PD - 93888B

International
IOR Rectifier

SMPS MOSFET

IRF3704
IRF3704S
IRF3704L

HEXFET® Power MOSFET

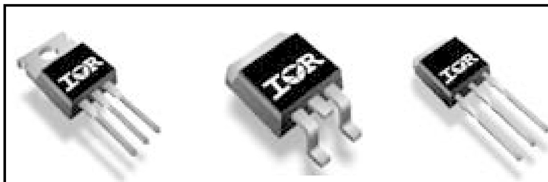
Applications

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

V_{DSS}	$R_{DS(on)}$ max	I_D
20V	**9.0mΩ**	**77A**⑤

Benefits

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



TO-220AB	D²Pak	TO-262
IRF3704	IRF3704S	IRF3704L

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	77 ⑤	A
I_D @ T_C = 70°C	Continuous Drain Current, V_{GS} @ 10V	64	
I_{DM}	Pulsed Drain Current①	308	
P_D @T_C = 25°C	Maximum Power Dissipation③	87	W
P_D @T_C = 70°C	Maximum Power Dissipation③	61	W
	Linear Derating Factor	0.59	mW/°C
T_J , T_{STG}	Junction and Storage Temperature Range	-55 to + 175	°C

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	1.73	°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)*	——	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

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	——	6.3	9.0	mΩ	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 = 250µA
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°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	200	nA	V_{GS} = 16V
	Gate-to-Source Reverse Leakage	——	——	-200		V_{GS} = -16V

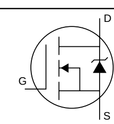
Dynamic @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	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 = 1.8Ω
t_f	Fall Time	——	5.0	——		V_{GS} = 4.5V ③
C_{iss}	Input Capacitance	——	1996	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	1085	——		V_{DS} = 10V
C_{rss}	Reverse Transfer Capacitance	——	155	——		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°C, I_S = 35.5A, V_{GS} = 0V ③
		——	0.82	——		T_J = 125°C, I_S = 35.5A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	——	38	57	ns	T_J = 25°C, I_F = 35.5A, V_R=20V
Q_{rr}	Reverse Recovery Charge	——	45	68	nC	di/dt = 100A/µs ③
t_{rr}	Reverse Recovery Time	——	41	62	ns	T_J = 125°C, I_F = 35.5A, V_R=20V
Q_{rr}	Reverse Recovery Charge	——	50	75	nC	di/dt = 100A/µs ③

