

IRF3808PbF

HEXFET® Power MOSFET

Typical Applications

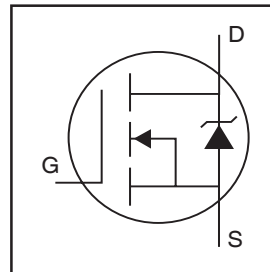
- Industrial Motor Drive

Benefits

- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free

Description

This Advanced Planar Stripe HEXFET® Power MOSFET 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, low RθJC, fast switching speed and improved repetitive avalanche rating. This combination makes the design an extremely efficient and reliable choice for use in a wide variety of applications.



$$V_{DSS} = 75V$$

$$R_{DS(on)} = 0.007\Omega$$

$$I_D = 140A\text{⑥}$$



TO-220AB

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ $T_C = 25^\circ C$	Continuous Drain Current, V_{GS} @ 10V	140⑥	A
I_D @ $T_C = 100^\circ C$	Continuous Drain Current, V_{GS} @ 10V	97⑥	
I_{DM}	Pulsed Drain Current ①	550	
P_D @ $T_C = 25^\circ C$	Power Dissipation	330	W
	Linear Derating Factor	2.2	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②	430	mJ
I_{AR}	Avalanche Current①	82	A
E_{AR}	Repetitive Avalanche Energy⑦	See Fig.12a, 12b, 15, 16	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.5	V/ns
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	10 lbf•in (1.1N•m)	

Thermal Resistance

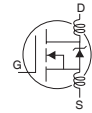
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.45	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	

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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	—	0.086	—	V/°C	Reference to 25°C , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	5.9	7.0	mΩ	$V_{GS} = 10V, I_D = 82A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = 10V, I_D = 250\mu A$
g_{fs}	Forward Transconductance	100	—	—	S	$V_{DS} = 25V, I_D = 82A$
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	—	150	220	nC	$I_D = 82A$
Q_{gs}	Gate-to-Source Charge	—	31	47		$V_{DS} = 60V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	50	76		$V_{GS} = 10V$ ④
$t_{d(on)}$	Turn-On Delay Time	—	16	—	ns	$V_{DD} = 38V$
t_r	Rise Time	—	140	—		$I_D = 82A$
$t_{d(off)}$	Turn-Off Delay Time	—	68	—		$R_G = 2.5\Omega$
t_f	Fall Time	—	120	—		$V_{GS} = 10V$ 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	—	5310	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	890	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	130	—		$f = 1.0MHz$, See Fig. 5
C_{oss}	Output Capacitance	—	6010	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
C_{oss}	Output Capacitance	—	570	—		$V_{GS} = 0V, V_{DS} = 60V, f = 1.0MHz$
$C_{oss \text{ eff.}}$	Effective Output Capacitance ⑤	—	1140	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 60V$



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	140	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	550		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 82A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	93	140	ns	$T_J = 25^\circ\text{C}, I_F = 82A$
Q_{rr}	Reverse Recovery Charge	—	340	510	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 $T_J = 25^\circ\text{C}$, $L = 0.130mH$
 $R_G = 25\Omega$, $I_{AS} = 82A$. (See Figure 12).
- ③ $I_{SD} \leq 82A$, $di/dt \leq 310A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$
- 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 Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.
- ⑦ Limited by T_{Jmax} , see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.

