

International IR Rectifier

SMPS MOSFET

PD - 93888B

IRF3704
IRF3704S
IRF3704L

HEXFET® Power MOSFET

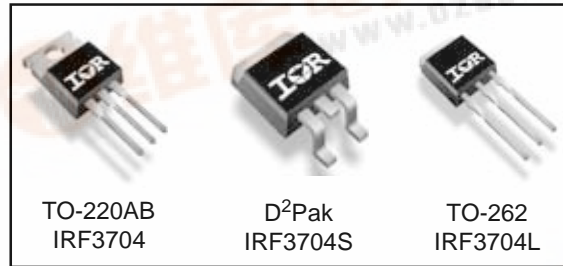
Applications

- 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	9.0mΩ	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°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 Current ^①	308	
P _D @ T _C = 25°C	Maximum Power Dissipation ^③	87	W
P _D @ T _C = 70°C	Maximum Power Dissipation ^③	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 _{θJC}	Junction-to-Case	—	1.73	°C/W
R _{θCS}	Case-to-Sink, Flat, Greased Surface ^④	0.50	—	
R _{θJA}	Junction-to-Ambient ^④	—	62	
R _{θJA}	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°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
ΔV _{(BR)DSS} /ΔT _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

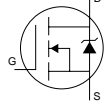
Dynamic @ T_J = 25°C (unless otherwise specified)

