

International IR Rectifier

- Advanced Process Technology
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Ease of Paralleling
- Simple Drive Requirements
- Lead-Free

Description

Fifth Generation HEXFET® Power MOSFETs 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 TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.

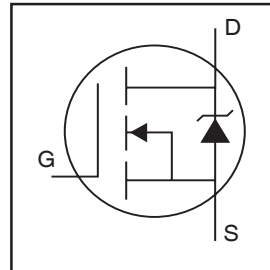
The D²Pak is a surface mount power package capable of accommodating die sizes up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The D²Pak is suitable for high current applications because of its low internal connection resistance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

The through-hole version (IRF630NL) is available for low-profile application.

PD - 95047A

IRF630NPbF
IRF630NSPbF
IRF630NLPbF

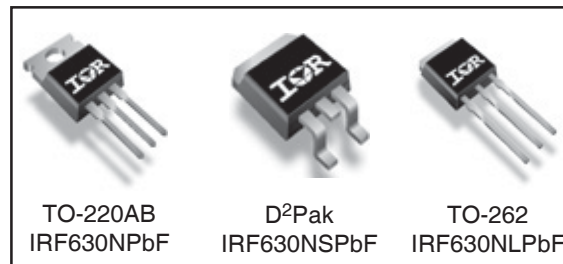
HEXFET® Power MOSFET



$$V_{DS} = 200V$$

$$R_{DS(on)} = 0.30\Omega$$

$$I_D = 9.3A$$



Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ $T_C = 25^\circ C$	Continuous Drain Current, V_{GS} @ 10V	9.3	A
I_D @ $T_C = 100^\circ C$	Continuous Drain Current, V_{GS} @ 10V	6.5	
I_{DM}	Pulsed Drain Current ①	37	
P_D @ $T_C = 25^\circ C$	Power Dissipation	82	W
	Linear Derating Factor	0.5	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ②	94	mJ
I_{AR}	Avalanche Current ①	9.3	A
E_{AR}	Repetitive Avalanche Energy ①	8.2	mJ
dv/dt	Peak Diode Recovery dv/dt ⑥	8.1	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +175	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw ④	10 lbf•in (1.1N•m)	

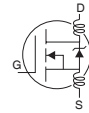
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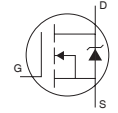
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Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	200	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.26	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.30	Ω	$V_{GS} = 10V, I_D = 5.4A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
g_{fs}	Forward Transconductance	4.9	—	—	S	$V_{DS} = 50V, I_D = 5.4A$ ③
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 200V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 160V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
Q_g	Total Gate Charge	—	—	35	nC	$I_D = 5.4A$
Q_{gs}	Gate-to-Source Charge	—	—	6.5		$V_{DS} = 160V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	17		$V_{GS} = 10V$ ③
$t_{d(on)}$	Turn-On Delay Time	—	7.9	—	ns	$V_{DD} = 100V$
t_r	Rise Time	—	14	—		$I_D = 5.4A$
$t_{d(off)}$	Turn-Off Delay Time	—	27	—		$R_G = 13\Omega$
t_f	Fall Time	—	15	—		$R_D = 18\Omega$ ③
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	—	575	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	89	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	25	—		$f = 1.0\text{MHz}$

**Source-Drain Ratings and Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	9.3	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode)①	—	—	37		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 5.4A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	117	176	ns	$T_J = 25^\circ\text{C}, I_F = 5.4A$
Q_{rr}	Reverse Recovery Charge	—	542	813	nC	$di/dt = 100A/\mu s$ ③
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

**Thermal Resistance**

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.83	$^\circ\text{C/W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface ④	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient④	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB mount)⑤	—	40	