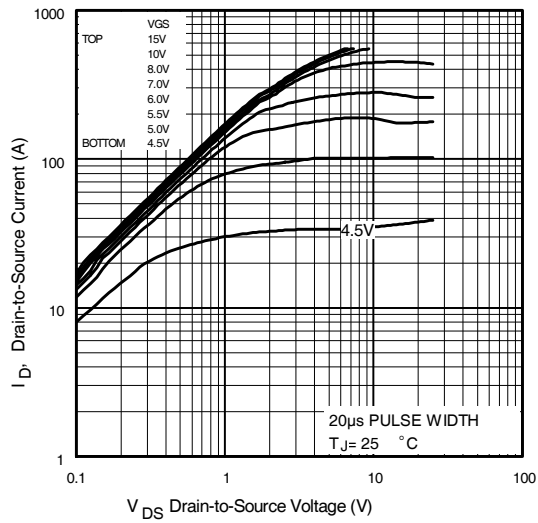


Fig 1. Typical Output Characteristics

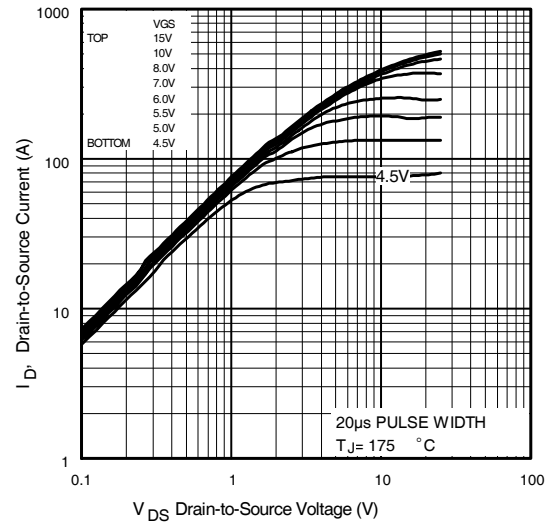


Fig 2. Typical Output Characteristics

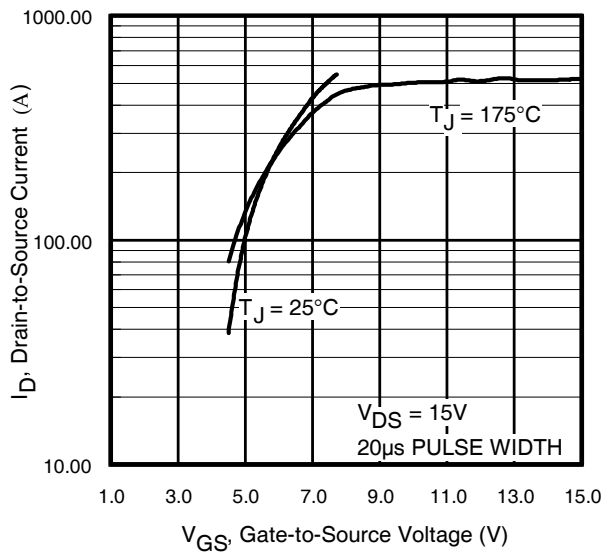