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

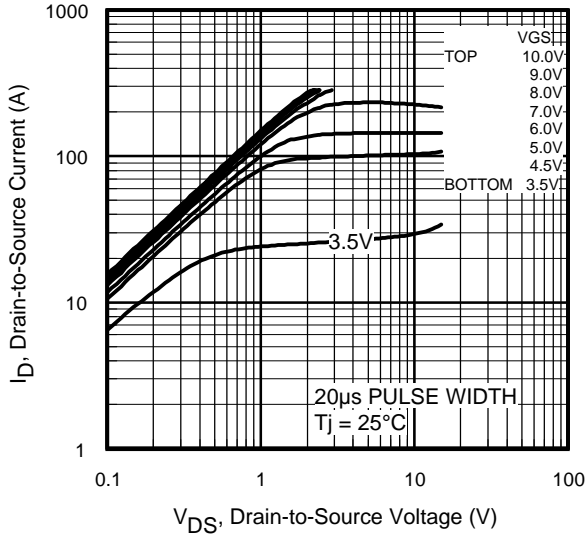


Fig 1. Typical Output Characteristics

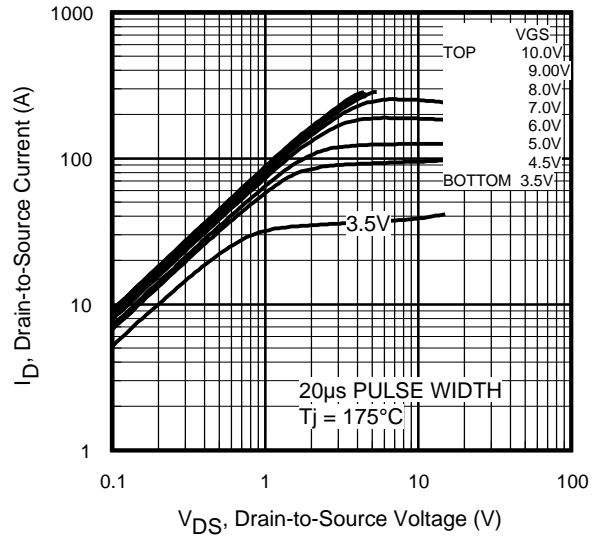


Fig 2. Typical Output Characteristics

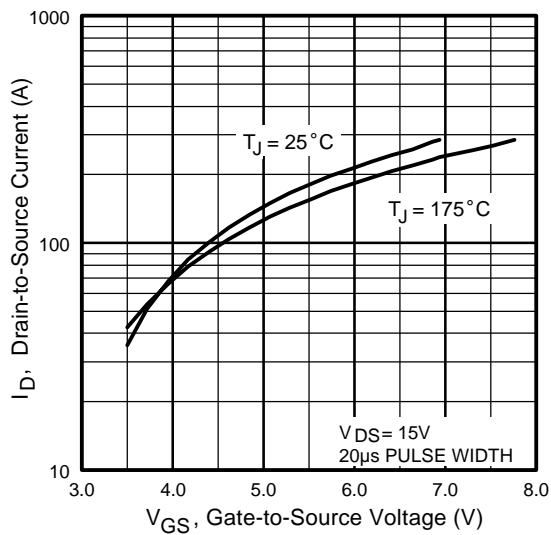


Fig 3. Typical Transfer Characteristics

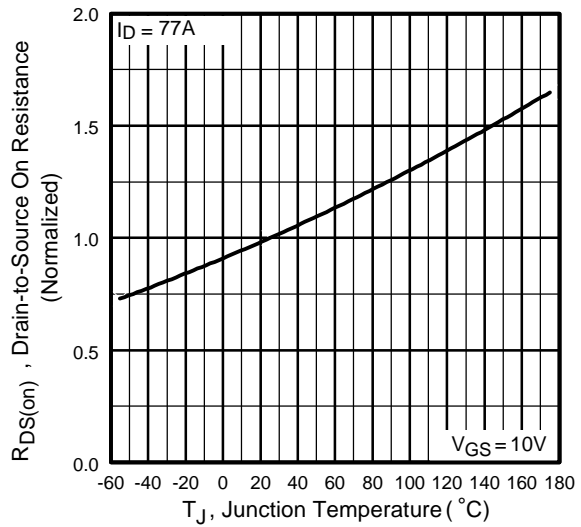


Fig 4. Normalized On-Resistance Vs. Temperature

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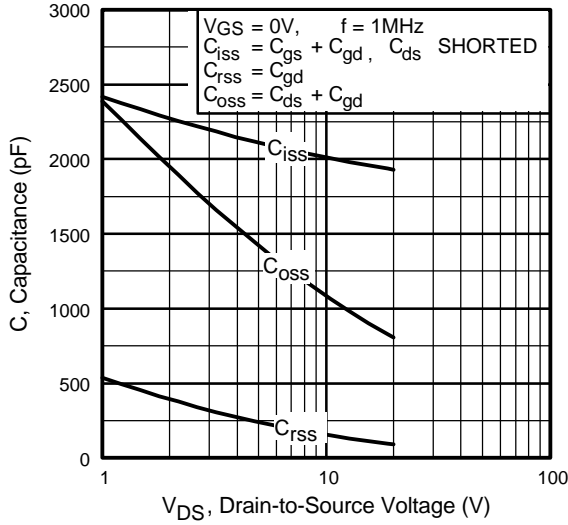


