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PD - 95448

International
IOR Rectifier

SMPS MOSFET

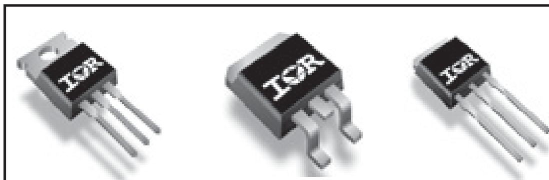
IRL3716PbF
IRL3716SPbF
IRL3716LPbF

HEXFET® Power MOSFET

V_{DSS}	$R_{DS(on)}$ max	I_D
20V	**4.0mΩ**	**180A**⑥

Applications
- High Frequency Isolated DC-DC Converters with Synchronous Rectification for Telecom and Industrial Use
- High Frequency Buck Converters for Computer Processor Power
- Active Oring
- Lead-Free

Benefits
- Ultra-Low Gate Impedance
- Very Low $R_{DS(on)}$ at 4.5V V_{GS}
- Fully Characterized Avalanche Voltage and Current



TO-220AB IRL3716 | D²Pak IRL3716S | TO-262 IRL3716L

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
V_{DS}	Drain-Source Voltage	20	V
V_{GS}	Gate-to-Source Voltage	± 20	V
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	180⑥	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	130	
I_{DM}	Pulsed Drain Current①	720	
P_D @T_C = 25°C	Maximum Power Dissipation③	210	W
P_D @T_C = 100°C	Maximum Power Dissipation③	100	W
	Linear Derating Factor	1.4	W/°C
T_J , T_{STG}	Junction and Storage Temperature Range	-55 to + 175	°C

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{θJC}$	Junction-to-Case	——	0.72	°C/W
$R_{θCS}$	Case-to-Sink, Flat, Greased Surface ④	0.50	——	
$R_{θJA}$	Junction-to-Ambient④	——	62	
$R_{θJA}$	Junction-to-Ambient (PCB mount)⑤	——	40	

Notes ① through ⑥ are on page 11

6/22/04

Static @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	20	–––	–––	V	V_{GS} = 0V, I_D = 250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	–––	0.021	–––	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	–––	3.0	4.0	mΩ	V_{GS} = 10V, I_D = 90A ③
		–––	4.0	4.8		V_{GS} = 4.5V, I_D = 72A ③
$V_{GS(th)}$	Gate Threshold Voltage	1.0	–––	3.0	V	V_{DS} = V_{GS}, I_D = 250μA
I_{DSS}	Drain-to-Source Leakage Current	–––	–––	20	μA	V_{DS} = 16V, V_{GS} = 0V
		–––	–––	250		V_{DS} = 16V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	–––	–––	200	nA	V_{GS} = 16V
	Gate-to-Source Reverse Leakage	–––	–––	-200		V_{GS} = -16V

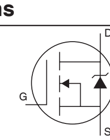
Dynamic @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	100	–––	–––	S	V_{DS} = 10V, I_D = 72A
Q_g	Total Gate Charge	–––	53	79	nC	I_D = 72A
Q_{gs}	Gate-to-Source Charge	–––	17	26		V_{DS} = 16V
Q_{gd}	Gate-to-Drain ("Miller") Charge	–––	24	35		V_{GS} = 4.5V
Q_{oss}	Output Gate Charge	–––	50	75		V_{GS} = 0V, V_{DS} = 10V
$t_{d(on)}$	Turn-On Delay Time	–––	18	–––	ns	V_{DD} = 10V
t_r	Rise Time	–––	140	–––		I_D = 72A
$t_{d(off)}$	Turn-Off Delay Time	–––	38	–––		R_G = 3.9Ω
t_f	Fall Time	–––	36	–––		V_{GS} = 4.5V ③
C_{iss}	Input Capacitance	–––	5090	–––	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	–––	3440	–––		V_{DS} = 10V
C_{rss}	Reverse Transfer Capacitance	–––	560	–––		ƒ = 1.0MHz

Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	–––	640	mJ
I_{AR}	Avalanche Current①	–––	72	A

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	–––	–––	180⑥	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	–––	–––	720		
V_{SD}	Diode Forward Voltage	–––	0.93	1.3	V	T_J = 25°C, I_S = 72A, V_{GS} = 0V ③
		–––	0.80	–––		T_J = 125°C, I_S = 72A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	–––	180	280	ns	T_J = 25°C, I_F = 72A, V_R=20V
Q_{rr}	Reverse Recovery Charge	–––	87	130	nC	di/dt = 100A/μs ③
t_{rr}	Reverse Recovery Time	–––	190	280	ns	T_J = 125°C, I_F = 72A, V_R=20V
Q_{rr}	Reverse Recovery Charge	–––	85	130	nC	di/dt = 100A/μs ③

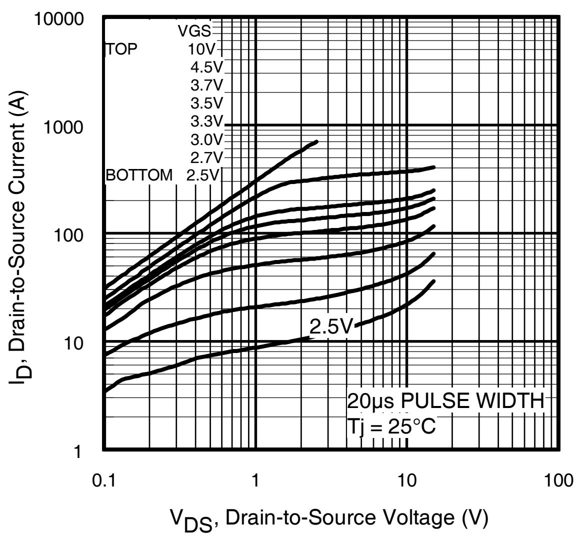


Fig 1. Typical Output Characteristics

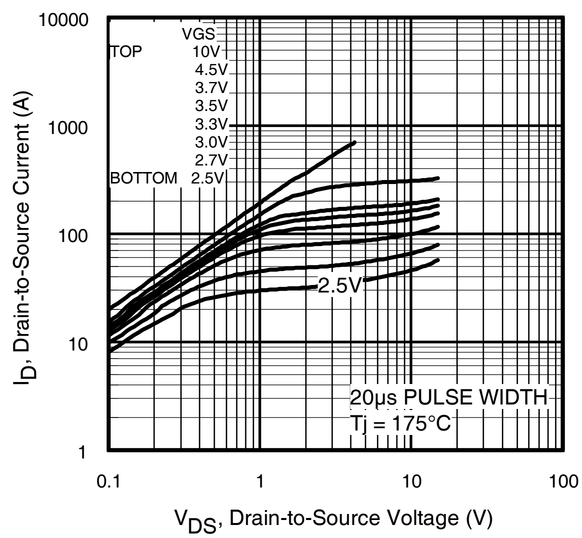


Fig 2. Typical Output Characteristics

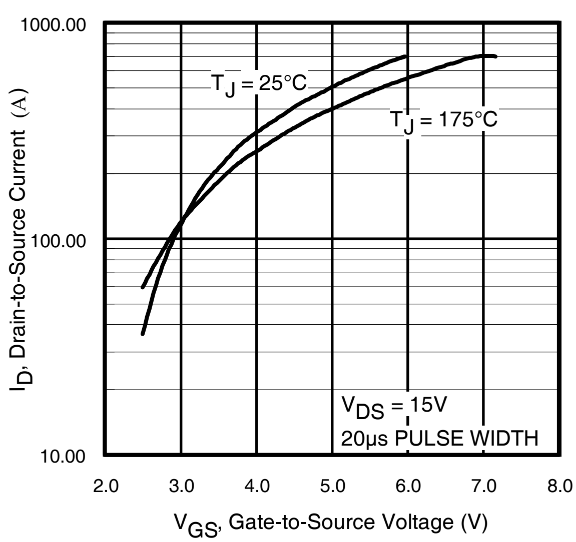


