

IRF3007PbF

Typical Applications

- Industrial Motor Drive

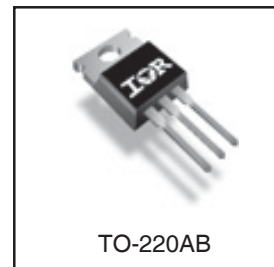
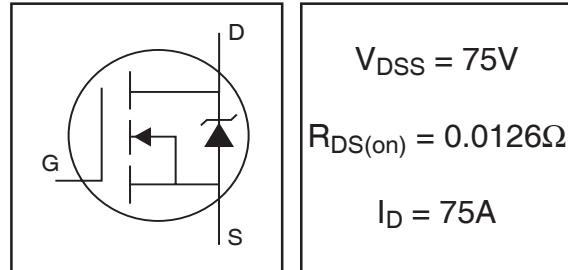
Features

- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to T_{jmax}
- Lead-Free

Description

This design of HEXFET® Power MOSFETs utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this HEXFET power MOSFET are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These combine to make this design an extremely efficient and reliable device for use in a wide variety of applications.

HEXFET® Power MOSFET



Absolute Maximum Ratings

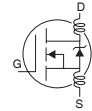
	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Silicon limited)	80	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (See Fig.9)	56	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Package limited)	75	
I_{DM}	Pulsed Drain Current ①	320	
$P_D @ T_C = 25^\circ C$	Power Dissipation	200	W
	Linear Derating Factor	1.3	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②	280	mJ
$E_{AS} (6 \text{ sigma})$	Single Pulse Avalanche Energy Tested Value②	946	
I_{AR}	Avalanche Current①	See Fig.12a, 12b, 15, 16	A
E_{AR}	Repetitive Avalanche Energy③		mJ
T_J	Operating Junction and	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting Torque, 6-32 or M3 screw	1.1 (10)	N•m (lb•in)

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.74	°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	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	75	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.084	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	10.5	12.6	m Ω	$V_{GS} = 10V, I_D = 48A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = 10V, I_D = 250\mu A$
g_{fs}	Forward Transconductance	180	—	—	S	$V_{DS} = 25V, I_D = 48A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 75V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 60V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{GS} = -20V$
Q_g	Total Gate Charge	—	89	130	nC	$I_D = 48A$
Q_{gs}	Gate-to-Source Charge	—	21	32		$V_{DS} = 60V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	30	45		$V_{GS} = 10V$
$t_{d(on)}$	Turn-On Delay Time	—	12	—	ns	$V_{DD} = 38V$
t_r	Rise Time	—	80	—		$I_D = 48A$
$t_{d(off)}$	Turn-Off Delay Time	—	55	—		$R_G = 4.6\Omega$
t_f	Fall Time	—	49	—		$V_{GS} = 10V$ ④
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L_S	Internal Source Inductance	—	7.5	—		
C_{iss}	Input Capacitance	—	3270	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	520	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	78	—		$f = 1.0\text{MHz}$, See Fig. 5
C_{oss}	Output Capacitance	—	3500	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	340	—		$V_{GS} = 0V, V_{DS} = 60V, f = 1.0\text{MHz}$
$C_{oss \text{ eff.}}$	Effective Output Capacitance ⑤	—	640	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 60V$



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	80	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	320		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 48A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	85	130	ns	$T_J = 25^\circ\text{C}, I_F = 48A, V_{DD} = 38V$
Q_{rr}	Reverse Recovery Charge	—	280	420	nC	$di/dt = 100A/\mu s$ 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 fig. 11).
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.24\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 48A$, $V_{GS} = 10V$ (See Figure 12).
- ③ $I_{SD} \leq 48A$, $di/dt \leq 330A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$
- ④ Pulse width $\leq 400\mu s$; 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} .
- ⑥ Limited by T_{Jmax} , see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
- ⑦ This value determined from sample failure population. 100% tested to this value in production.