Fig 3. Typical Transfer Characteristics

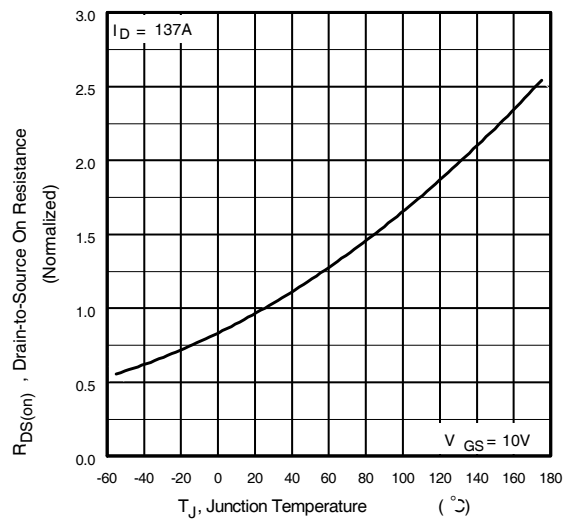
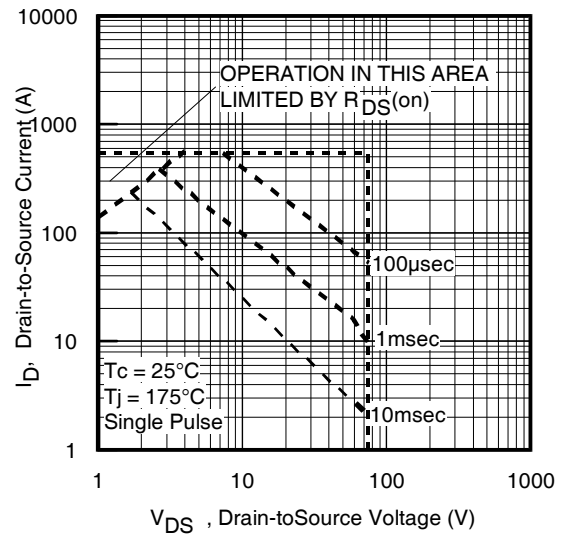
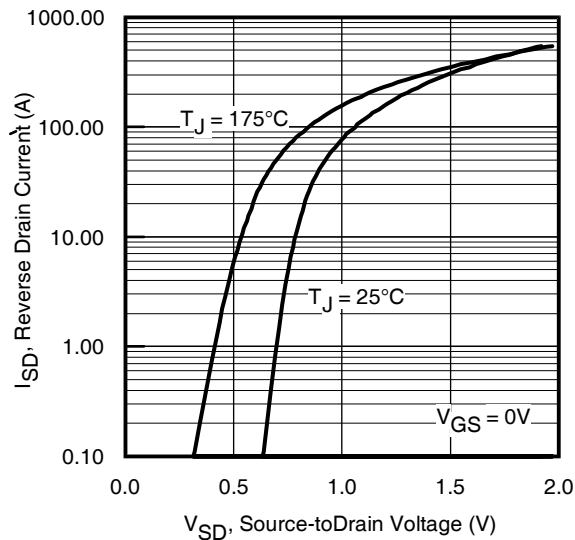
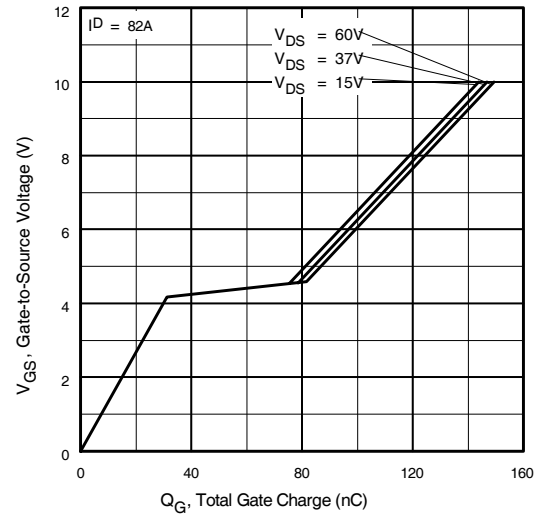
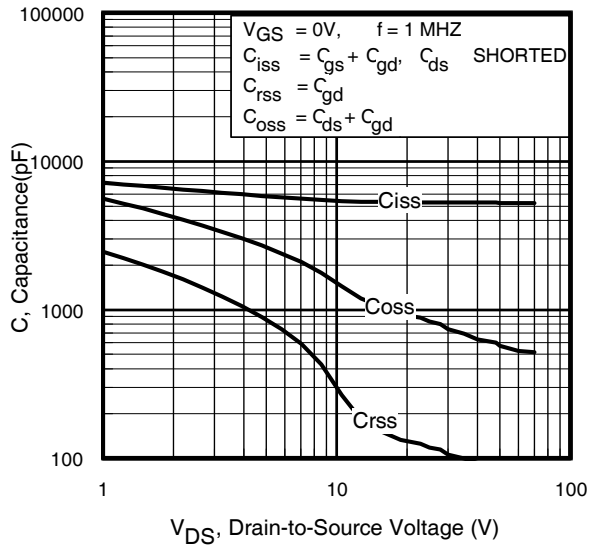


