

International  
**IR** Rectifier

SMPS MOSFET

IRFR420A

IRFU420A

PD - 94355

HEXFET® Power MOSFET

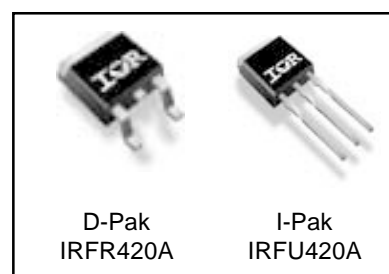
### Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High speed power switching

$V_{DSS}$	$R_{DS(on)}$ max	$I_D$
500V	3.0 $\Omega$	3.3A

### Benefits

- Low Gate Charge  $Q_g$  results in Simple Drive Requirement
- Improved Gate, Avalanche and dynamic  $dv/dt$  Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Effective  $C_{OSS}$  specified (See AN 1001)



### Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D$ @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	3.3	A
$I_D$ @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	2.1	
$I_{DM}$	Pulsed Drain Current ①	10	
$P_D$ @ $T_C = 25^\circ\text{C}$	Power Dissipation	83	W
	Linear Derating Factor	0.67	W/ $^\circ\text{C}$
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$dv/dt$	Peak Diode Recovery $dv/dt$ ③	3.4	V/ns
$T_J$	Operating Junction and	-55 to + 150	
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds		

### Avalanche Characteristics

	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy②	—	140	mJ
$I_{AR}$	Avalanche Current①	—	2.5	A
$E_{AR}$	Repetitive Avalanche Energy①	—	5.0	mJ

### Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.5	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	

www.irf.com

1

12/10/01

## IRFR420A/IRFU420A

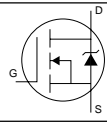
International  
IR RectifierStatic @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	500	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.60	—	V/°C	Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	3.0	$\Omega$	$V_{GS} = 10V, I_D = 1.5A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.5	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS} = 500V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -30V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$g_{fs}$	Forward Transconductance	1.4	—	—	S	$V_{DS} = 50V, I_D = 1.5A$
$Q_g$	Total Gate Charge	—	—	17	nC	$I_D = 2.5A$
$Q_{gs}$	Gate-to-Source Charge	—	—	4.3		$V_{DS} = 400V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	8.5		$V_{GS} = 10V$ , See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	8.1	—	ns	$V_{DD} = 250V$
$t_r$	Rise Time	—	12	—		$I_D = 2.5A$
$t_{d(off)}$	Turn-Off Delay Time	—	16	—		$R_G = 21\Omega$
$t_f$	Fall Time	—	13	—		$R_D = 97\Omega$ , See Fig. 10 ④
$C_{iss}$	Input Capacitance	—	340	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	53	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	2.7	—		$f = 1.0\text{MHz}$ , See Fig. 5
$C_{oss}$	Output Capacitance	—	490	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	15	—		$V_{GS} = 0V, V_{DS} = 400V, f = 1.0\text{MHz}$
$C_{oss\ eff.}$	Effective Output Capacitance	—	28	—		$V_{GS} = 0V, V_{DS} = 0V$ to $400V$ ⑤

## Diode Characteristics

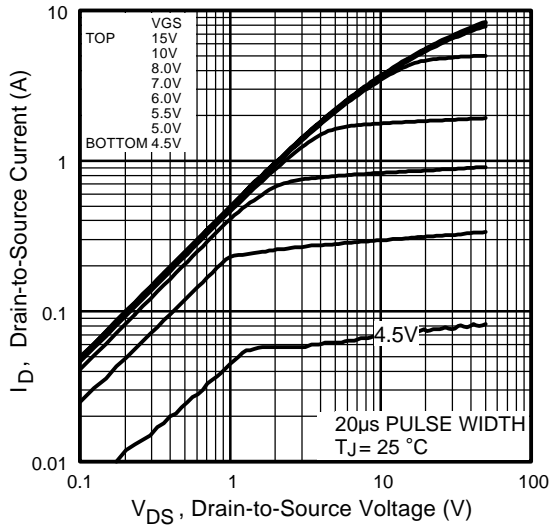
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	3.3	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	10		
$V_{SD}$	Diode Forward Voltage	—	—	1.6	V	$T_J = 25^\circ\text{C}, I_S = 2.5A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	330	500	ns	$T_J = 25^\circ\text{C}, I_F = 2.5A$
$Q_{rr}$	Reverse Recovery Charge	—	760	1140	nC	$di/dt = 100A/\mu s$ ④
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ )				

