

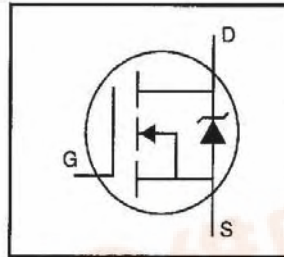
International Rectifier

PD - 95360A

IRLR014PbF IRLU014PbF

HEXFET® Power MOSFET

- Dynamic dv/dt Rating
- Surface Mount (IRLR014)
- Straight Lead (IRLU014)
- Available in Tape & Reel
- Logic-Level Gate Drive
- R_{DS(on)} Specified at V_{GS}=4V & 5V
- Fast Switching
- Lead-Free

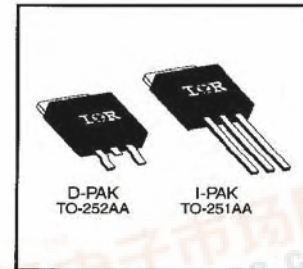


$V_{DSS} = 60V$
 $R_{DS(on)} = 0.20\Omega$
 $I_D = 7.7A$

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
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 5.0 V$	7.7
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 5.0 V$	4.9
I_{DM}	Pulsed Drain Current ①	31
$P_D @ T_C = 25^\circ C$	Power Dissipation	25
$P_D @ T_A = 25^\circ C$	Power Dissipation (PCB Mount)**	2.5
	Linear Derating Factor	0.20
	Linear Derating Factor (PCB Mount)**	0.020
V_{GS}	Gate-to-Source Voltage	± 10
E_{AS}	Single Pulse Avalanche Energy ②	47
dv/dt	Peak Diode Recovery dv/dt ③	4.5
T_J, T_{STG}	Junction and Storage Temperature Range	-55 to +150
	Soldering Temperature, for 10 seconds	260 (1.6mm from case)

Thermal Resistance

Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	5.0	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB mount)**	—	50	
$R_{\theta JA}$	Junction-to-Ambient	—	110	

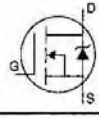
** When mounted on 1" square PCB (FR-4 or G-10 Material).
For recommended footprint and soldering techniques refer to application note #AN-994.



Electrical Characteristics @ T_J = 25°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 = 250μA
ΔV _{(BR)DSS} /ΔT _J	Breakdown Voltage Temp. Coefficient	—	0.073	—	V/°C	Reference to 25°C, I _D = 1mA
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	—	0.20	Ω	V _{GS} =5.0V, I _D =4.6A ④
		—	—	0.28		V _{GS} =4.0V, I _D =3.9A ④
V _{GS(th)}	Gate Threshold Voltage	1.0	—	2.0	V	V _{DS} =V _{GS} , I _D = 250μA
g _{fs}	Forward Transconductance	3.4	—	—	S	V _{DS} =25V, I _D =4.6A ④
I _{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	V _{DS} =60V, V _{GS} =0V
		—	—	250		V _{DS} =48V, V _{GS} =0V, T _J =125°C
I _{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V _{GS} =10V
	Gate-to-Source Reverse Leakage	—	—	-100		V _{GS} =-10V
Q _g	Total Gate Charge	—	—	8.4	nC	I _D =10A
Q _{gs}	Gate-to-Source Charge	—	—	3.5		V _{DS} =48V
Q _{gd}	Gate-to-Drain ("Miller") Charge	—	—	6.0		V _{GS} =5.0V See Fig. 6 and 13 ④
t _{d(on)}	Turn-On Delay Time	—	9.3	—	ns	V _{DD} =30V
t _r	Rise Time	—	110	—		I _D =10A
t _{d(off)}	Turn-Off Delay Time	—	17	—		R _G =12Ω
t _f	Fall Time	—	26	—		R _D =2.8Ω See Figure 10 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	—	400	—	pF	V _{GS} =0V
C _{oss}	Output Capacitance	—	170	—		V _{DS} =25V
C _{rss}	Reverse Transfer Capacitance	—	42	—		f=1.0MHz See Figure 5