Fig 4. Normalized On-Resistance Vs. Temperature



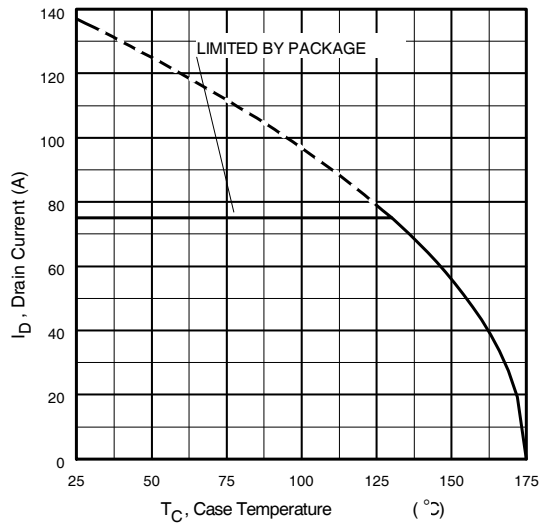


Fig 9. Maximum Drain Current Vs. Case Temperature

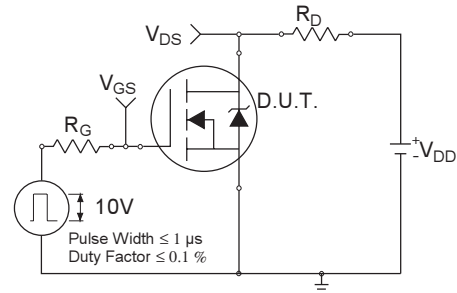


Fig 10a. Switching Time Test Circuit

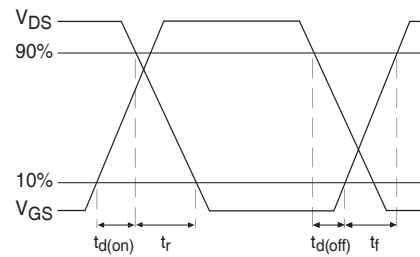


Fig 10b. Switching Time Waveforms

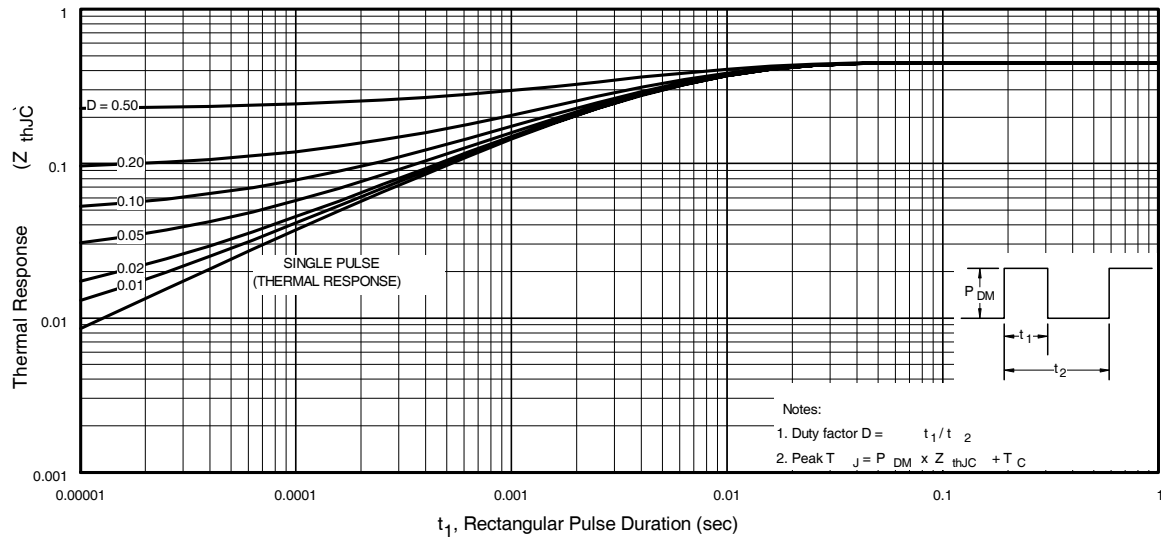


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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IR Rectifier

