

PD - 95380

# International IR Rectifier

## SMPS MOSFET

IRL3715PbF  
 IRL3715SPbF  
 IRL3715LPbF

HEXFET® Power MOSFET

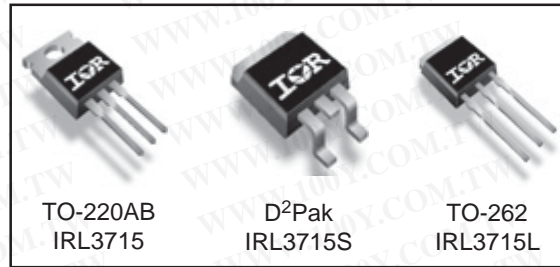
### Applications

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

### Benefits

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

$V_{DS}$	$R_{DS(on)}$ max	$I_D$
20V	14m $\Omega$	54A <sup>Ⓒ</sup>



### Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
$V_{DS}$	Drain-Source Voltage	20	V
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	54 <sup>Ⓒ</sup>	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	38 <sup>Ⓒ</sup>	
$I_{DM}$	Pulsed Drain Current <sup>Ⓓ</sup>	210	
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	71	W
$P_D @ T_A = 25^\circ\text{C}$	Maximum Power Dissipation <sup>Ⓔ</sup>	3.8	W
	Linear Derating Factor	0.48	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	—	2.1	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface <sup>Ⓓ</sup>	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient <sup>Ⓓ</sup>	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB mount) <sup>Ⓔ</sup>	—	40	

Notes <sup>Ⓓ</sup> through <sup>Ⓔ</sup> are on page 11

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## Static @ T<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	20	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	0.022	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	11	14	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 26A ③
		—	15	20		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 21A ③
V <sub>GS(th)</sub>	Gate Threshold Voltage	1.0	—	3.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	20	μA	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
		—	—	100		V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	200	nA	V <sub>GS</sub> = 16V
	Gate-to-Source Reverse Leakage	—	—	-200		V <sub>GS</sub> = -16V

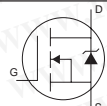
## Dynamic @ T<sub>J</sub> = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g <sub>fs</sub>	Forward Transconductance	26	—	—	S	V <sub>DS</sub> = 10V, I <sub>D</sub> = 21A
Q <sub>g</sub>	Total Gate Charge	—	11	17	nC	I <sub>D</sub> = 21A
Q <sub>gs</sub>	Gate-to-Source Charge	—	3.8	—		V <sub>DS</sub> = 10V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	4.4	—		V <sub>GS</sub> = 4.5V
Q <sub>oss</sub>	Output Gate Charge	—	11	17		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 10V
t <sub>d(on)</sub>	Turn-On Delay Time	—	6.4	—	ns	V <sub>DD</sub> = 10V
t <sub>r</sub>	Rise Time	—	73	—		I <sub>D</sub> = 21A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	12	—		R <sub>G</sub> = 1.8Ω
t <sub>f</sub>	Fall Time	—	5.1	—		V <sub>GS</sub> = 4.5V ③
C <sub>iss</sub>	Input Capacitance	—	1060	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	700	—		V <sub>DS</sub> = 10V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	120	—		f = 1.0MHz

## Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy②	—	110	mJ
I <sub>AR</sub>	Avalanche Current①	—	21	A

## Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	54⑥	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	210		
V <sub>SD</sub>	Diode Forward Voltage	—	0.9	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 21A, V <sub>GS</sub> = 0V ③
		—	0.8	—		T <sub>J</sub> = 125°C, I <sub>S</sub> = 21A, V <sub>GS</sub> = 0V ③
t <sub>rr</sub>	Reverse Recovery Time	—	37	56	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 21A, V <sub>R</sub> = 20V
Q <sub>rr</sub>	Reverse Recovery Charge	—	28	42	nC	di/dt = 100A/μs ③
t <sub>rr</sub>	Reverse Recovery Time	—	38	57	ns	T <sub>J</sub> = 125°C, I <sub>F</sub> = 21A, V <sub>R</sub> = 20V
Q <sub>rr</sub>	Reverse Recovery Charge	—	30	45	nC	di/dt = 100A/μs ③

