

IRF3007SPbF IRF3007LPbF

HEXFET® Power MOSFET

Typical Applications

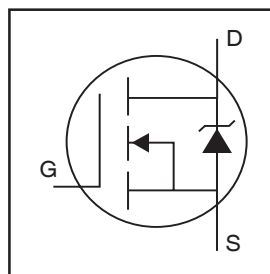
- Industrial Motor Drive

Features

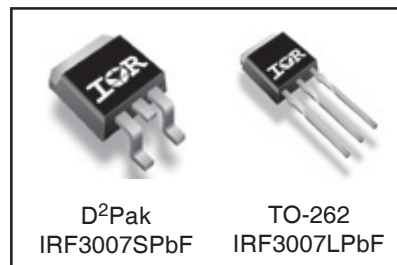
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to T_{jmax}
- Lead-Free

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.



$V_{DSS} = 75V$
$R_{DS(on)} = 0.0126\Omega$
$I_D = 62A$



Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	62	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	44	
I_{DM}	Pulsed Drain Current ①	320	
$P_D @ T_C = 25^\circ C$	Power Dissipation	120	W
	Linear Derating Factor	0.8	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ②	290	mJ
$E_{AS} (6 \text{ sigma})$	Single Pulse Avalanche Energy Tested Value ②	946	
I_{AR}	Avalanche Current ①	See Fig.12a, 12b, 15, 16	A
E_{AR}	Repetitive Avalanche Energy ⑥		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)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.25	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mounted, steady state)**	—	62	

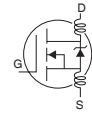
** This is applied to D²Pak, when mounted on 1" square PCB (FR-4 or G-10 Material).
For recommended footprint and soldering techniques refer to application note #AN-994.

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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	—	0.084	—	V/ $^\circ\text{C}$	Reference to 25°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.