## Notes:

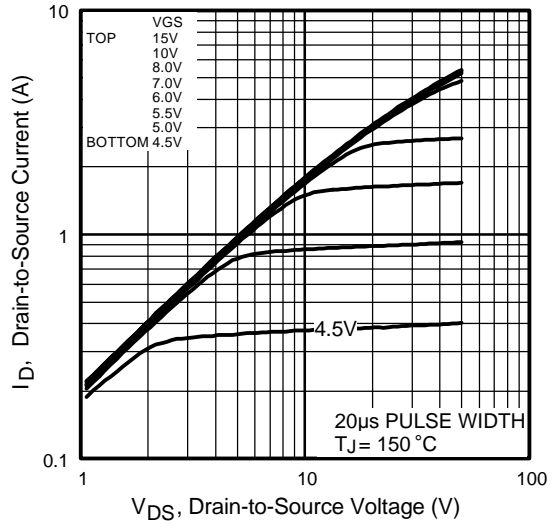
- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 45\text{mH}$   
 $R_G = 25\Omega, I_{AS} = 2.5A$ . (See Figure 12)
- ③  $I_{SD} \leq 2.5A, di/dt \leq 270A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 150^\circ\text{C}$

④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .⑤  $C_{oss\ eff.}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$

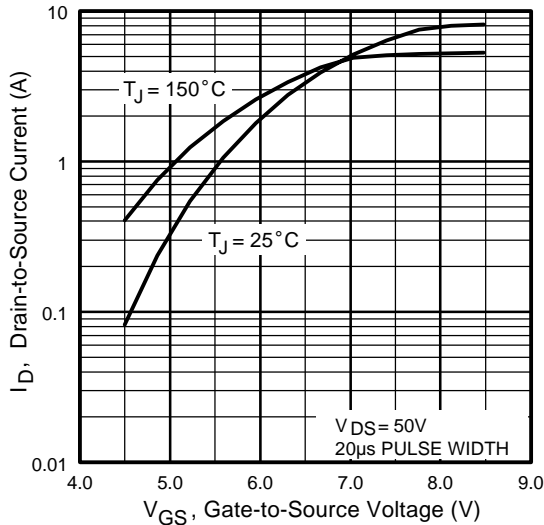
# IRFR420A/IRFU420A



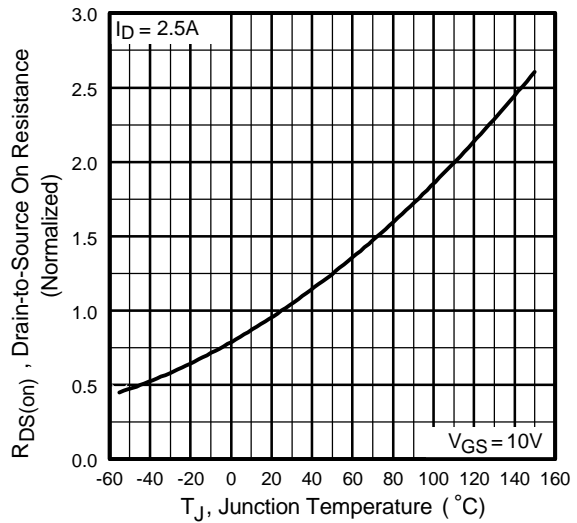
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



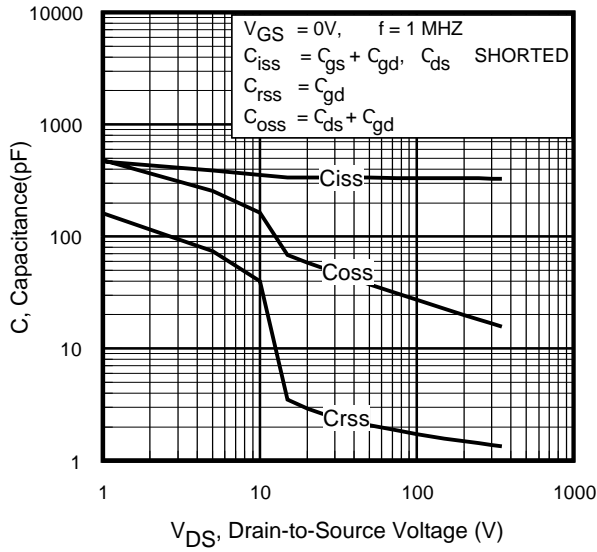
**Fig 3.** Typical Transfer Characteristics



