

IRFR024NPbF IRFU024NPbF

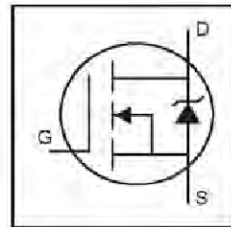
- Ultra Low On-Resistance
- Surface Mount (IRFR024N)
- Straight Lead (IRFU024N)
- Advanced Process Technology
- Fast Switching
- Fully Avalanche Rated
- Lead-Free

Description

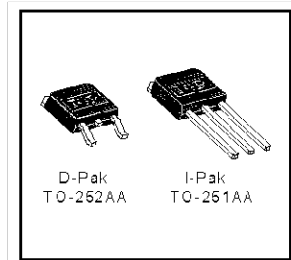
Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve the lowest possible on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer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

HEXFET® Power MOSFET



$V_{DS} = 55V$
$R_{DS(on)} = 0.075\Omega$
$I_D = 17A$



Absolute Maximum Ratings

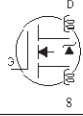
	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	17	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	12	
I_{DM}	Pulsed Drain Current ①⑥	68	
$P_D @ T_C = 25^\circ C$	Power Dissipation	45	W
	Linear Derating Factor	0.30	WPC
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ②⑥	71	mJ
I_{AR}	Avalanche Current ①	10	A
E_{AR}	Repetitive Avalanche Energy ①	4.5	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑥	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

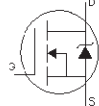
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	---	3.3	°C/W
$R_{\theta JA}$	Case-to-Ambient (PCB mount)**	---	50	
$R_{\theta JA}$	Junction-to-Ambient	---	110	

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

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

Parameter	Min.	Typ.	Max.	Units	Conditions	
$V_{(BR)DSS}$	55	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$	
$\Delta V_{(ER)DSS}/\Delta T_J$	—	0.052	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1mA$	
$R_{DS(on)}$	—	—	0.075	Ω	$V_{GS} = 10V, I_D = 10A$ ④	
$V_{GS(th)}$	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$	
g_{fs}	4.5	—	—	S	$V_{DS} = 25V, I_D = 10A$ ⑥	
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	—	—	20	nC	$I_D = 10A$
Q_{gs}	Gate-to-Source Charge	—	—	5.3		$V_{DS} = 44V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	7.6		$V_{GS} = 10V$, See Fig. 6 and 13 ④⑥
$t_{d(on)}$	Turn-On Delay Time	—	4.9	—	ns	$V_{DD} = 28V$
t_r	Rise Time	—	34	—		$I_D = 10A$
$t_{d(off)}$	Turn-Off Delay Time	—	19	—		$R_G = 24\Omega$
t_f	Fall Time	—	27	—		$R_D = 2.6\Omega$, See Fig. 10 ④
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	—	370	—	pF	$V_{GS} = 0V$
C_{OSS}	Output Capacitance	—	140	—		$V_{DS} = 25V$
C_{RSS}	Reverse Transfer Capacitance	—	65	—		$f = 1.0MHz$, See Fig. 5

Source-Drain Ratings and Characteristics

Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	—	—	17 ⑤	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	—	—	68		
V_{SD}	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 10A, V_{GS} = 0V$ ④
t_{rr}	—	56	83	ns	$T_J = 25^\circ\text{C}, I_F = 10A$
Q_{rr}	—	120	180	nC	$di/dt = 100A/\mu s$ ③⑥
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 $T_J = 25^\circ\text{C}$, $L = 1.0mH$
 $R_G = 25\Omega, I_{AS} = 10A$. (See Figure 12)
- ③ $I_{SD} \leq 10A, di/dt \leq 280A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_c \leq 175^\circ\text{C}$

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 IRFZ24N data and test conditions.

