

International IOR Rectifier

SMPS MOSFET

PD - 93888B

IRF3704
 IRF3704S
 IRF3704L

HEXFET® Power MOSFET

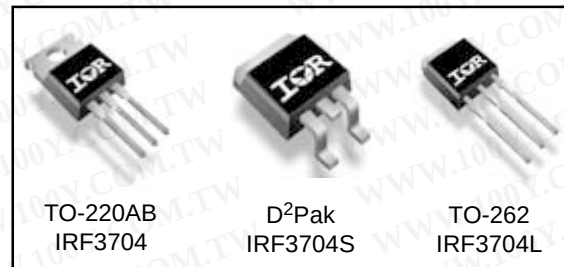
Applications

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

V_{DS}	$R_{DS(on)}$ max	I_D
20V	9.0m Ω	77A ^⑤

Benefits

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



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	77 ^⑤	A
I_D @ $T_C = 70^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	64	
I_{DM}	Pulsed Drain Current ^①	308	
P_D @ $T_C = 25^\circ\text{C}$	Maximum Power Dissipation ^③	87	W
P_D @ $T_C = 70^\circ\text{C}$	Maximum Power Dissipation ^③	61	W
	Linear Derating Factor	0.59	mW/ $^\circ\text{C}$
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	—	1.73	$^\circ\text{C/W}$
$R_{\theta CS}$	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)*	—	40	

* When mounted on 1" square PCB (FR-4 or G-10 Material) .
 For recommended footprint and soldering techniques refer to application note #AN-994

Notes ① through ④ are on page 10

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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 $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	6.3	9.0	$m\Omega$	$V_{GS} = 10V, I_D = 15A$ ③
		—	9.8	13.5		$V_{GS} = 4.5V, I_D = 12A$ 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	$V_{DS} = 16V, V_{GS} = 0V$
		—	—	100		$V_{DS} = 16V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
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	42	—	—	S	$V_{DS} = 10V, I_D = 57A$
Q_g	Total Gate Charge	—	19	—	nC	$I_D = 28.4A$
Q_{gs}	Gate-to-Source Charge	—	8.1	—		$V_{DS} = 10V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	6.4	—		$V_{GS} = 4.5V$ ③
Q_{oss}	Output Gate Charge	—	16	24		$V_{GS} = 0V, V_{DS} = 10V$
$t_{d(on)}$	Turn-On Delay Time	—	8.4	—	ns	$V_{DD} = 10V$
t_r	Rise Time	—	98	—		$I_D = 28.4A$
$t_{d(off)}$	Turn-Off Delay Time	—	12	—		$R_G = 1.8\Omega$
t_f	Fall Time	—	5.0	—		$V_{GS} = 4.5V$ ③
C_{iss}	Input Capacitance	—	1996	—		$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	1085	—		$V_{DS} = 10V$
C_{rss}	Reverse Transfer Capacitance	—	155	—	pF	$f = 1.0MHz$

Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	—	216	mJ
I_{AR}	Avalanche Current①	—	71	A

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	77⑤	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	308		
V_{SD}	Diode Forward Voltage	—	0.88	1.3	V	$T_J = 25^\circ\text{C}, I_S = 35.5A, V_{GS} = 0V$ ③
		—	0.82	—		$T_J = 125^\circ\text{C}, I_S = 35.5A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	38	57	ns	$T_J = 25^\circ\text{C}, I_F = 35.5A, V_R = 20V$
Q_{rr}	Reverse Recovery Charge	—	45	68	nC	$di/dt = 100A/\mu s$ ③
t_{rr}	Reverse Recovery Time	—	41	62	ns	$T_J = 125^\circ\text{C}, I_F = 35.5A, V_R = 20V$
Q_{rr}	Reverse Recovery Charge	—	50	75	nC	$di/dt = 100A/\mu s$ ③

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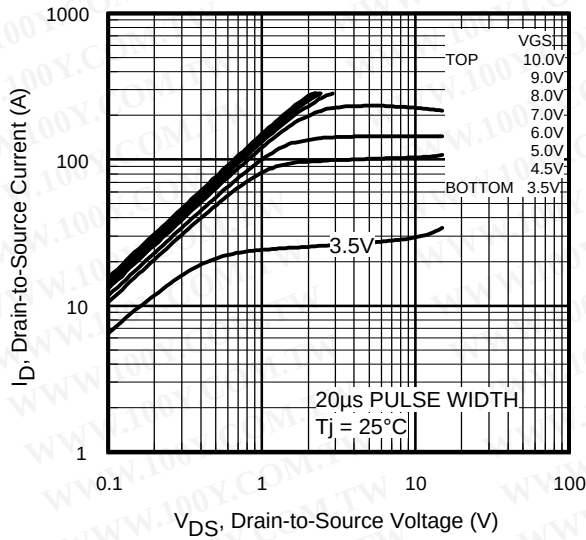


