

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

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 (IRF634NL) is available for low-profile application.

Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	8.0	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	5.6	
I_{DM}	Pulsed Drain Current ①	32	
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation	88	W
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation ⑤	3.8	
	Linear Derating Factor	0.59	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ②	110	mJ
I_{AR}	Avalanche Current ①	4.8	A
E_{AR}	Repetitive Avalanche Energy ①	8.8	mJ
dv/dt	Peak Diode Recovery dv/dt	7.3	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 ④	10 lbf•in (1.1N•m)	

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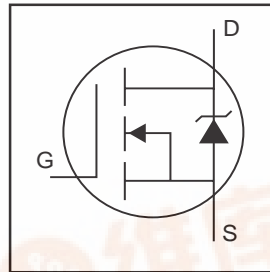
PD - 94310

IRF634N

IRF634NS

IRF634NL

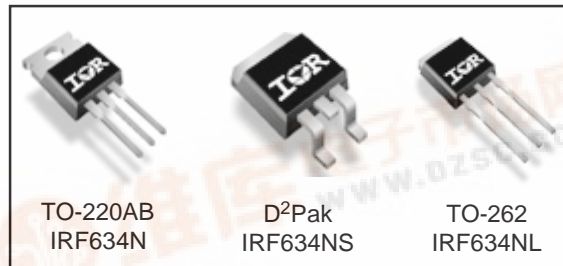
HEXFET® Power MOSFET



$V_{DSS} = 250\text{V}$

$R_{DS(on)} = 0.435\Omega$

$I_D = 8.0\text{A}$



TO-220AB
IRF634N

D²Pak
IRF634NS

TO-262
IRF634NL

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	250	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.33	—	V/°C	Reference to 25°C , $I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.435	Ω	$V_{GS} = 10V, I_D = 4.8A$ 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	5.4	—	—	S	$V_{DS} = 50V, I_D = 4.8A$ ③
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 250V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 200V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
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	—	—	34	nC	$I_D = 4.8A$
Q_{gs}	Gate-to-Source Charge	—	—	6.5		$V_{DS} = 200V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	16		$V_{GS} = 10V$, See Fig. 6 and 13
$t_{d(on)}$	Turn-On Delay Time	—	8.4	—	ns	$V_{DD} = 125V$ $I_D = 4.8A$ $R_G = 1.3\Omega$ $V_{GS} = 10V$, See Fig. 10 ③
t_r	Rise Time	—	16	—		
$t_{d(off)}$	Turn-Off Delay Time	—	28	—		
t_f	Fall Time	—	15	—		
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	—	620	—	pF	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1.0\text{MHz}$, See Fig. 5
C_{oss}	Output Capacitance	—	84	—		
C_{rss}	Reverse Transfer Capacitance	—	23	—		

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	8.0	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode)①	—	—	32		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 4.8A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	130	200	ns	$T_J = 25^\circ\text{C}, I_F = 4.8A$
Q_{rr}	Reverse Recovery Charge	—	650	980	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	—	1.7	°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	