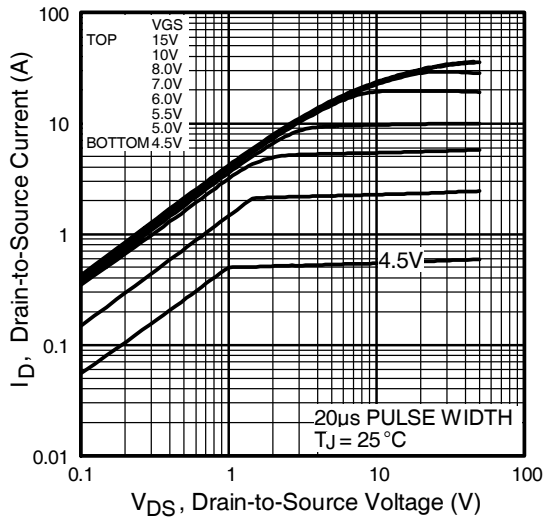


Fig 1. Typical Output Characteristics

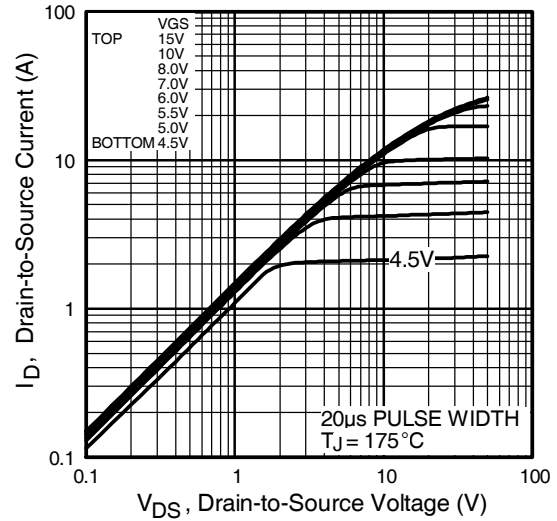


Fig 2. Typical Output Characteristics

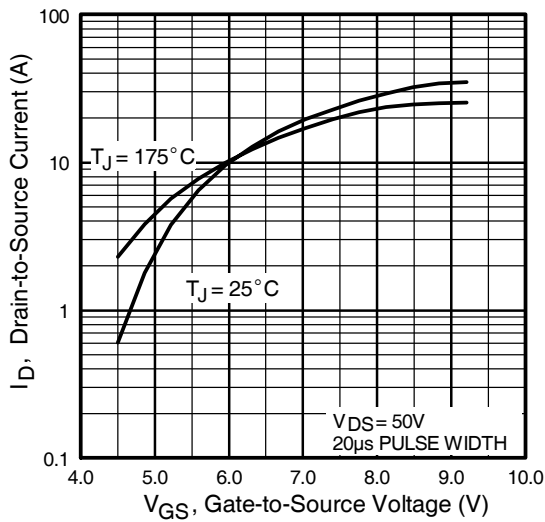


Fig 3. Typical Transfer Characteristics

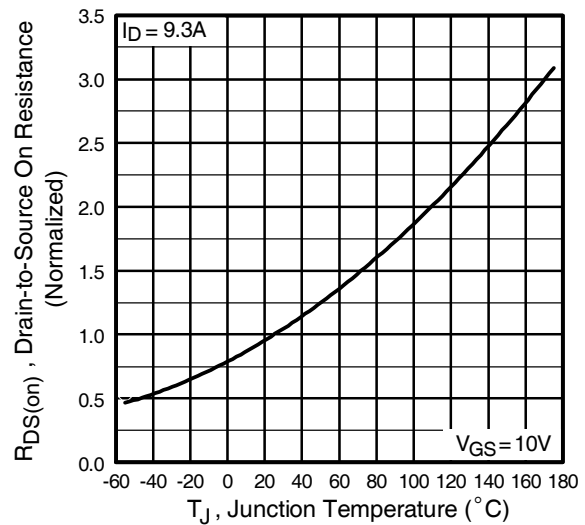


Fig 4. Normalized On-Resistance
Vs. Temperature

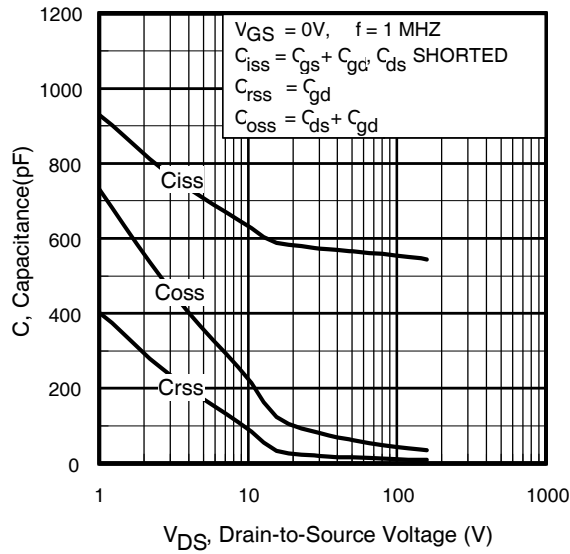