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

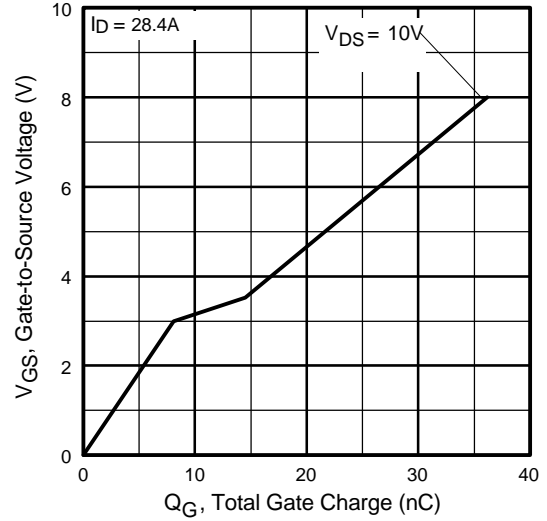


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

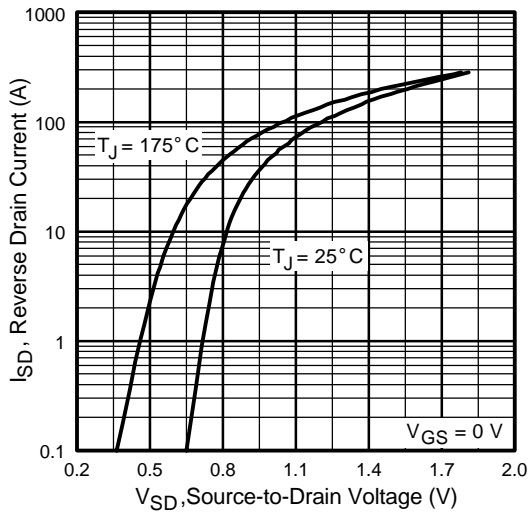


Fig 7. Typical Source-Drain Diode Forward Voltage

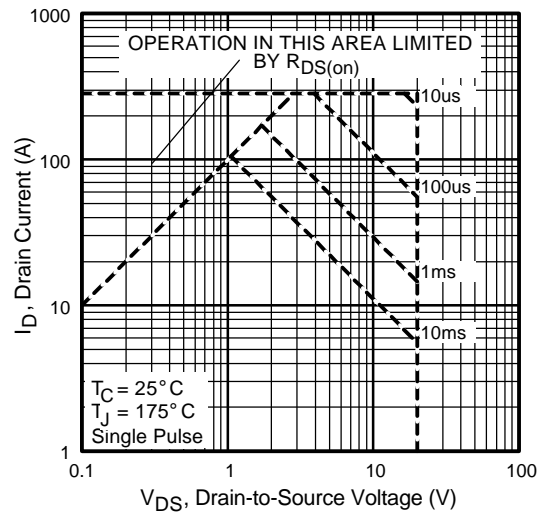


Fig 8. Maximum Safe Operating Area

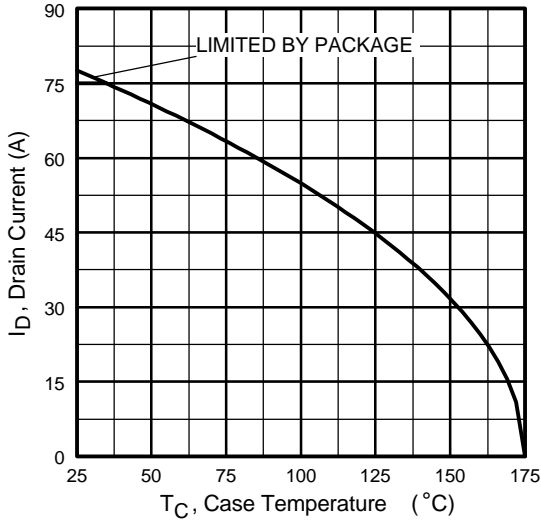


Fig 9. Maximum Drain Current Vs. Case Temperature

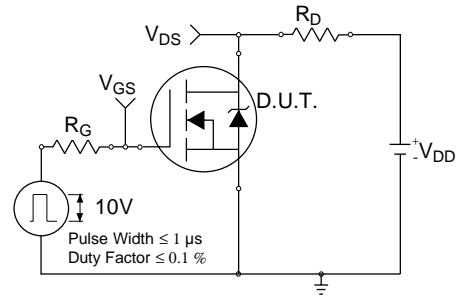


Fig 10a. Switching Time Test Circuit

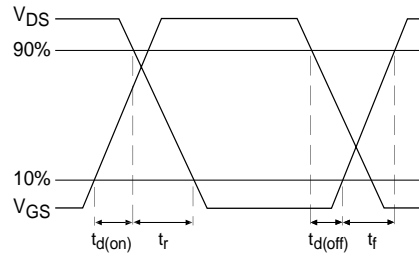


Fig 10b. Switching Time Waveforms

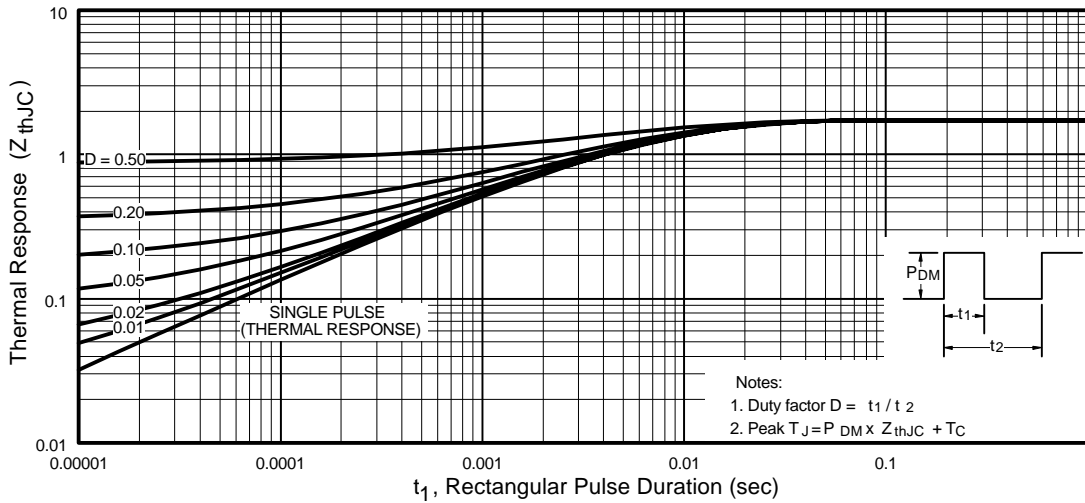


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

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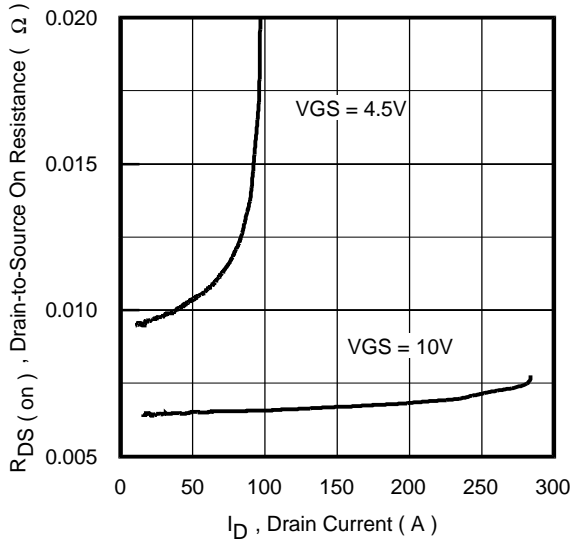