Fig 1. Typical Output Characteristics

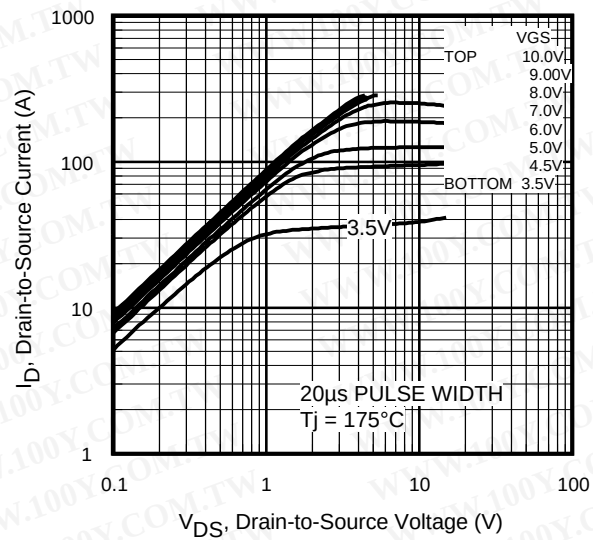


Fig 2. Typical Output Characteristics

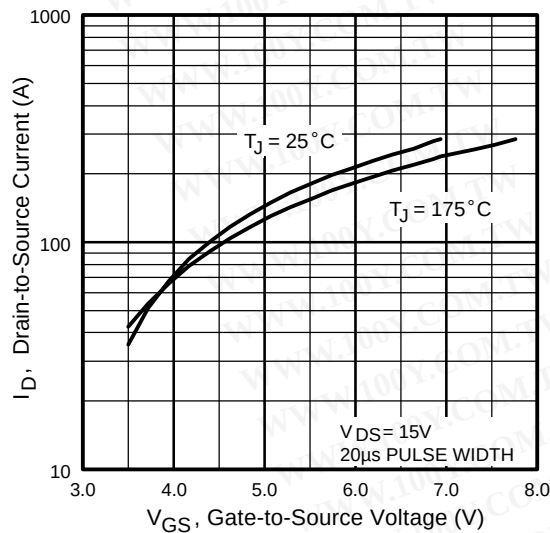


Fig 3. Typical Transfer Characteristics

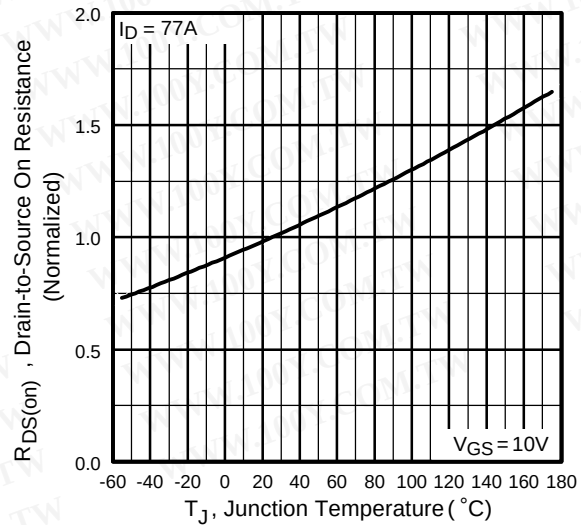
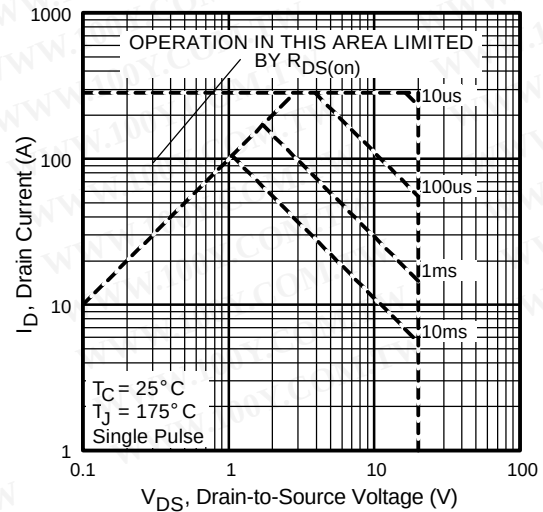