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I _S	Continuous Source Current (Body Diode)	—	—	7.7	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I _{SM}	Pulsed Source Current (Body Diode) ①	—	—	31		
V _{SD}	Diode Forward Voltage	—	—	1.6	V	T _J =25°C, I _S =7.7A, V _{GS} =0V ④
t _{rr}	Reverse Recovery Time	—	65	130	ns	T _J =25°C, I _F =10A
Q _{rr}	Reverse Recovery Charge	—	0.33	0.65	μC	di/dt=100A/μs 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 (See Figure 11)
- ② V_{DD}=25V, starting T_J=25°C, L=924μH, R_G=25Ω, I_{AS}=7.7A (See Figure 12)
- ③ I_{SD}≤10A, di/dt≤90A/μs, V_{DD}≤V_{(BR)DSS}, T_J≤150°C
- ④ Pulse width ≤ 300 μs; duty cycle ≤2%.

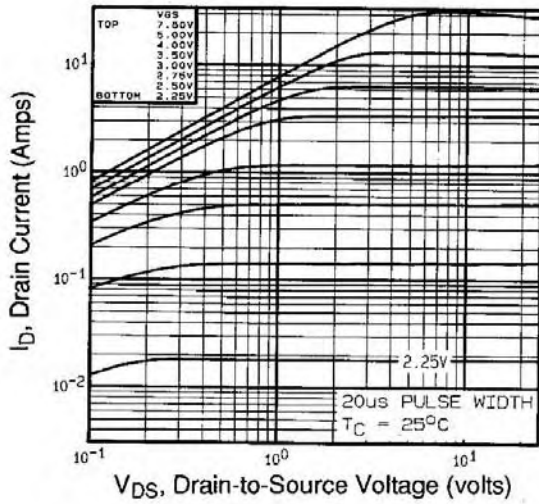


Fig 1. Typical Output Characteristics,
 $T_C=25^\circ\text{C}$

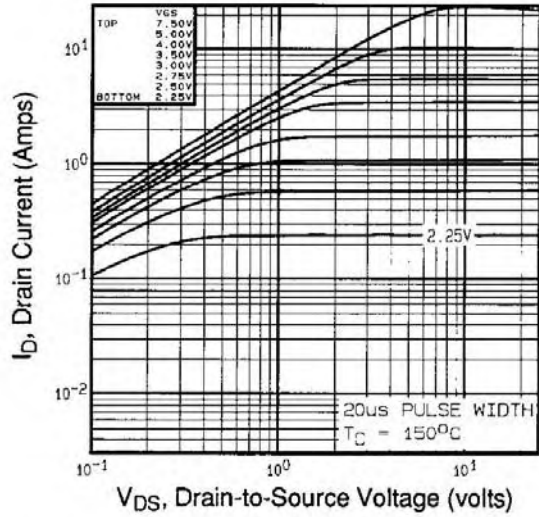


Fig 2. Typical Output Characteristics,
 $T_C=150^\circ\text{C}$

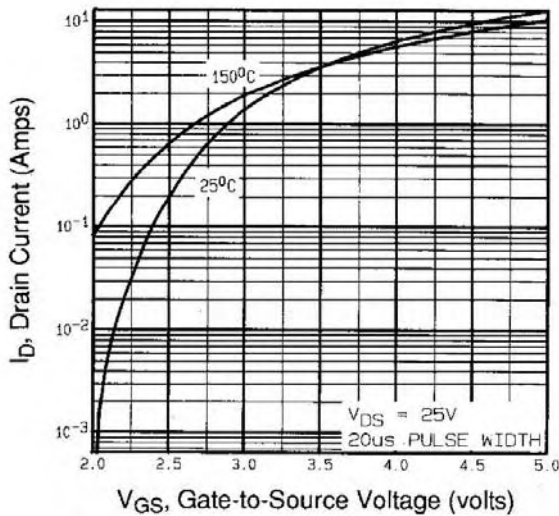


Fig 3. Typical Transfer Characteristics

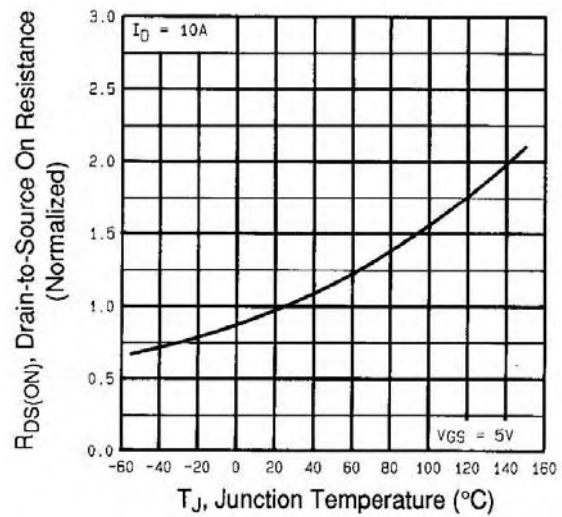


Fig 4. Normalized On-Resistance
 Vs. Temperature

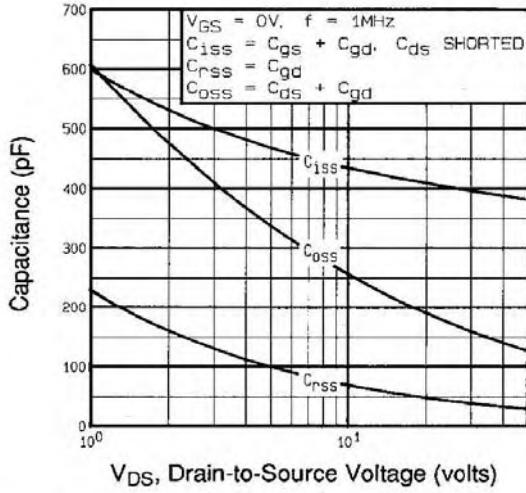


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

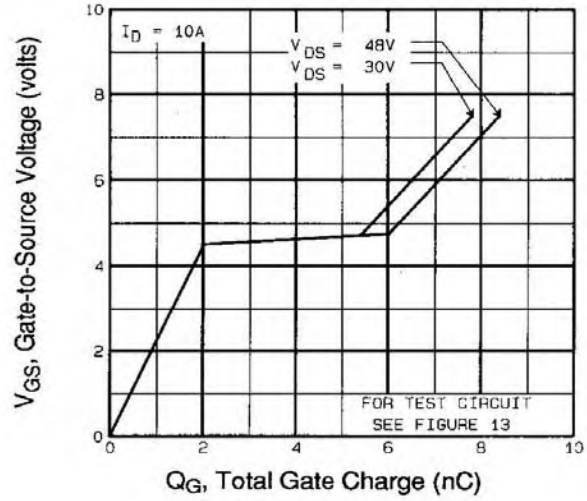


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

