

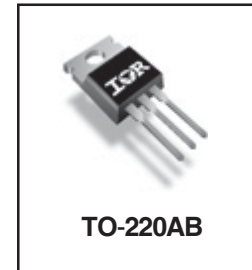
Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits

V_{DSS}	R_{DS(on)} typ.	I_D
500V	0.21Ω	20A

Benefits

- Low Gate Charge Qg results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamicdv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Low R_{DS(on)}



Absolute Maximum Ratings

	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V	20	A
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V	12	
I _{DM}	Pulsed Drain Current ①	80	
P _D @T _C = 25°C	Power Dissipation	280	W
	Linear Derating Factor	2.2	W/°C
V _{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery ③	10	V/ns
T _J	Operating Junction and	-55 to + 150	°C
T _{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting Torque, 6-32 or M3 screw	10	N

Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E _{AS}	Single Pulse Avalanche Energy②	—	330	mJ
I _{AR}	Avalanche Current①	—	20	A
E _{AR}	Repetitive Avalanche Energy①	—	28	mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case	—	0.45	°C/W
R _{θCS}	Case-to-Sink, Flat, Greased Surface	0.50	—	
R _{θJA}	Junction-to-Ambient	—	58	

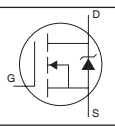
Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	500	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.61	—	$V/^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	0.21	0.25	Ω	$V_{GS} = 10V, I_D = 12A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	50	μA	$V_{DS} = 500V, V_{GS} = 0V$
		—	—	250	μA	$V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
	Gate-to-Source Reverse Leakage	—	—	-100	nA	$V_{GS} = -30V$

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	11	—	—	S	$V_{DS} = 50V, I_D = 12A$
Q_g	Total Gate Charge	—	—	110	nC	$I_D = 20A$
Q_{gs}	Gate-to-Source Charge	—	—	33		$V_{DS} = 400V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	54		$V_{GS} = 10V$, See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	22	—	ns	$V_{DD} = 250V$
t_r	Rise Time	—	74	—		$I_D = 20A$
$t_{d(off)}$	Turn-Off Delay Time	—	45	—		$R_G = 7.5\Omega$
t_f	Fall Time	—	33	—		$V_{GS} = 10V$, See Fig. 10 ④
C_{iss}	Input Capacitance	—	2870	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	320	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	34	—		$f = 1.0\text{MHz}$, See Fig. 5
C_{oss}	Output Capacitance	—	3480	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	85	—		$V_{GS} = 0V, V_{DS} = 400V, f = 1.0\text{MHz}$
$C_{oss \text{ eff.}}$	Effective Output Capacitance	—	160	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$ ⑤

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	20	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	80		
V_{SD}	Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}, I_S = 20A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	520	780	ns	$T_J = 25^\circ\text{C}, I_F = 20A$
Q_{rr}	Reverse Recovery Charge	—	5.3	8.0	μC	$di/dt = 100A/\mu\text{s}$ ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 1.6\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 20A$,
- ③ $I_{SD} \leq 20A$, $di/dt \leq 530A/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150^\circ\text{C}$
- ④ Pulse width $\leq 400\mu\text{s}$; duty cycle $\leq 2\%$.

