

International **IR** Rectifier

SMPS MOSFET

IRFR3704 IRFU3704

PD-93887D

HEXFET® Power MOSFET

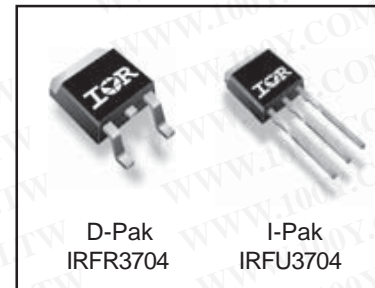
Applications

- High Frequency DC-DC Isolated Converters with Synchronous Rectification for Telecom and Industrial use
- High Frequency Buck Converters for Computer Processor Power
- 100% R_G Tested

V _{DSS}	R _{DS(on)} max	I _D
20V	9.5mΩ	75A

Benefits

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



Absolute Maximum Ratings

Symbol	Parameter	Max	Units
V _{DS}	Drain-Source Voltage	20	V
V _{GS}	Gate-Source Voltage	± 20	
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V	75 ④	A
I _D @ T _C = 70°C	Continuous Drain Current, V _{GS} @ 10V	63 ④	
I _{DM}	Pulsed Drain Current ①	300	
P _D @ T _C = 25°C	Maximum Power Dissipation ③	90	W
P _D @ T _A = 70°C	Maximum Power Dissipation ③	62	
	Linear Derating Factor	0.58	W/°C
T _J , T _{STG}	Junction and Storage Temperature Range	-55 to +175	°C

Thermal Resistance

Symbol	Parameter	Typ	Max	Units
R _{θJC}	Junction-to-Case ⑤	—	1.7	°C/W
R _{θJA}	Junction-to-Ambient (PCB Mount) *⑤	—	50	
R _{θJA}	Junction-to-Ambient ⑤	—	110	

* 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 ⑤ are on page 9

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

Symbol	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	—	7.3	9.5	m Ω	$V_{GS} = 10V, I_D = 15A$ ③
		—	11	14		$V_{GS} = 4.5V, I_D = 12A$ 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	—	—	10	μA	$V_{DS} = 20V, V_{GS} = 0V$
		—	—	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	$V_{DS} = 25V, I_D = 57A$
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		$V_{GS} = 0V, V_{DS} = 10V$
R_G	Gate Resistance	0.3	—	3.2	Ω	
$t_{d(on)}$	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	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	1085	—		$V_{DS} = 10V$
C_{riss}	Reverse Transfer Capacitance	—	155	—		$f = 1.0\text{MHz}$

Avalanche Characteristics

Symbol	Parameter	Typ	Max	Units
E_{AS}	Single Pulse Avalanche Energy ②	—	216	mJ
I_{AR}	Avalanche Current ①	—	71	A

Diode Characteristics

Symbol	Parameter	Min	Typ	Max	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	75 ④	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	300		
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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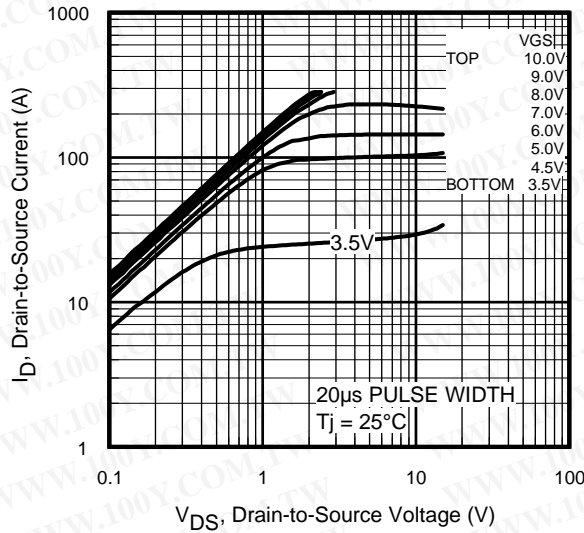