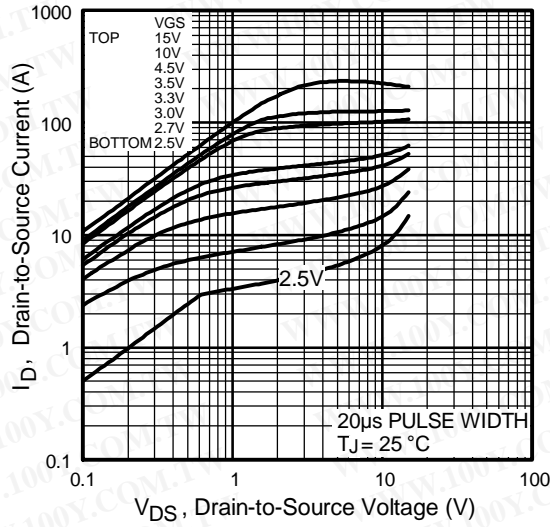


Fig 1. Typical Output Characteristics

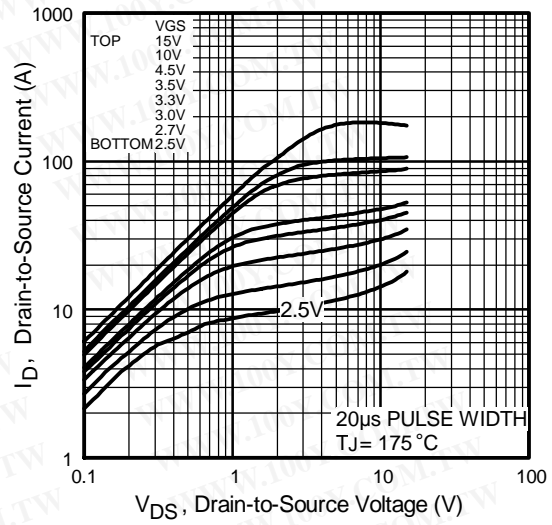


Fig 2. Typical Output Characteristics

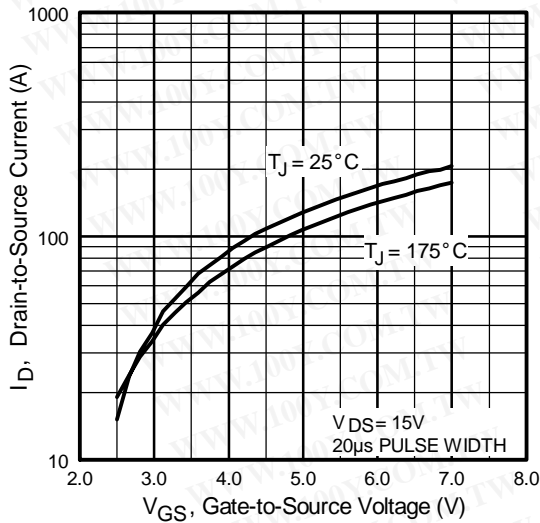


Fig 3. Typical Transfer Characteristics

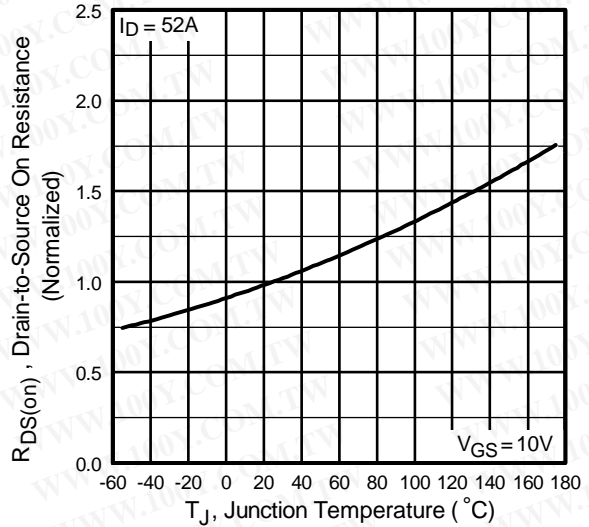
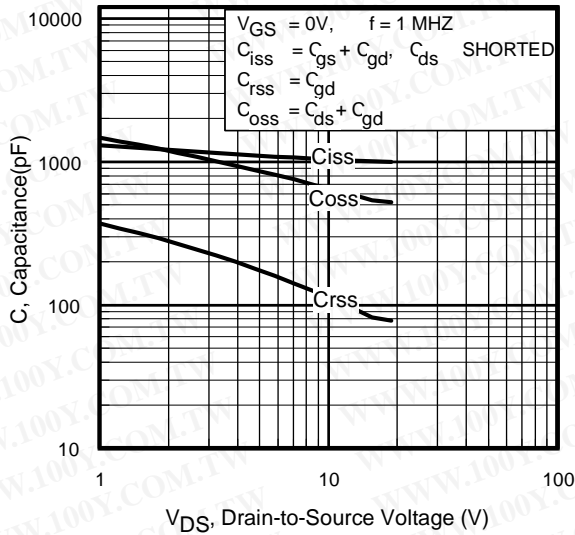


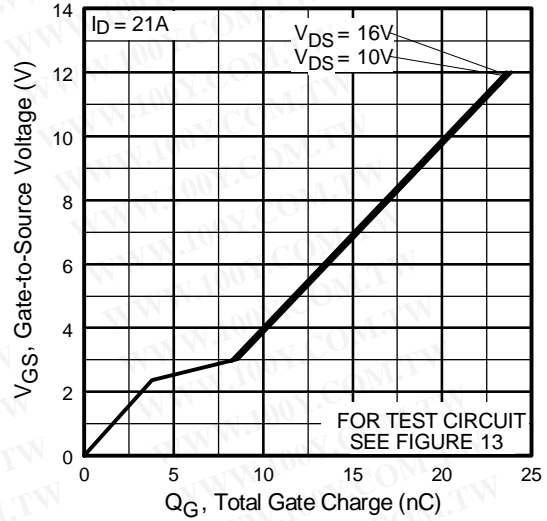
