

# International IR Rectifier

PD - 95555A

## SMPS MOSFET

IRLR3715PbF

IRLU3715PbF

HEXFET® Power MOSFET

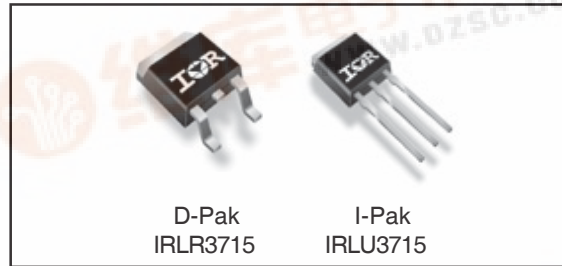
### Applications

- High Frequency Isolated DC-DC 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

$V_{DSS}$	$R_{DS(on)}$ max	$I_D$
20V	14mΩ	54A



### Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
$V_{DS}$	Drain-Source Voltage	20	V
$V_{GS}$	Gate-to-Source Voltage	± 20	V
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	54④	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	38④	
$I_{DM}$	Pulsed Drain Current①	210	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	71	W
$P_D @ T_A = 25^\circ C$	Maximum Power Dissipation⑤	3.8	W
	Linear Derating Factor	0.48	W/°C
$T_J, T_{STG}$	Junction and Storage Temperature Range	-55 to + 175	°C

### Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	2.1	°C/W
$R_{\theta JA}$	Junction-to-Ambient	—	110	
$R_{\theta JA}$	Junction-to-Ambient (PCB mount)⑤	—	50	

Notes ① through ⑤ are on page 10

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## Static @ T<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	20	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	0.022	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	11	14	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 26A ③
		—	15	20		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 21A ③
V <sub>GS(th)</sub>	Gate Threshold Voltage	1.0	—	3.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	20	μA	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
		—	—	100		V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	200	nA	V <sub>GS</sub> = 16V
	Gate-to-Source Reverse Leakage	—	—	-200		V <sub>GS</sub> = -16V

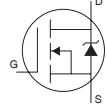
## Dynamic @ T<sub>J</sub> = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g <sub>fs</sub>	Forward Transconductance	26	—	—	S	V <sub>DS</sub> = 10V, I <sub>D</sub> = 21A
Q <sub>g</sub>	Total Gate Charge	—	11	17	nC	I <sub>D</sub> = 21A
Q <sub>gs</sub>	Gate-to-Source Charge	—	3.8	—		V <sub>DS</sub> = 10V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	4.4	—		V <sub>GS</sub> = 4.5V
Q <sub>oss</sub>	Output Gate Charge	—	11	17		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 10V
t <sub>d(on)</sub>	Turn-On Delay Time	—	6.4	—	ns	V <sub>DD</sub> = 10V
t <sub>r</sub>	Rise Time	—	73	—		I <sub>D</sub> = 21A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	12	—		R <sub>G</sub> = 1.8Ω
t <sub>f</sub>	Fall Time	—	5.1	—		V <sub>GS</sub> = 4.5V ③
C <sub>iss</sub>	Input Capacitance	—	1060	—		V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	700	—	pF	V <sub>DS</sub> = 10V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	120	—		f = 1.0MHz

## Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy②	—	110	mJ
I <sub>AR</sub>	Avalanche Current①	—	21	A

## Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	54④	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	210		
V <sub>SD</sub>	Diode Forward Voltage	—	0.9	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 21A, V <sub>GS</sub> = 0V ③
		—	0.8	—		T <sub>J</sub> = 125°C, I <sub>S</sub> = 21A, V <sub>GS</sub> = 0V ③
t <sub>rr</sub>	Reverse Recovery Time	—	37	56	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 21A, V <sub>R</sub> = 20V
Q <sub>rr</sub>	Reverse Recovery Charge	—	28	42	nC	di/dt = 100A/μs ③
t <sub>rr</sub>	Reverse Recovery Time	—	38	57	ns	T <sub>J</sub> = 125°C, I <sub>F</sub> = 21A, V <sub>R</sub> = 20V
Q <sub>rr</sub>	Reverse Recovery Charge	—	30	45	nC	di/dt = 100A/μs ③