Fig 1. Typical Output Characteristics

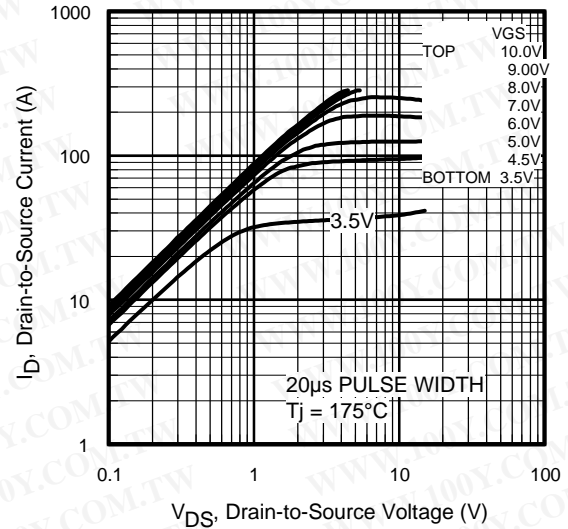


Fig 2. Typical Output Characteristics

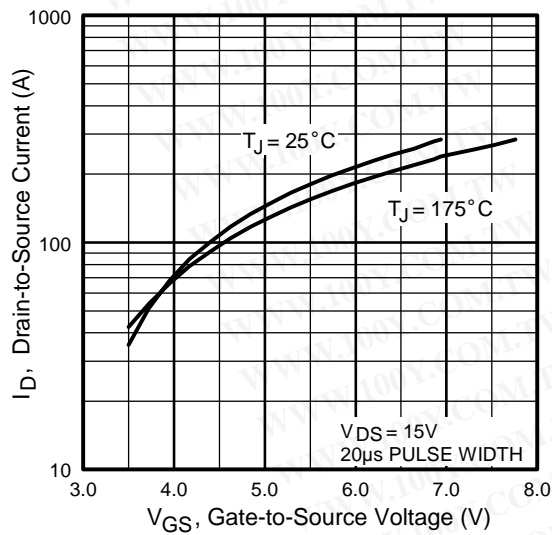


Fig 3. Typical Transfer Characteristics

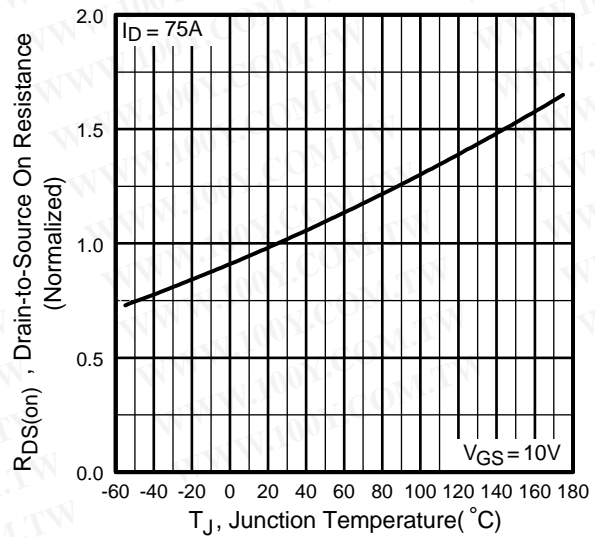


Fig 4. Normalized On-Resistance Vs. Temperature

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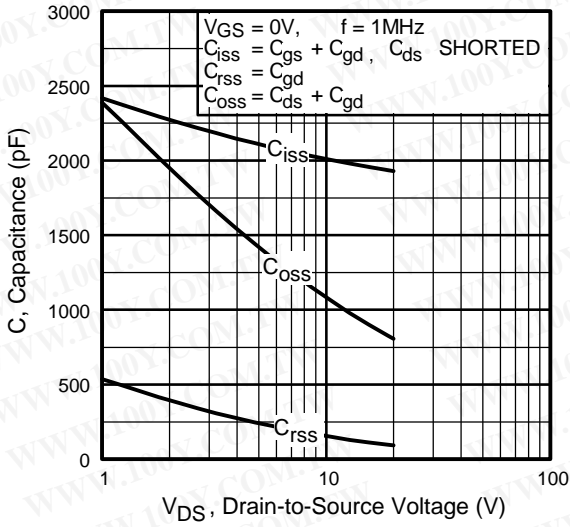