Fig 4. Normalized On-Resistance Vs. Temperature

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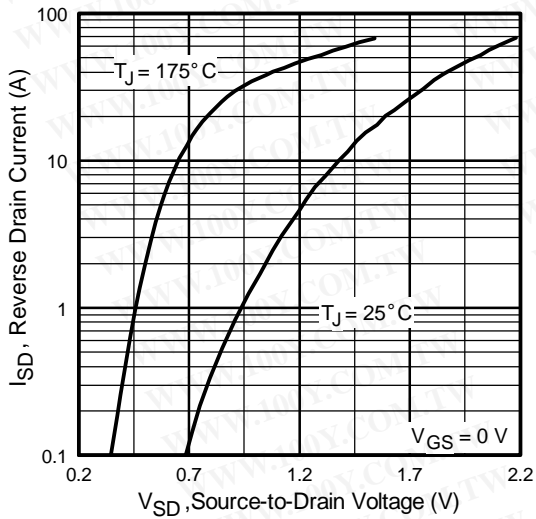
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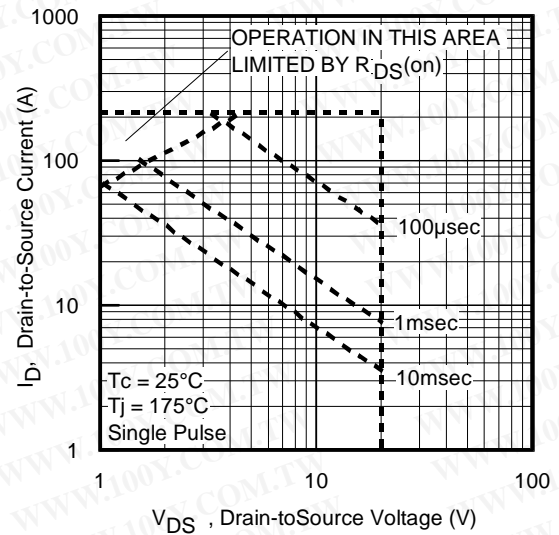
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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