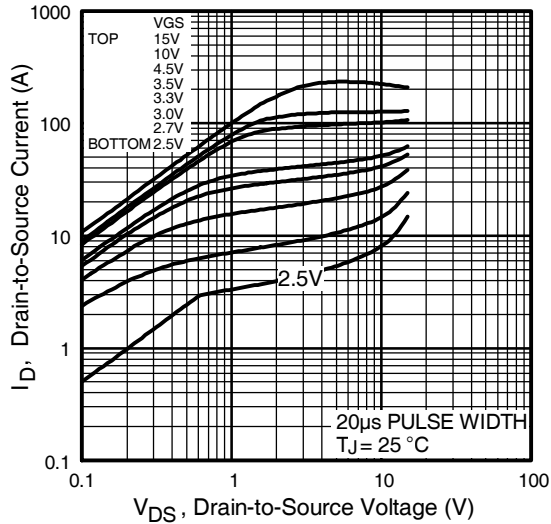


Fig 1. Typical Output Characteristics

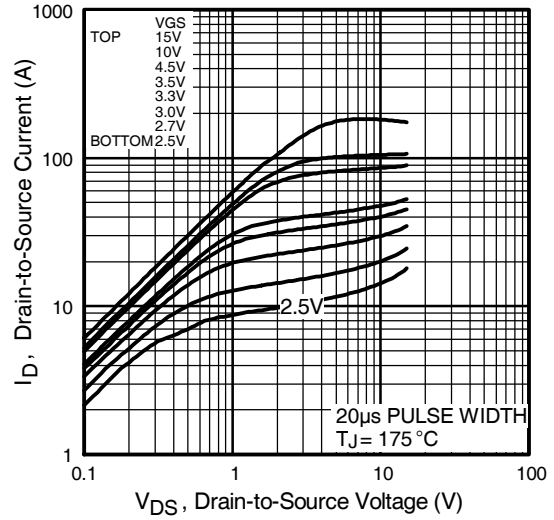


Fig 2. Typical Output Characteristics

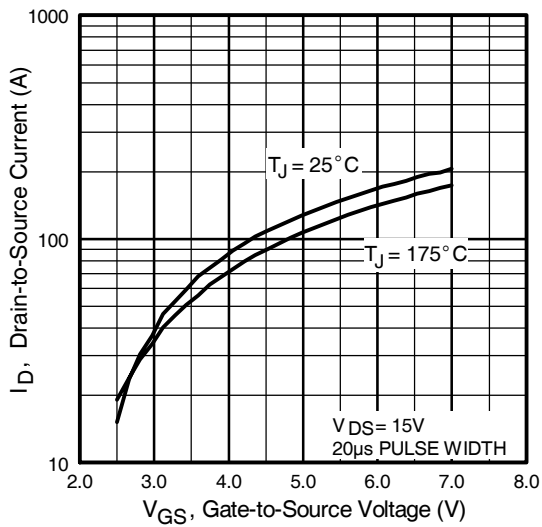


Fig 3. Typical Transfer Characteristics

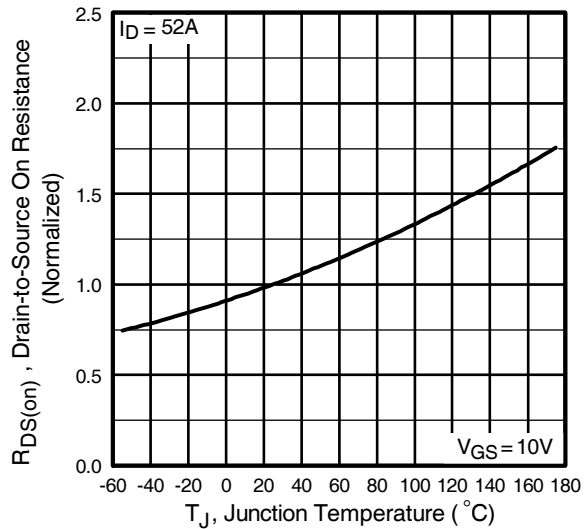