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

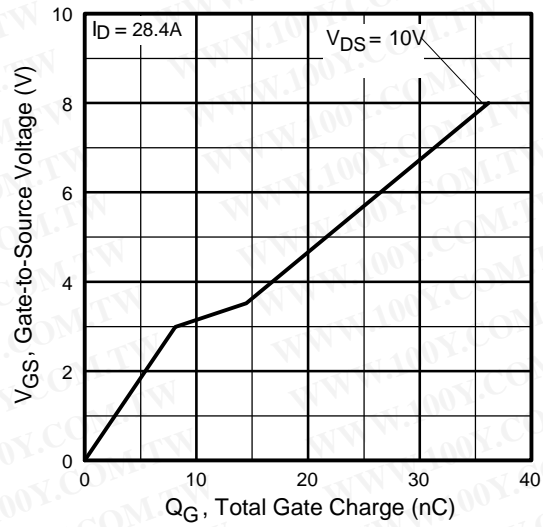


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

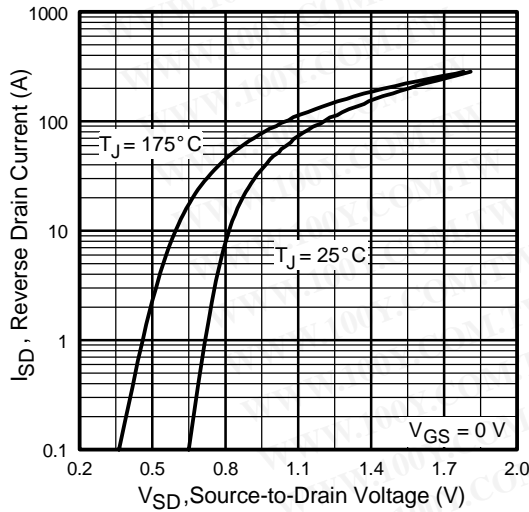


Fig 7. Typical Source-Drain Diode Forward Voltage

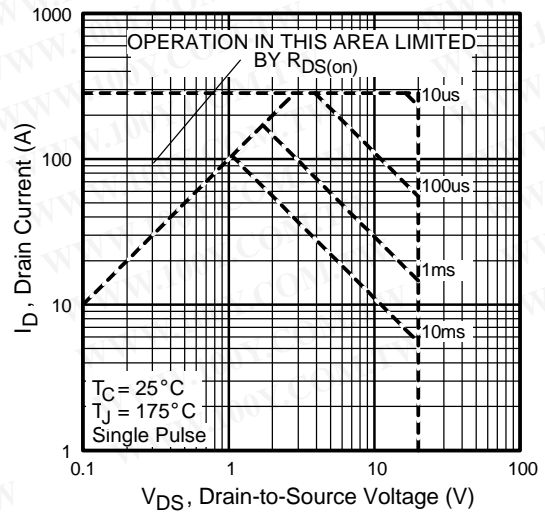


Fig 8. Maximum Safe Operating Area

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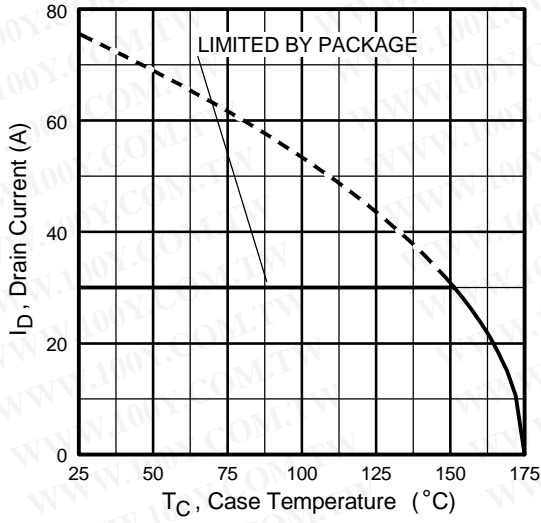