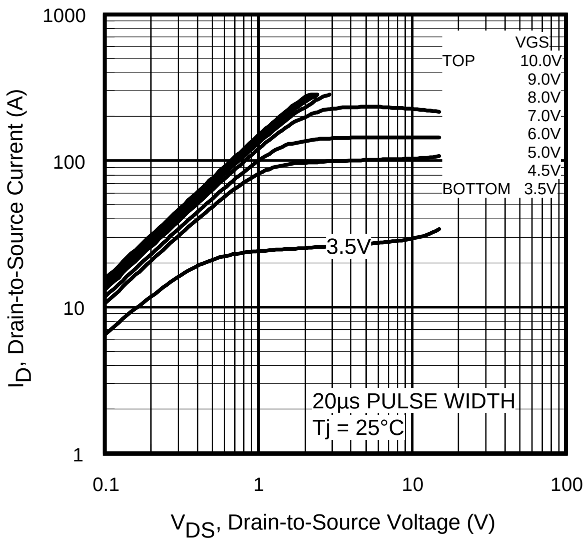


Fig 1. Typical Output Characteristics

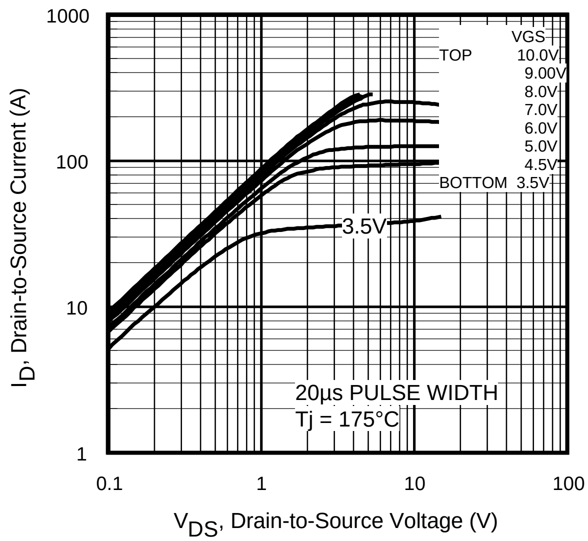


Fig 2. Typical Output Characteristics

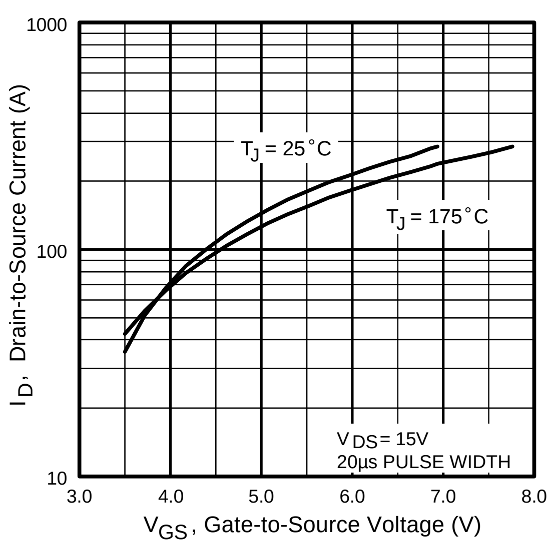


Fig 3. Typical Transfer Characteristics

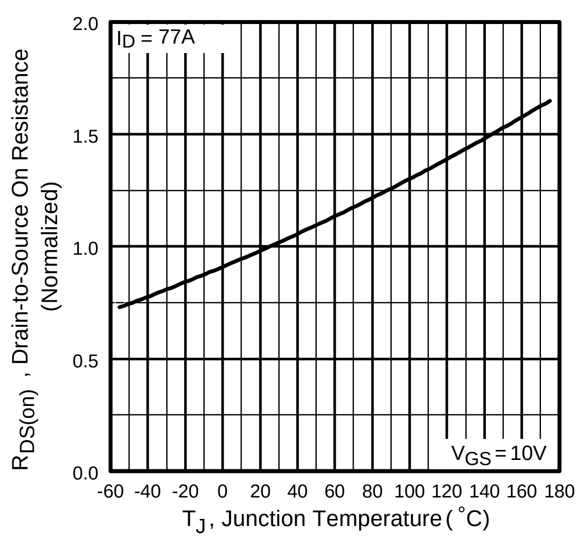


Fig 4. Normalized On-Resistance Vs. Temperature

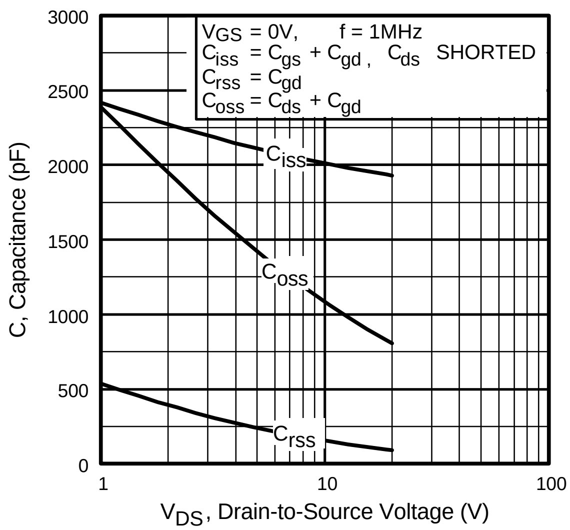


