

IRFR/U120N

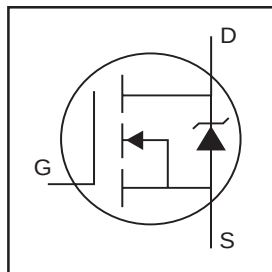
HEXFET® Power MOSFET

- Surface Mount (IRFR120N)
- Straight Lead (IRFU120N)
- Advanced Process Technology
- 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.

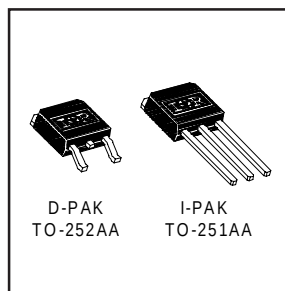
The D-PAK is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRFU series) is for through-hole mounting applications. Power dissipation levels up to 1.5 watts are possible in typical surface mount applications.



$$V_{DS} = 100V$$

$$R_{DS(on)} = 0.21\Omega$$

$$I_D = 9.4A$$



Absolute Maximum Ratings

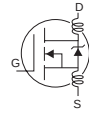
	Parameter	Max.	Units
I_D @ $T_C = 25^\circ C$	Continuous Drain Current, V_{GS} @ 10V	9.4	A
I_D @ $T_C = 100^\circ C$	Continuous Drain Current, V_{GS} @ 10V	6.6	
I_{DM}	Pulsed Drain Current ①⑥	38	
P_D @ $T_C = 25^\circ C$	Power Dissipation	48	W
	Linear Derating Factor	0.32	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②⑥	91	mJ
I_{AR}	Avalanche Current①⑥	5.7	A
E_{AR}	Repetitive Avalanche Energy①⑥	4.8	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
T_J	Operating Junction and	-55 to + 175	°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	—	3.1	°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	100	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.12	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.21		$V_{GS} = 10V, I_D = 5.6A$ 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	2.7	—	—	S	$V_{DS} = 25V, I_D = 5.7A$ ⑥
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 100V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 80V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
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	—	—	25	nC	$I_D = 5.7A$
Q_{gs}	Gate-to-Source Charge	—	—	4.8		$V_{DS} = 80V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	11		$V_{GS} = 10V$, See Fig. 6 and 13 ④ ⑥
$t_{d(on)}$	Turn-On Delay Time	—	4.5	—	ns	$V_{DD} = 50V$
t_r	Rise Time	—	23	—		$I_D = 5.7A$
$t_{d(off)}$	Turn-Off Delay Time	—	32	—		$R_G = 22\Omega$
t_f	Fall Time	—	23	—		$R_D = 8.6\Omega$, See Fig. 10 ④ ⑥
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact ⑤
L_S	Internal Source Inductance	—	7.5	—		
C_{iss}	Input Capacitance	—	330	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	92	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	54	—		$f = 1.0MHz$, See Fig. 5 ⑥



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	9.4	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ① ⑥	—	—	38		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 5.5A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	99	150	ns	$T_J = 25^\circ\text{C}, I_F = 5.7A$
Q_{rr}	Reverse Recovery Charge	—	390	580	nC	$di/dt = 100A/\mu s$ ④ ⑥
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 $T_J = 25^\circ\text{C}$, $L = 4.7mH$
 $R_G = 25\Omega$, $I_{AS} = 5.7A$. (See Figure 12)
- ③ $I_{SD} \leq 5.7A$, $di/dt \leq 240A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 175^\circ\text{C}$
- ④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$
- ⑤ This is applied for I-PAK, L_S of D-PAK is measured between lead and center of die contact
- ⑥ Uses IRF520N 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