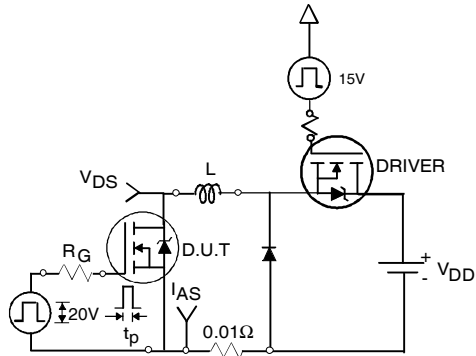


Fig 12a. Unclamped Inductive Test Circuit

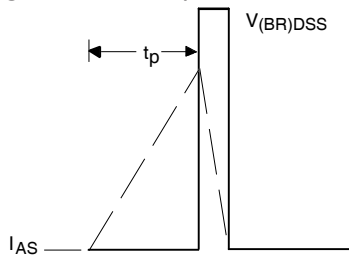


Fig 12b. Unclamped Inductive Waveforms

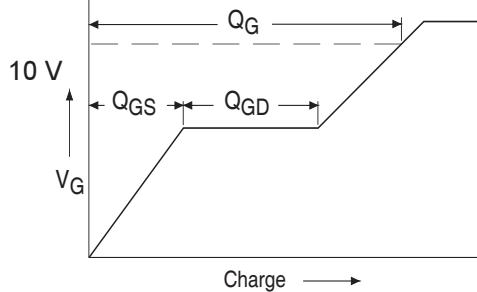


Fig 13a. Basic Gate Charge Waveform

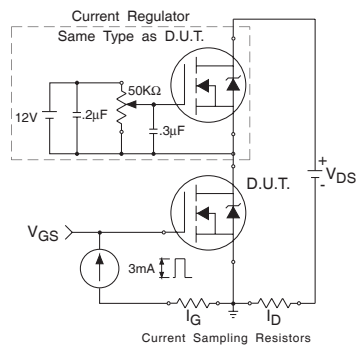


Fig 13b. Gate Charge Test Circuit

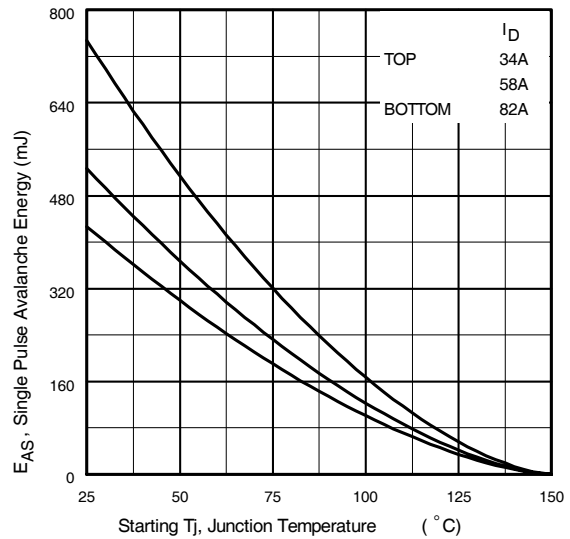


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

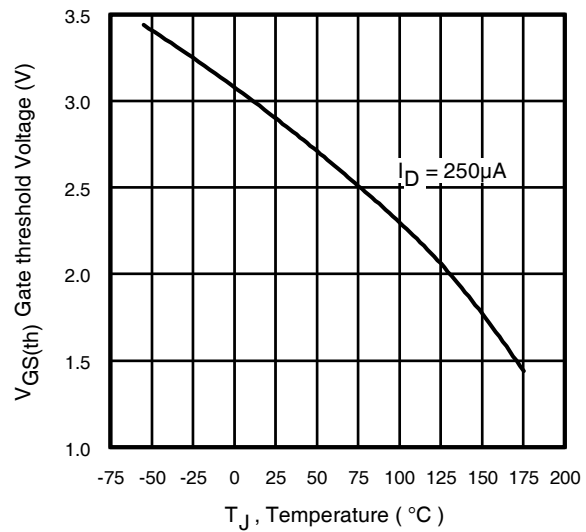


Fig 14. Threshold Voltage Vs. Temperature