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

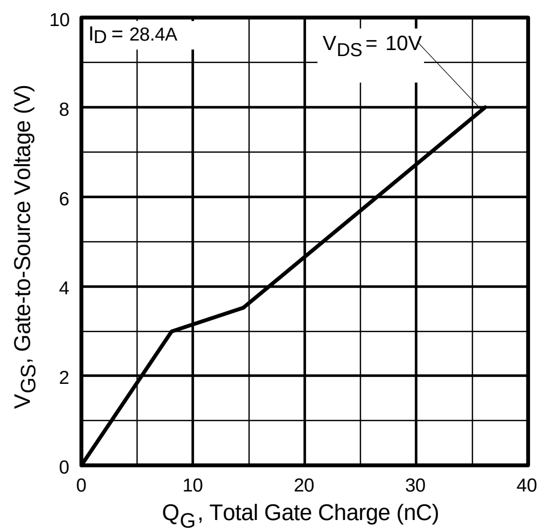


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

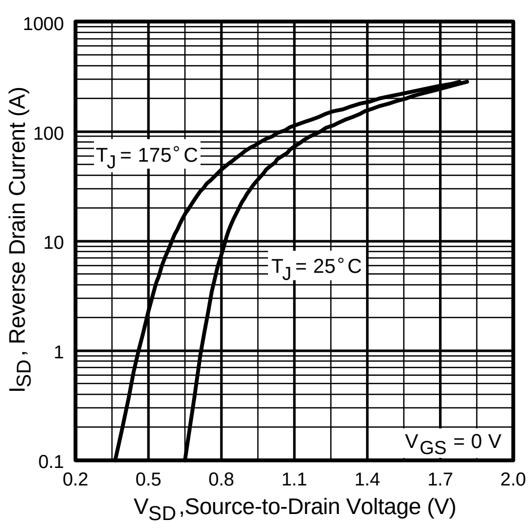


Fig 7. Typical Source-Drain Diode Forward Voltage

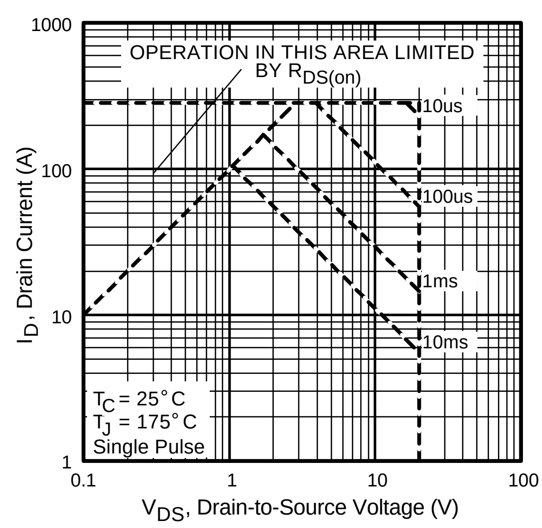


Fig 8. Maximum Safe Operating Area