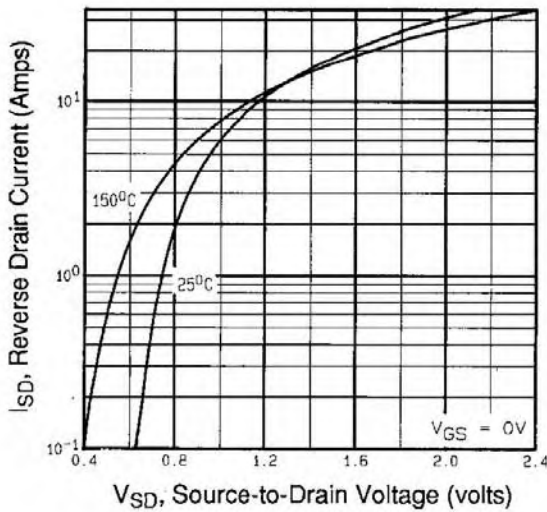


Fig 7. Typical Source-Drain Diode Forward Voltage

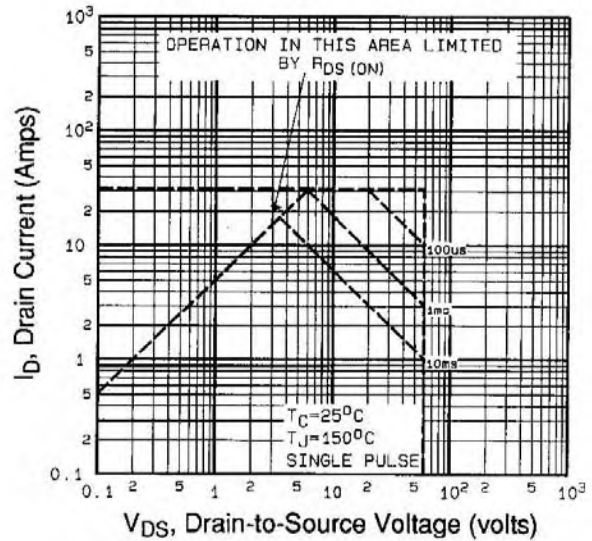


Fig 8. Maximum Safe Operating Area

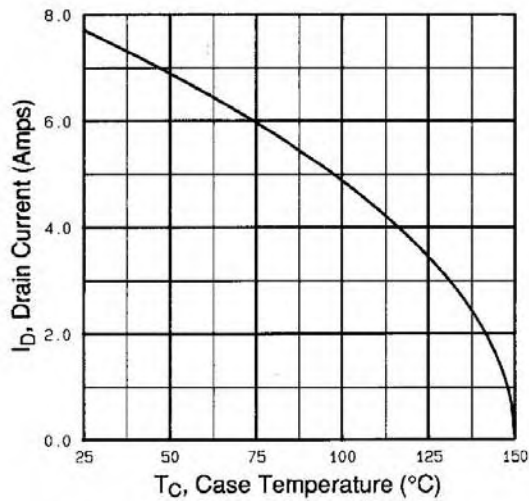


Fig 9. Maximum Drain Current Vs. Case Temperature

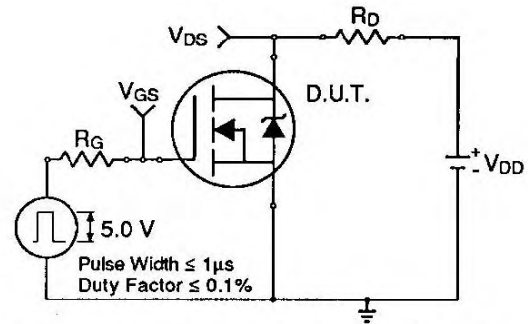


Fig 10a. Switching Time Test Circuit

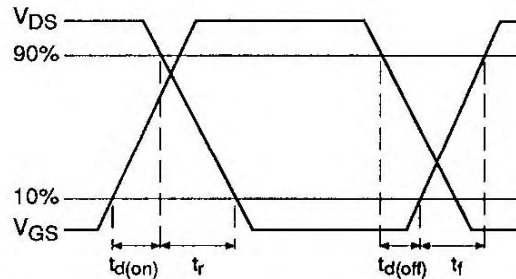


Fig 10b. Switching Time Waveforms

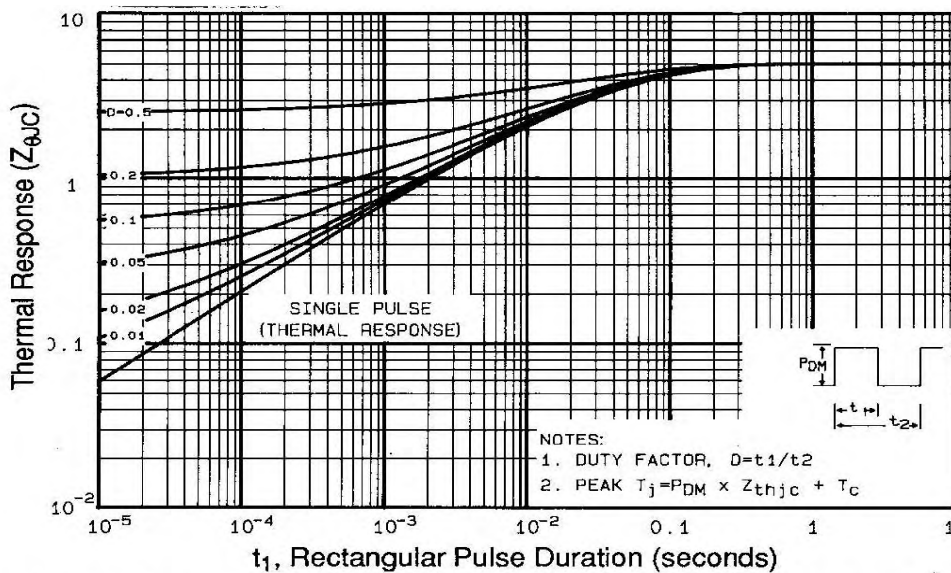


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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IR Rectifier