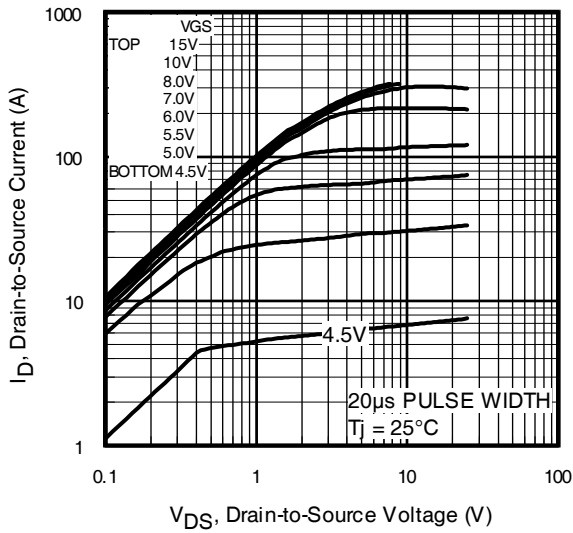


Fig 1. Typical Output Characteristics

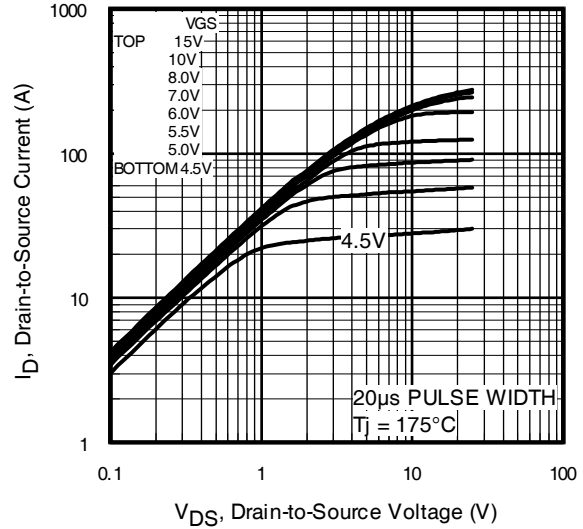


Fig 2. Typical Output Characteristics

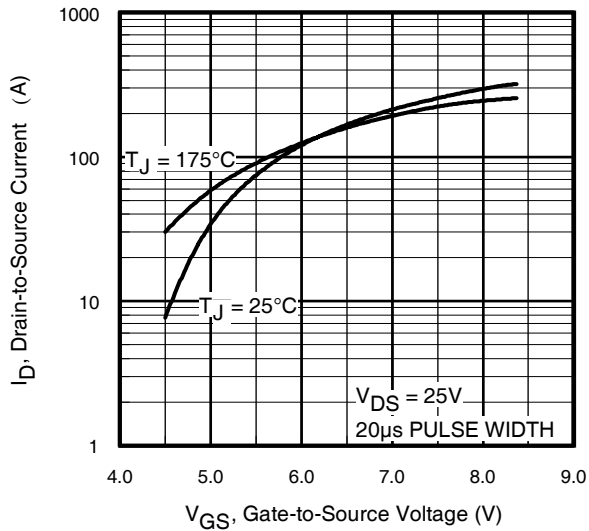


Fig 3. Typical Transfer Characteristics

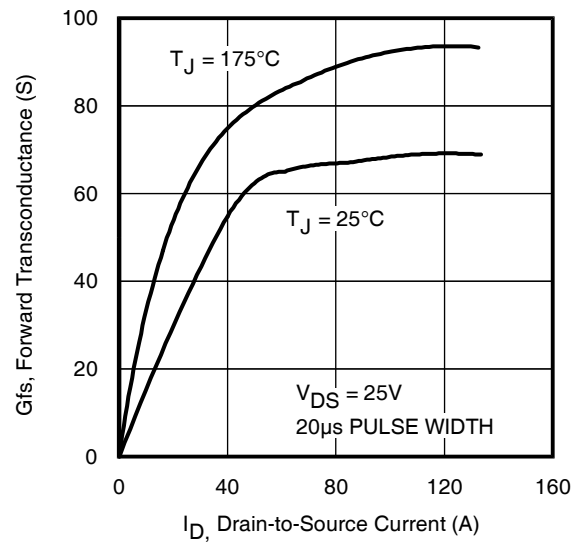


Fig 4. Typical Forward Transconductance Vs. Drain Current