Fig 9. Maximum Drain Current Vs. Case Temperature

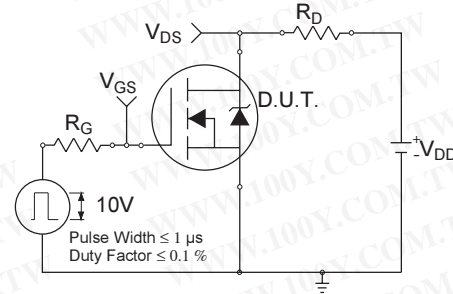


Fig 10a. Switching Time Test Circuit

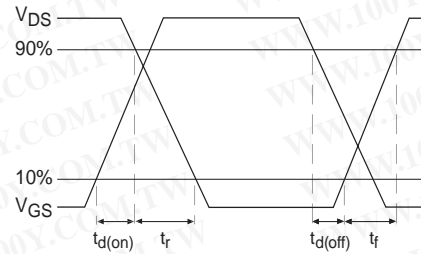


Fig 10b. Switching Time Waveforms

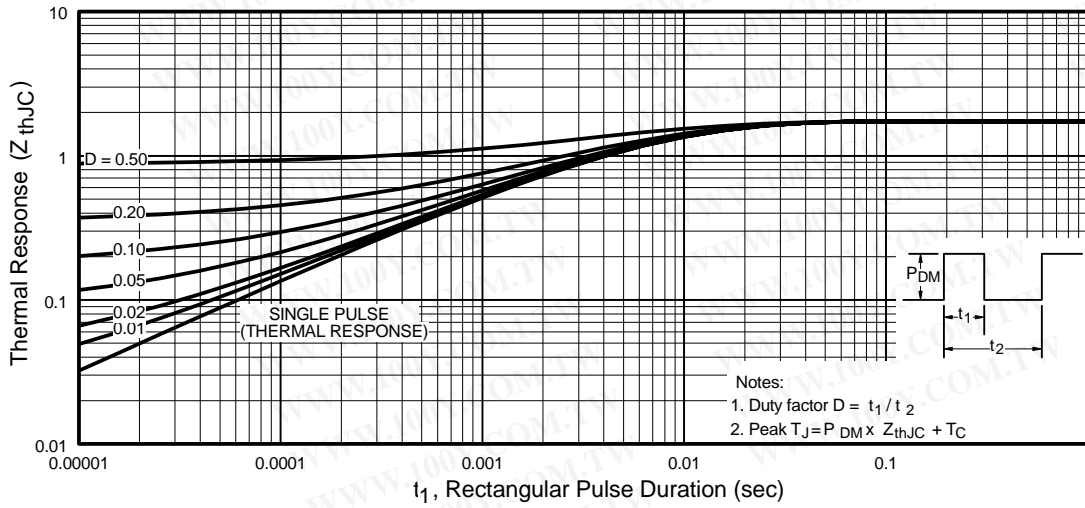


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

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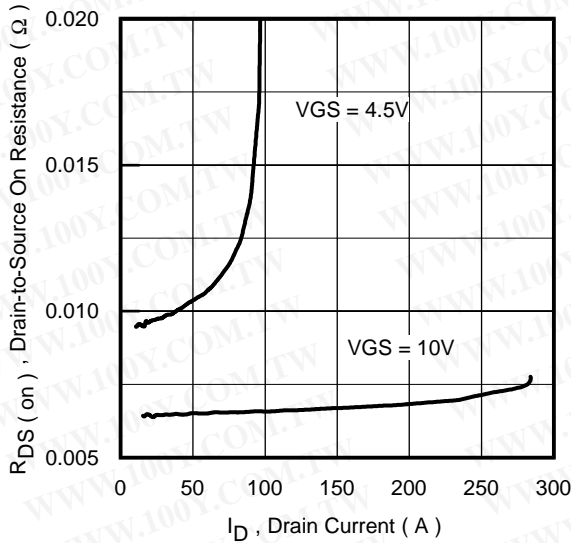