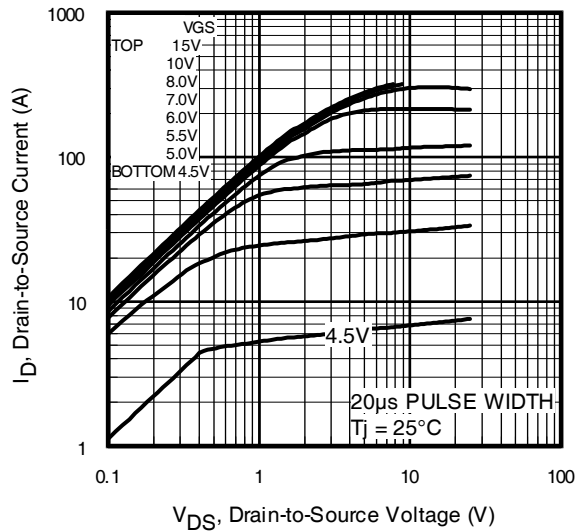


Fig 1. Typical Output Characteristics

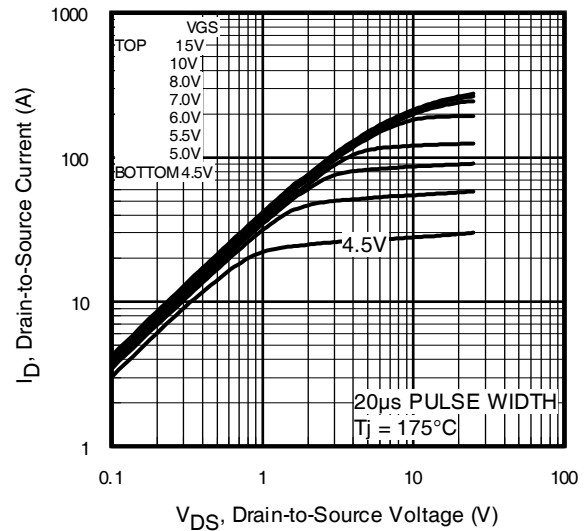


Fig 2. Typical Output Characteristics

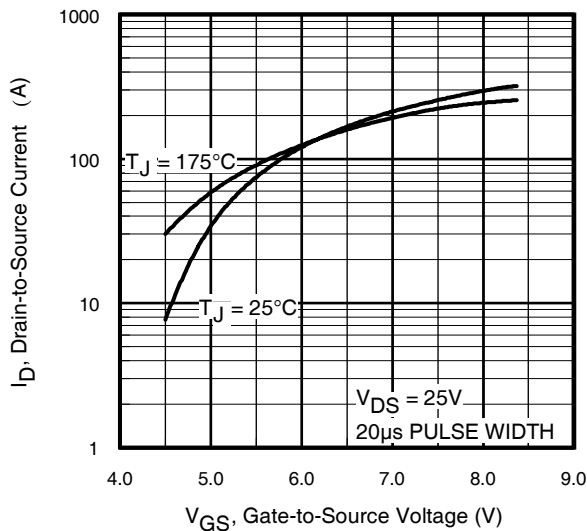


Fig 3. Typical Transfer Characteristics

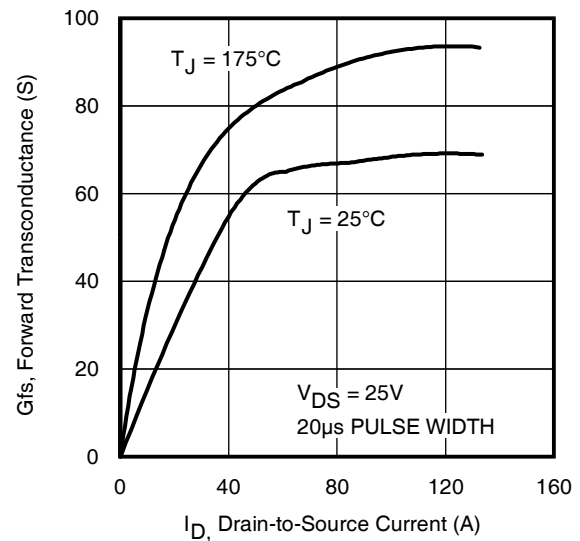


Fig 4. Typical Forward Transconductance Vs. Drain Current

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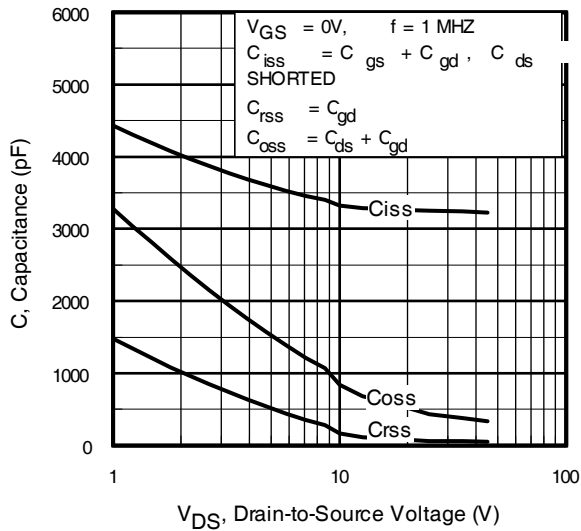