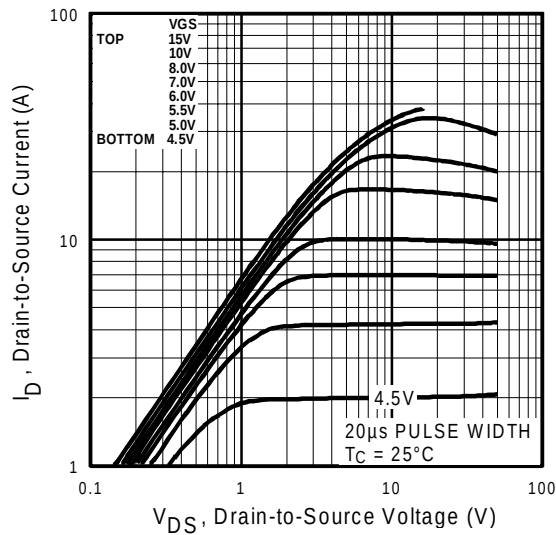


Fig 1. Typical Output Characteristics

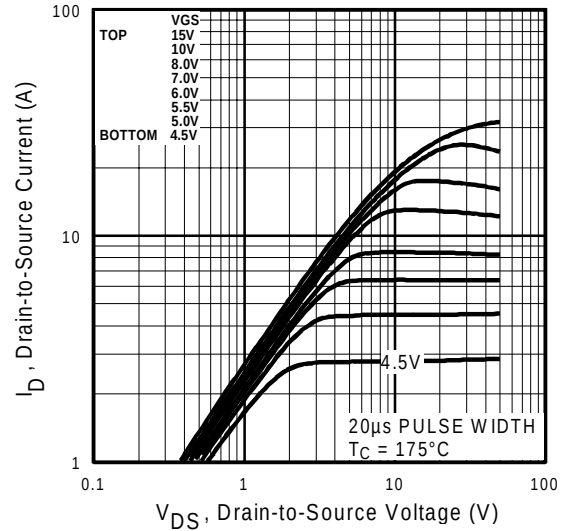


Fig 2. Typical Output Characteristics

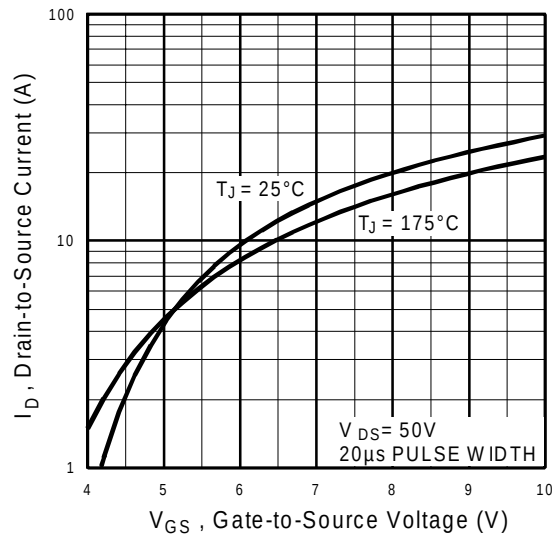