Fig 3. Typical Transfer Characteristics

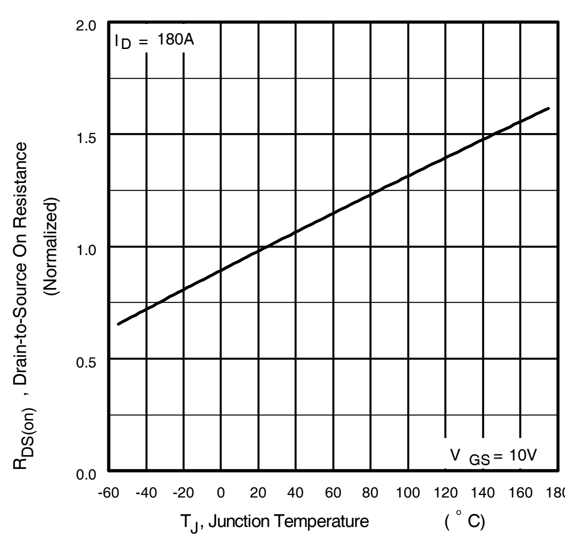


Fig 4. Normalized On-Resistance Vs. Temperature

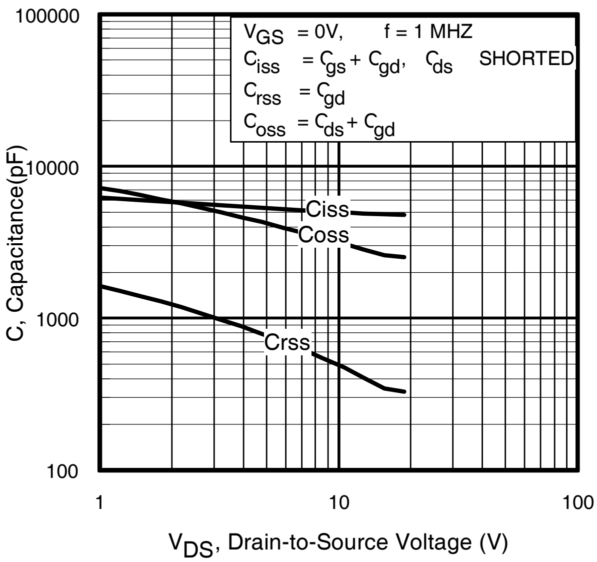


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

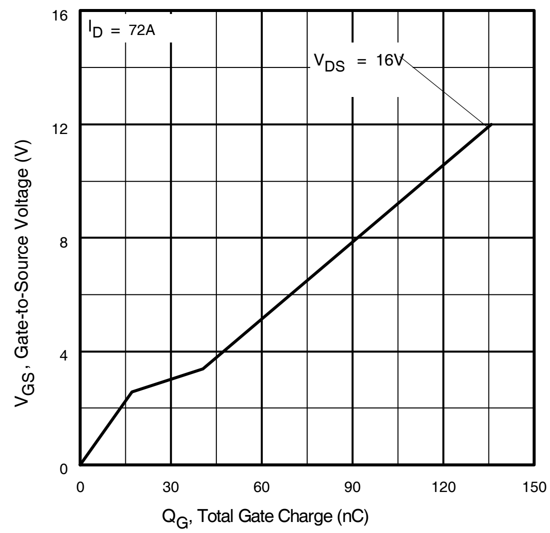


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

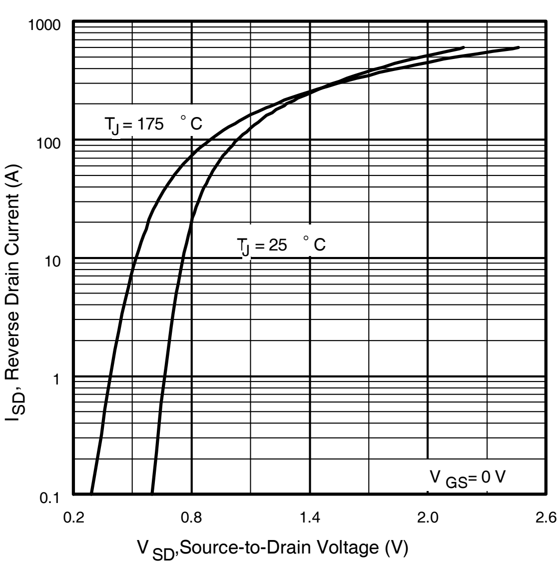


Fig 7. Typical Source-Drain Diode Forward Voltage

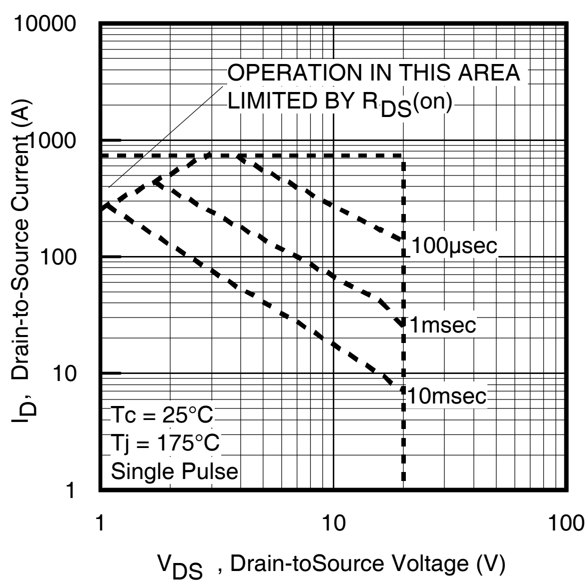


