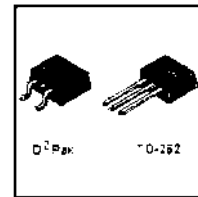
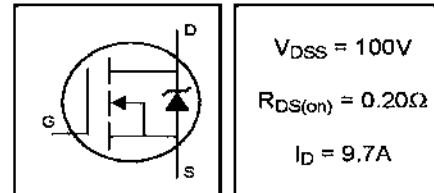


IRF520NSPbF
IRF520NLPbF

- Advanced Process Technology
- Surface Mount (IRF520NS)
- Low-profile through-hole (IRF520NL)
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Lead-Free



Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The D²Pak is a surface mount power package capable of accommodating die sizes up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The D²Pak is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0W in a typical surface mount application. The through-hole version (IRF520NL) is available for low-profile applications.

Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ⑤	9.7	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ⑤	6.8	
I_{DM}	Pulsed Drain Current ①⑤	38	
$P_D @ T_A = 25^\circ C$	Power Dissipation	3.8	W
$P_D @ T_C = 25^\circ C$	Power Dissipation	48	W
V_{GS}	Linear Derating Factor	0.32	W/°C
	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②⑤	91	mJ
I_{AR}	Avalanche Current①	5.7	A
E_{AR}	Repetitive Avalanche Energy①	4.8	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑤	5.0	V/ns
T_J	Operating Junction and Storage Temperature Range	-55 to + 175	°C
T_{STG}			
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

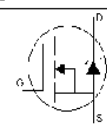
Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	3.1	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mounted, steady-state)**	—	40	

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

Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	100	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	—	0.11	—	$V/^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ Ⓞ
$R_{DS(on)}$	—	—	0.20	Ω	$V_{GS} = 10V, I_D = 5.7A$ Ⓞ
$V_{GS(th)}$	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
g_{fs}	2.7	—	—	S	$V_{DS} = 25V, I_D = 5.7A$ Ⓞ
I_{DSS}	—	—	25	μA	$V_{DS} = 100V, V_{GS} = 0V$
	—	—	250		$V_{DS} = 80V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS}	—	—	100	nA	$V_{DS} = 20V$
	—	—	-100		$V_{GS} = -20V$
Q_g	—	—	25	nC	$I_D = 5.7A$
Q_{gs}	—	—	4.8	nC	$V_{DS} = 80V$
Q_{gd}	—	—	11	nC	$V_{GS} = 10V$, See Fig. 6 and 13 ⓄⓄ
$t_{di(on)}$	—	4.5	—	ns	$V_{LJ} = 50V$
t_r	—	23	—	ns	$I_D = 5.7A$
$t_{di(off)}$	—	32	—	ns	$R_G = 22\Omega$
t_f	—	23	—	ns	$R_D = 8.6\Omega$, See Fig. 10 ⓄⓄ
L_S	—	7.5	—	nH	Between lead, and center of die contact
C_{iss}	—	330	—	pF	$V_{DS} = 0V$
C_{oss}	—	92	—	pF	$V_{DS} = 25V$
C_{riss}	—	54	—	pF	$f = 1.0\text{MHz}$, See Fig. 5Ⓞ

Source-Drain Ratings and Characteristics

Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	—	—	9.7	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	—	—	38	A	
V_{SD}	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 5.7A, V_{GS} = 0V$ Ⓞ
t_r	—	99	150	ns	$T_J = 25^\circ\text{C}, I_S = 5.7A$
Q_{rr}	—	390	580	nC	$di/dt = 100A/\mu s$ ⓄⓄ
t_{or}	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

Notes:

- Ⓞ Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)
- Ⓞ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.
- Ⓜ $V_{LD} = 25V$, starting $T_J = 25^\circ\text{C}$, $L = 4.7\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 5.7A$. (See Figure 12)
- Ⓝ Uses IRF520N data and test conditions
- Ⓞ $I_{SD} \leq 5.7A$, $di/dt \leq 240A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J < 175^\circ\text{C}$

** When mounted on FR-4 board using minimum recommended footprint.
For recommended footprint and soldering techniques refer to application note #AN-994.