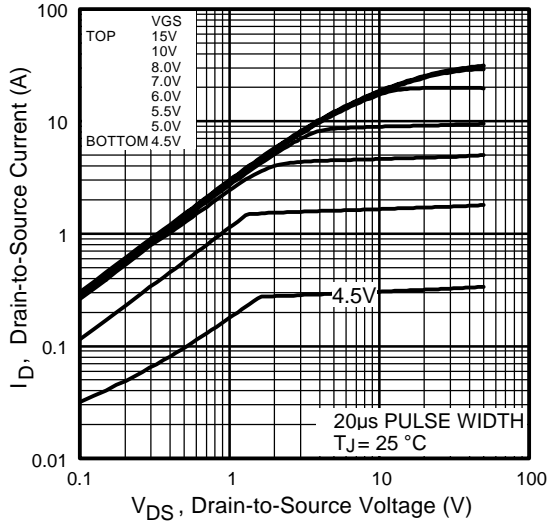


Fig 1. Typical Output Characteristics

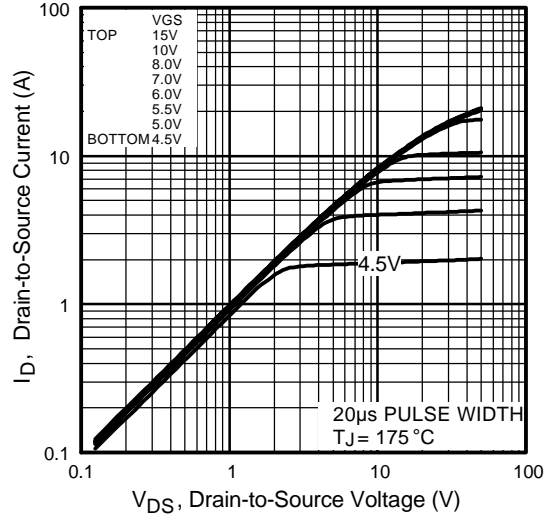


Fig 2. Typical Output Characteristics

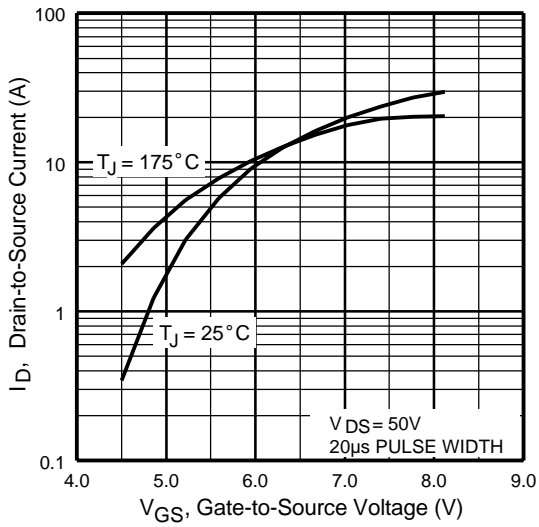


Fig 3. Typical Transfer Characteristics

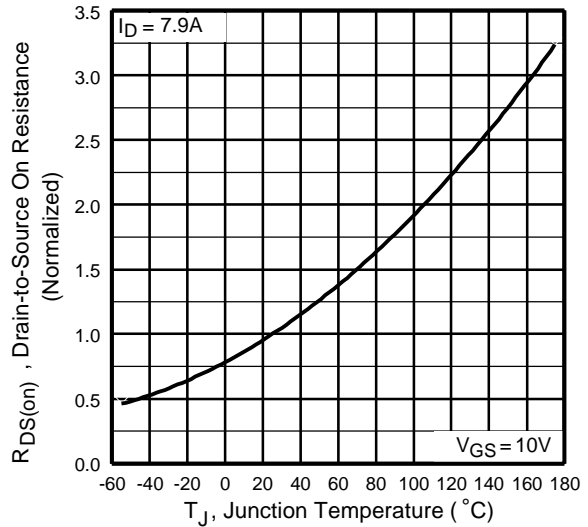


Fig 4. Normalized On-Resistance Vs. Temperature

IRF634N/S/L

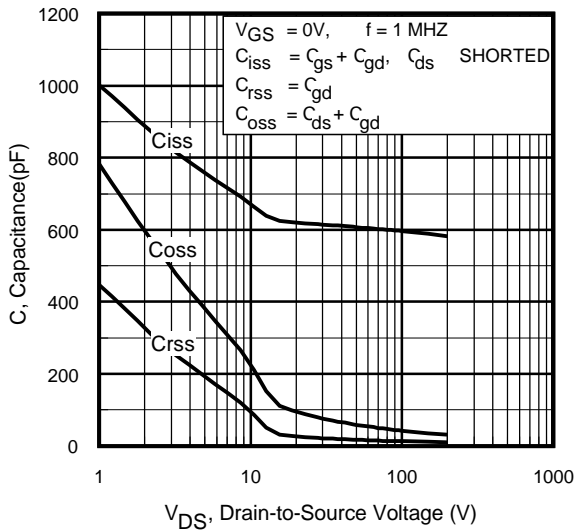