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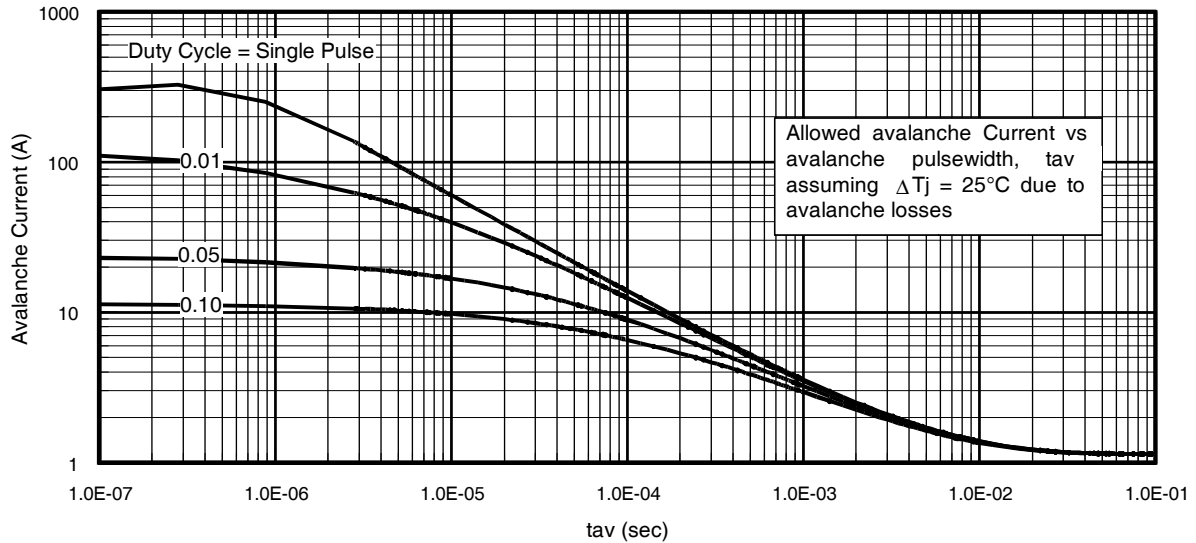


Fig 15. Typical Avalanche Current Vs. Pulsewidth

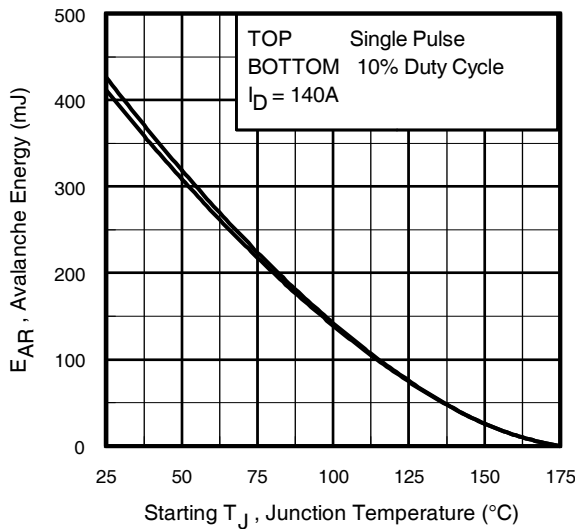


Fig 16. Maximum Avalanche Energy Vs. Temperature

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

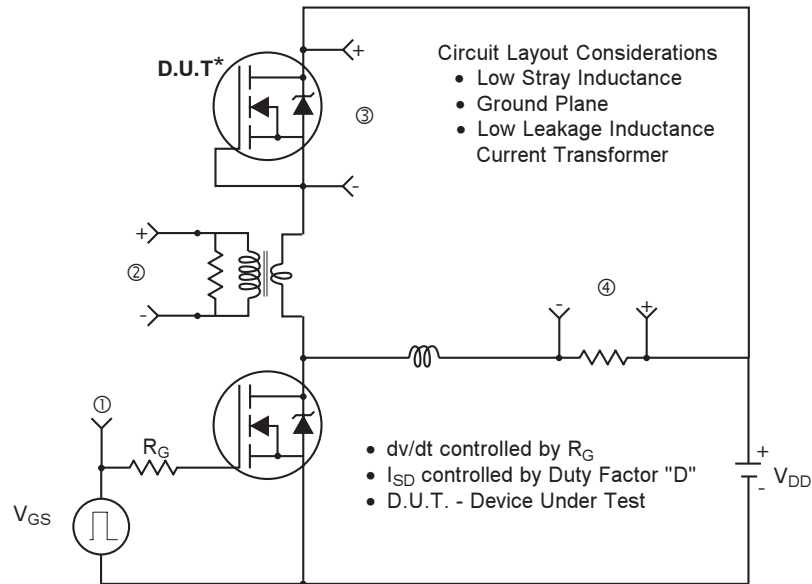
1. Avalanche failures assumption:
Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax} . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in 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)