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

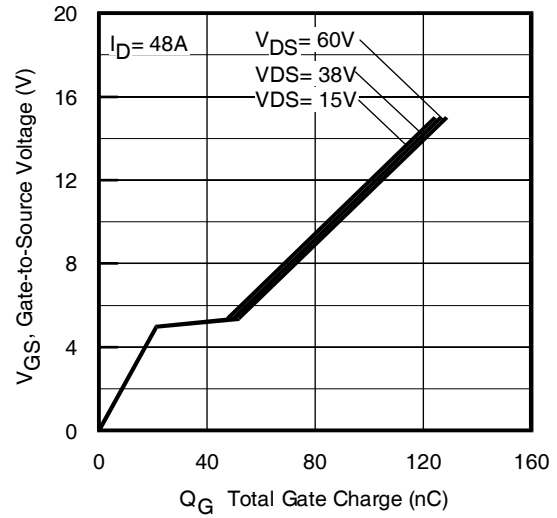


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

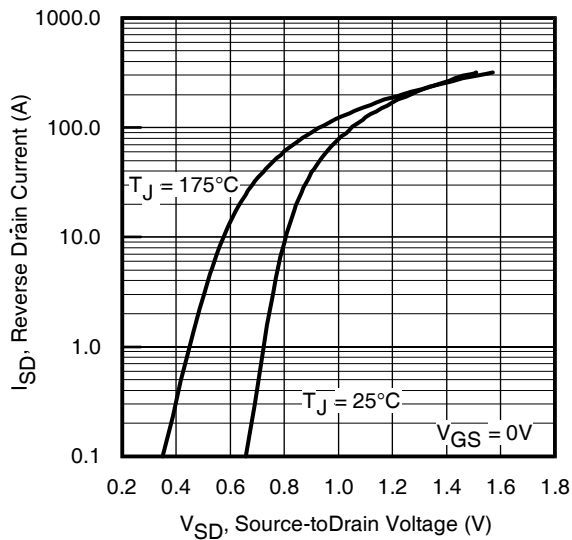


Fig 7. Typical Source-Drain Diode Forward Voltage

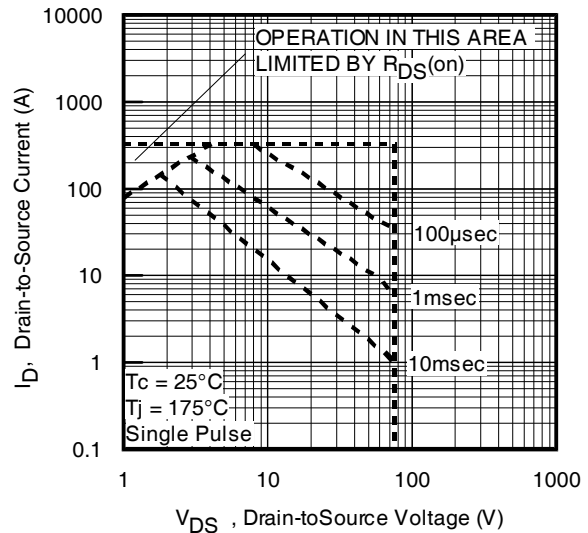


Fig 8. Maximum Safe Operating Area

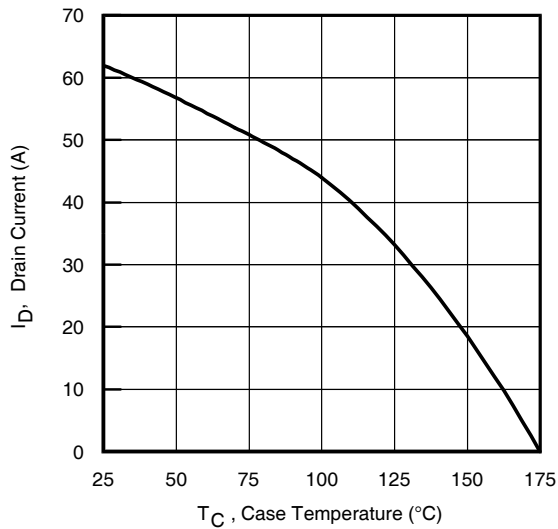