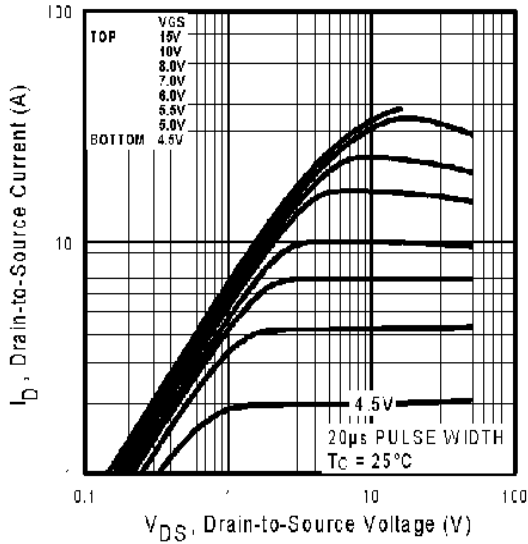


Fig 1. Typical Output Characteristics

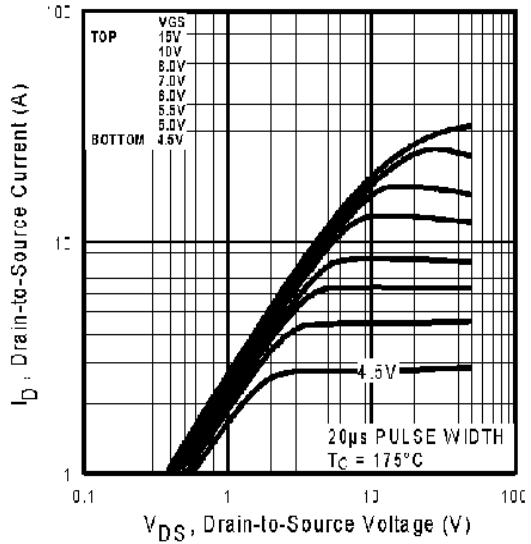


Fig 2. Typical Output Characteristics

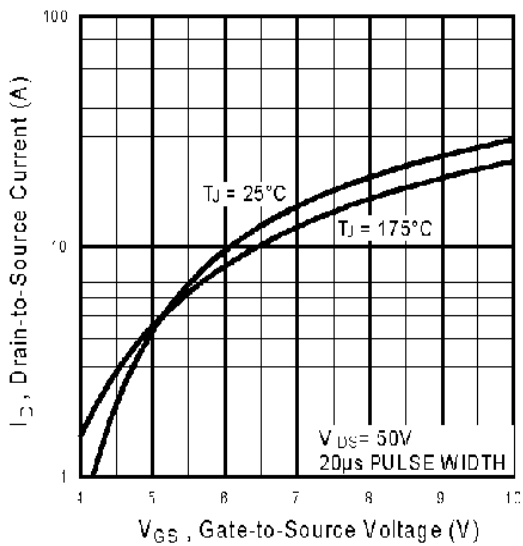


Fig 3. Typical Transfer Characteristics

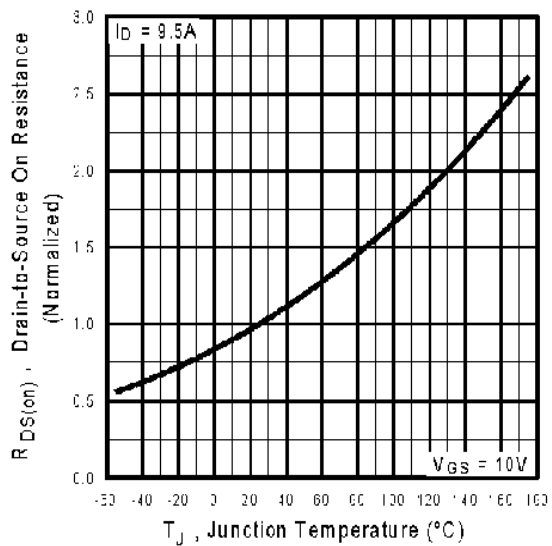


Fig 4. Normalized On-Resistance Vs. Temperature

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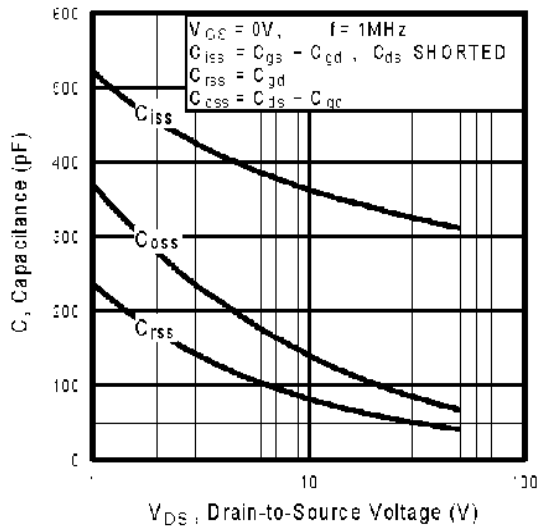