Fig 12. On-Resistance Vs. Drain Current

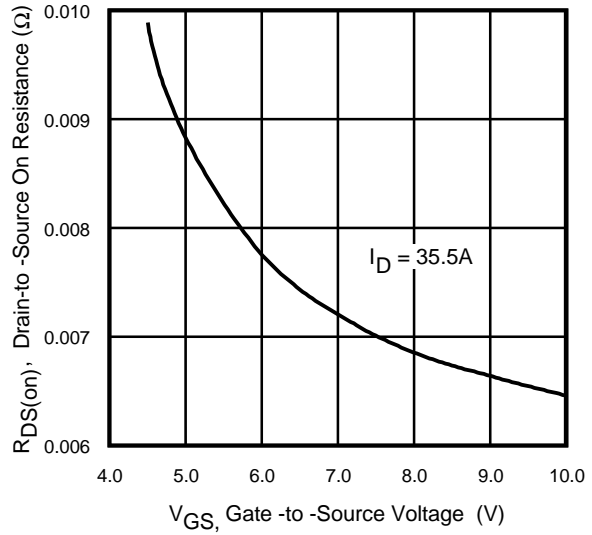


Fig 13. On-Resistance Vs. Gate Voltage

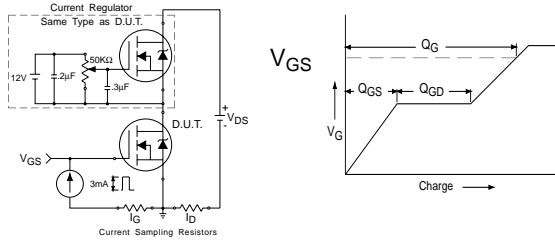


Fig 14a&b. Basic Gate Charge Test circuit and Waveforms

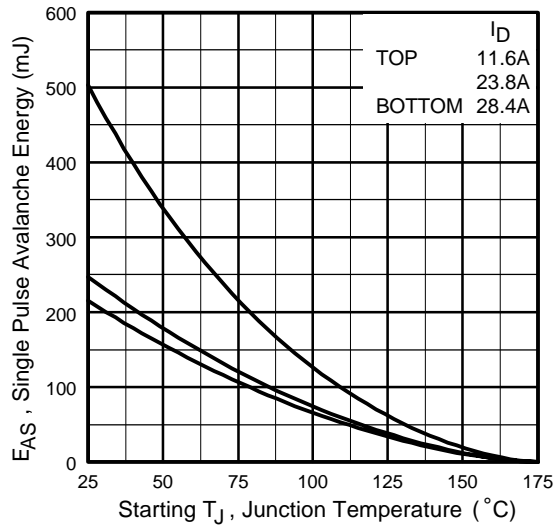


Fig 15c. Maximum Avalanche Energy Vs. Drain Current

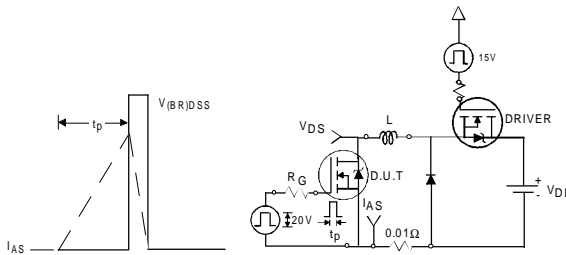
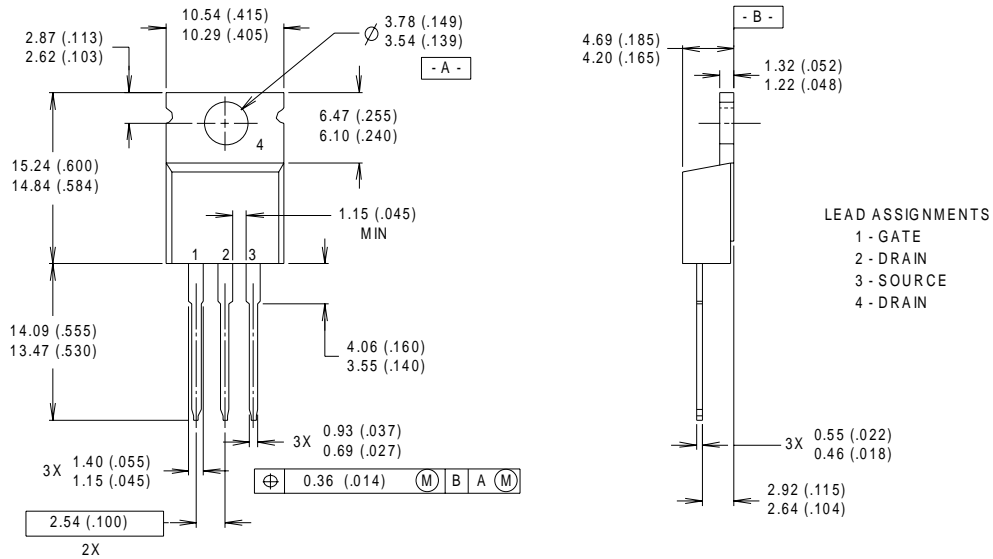