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

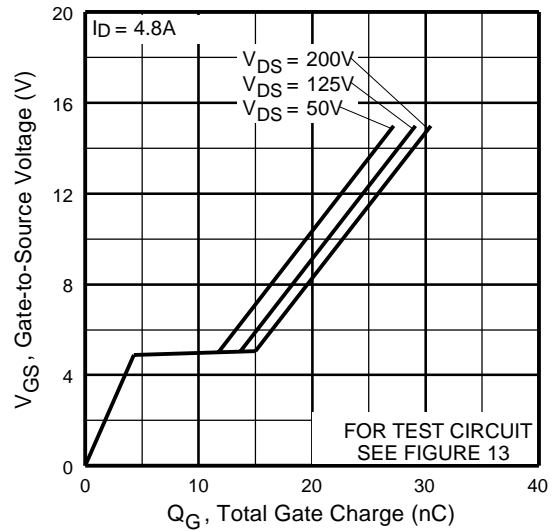


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

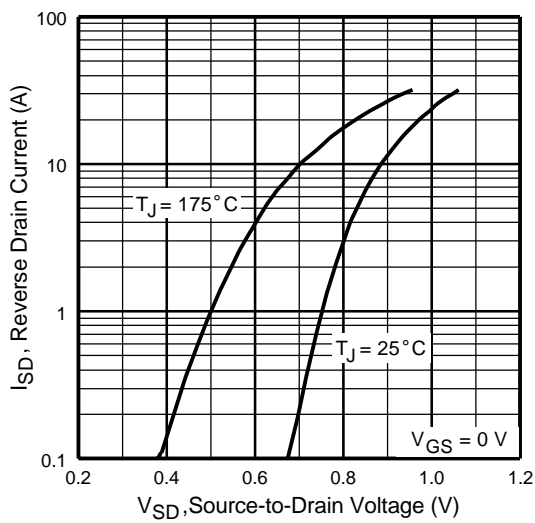


Fig 7. Typical Source-Drain Diode Forward Voltage

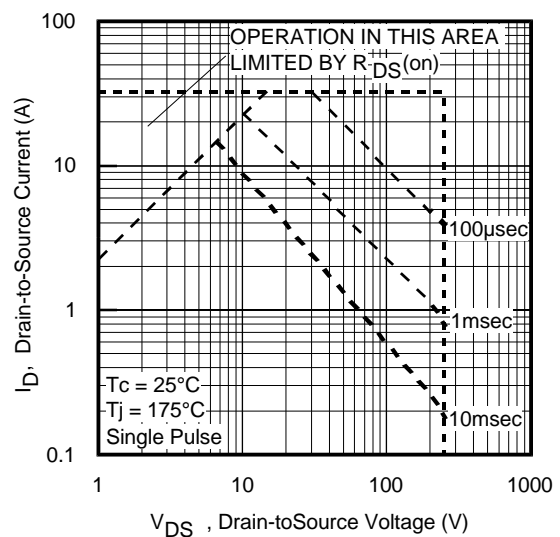


Fig 8. Maximum Safe Operating Area

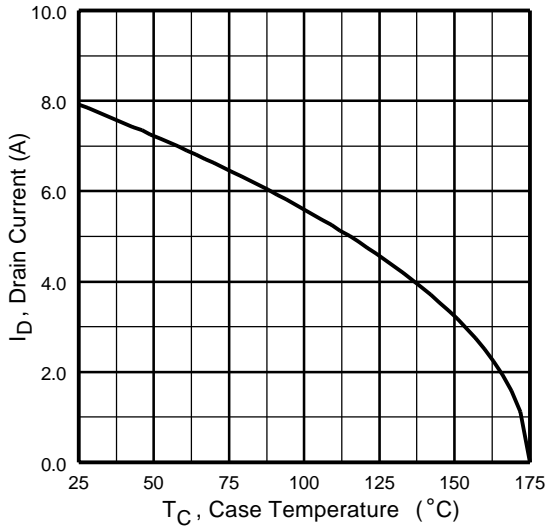


