

International IR Rectifier

SMPS MOSFET

PD - 95448

IRL3716PbF
IRL3716SPbF
IRL3716LPbF

HEXFET® Power MOSFET

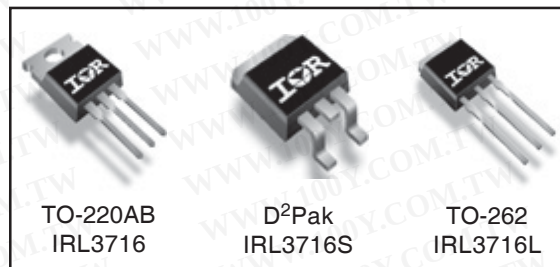
Applications

- 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

V_{DSS}	$R_{DS(on)}$ max	I_D
20V	4.0m Ω	180A ^⑥



Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
V_{DS}	Drain-Source Voltage	20	V
V_{GS}	Gate-to-Source Voltage	± 20	V
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	180 ^⑥	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	130	
I_{DM}	Pulsed Drain Current ^①	720	
P_D @ $T_C = 25^\circ\text{C}$	Maximum Power Dissipation ^③	210	W
P_D @ $T_C = 100^\circ\text{C}$	Maximum Power Dissipation ^③	100	W
	Linear Derating Factor	1.4	W/ $^\circ\text{C}$
T_J, T_{STG}	Junction and Storage Temperature Range	-55 to + 175	$^\circ\text{C}$

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.72	$^\circ\text{C/W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface ^④	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient ^④	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB mount) ^⑤	—	40	

Notes ^① through ^⑥ are on page 11

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

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

Dynamic @ $T_J = 25^\circ\text{C}$ (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	—		$R_G = 3.9\Omega$
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	—		$f = 1.0\text{MHz}$

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	$T_J = 25^\circ\text{C}, I_S = 72A, V_{GS} = 0V$ ③
		—	0.80	—		$T_J = 125^\circ\text{C}, I_S = 72A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	180	280	ns	$T_J = 25^\circ\text{C}, I_F = 72A, V_R = 20V$
Q_{rr}	Reverse Recovery Charge	—	87	130	nC	$di/dt = 100A/\mu s$ ③
t_{rr}	Reverse Recovery Time	—	190	280	ns	$T_J = 125^\circ\text{C}, I_F = 72A, V_R = 20V$
Q_{rr}	Reverse Recovery Charge	—	85	130	nC	$di/dt = 100A/\mu s$ ③

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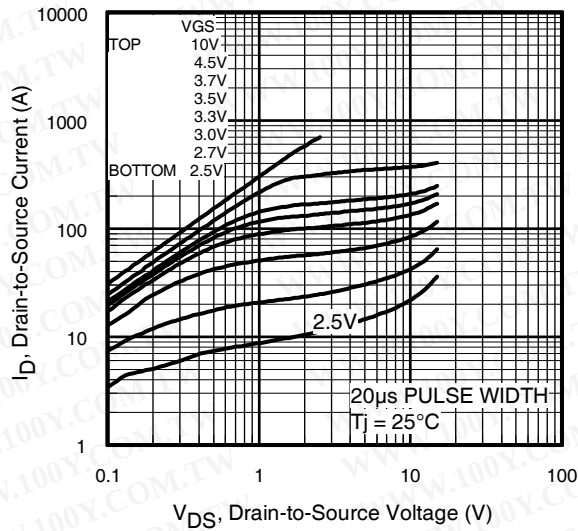