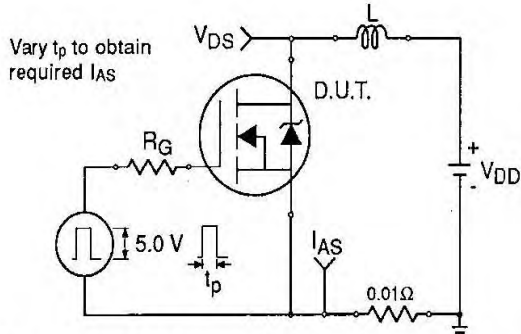


Fig 12a. Unclamped Inductive Test Circuit

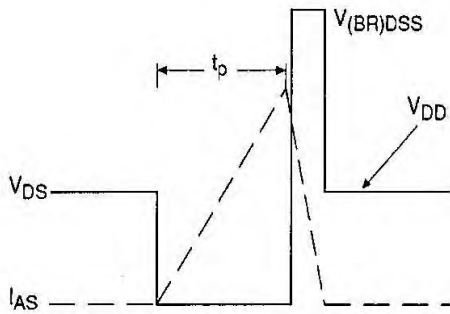


Fig 12b. Unclamped Inductive Waveforms

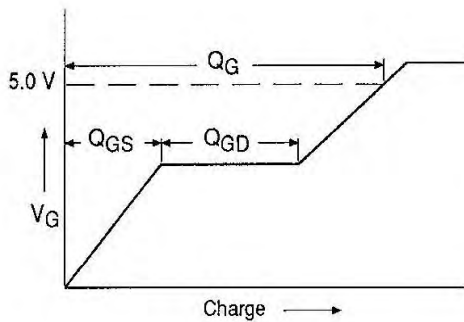


Fig 13a. Basic Gate Charge Waveform