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International
IR Rectifier

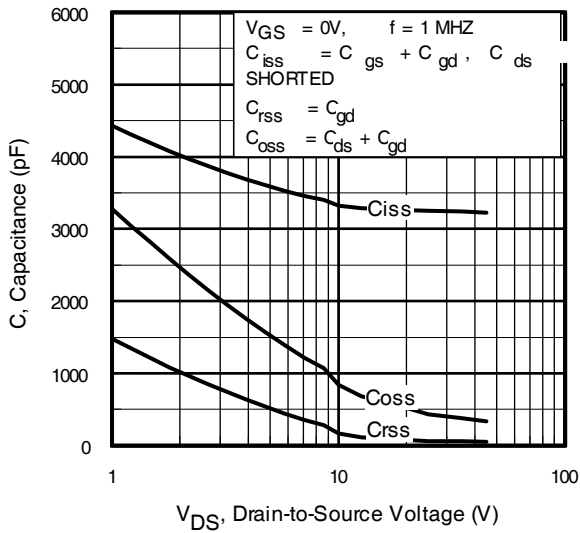


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

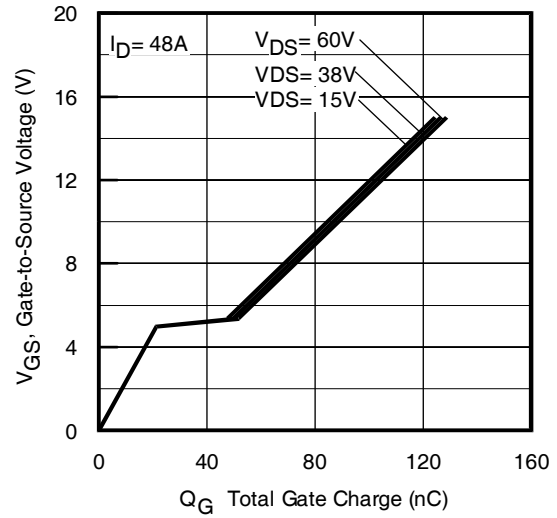


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

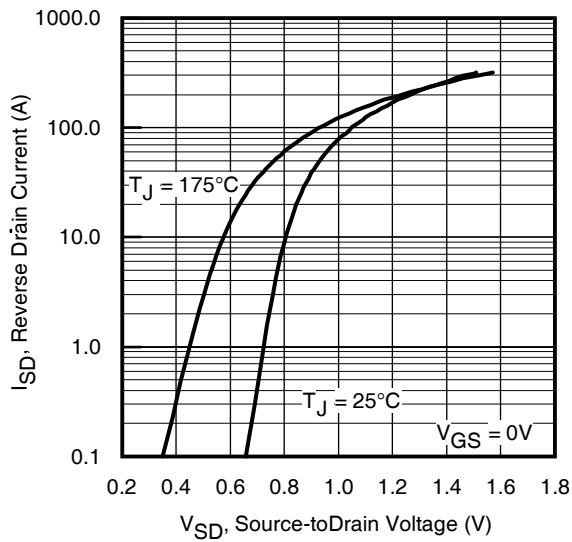


Fig 7. Typical Source-Drain Diode Forward Voltage

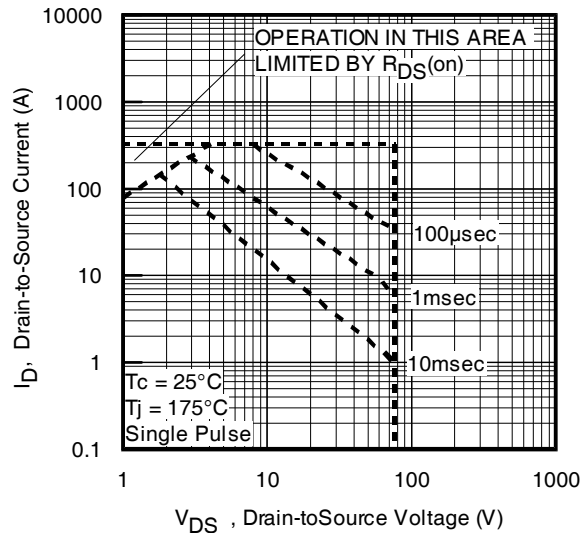