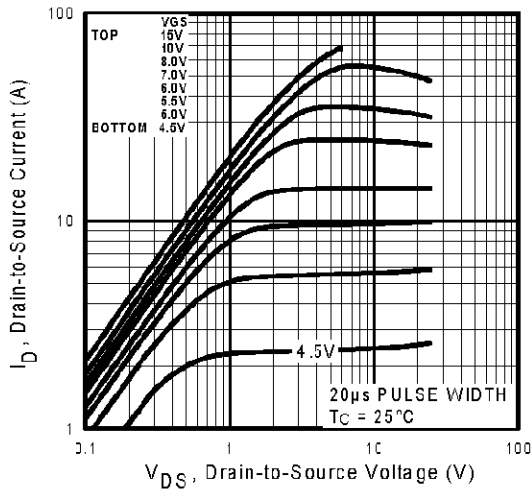


Fig 1. Typical Output Characteristics

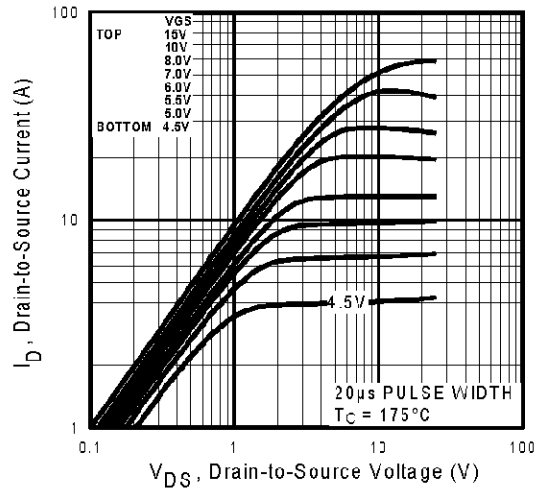


Fig 2. Typical Output Characteristics

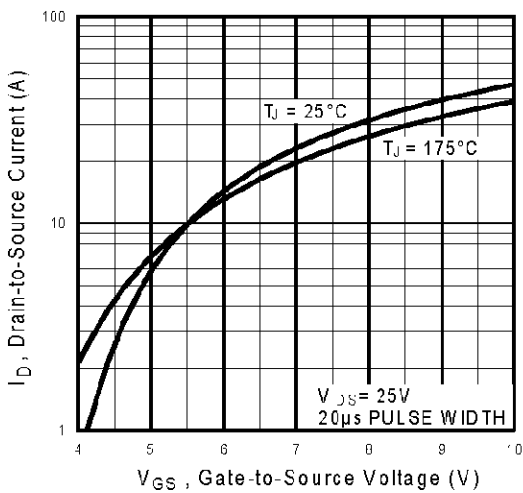


Fig 3. Typical Transfer Characteristics

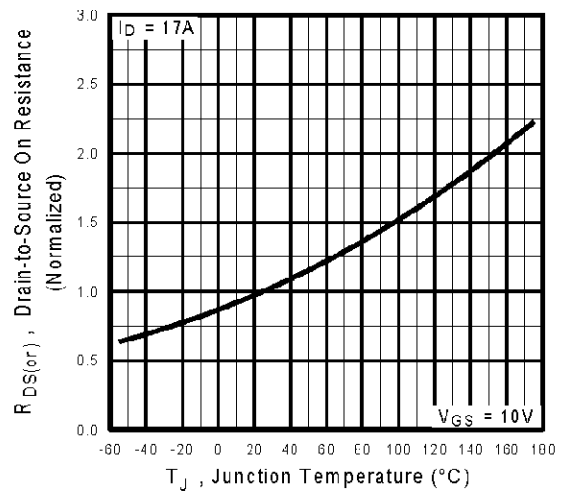


Fig 4. Normalized On-Resistance Vs. Temperature

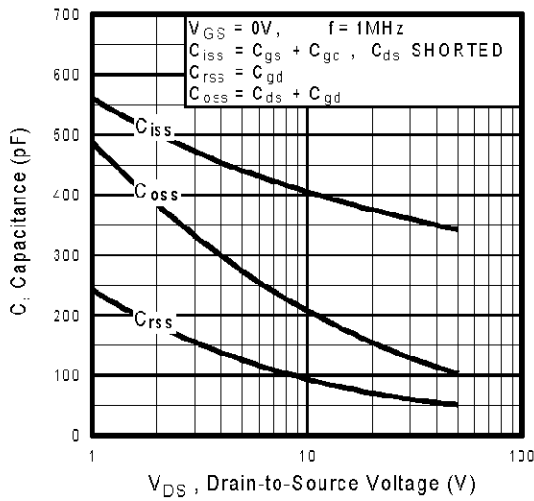