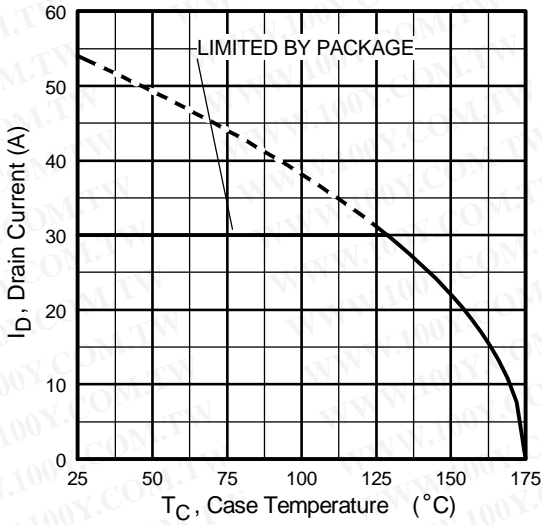


**Fig 7.** Typical Source-Drain Diode Forward Voltage

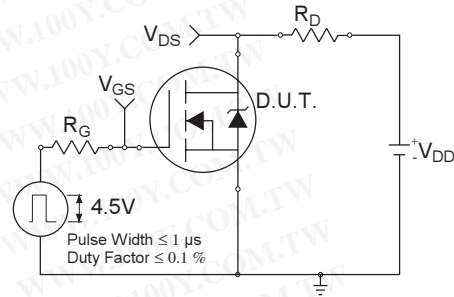


**Fig 8.** Maximum Safe Operating Area

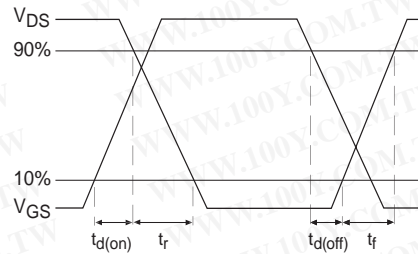




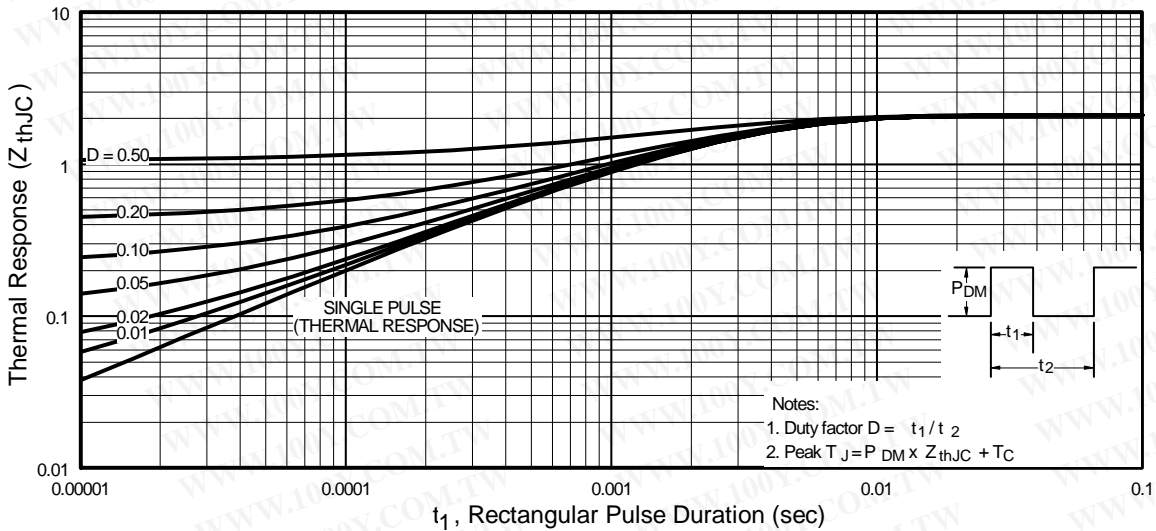
**Fig 9.** Maximum Drain Current Vs. Case Temperature



