

IRFB812PbF

HEXFET® Power MOSFET

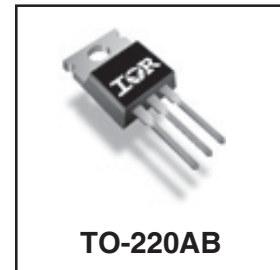
Applications

- Zero Voltage Switching SMPS
- Uninterruptible Power Supplies
- Motor Control applications

V_{DSS}	$R_{DS(on)}$ typ.	T_{rr} typ.	I_D
500V	1.75Ω	75ns	3.6A

Features and Benefits

- Fast body diode eliminates the need for external diodes in ZVS applications.
- Lower Gate charge results in simpler drive requirements.
- Higher Gate voltage threshold offers improved noise immunity.



Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	3.6	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	2.3	
I_{DM}	Pulsed Drain Current ①	14.4	
P_D @ $T_C = 25^\circ\text{C}$	Power Dissipation	78	W
	Linear Derating Factor	0.63	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery dv/dt ③	32	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	10lb·in (1.1N·m)	

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	3.6	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	14.4		
V_{SD}	Diode Forward Voltage	—	—	1.2	V	$T_J = 25^\circ\text{C}$, $I_S = 3.6\text{A}$, $V_{GS} = 0\text{V}$ ④
t_{rr}	Reverse Recovery Time	—	75	110	ns	$T_J = 25^\circ\text{C}$, $I_F = 3.6\text{A}$
		—	94	140		$T_J = 125^\circ\text{C}$, $di/dt = 100\text{A}/\mu\text{s}$ ④
Q_{rr}	Reverse Recovery Charge	—	135	200	nC	$T_J = 25^\circ\text{C}$, $I_S = 3.6\text{A}$, $V_{GS} = 0\text{V}$ ④
		—	220	330		$T_J = 125^\circ\text{C}$, $di/dt = 100\text{A}/\mu\text{s}$ ④
I_{RRM}	Reverse Recovery Current	—	3.2	4.8	A	$T_J = 25^\circ\text{C}$
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes ① through ⑥ are on page 2

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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	$V_{GS} = 0V, I_D = 250\mu\text{A}$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.37	—	V/°C	Reference to $25^\circ\text{C}, I_D = 250\mu\text{A}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	1.75	2.2	Ω	$V_{GS} = 10V, I_D = 2.2A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 500V, V_{GS} = 0V$
		—	—	2.0	mA	$V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100	nA	$V_{GS} = -20V$

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	7.6	—	—	S	$V_{DS} = 50V, I_D = 2.2A$
Q_g	Total Gate Charge	—	—	20	nC	$I_D = 3.6A$ $V_{DS} = 400V$ $V_{GS} = 10V$, See Fig.14a & 14b ④
Q_{gs}	Gate-to-Source Charge	—	—	7.3		
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	7.1		
$t_{d(on)}$	Turn-On Delay Time	—	14	—	ns	$V_{DD} = 250V$ $I_D = 3.6A$ $R_G = 17\Omega$ $V_{GS} = 10V$, See Fig. 15a & 15b ④
t_r	Rise Time	—	22	—		
$t_{d(off)}$	Turn-Off Delay Time	—	24	—		
t_f	Fall Time	—	17	—		
C_{iss}	Input Capacitance	—	810	—	pF	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1.0\text{MHz}$, See Fig. 5 $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$ $V_{GS} = 0V, V_{DS} = 400V, f = 1.0\text{MHz}$ $V_{GS} = 0V, V_{DS} = 0V$ to $400V$ ⑤
C_{oss}	Output Capacitance	—	47	—		
C_{riss}	Reverse Transfer Capacitance	—	7.3	—		
C_{oss}	Output Capacitance	—	610	—		
C_{oss}	Output Capacitance	—	16	—		
$C_{oss \text{ eff.}}$	Effective Output Capacitance	—	5.9	—		
$C_{oss \text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related)	—	37	—		

Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②	—	150	mJ
I_{AR}	Avalanche Current ①	—	1.8	A
E_{AR}	Repetitive Avalanche Energy ①	—	7.8	mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑥	—	1.6	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.5	—	
$R_{\theta JA}$	Junction-to-Ambient ⑥	—	62	

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See Fig. 11)
- ② Starting $T_J = 25^\circ\text{C}$, $L = 93\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 1.8A$. (See Figure 13).
- ③ $I_{SD} = 3.6A$, $di/dt \leq 520A/\mu\text{s}$, $V_{DD}V_{(BR)DSS}$, $T_J \leq 150^\circ\text{C}$.

④ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.

⑤ $C_{oss \text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

$C_{oss \text{ eff. (ER)}}$ is a fixed capacitance that stores the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

⑥ R_{θ} is measured at T_J approximately 90°C

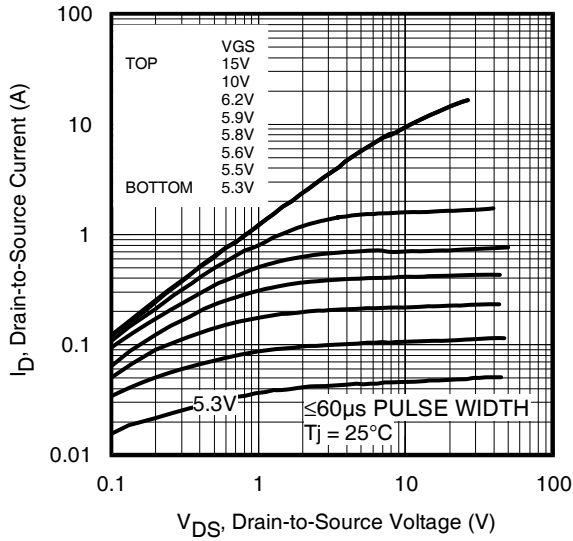


Fig 1. Typical Output Characteristics

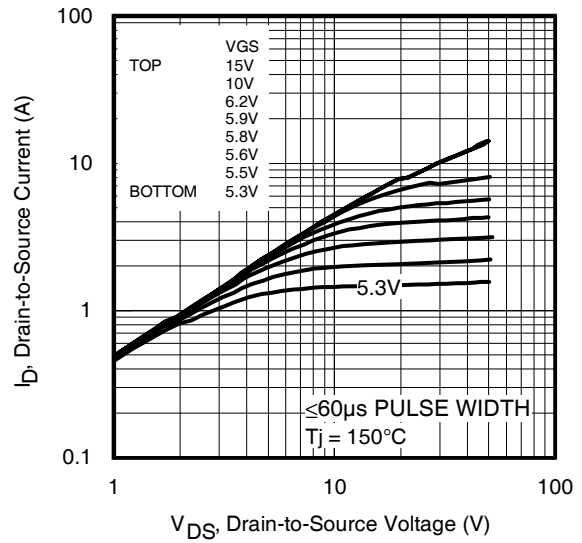


Fig 2. Typical Output Characteristics

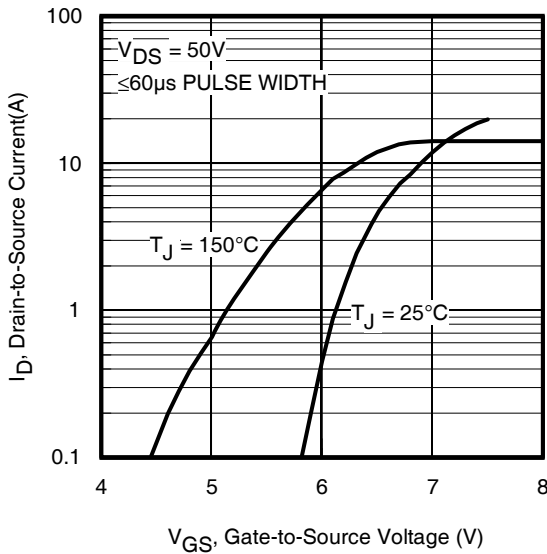


Fig 3. Typical Transfer Characteristics

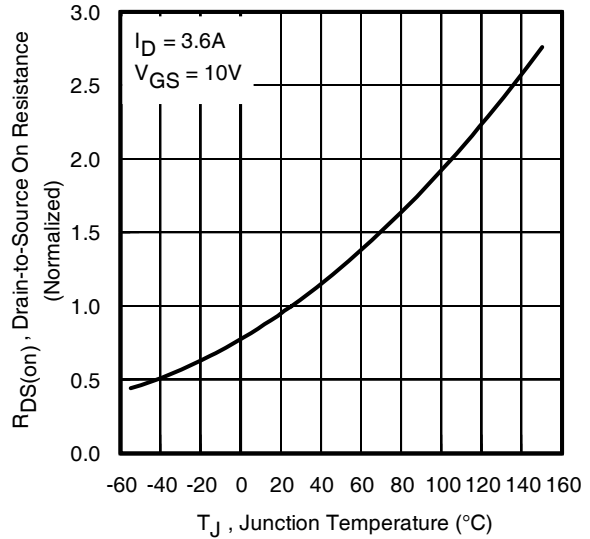


Fig 4. Normalized On-Resistance Vs. Temperature

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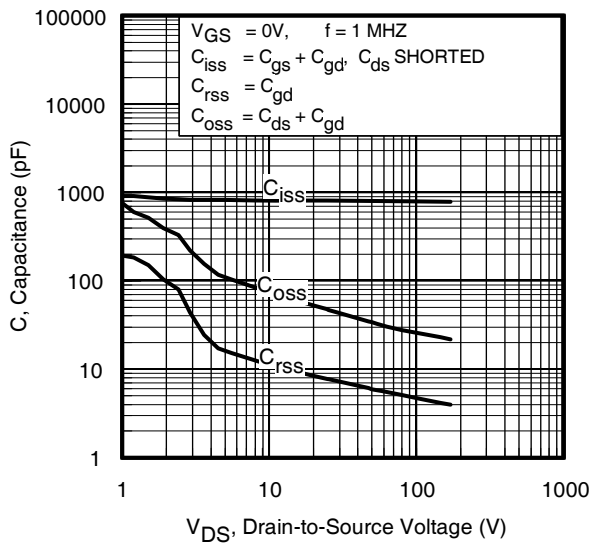


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

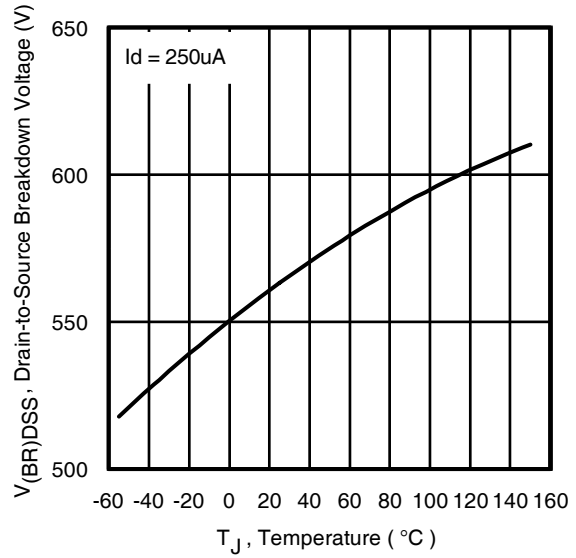
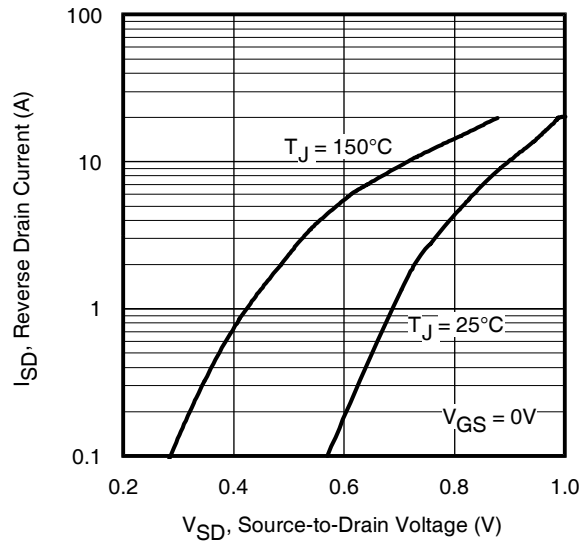
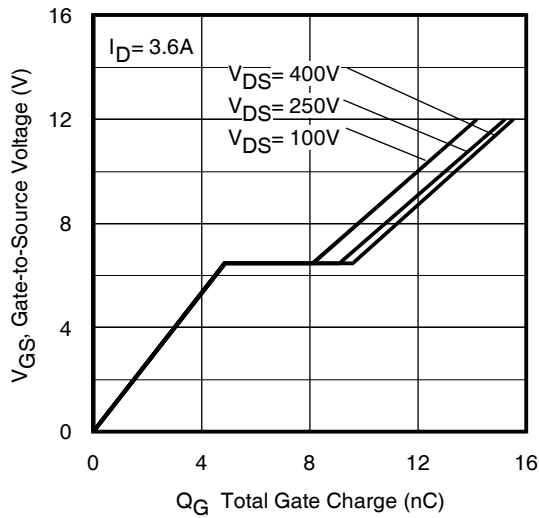