Fig 8. Maximum Safe Operating Area

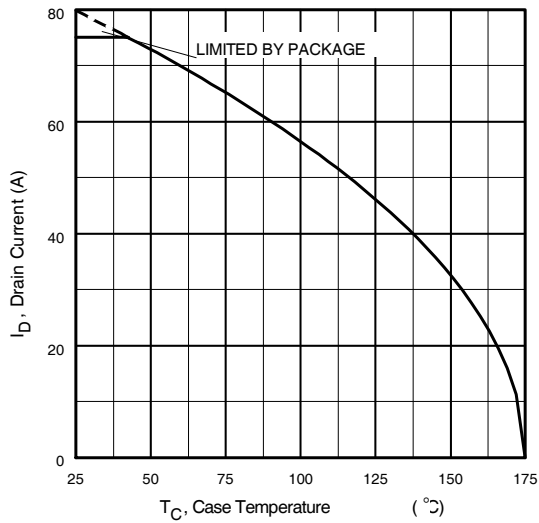


Fig 9. Maximum Drain Current Vs. Case Temperature

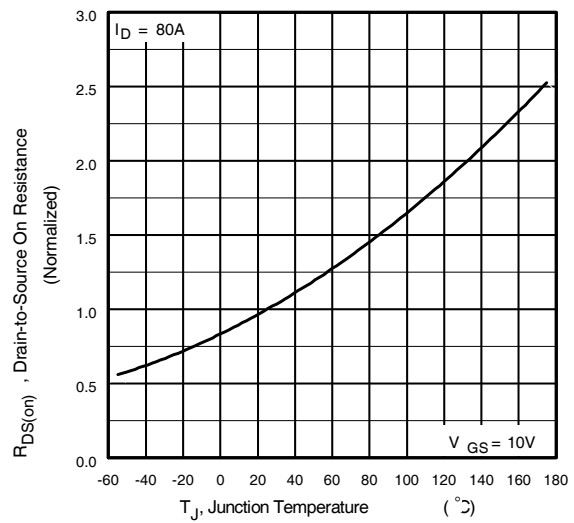


Fig 10. Normalized On-Resistance Vs. Temperature

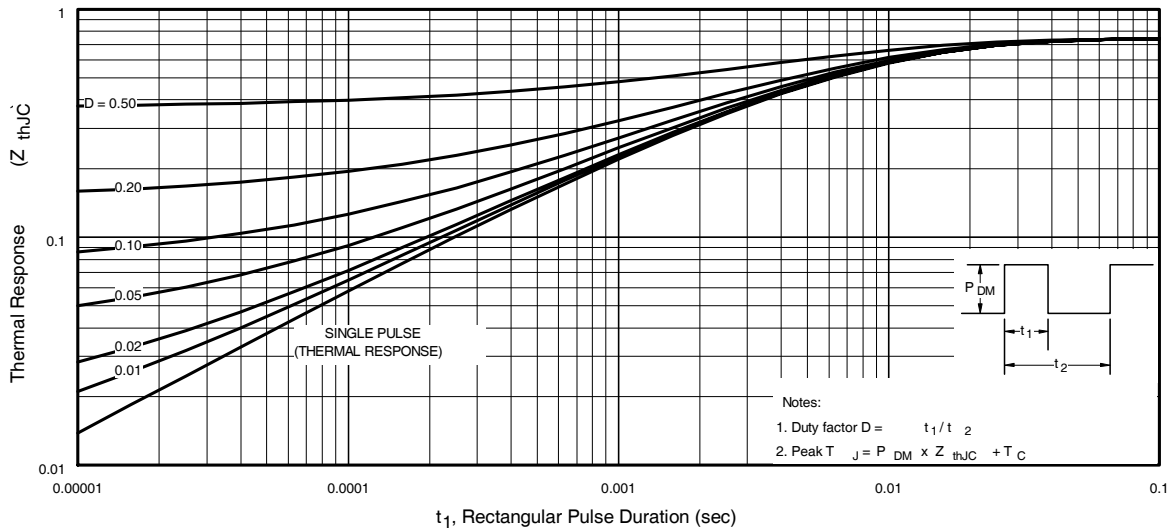


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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IR Rectifier