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

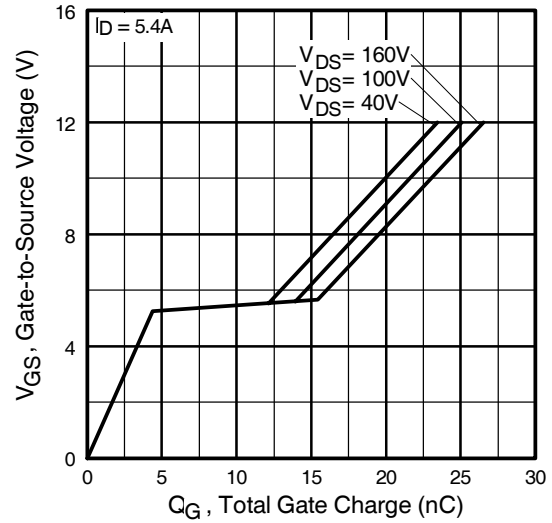


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

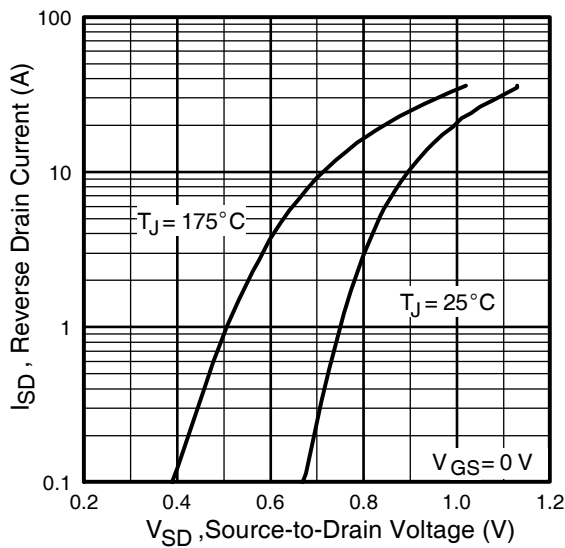


Fig 7. Typical Source-Drain Diode Forward Voltage

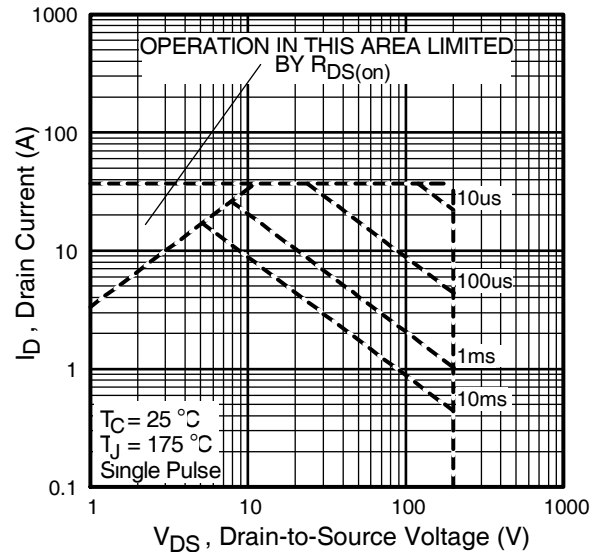


Fig 8. Maximum Safe Operating Area

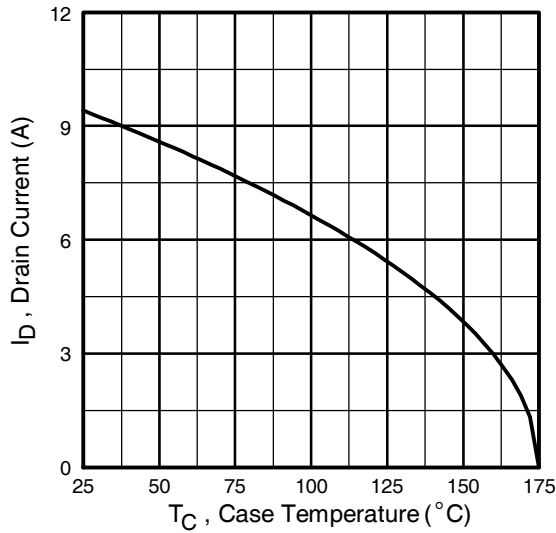


Fig 9. Maximum Drain Current Vs. Case Temperature