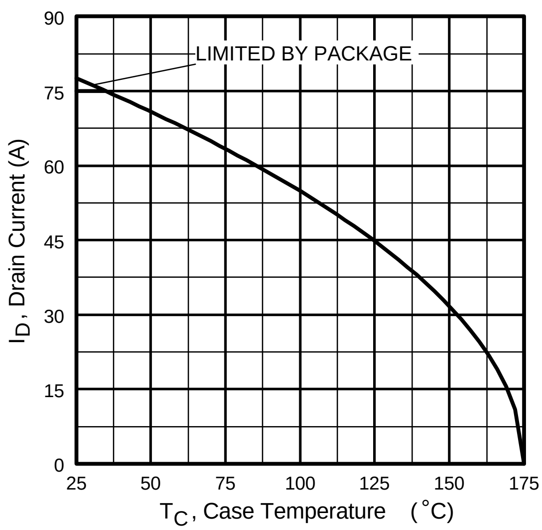


Fig 9. Maximum Drain Current Vs. Case Temperature

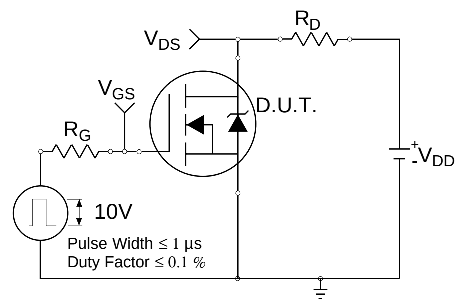


Fig 10a. Switching Time Test Circuit

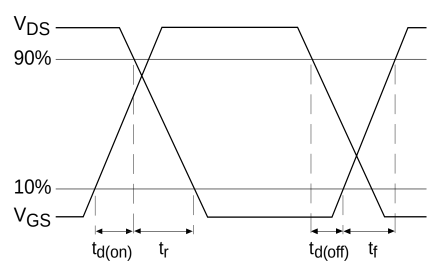


Fig 10b. Switching Time Waveforms

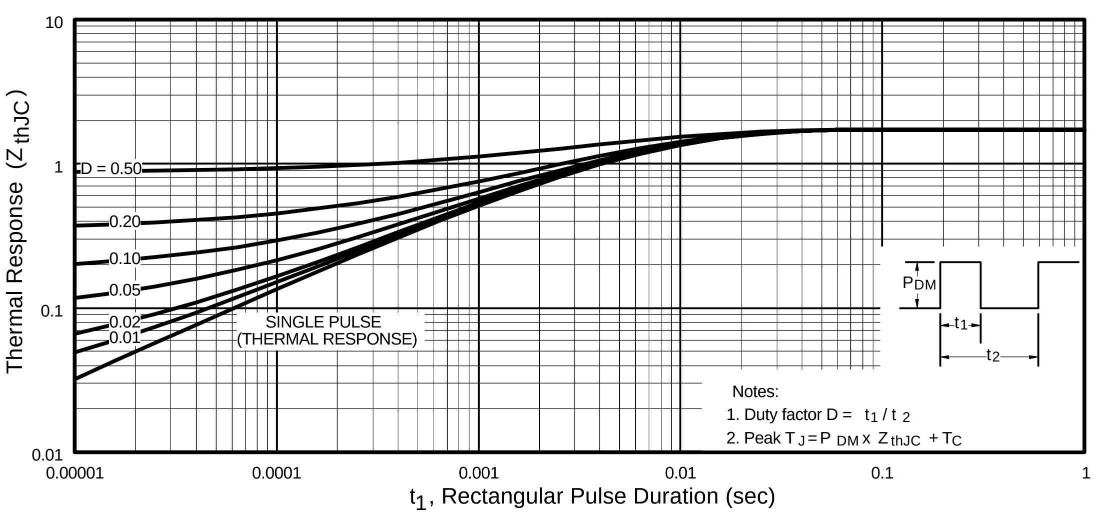


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

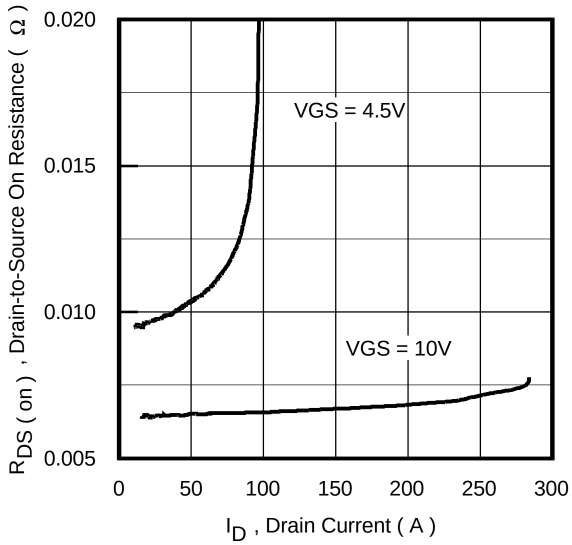