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

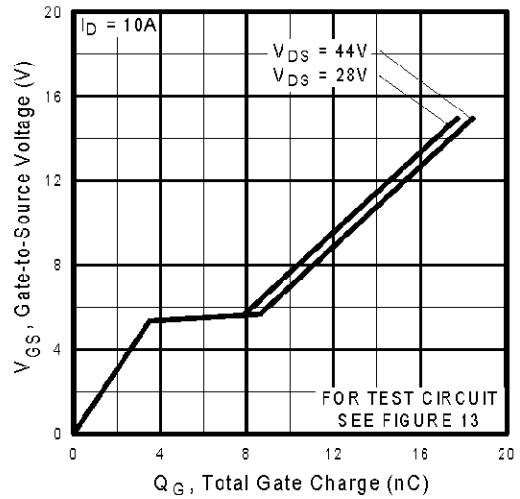


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

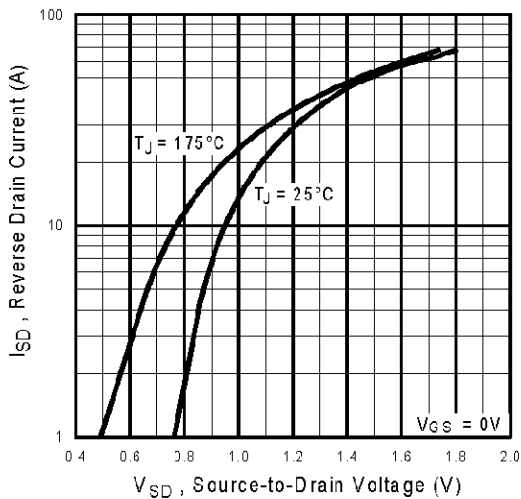


Fig 7. Typical Source-Drain Diode Forward Voltage

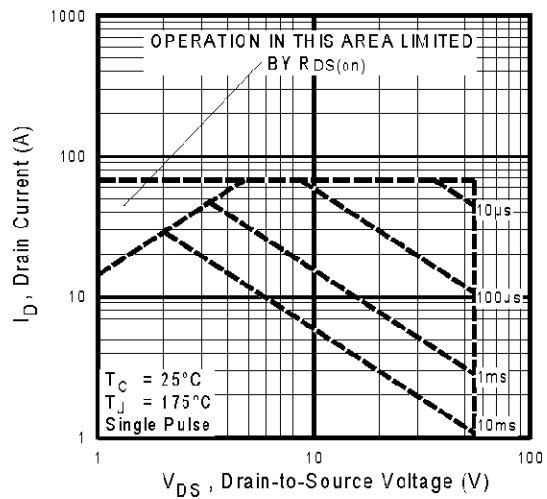


Fig 8. Maximum Safe Operating Area

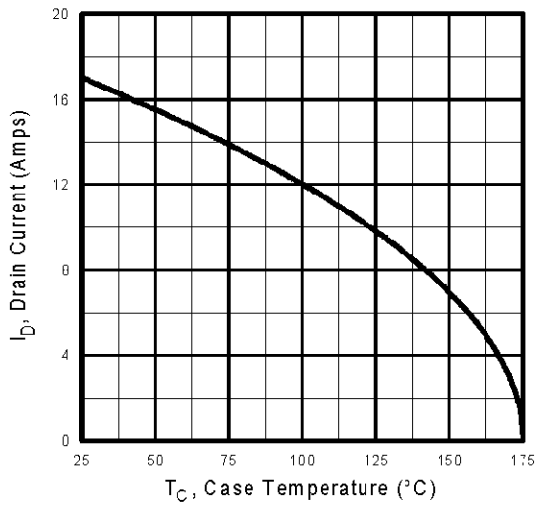


