

IRFR/U1205

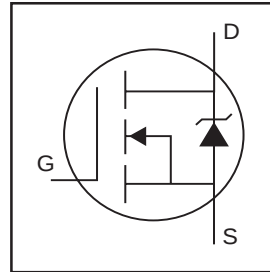
HEXFET® Power MOSFET

- Ultra Low On-Resistance
- Surface Mount (IRFR1205)
- Straight Lead (IRFU1205)
- Fast Switching
- Fully Avalanche Rated

Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve the lowest possible on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient device for use in a wide variety of applications.

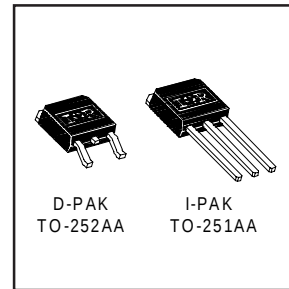
The D-PAK is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRFU series) is for through-hole mounting applications. Power dissipation levels up to 1.5 watts are possible in typical surface mount applications.



$$V_{DS} = 55V$$

$$R_{DS(on)} = 0.027\Omega$$

$$I_D = 44A^{\circ}$$



D-PAK
TO-252AA

I-PAK
TO-251AA

Absolute Maximum Ratings

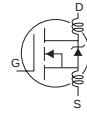
	Parameter	Max.	Units
I_D @ $T_C = 25^{\circ}C$	Continuous Drain Current, V_{GS} @ 10V	44 [Ⓢ]	A
I_D @ $T_C = 100^{\circ}C$	Continuous Drain Current, V_{GS} @ 10V	31 [Ⓢ]	
I_{DM}	Pulsed Drain Current ①⑦	160	
P_D @ $T_C = 25^{\circ}C$	Power Dissipation	107	W
	Linear Derating Factor	0.71	W/ $^{\circ}C$
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②⑦	210	mJ
I_{AR}	Avalanche Current①⑦	25	A
E_{AR}	Repetitive Avalanche Energy①⑦	11	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
T_J	Operating Junction and	-55 to + 175	$^{\circ}C$
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

Thermal Resistance

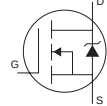
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.4	$^{\circ}C/W$
$R_{\theta JA}$	Junction-to-Ambient (PCB mount) **	—	50	
$R_{\theta JA}$	Junction-to-Ambient	—	110	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	55	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.055	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.027		$V_{GS} = 10V, I_D = 26A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
g_{fs}	Forward Transconductance	17	—	—	S	$V_{DS} = 25V, I_D = 25A$ ⑦
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 55V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 44V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
Q_g	Total Gate Charge	—	—	65	nC	$I_D = 25A$
Q_{gs}	Gate-to-Source Charge	—	—	12		$V_{DS} = 44V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	27		$V_{GS} = 10V$, See Fig. 6 and 13 ④ ⑦
$t_{d(on)}$	Turn-On Delay Time	—	7.3	—	ns	$V_{DD} = 28V$
t_r	Rise Time	—	69	—		$I_D = 25A$
$t_{d(off)}$	Turn-Off Delay Time	—	47	—		$R_G = 12\Omega$
t_f	Fall Time	—	60	—		$R_D = 1.1\Omega$, See Fig. 10 ④ ⑦
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact⑥
L_S	Internal Source Inductance	—	7.5	—		
C_{iss}	Input Capacitance	—	1300	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	410	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	150	—		$f = 1.0MHz$, See Fig. 5⑦



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	44	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ① ⑦	—	—	160		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 22A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	65	98	ns	$T_J = 25^\circ\text{C}, I_F = 25A$
Q_{rr}	Reverse Recovery Charge	—	160	240	nC	$di/dt = 100A/\mu s$ ④ ⑦
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)
 ② $V_{DD} = 25V$, starting $T_J = 25^\circ\text{C}$, $L = 470\mu H$, $R_G = 25\Omega$, $I_{AS} = 25A$. (See Figure 12)
 ③ $I_{SD} \leq 25A$, $di/dt \leq 320A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 175^\circ\text{C}$
 ④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.
 ⑤ Calculated continuous current based on maximum allowable junction temperature; Package limitation current = 20A
 ⑥ This is applied for I-PAK, L_S of D-PAK is measured between lead and center of die contact
 ⑦ Uses IRFZ44N data and test conditions