Fig 6. Typ. Breakdown Voltage vs. Temperature



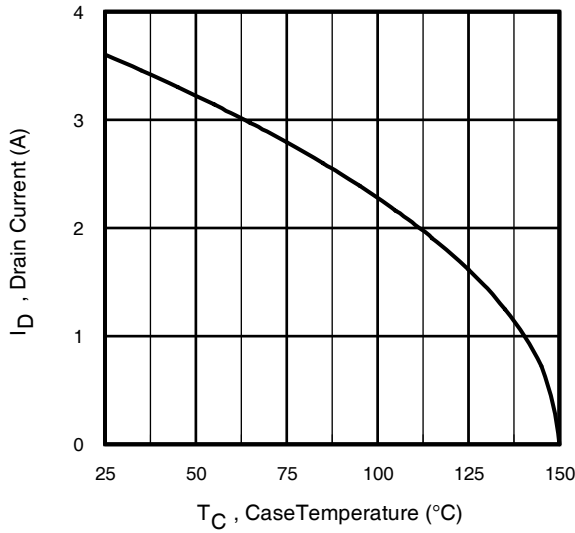


Fig 9. Maximum Drain Current Vs. Case Temperature

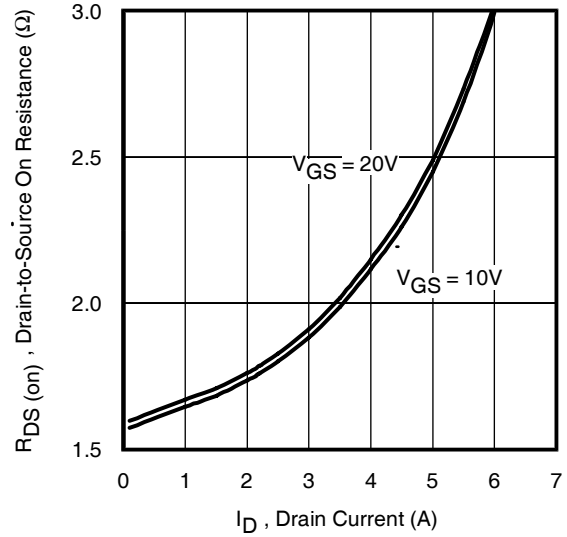


Fig 9. Typical $R_{ds(on)}$ Vs. Drain Current