**Fig 10a.** Switching Time Test Circuit



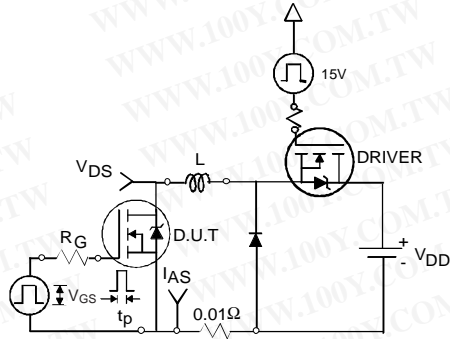
**Fig 10b.** Switching Time Waveforms



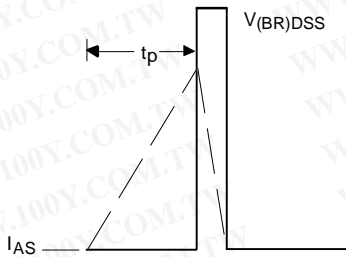
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

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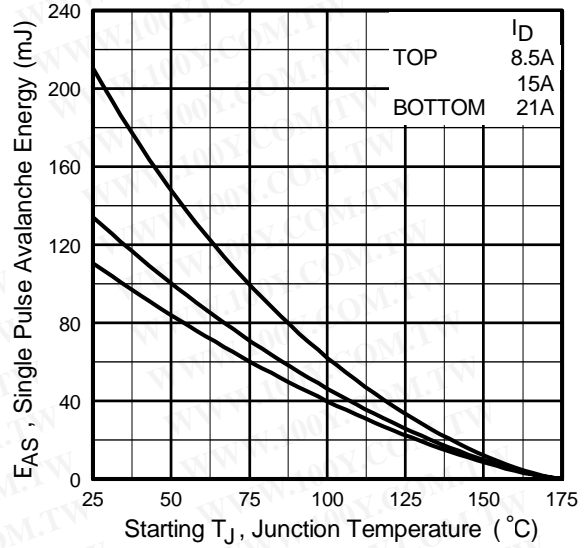
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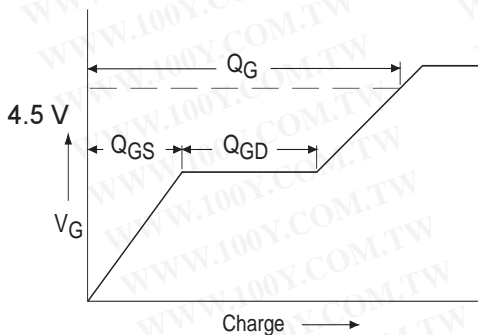
**Fig 12a.** Unclamped Inductive Test Circuit



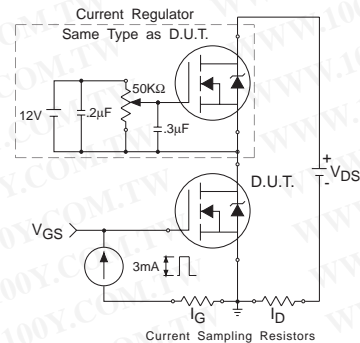
**Fig 12b.** Unclamped Inductive Waveforms