Fig 3. Typical Transfer Characteristics

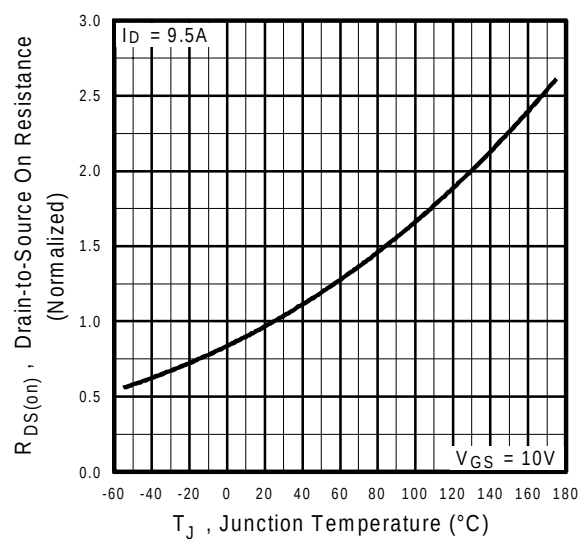
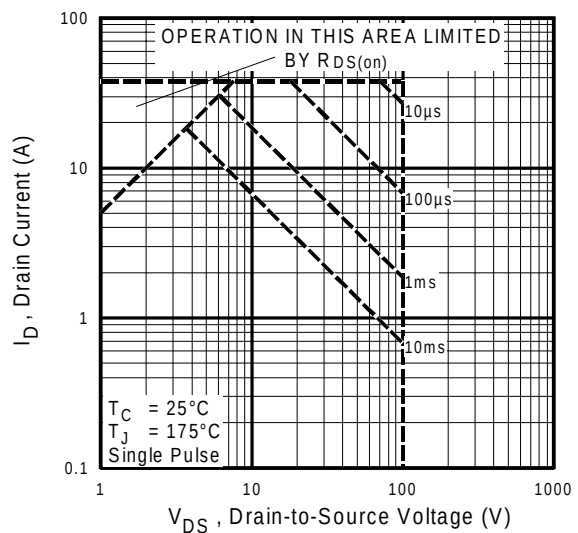
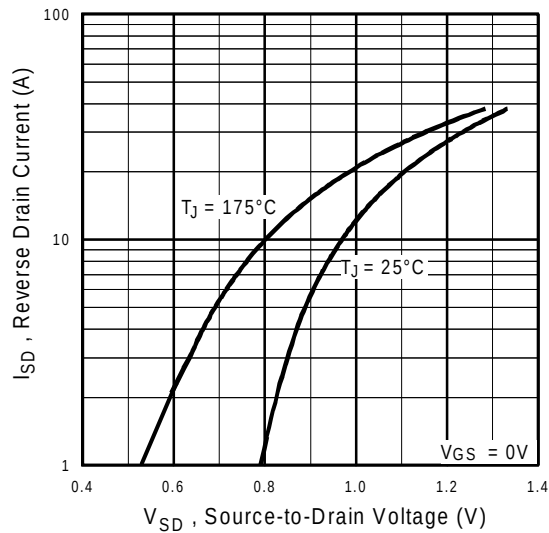
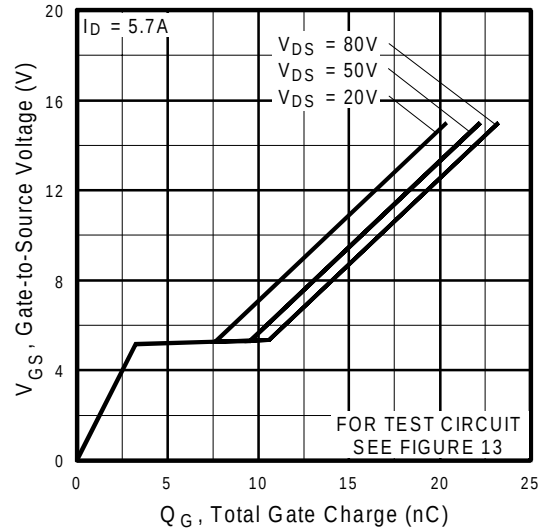
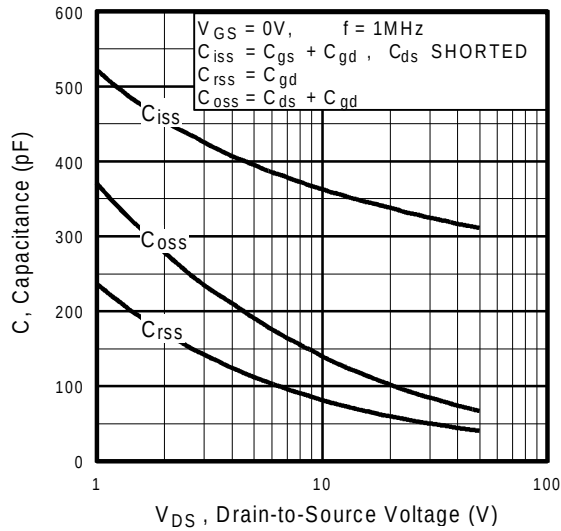