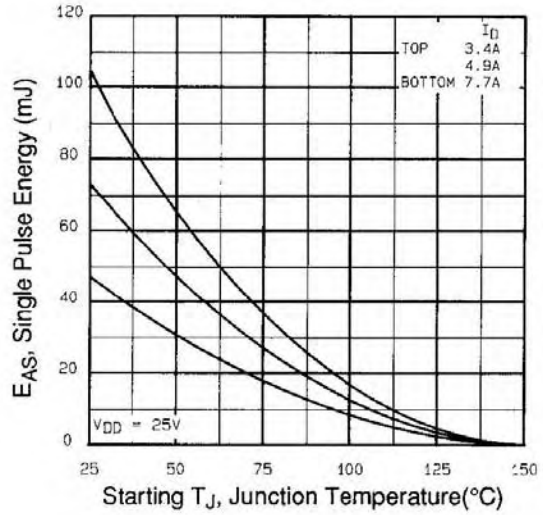


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

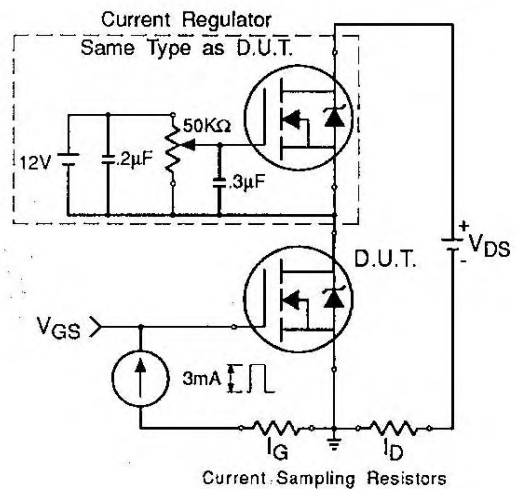
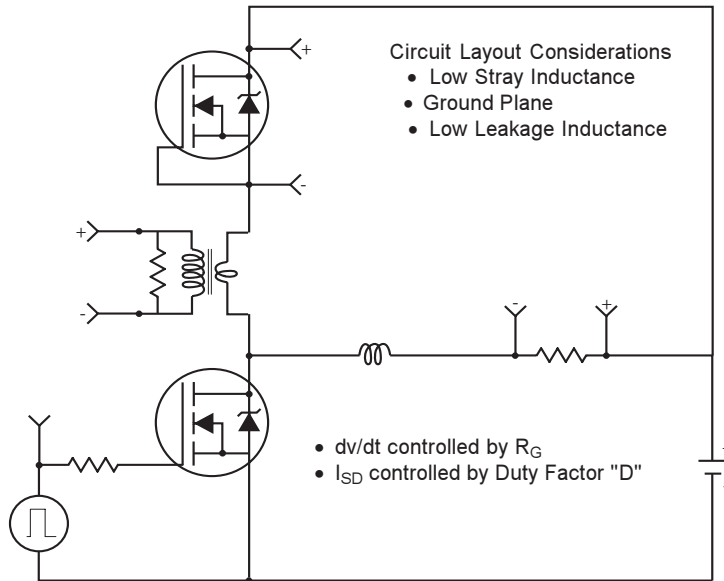
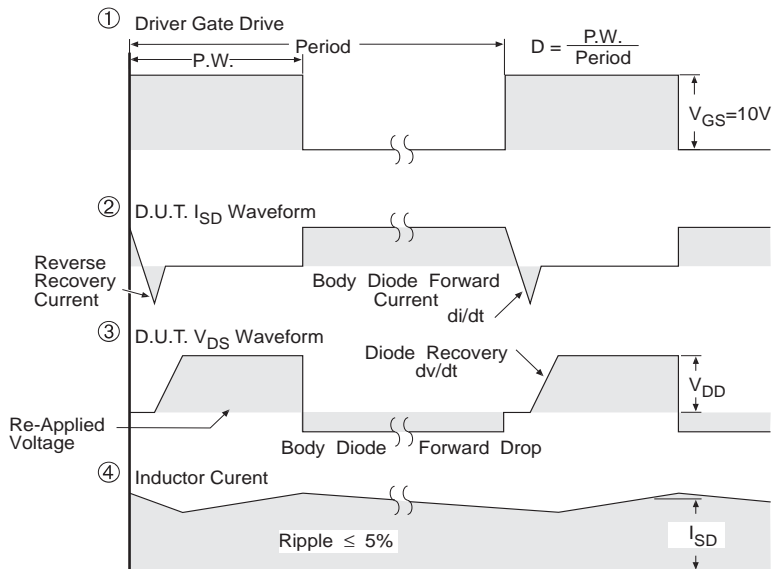


