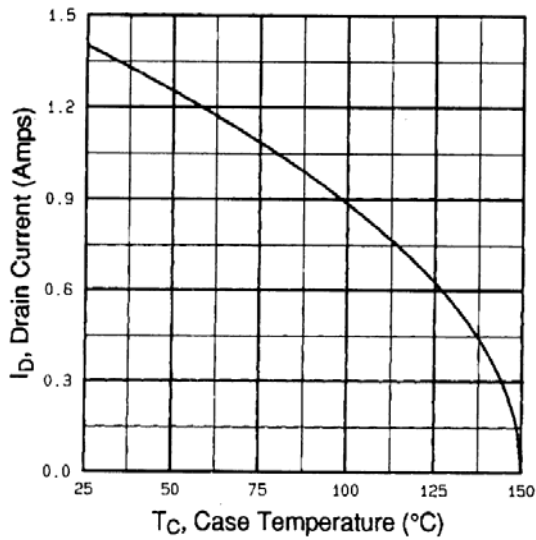
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



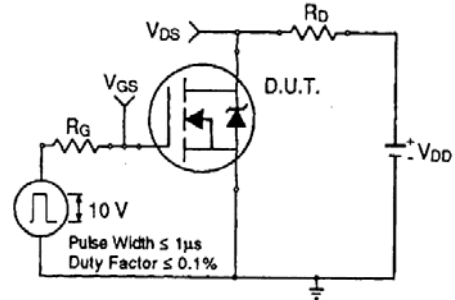
**Fig 7.** Typical Source-Drain Diode Forward Voltage



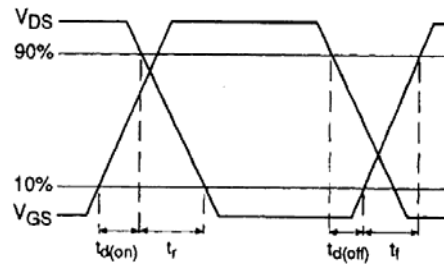
**Fig 8.** Maximum Safe Operating Area



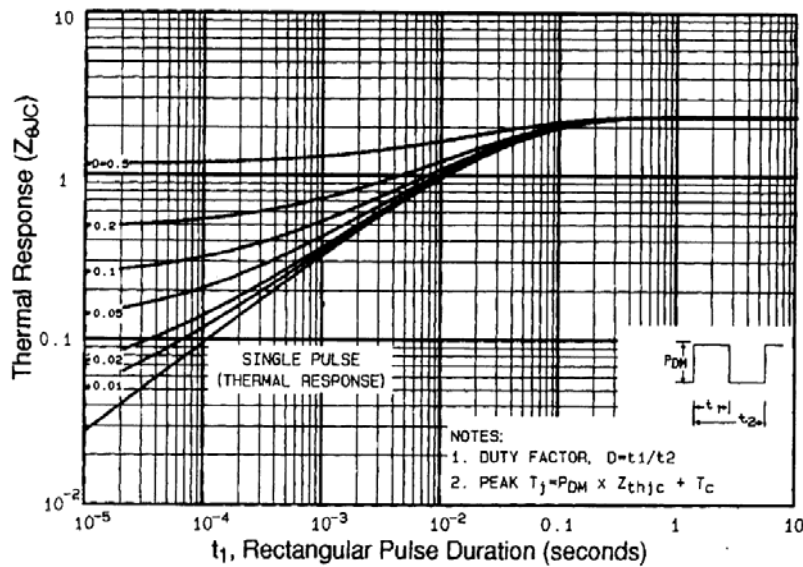
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



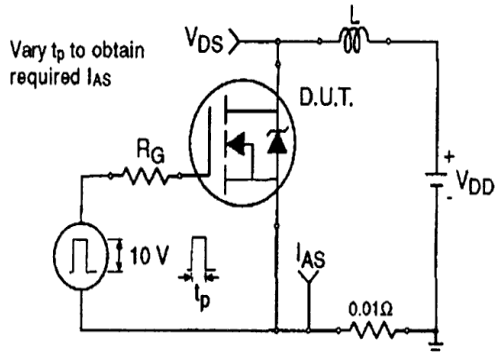
**Fig 10b.** Switching Time Waveforms



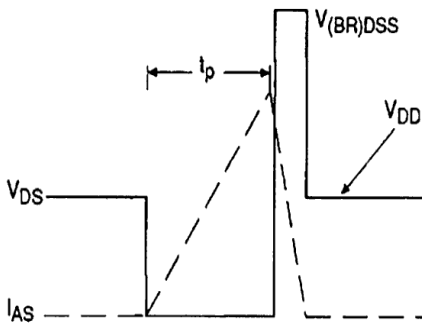
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