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

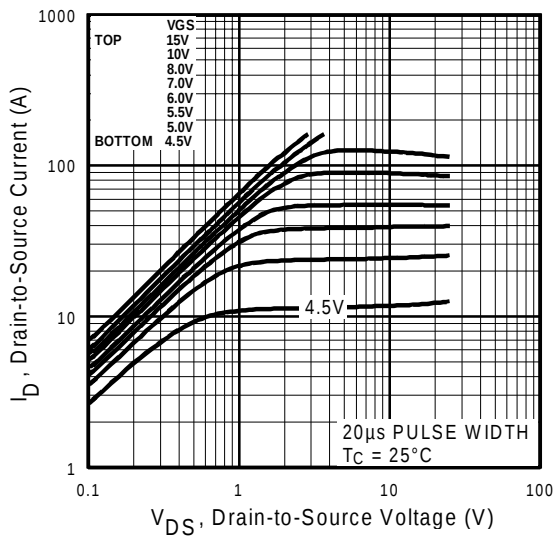


Fig 1. Typical Output Characteristics

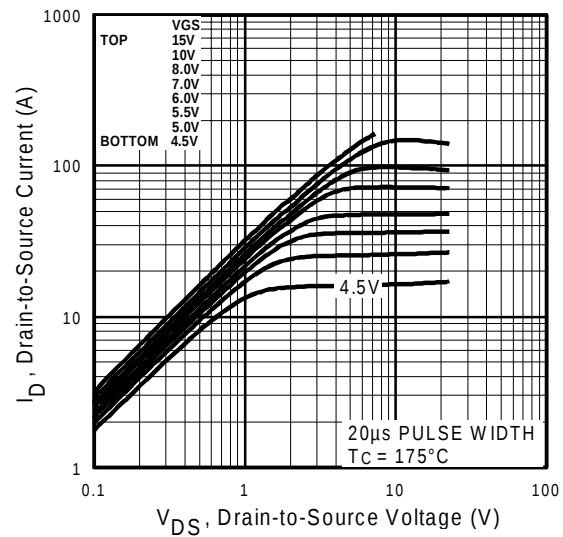


Fig 2. Typical Output Characteristics

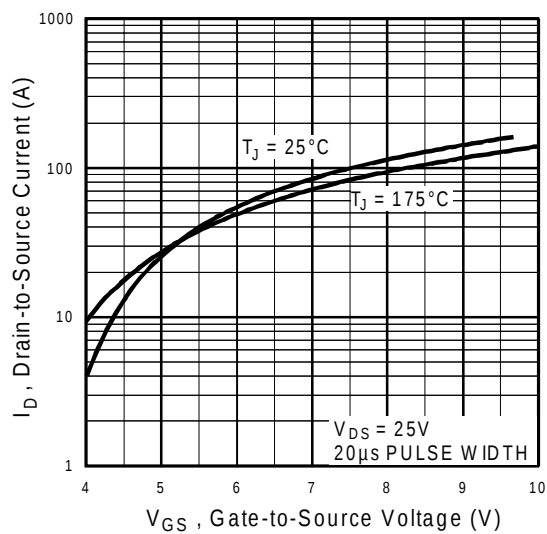


Fig 3. Typical Transfer Characteristics

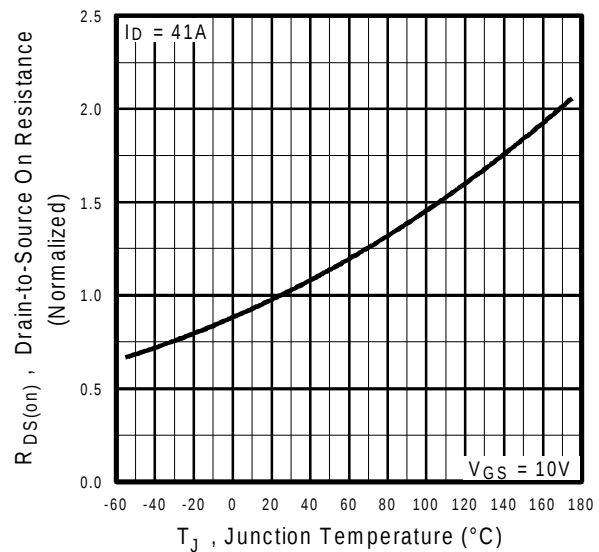


Fig 4. Normalized On-Resistance Vs. Temperature

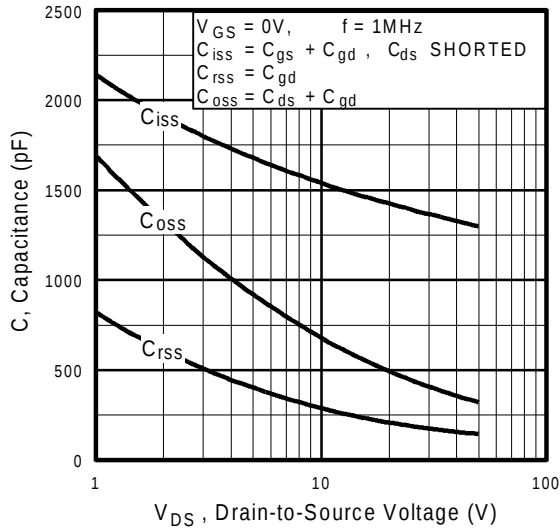


