

HEXFET® Power MOSFET

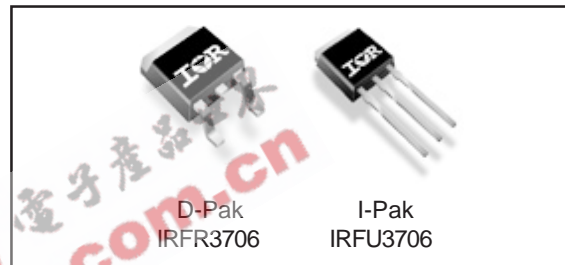
**Applications**

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

V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
20V	9.0mΩ	75A <sup>④</sup>

**Benefits**

- Ultra-Low Gate Impedance
- Very Low R<sub>DS(on)</sub> at 4.5V V<sub>GS</sub>
- Fully Characterized Avalanche Voltage and Current



**Absolute Maximum Ratings**

Symbol	Parameter	Max.	Units
V <sub>DS</sub>	Drain-Source Voltage	20	V
V <sub>GS</sub>	Gate-to-Source Voltage	± 12	V
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	75 <sup>④</sup>	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	53 <sup>④</sup>	
I <sub>DM</sub>	Pulsed Drain Current <sup>①</sup>	280	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Maximum Power Dissipation <sup>③</sup>	88	W
P <sub>D</sub> @ T <sub>C</sub> = 100°C	Maximum Power Dissipation <sup>③</sup>	44	W
	Linear Derating Factor	0.59	mW/°C
T <sub>J</sub> , T <sub>STG</sub>	Junction and Storage Temperature Range	-55 to + 175	°C

**Thermal Resistance**

	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case	—	1.7	°C/W
R <sub>θJA</sub>	Junction-to-Ambient (PCB mount)*	—	50	
R <sub>θJA</sub>	Junction-to-Ambient	—	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 ④ are on page 10

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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/ΔT<sub>J</sub></sub>	Breakdown Voltage Temp. Coefficient	—	0.021	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	6.9	9.0	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 36A ③
		—	8.1	11		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 28A ③
		—	11.5	23		V <sub>GS</sub> = 2.8V, I <sub>D</sub> = 18A ③
V <sub>GS(th)</sub>	Gate Threshold Voltage	0.6	—	2.0	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> = 12V
	Gate-to-Source Reverse Leakage	—	—	-200		V <sub>GS</sub> = -12V

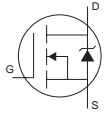
## Dynamic @ T<sub>J</sub> = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g <sub>fs</sub>	Forward Transconductance	53	—	—	S	V <sub>DS</sub> = 16V, I <sub>D</sub> = 57A
Q <sub>g</sub>	Total Gate Charge	—	23	35	nC	I <sub>D</sub> = 28A
Q <sub>gs</sub>	Gate-to-Source Charge	—	8.0	12		V <sub>DS</sub> = 10V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	5.5	8.3	ns	V <sub>GS</sub> = 4.5V ③
Q <sub>oss</sub>	Output Gate Charge	—	16	24		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 10V
t <sub>d(on)</sub>	Turn-On Delay Time	—	6.8	—	ns	V <sub>DD</sub> = 10V
t <sub>r</sub>	Rise Time	—	87	—		I <sub>D</sub> = 28A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	17	—		R <sub>G</sub> = 1.8Ω
t <sub>f</sub>	Fall Time	—	4.8	—		V <sub>GS</sub> = 4.5V ③
C <sub>iss</sub>	Input Capacitance	—	2410	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	1070	—		V <sub>DS</sub> = 10V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	140	—		f = 1.0MHz

## Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy②	—	220	mJ
I <sub>AR</sub>	Avalanche Current①	—	28	A

## Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	75④	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	280		
V <sub>SD</sub>	Diode Forward Voltage	—	0.88	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 36A, V <sub>GS</sub> = 0V ③
		—	0.82	—		T <sub>J</sub> = 125°C, I <sub>S</sub> = 36A, V <sub>GS</sub> = 0V ③
t <sub>rr</sub>	Reverse Recovery Time	—	45	68	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 36A, V <sub>R</sub> = 20V
Q <sub>rr</sub>	Reverse Recovery Charge	—	65	98	nC	di/dt = 100A/μs ③
t <sub>rr</sub>	Reverse Recovery Time	—	49	74	ns	T <sub>J</sub> = 125°C, I <sub>F</sub> = 36A, V <sub>R</sub> = 20V
Q <sub>rr</sub>	Reverse Recovery Charge	—	78	120	nC	di/dt = 100A/μs ③

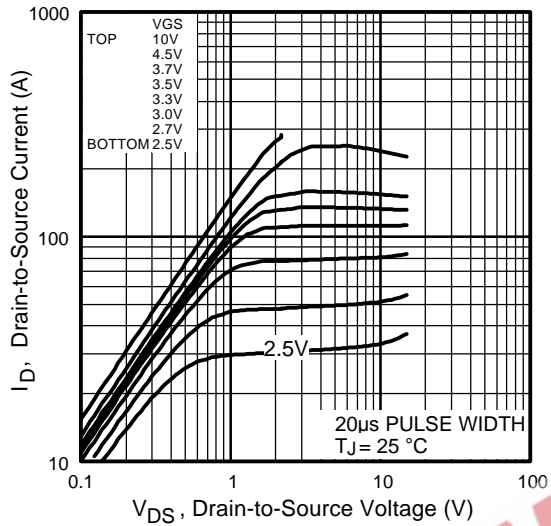


Fig 1. Typical Output Characteristics

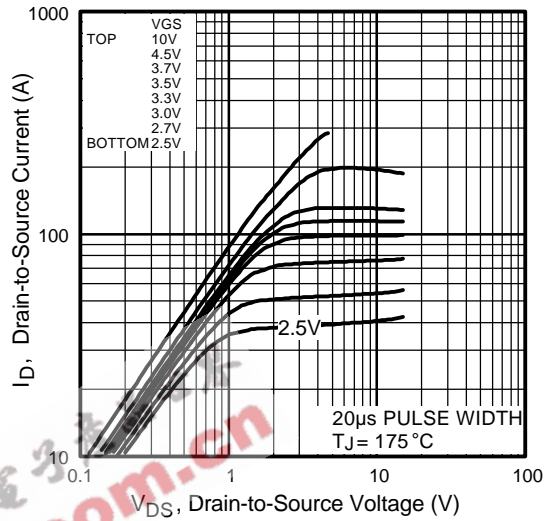


Fig 2. Typical Output Characteristics

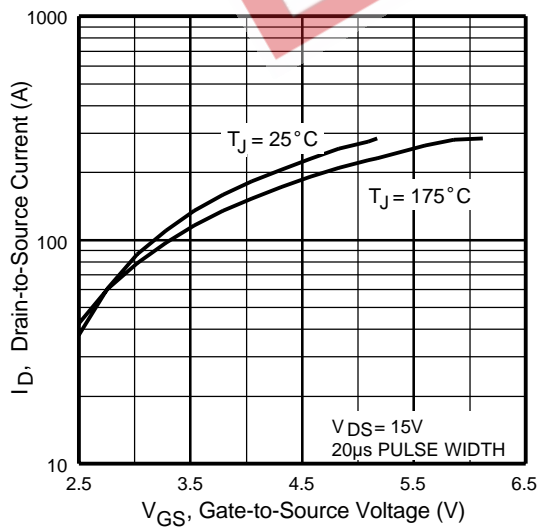


Fig 3. Typical Transfer Characteristics

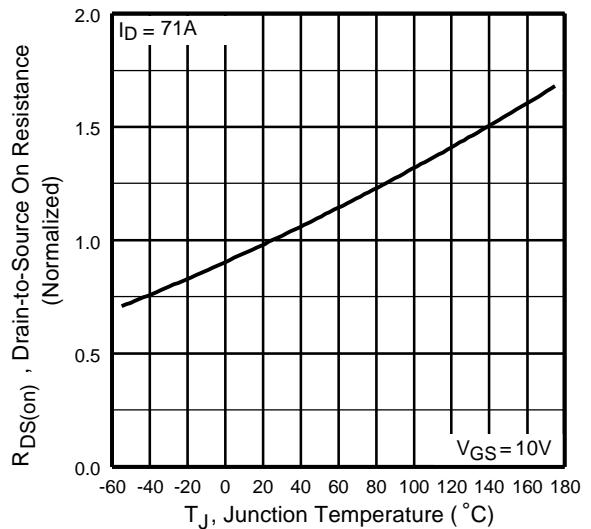
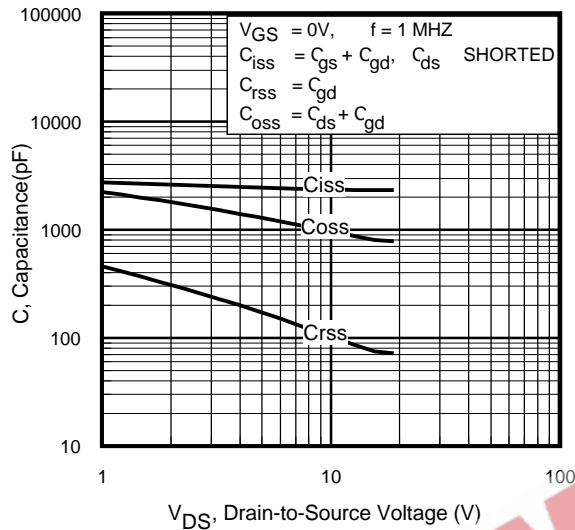
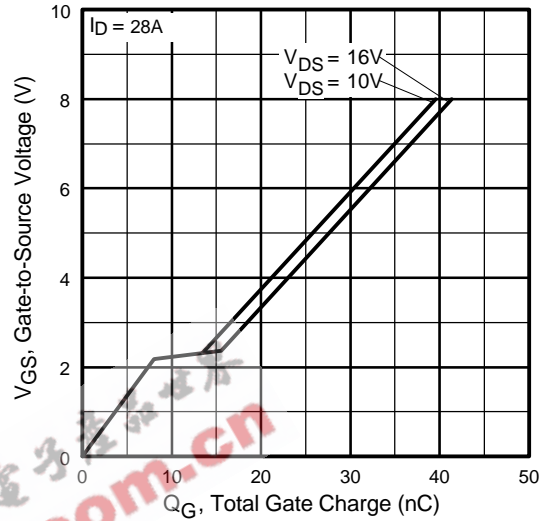


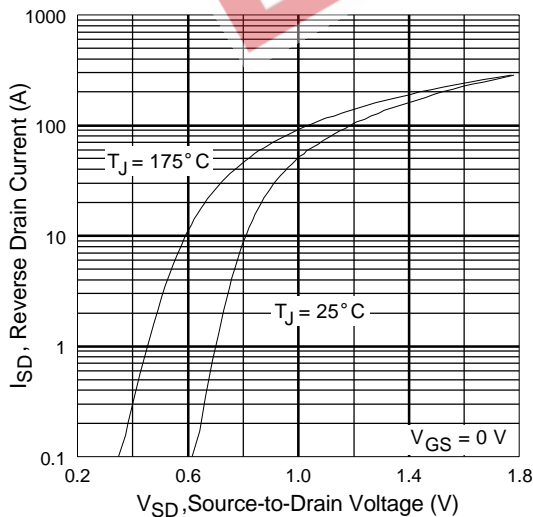
Fig 4. Normalized On-Resistance Vs. Temperature