Fig 4. Normalized On-Resistance
Vs. Temperature



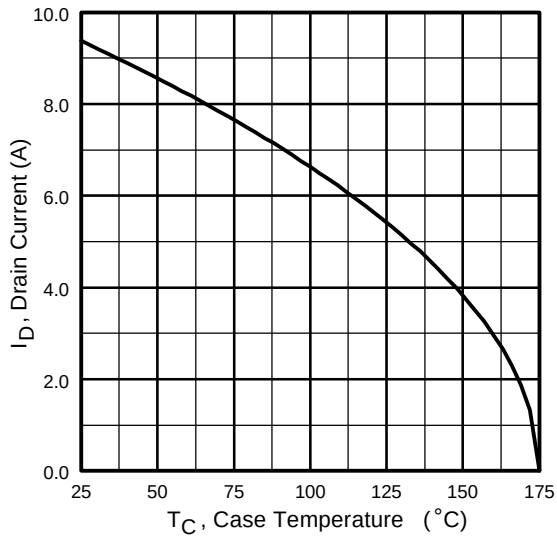


Fig 9. Maximum Drain Current Vs. Case Temperature

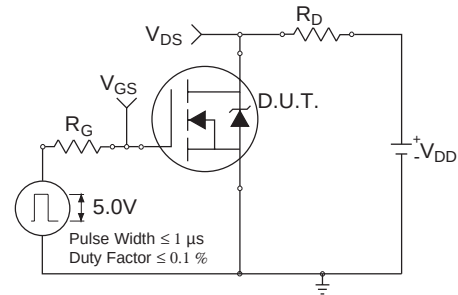


Fig 10a. Switching Time Test Circuit

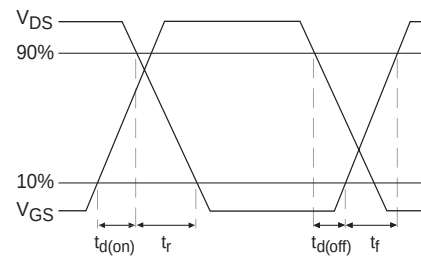


Fig 10b. Switching Time Waveforms

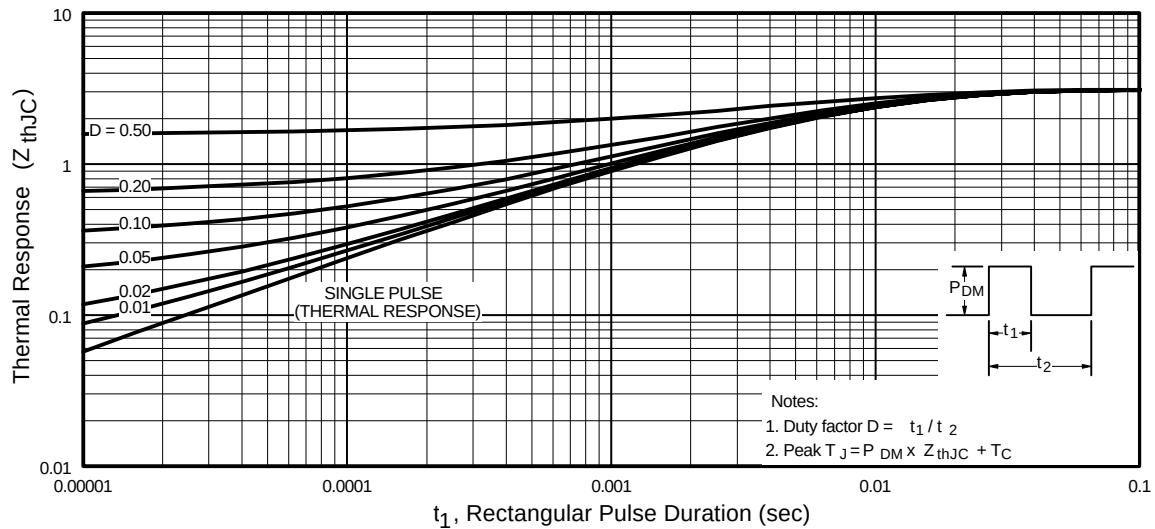


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

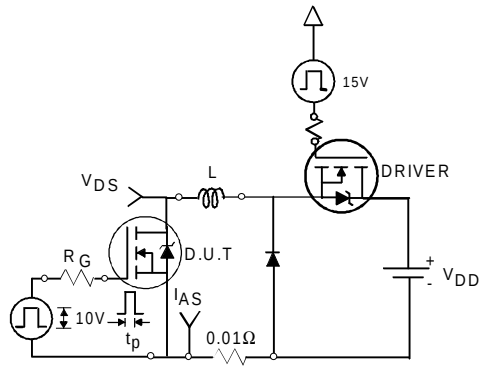


Fig 12a. Unclamped Inductive Test Circuit