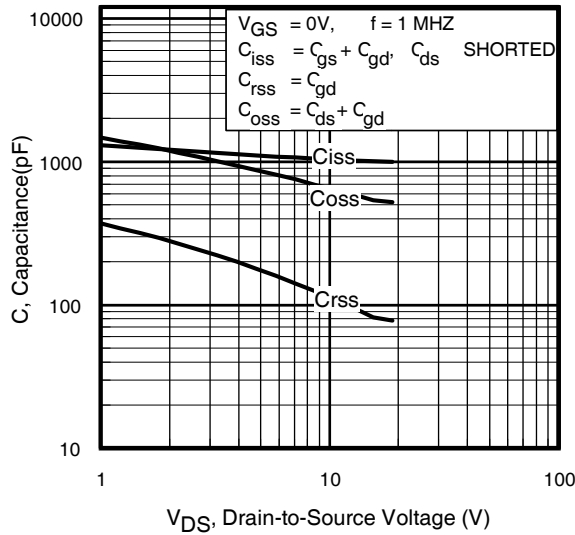
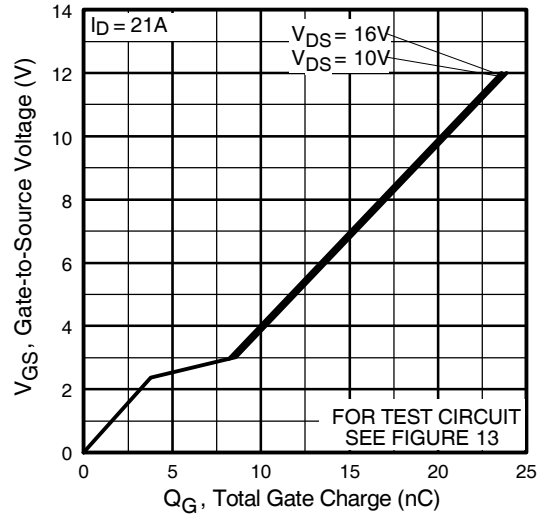


Fig 4. Normalized On-Resistance Vs. Temperature

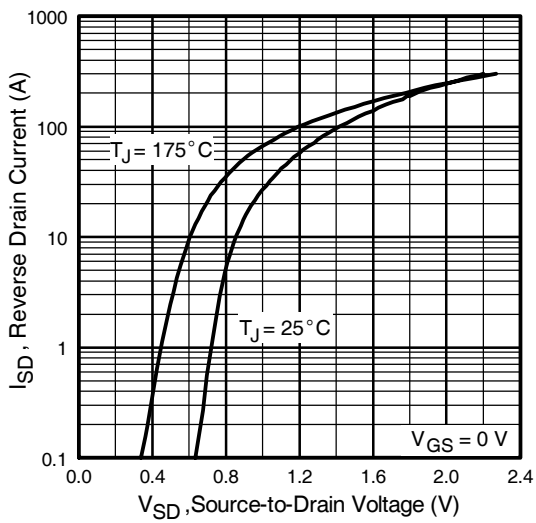
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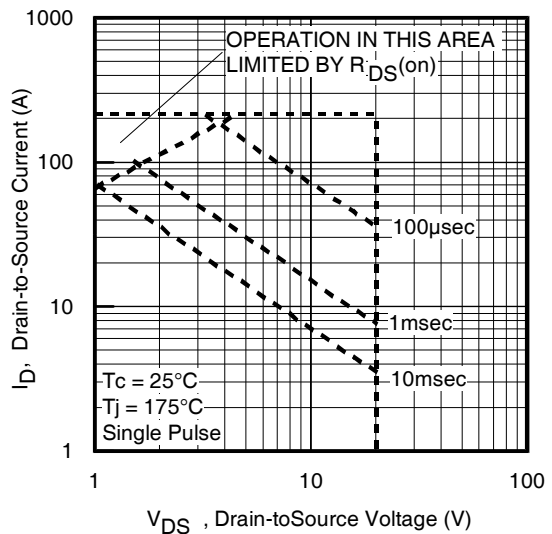
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