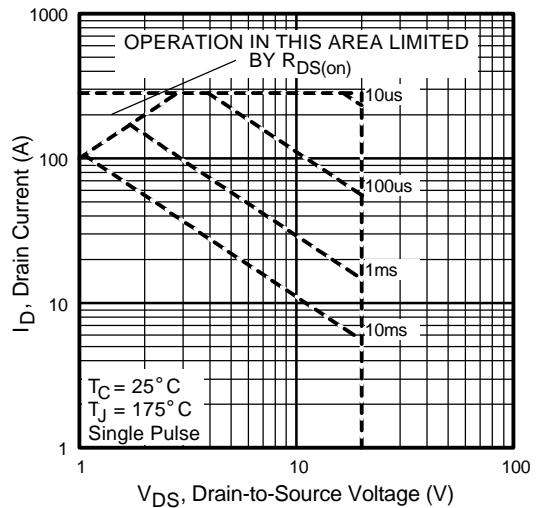
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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



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



**Fig 8.** Maximum Safe Operating Area

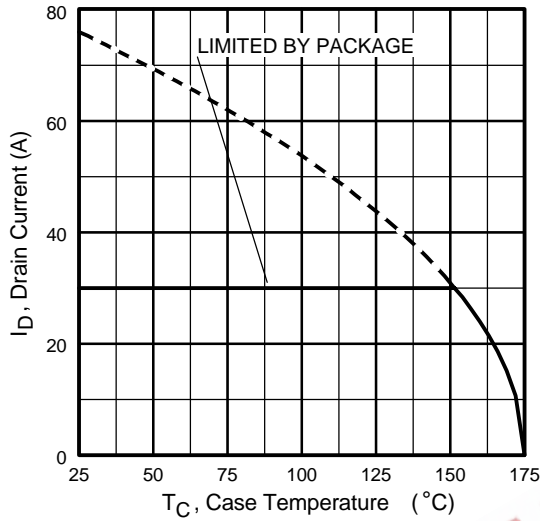


Fig 9. Maximum Drain Current Vs. Case Temperature

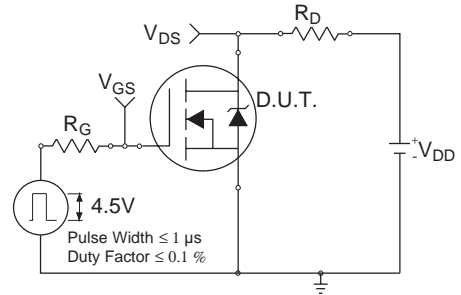


Fig 10a. Switching Time Test Circuit

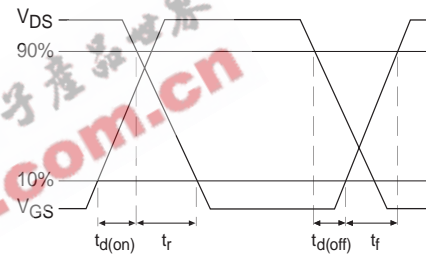


