

Applications

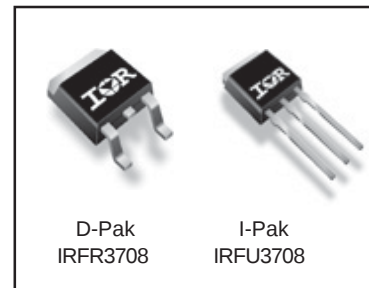
- High Frequency DC-DC Isolated Converters with Synchronous Rectification for Telecom and Industrial Use
- High Frequency Buck Converters for Computer Processor Power
- Lead-Free

Benefits

- Ultra-Low Gate Impedance
- Very Low $R_{DS(on)}$ at 4.5V V_{GS}
- Fully Characterized Avalanche Voltage and Current

HEXFET® Power MOSFET

V_{DSS}	$R_{DS(on)}$ max	I_D
30V	12.5m Ω	61A ^④



Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
V_{DS}	Drain-Source Voltage	30	V
V_{GS}	Gate-to-Source Voltage	± 12	V
I_D @ $T_A = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	61 ^④	A
I_D @ $T_A = 70^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	51 ^④	
I_{DM}	Pulsed Drain Current ^①	244	
P_D @ $T_A = 25^\circ\text{C}$	Maximum Power Dissipation ^③	87	W
P_D @ $T_A = 70^\circ\text{C}$	Maximum Power Dissipation ^③	61	W
	Linear Derating Factor	0.58	W/ $^\circ\text{C}$
T_J, T_{STG}	Junction and Storage Temperature Range	-55 to + 175	$^\circ\text{C}$

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.73	$^\circ\text{C/W}$
$R_{\theta JA}$	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

Notes ① through ④ are on page 9

www.irf.com

IRFR/U3708PbF

International
IR Rectifier

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.028	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	8.5	12.5	m Ω	$V_{GS} = 10V, I_D = 15A$ ③
		—	10.0	14.0		$V_{GS} = 4.5V, I_D = 12A$ ③
		—	15.0	30.0		$V_{GS} = 2.8V, I_D = 7.5A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	0.6	—	2.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 24V, V_{GS} = 0V$
		—	—	100		$V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{GS} = 12V$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{GS} = -12V$