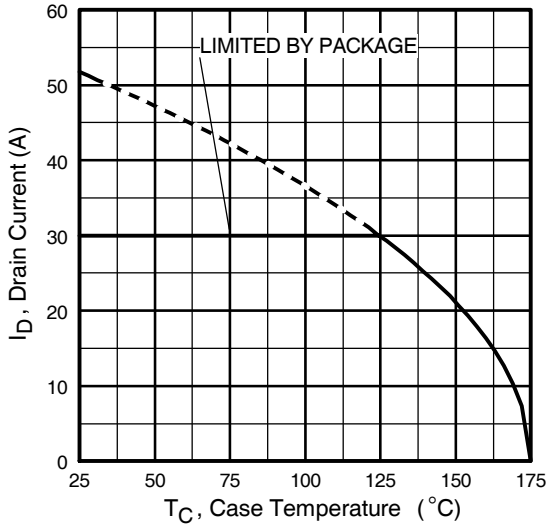
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



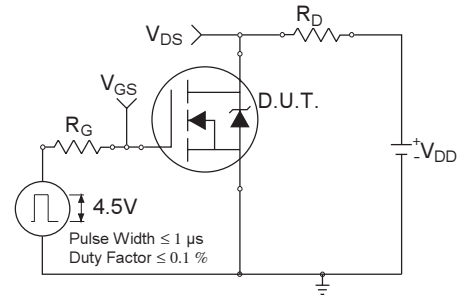
**Fig 7.** Typical Source-Drain Diode Forward Voltage



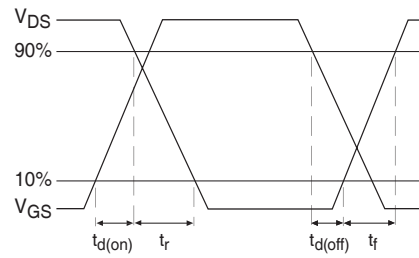
**Fig 8.** Maximum Safe Operating Area



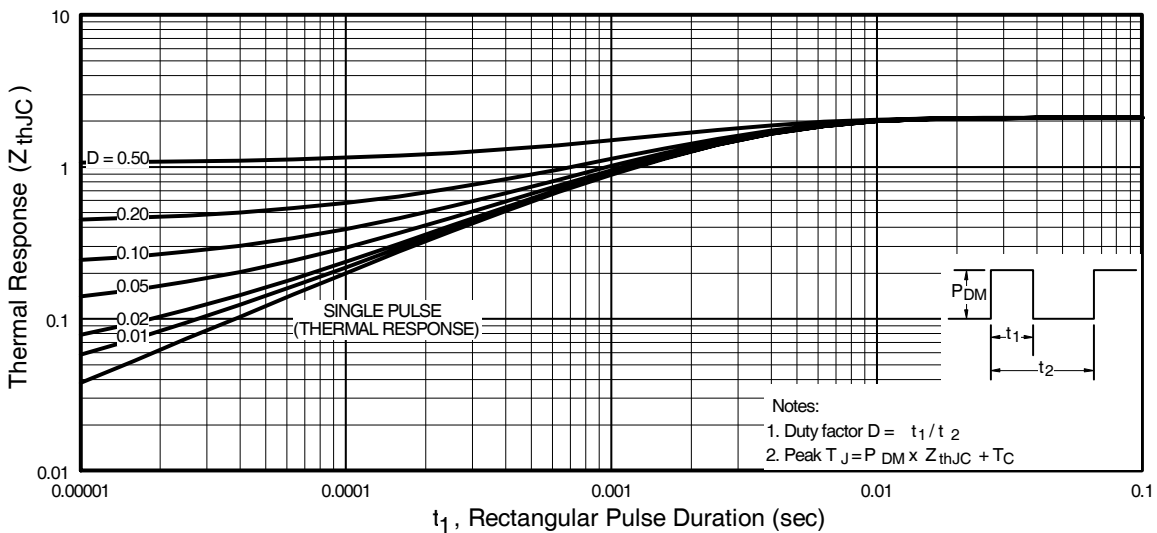
**Fig 9.** Maximum Drain Current Vs. Case Temperature