Fig 9. Maximum Drain Current Vs. Case Temperature

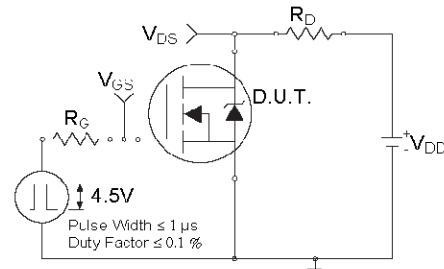


Fig 10a. Switching Time Test Circuit

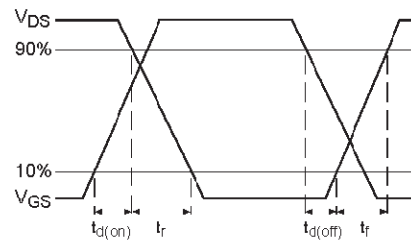


Fig 10b. Switching Time Waveforms

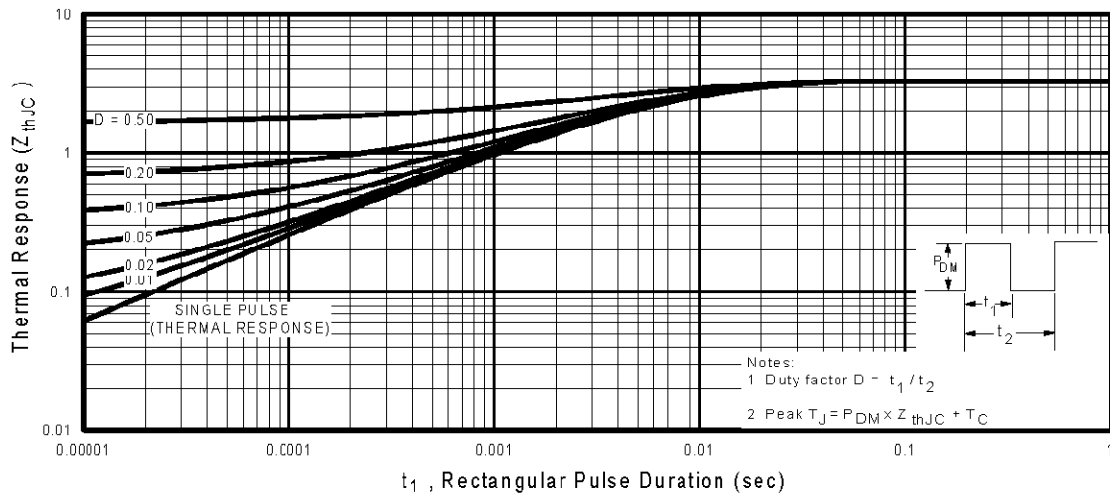


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

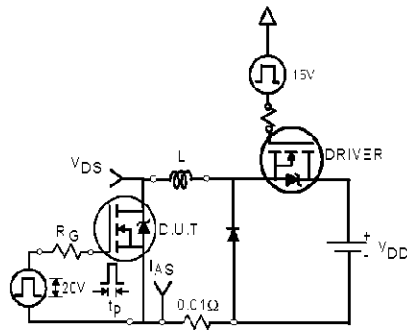


Fig 12a. Unclamped Inductive Test Circuit