Fig 9. Maximum Drain Current Vs. Case Temperature

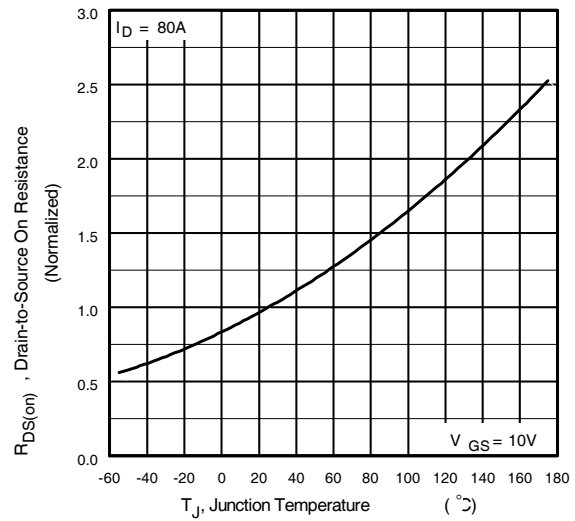


Fig 10. Normalized On-Resistance Vs. Temperature

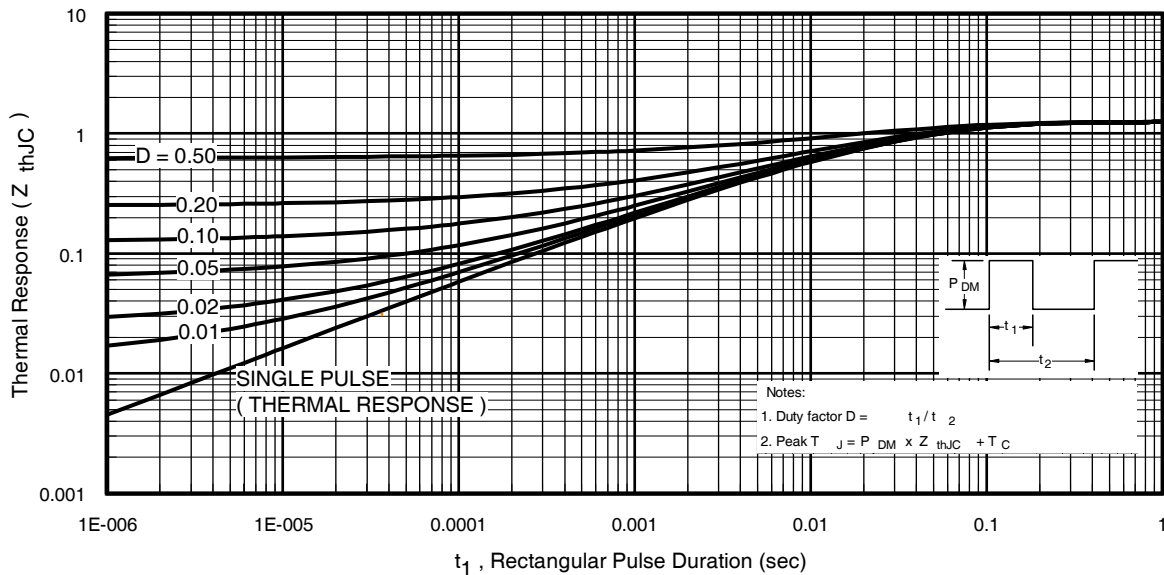


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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Fig 12a. Unclamped Inductive Test Circuit