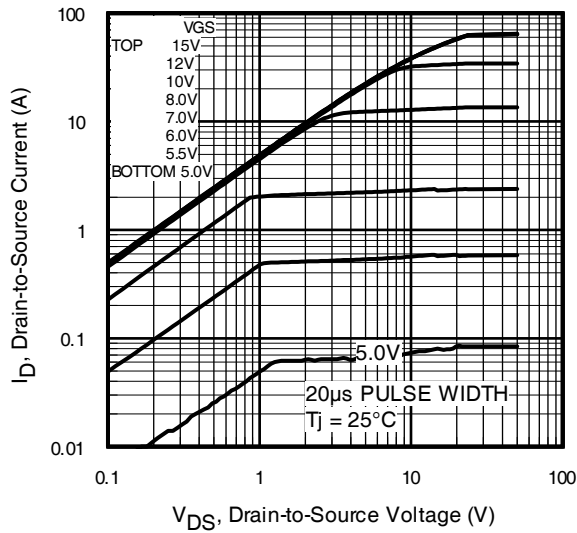


Fig 1. Typical Output Characteristics

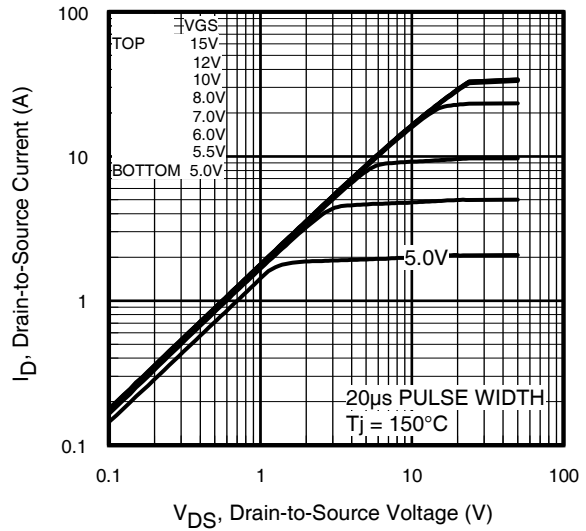


Fig 2. Typical Output Characteristics

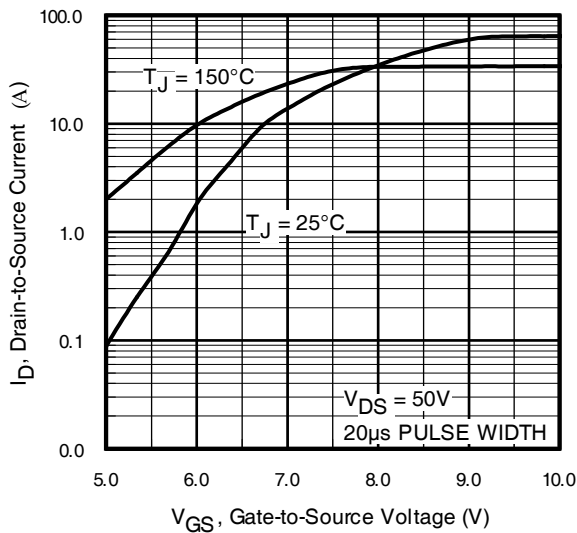


Fig 3. Typical Transfer Characteristics

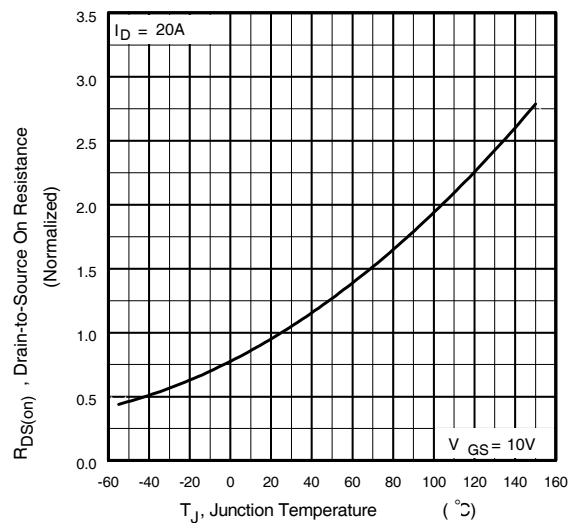


Fig 4. Normalized On-Resistance Vs. Temperature

IRFB20N50K

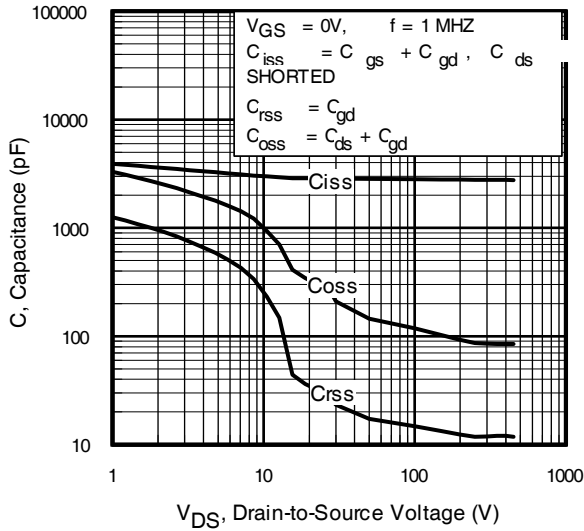