Fig 8. Maximum Safe Operating Area

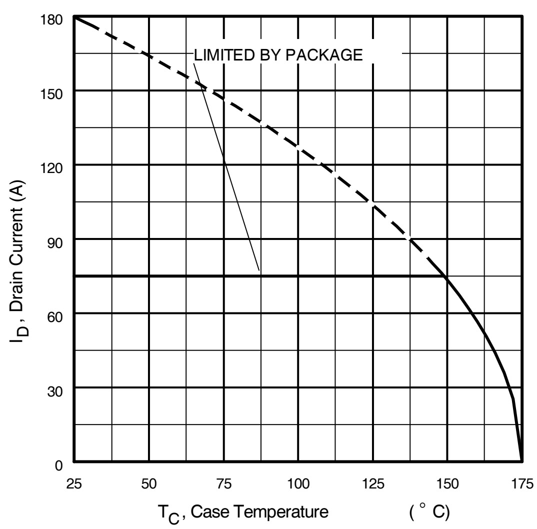


Fig 9. Maximum Drain Current Vs. Case Temperature

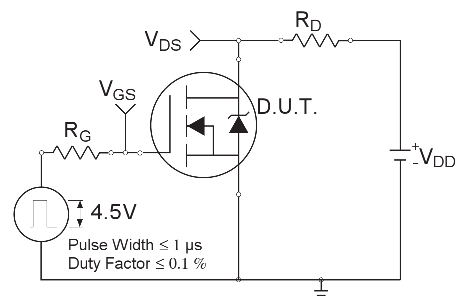


Fig 10a. Switching Time Test Circuit

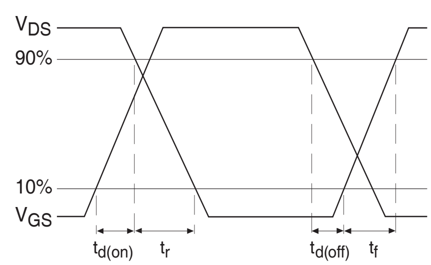


Fig 10b. Switching Time Waveforms

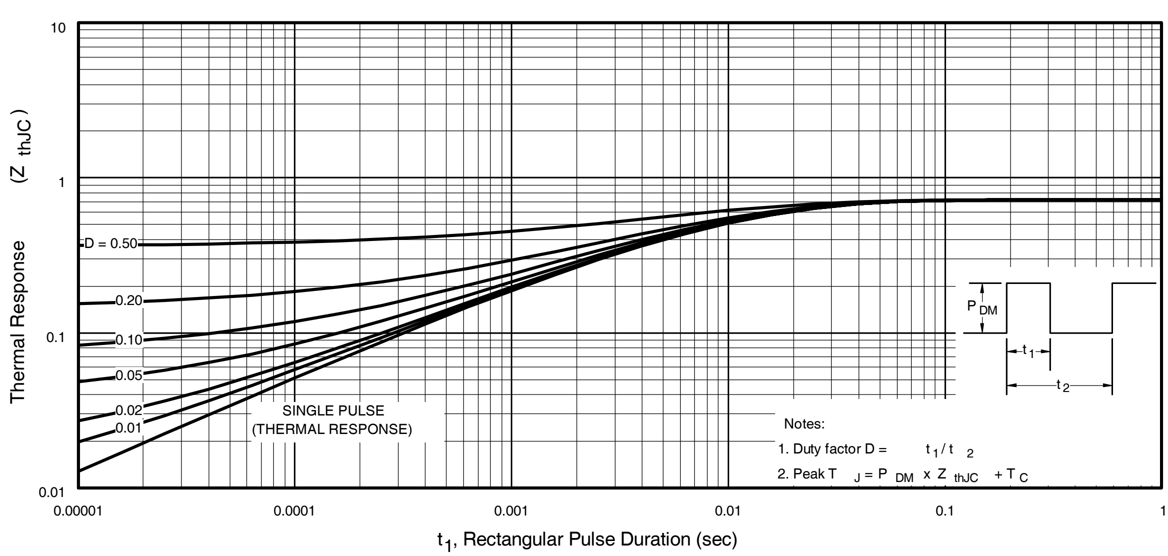


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

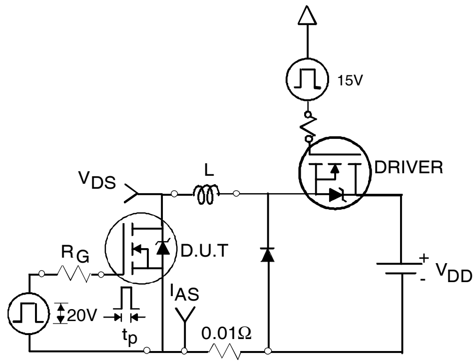