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

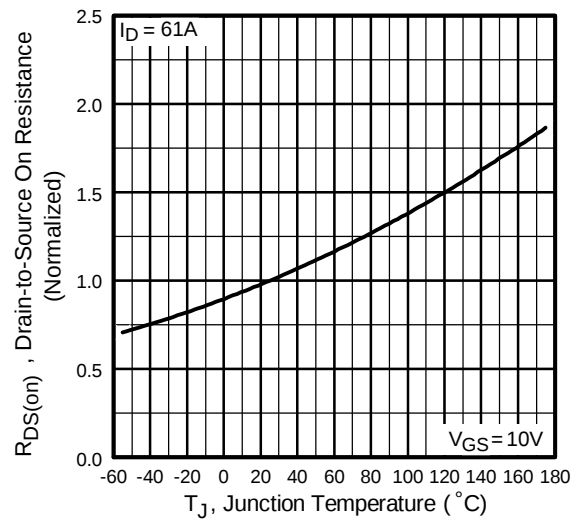
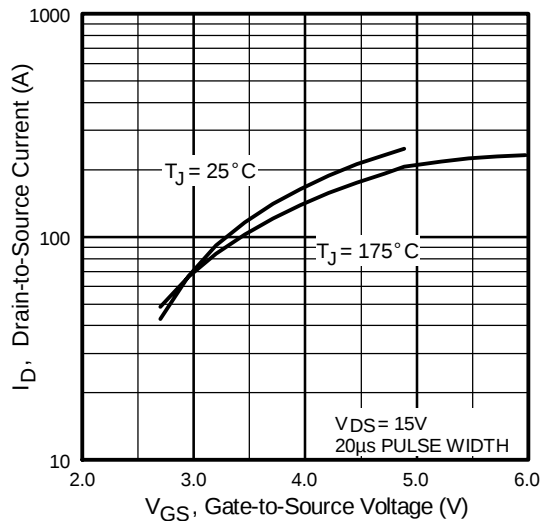
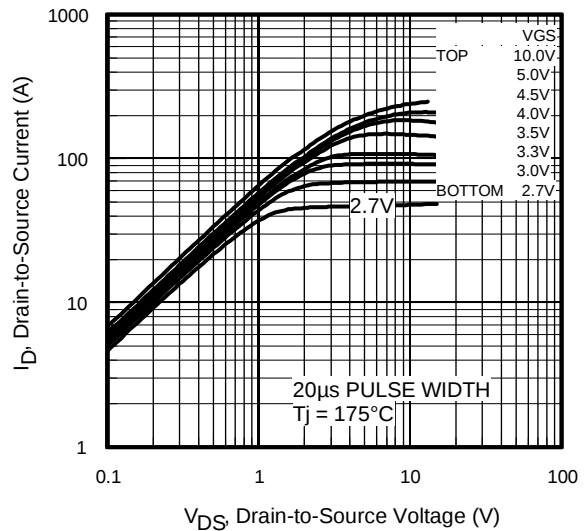
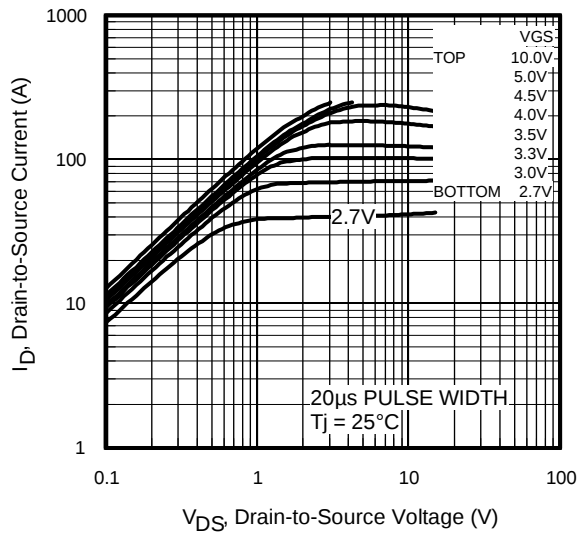
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	49	—	—	S	$V_{DS} = 15V, I_D = 50A$
Q_g	Total Gate Charge	—	24	—	nC	$I_D = 24.8A$
Q_{gs}	Gate-to-Source Charge	—	6.7	—		$V_{DS} = 15V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	5.8	—		$V_{GS} = 4.5V$ ③
Q_{oss}	Output Gate Charge	—	14	21		$V_{GS} = 0V, I_D = 24.8A, V_{DS} = 15V$
$t_{d(on)}$	Turn-On Delay Time	—	7.2	—	ns	$V_{DD} = 15V$
t_r	Rise Time	—	50	—		$I_D = 24.8A$
$t_{d(off)}$	Turn-Off Delay Time	—	17.6	—		$R_G = 0.6\Omega$
t_f	Fall Time	—	3.7	—		$V_{GS} = 4.5V$ ③
C_{iss}	Input Capacitance	—	2417	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	707	—		$V_{DS} = 15V$
C_{rss}	Reverse Transfer Capacitance	—	52	—		$f = 1.0MHz$

Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	—	213	mJ
I_{AR}	Avalanche Current①	—	62	A

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	61④	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	244		
V_{SD}	Diode Forward Voltage	—	0.88	1.3	V	$T_J = 25^\circ\text{C}, I_S = 31A, V_{GS} = 0V$ ③
		—	0.80	—		$T_J = 125^\circ\text{C}, I_S = 31A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	41	62	ns	$T_J = 25^\circ\text{C}, I_F = 31A, V_R = 20V$
Q_{rr}	Reverse Recovery Charge	—	64	96	nC	$di/dt = 100A/\mu s$ ③
t_{rr}	Reverse Recovery Time	—	43	65	ns	$T_J = 125^\circ\text{C}, I_F = 31A, V_R = 20V$
Q_{rr}	Reverse Recovery Charge	—	70	105	nC	$di/dt = 100A/\mu s$ ③