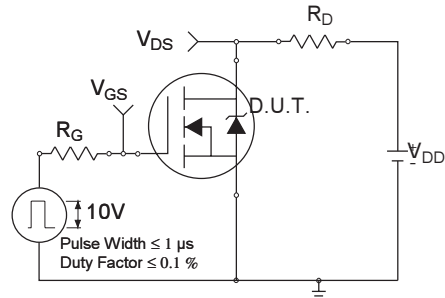


Fig 10a. Switching Time Test Circuit

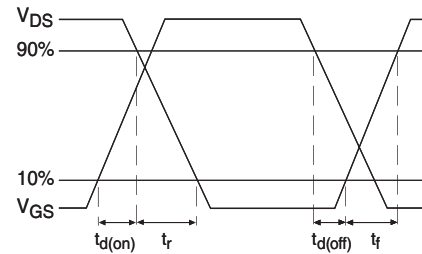


Fig 10b. Switching Time Waveforms

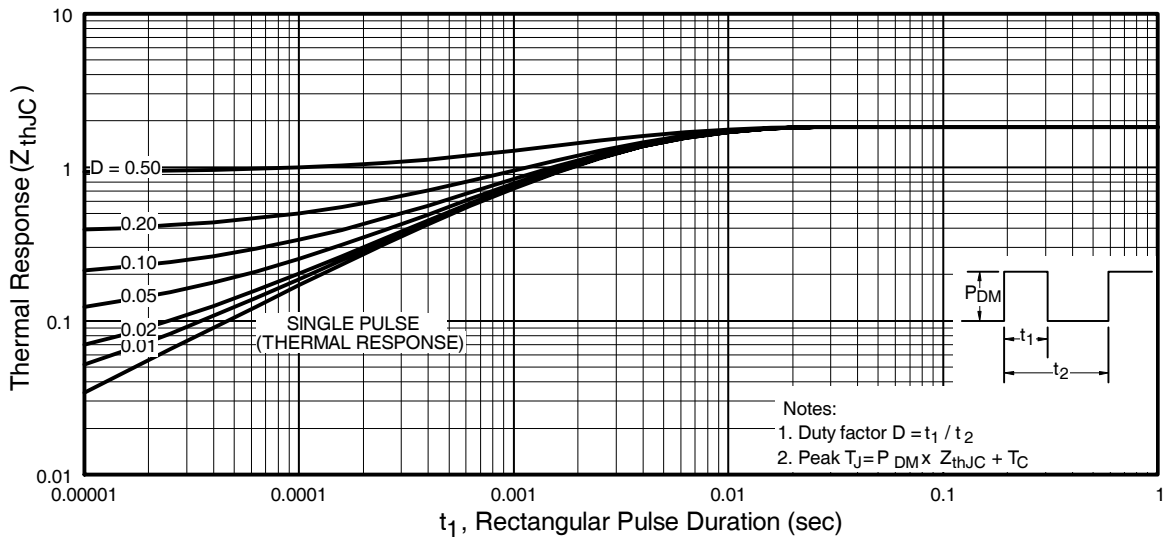


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

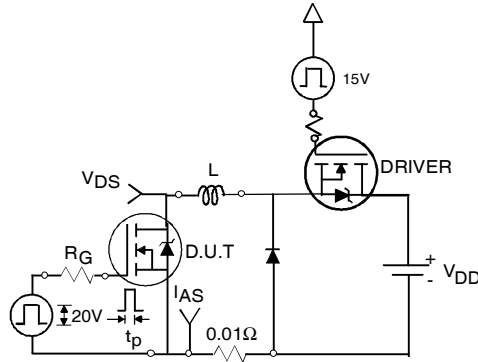


Fig 12a. Unclamped Inductive Test Circuit

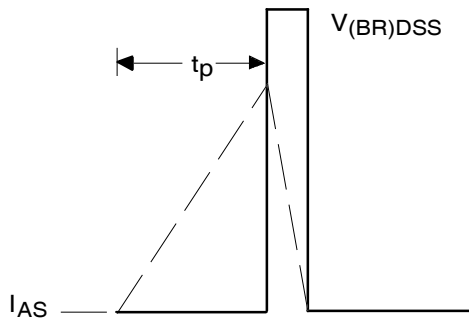