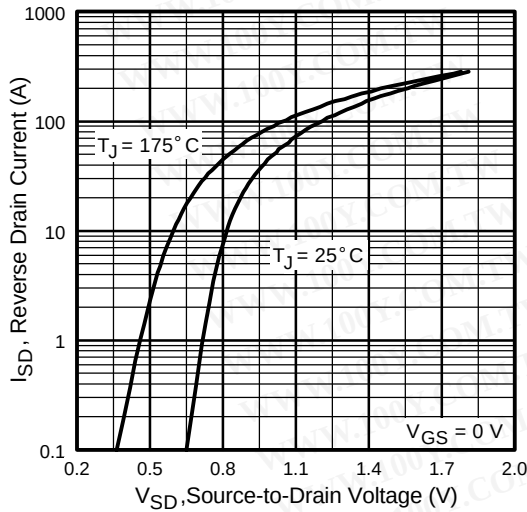
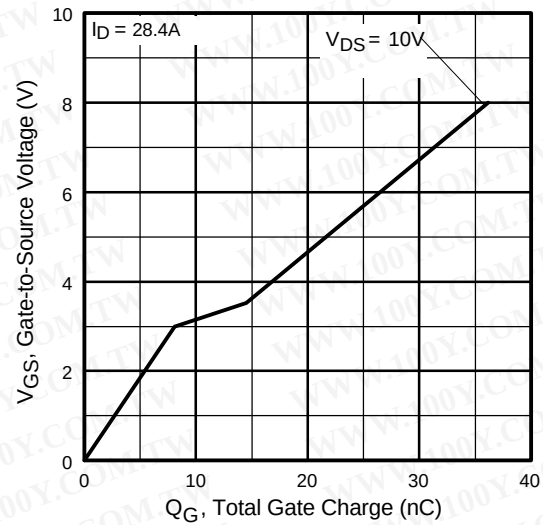
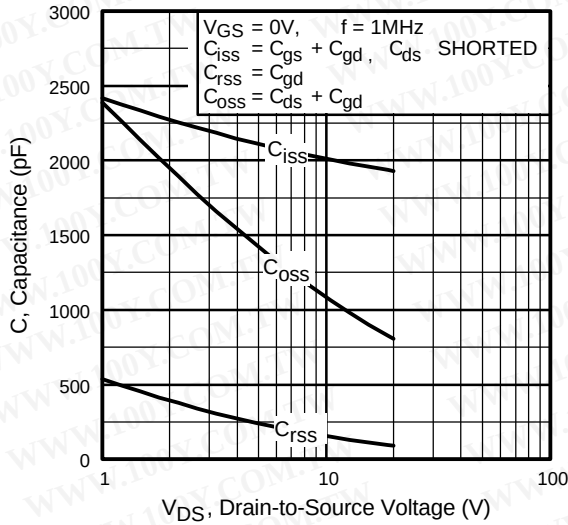


Fig 4. Normalized On-Resistance Vs. Temperature

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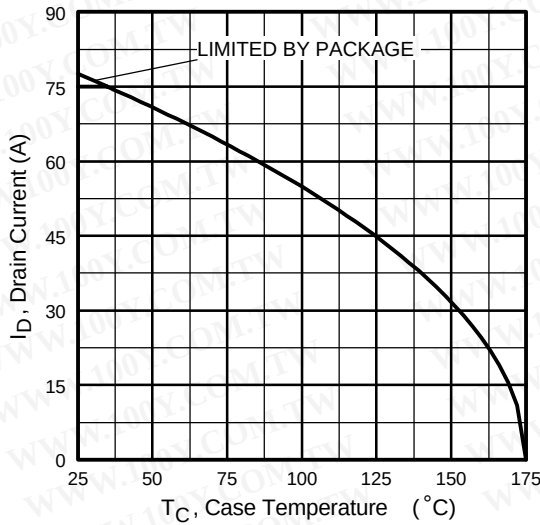