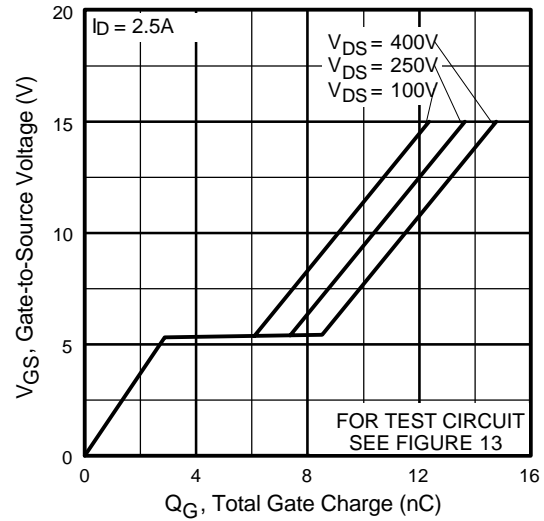
**Fig 4.** Normalized On-Resistance Vs. Temperature

# IRFR420A/IRFU420A

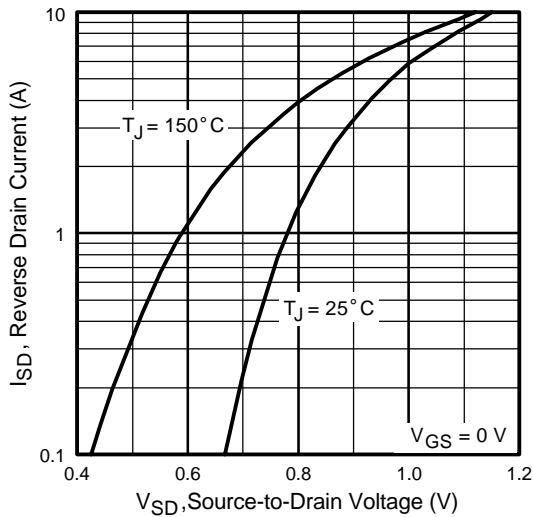
International  
**IR** Rectifier



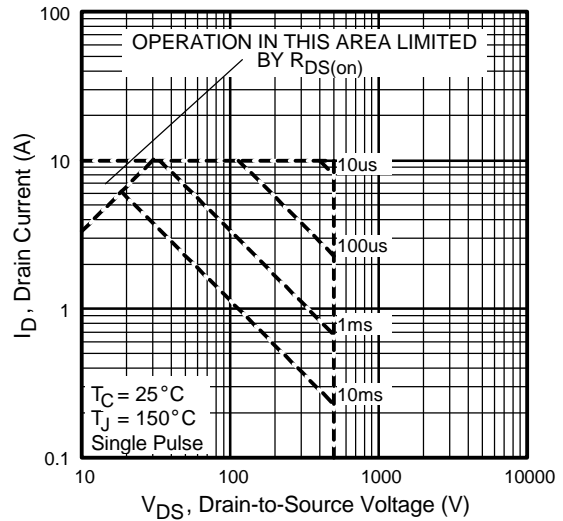
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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