# IRFBG20PbF

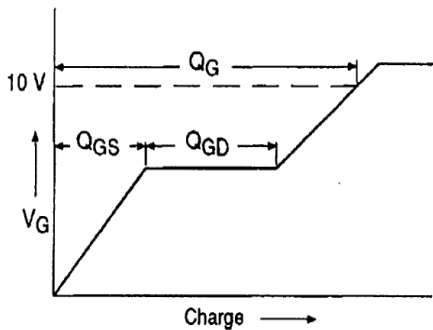
International  
**IR** Rectifier



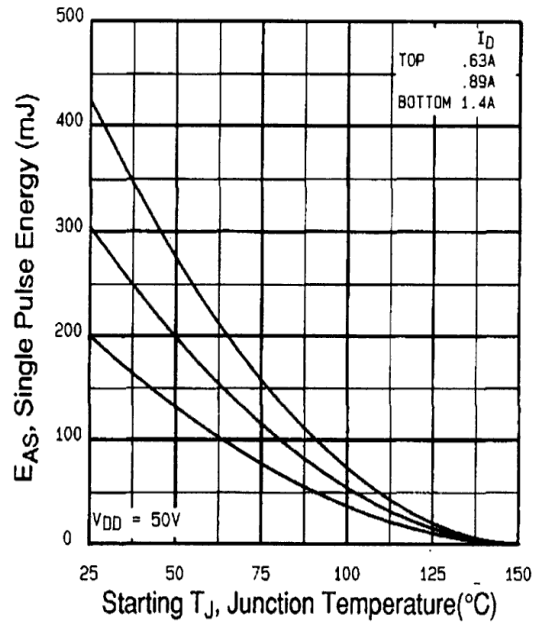
**Fig 12a.** Unclamped Inductive Test Circuit



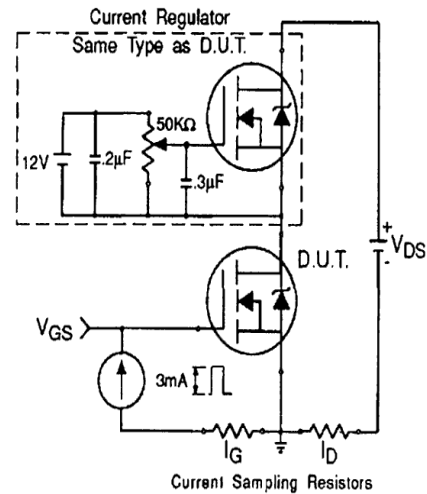
**Fig 12b.** Unclamped Inductive Waveforms