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

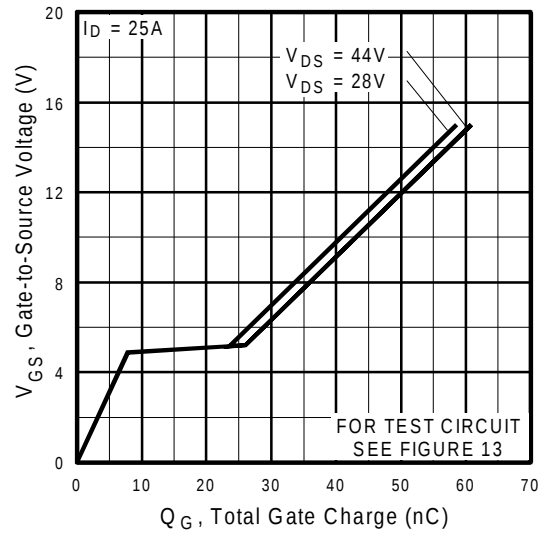


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

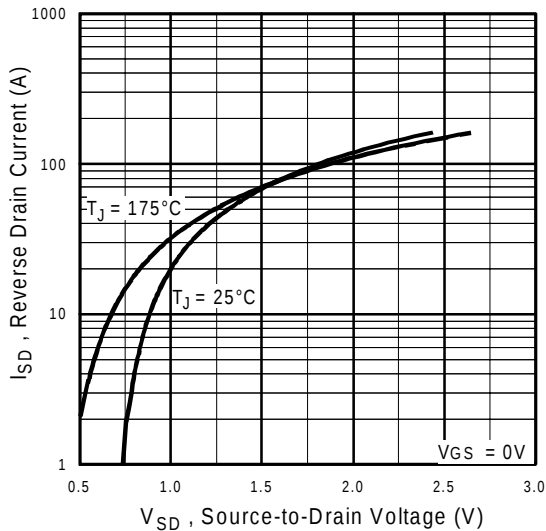


Fig 7. Typical Source-Drain Diode Forward Voltage

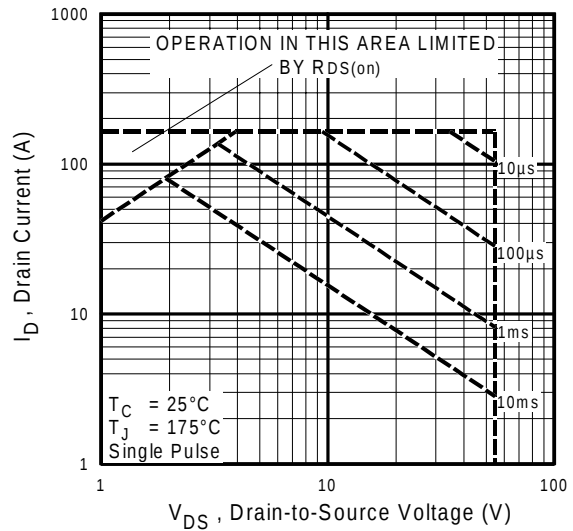


Fig 8. Maximum Safe Operating Area

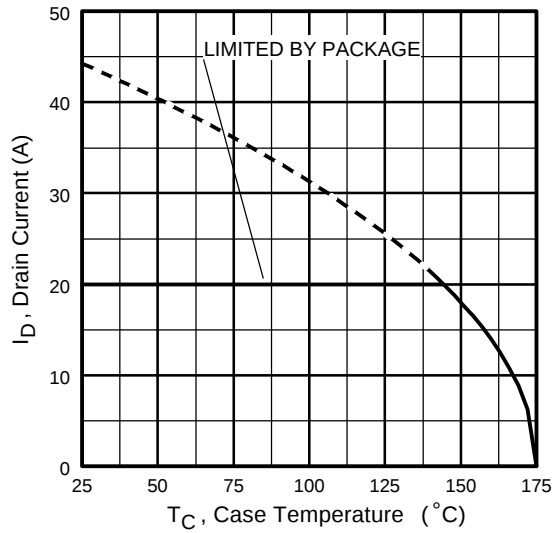


Fig 9. Maximum Drain Current Vs. Case Temperature

