

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 <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
500V	3.0Ω	3.3A

**Benefits**

- Low Gate Charge Q<sub>g</sub> results in Simple Drive Requirement
- Improved Gate, Avalanche and dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Effective C<sub>OSS</sub> specified (See AN 1001)



**Absolute Maximum Ratings**

	Parameter	Max.	Units
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	3.3	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	2.1	
I <sub>DM</sub>	Pulsed Drain Current ①	10	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Power Dissipation	83	W
	Linear Derating Factor	0.67	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ③	3.4	V/ns
T <sub>J</sub>	Operating Junction and	-55 to + 150	
T <sub>STG</sub>	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

**Avalanche Characteristics**

	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy②	—	140	mJ
I <sub>AR</sub>	Avalanche Current①	—	2.5	A
E <sub>AR</sub>	Repetitive Avalanche Energy①	—	5.0	mJ

**Thermal Resistance**

	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case	—	1.5	°C/W
R <sub>θCS</sub>	Case-to-Sink, Flat, Greased Surface	0.50	—	
R <sub>θJA</sub>	Junction-to-Ambient	—	62	



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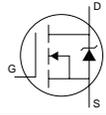
## Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	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		$V_{GS} = 10V, \text{See Fig. 6 and 13}$ 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	—		$R_D = 97\Omega, \text{See Fig. 10}$ 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	—		$f = 1.0\text{MHz}, \text{See Fig. 5}$
$C_{oss}$	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	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$ 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%  $V_{DSS}$