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

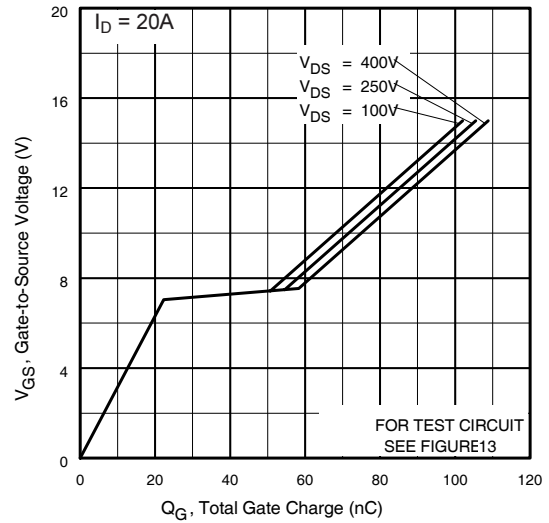


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

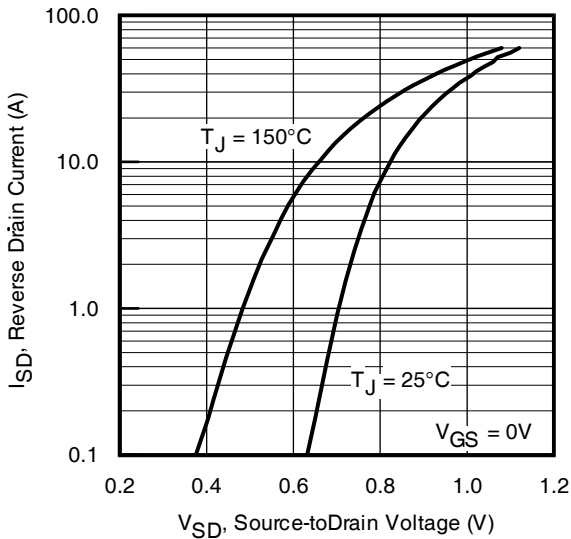


Fig 7. Typical Source-Drain Diode Forward Voltage

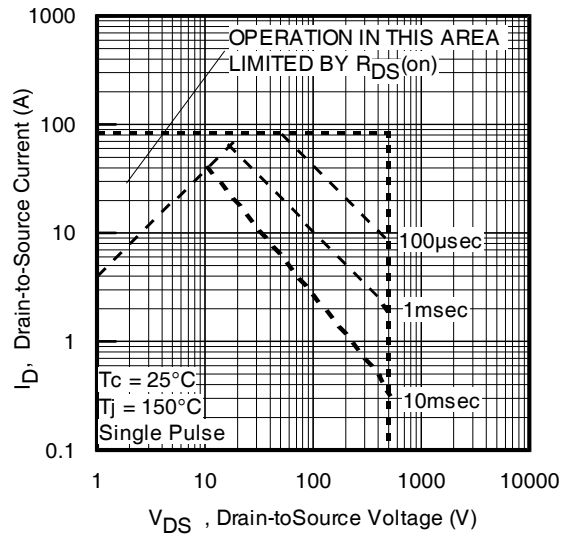


Fig 8. Maximum Safe Operating Area

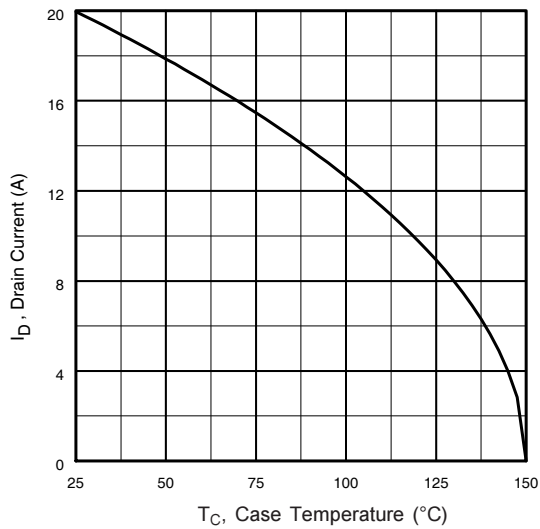