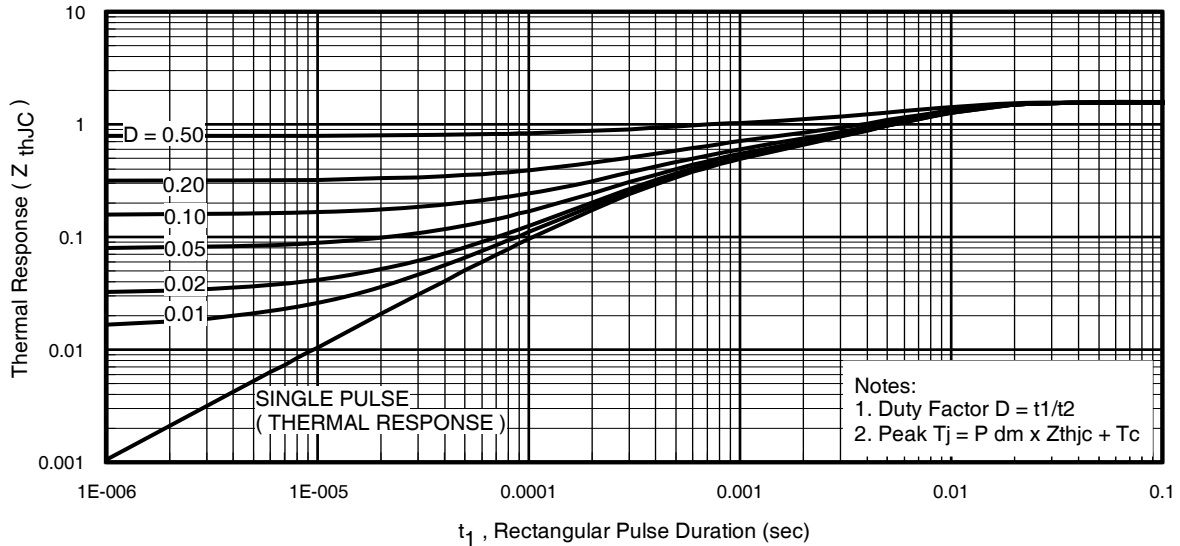


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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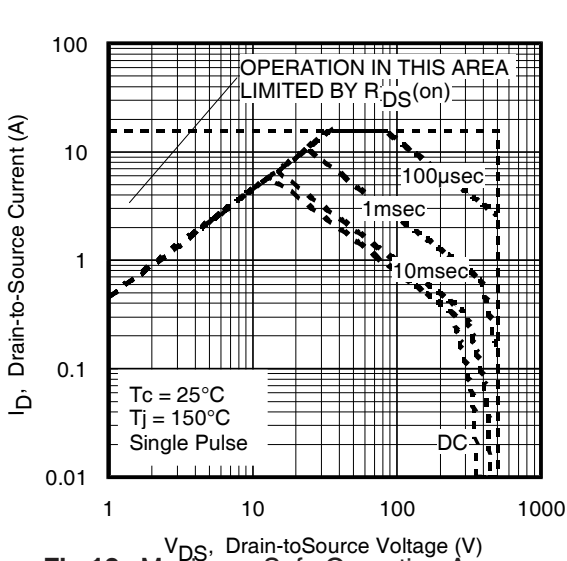