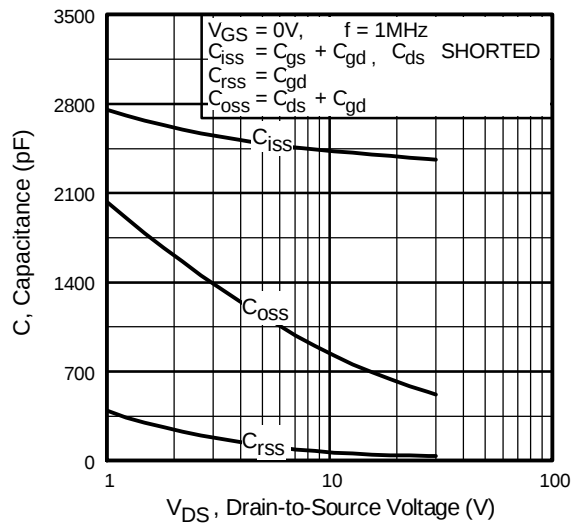


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

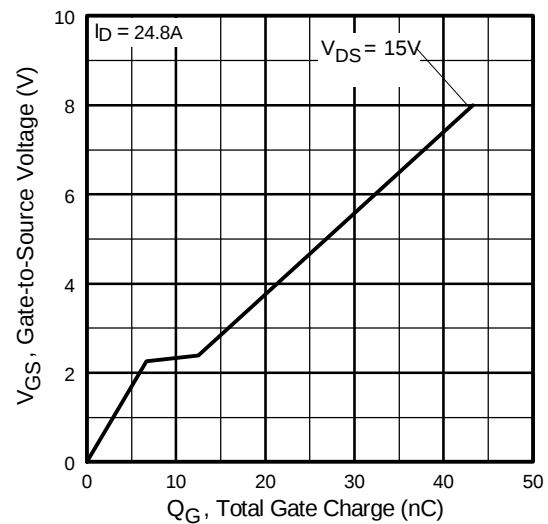


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

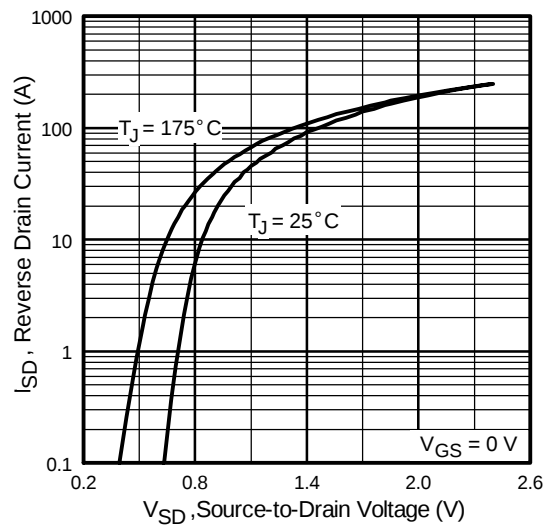


Fig 7. Typical Source-Drain Diode Forward Voltage

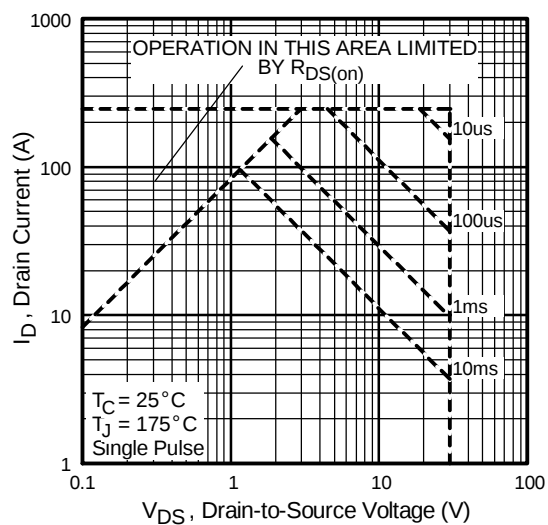