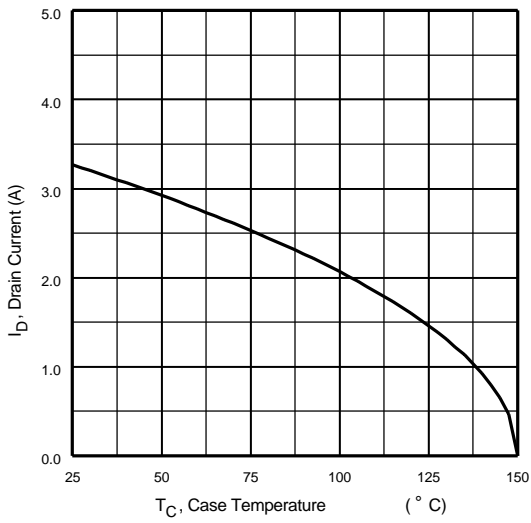


**Fig 7.** Typical Source-Drain Diode Forward Voltage

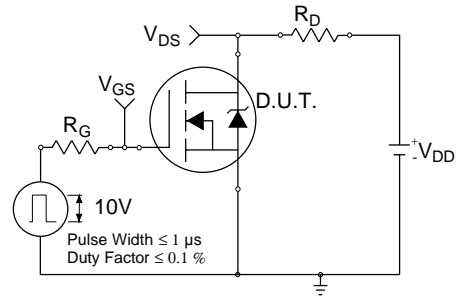


**Fig 8.** Maximum Safe Operating Area

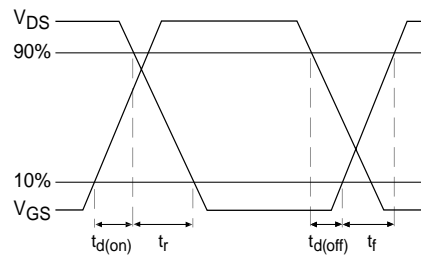
# IRFR420A/IRFU420A



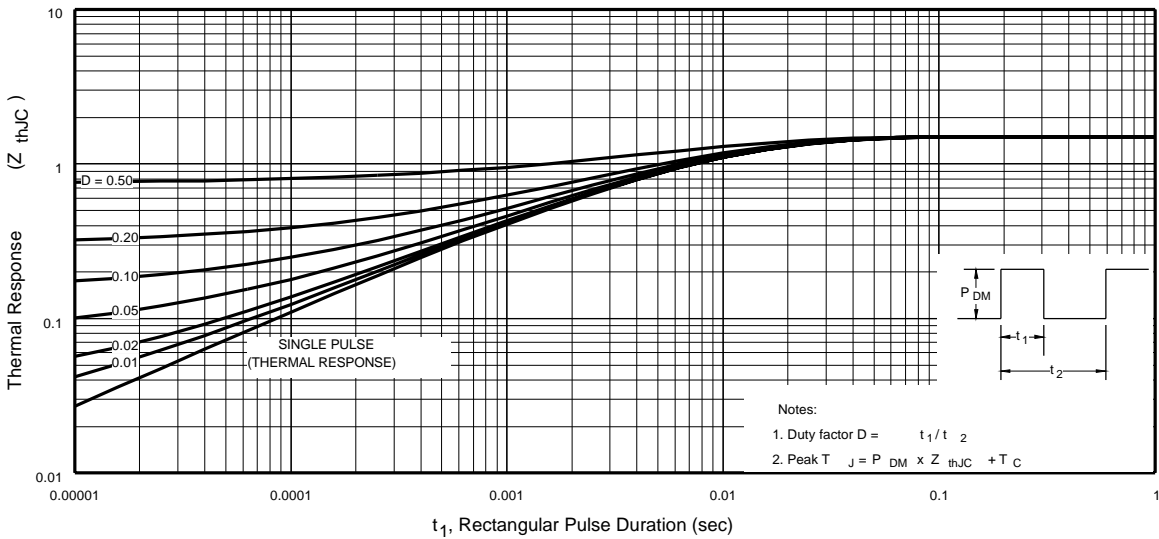
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



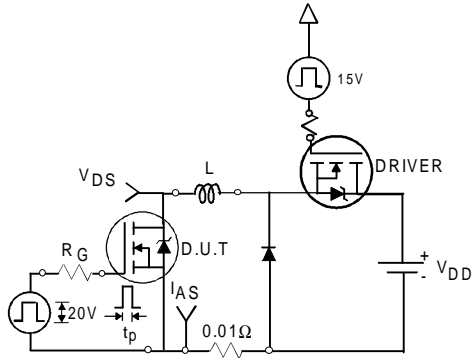
**Fig 10b.** Switching Time Waveforms



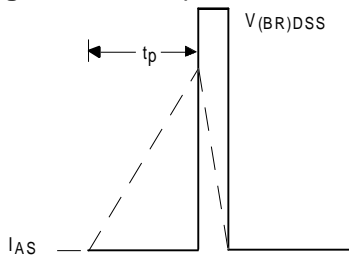
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