**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current

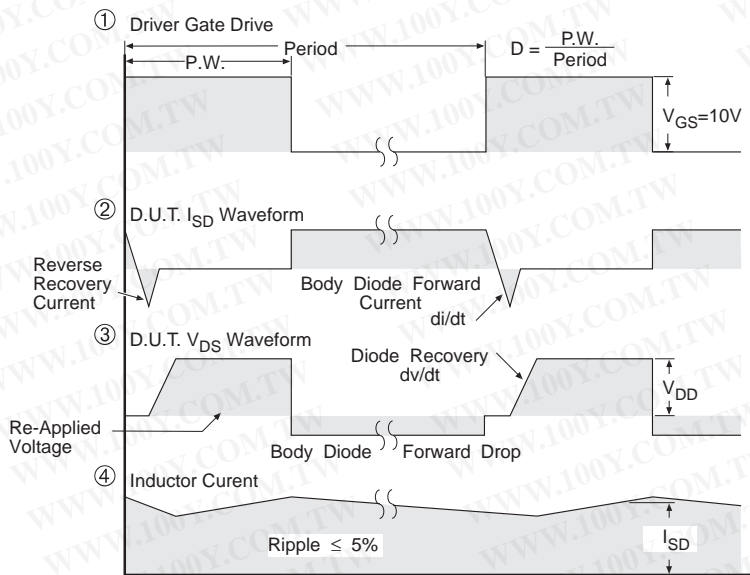
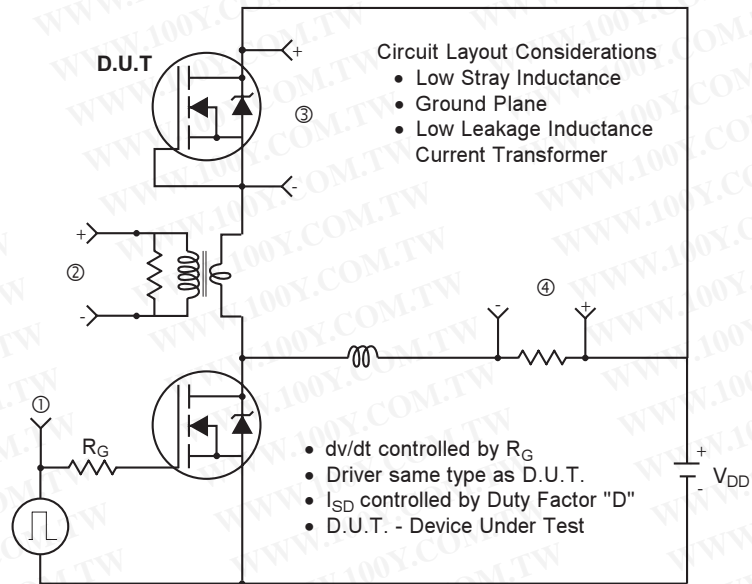


**Fig 13a.** Basic Gate Charge Waveform



**Fig 13b.** Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

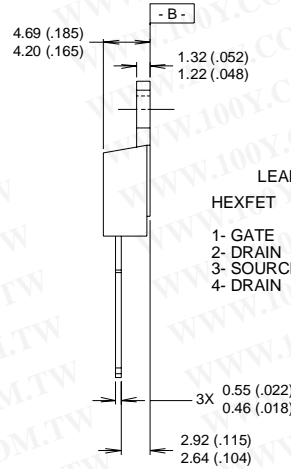
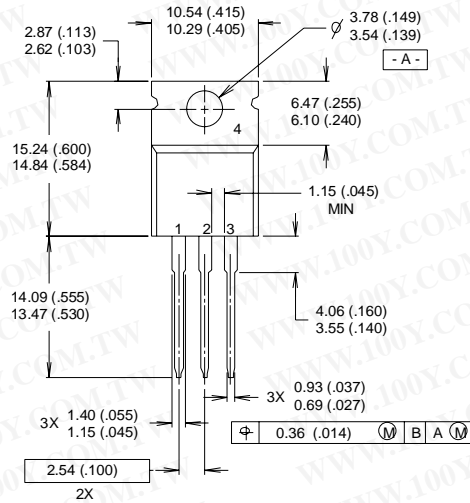
Fig 14. For N-Channel HEXFET® Power MOSFETs

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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