Fig 1. Typical Output Characteristics

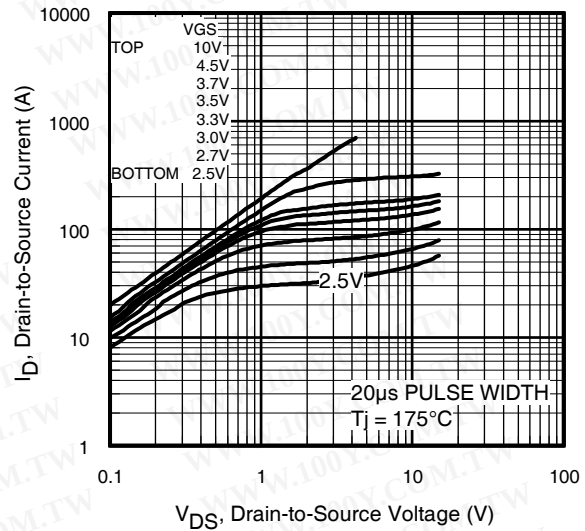


Fig 2. Typical Output Characteristics

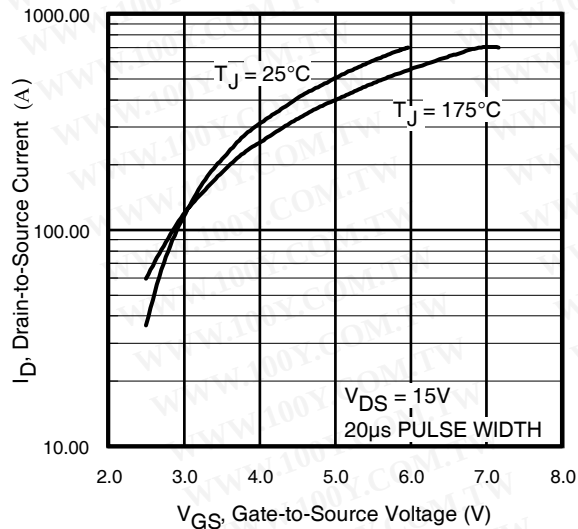


Fig 3. Typical Transfer Characteristics

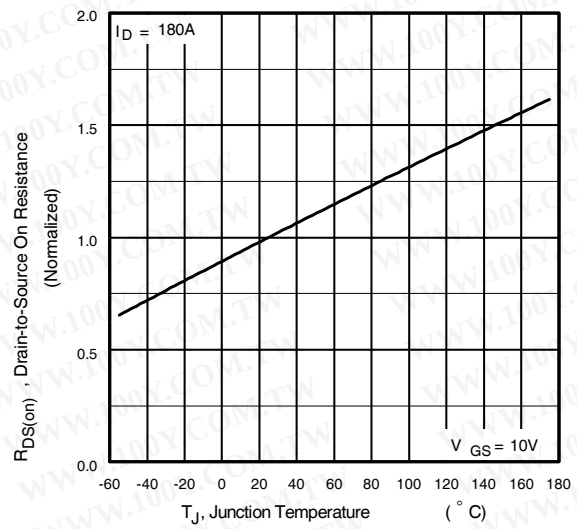
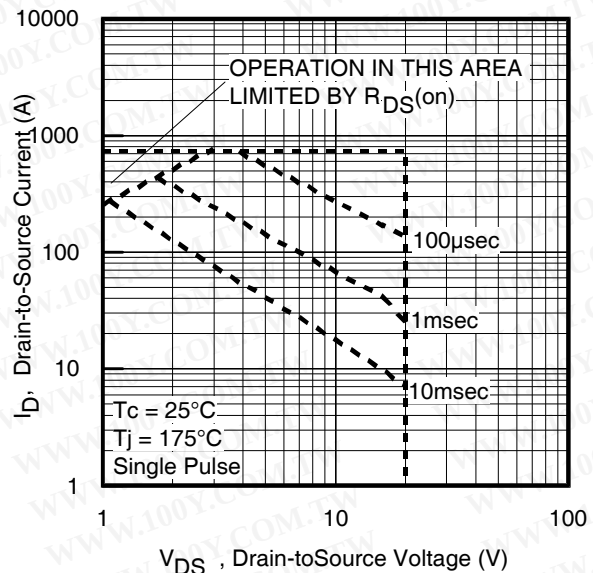