Fig 12a. Unclamped Inductive Test Circuit

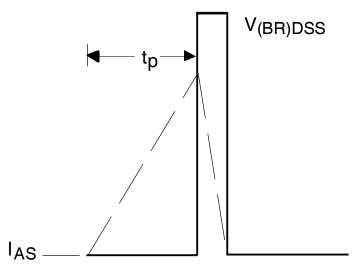


Fig 12b. Unclamped Inductive Waveforms

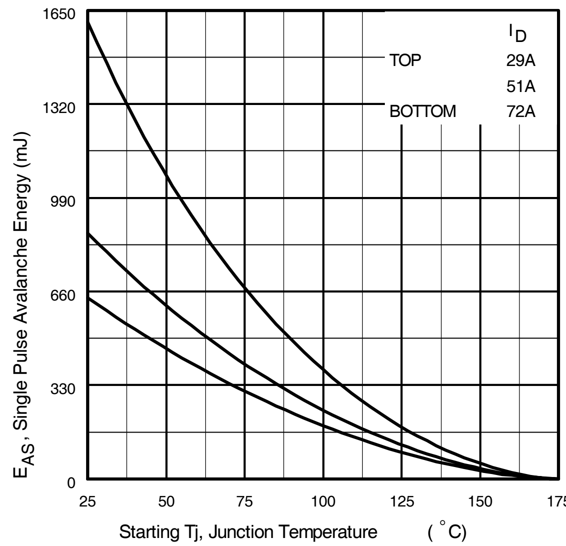


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

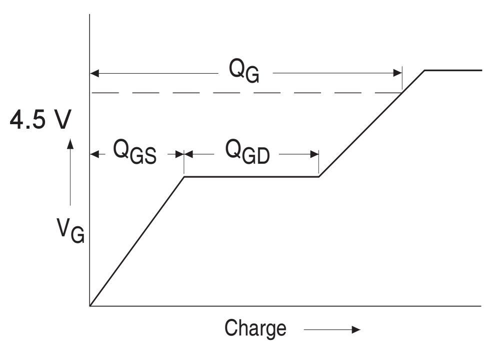


Fig 13a. Basic Gate Charge Waveform

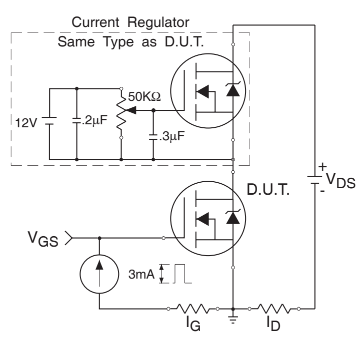
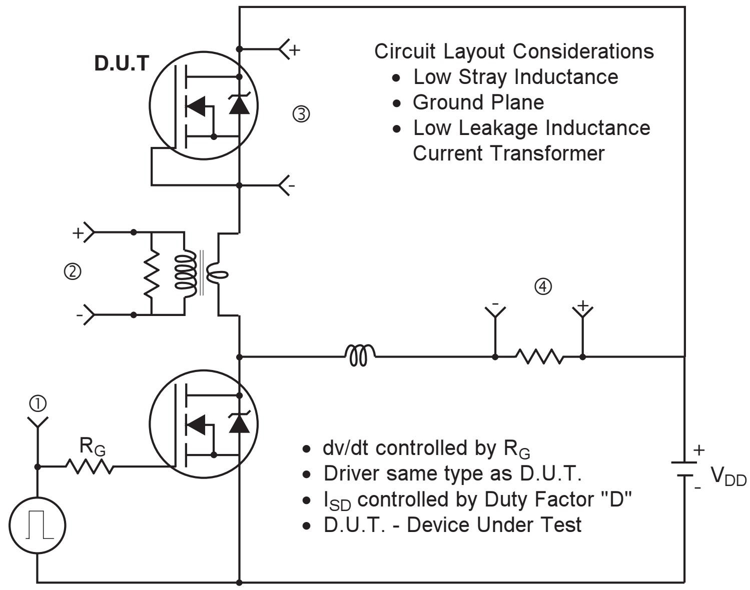
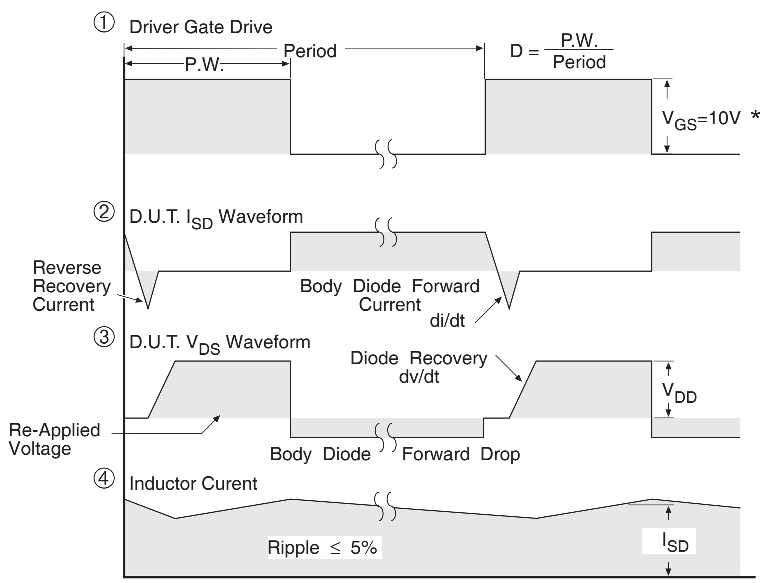