Fig 15a&b. Unclamped Inductive Test circuit and Waveforms

TO-220AB Package Outline

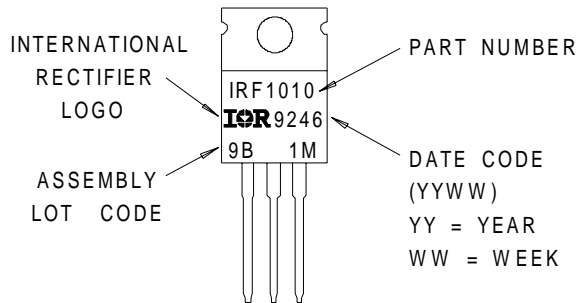
Dimensions are shown in millimeters (inches)



- 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

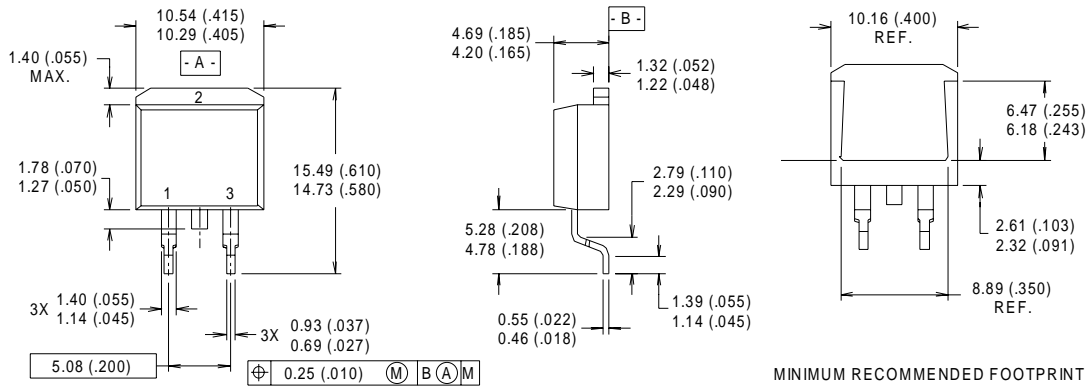


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D²Pak Package Outline

Dimensions are shown in millimeters (inches)



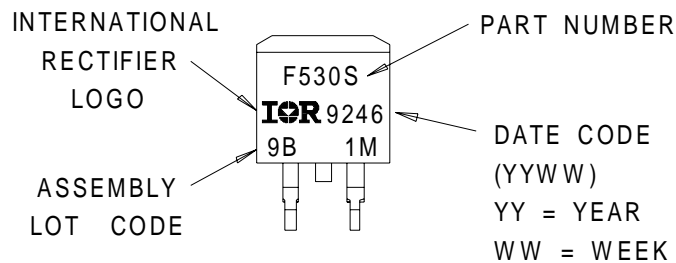
NOTES:

- 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

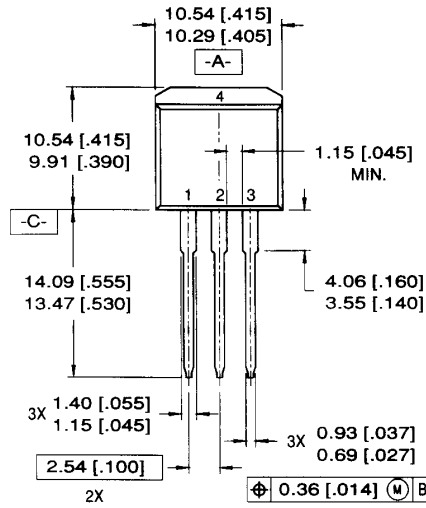
- 1 - GATE
- 2 - DRAIN
- 3 - SOURCE

D²Pak Part Marking Information



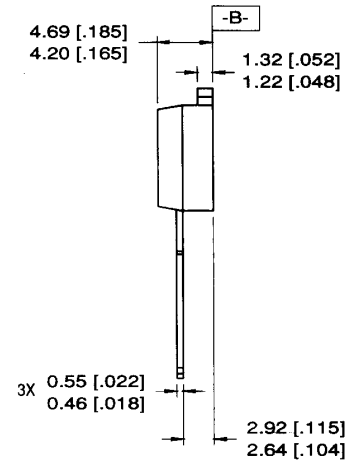
TO-262 Package Outline

Dimensions are shown in millimeters (inches)



LEAD ASSIGNMENTS

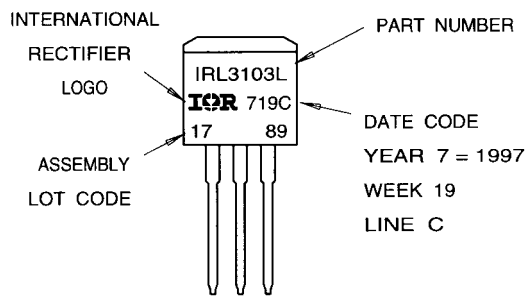
1 = GATE	3 = SOURCE
2 = DRAIN	4 = DRAIN



- 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"

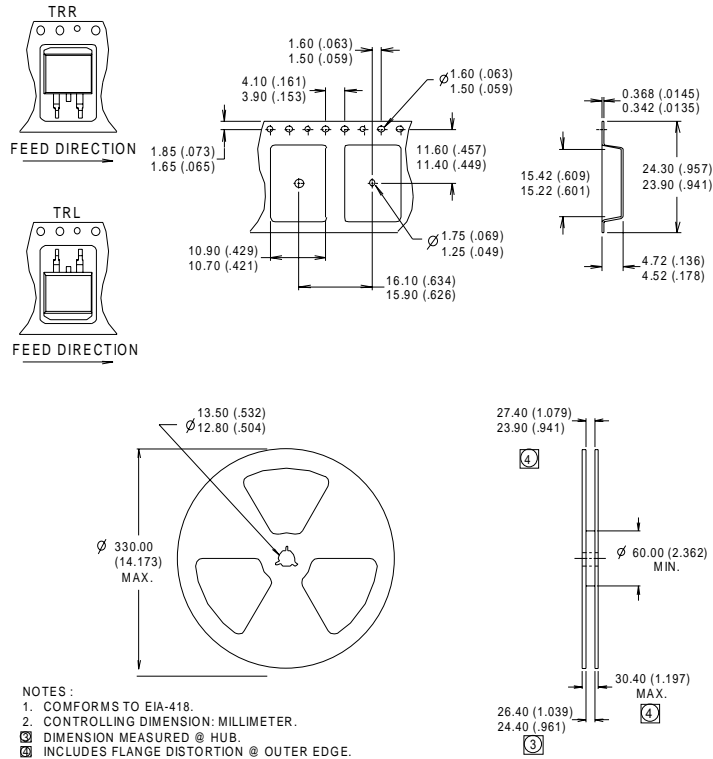


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D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.5\text{ mH}$
 $R_G = 25\Omega$, $I_{AS} = 28.4\text{ A}$.
- 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

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IR TAIWAN: 16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673 Tel: 886-(0)2 2377 9936

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