Fig 9. Maximum Drain Current Vs. Case Temperature

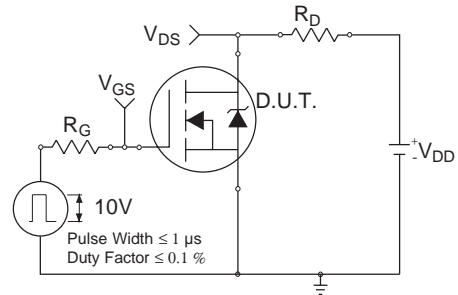


Fig 10a. Switching Time Test Circuit

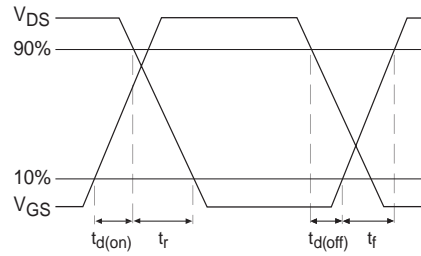


Fig 10b. Switching Time Waveforms

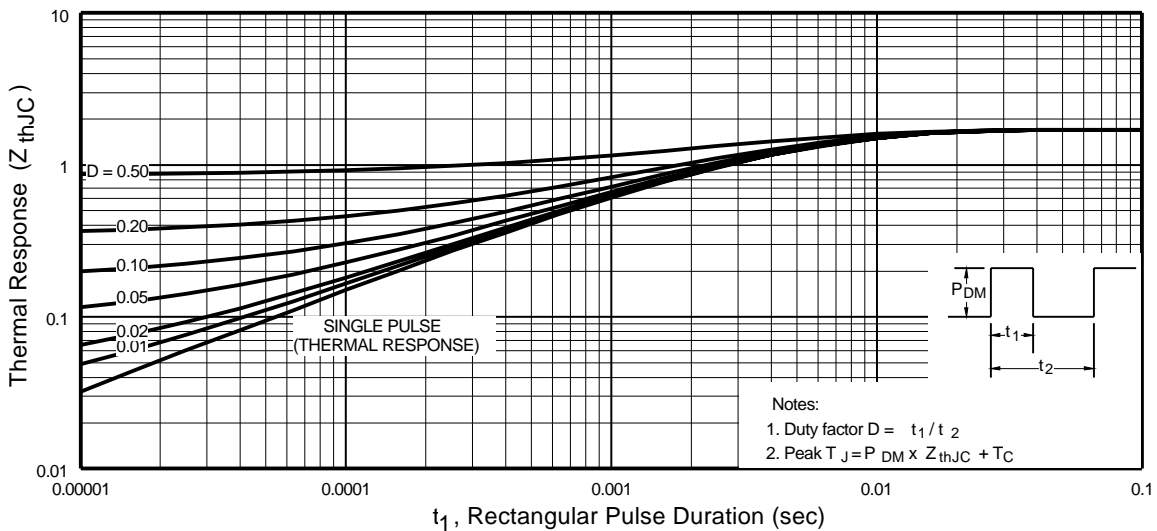


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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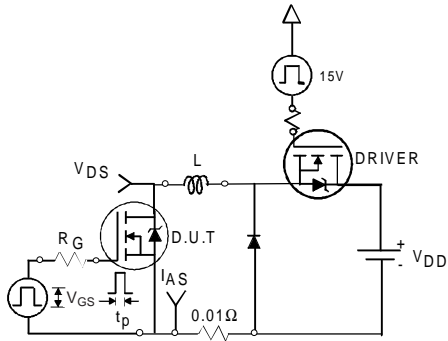