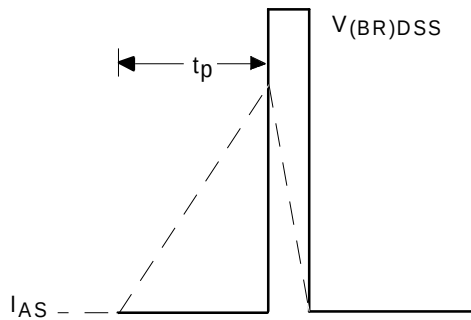


Fig 12b. Unclamped Inductive Waveforms

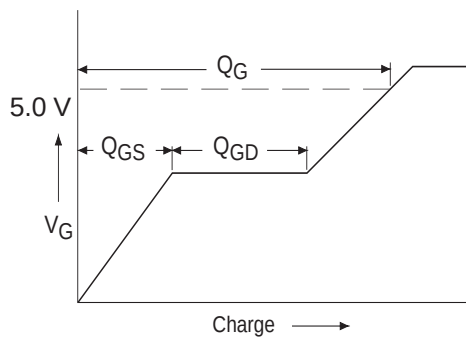


Fig 13a. Basic Gate Charge Waveform

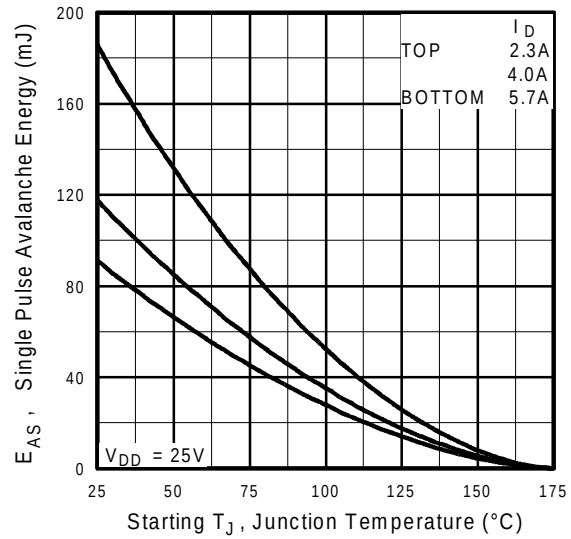


Fig 12c. Maximum Avalanche Energy
Vs. Drain Current

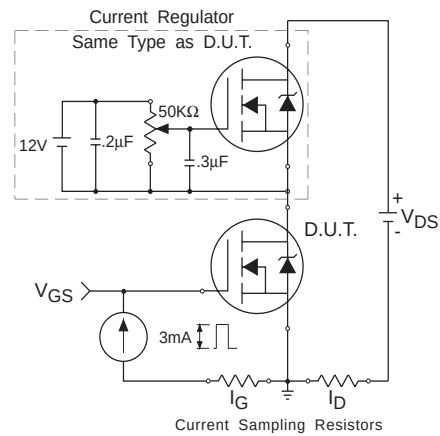


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

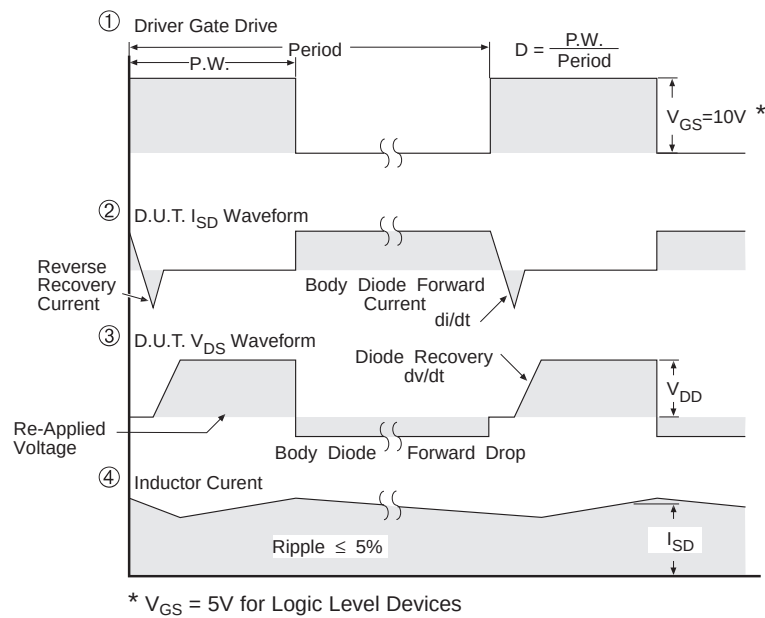
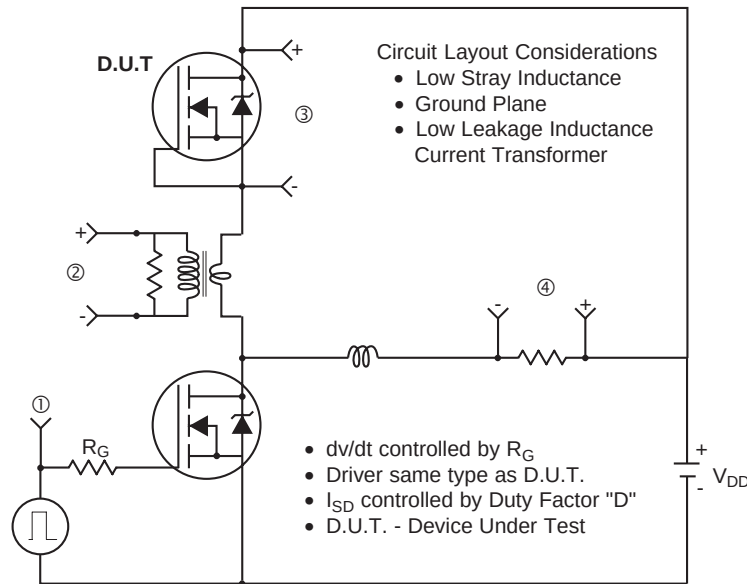
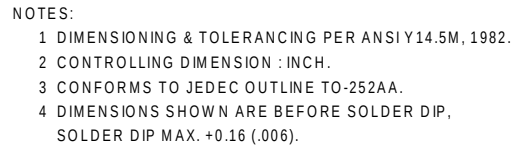


Fig 14. For N-Channel HEXFETS

International
IOR Rectifier

Dimensions are shown in millimeters (inches)



TO-252AA (D-PARK)

Diagram illustrating the marking on the IRFR120 MOSFET package:

- INTERNATIONAL RECTIFIER LOGO**: Points to the IR logo on the package.
- FIRST PORTION OF PART NUMBER**: Points to the 'IRFR' marking.
- IRFR120**: The main part number marking.
- SECOND PORTION OF PART NUMBER**: Points to the '120' marking.
- 9U 1P**: Markings indicating the assembly lot code.
- ASSEMBLY LOT CODE**: Points to the '9U 1P' markings.