Fig 12b. Unclamped Inductive Waveforms



Fig 13a. Basic Gate Charge Test Circuit

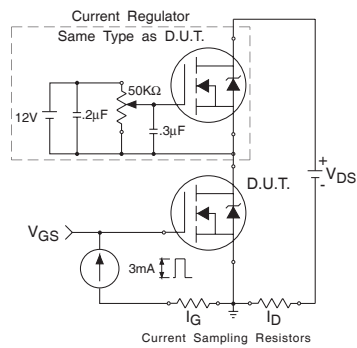


Fig 13b. Gate Charge Test Circuit

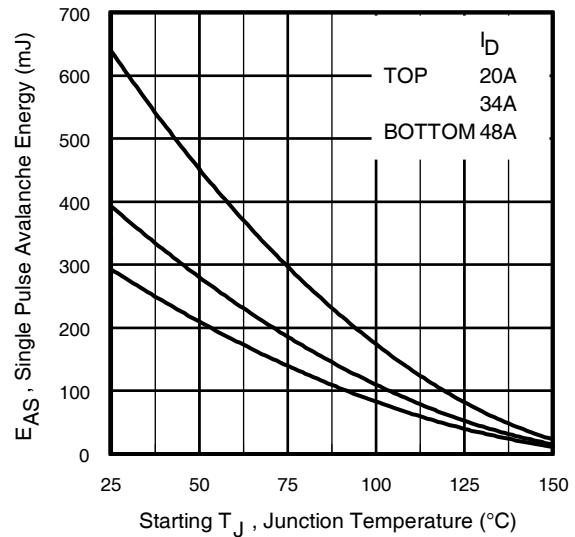


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

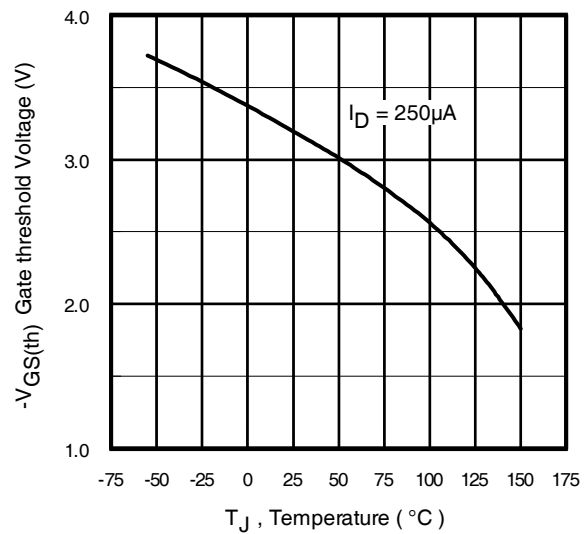


Fig 14. Threshold Voltage Vs. Temperature

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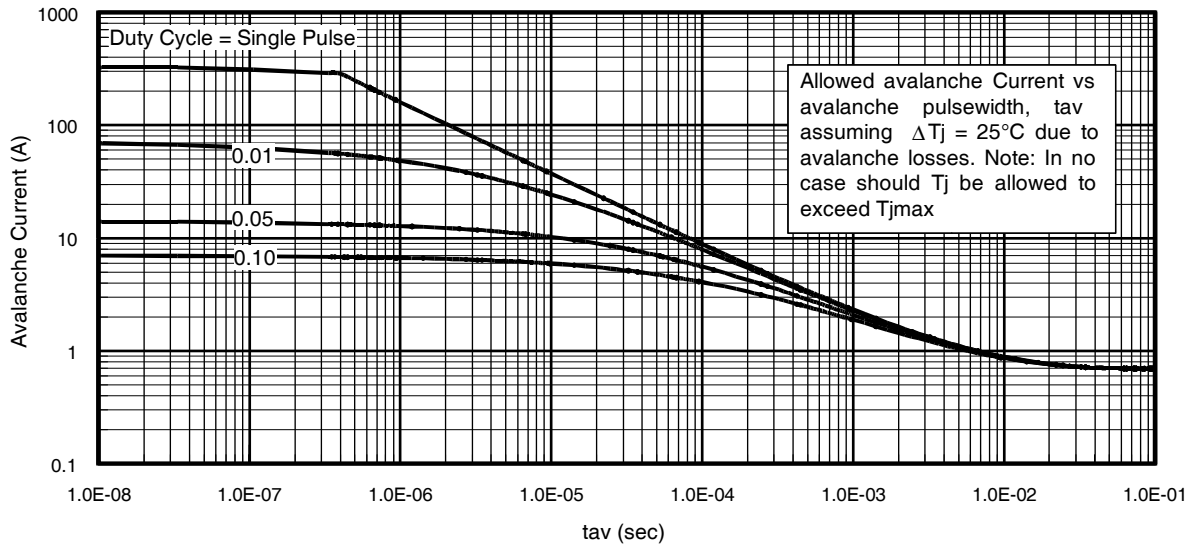


Fig 15. Typical Avalanche Current Vs. Pulsewidth

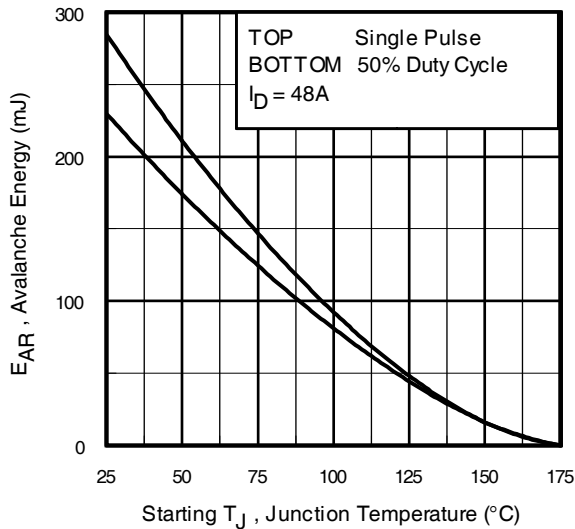


Fig 16. Maximum Avalanche Energy Vs. Temperature

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)