Fig 12. On-Resistance Vs. Drain Current

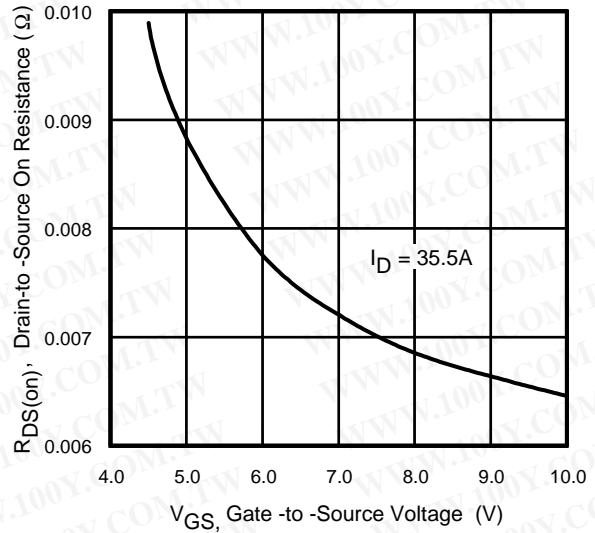


Fig 13. On-Resistance Vs. Gate Voltage

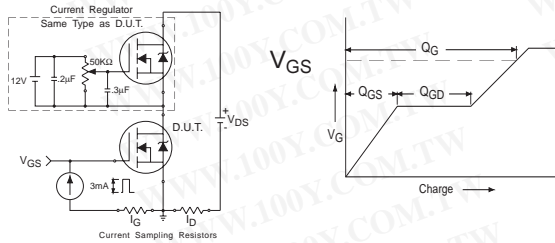


Fig 14a&b. Basic Gate Charge Test Circuit and Waveforms

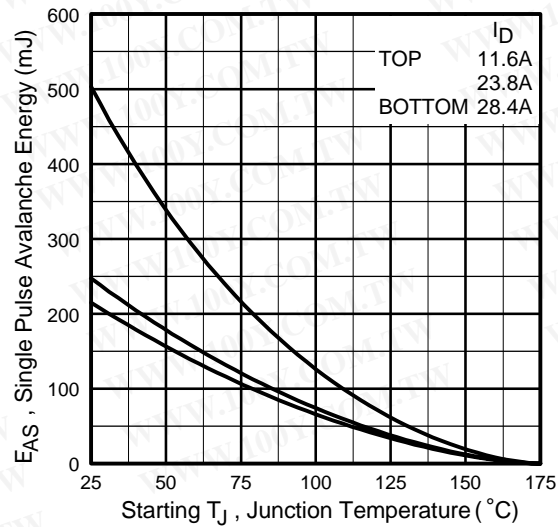


Fig 15c. Maximum Avalanche Energy Vs. Drain Current

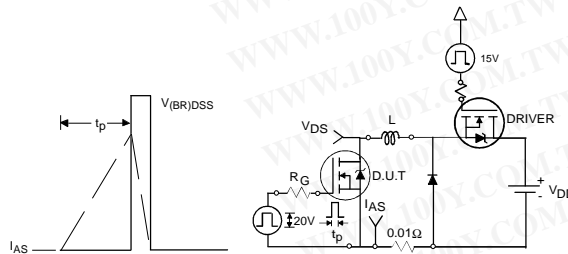


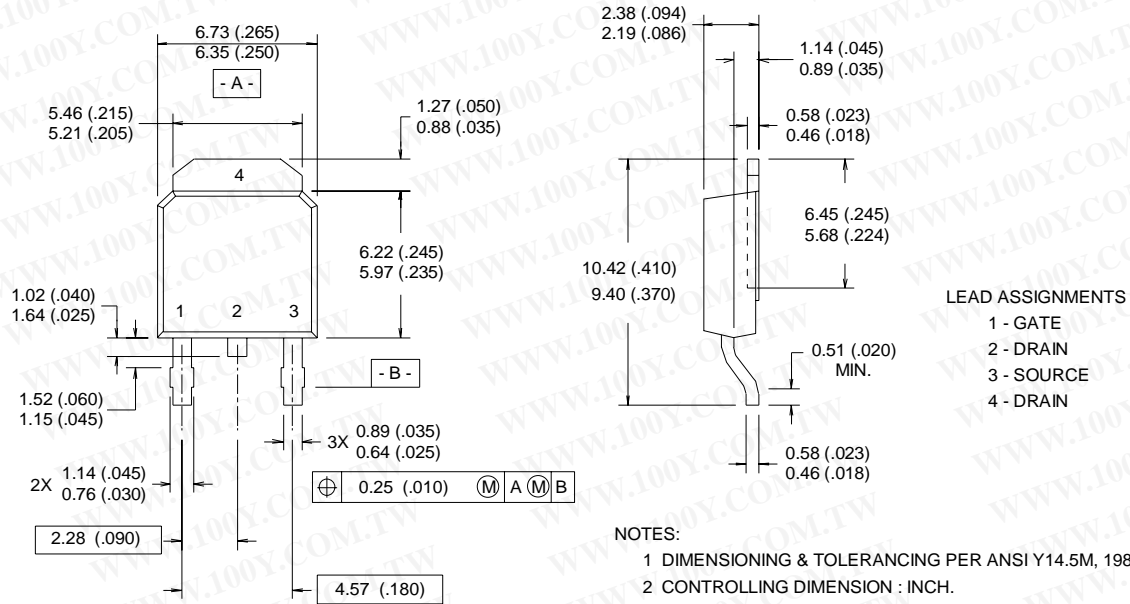
Fig 15a&b. Unclamped Inductive Test Circuit and Waveforms

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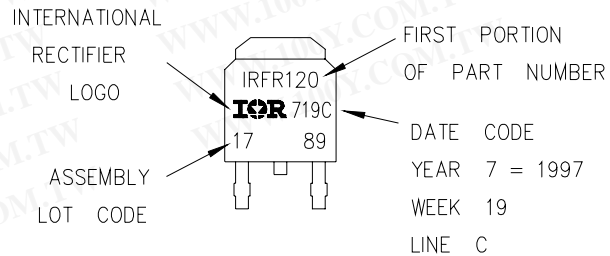
D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