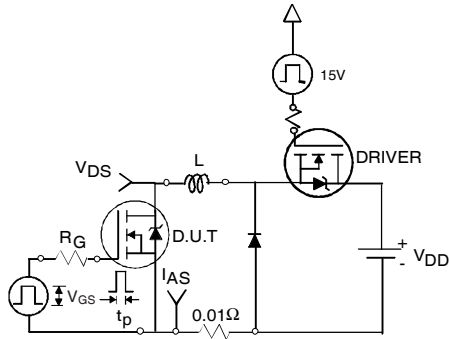


Fig 12a. Unclamped Inductive Test Circuit



Fig 12b. Unclamped Inductive Waveforms



Fig 13a. Basic Gate Charge Waveform



Fig 13b. Gate Charge Test Circuit

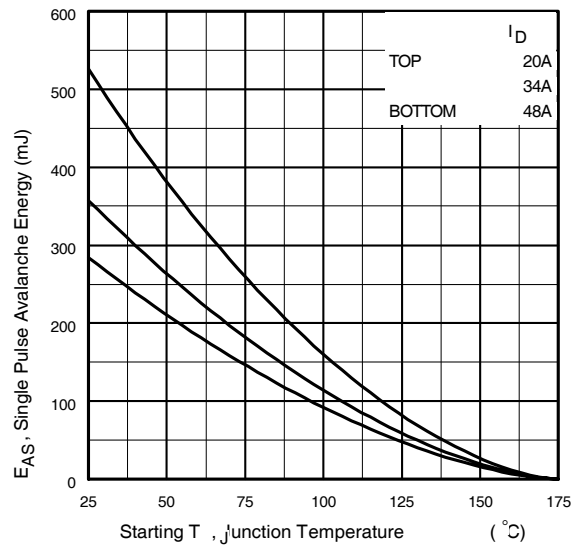


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

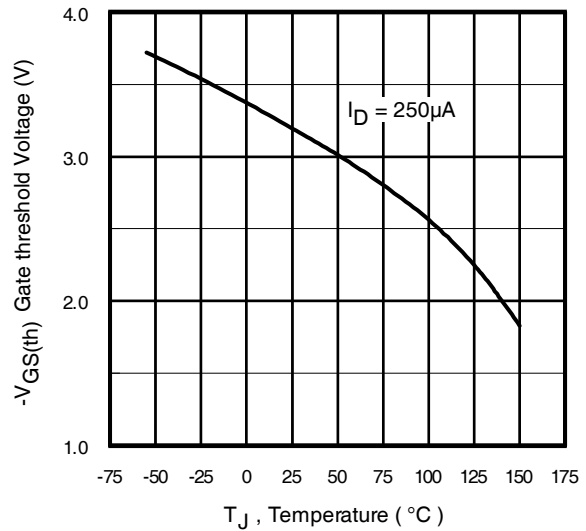


Fig 14. Threshold Voltage Vs. Temperature

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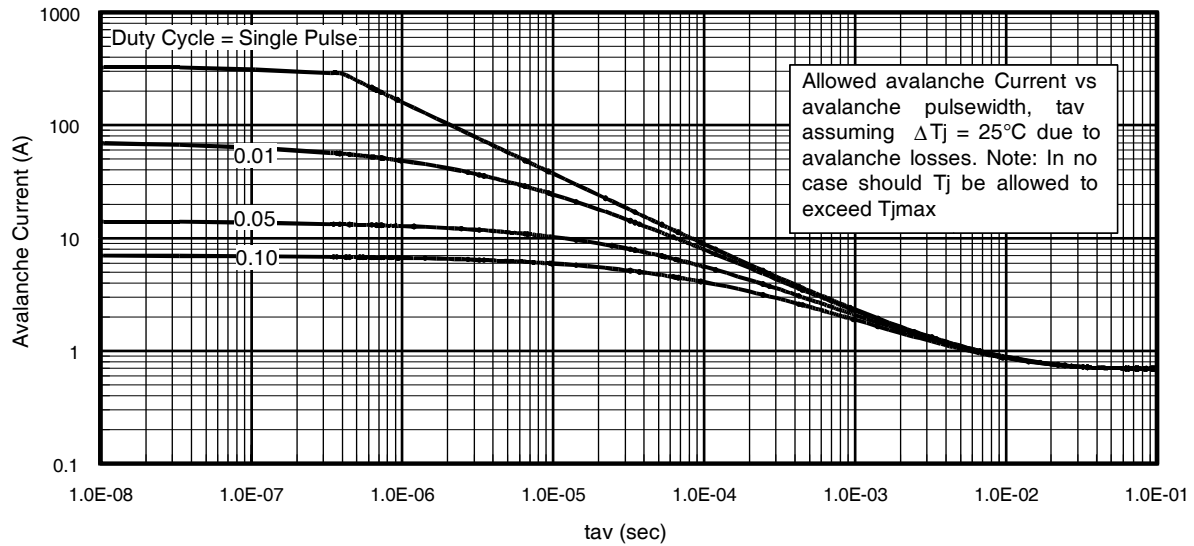