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

$$I_{av} = \frac{2\Delta T}{1.3 \cdot BV \cdot Z_{thJC}}$$

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

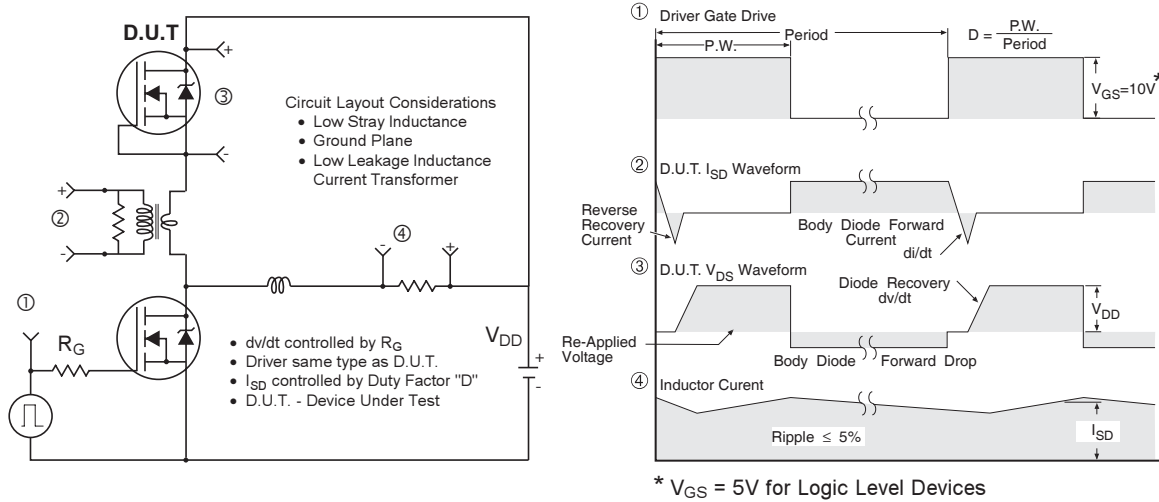


Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

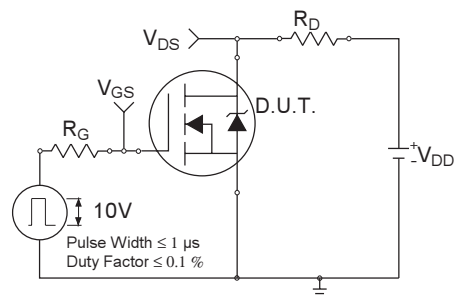


Fig 18a. Switching Time Test Circuit

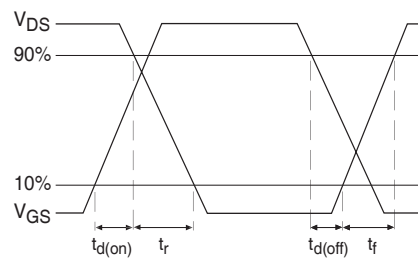
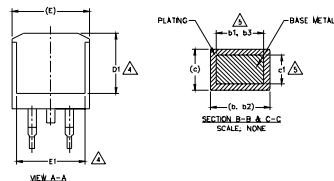
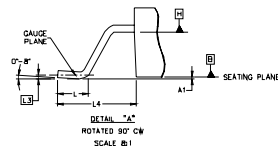
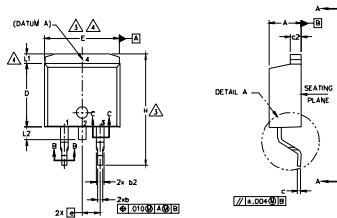


Fig 18b. Switching Time Waveforms

IRF3007S/LPbF

D²Pak (TO-263AB) Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.61	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.34	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86	—	.270	—	
E	9.65	10.67	.380	.420	3,
E1	6.22	—	.245	—	4
e	2.54 BSC		.100 BSC		
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	—	1.65	—	.066	4
L2	—	1.78	—	.070	
L3	0.25 BSC		.010 BSC		
L4	4.78	5.28	.188	.208	

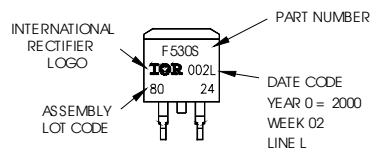
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE PLASTIC BODY AT DATUM H.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
4. DIMENSION D1 AND C1 APPLY TO BASE METAL ONLY.
5. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
6. CONTROLLING DIMENSION: INCH.
7. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

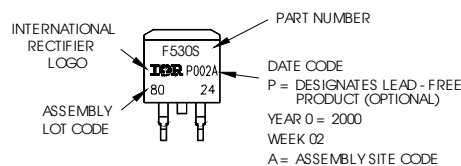
D²Pak (TO-263AB) Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW02, 2000
IN THE ASSEMBLY LINE "L"

Note: "P" in assembly line position indicates "Lead - Free"



OR



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/>

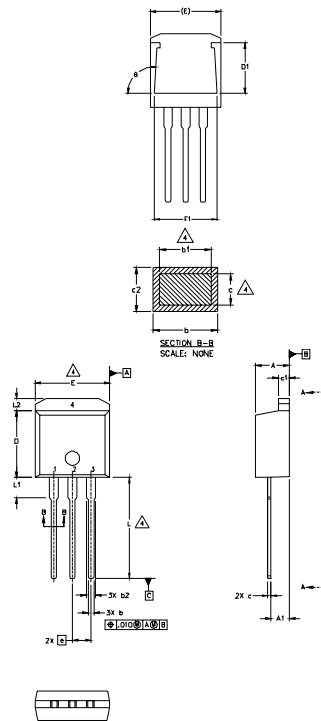
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TO-262 Package Outline