D-Pak (TO-252AA) Part Marking Information

EXAMPLE: THIS IS AN IRFR120
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"

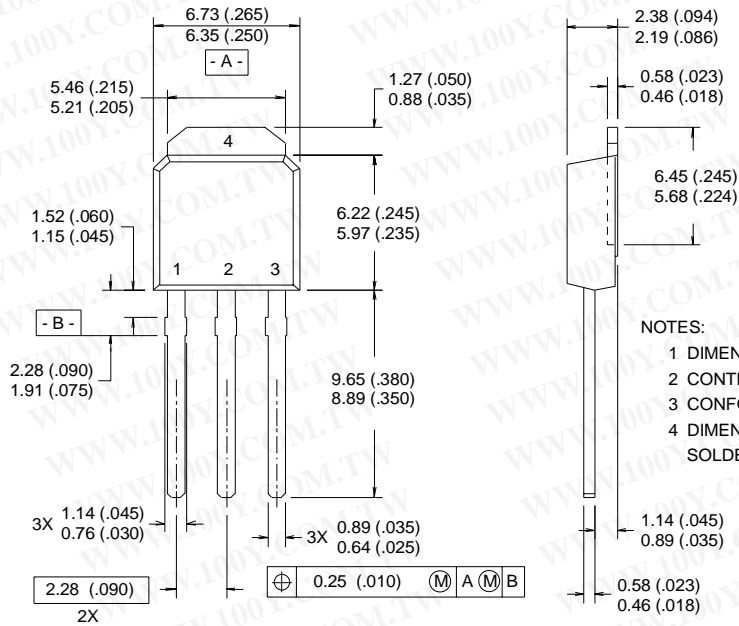


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I-Pak (TO-251AA) Package Outline

Dimensions are shown in millimeters (inches)



LEAD ASSIGNMENTS

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

NOTES:

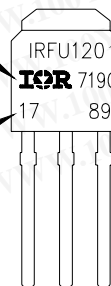
- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH.
- 3 CONFORMS TO JEDEC OUTLINE TO-252AA.
- 4 DIMENSIONS SHOWN ARE BEFORE SOLDER DIP, SOLDER DIP MAX. +0.16 (.006).

I-Pak (TO-251AA) Part Marking Information

EXAMPLE: THIS IS AN IRFU120
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"

INTERNATIONAL
 RECTIFIER
 LOGO

ASSEMBLY
 LOT CODE



FIRST PORTION
 OF PART NUMBER

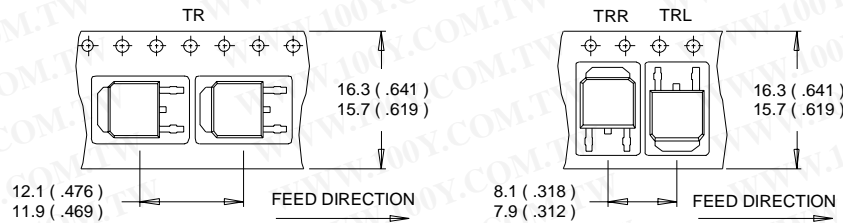
DATE CODE
 YEAR 7 = 1997
 WEEK 19
 LINE C

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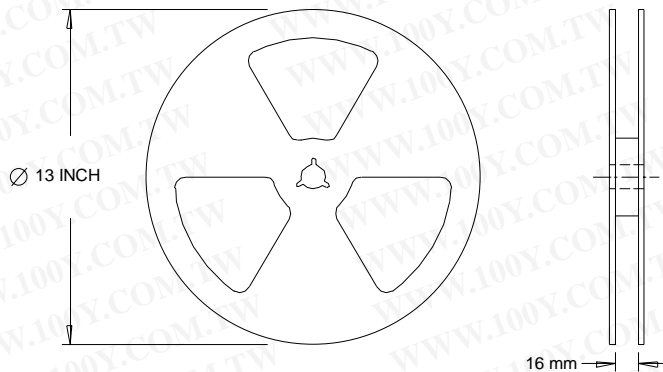
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D-Pak (TO-252AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)



- NOTES:
1. CONTROLLING DIMENSION: MILLIMETER.
 2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
 3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



- NOTES:
1. OUTLINE CONFORMS TO EIA-481.

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 Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 30A
- ⑤ R_θ is measured at T_J approximately 90°C

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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