Fig 15. Typical Avalanche Current Vs. Pulsewidth

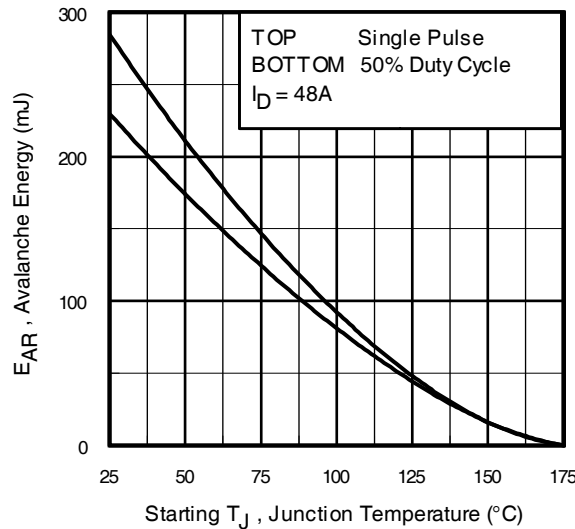


Fig 16. Maximum Avalanche Energy Vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 15, 16:
(For further info, see AN-1005 at www.irf.com)

1. Avalanche failures assumption:
Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax} . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
4. $P_{D(ave)}$ = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. I_{av} = Allowable avalanche current.
7. ΔT = Allowable rise in junction temperature, not to exceed T_{jmax} (assumed as 25°C in Figure 15, 16).
 t_{av} = Average time in avalanche.
 D = Duty cycle in avalanche = $t_{av} \cdot f$
 $Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see figure 11)