Fig 10b. Switching Time Waveforms

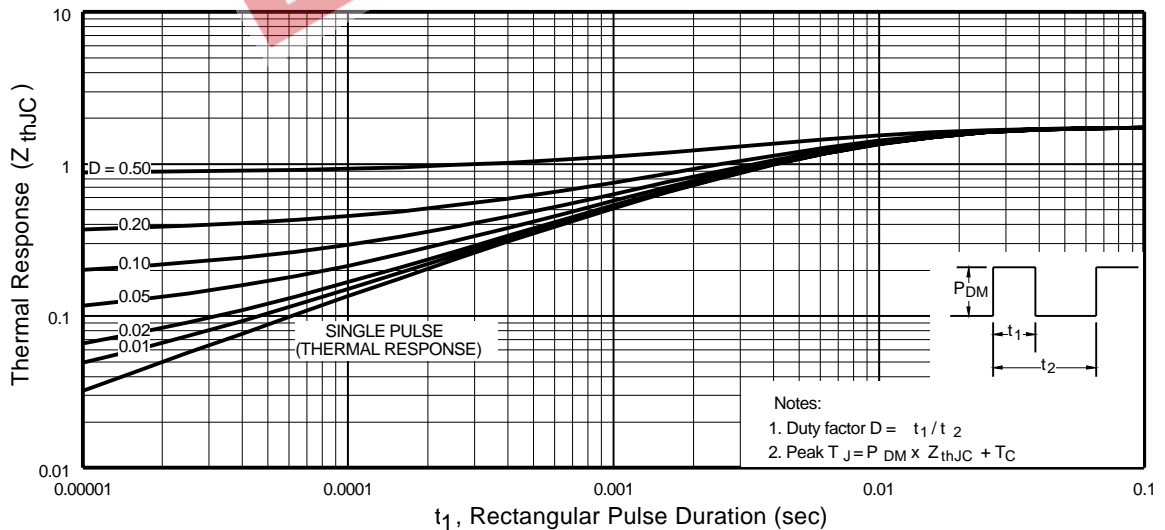
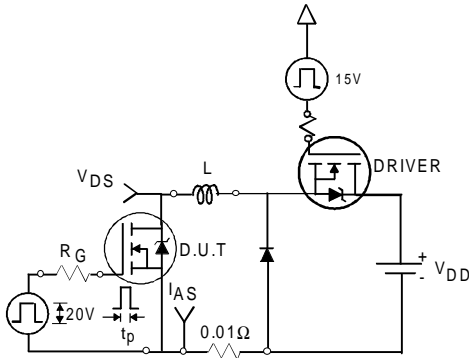
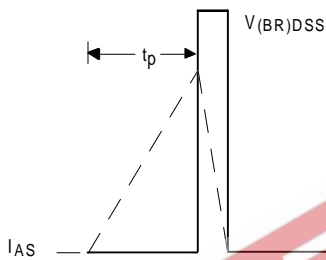


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

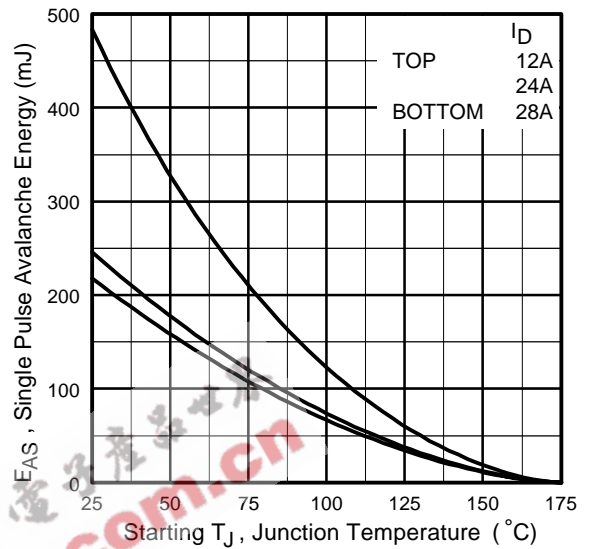
# IRFR/U3706



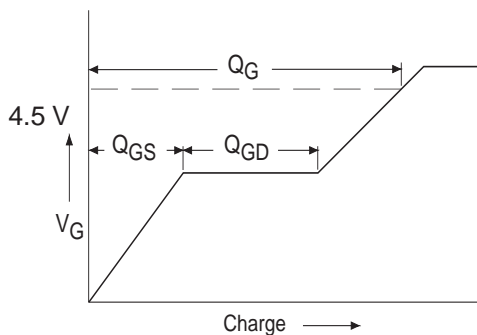
**Fig 12a.** Unclamped Inductive Test Circuit



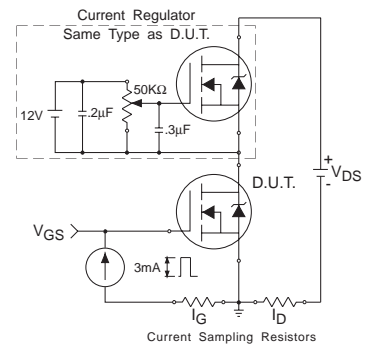
**Fig 12b.** Unclamped Inductive Waveforms