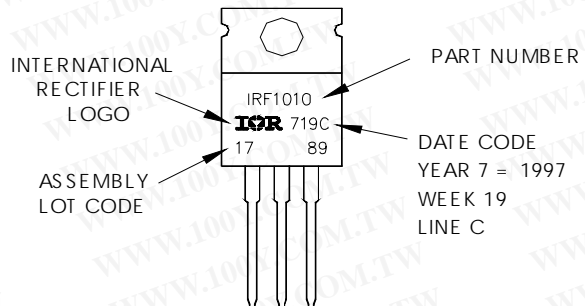
NOTES:

- 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"





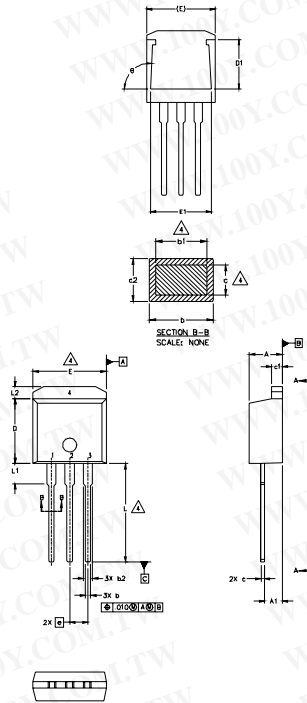


# IRL3715/S/LPbF

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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	
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:

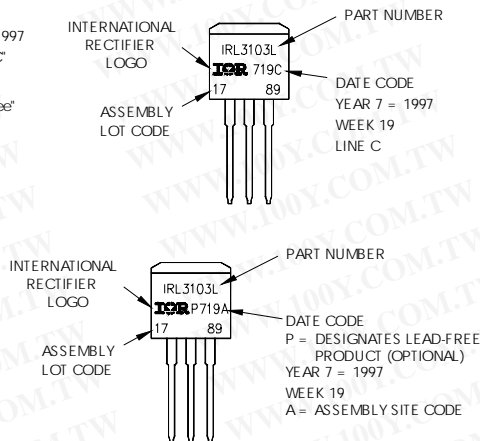
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. DIMENSION b1 AND c1 APPLY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



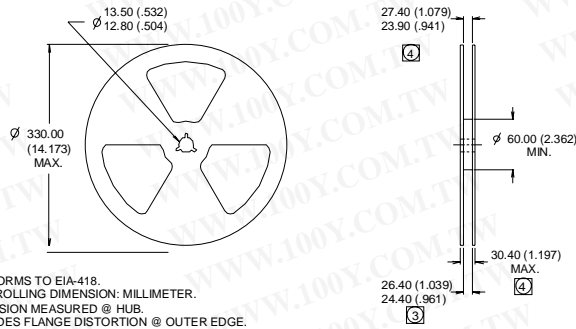
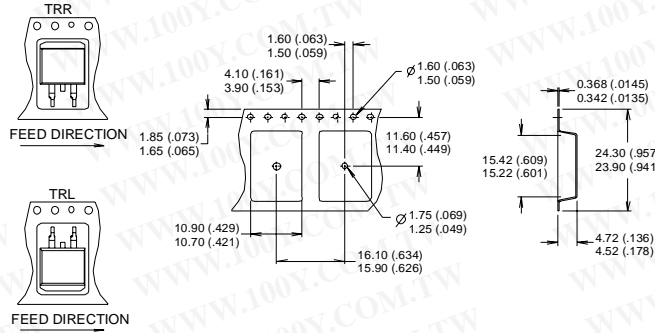
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## D<sup>2</sup>Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)



- 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  $T_J = 25^\circ\text{C}$ ,  $L = 0.51\text{mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 21\text{A}$ ,  $V_{GS} = 10\text{V}$
- ③ This is applied to D<sup>2</sup>Pak, when mounted on 1" square PCB (FR-4 or G-10 Material).  
 For recommended footprint and soldering techniques refer to application note #AN-994.
- ④ Calculated continuous current based on maximum allowable junction temperature.  
 Package limitation current is 30A.
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ This is only applied to TO-220A package

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.

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IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105

TAC Fax: (310) 252-7903

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