Fig 9. Maximum Drain Current Vs. Case Temperature

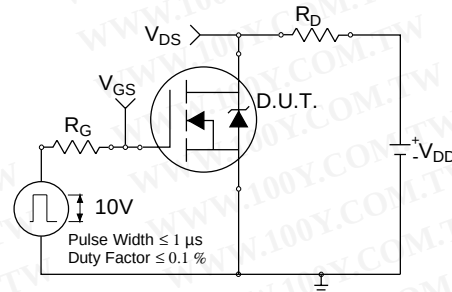


Fig 10a. Switching Time Test Circuit

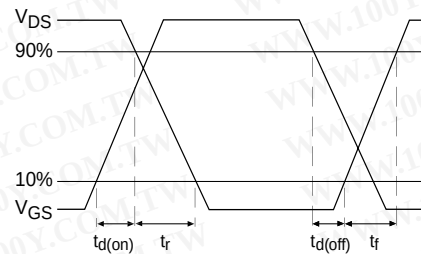


Fig 10b. Switching Time Waveforms

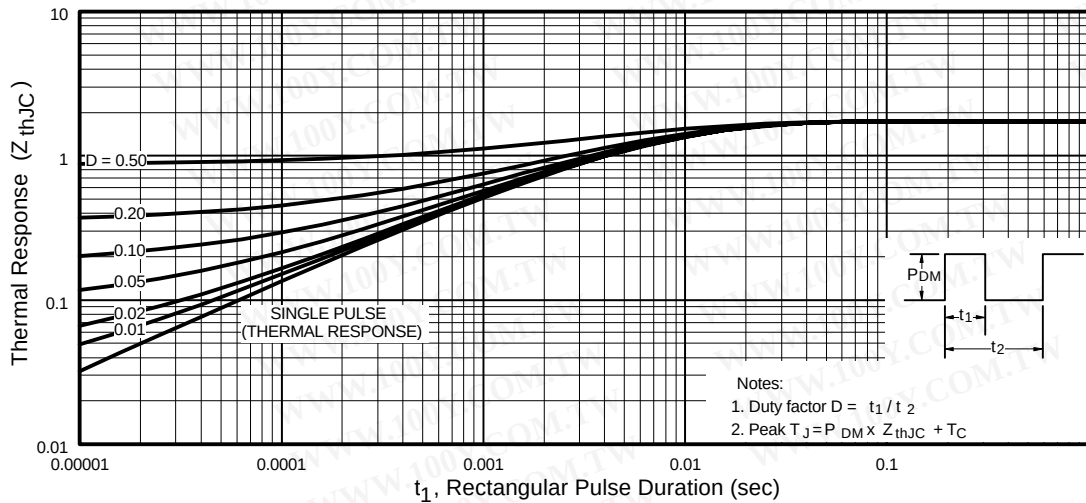


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

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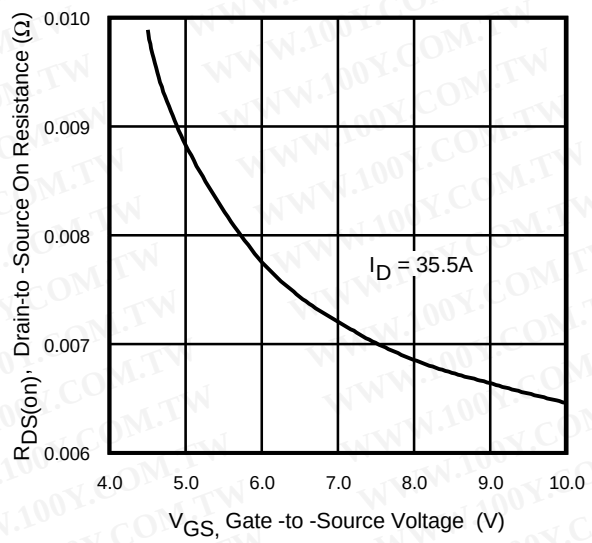
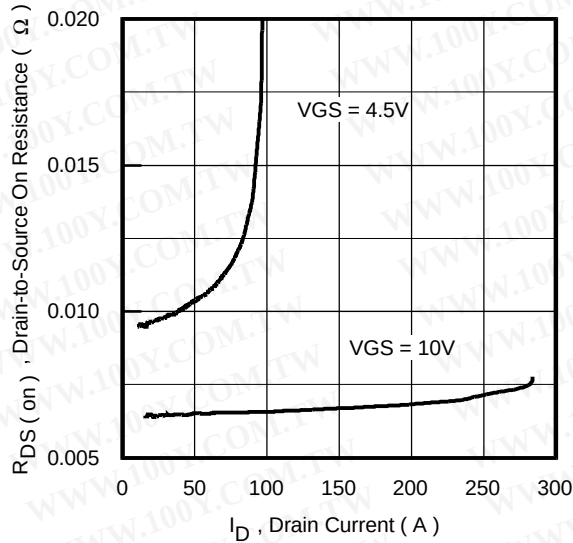