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

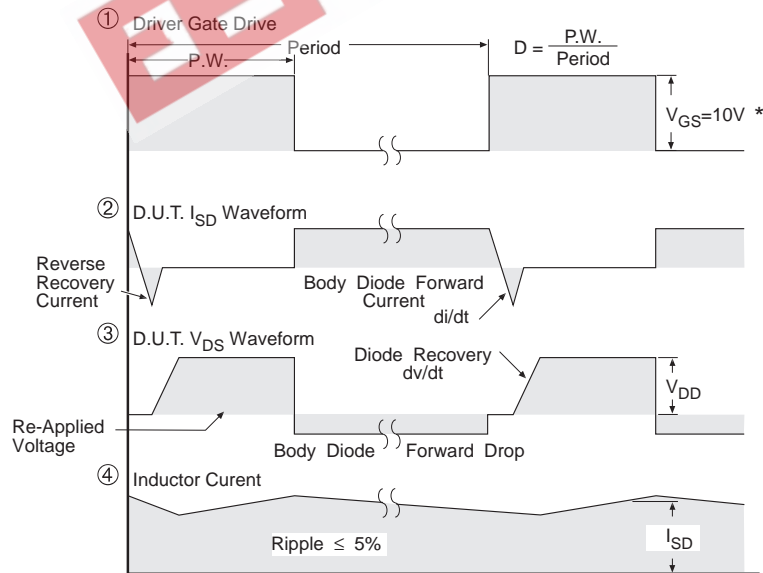
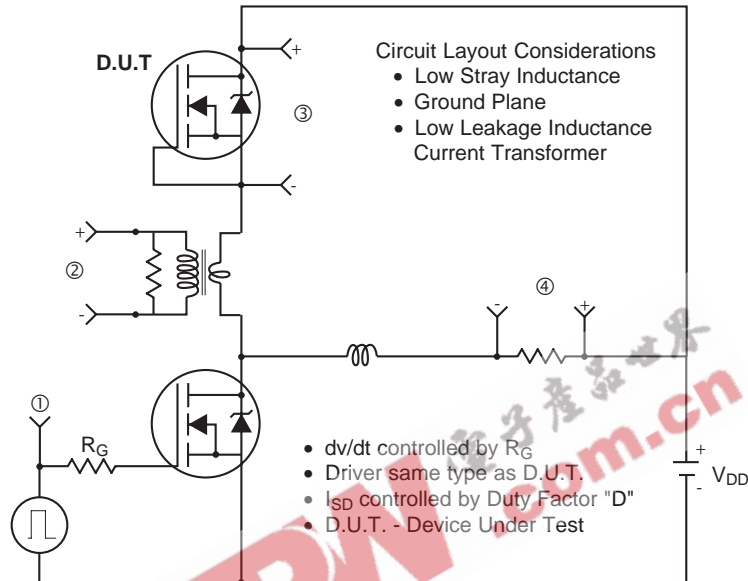