**Fig 10a.** Switching Time Test Circuit



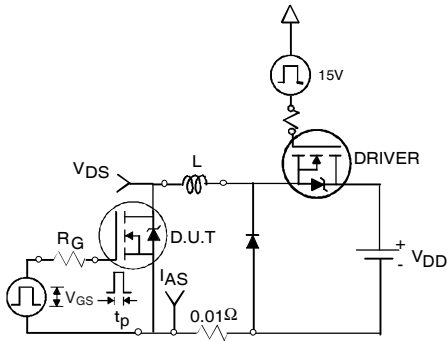
**Fig 10b.** Switching Time Waveforms



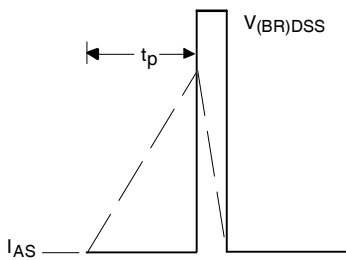
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

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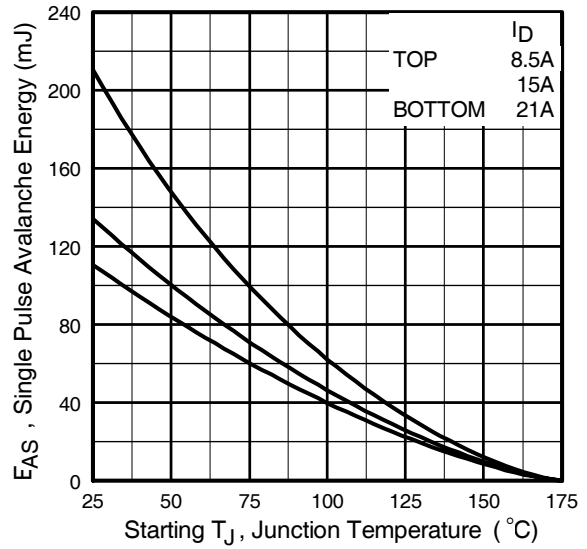
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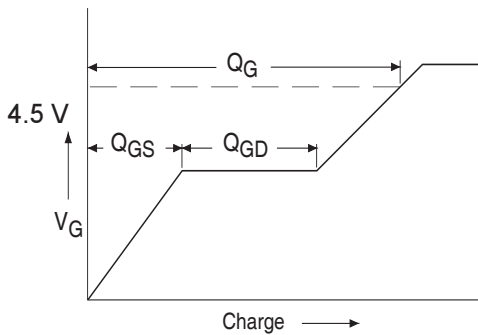
**Fig 12a.** Unclamped Inductive Test Circuit



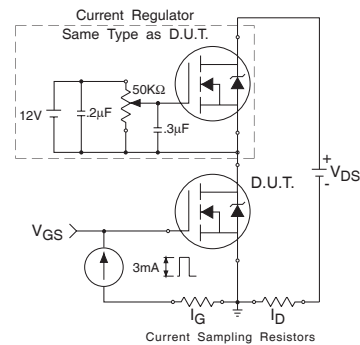
**Fig 12b.** Unclamped Inductive Waveforms



**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current

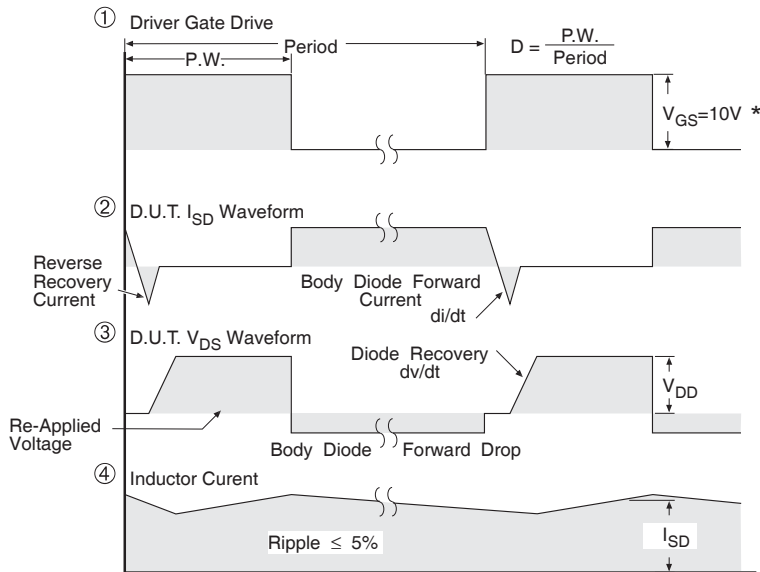
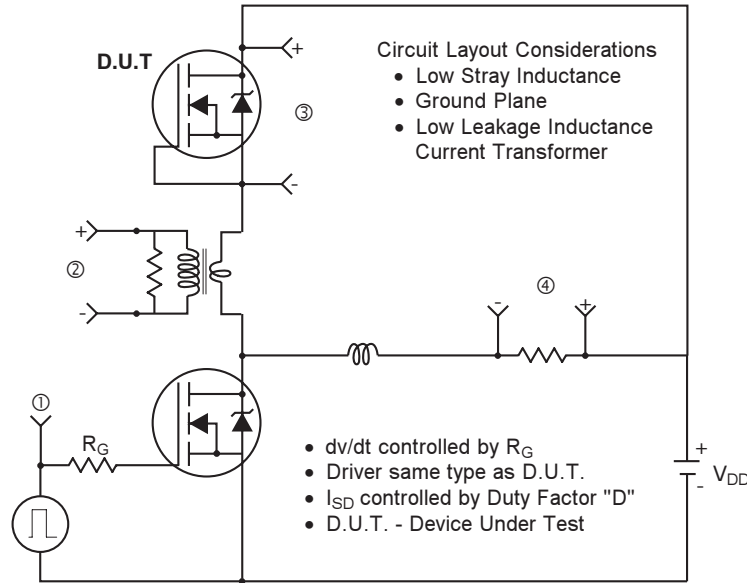