Fig 12. On-Resistance Vs. Drain Current

Fig 13. On-Resistance Vs. Gate Voltage

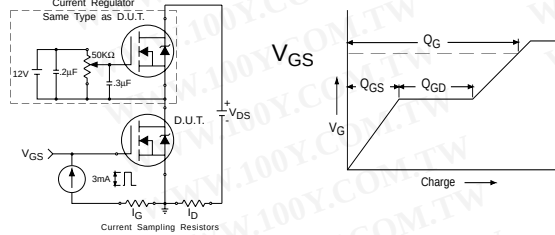


Fig 14a&b. Basic Gate Charge Test circuit and Waveforms

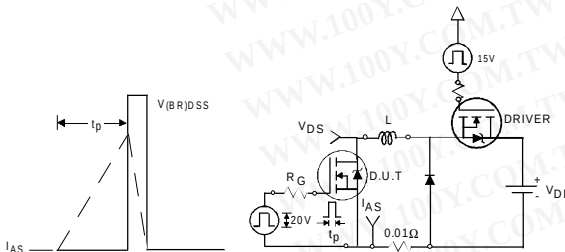


Fig 15a&b. Unclamped Inductive Test circuit and Waveforms

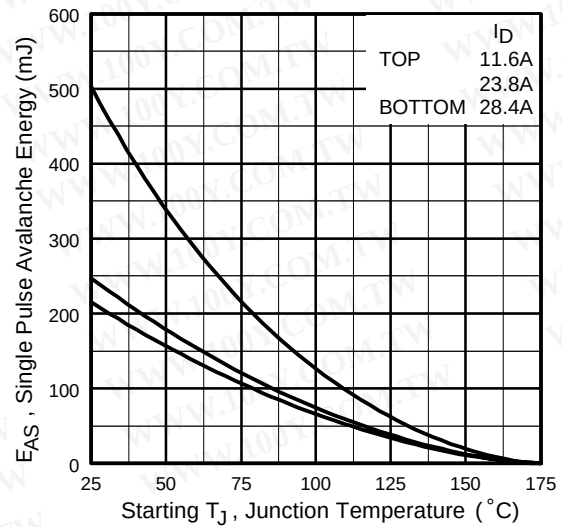


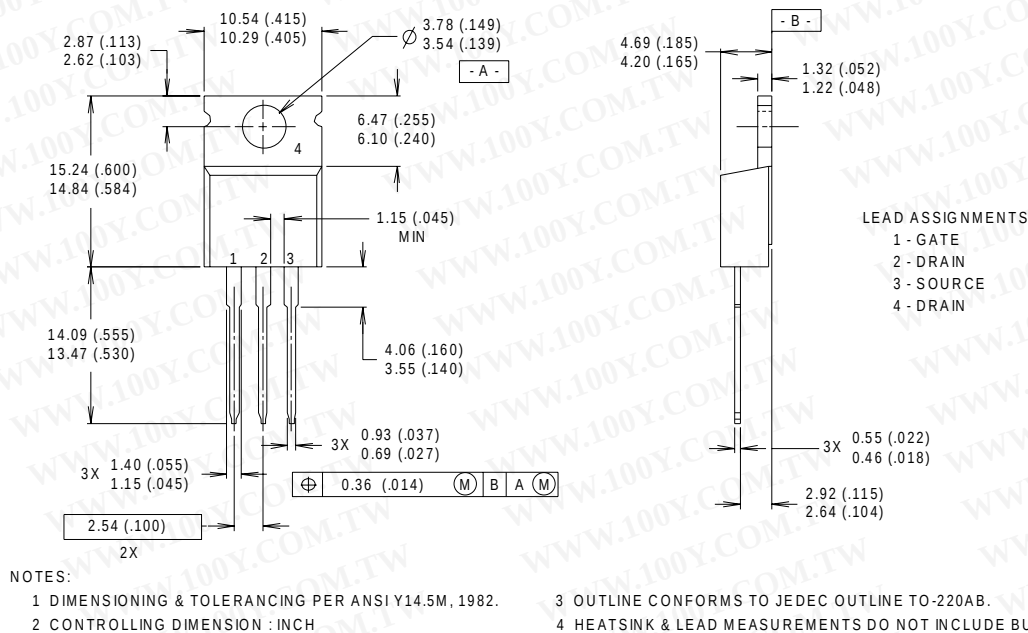
Fig 15c. Maximum Avalanche Energy Vs. Drain Current