Fig 8. Maximum Safe Operating Area

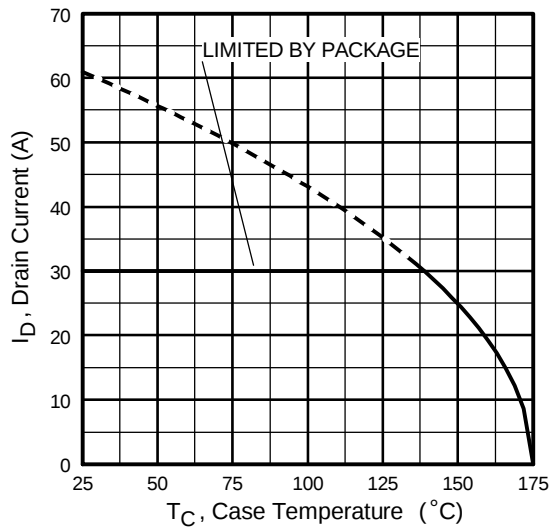


Fig 9. Maximum Drain Current Vs. Case Temperature

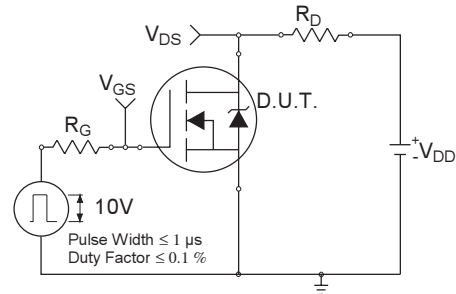


Fig 10a. Switching Time Test Circuit

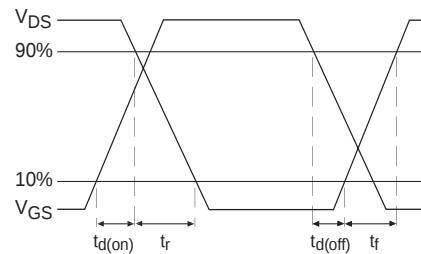


Fig 10b. Switching Time Waveforms

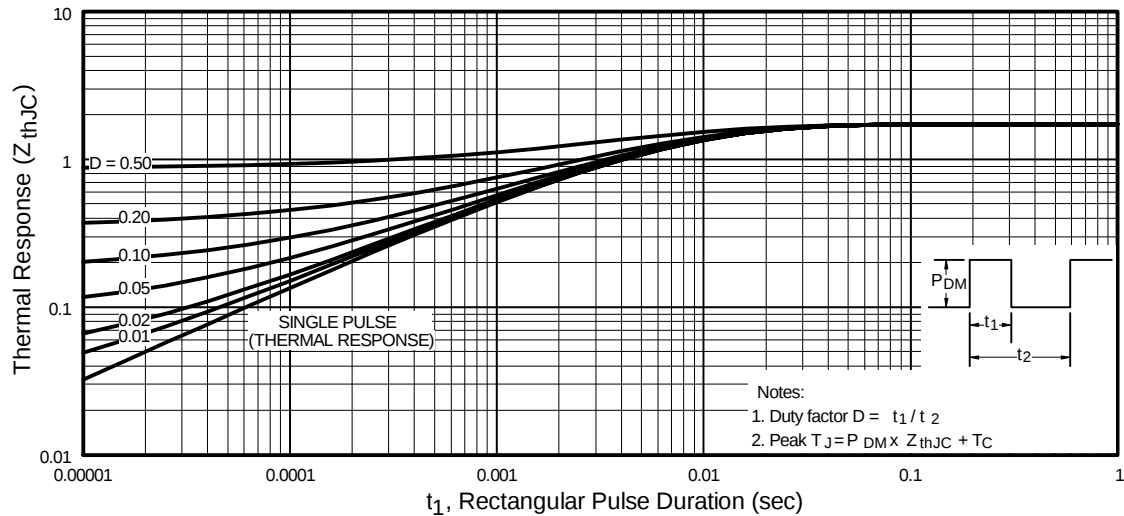