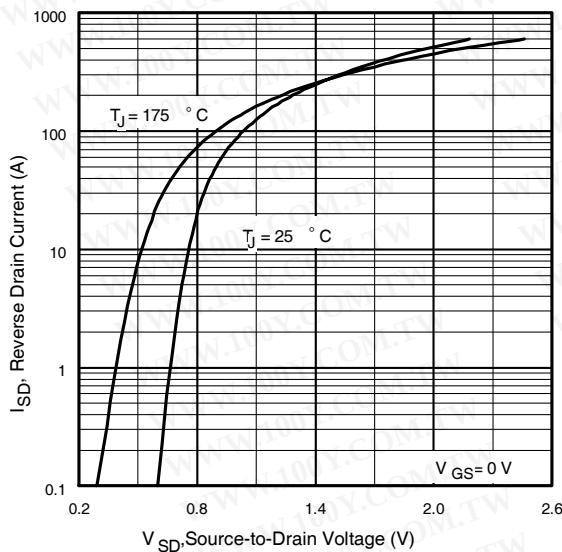
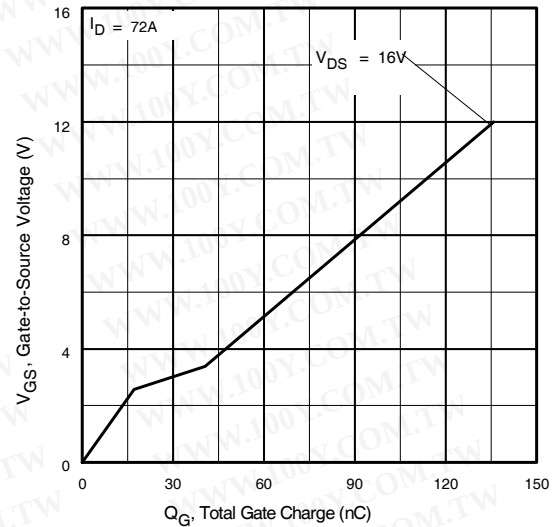
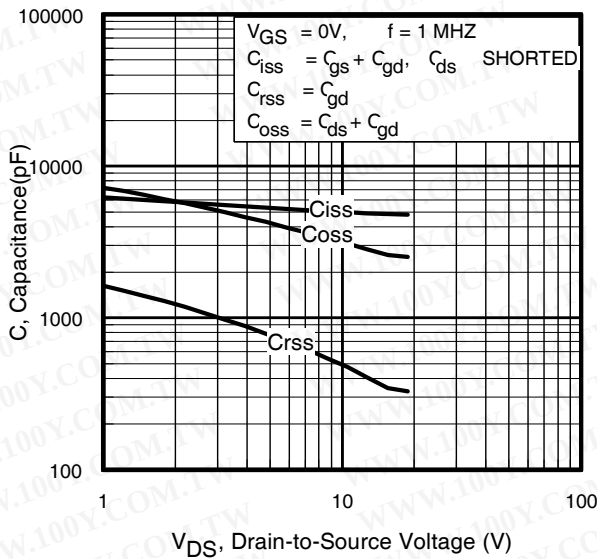


Fig 4. Normalized On-Resistance Vs. Temperature

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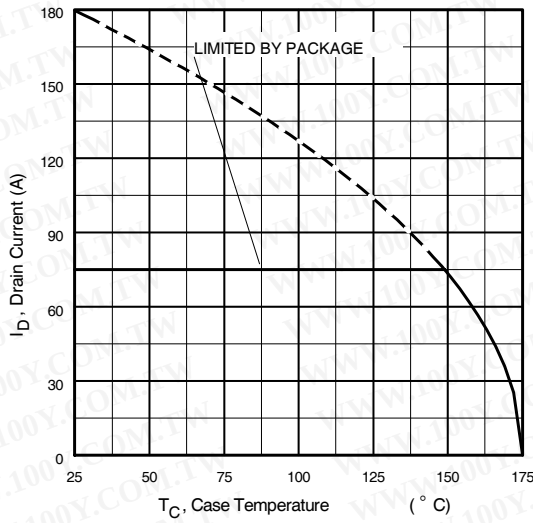