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

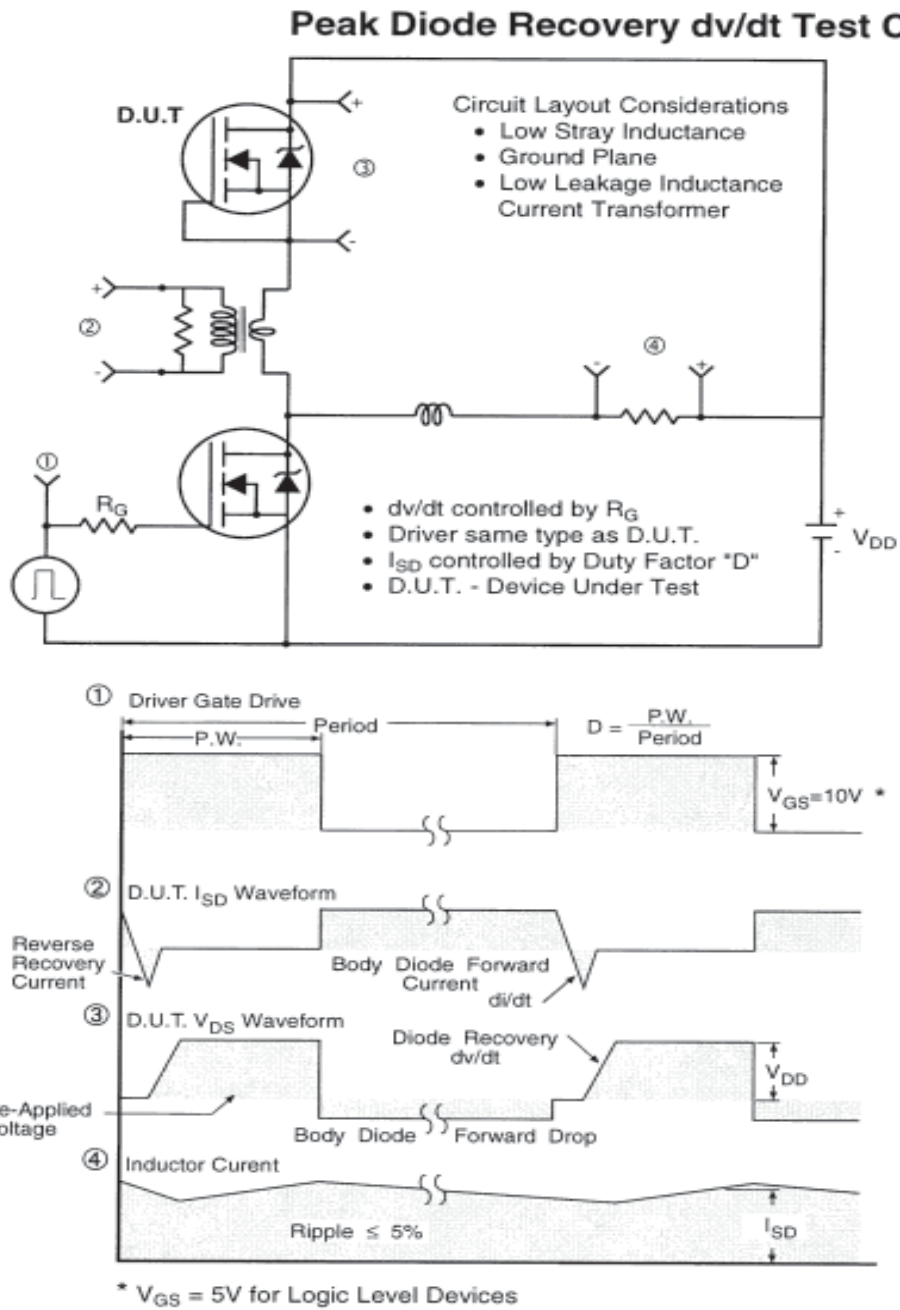


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



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



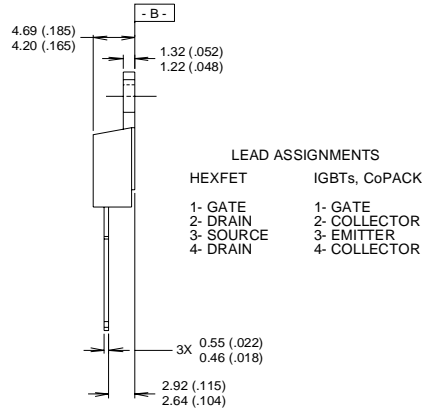
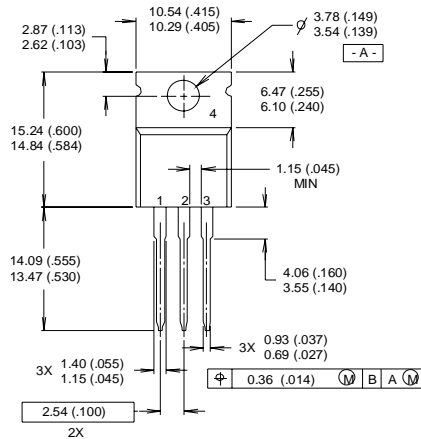


**Fig 14.** For N-Channel HEXFETS

# IRFBG20PbF

## TO-220AB Package Outline

International  
**IR** Rectifier



LEAD ASSIGNMENTS

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

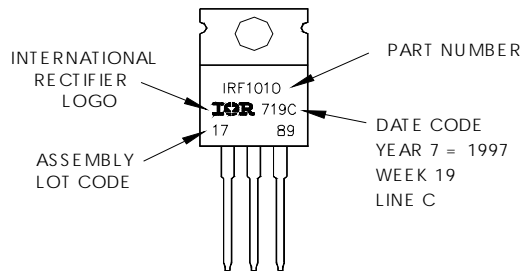
**NOTES:**

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"



Data and specifications subject to change without notice.

International  
**IR** Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
 TAC Fax: (310) 252-7903

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