Fig 9. Maximum Drain Current Vs. Case Temperature

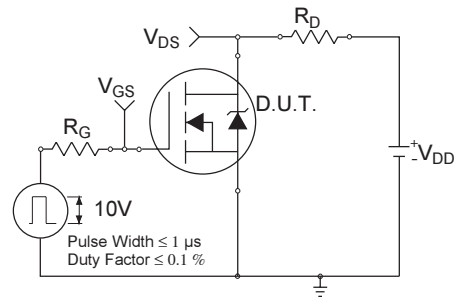


Fig 10a. Switching Time Test Circuit

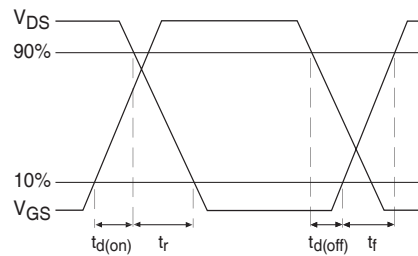


Fig 10b. Switching Time Waveforms

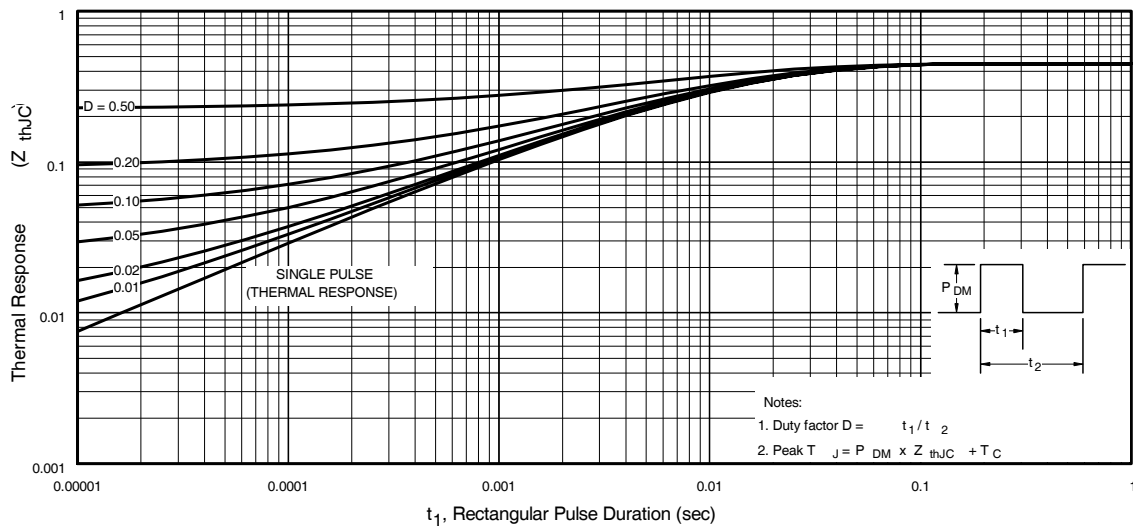


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

IRFB20N50K

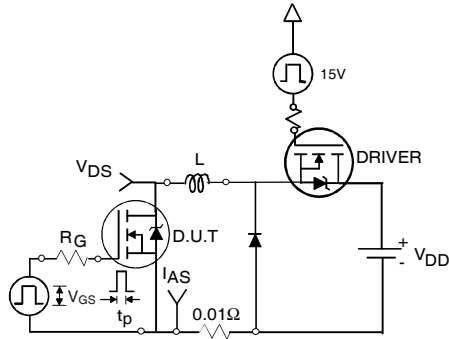


Fig 12a. Unclamped Inductive Test Circuit