Fig 9. Maximum Drain Current Vs. Case Temperature

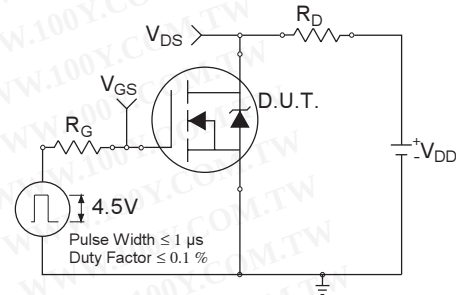


Fig 10a. Switching Time Test Circuit

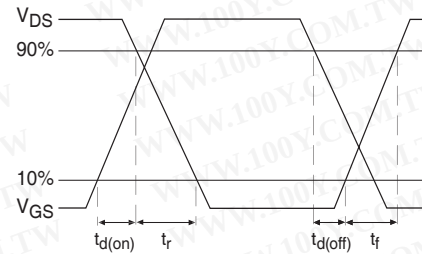


Fig 10b. Switching Time Waveforms

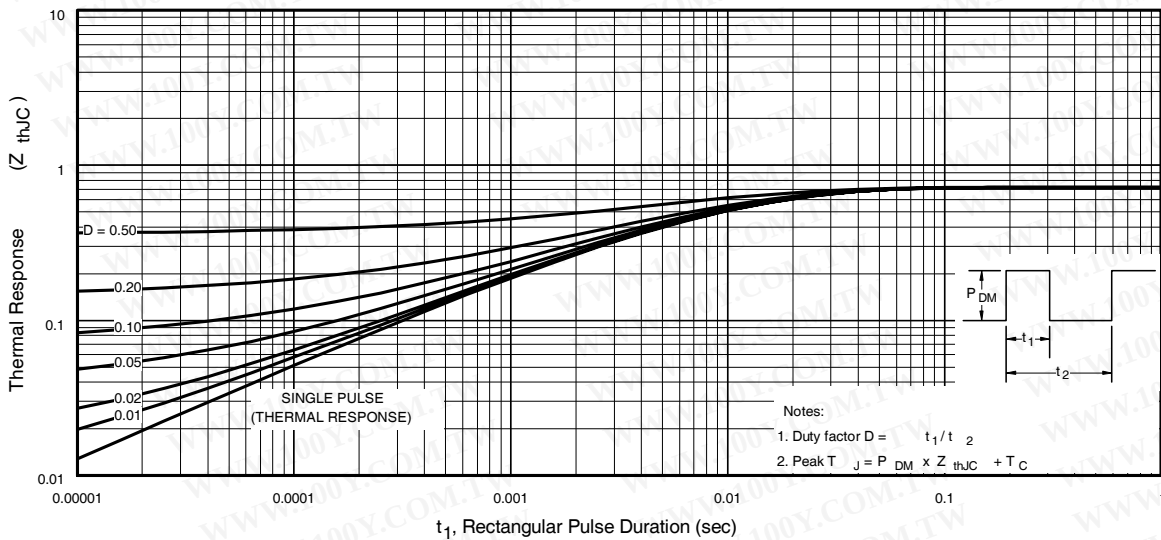


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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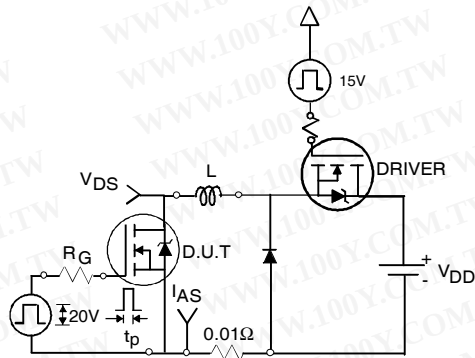