# IRFR420A/IRFU420A

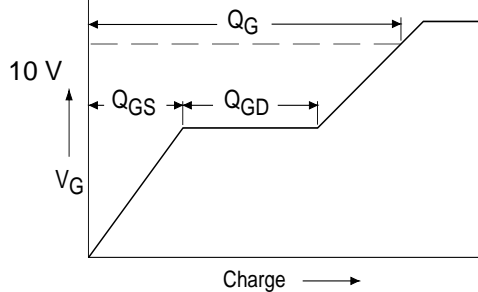
International  
**IR** Rectifier



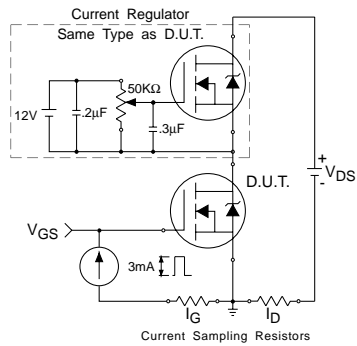
**Fig 12a.** Unclamped Inductive Test Circuit



**Fig 12b.** Unclamped Inductive Waveforms

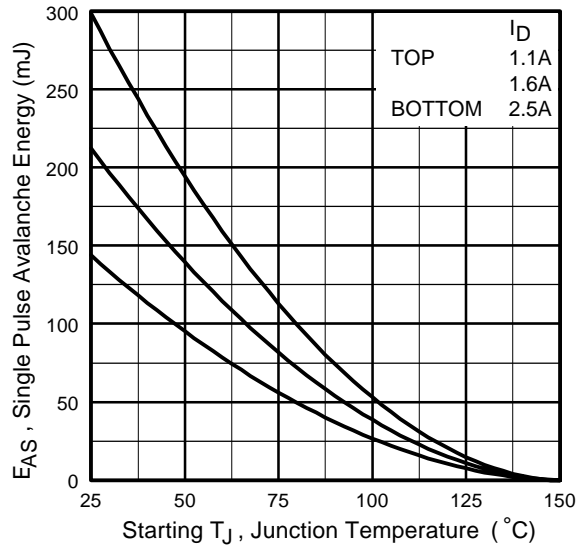


**Fig 13a.** Basic Gate Charge Waveform

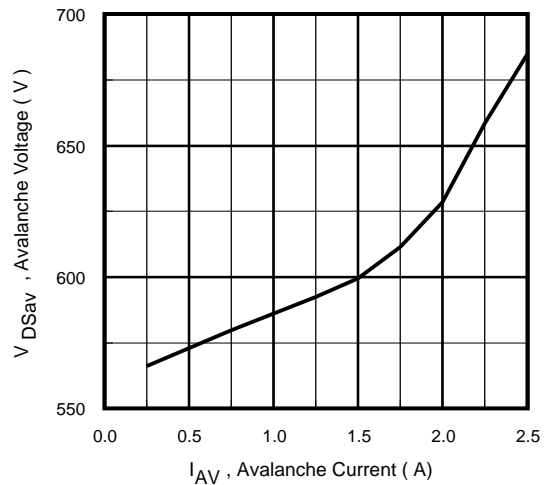


**Fig 13b.** Gate Charge Test Circuit

6



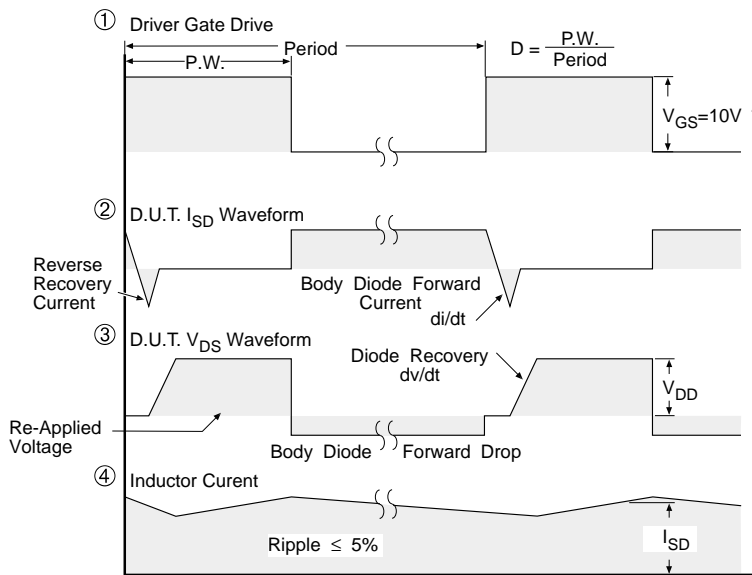
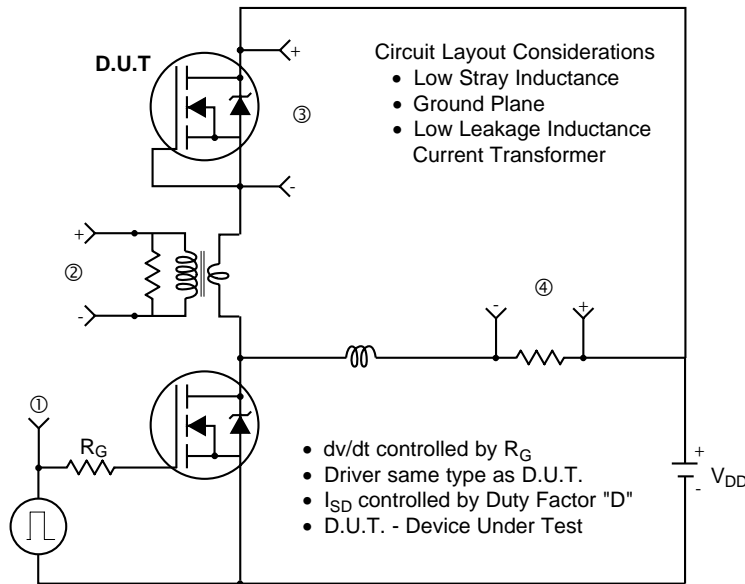
**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