Dimensions are shown in millimeters (inches)

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SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.38	0.63	.015	.025	
c1	1.14	1.40	.045	.055	
c2	0.43	.063	.017	.029	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	13.46	14.09	.530	.555	
L1	3.56	3.71	.140	.146	
L2		1.65		.065	

LEAD ASSIGNMENTS

HEXFET

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

IGBT

- 1 - GATE
- 2 - COLLECTOR
- 3 - EMITTER

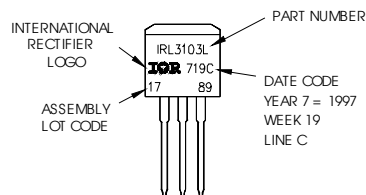
ES:
DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

TO-262 Part Marking Information

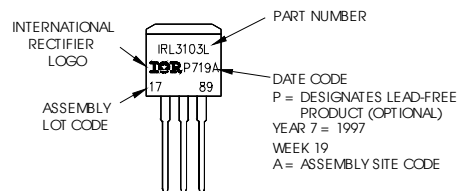
EXAMPLE: THIS IS AN IRL3103L

LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

Note: "P" in assembly line position indicates "Lead-Free"



OR

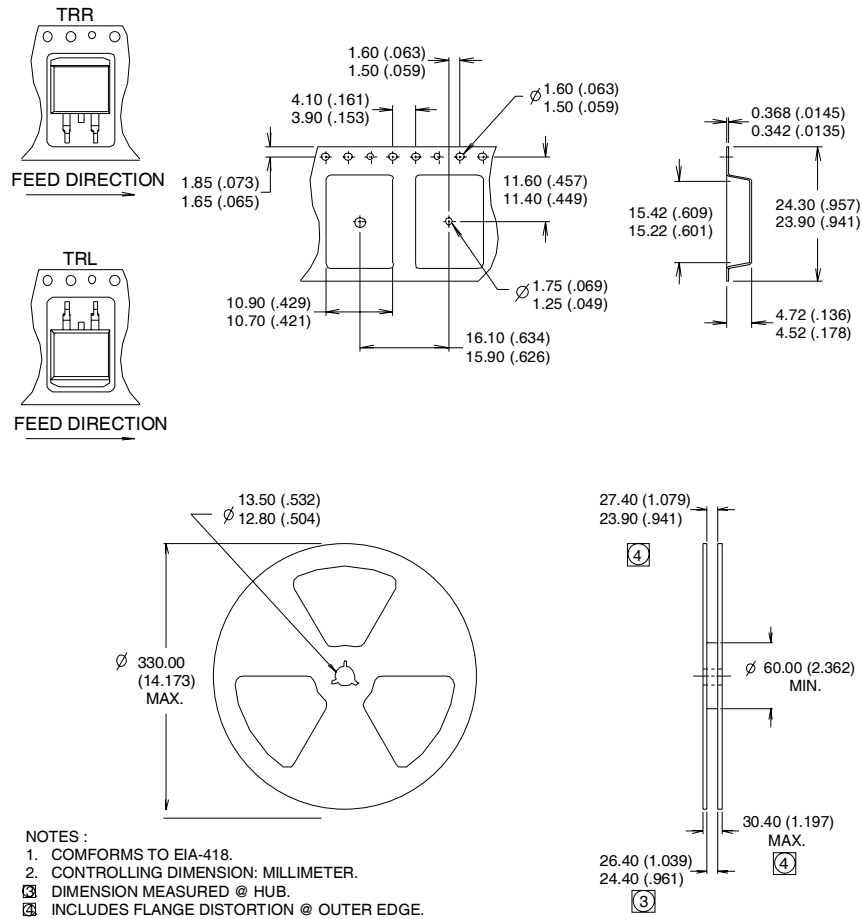


Notes:

1. For an Automotive Qualified version of this part please see <http://www.irf.com/product-info/aut/>
2. For the most current drawing please refer to IR website at <http://www.irf.com/package/>

D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



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

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