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

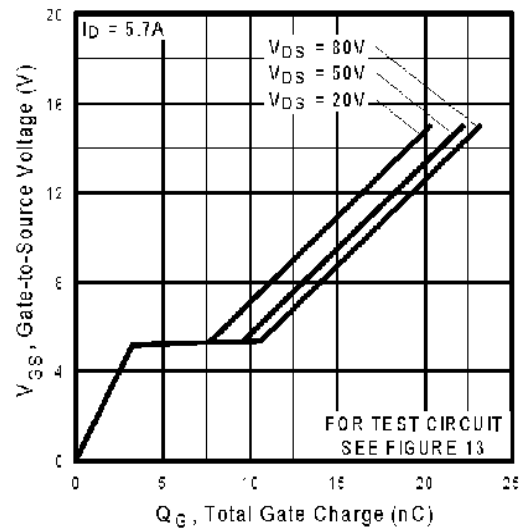


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

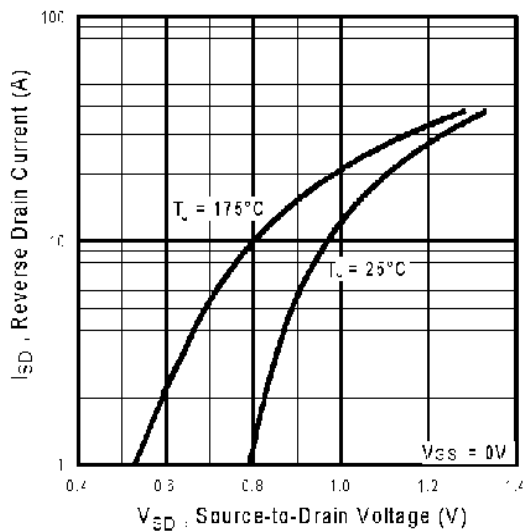


Fig 7. Typical Source-Drain Diode Forward Voltage

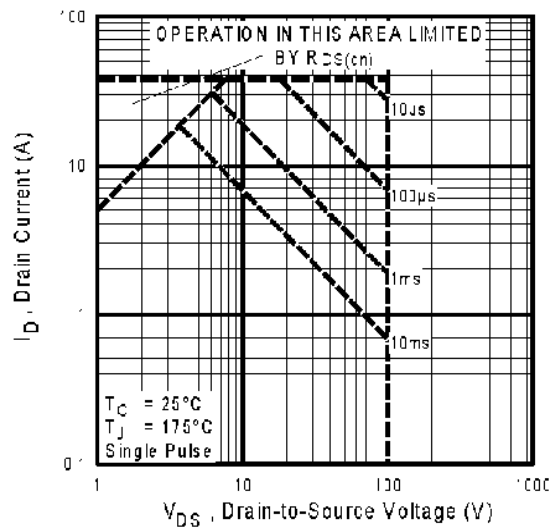


Fig 8. Maximum Safe Operating Area

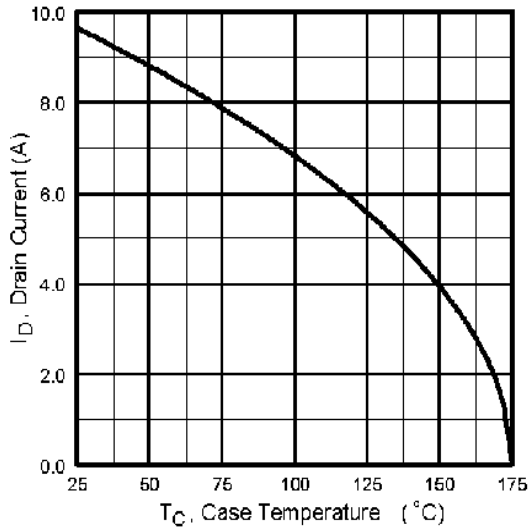