TO-251AA Outline

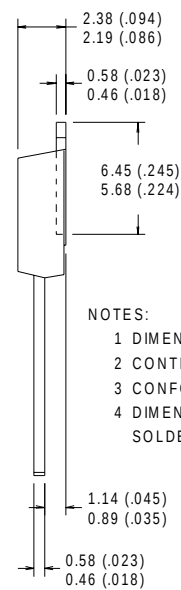
Technical drawing of a mechanical part, likely a valve or plug, showing dimensions in inches and millimeters. The drawing includes a top view with features 1, 2, and 3, and a side view with features 4 and 5. Dimensions are provided for various features, including diameters, radii, and lengths. A table at the bottom right lists material and finish specifications.

Dimensions (Inches / Millimeters):

- Top View:
 - Overall Width: 6.73 (.265) / 6.35 (.250)
 - Feature 1: 5.46 (.215) / 5.21 (.205)
 - Feature 2: 1.52 (.060) / 1.15 (.045)
 - Feature 3: 6.22 (.245) / 5.97 (.235)
 - Feature 4: 1.27 (.050) / 0.88 (.035)
 - Feature 5: 9.65 (.380) / 8.89 (.350)
 - Feature 6: 2.28 (.090) / 1.91 (.075)
 - Feature 7: 1.14 (.045) / 0.76 (.030)
 - Feature 8: 0.89 (.035) / 0.64 (.025)
- Side View:
 - Overall Height: 2.28 (.090)
 - Feature 9: 0.25 (.010)
 - Feature 10: 0.89 (.035) / 0.64 (.025)

Material and Finish Specifications:

Material	Finish	Material	Finish
M	A	M	B



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).

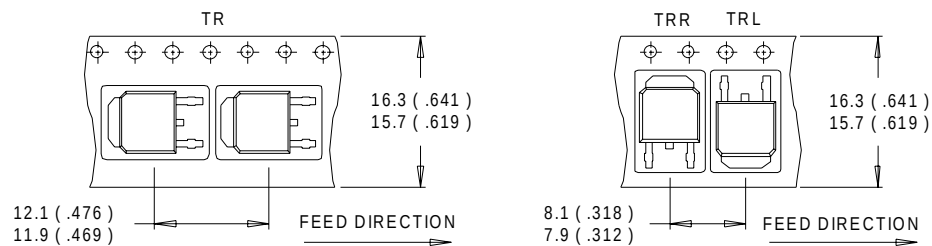
TO-251AA (I-PARK)

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

- INTERNATIONAL RECTIFIER LOGO**: Points to the 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.

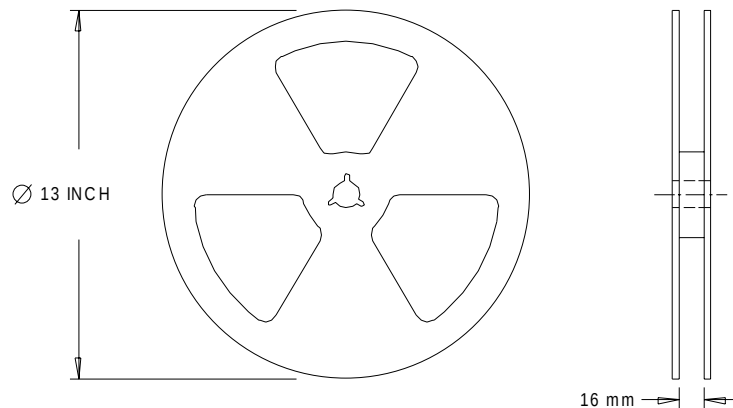
Tape & Reel Information

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.