**Fig 12d.** Typical Drain-to-Source Voltage Vs. Avalanche Current

www.irf.com

## Peak Diode Recovery dv/dt Test Circuit



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

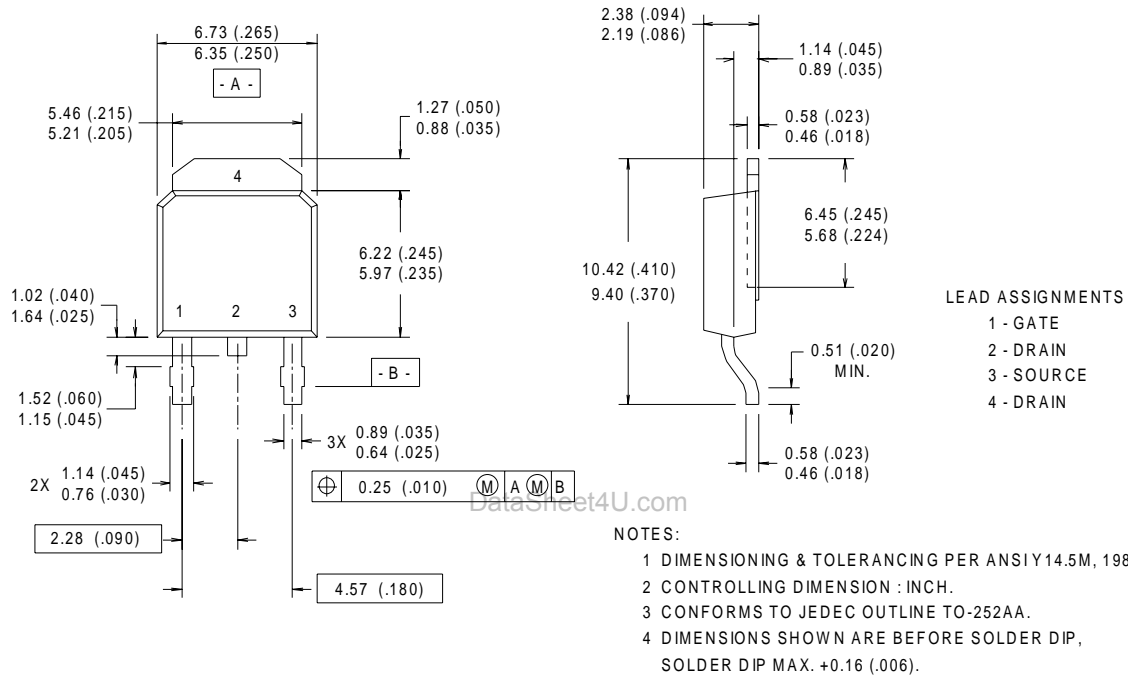
**Fig 14.** For N-Channel HEXFET® Power MOSFETs