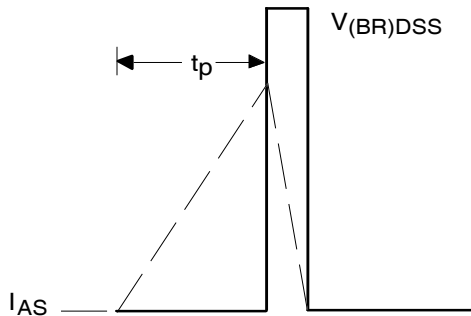


Fig 12b. Unclamped Inductive Waveforms

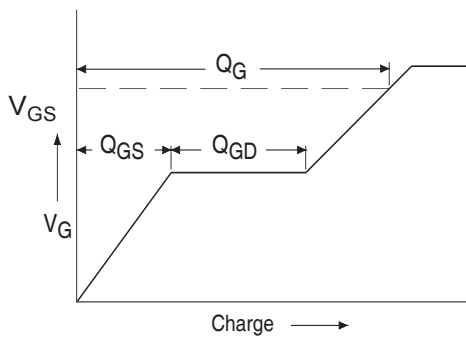


Fig 13a. Basic Gate Charge Waveform

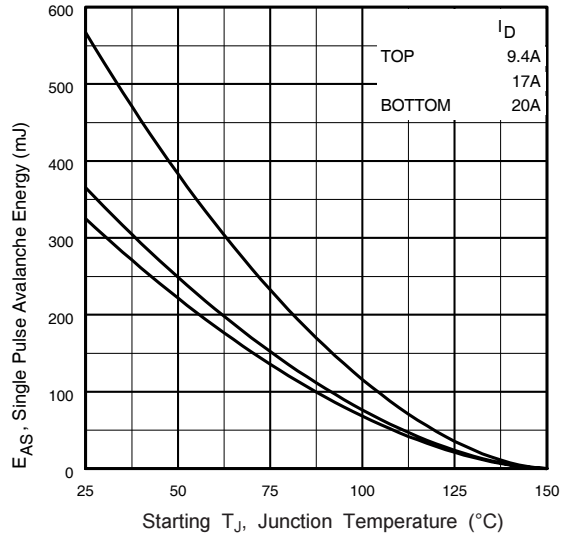


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

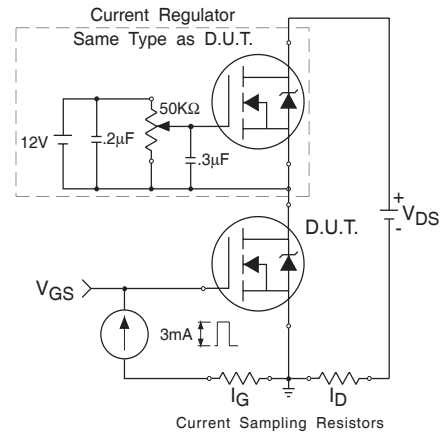
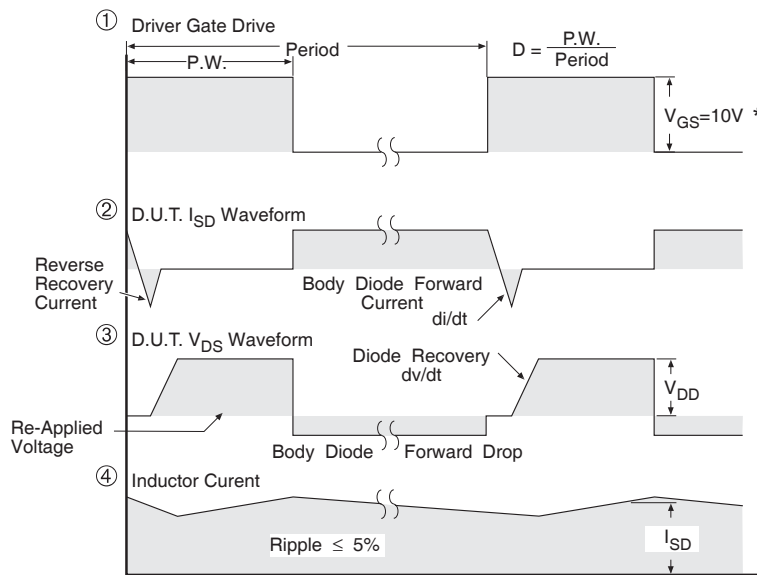
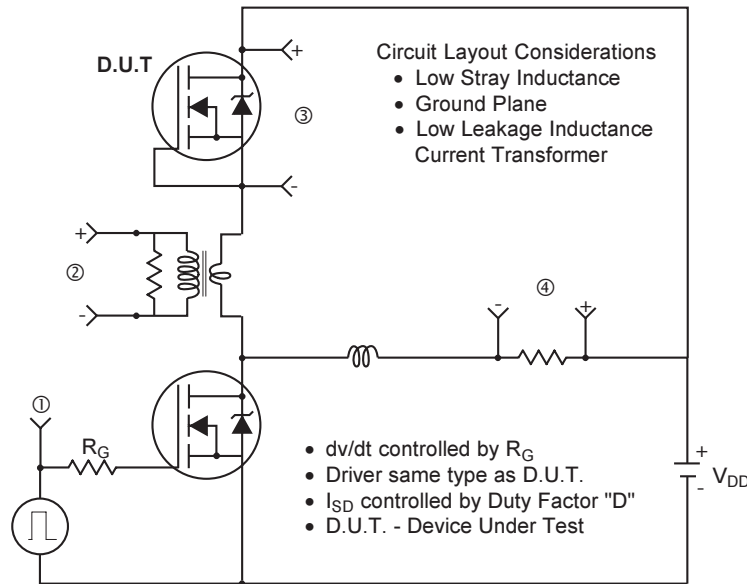