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

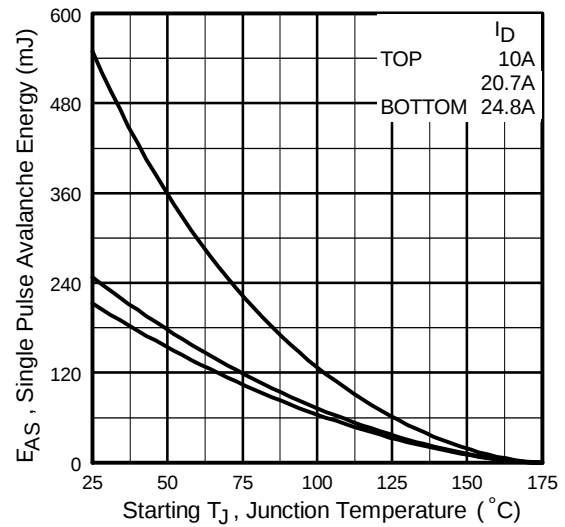
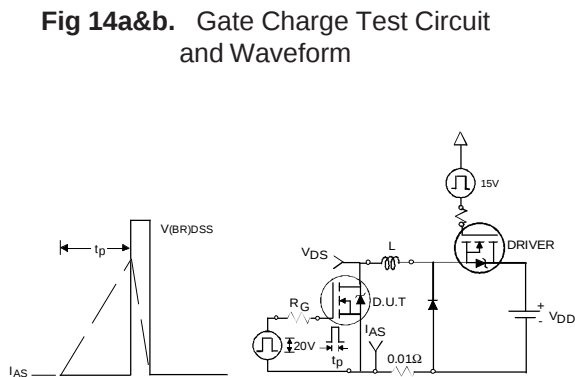
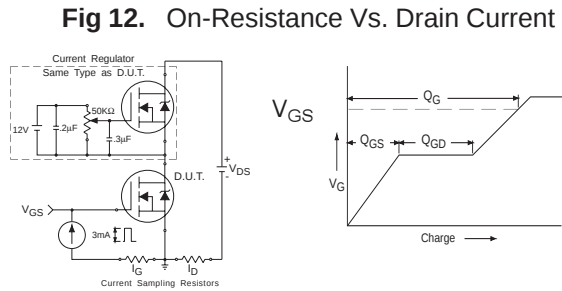
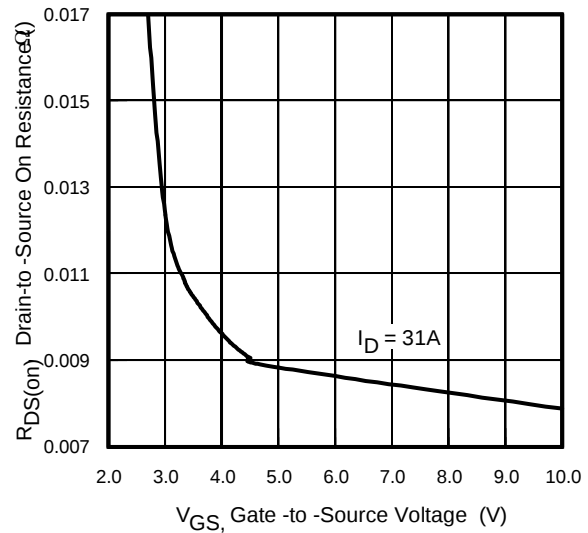
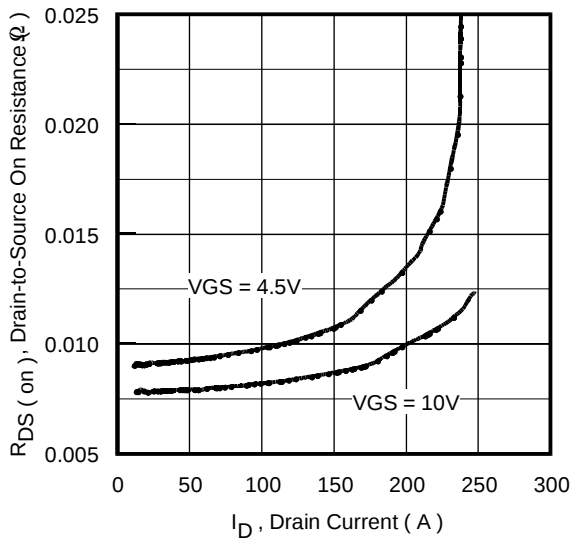
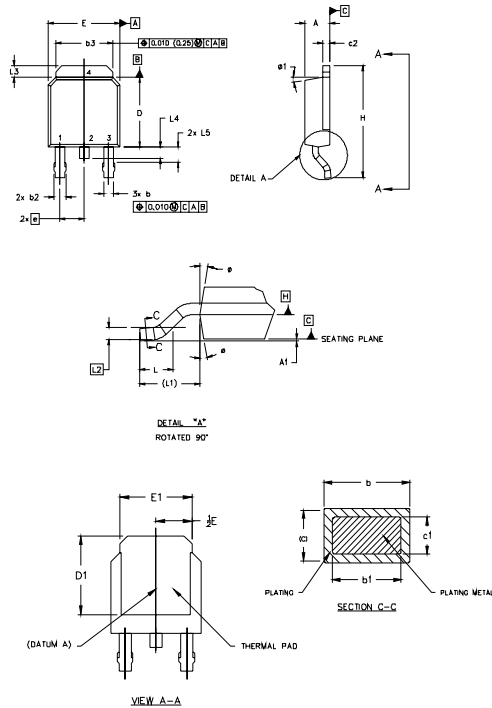


