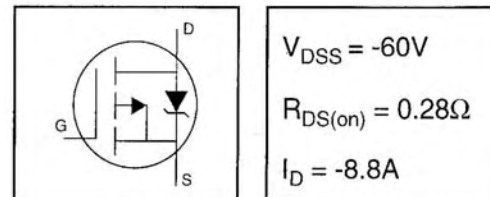


IRFR9024PbF

IRFU9024PbF

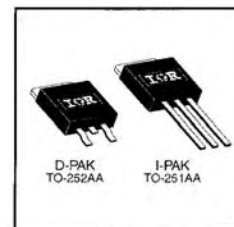
- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Surface Mount (IRFR9024)
- Straight Lead (IRFU9024)
- Available in Tape & Reel
- P-Channel
- Fast Switching
- Lead-Free



Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

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.



Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10\text{ V}$	-8.8	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10\text{ V}$	-5.6	
I_{DM}	Pulsed Drain Current ①	-35	
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation	42	W
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation (PCB Mount)**	2.5	
	Linear Derating Factor	0.33	$\text{W}/^\circ\text{C}$
	Linear Derating Factor (PCB Mount)**	0.020	
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ②	300	mJ
I_{AR}	Avalanche Current ①	-8.8	A
E_{AR}	Repetitive Avalanche Energy ①	5.0	mJ
dv/dt	Peak Diode Recovery dv/dt ③	-4.5	V/ns
T_J, T_{STG}	Junction and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
	Soldering Temperature, for 10 seconds	260 (1.6mm from case)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	3.0	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient (PCB mount)**	—	—	50	
$R_{\theta JA}$	Junction-to-Ambient	—	—	110	

** When mounted on 1" square PCB (FR-4 or G-10 Material).

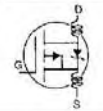
For recommended footprint and soldering techniques refer to application note #AN-994.

IRFR/U9024PbF

International
IR Rectifier

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

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	-60	—	—	V	$V_{GS}=0V, I_D=-250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	-0.063	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D=-1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.28	Ω	$V_{GS}=-10V, I_D=-5.3A$ 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	2.9	—	—	S	$V_{DS}=-25V, I_D=-5.3A$ ④
I_{DSS}	Drain-to-Source Leakage Current	—	—	-100	μA	$V_{DS}=-60V, V_{GS}=0V$
		—	—	-500		$V_{DS}=-48V, V_{GS}=0V, T_J=125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	-100	nA	$V_{DS}=-20V$
	Gate-to-Source Reverse Leakage	—	—	100		$V_{GS}=20V$
Q_g	Total Gate Charge	—	—	19	nC	$I_D=-11A$
Q_{gs}	Gate-to-Source Charge	—	—	5.4		$V_{DS}=-48V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	11		$V_{GS}=-10V$ ④
$t_{d(on)}$	Turn-On Delay Time	—	13	—		$V_{DD}=-30V$
t_r	Rise Time	—	68	—	ns	$I_D=-11A$
$t_{d(off)}$	Turn-Off Delay Time	—	15	—		$R_G=18\Omega$
t_f	Fall Time	—	29	—		$R_D=2.5\Omega$ ④
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6 mm (0.25in.) from package and center of die contact
L_S	Internal Source Inductance	—	7.5	—		
C_{iss}	Input Capacitance	—	570	—	pF	$V_{GS}=0V$
C_{oss}	Output Capacitance	—	360	—		$V_{DS}=-25V$
C_{rss}	Reverse Transfer Capacitance	—	65	—		$f=1.0\text{MHz}$



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	—	—	-8.8	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	-35		
V_{SD}	Diode Forward Voltage	—	—	-6.3	V	$T_J=25^\circ\text{C}, I_S=-8.8A, V_{GS}=0V$ ④
t_{rr}	Reverse Recovery Time	—	100	200	ns	$T_J=25^\circ\text{C}, I_F=-11A$
Q_{rr}	Reverse Recovery Charge	—	0.32	0.64	μC	$di/dt=100A/\mu s$ ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

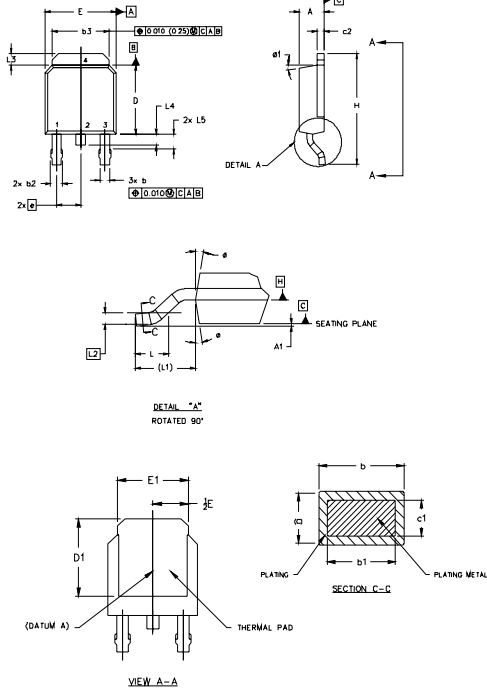
- ① Repetitive rating; pulse width limited by max. junction temperature
- ② $V_{DD}=-25V$, starting $T_J=25^\circ\text{C}$, $L=4.5\text{mH}$, $R_G=25\Omega$, $I_{AS}=-8.8A$
- ③ $I_{SD}\leq 11A$, $di/dt\leq 140A/\mu s$, $V_{DD}\leq V_{(BR)DSS}$, $T_J\leq 150^\circ\text{C}$
- ④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.