Fig 12. On-Resistance Vs. Drain Current

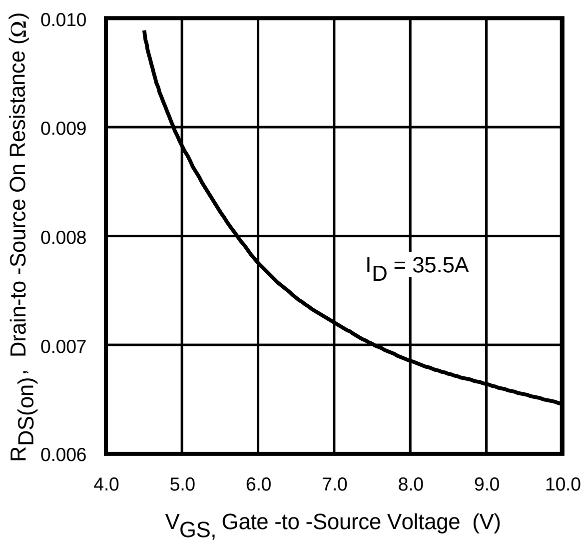


Fig 13. On-Resistance Vs. Gate Voltage

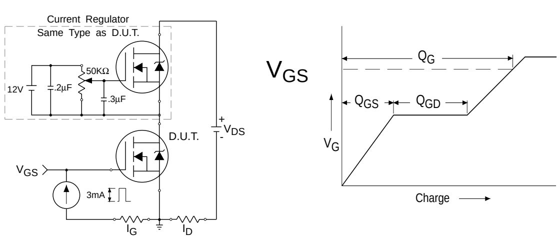
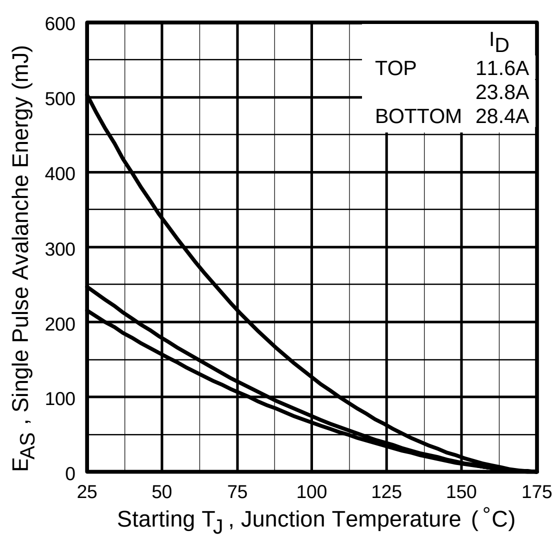


Fig 14a&b. Basic Gate Charge Test circuit and Waveforms



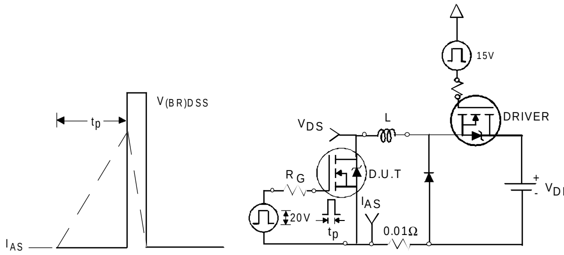
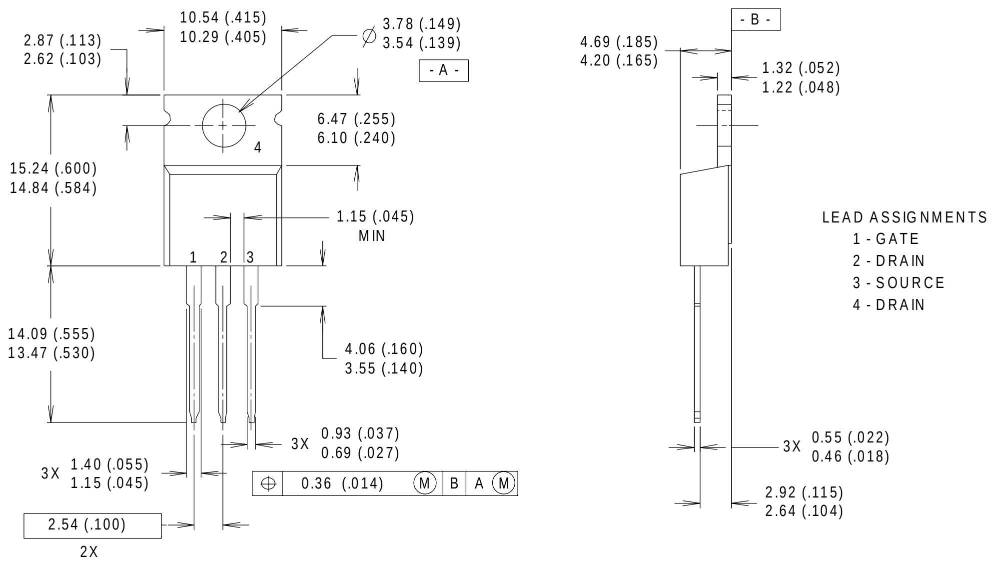