Fig 12. Maximum Safe Operating Area

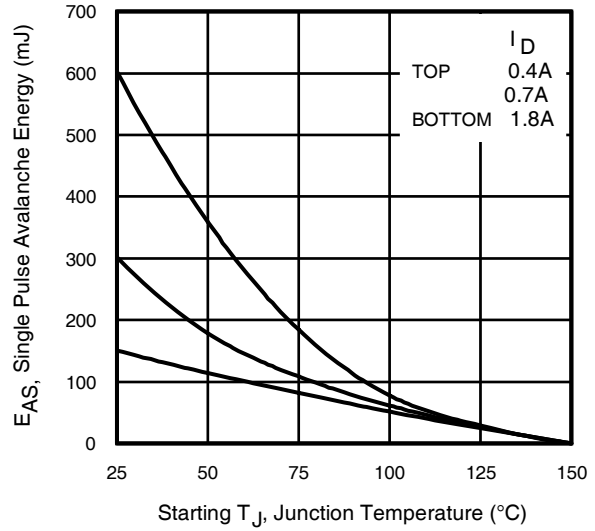


Fig 13. Maximum Avalanche Energy vs. Drain Current

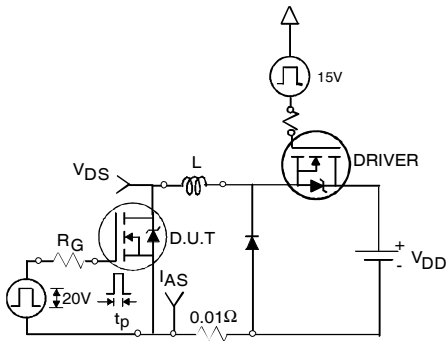


Fig 13a. Unclamped Inductive Test Circuit

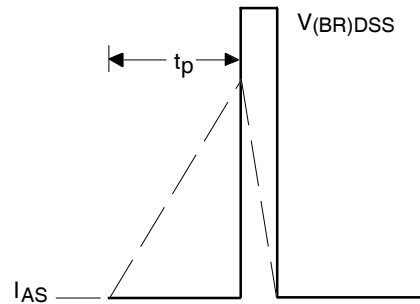


Fig 13b. Unclamped Inductive Waveforms

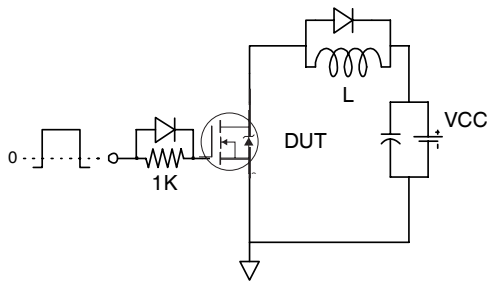


Fig 14a. Gate Charge Test Circuit

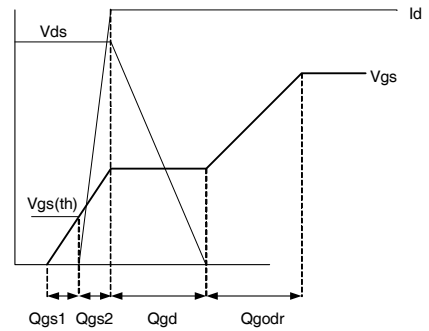


Fig 14b. Gate Charge Waveform

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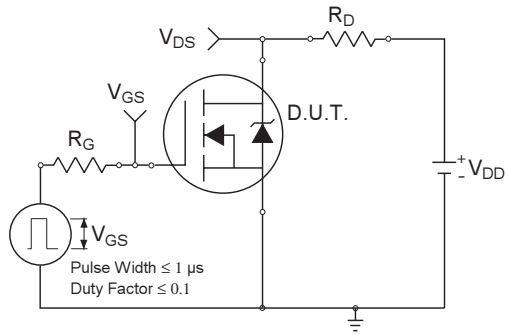