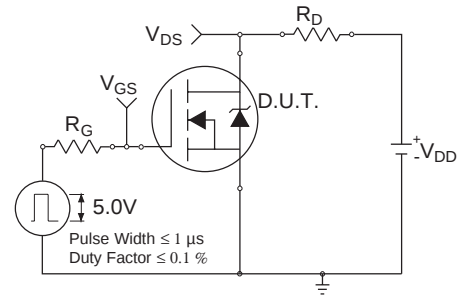


Fig 10a. Switching Time Test Circuit

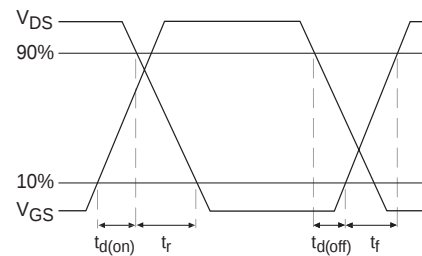


Fig 10b. Switching Time Waveforms

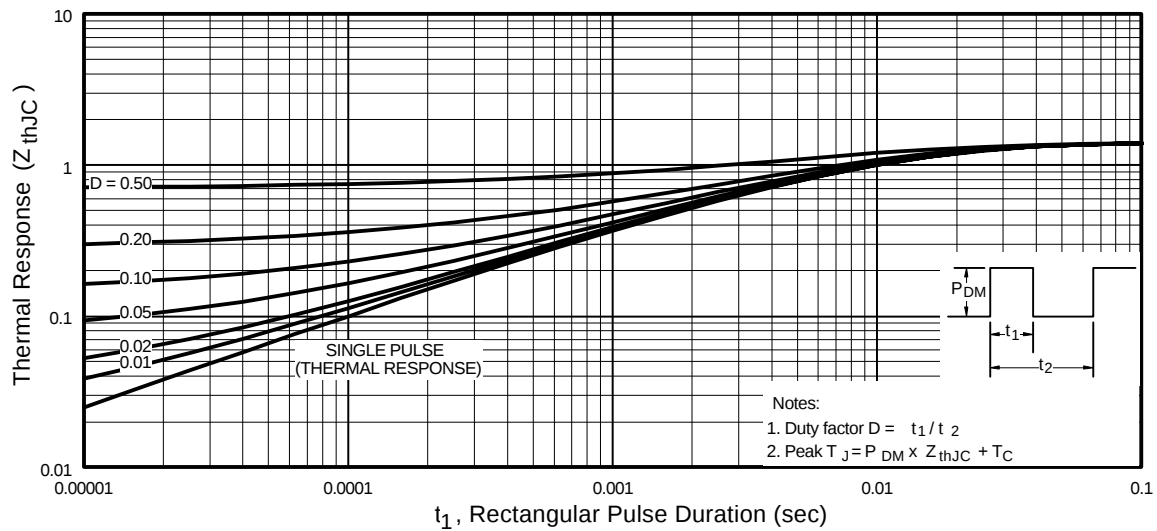


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

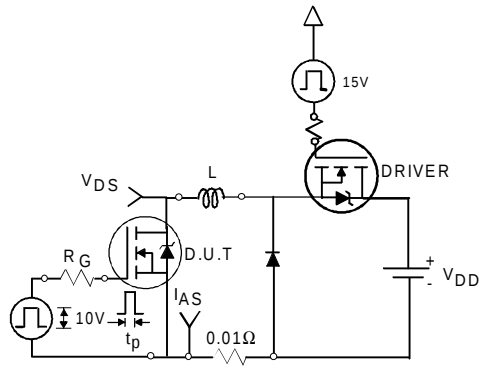


Fig 12a. Unclamped Inductive Test Circuit

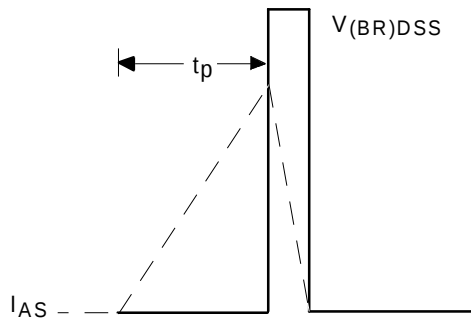


Fig 12b. Unclamped Inductive Waveforms