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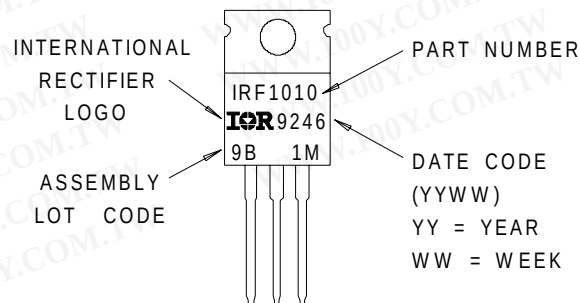
TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



TO-220AB Part Marking Information

EXAMPLE : THIS IS AN IRF1010
WITH ASSEMBLY
LOT CODE 9B1M

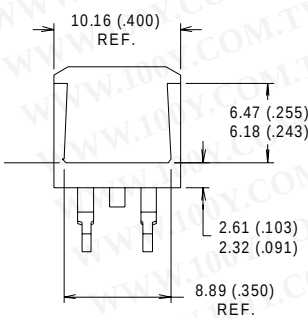
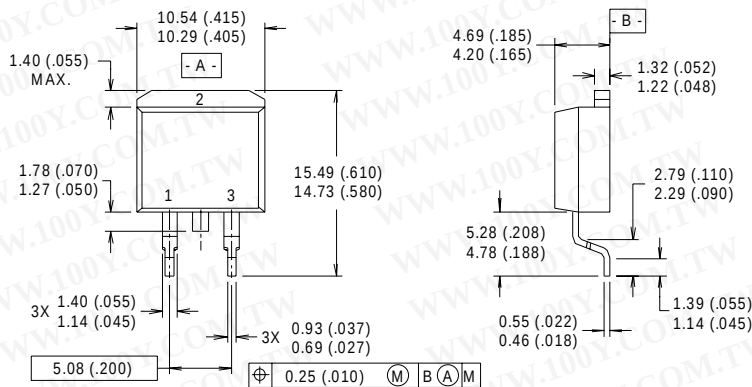


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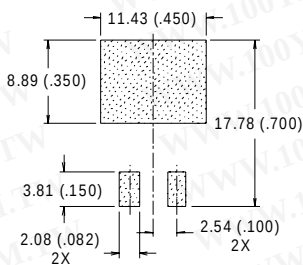
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D²Pak Package Outline

Dimensions are shown in millimeters (inches)



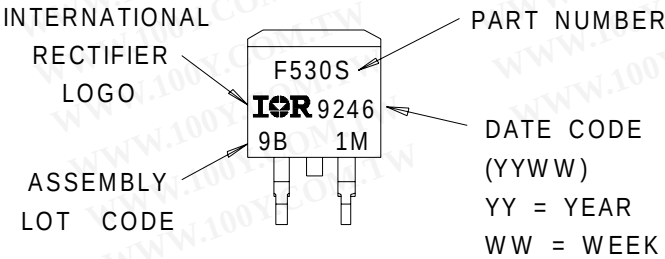
MINIMUM RECOMMENDED FOOTPRINT



- NOTES:
 1 DIMENSIONS AFTER SOLDER DIP.
 2 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
 3 CONTROLLING DIMENSION : INCH.
 4 HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