$$P_{D(ave)} = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$

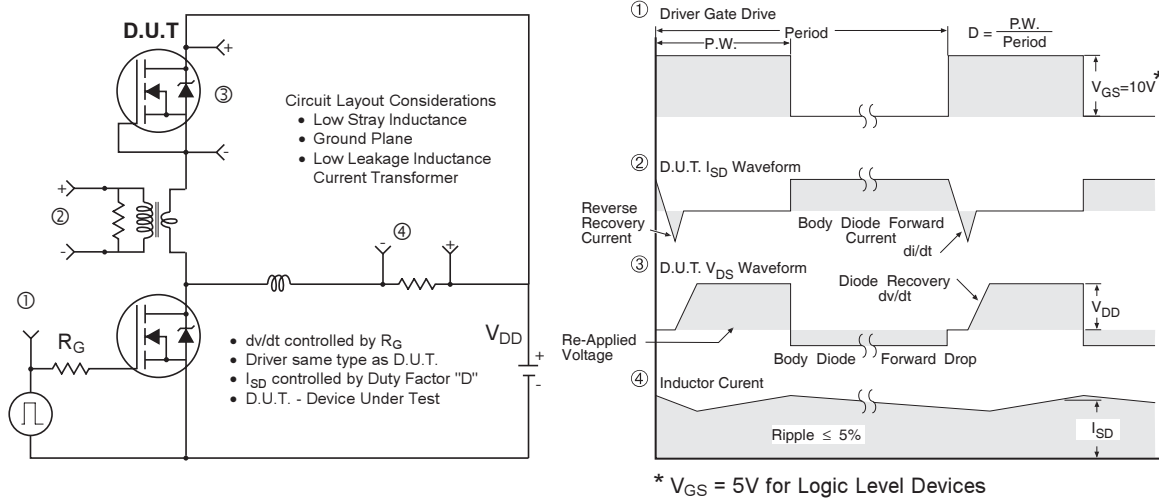


Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

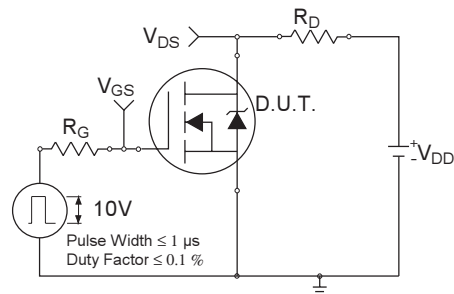


Fig 18a. Switching Time Test Circuit

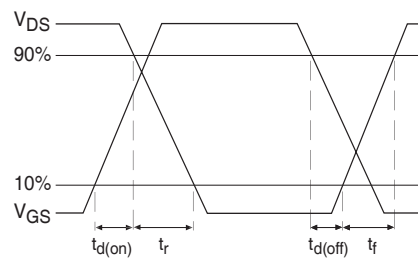
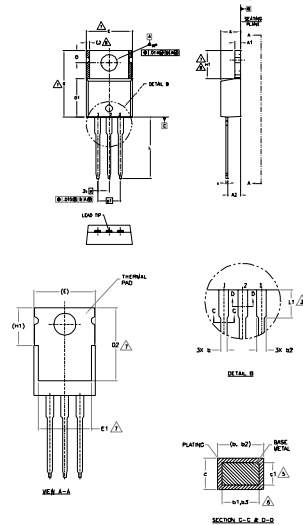


Fig 18b. Switching Time Waveforms

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



- NOTES:
1. DIMENSIONS AND TOLERANCING AS PER ASME Y14.5 M-1994
 2. DIMENSIONS ARE SHOWN IN INCHES (MILLIMETERS)
 3. LEAD DIMENSION AND PITCH UNCONTROLLED IN 11
 4. DIMENSION 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) SHALL NOT EXCEED 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMITY OF THE PLASTIC BODY
 5. DIMENSION 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) SHALL NOT EXCEED 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMITY OF THE PLASTIC BODY
 6. DIMENSION 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) SHALL NOT EXCEED 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMITY OF THE PLASTIC BODY
 7. DIMENSION 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) SHALL NOT EXCEED 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMITY OF THE PLASTIC BODY
 8. DIMENSION 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) SHALL NOT EXCEED 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMITY OF THE PLASTIC BODY
 9. DIMENSION 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) SHALL NOT EXCEED 10.00 ± 0.05 INCHES (254.00 ± 1.27 MM) THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMITY OF THE PLASTIC BODY