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



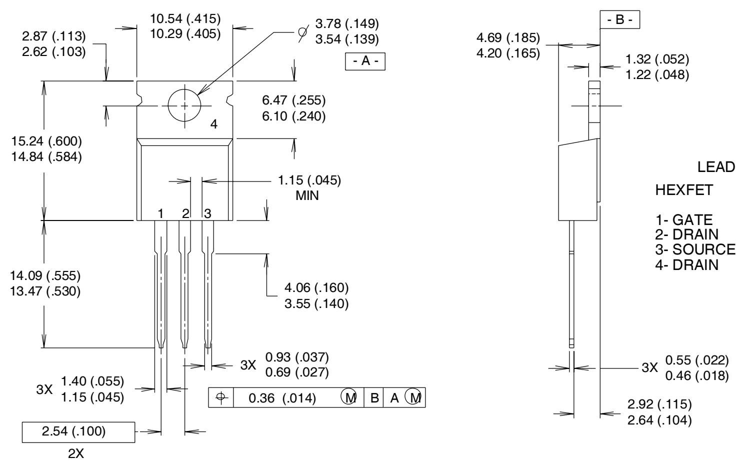


* V_{GS} = 5V for Logic Level Devices

Fig 14. For N-Channel HEXFET® Power MOSFETs

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



LEAD ASSIGNMENTS

HEXFET	IGBTs, CoPACK
1- GATE	1- GATE
2- DRAIN	2- COLLECTOR
3- SOURCE	3- EMITTER
4- DRAIN	4- COLLECTOR

NOTES:

1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.

2 CONTROLLING DIMENSION : INCH

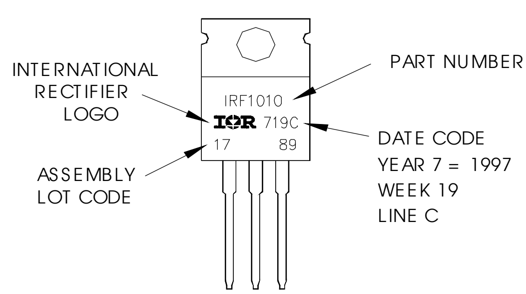
3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.

4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

TO-220AB Part Marking Information

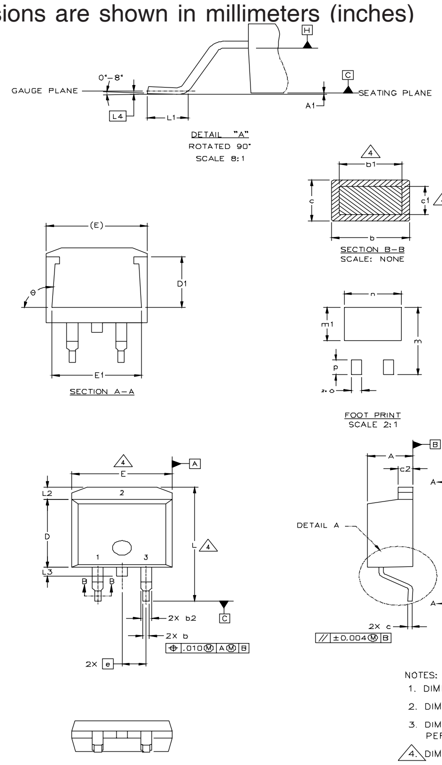
EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

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



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	
A1		0.127		.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	4
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.

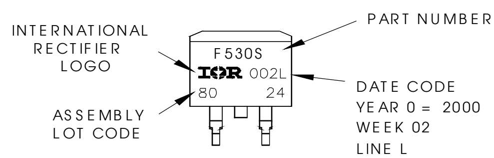
NOTES:

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 [.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.