Fig 12a. Unclamped Inductive Test Circuit

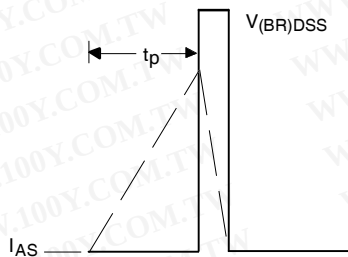


Fig 12b. Unclamped Inductive Waveforms

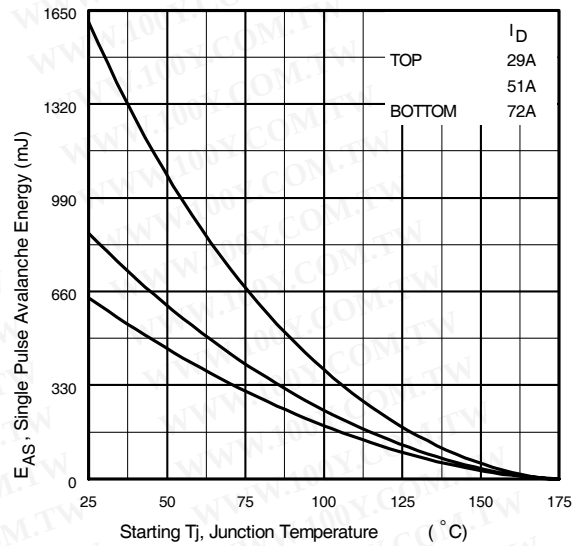


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

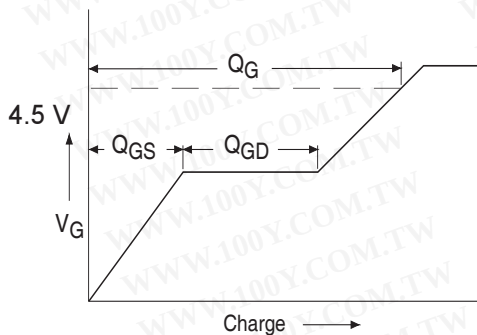


Fig 13a. Basic Gate Charge Waveform

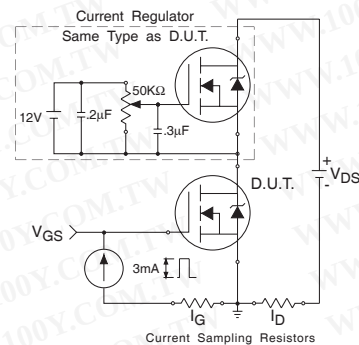
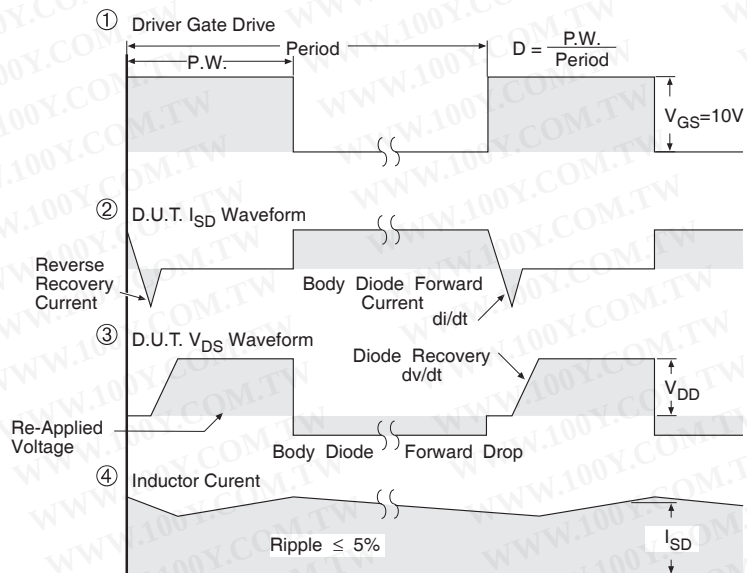
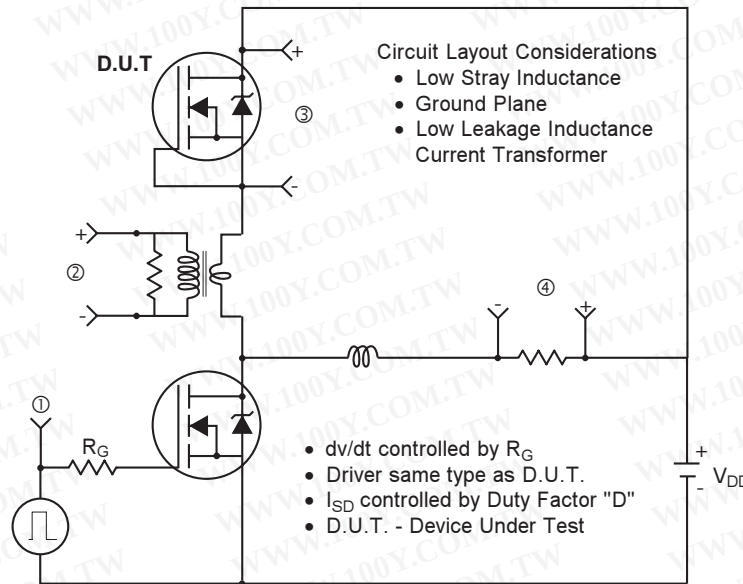