Fig 9. Maximum Drain Current Vs. Case Temperature

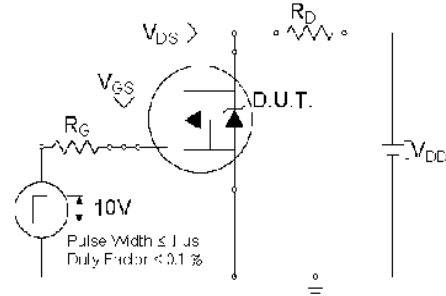


Fig 10a. Switching Time Test Circuit

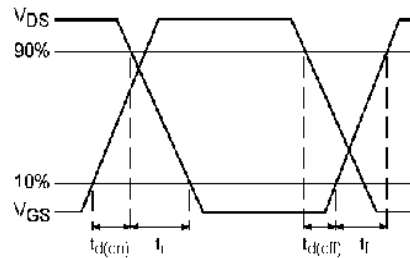


Fig 10b. Switching Time Waveforms

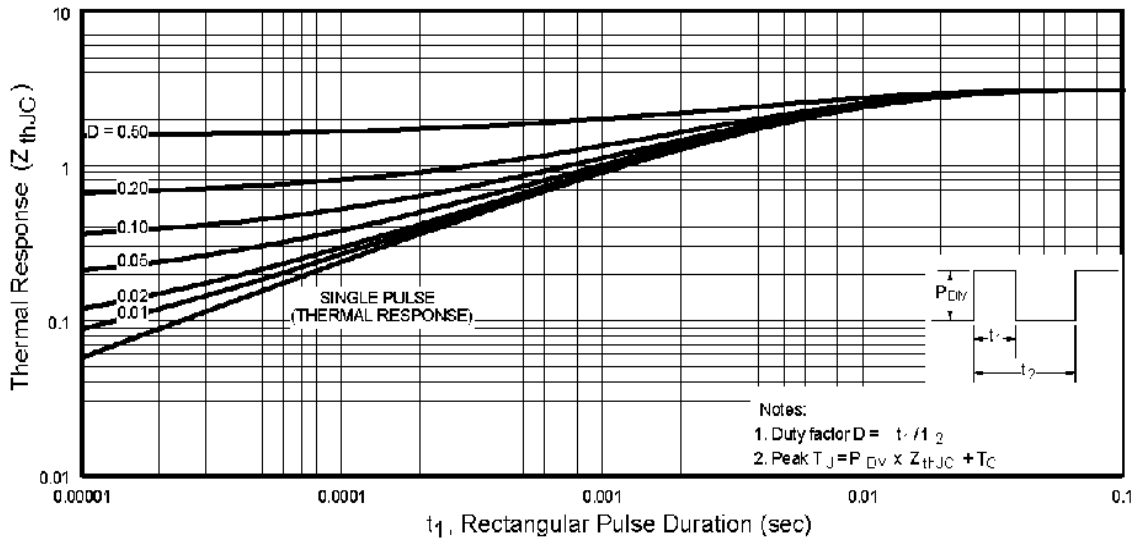


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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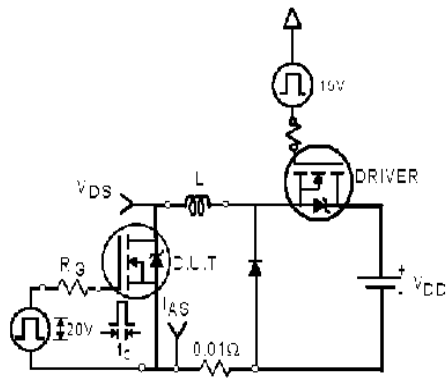