# IRFR420A/IRFU420A

International  
**IR** Rectifier

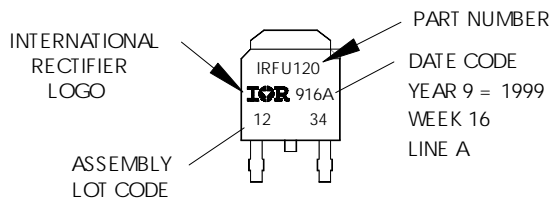
## D-Pak (TO-252AA) Package Outline

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"

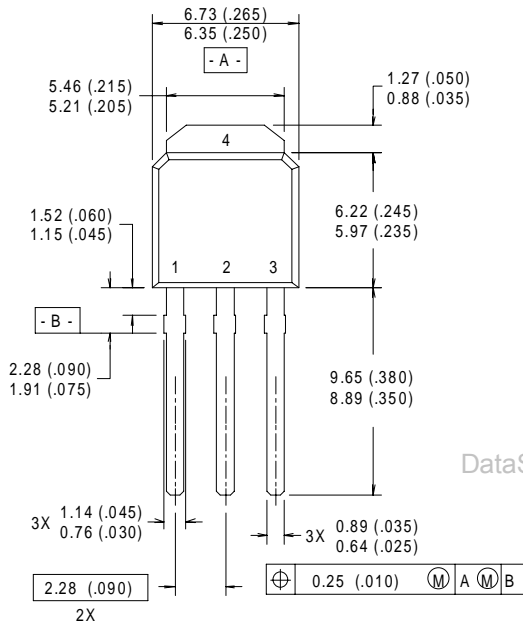




# IRFR420A/IRFU420A

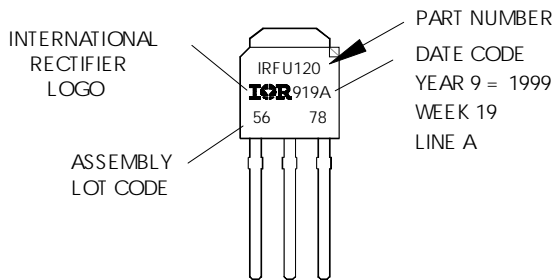
## I-Pak (TO-251AA) Package Outline

Dimensions are shown in millimeters (inches)



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

EXAMPLE: THIS IS AN IRFR120  
 WITH ASSEMBLY  
 LOT CODE 5678  
 ASSEMBLED ON WW 19, 1999  
 IN THE ASSEMBLY LINE "A"

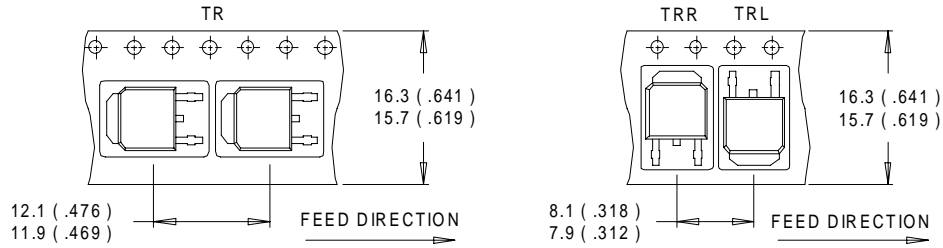


# IRFR420A/IRFU420A

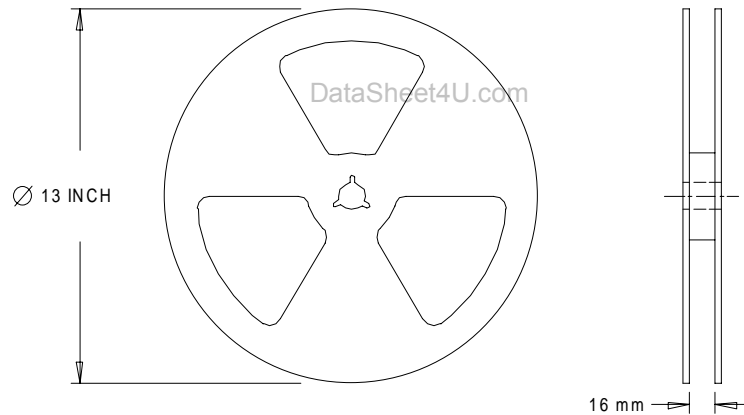
International  
**IR** Rectifier

## 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.  
This product has been designed and qualified for the Industrial market.  
Qualification Standards can be found on IR's Web site.

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](http://www.irf.com) for sales contact information.12/01

[www.irf.com](http://www.irf.com)