Fig 13b. Gate Charge Test Circuit

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Peak Diode Recovery dv/dt Test Circuit



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

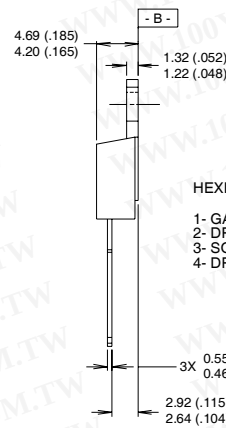
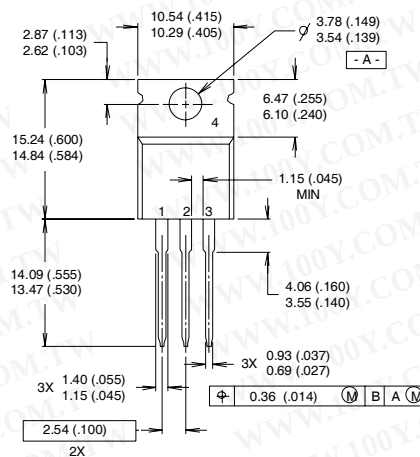
Fig 14. For N-Channel HEXFET® Power MOSFETs

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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:

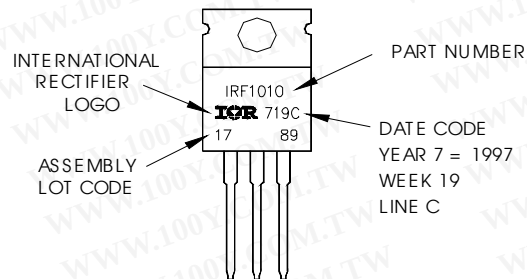
- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH

- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.

- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

TO-220AB Part Marking Information

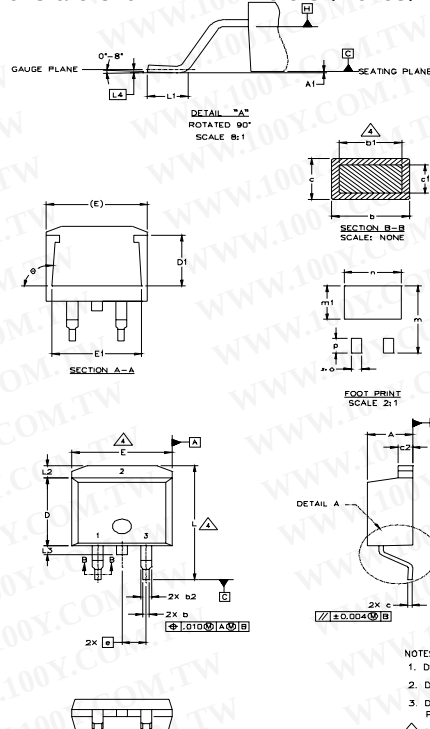
EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"
Note: "P" in assembly line
position indicates "Lead-Free"