**Fig 13a.** Basic Gate Charge Waveform



**Fig 13b.** Gate Charge Test Circuit

**Peak Diode Recovery dv/dt Test Circuit**



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

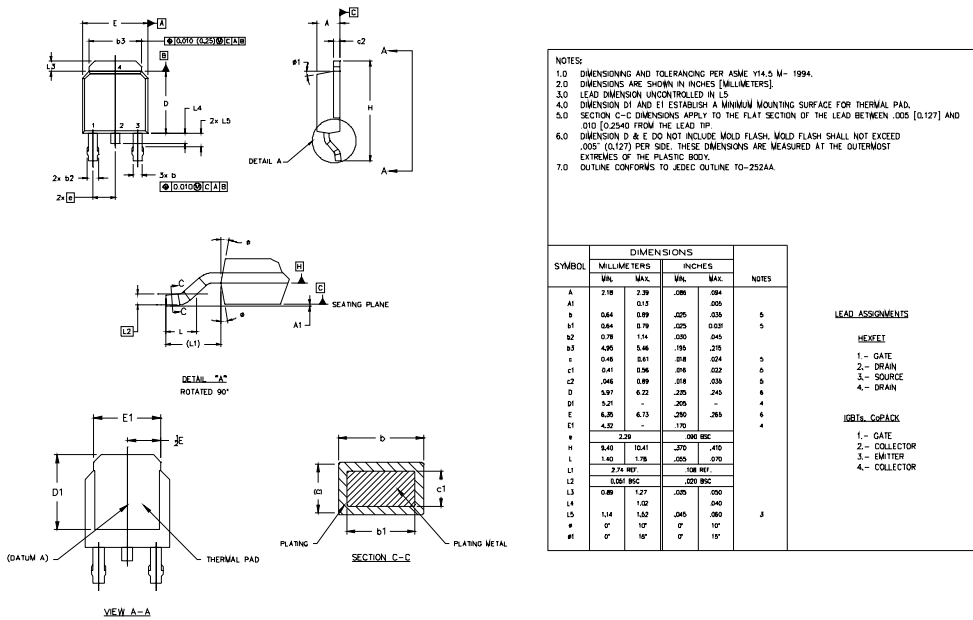
**Fig 14.** For N-Channel HEXFET® Power MOSFETs

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## D-Pak (TO-252AA) Package Outline

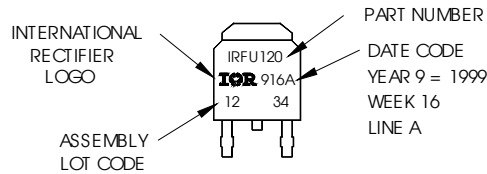
Dimensions are shown in millimeters (inches)