Fig 12a. Unclamped Inductive Test Circuit

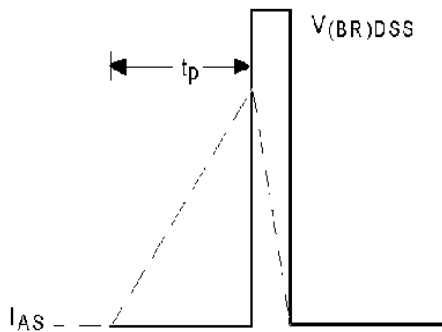


Fig 12b. Unclamped Inductive Waveforms

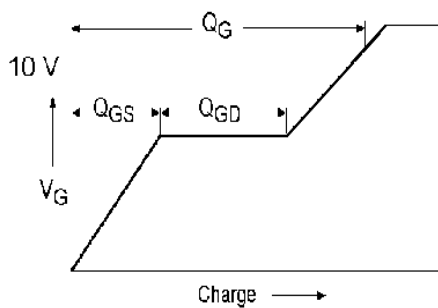


Fig 13a. Basic Gate Charge Waveform

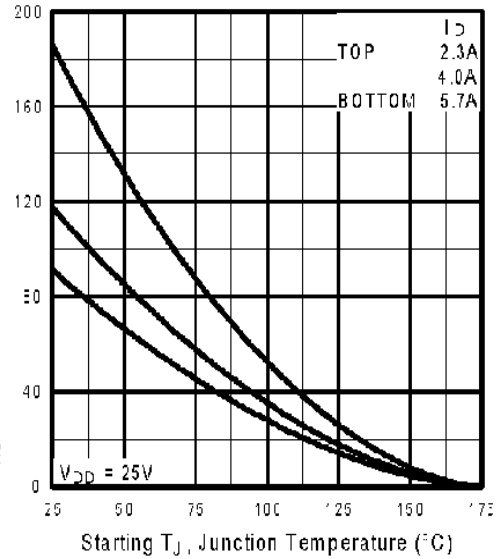


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

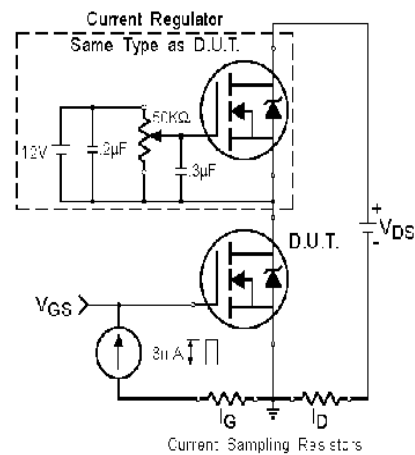
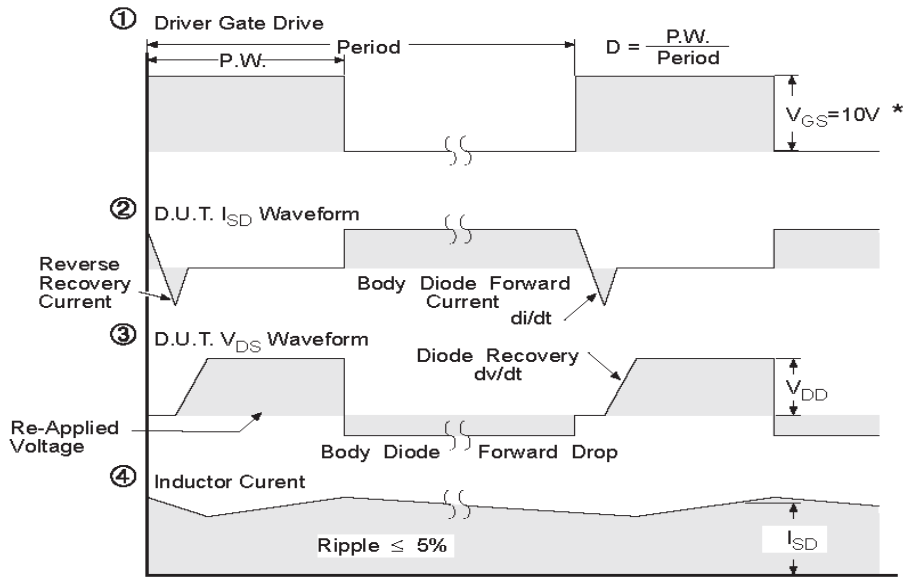
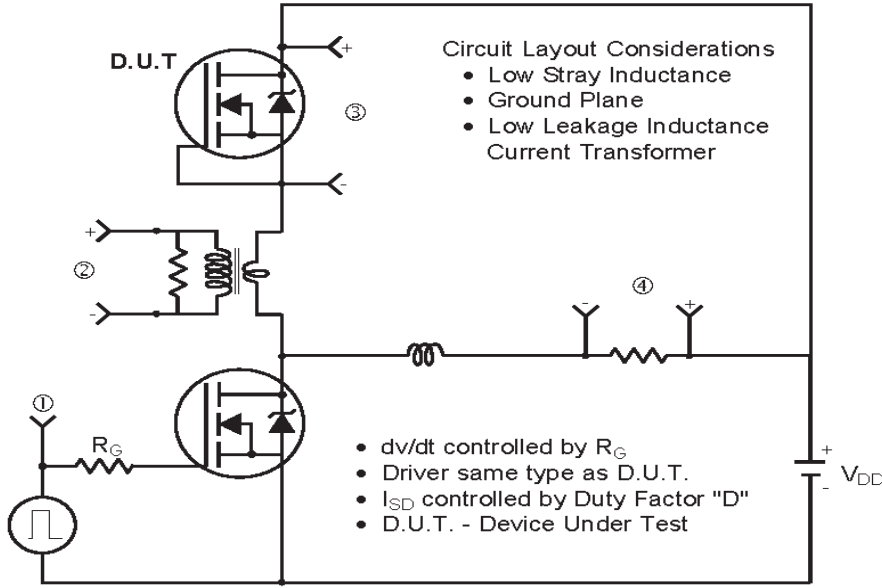