Fig 12b. Unclamped Inductive Waveforms

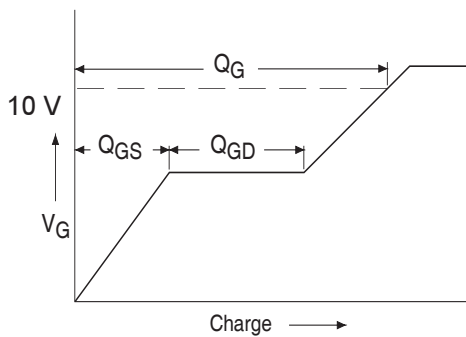


Fig 13a. Basic Gate Charge Waveform

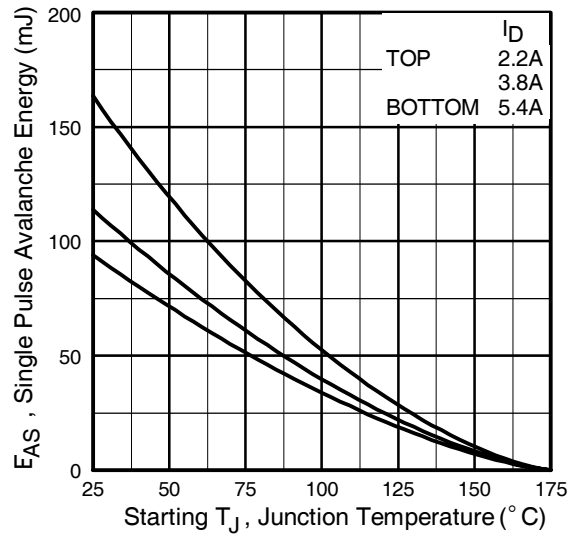


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

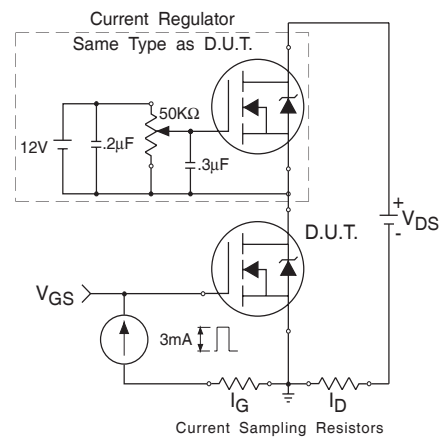


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

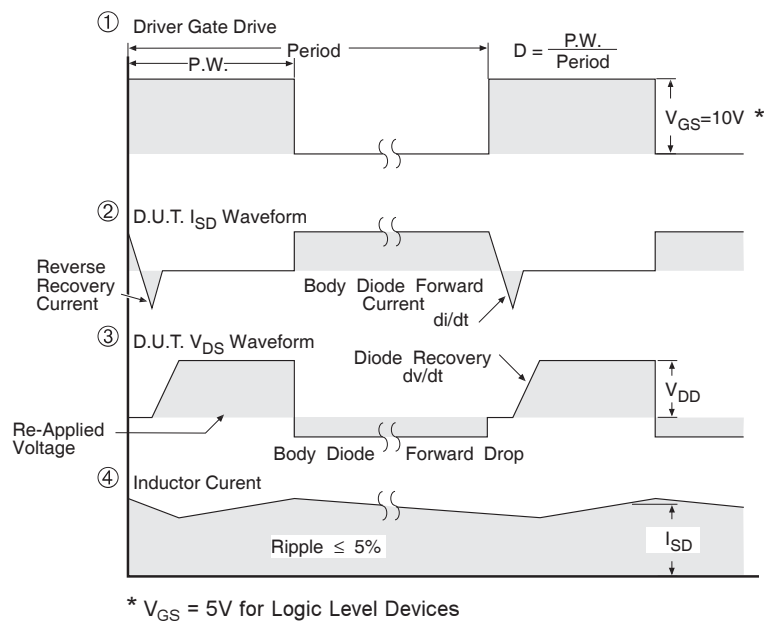
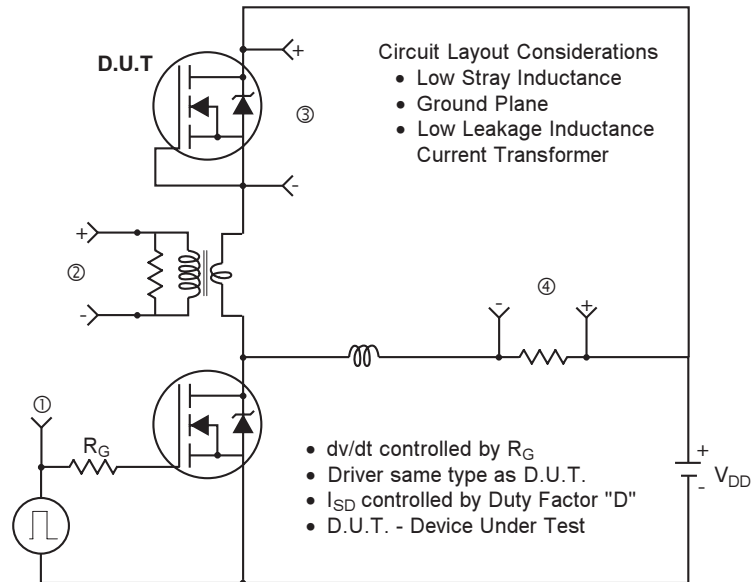