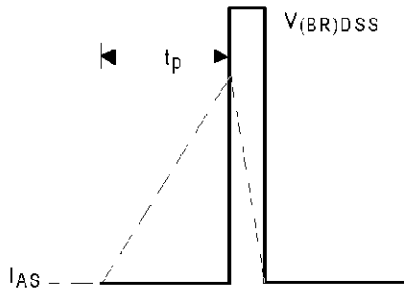


Fig 12b. Unclamped Inductive Waveforms

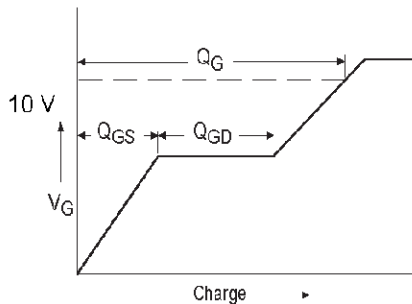


Fig 13a. Basic Gate Charge Waveform

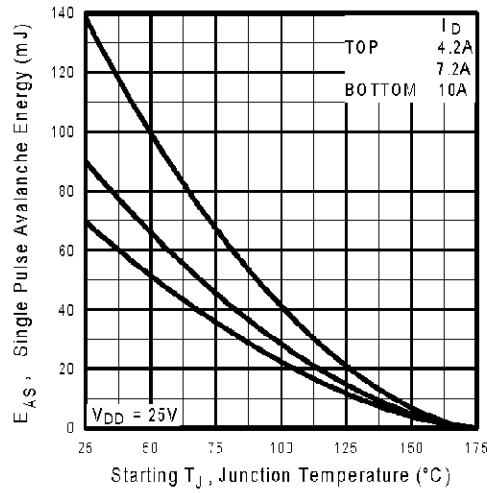


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

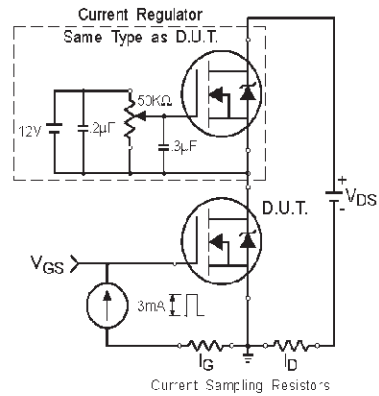
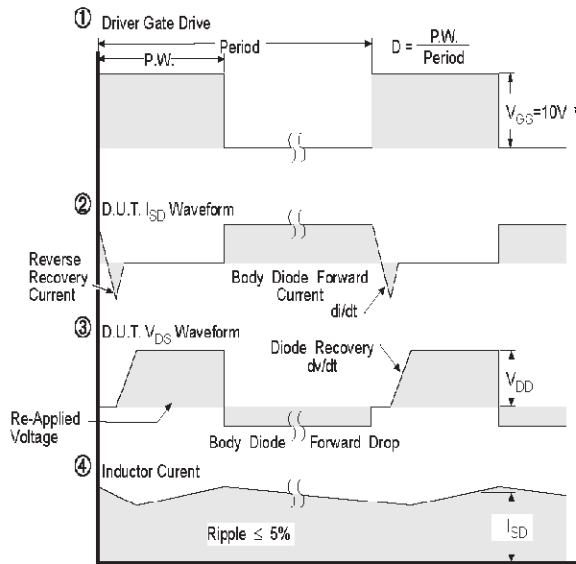
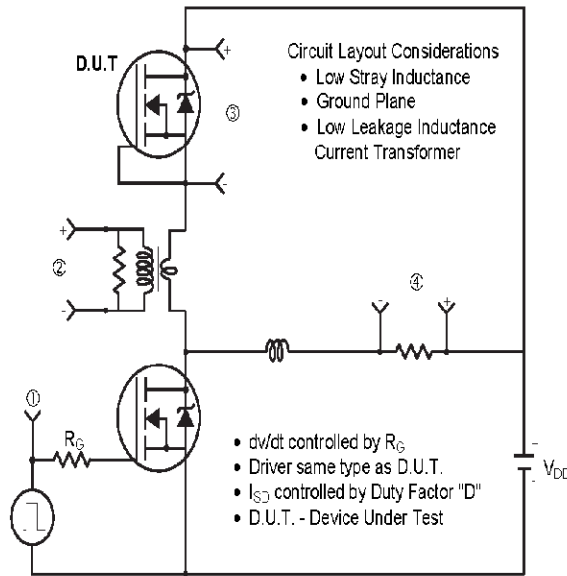