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

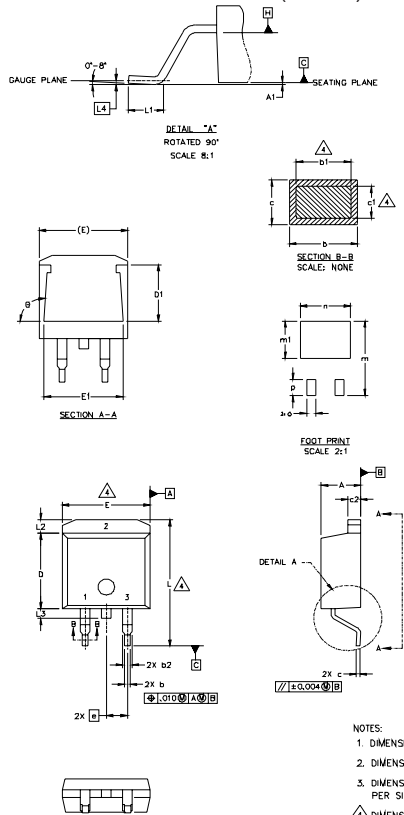
Fig 14. For N-Channel HEXFETS

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D²Pak Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1	0.127	0.127	.005	.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	3
c2	1.14	1.40	.045	.055	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	14.61	15.88	.575	.625	
L1	1.78	2.79	.070	.110	
L2		1.65		.065	
L3	1.27	1.78	.050	.070	
L4	0.25 BSC		.010 BSC		
m	17.78		.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
θ	90°	93°	90°	93°	

LEAD ASSIGNMENTS

HEXFET	IGBTs_CoPACK	DIODES
1.- GATE	1.- GATE	1.- ANODE *
2.- DRAIN	2.- COLLECTOR	2.- CATHODE
3.- SOURCE	3.- EMITTER	3.- ANODE

* PART DEPENDENT.

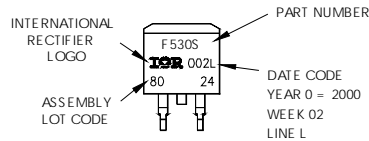
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. 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.
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

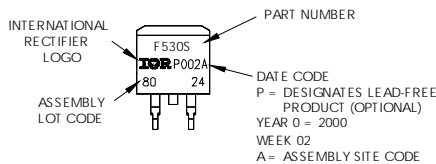
D²Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON VW 02, 2000
IN THE ASSEMBLY LINE "L"

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

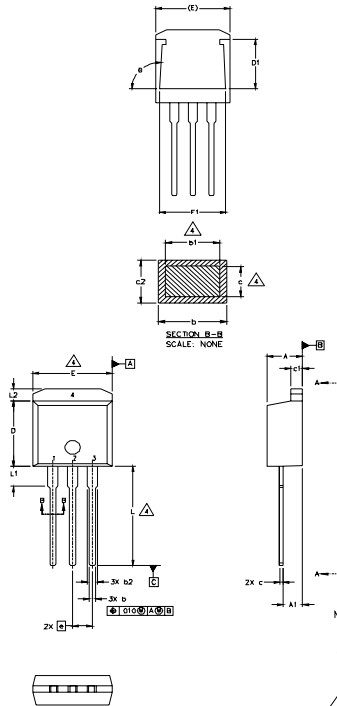


OR



TO-262 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	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.38	0.63	.015	.025	4
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	3
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