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

D²Pak Part Marking Information

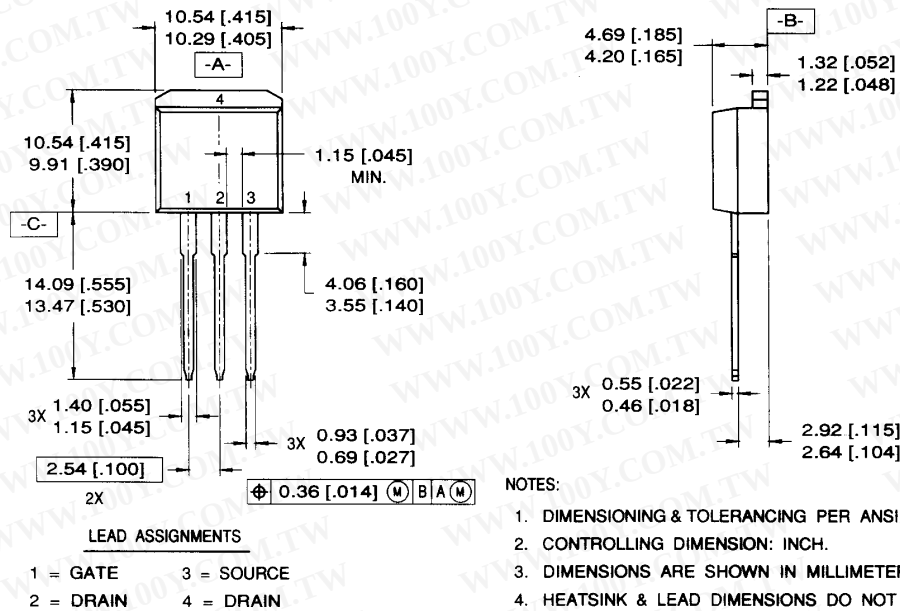


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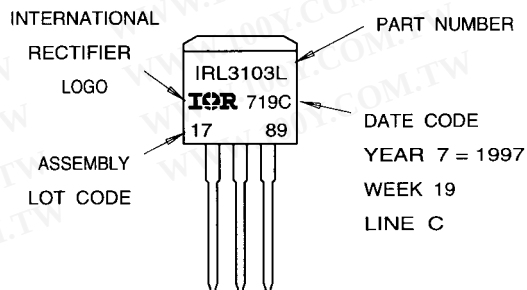
TO-262 Package Outline

Dimensions are shown in millimeters (inches)



TO-262 Part Marking Information

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

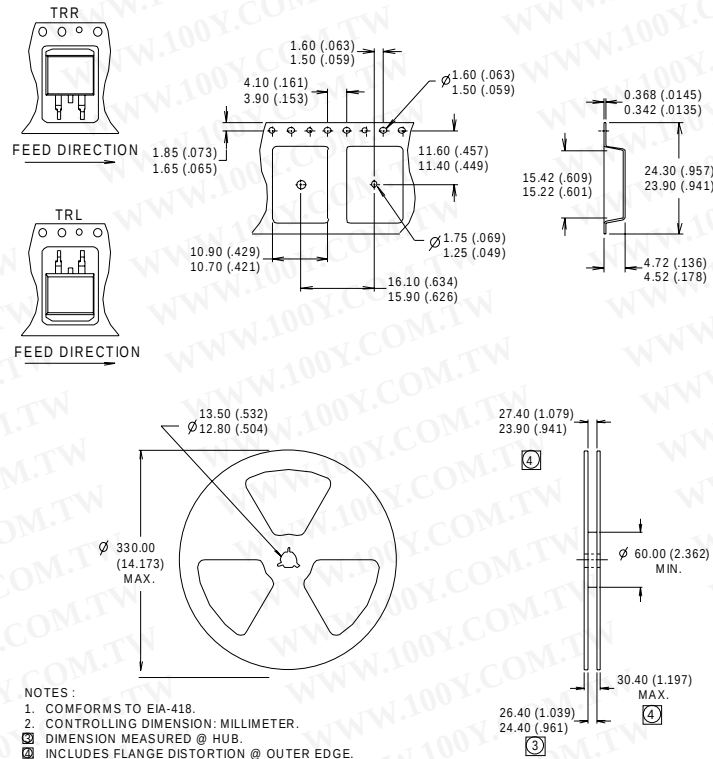


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D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)

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Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.5\text{ mH}$
 $R_G = 25\Omega$, $I_{AS} = 28.4\text{ A}$.
- ③ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.
- ④ This is only applied to TO-220AB package
- ⑤ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.

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IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 (0) 6172 96590
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 011 451 0111
IR JAPAN: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo 171 Tel: 81 (0)3 3983 0086
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Data and specifications subject to change without notice. 8/00