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

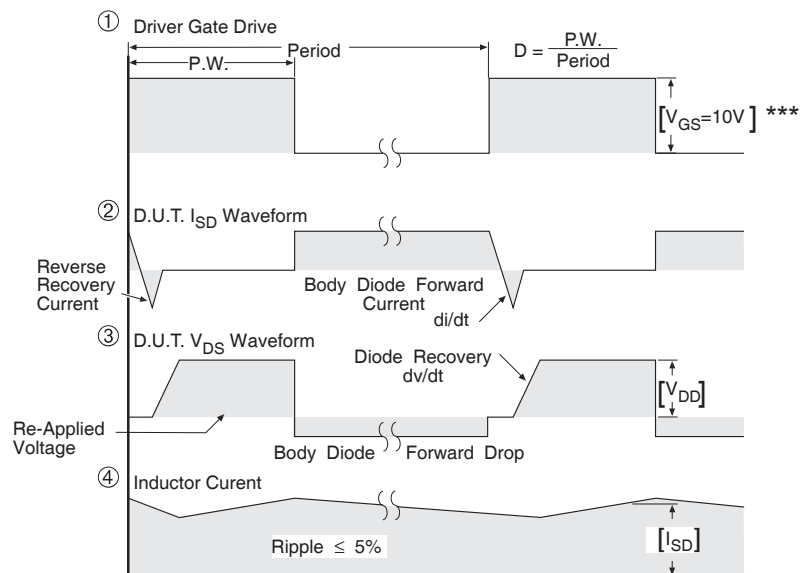
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

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

Peak Diode Recovery dv/dt Test Circuit



* Reverse Polarity of D.U.T for P-Channel

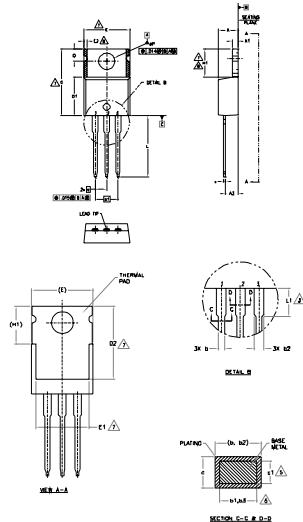


*** $V_{GS} = 5.0V$ for Logic Level and 3V Drive Devices

Fig 17. For N-channel HEXFET® power MOSFETs

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 UNLESS OTHERWISE NOTED
 - 4- DIMENSIONS D, E, F & G DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127 mm) FOR BOX. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMITY OF THE PLASTIC BODY
 - 5- DIMENSION H IS A MIN. DIM. TO BASE METAL ONLY.
 - 6- CONTROLLING DIMENSION - INCHES
 - 7- THERMAL HAS CONTOUR SPINDLE. SPINDLE DIMENSIONS (H102 & T1) AND SPALLATION UNDESIRABLE ARE ALLOWED
 - 8- DIMENSION (T) IS A MIN. DIM. TO A ZONE. WHERE STAMPING AND SPALLATION UNDESIRABLE ARE ALLOWED
 - 9- OUTLINE CONFORMS TO ASSEMBLY 10-220 EXCEPT AS (mm) AND (in) (mm) DIMENSIONS ARE SHOWN FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MAX.	MIN.	MAX.	MIN.	
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
H	1.14	1.78	.045	.070	
H2	1.14	1.73	.045	.068	5
E	0.36	0.81	.014	.031	
F	0.36	0.56	.014	.022	
G	14.22	16.51	.560	.650	4
D1	8.38	9.52	.330	.375	
D2	11.48	12.86	.450	.507	7
E	9.85	10.67	.390	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	-	0.76	-	.030	8
T	2.54	2.54	.100	.100	
H1	0.84	6.86	.033	.270	7,8
L	12.70	14.73	.500	.580	
L1	5.56	4.06	.220	.160	
W	5.24	4.08	.208	.161	3
Q	2.54	2.54	.100	.100	

USE DIMENSIONS

- 1- SEE
- 2- DIM
- 3- DIM

USE DIMENSIONS

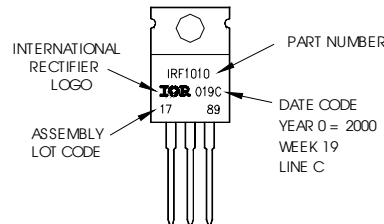
- 1- SEE
- 2- DIM
- 3- DIM

USE DIMENSIONS

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.