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

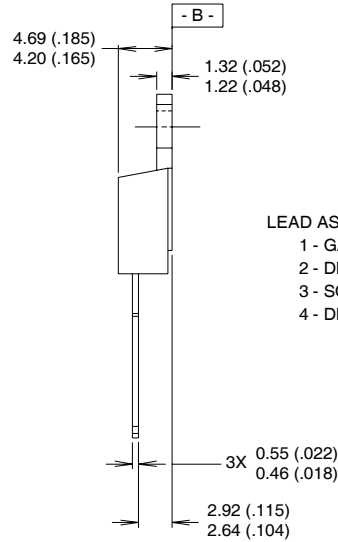
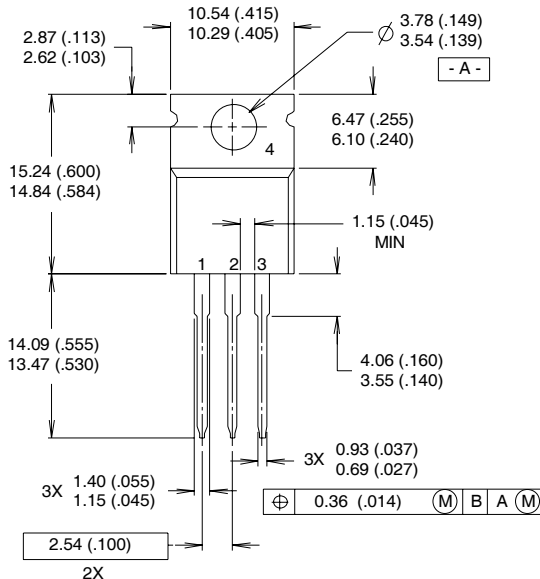
Fig 14. For N-Channel HEXFETS

IRFB20N50K

International
IR Rectifier

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



LEAD ASSIGNMENTS

- 1 - GATE
- 2 - DRAIN
- 3 - SOURCE
- 4 - DRAIN

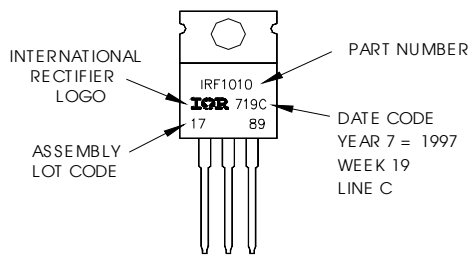
NOTES:

- 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"



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

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

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