Fig 15a. Switching Time Test Circuit

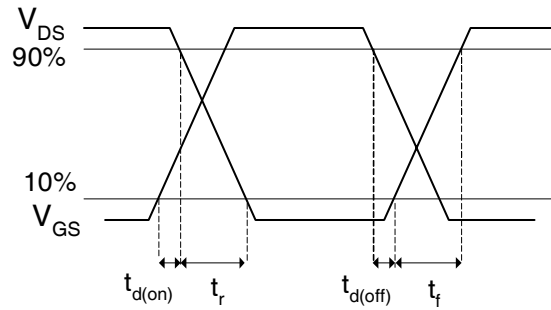


Fig 15b. Switching Time Waveforms

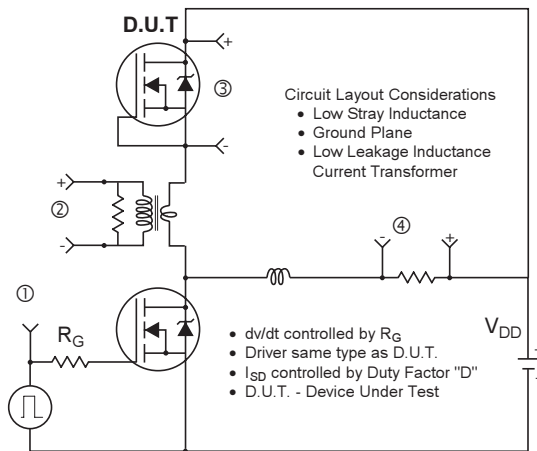
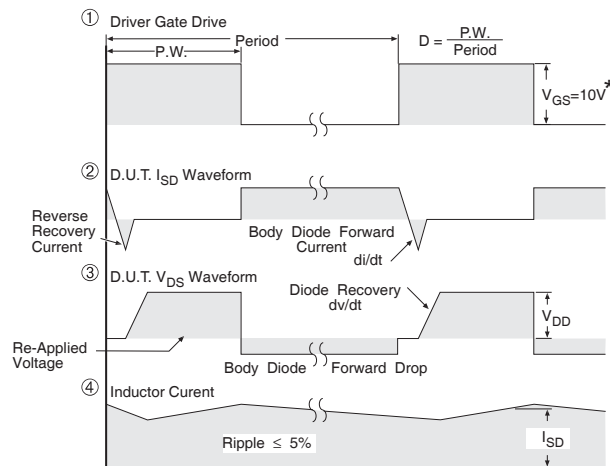


Fig 16. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET[®] Power MOSFETs



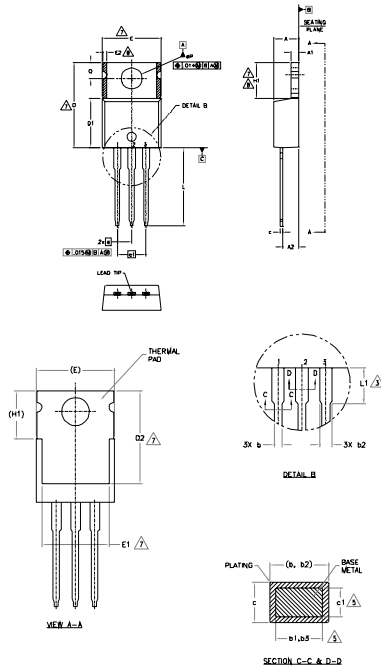
* $V_{GS} = 5V$ for Logic Level Devices

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TO-220AB Package Outline

Dimensions are shown in millimeters (inches)

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- 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 LT
 - 4.- DIMENSION D1, D1 & E DO NOT INCLUDE WELD FLASH; WELD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
 - 5.- DIMENSION B1, B2 & C1 APPLY TO BASE METAL ONLY.
 - 6.- CONTROLLING DIMENSION IS INCHES.
 - 7.- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E1, D2 & E1
 - 8.- DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SIMULATION 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.

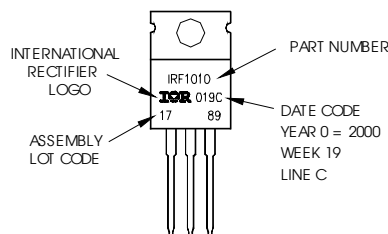
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.83	.140	.190	
A1	0.51	1.40	.020	.056	
A2	2.03	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.97	.015	.038	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	11.58	12.88	.460	.507	
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	0.76 BSC		.030 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.75	.500	.580	
L1	3.56	4.06	.140	.160	5
MP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

- LEAD ASSIGNMENTS
- 1.- GATE
 - 2.- SOURCE
 - 3.- SOURCE
- WELD SYMBOLS
- 1.- GATE
 - 2.- SOLDER
 - 3.- WELDER
- DOSES
- 1.- INCH
 - 2.- DIMENSIONS
 - 3.- INCH

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"



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/>

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.

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