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



* Reverse Polarity for P-Channel



*** $V_{GS} = 5.0V$ for Logic Level and 3V Drive Devices

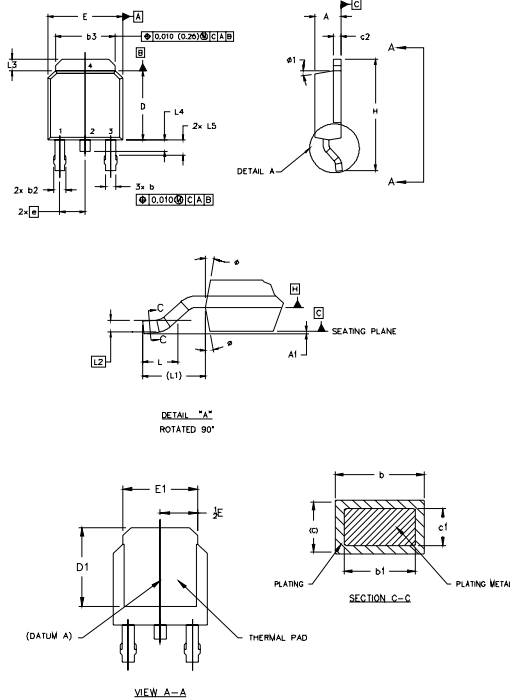
Fig 14 For N Channel HEXFETS

IRLR/U014PbF



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 [0.2540] 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	
A	2.18	2.39	.086 .094
A1	0.15	0.15	.059
b	0.64	0.89	.025 .035
b1	0.64	0.79	.025 0.031
b2	0.76	1.14	.030 .045
b3	4.95	5.46	.195 .215
c	0.46	0.61	.018 .024
c1	0.41	0.56	.016 .022
c2	.046	0.89	.018 .035
D	5.97	6.22	.235 .245
D1	5.21	-	.205
E	6.35	6.73	.250 .265
E1	4.32	-	.170
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	-	1.02	.040
L5	1.14	1.52	.045 .060
φ	0"	10"	0" 10"
φ1	0"	15"	0" 15"

LEAD ASSIGNMENTS

HEXFET

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

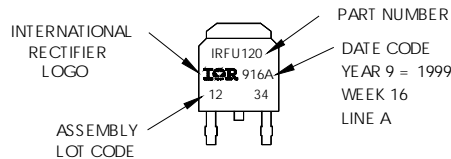
IGBTs, CoPACK

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

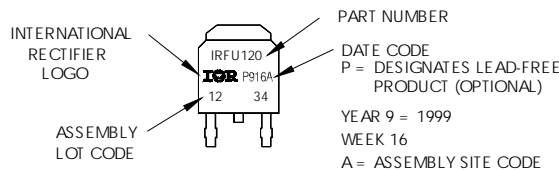
D-Pak (TO-252AA) Part Marking Information

EXAMPLE: THIS IS AN IRFR120 WITH ASSEMBLY LOT CODE 1234 ASSEMBLED ON VW 16, 1999 IN THE ASSEMBLY LINE "A"