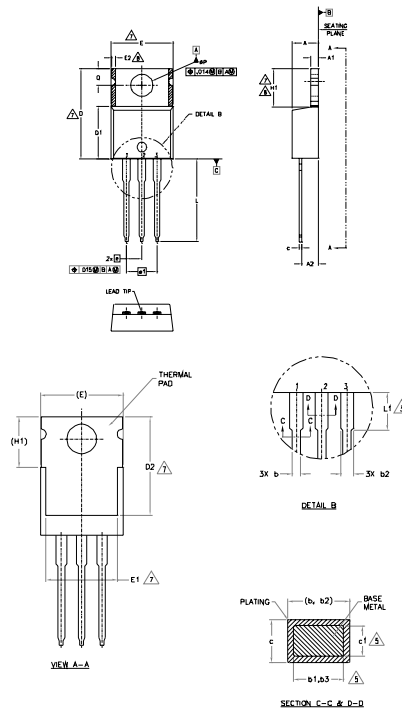
Fig 14. For N-Channel HEXFET® Power MOSFETs

IRF630N/S/LPbF

International
IR Rectifier

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



- 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 L1.
 - 4.- DIMENSION D, D1 & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .002" (0.027) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
 - 5.- DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
 - 6.- CONTROLLING DIMENSION - INCHES.
 - 7.- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E1, D2 & E1
 - 8.- DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION 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	.055	
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	11.68	12.88	.460	.507	7
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	5.08 BSC		.200 BSC		
H1	6.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	3.56	4.06	.140	.160	3
W	3.54	4.08	.139	.161	
O	2.54	3.42	.100	.135	

LEAD ASSIGNMENT

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

ORIENT. SYMBOL

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

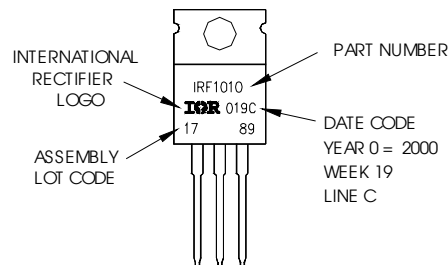
DIGITS

- 1.- ANODE
2.- CATHODE
3.- ANODE

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON VW 19, 2000
IN THE ASSEMBLY LINE "C"

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



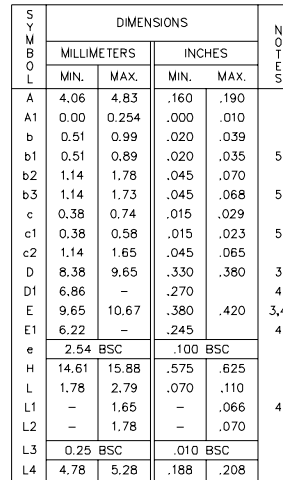
TO-220AB package is not recommended for Surface Mount Application

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/>

www.irf.com

Dimensions are shown in millimeters (inches)



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 QUOTED EXTREMES OF THE PLASTIC BODY AT DATUM H.
- △ THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
- △ DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

Diagram illustrating the markings on a 2-pin rectifier component:

- INTERNATIONAL RECTIFIER LOGO**: Points to the stylized logo on the component.
- PART NUMBER**: Points to the text **F530S** on the component.
- DATE CODE**: Points to the text **P =** on the component.
- ASSEMBLY LOT CODE**: Points to the text **80** and **24** on the component.