Fig 12a. Unclamped Inductive Test Circuit

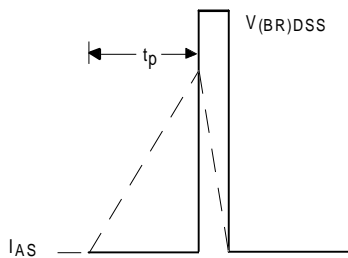


Fig 12b. Unclamped Inductive Waveforms

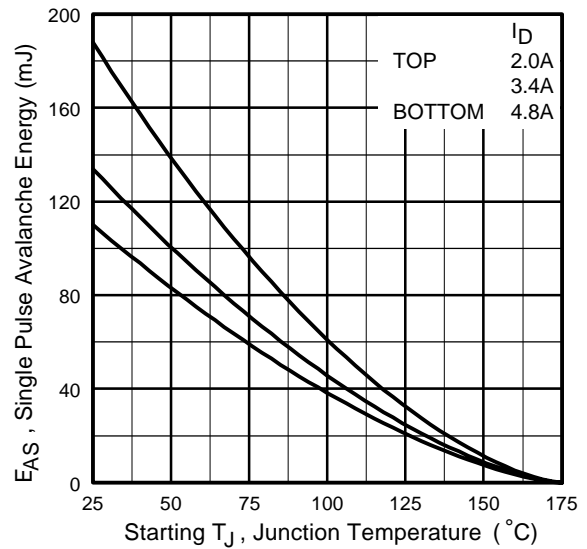


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

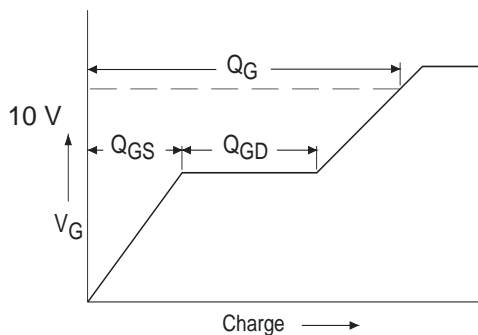


Fig 13a. Basic Gate Charge Waveform

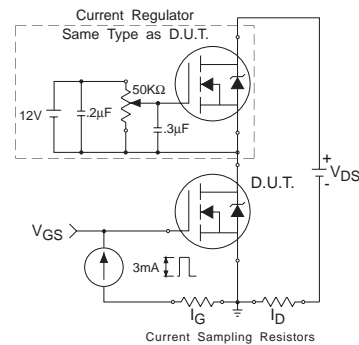
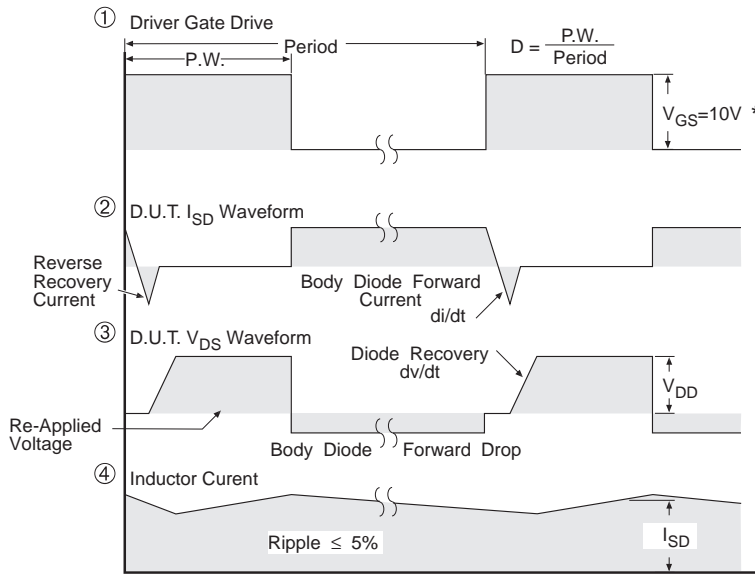
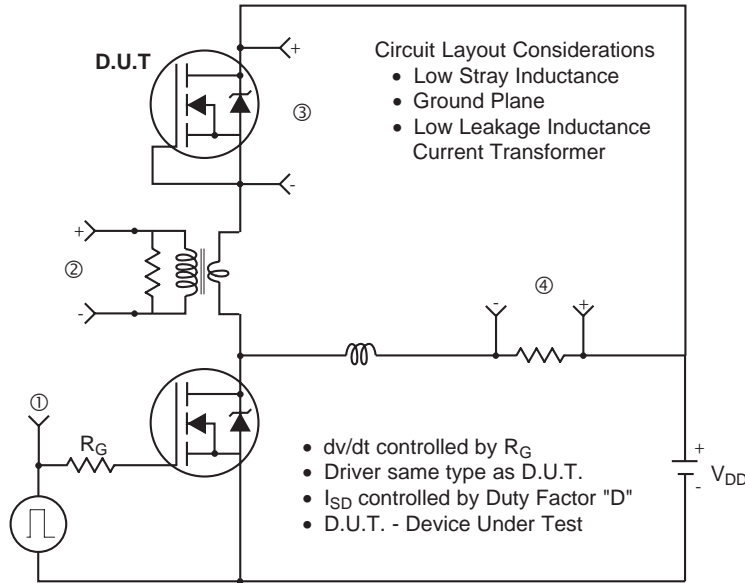