IRL3716/3716S/3716LPbF

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		.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	
c2	1.14	1.40	.045	.055	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		3
E	9.65	10.67	.380	.420	
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

INTERNATIONAL
RECTIFIER
LOGO

ASSEMBLY
LOT CODE

PART NUMBER

DATE CODE
YEAR 0 = 2000
WEEK 02
LINE L

INTERNATIONAL
RECTIFIER
LOGO

ASSEMBLY
LOT CODE

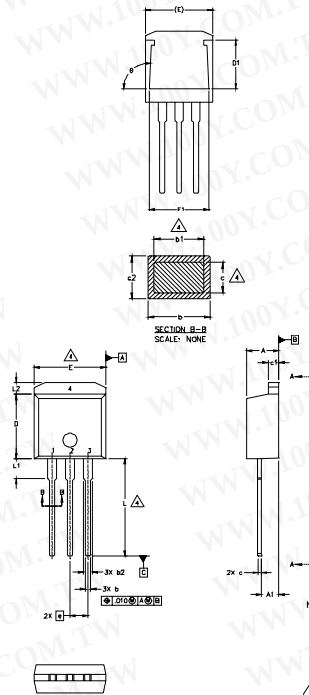
PART NUMBER

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

IRL3716/3716S/3716LPbF

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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

IGBT

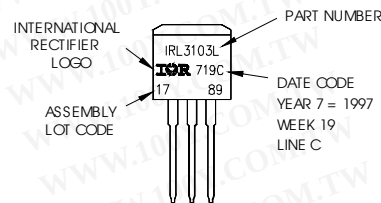
HEXFET

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

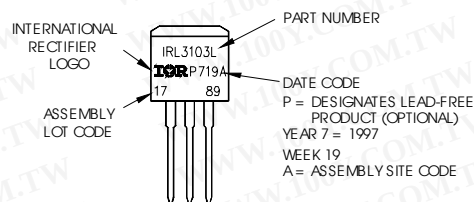
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
 2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
 3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
 4. DIMENSION b1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

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"



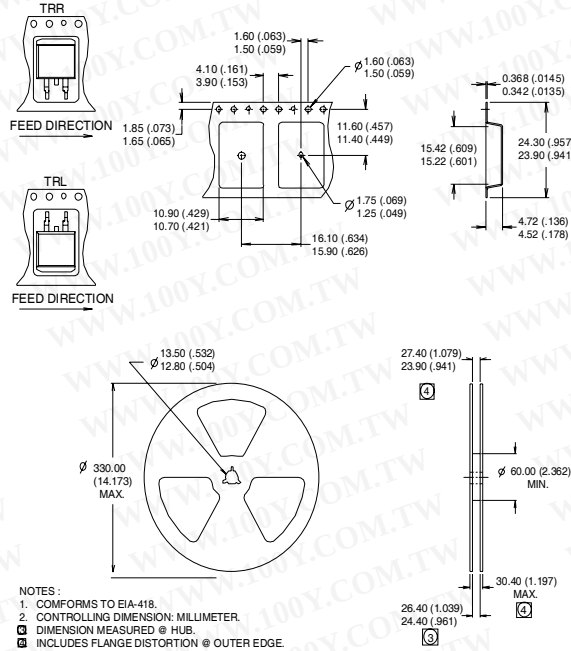
OR



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IRL3716/3716S/3716LPbF

D²Pak Tape & Reel Infomation



Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.25\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 72\text{A}$.
- 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 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
IR Rectifier

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