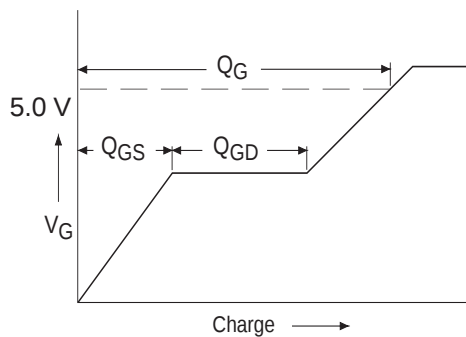


Fig 13a. Basic Gate Charge Waveform

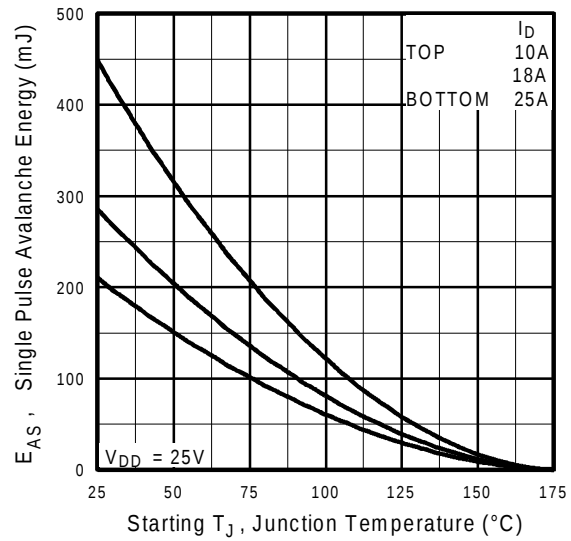


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

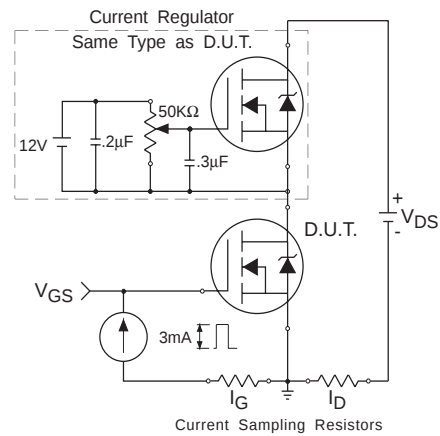


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

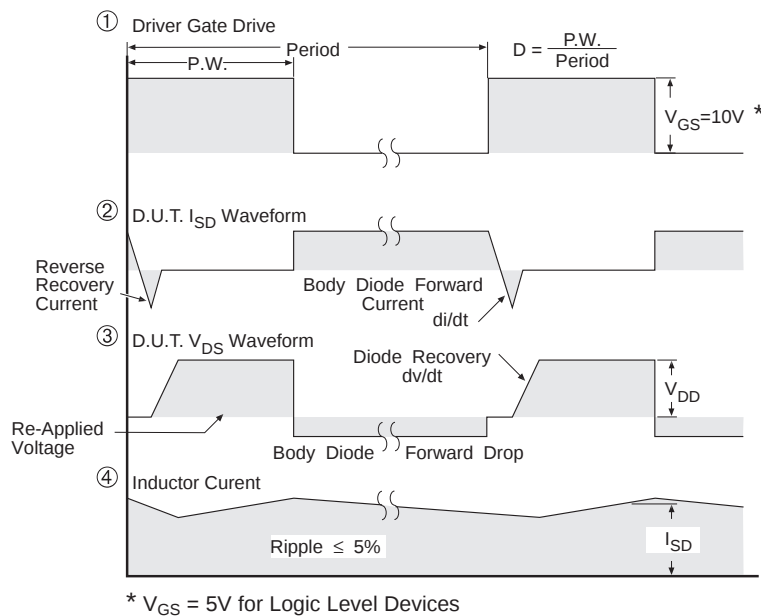
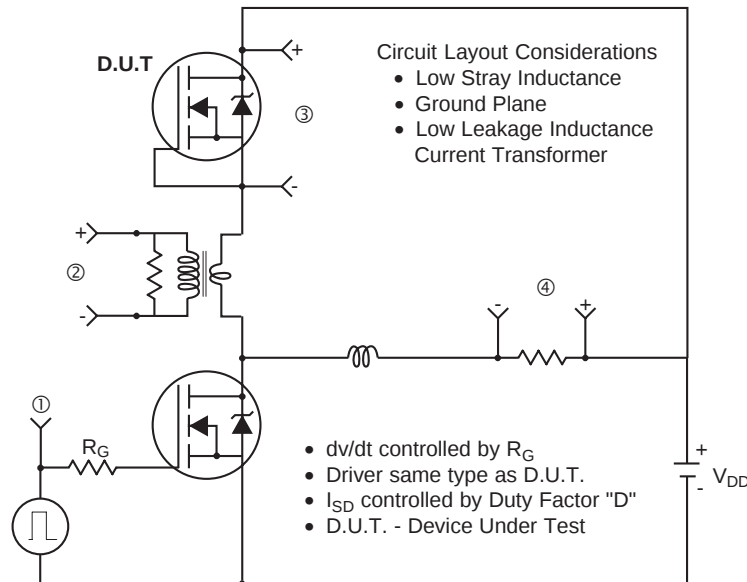
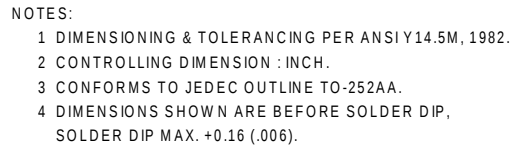


Fig 14. For N-Channel HEXFETS

Dimensions are shown in millimeters (inches)



TO-252AA (D-PARK)

Diagram illustrating the marking on the IRFR120P MOSFET package:

- INTERNATIONAL RECTIFIER LOGO:** Points to the **IR** logo on the package.
- FIRST PORTION OF PART NUMBER:** Points to the **120** marking on the package.
- SECOND PORTION OF PART NUMBER:** Points to the **1P** marking on the package.
- ASSEMBLY LOT CODE:** Points to the **9U** marking on the package.