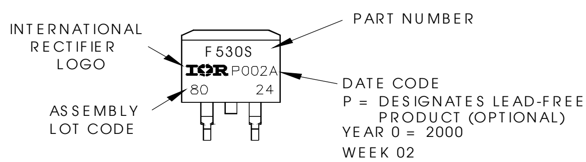
D2Pak Part Marking Information (Lead-Free)

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

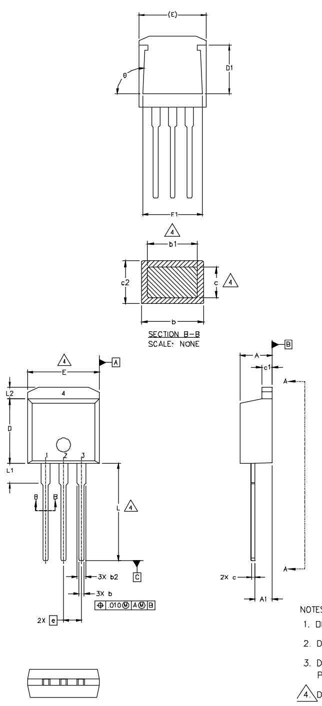
Note: "P" in assembly line position indicates "Lead-Free"



OR



TO-262 Package Outline



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

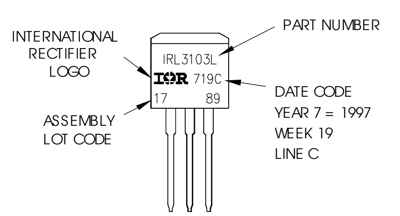
IGBT
1- GATE
2- COLLECTOR
3- EMITTER

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.

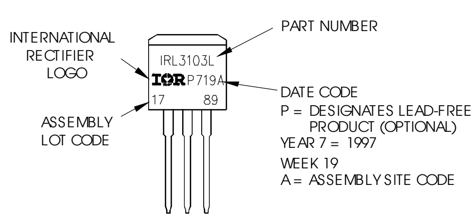
TO-262 Part Marking Information

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

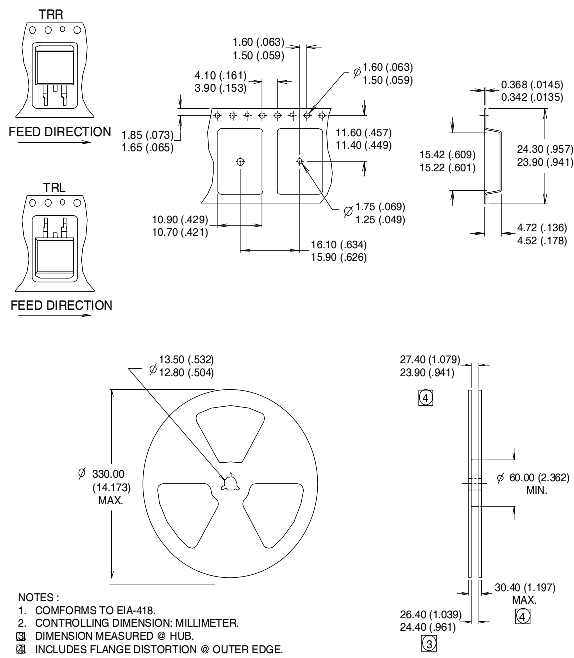
Note: "P" in assembly line position indicates "Lead-Free"



OR



D^2Pak Tape & Reel Infomation



Notes:

① Repetitive rating; pulse width limited by max. junction temperature.

② Starting $T_J = 25°C$, $L = 0.25mH$ $R_G = 25\Omega$, $I_{AS} = 72A$.

③ Pulse width ≤ 400µs; duty cycle ≤ 2%.

④ This is only applied to TO-220AB package

⑤ This is applied to D^2Pak, 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 Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.

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.

International
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.06/04

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