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

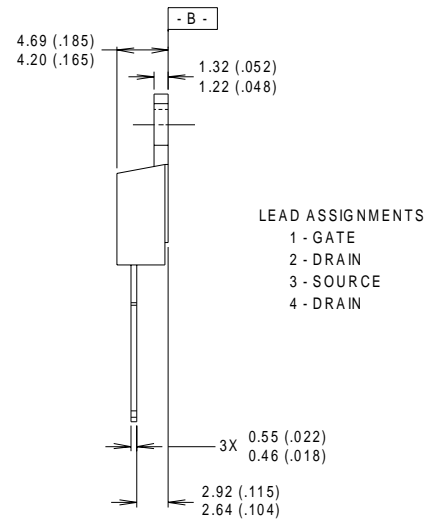
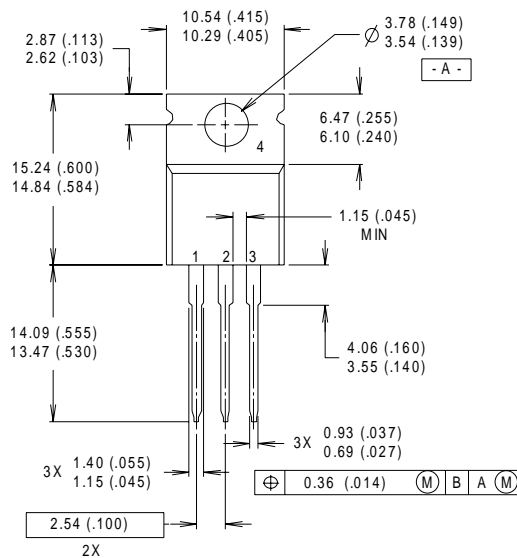
Fig 14. For N-Channel HEXFET® Power MOSFETs

IRF634N/S/L



TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



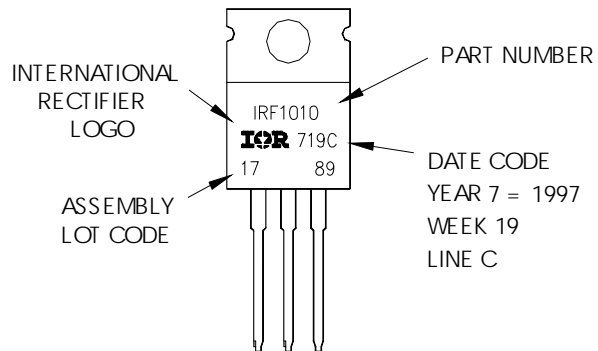
- LEAD ASSIGNMENTS
- 1 - GATE
 - 2 - DRAIN
 - 3 - SOURCE
 - 4 - DRAIN

NOTES:

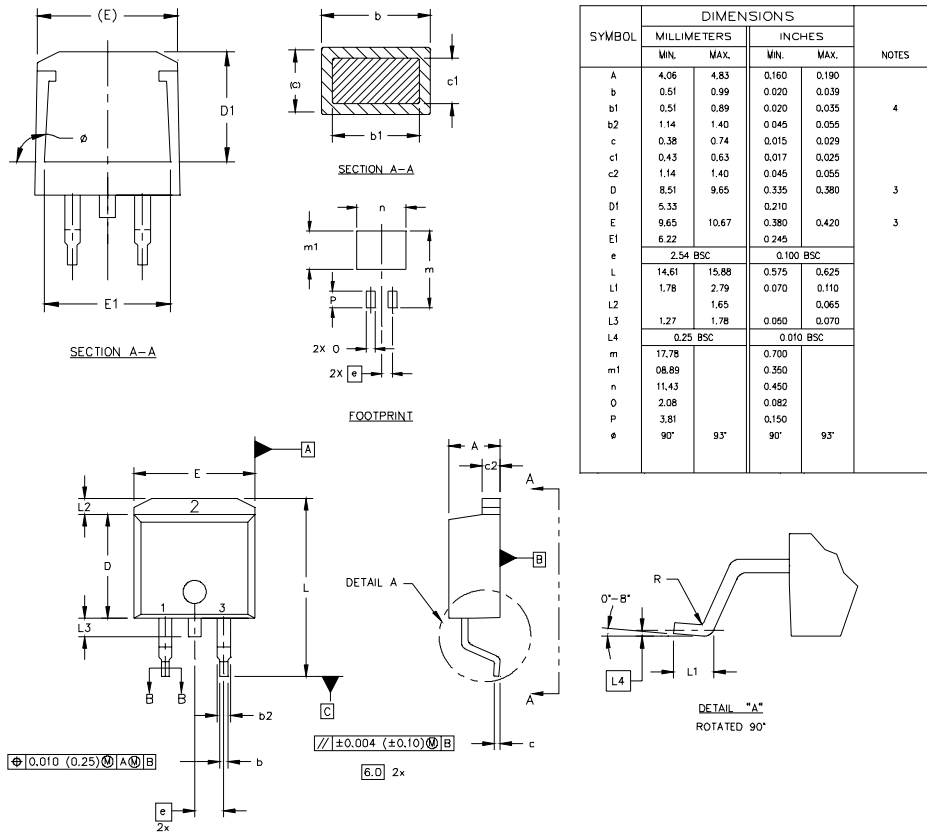
- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH
- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"



D²Pak Package Outline



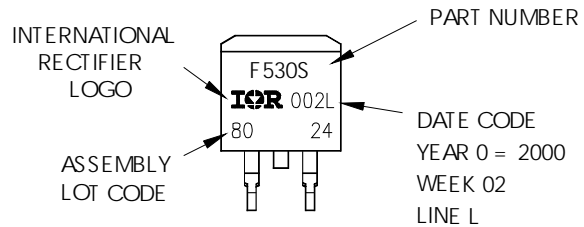
NOTES:
 1.0 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
 2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
 3.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
 4.0 DIMENSION b1 APPLY TO BASE METAL ONLY.
 5.0 OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB
 6.0 CONTROLLING DIMENSION : INCHES.

LEAD ASSIGNMENTS

HEXFET	IGBTs, CoPACK	DIODES
1.- GATE	1.- GATE	1.- ANODE
2.- DRAIN	2.- COLLECTOR	2.- CATHODE
3.- SOURCE	3.- EMITTER	3.- ANODE

D²Pak Part Marking Information

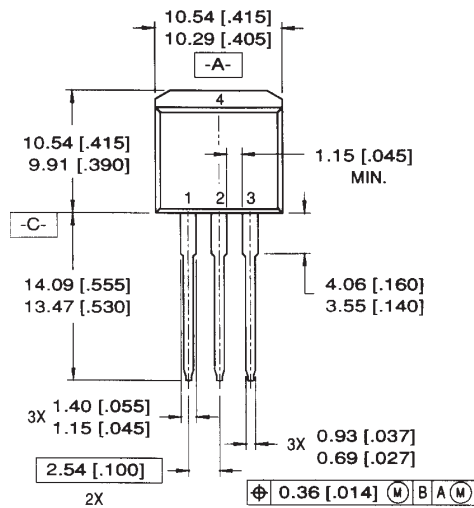
EXAMPLE: THIS IS AN IRF530S WITH
 LOT CODE 8024
 ASSEMBLED ON WW02, 2000
 IN THE ASSEMBLY LINE "L"