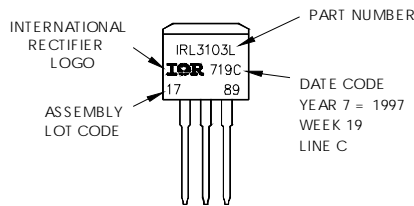
HEXFET	IGBT
1. - GATE	1 - GATE
2. - DRAIN	2 - COLLECTOR
3. - SOURCE	3 - EMITTER
4. - DRAIN	

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
 2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
 3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
 4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY
 5. CONTROLLING DIMENSION: INCH.

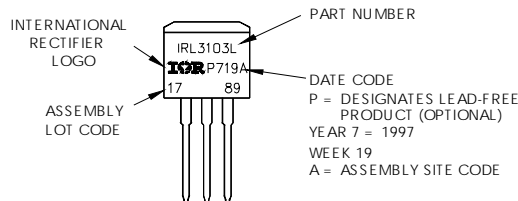
TO-262 Part Marking Information

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

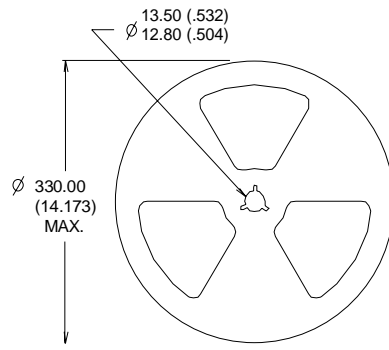
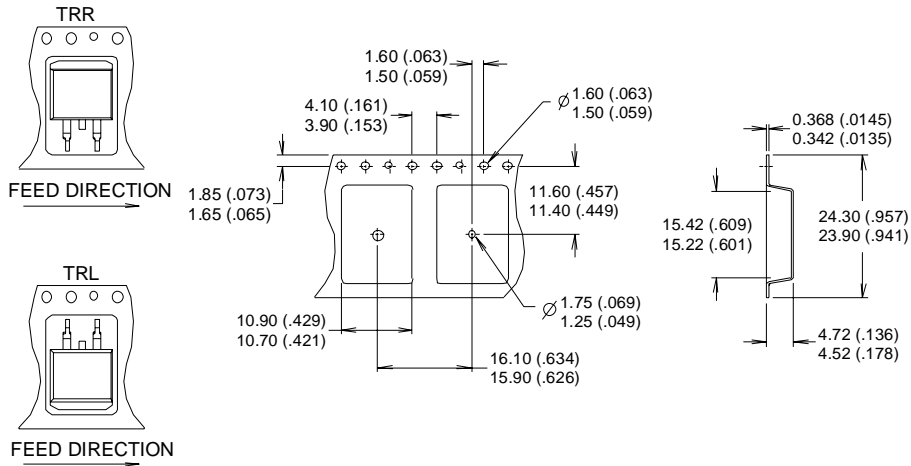


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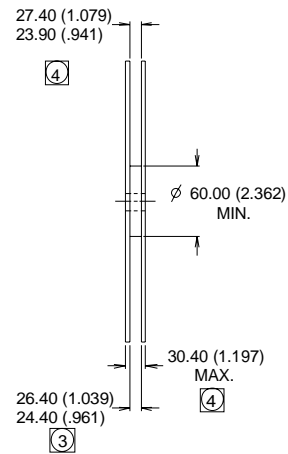
D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



NOTES :

1. COMFORMS TO EIA-418.
2. CONTROLLING DIMENSION: MILLIMETER.
- ③ DIMENSION MEASURED @ HUB.
- ④ INCLUDES FLANGE DISTORTION @ OUTER EDGE.



Data and specifications subject to change without notice.

International
IR Rectifier

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TAC Fax: (310) 252-7903

Visit us at www.irf.com for sales contact information. 08/04

www.irf.com

Note: For the most current drawings please refer to the IR website at:
<http://www.irf.com/package/>