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

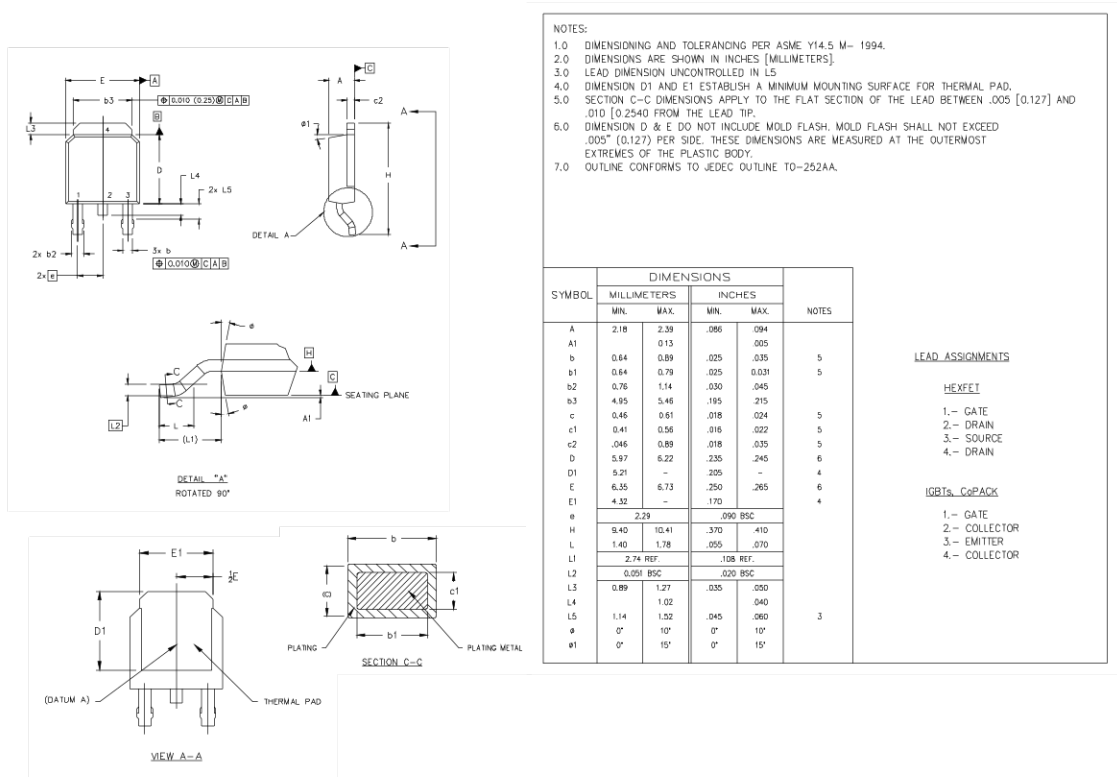
Fig 14. For N-Channel HEXFETS

IRFR/U024NPbF

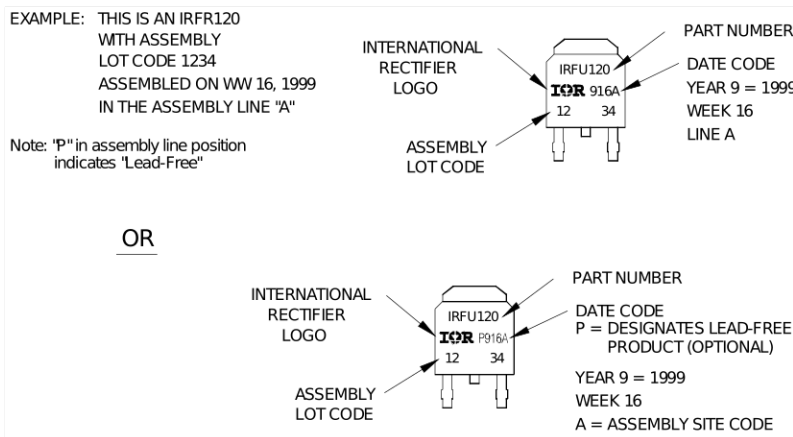


D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



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

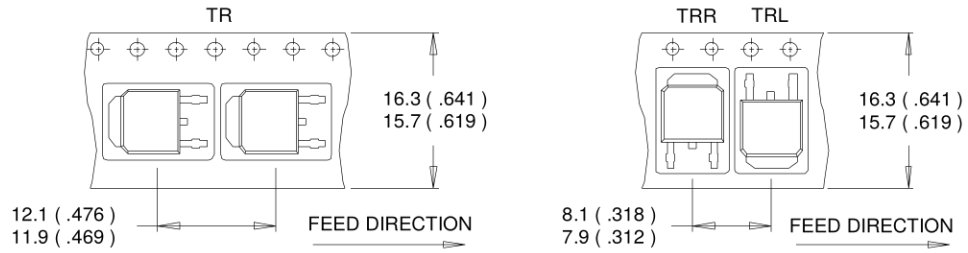


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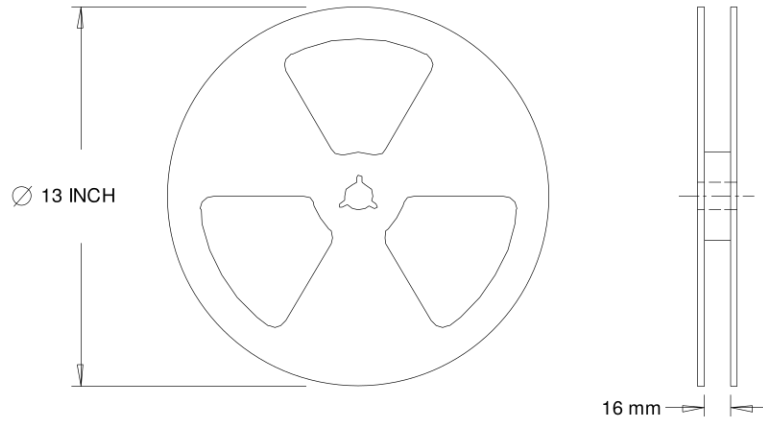
D-Pak (TO-252AA) Tape & Reel Information

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.

Data and specifications subject to change without notice.

International
IR Rectifier

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