SYMBOL	MILLIMETERS		INCHES		NOTES
	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	1.02	.015	.040	5
B1	0.38	0.97	.015	.038	
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	14.32	16.51	.563	.650	4
D1	8.26	9.52	.325	.375	
D2	11.68	12.88	.460	.507	7
E	9.85	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	-	0.76	-	.030	8
F	5.08	5.08	.200	.200	
F1	5.08	5.08	.200	.200	
F2	5.08	5.08	.200	.200	
F3	5.08	5.08	.200	.200	
F4	5.08	5.08	.200	.200	
F5	5.08	5.08	.200	.200	
F6	5.08	5.08	.200	.200	
F7	5.08	5.08	.200	.200	
F8	5.08	5.08	.200	.200	
F9	5.08	5.08	.200	.200	
F10	5.08	5.08	.200	.200	
F11	5.08	5.08	.200	.200	
F12	5.08	5.08	.200	.200	
F13	5.08	5.08	.200	.200	
F14	5.08	5.08	.200	.200	
F15	5.08	5.08	.200	.200	
F16	5.08	5.08	.200	.200	
F17	5.08	5.08	.200	.200	
F18	5.08	5.08	.200	.200	
F19	5.08	5.08	.200	.200	
F20	5.08	5.08	.200	.200	
F21	5.08	5.08	.200	.200	
F22	5.08	5.08	.200	.200	
F23	5.08	5.08	.200	.200	
F24	5.08	5.08	.200	.200	
F25	5.08	5.08	.200	.200	
F26	5.08	5.08	.200	.200	
F27	5.08	5.08	.200	.200	
F28	5.08	5.08	.200	.200	
F29	5.08	5.08	.200	.200	
F30	5.08	5.08	.200	.200	
F31	5.08	5.08	.200	.200	
F32	5.08	5.08	.200	.200	
F33	5.08	5.08	.200	.200	
F34	5.08	5.08	.200	.200	
F35	5.08	5.08	.200	.200	
F36	5.08	5.08	.200	.200	
F37	5.08	5.08	.200	.200	
F38	5.08	5.08	.200	.200	
F39	5.08	5.08	.200	.200	
F40	5.08	5.08	.200	.200	
F41	5.08	5.08	.200	.200	
F42	5.08	5.08	.200	.200	
F43	5.08	5.08	.200	.200	
F44	5.08	5.08	.200	.200	
F45	5.08	5.08	.200	.200	
F46	5.08	5.08	.200	.200	
F47	5.08	5.08	.200	.200	
F48	5.08	5.08	.200	.200	
F49	5.08	5.08	.200	.200	
F50	5.08	5.08	.200	.200	
F51	5.08	5.08	.200	.200	
F52	5.08	5.08	.200	.200	
F53	5.08	5.08	.200	.200	
F54	5.08	5.08	.200	.200	
F55	5.08	5.08	.200	.200	
F56	5.08	5.08	.200	.200	
F57	5.08	5.08	.200	.200	
F58	5.08	5.08	.200	.200	
F59	5.08	5.08	.200	.200	
F60	5.08	5.08	.200	.200	
F61	5.08	5.08	.200	.200	
F62	5.08	5.08	.200	.200	
F63	5.08	5.08	.200	.200	
F64	5.08	5.08	.200	.200	
F65	5.08	5.08	.200	.200	
F66	5.08	5.08	.200	.200	
F67	5.08	5.08	.200	.200	
F68	5.08	5.08	.200	.200	
F69	5.08	5.08	.200	.200	
F70	5.08	5.08	.200	.200	
F71	5.08	5.08	.200	.200	
F72	5.08	5.08	.200	.200	
F73	5.08	5.08	.200	.200	
F74	5.08	5.08	.200	.200	
F75	5.08	5.08	.200	.200	
F76	5.08	5.08	.200	.200	
F77	5.08	5.08	.200	.200	
F78	5.08	5.08	.200	.200	
F79	5.08	5.08	.200	.200	
F80	5.08	5.08	.200	.200	
F81	5.08	5.08	.200	.200	
F82	5.08	5.08	.200	.200	
F83	5.08	5.08	.200	.200	
F84	5.08	5.08	.200	.200	
F85	5.08	5.08	.200	.200	
F86	5.08	5.08	.200	.200	
F87	5.08	5.08	.200	.200	
F88	5.08	5.08	.200	.200	
F89	5.08	5.08	.200	.200	
F90	5.08	5.08	.200	.200	
F91	5.08	5.08	.200	.200	
F92	5.08	5.08	.200	.200	
F93	5.08	5.08	.200	.200	
F94	5.08	5.08	.200	.200	
F95	5.08	5.08	.200	.200	
F96	5.08	5.08	.200	.200	
F97	5.08	5.08	.200	.200	
F98	5.08	5.08	.200	.200	
F99	5.08	5.08	.200	.200	
F100	5.08	5.08	.200	.200	

USE DIMENSIONS

1. CASE

2. BODY

3. LEAD

4. CASE

5. BODY

6. LEAD

7. CASE

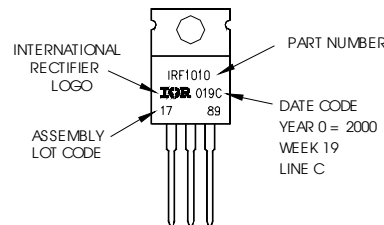
8. BODY

9. LEAD

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 package is not recommended for Surface Mount Application

Notes:

1. For an Automotive Qualified version of this part please see <http://www.irf.com/product-info/auto/>
2. 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.

International
IR Rectifier

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TAC Fax: (310) 252-7903

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