Fig 15a&b. Unclamped Inductive Test circuit and Waveforms

Fig 15c. Maximum Avalanche Energy Vs. Drain Current

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

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

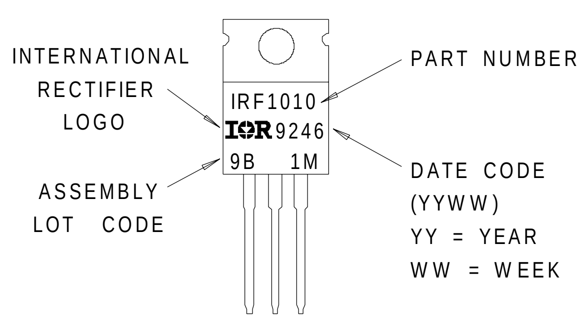
2 CONTROLLING DIMENSION : INCH

3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.

4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

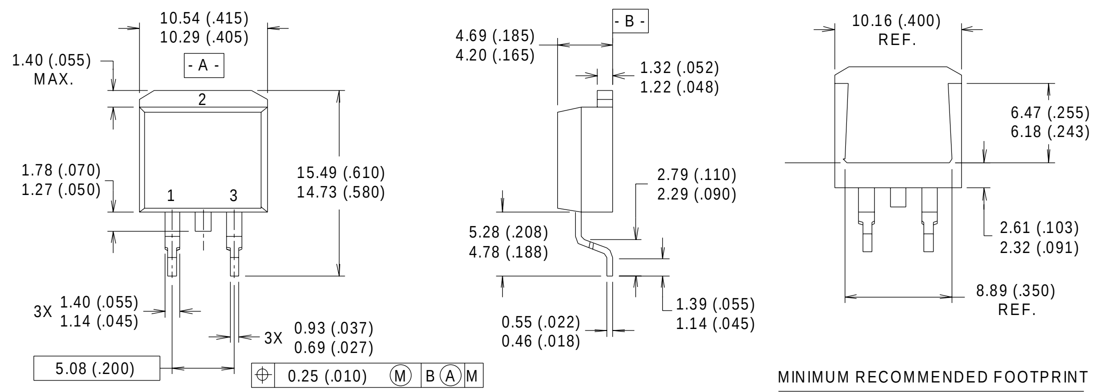
TO-220AB Part Marking Information

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

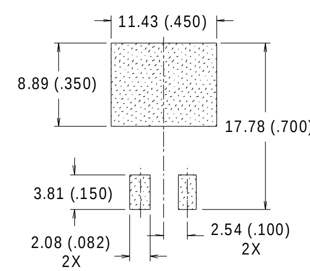


D²Pak Package Outline

Dimensions are shown in millimeters (inches)



MINIMUM RECOMMENDED FOOTPRINT

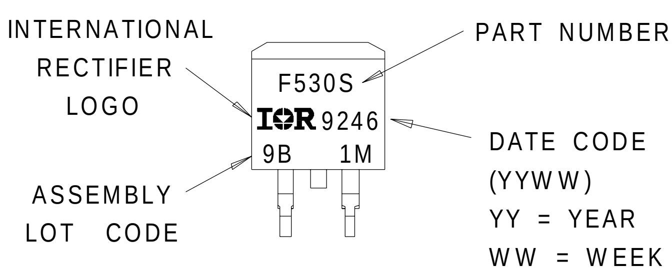


NOTES:

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.