**Fig 13a.** Basic Gate Charge Waveform



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

Peak Diode Recovery dv/dt Test Circuit



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

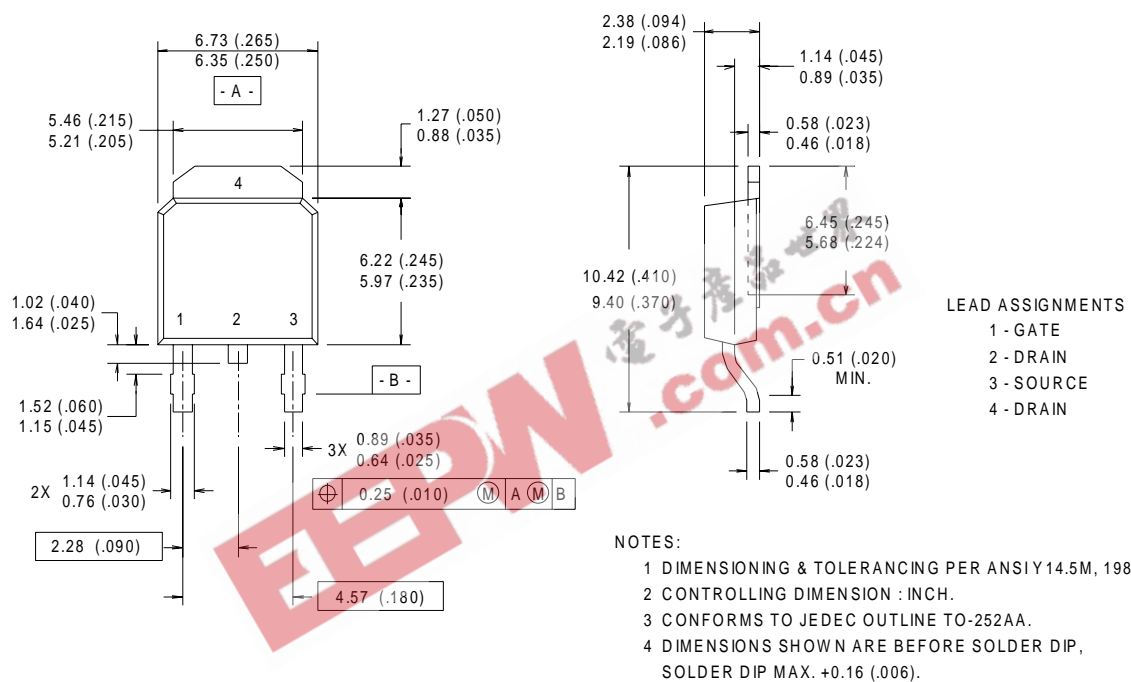
Fig 14. For N-Channel HEXFET® Power MOSFETs

# IRFR/U3706

International  
**IR** Rectifier

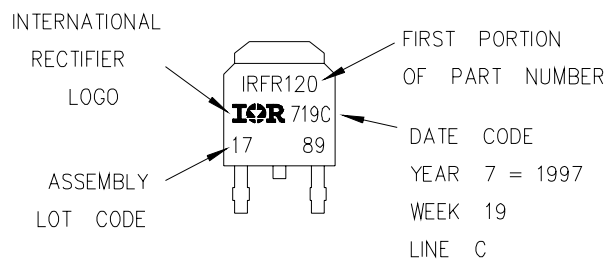
## D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



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

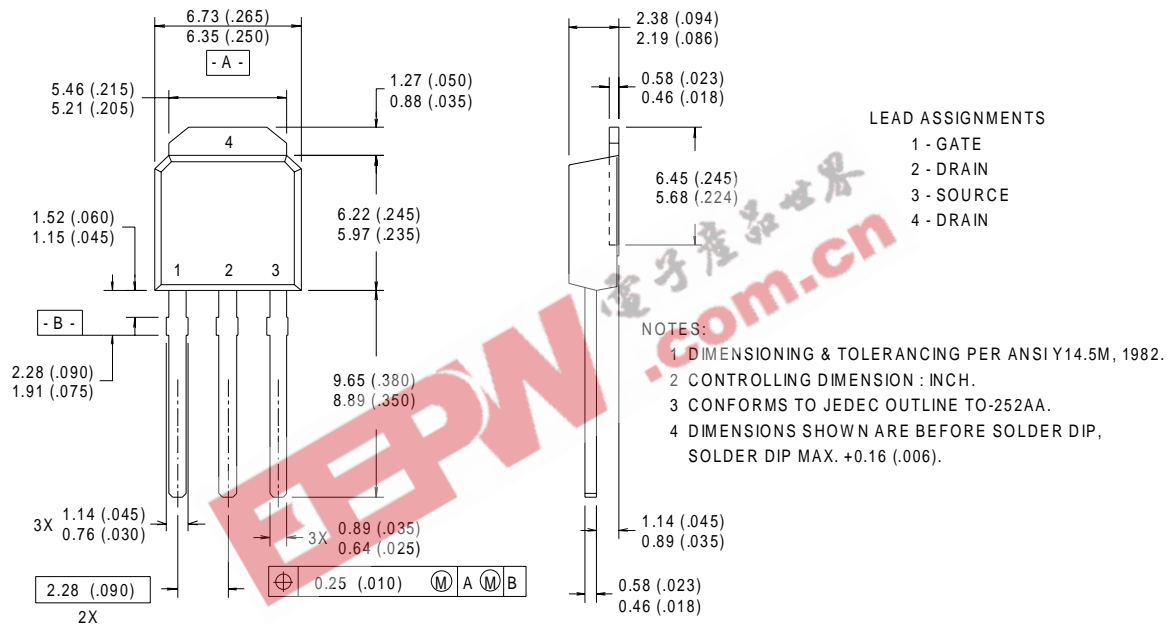
EXAMPLE: THIS IS AN IRFR120  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 1997  
 IN THE ASSEMBLY LINE "C"