TO-251AA Outline

6.73 (.265)
6.35 (.250)
- A -

5.46 (.215)
5.21 (.205)

1.27 (.050)
0.88 (.035)

4

1.52 (.060)
1.15 (.045)

6.22 (.245)
5.97 (.235)

1 2 3

- B -

2.28 (.090)
1.91 (.075)

9.65 (.380)
8.89 (.350)

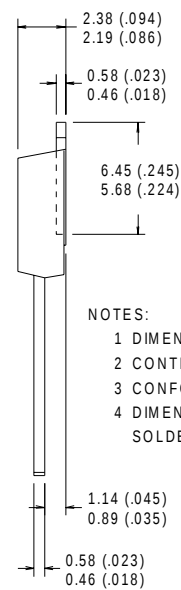
3X 1.14 (.045)
0.76 (.030)

0.89 (.035)
0.64 (.025)

2.28 (.090)

2X

⊕	0.25 (.010)	M	A	M	B
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1 - GATE
2 - DRAIN
3 - SOURCE
4 - DRAIN

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).

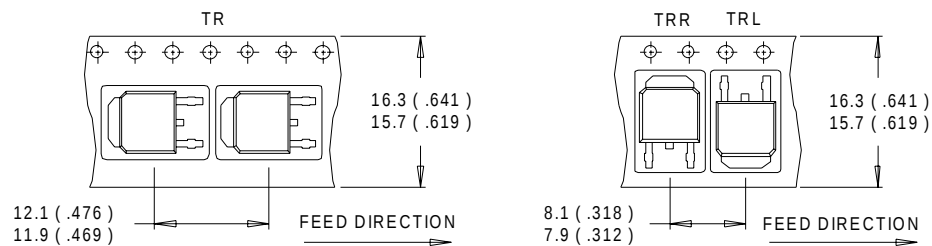
TO-251AA (I-PARK)

Diagram illustrating the markings on a MOSFET package (IRFU120P) and their corresponding labels:

- INTERNATIONAL RECTIFIER LOGO**: Points to the stylized "IR" logo on the package.
- FIRST PORTION OF PART NUMBER**: Points to the "IRFU" marking.
- SECOND PORTION OF PART NUMBER**: Points to the "120" marking.
- ASSEMBLY LOT CODE**: Points to the "9U" marking.
- 1P**: Points to the "1P" marking, indicating the package type.

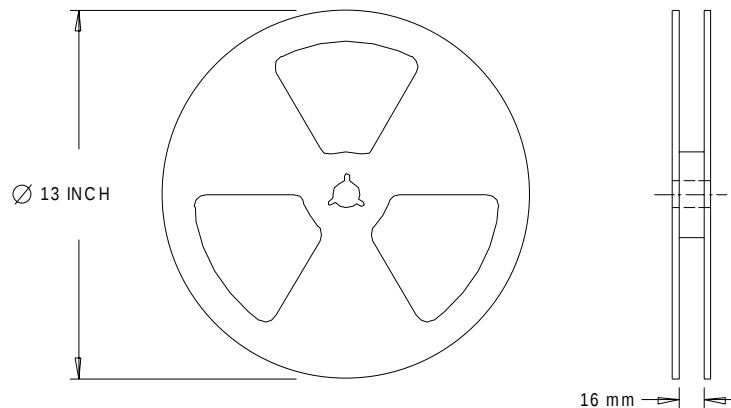
Tape & Reel Information

TO-252AA



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.

International
IOR Rectifier

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EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020

IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T 3Z2, Tel: (905) 453 2200

IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590

IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111

IR FAR EAST: 171 (K&H Bldg.) 30-4 Nishi-ikebukuro 3-chome, Toshima-ku, Tokyo Japan Tel: 81 33 983 0086

IR SOUTHEAST ASIA: 315 Outram Road, #10-02 Tan Boon Liat Building, Singapore 16907 Tel: 65 221 8371

Data and specifications subject to change without notice.

5/98

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