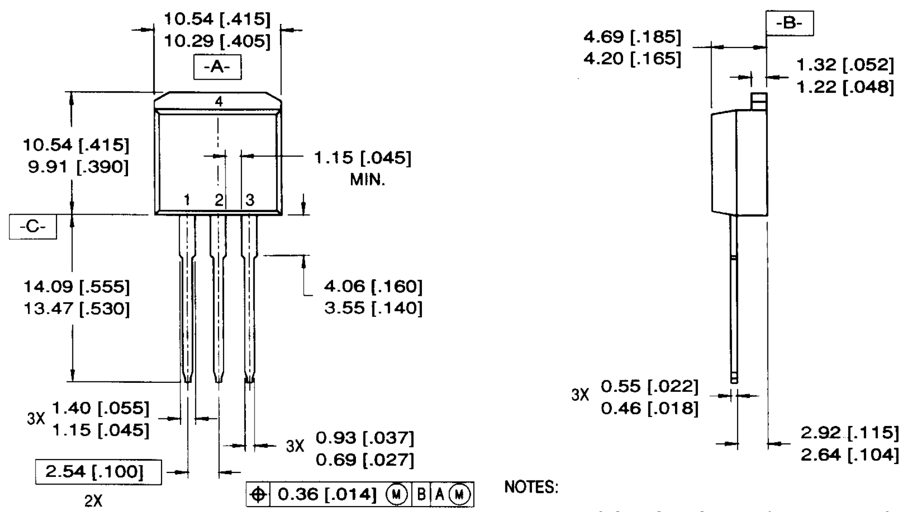
LEAD ASSIGNMENTS
1 - GATE
2 - DRAIN
3 - SOURCE

D²Pak Part Marking Information



TO-262 Package Outline

Dimensions are shown in millimeters (inches)



LEAD ASSIGNMENTS

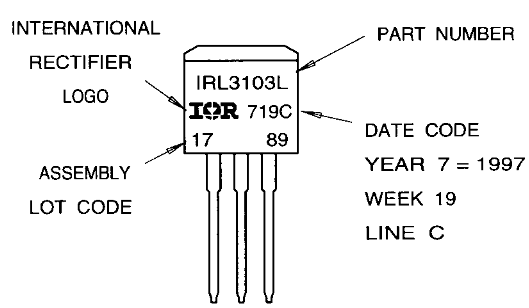
1 = GATE 3 = SOURCE
2 = DRAIN 4 = DRAIN

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.

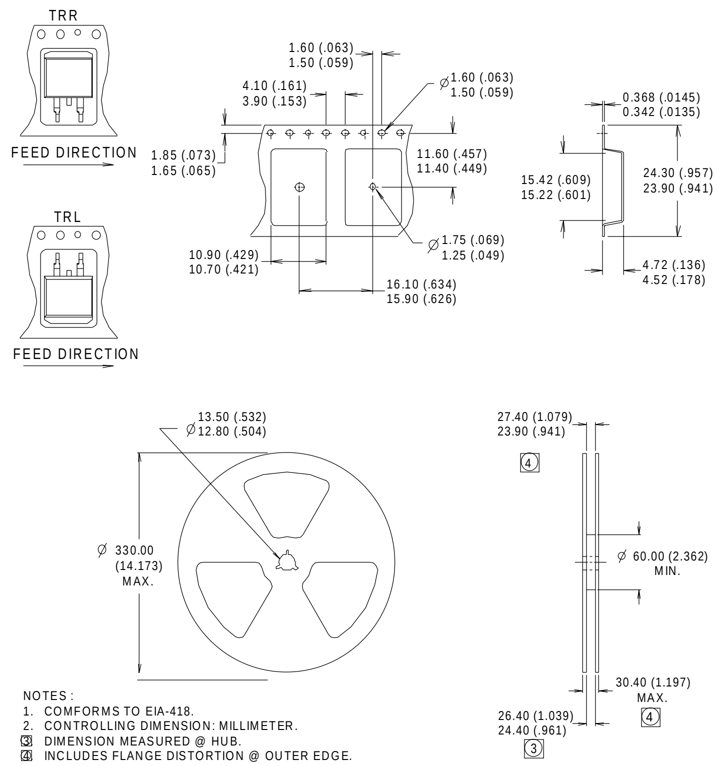
TO-262 Part Marking Information

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



D^2Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



Notes:

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

② Starting $T_J = 25°C$, L = 0.5 mH $R_G = 25\Omega$, $I_{AS} = 28.4$ A.

③ Pulse width ≤ 300µs; duty cycle ≤ 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.

International
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
IR EUROPEAN REGIONAL CENTRE: 439/445 Godstone Rd, Whyteleafe, Surrey CR3 OBL, UK Tel: ++ 44 (0)20 8645 8000
IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200
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
IR SOUTHEAST ASIA: 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 (0)838 4630
IR TAIWAN:16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673 Tel: 886-(0)2 2377 9936

Data and specifications subject to change without notice. 8/00

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