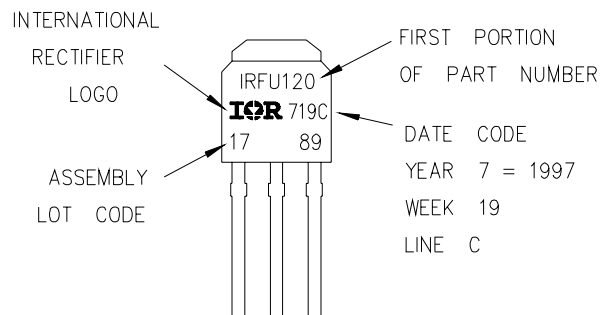
## I-Pak (TO-251AA) Package Outline

Dimensions are shown in millimeters (inches)



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

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

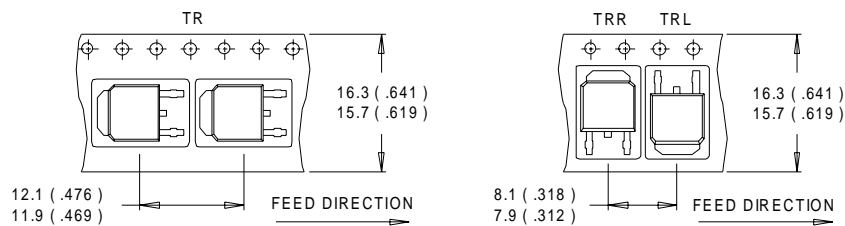


# IRFR/U3706

International  
**IR** Rectifier

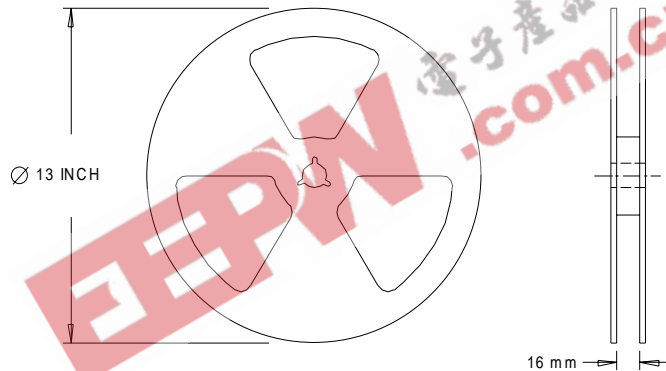
## D-Pak (TO-252AA) Tape & Reel Information

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  $T_J = 25^\circ\text{C}$ ,  $L = 0.54\text{mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 28\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 30A.

International  
**IR** Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
**IR EUROPEAN REGIONAL CENTER:** 439/445 Godstone Rd, Whyteleafe, Surrey CR3 0BL, 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. 7/00*