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D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



- NOTES:
- 1.0 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
 - 2.0 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
 - 3.0 LEAD DIMENSION UNCONTROLLED IN L5
 - 4.0 DIMENSION D1 AND E1 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
 - 5.0 SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 [0.127] AND .010 [0.254] FROM THE LEAD TIP.
 - 6.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
 - 7.0 OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.59	.086	.104	
A1		0.15		.005	
b	0.64	0.89	.025	.035	5
b1	0.64	0.79	.025	0.031	5
b2	0.76	1.14	.030	.045	
b3	4.95	5.46	.195	.215	
c	0.46	0.61	.018	.024	5
c1	0.41	0.56	.016	.022	5
c2	.046	0.69	.018	.035	5
D	5.97	6.22	.235	.245	6
D1	5.21	-	.205	-	4
E	6.35	6.73	.250	.265	6
E1	4.32	-	.170	-	4
e	2.29		.090 BSC		
H	9.40	10.41	.370	.410	
L	1.40	1.78	.055	.070	
L1	2.74 REF.		.108 REF.		
L2	0.051 BSC		.020 BSC		
L3	0.89	1.27	.035	.050	
L4	1.14	1.02	.040	.040	
L5	1.14	1.52	.045	.060	3
ø	0"	10"	0"	10"	
ø1	0"	15"	0"	15"	

LEAD ASSIGNMENTS

HEXFET

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

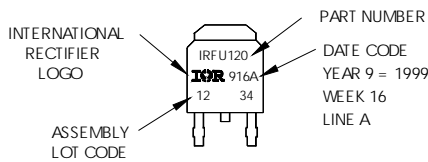
IGBTs, CoPACK

- 1- GATE
- 2- COLLECTOR
- 3- EMITTER
- 4- COLLECTOR

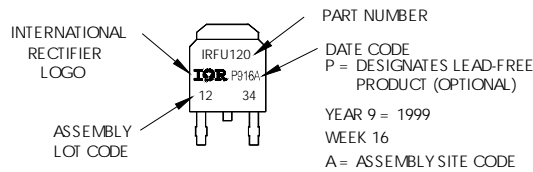
D-Pak (TO-252AA) Part Marking Information

EXAMPLE: THIS IS AN IRFR120
WITH ASSEMBLY
LOT CODE 1234
ASSEMBLED ON WW16, 1999
IN THE ASSEMBLY LINE "A"

Note: "P" in assembly line position
indicates "Lead-Free"



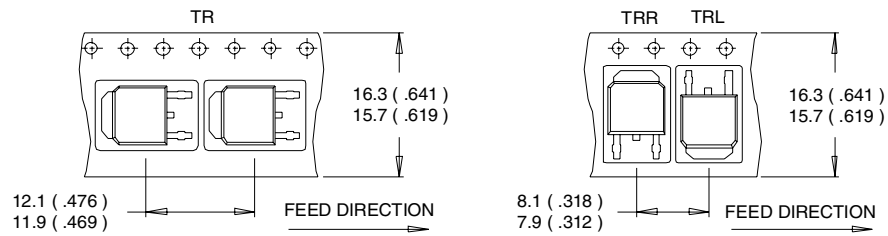
OR



IRFR/U9024PbF

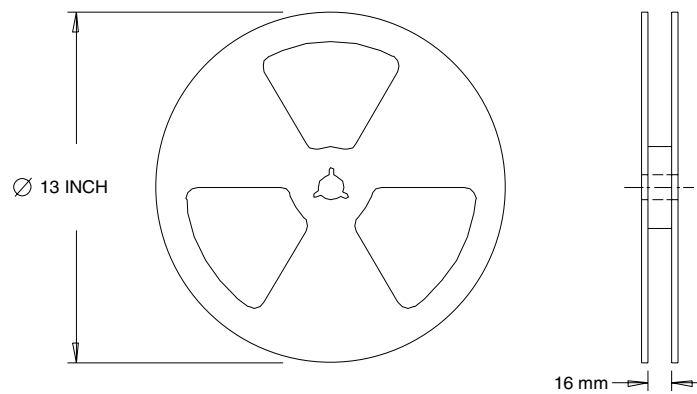
D-Pak (TO-252AA) Tape & Reel Information

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.