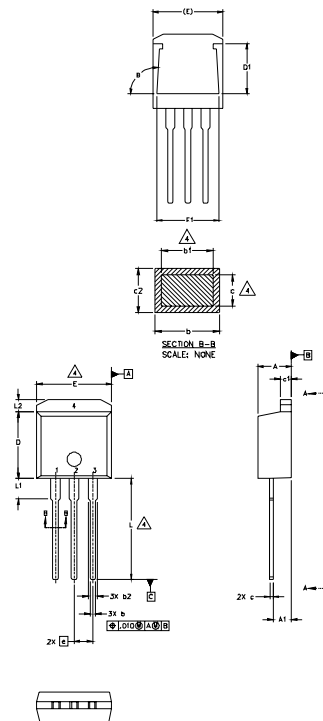
Legend for Date Code:

- P =** DESIGNATES LEAD-FREE PRODUCT (OPTIONAL)
- YEAR 0 = 2000**
- WEEK 02**
- A =** ASSEMBLY SITE CODE

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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	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	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

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

IGBT

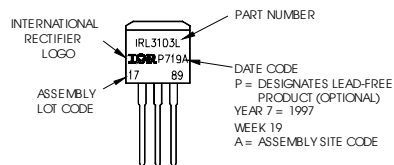
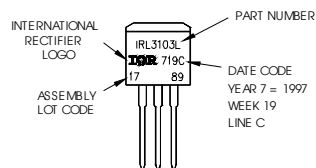
- 1 - GATE
- 2 - COLLECTOR
- 3 - EMITTER

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 "LeadFree"

OR

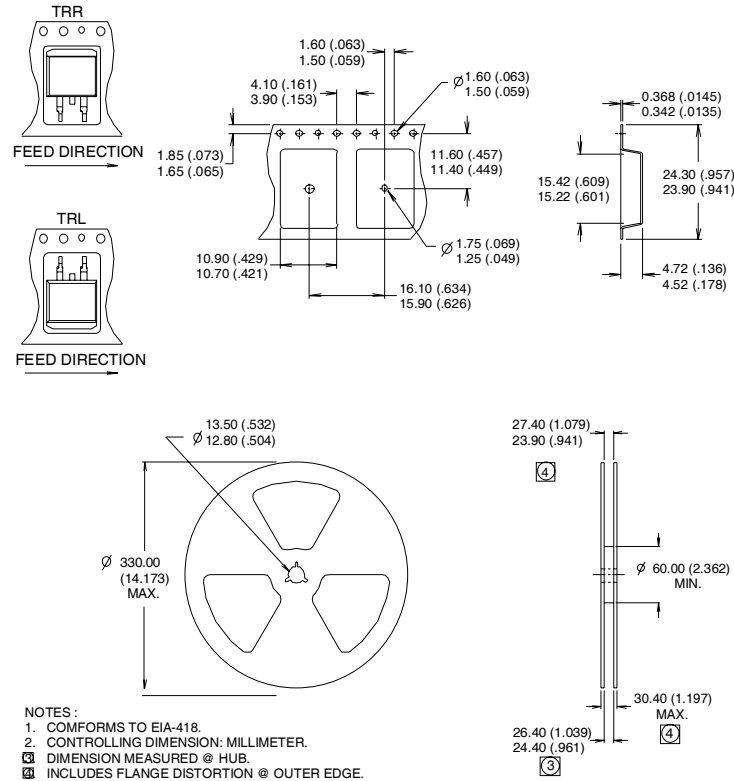


Notes:

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/>

D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 6.5\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 5.4\text{A}$.
- ③ Pulse width $\leq 400\mu\text{s}$; duty cycle $\leq 2\%$.
- ④ This is only applied to TO-220AB package.
- ⑤ 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.
- ⑥ $I_{SD} \leq 5.4\text{A}$, $di/dt \leq 280\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 175^\circ\text{C}$.

Data and specifications subject to change without notice.

International
IR Rectifier

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