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

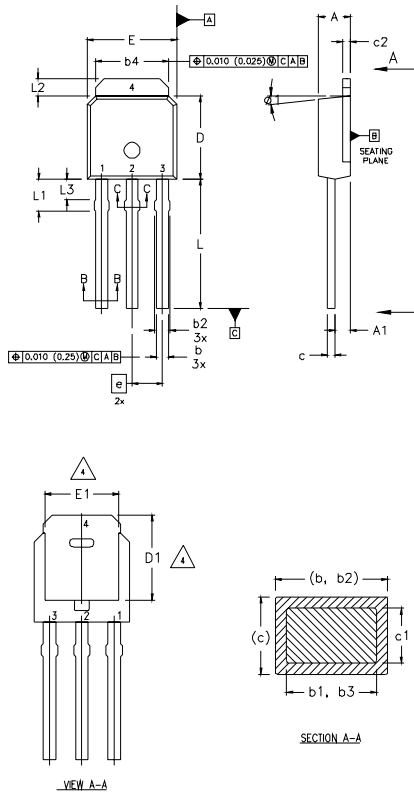


OR



I-Pak (TO-251AA) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- 1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- 3 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- 4 THERMAL PAD CONTOUR OPTION WITHIN DIMENSION b4, L2, E1 & D1.
- 5 LEAD DIMENSION UNCONTROLLED IN L3.
- 6 DIMENSION b1, b3 APPLY TO BASE METAL ONLY.
- 7 OUTLINE CONFORMS TO JEDEC OUTLINE TO-251AA.
- 8 CONTROLLING DIMENSION : INCHES.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	0.086	0.094	
A1	0.89	1.14	0.035	0.045	
b	0.64	0.89	0.025	0.035	
b1	0.64	0.79	0.025	0.031	4
b2	0.76	1.14	0.030	0.045	
b3	0.76	1.04	0.030	0.041	
b4	5.00	5.46	0.195	0.215	4
c	0.46	0.61	0.018	0.024	
c1	0.41	0.56	0.016	0.022	
c2	.046	0.86	0.018	0.035	3, 4
D	5.97	6.22	0.235	0.245	4
D1	5.21	-	0.205	-	4
E	6.35	6.73	0.250	0.265	3, 4
E1	4.32	-	0.170	-	4
e	2.29		0.090 BSC		
L	8.89	9.60	0.350	0.380	
L1	1.91	2.29	0.075	0.090	4
L2	0.89	1.27	0.035	0.050	5
L3	1.14	1.52	0.045	0.060	
ø1	Ø	15'	Ø	15'	

LEAD ASSIGNMENTS

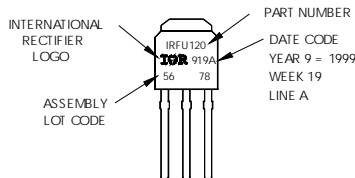
HEXFET

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

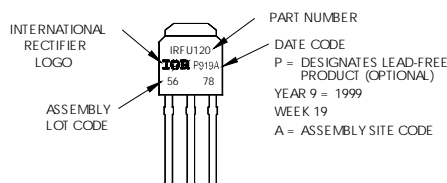
I-Pak (TO-251AA) Part Marking Information

EXAMPLE: THIS IS AN IRFU120
WITH ASSEMBLY
LOT CODE 5678
ASSEMBLED ON WW 19, 1999
IN THE ASSEMBLY LINE "A"

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



OR

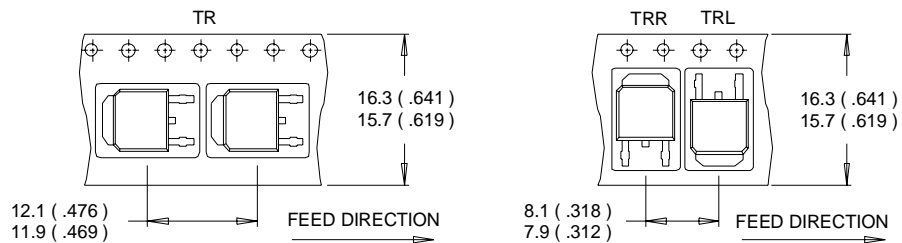


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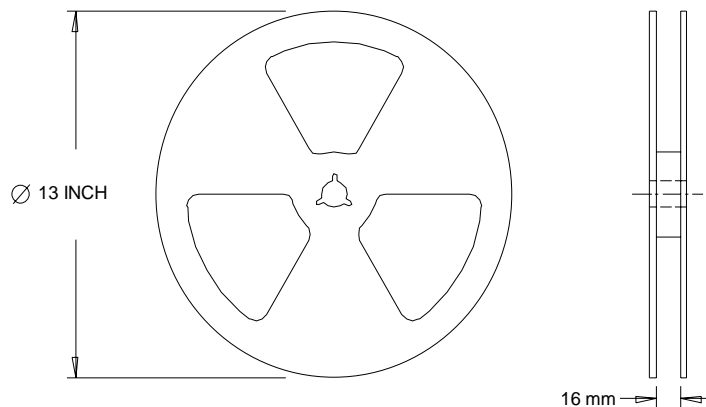
International
IR Rectifier

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.

Data and specifications subject to change without notice.

International
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TAC Fax: (310) 252-7903

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