IRF634N/S/L

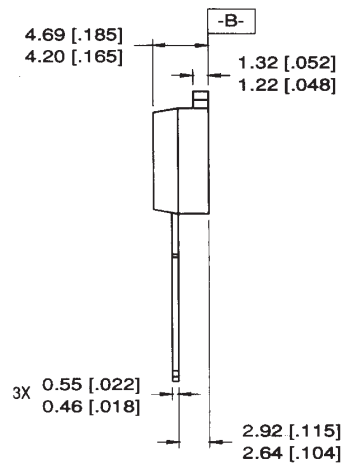


TO-262 Package Outline



LEAD ASSIGNMENTS

- | | |
|-----------|------------|
| 1 = GATE | 3 = SOURCE |
| 2 = DRAIN | 4 = DRAIN |

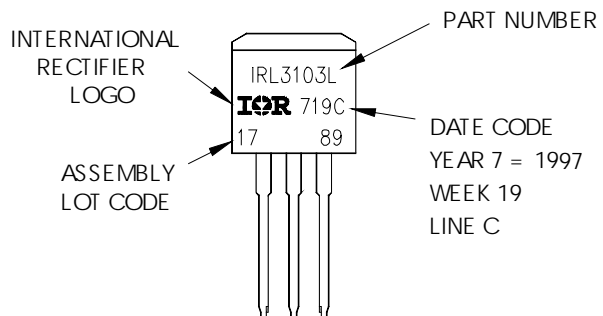


NOTES:

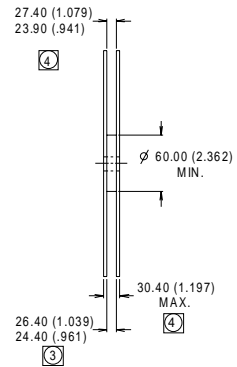
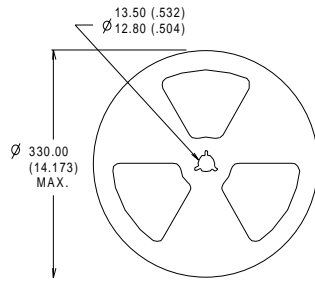
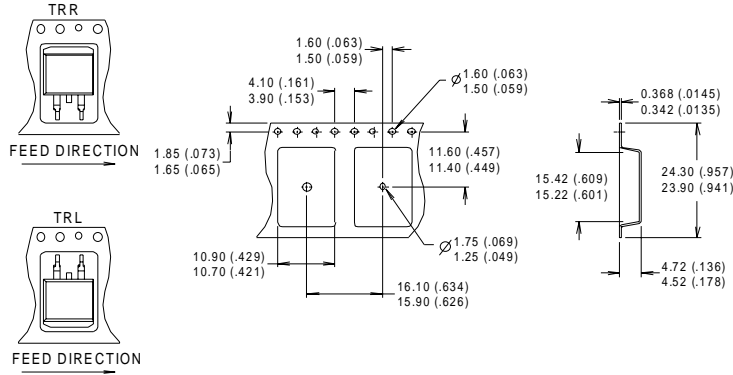
1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"



D²Pak Tape & Reel Information



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

Notes:

1. Repetitive rating; pulse width limited by max. junction temperature.
2. Starting $T_J = 25^\circ\text{C}$, $L = 9.5\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 4.8\text{A}$, $V_{GS} = 10\text{V}$
3. Pulse width $\leq 400\mu\text{s}$; duty cycle $\leq 2\%$.
4. This is only applied to TO-220A 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.

Data and specifications subject to change without notice.
 This product has been designed and qualified for the Automotive [Q101] (IRF634N), Industrial (IRF634NS and IRF634NL) market.
 Qualification Standards can be found on IR's Web site.