Fig 15a&b. Unclamped Inductive Test circuit and Waveforms

Fig 15c. Maximum Avalanche Energy Vs. Drain Current

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	2.39	.086	.094	
A1		0.13		.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	0.66	.016	.022	5
c2	.046	0.89	.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		1.02		.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

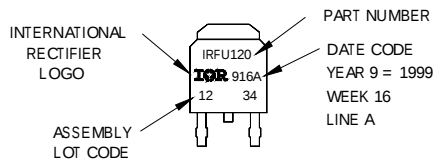
IGBTs, CoPACK

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

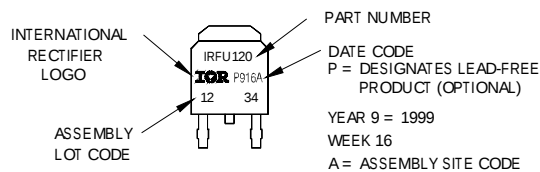
D-Pak (TO-252AA) Part Marking Information

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

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



OR

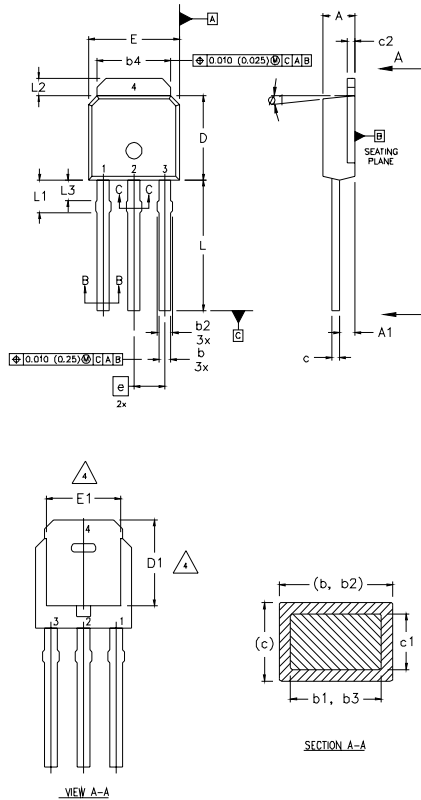


IRFR/U3708PbF

International
IR Rectifier

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.

LEAD ASSIGNMENTS

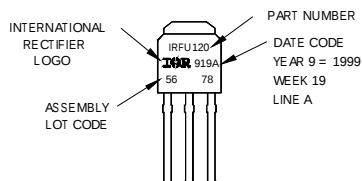
HEXFET

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

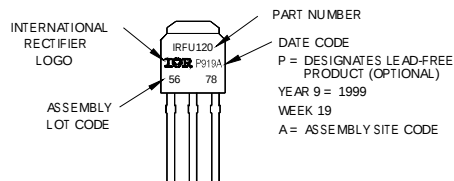
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	0.086	.094	
A1	0.89	1.14	0.035	0.045	
b	0.64	0.89	0.025	0.035	
b1	0.64	0.79	0.025	0.031	4
b2	0.76	1.14	0.030	0.045	
b3	0.76	1.04	0.030	0.041	
b4	5.00	5.46	0.195	0.215	4
c	0.46	0.61	0.018	0.024	
c1	0.41	0.56	0.016	0.022	
c2	0.46	0.86	0.018	0.035	
D	5.97	6.22	0.235	0.245	3, 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	
L2	0.89	1.27	0.035	0.050	4
L3	1.14	1.52	0.045	0.060	5
ø1	0"	15"	0"	15"	

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

EXAMPLE: THIS IS AN IRFU120
WITH ASSEMBLY
LOT CODE 5678
ASSEMBLED ON WW19, 1999
IN THE ASSEMBLY LINE "A"
Note: "P" in assembly line
position indicates "Lead-Free"

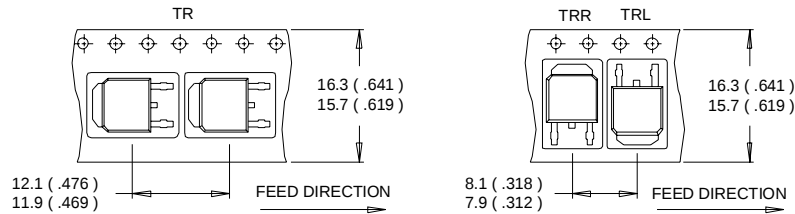


OR



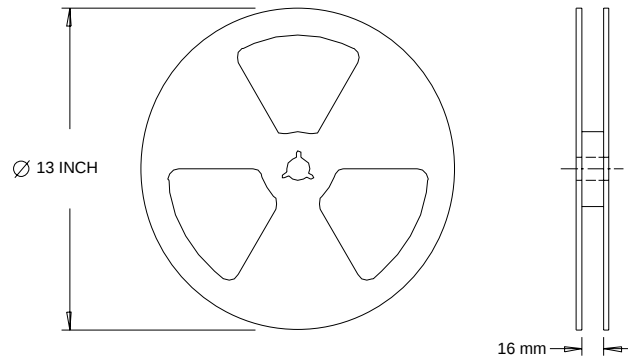
D-Pak (TO-252AA) Tape & Reel Information

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.

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.7 \text{ mH}$
 $R_G = 25\Omega$, $I_{AS} = 24.8 \text{ A}$.
- ③ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.
- ④ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 30A.

Data and specifications subject to change without notice.

International
IR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903

Visit us at www.irf.com for sales contact information12/04

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

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenhheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.