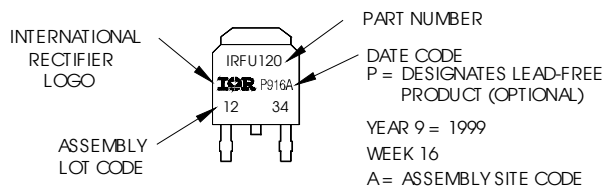
## D-Pak (TO-252AA) Part Marking Information

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"



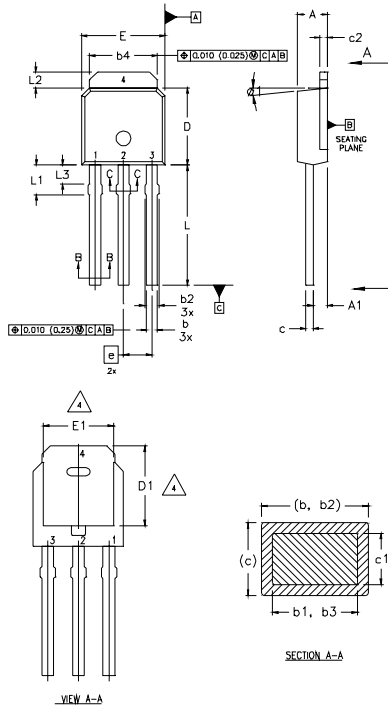
OR





## 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**

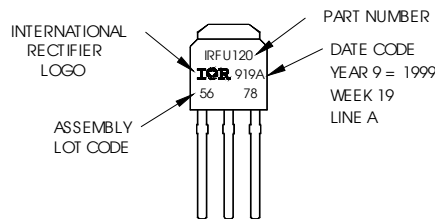
- HEXFEEET**
- 1.- GATE
  - 2.- DRAIN
  - 3.- SOURCE
  - 4.- DRAIN

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	0.196	0.215	4
c	0.46	0.61	0.018	0.024	
c1	0.41	0.56	0.016	0.022	
c2	.046	0.06	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	4.52	-	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
e1	0"	15'	0"	15'	

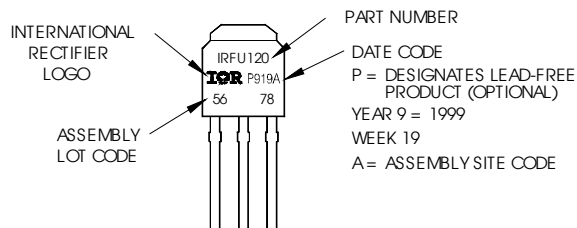
## I-Pak (TO-251AA) Part Marking Information

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**

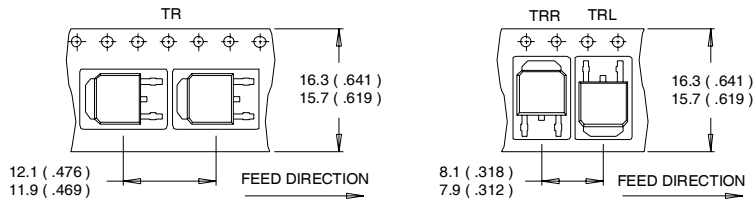


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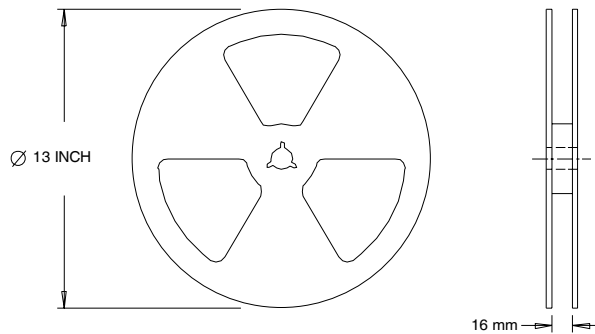
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## D-Pak (TO-252AA) Tape & Reel Information

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.

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.51\text{mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 21\text{A}$ ,  $V_{GS} = 10\text{V}$
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 30A.

- ⑤ When mounted on 1" square PCB (FR-4 or G-10 Material) .  
For recommended footprint and soldering techniques refer to application note #AN-994

Data and specifications subject to change without notice.  
This product has been designed and qualified for the Industrial market.  
Qualification Standards can be found on IR's Web site.

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