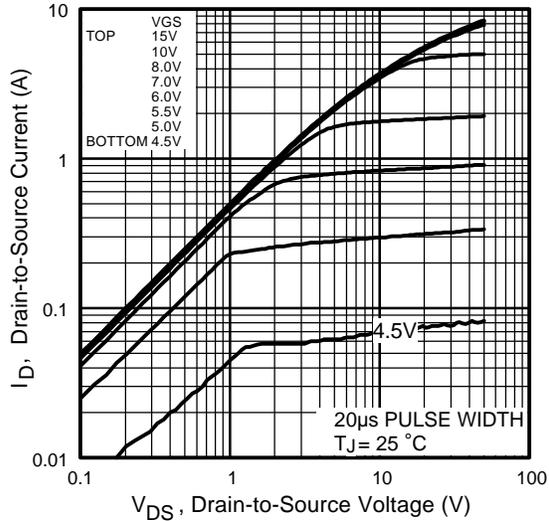


Fig 1. Typical Output Characteristics

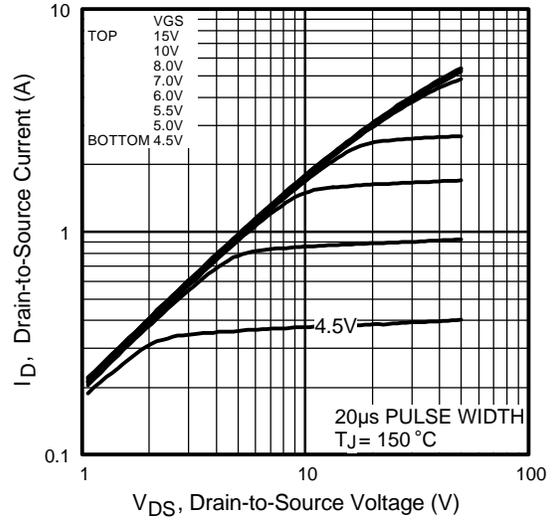


Fig 2. Typical Output Characteristics

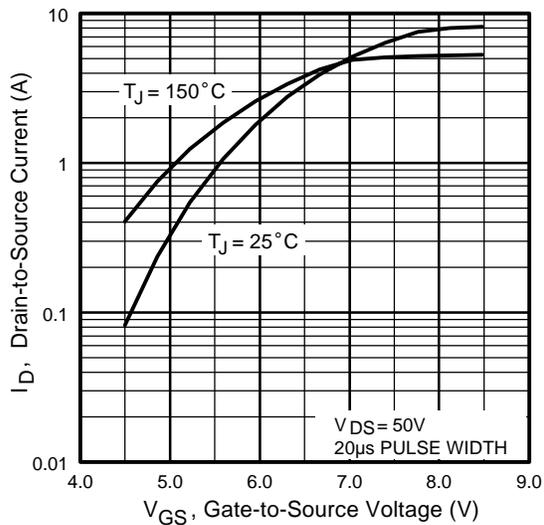


Fig 3. Typical Transfer Characteristics

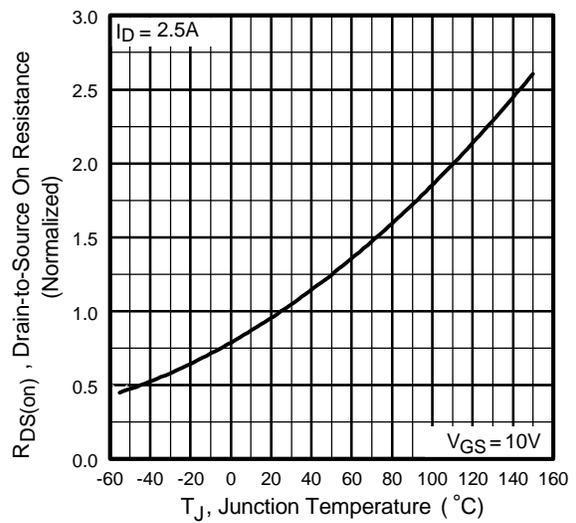
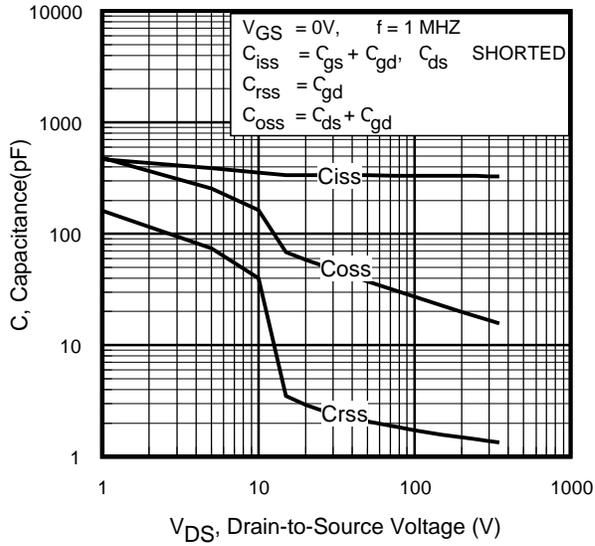


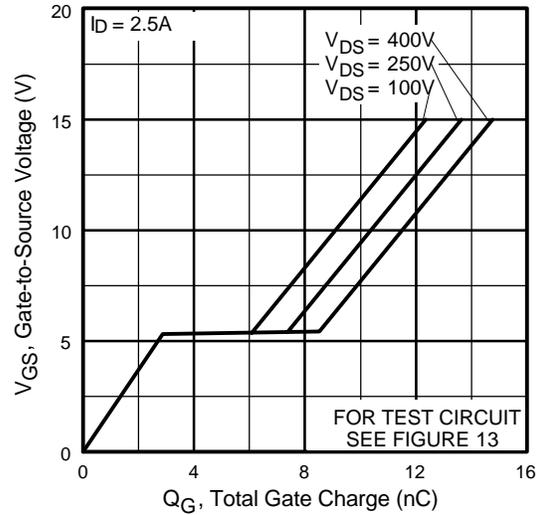
Fig 4. Normalized On-Resistance Vs. Temperature

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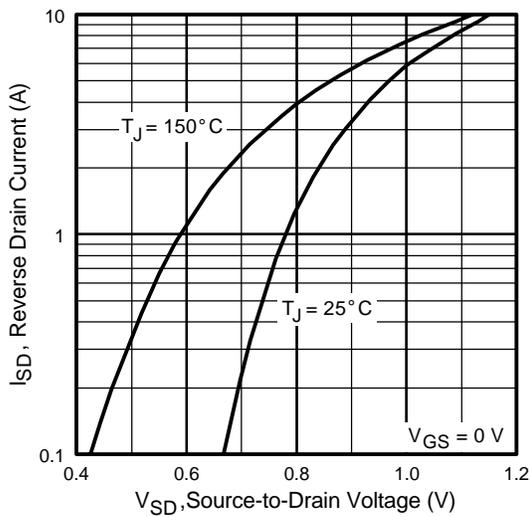
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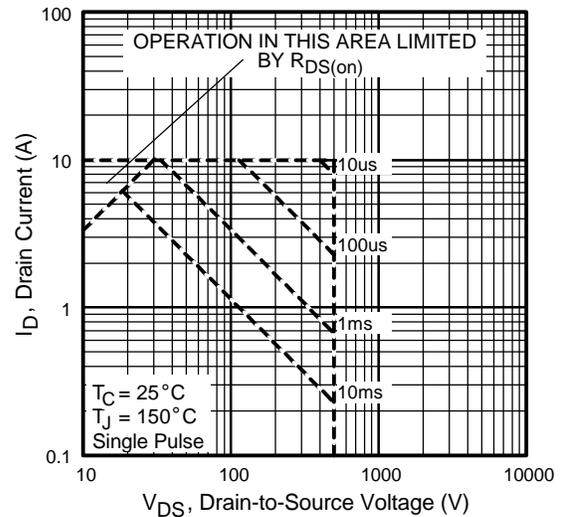
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



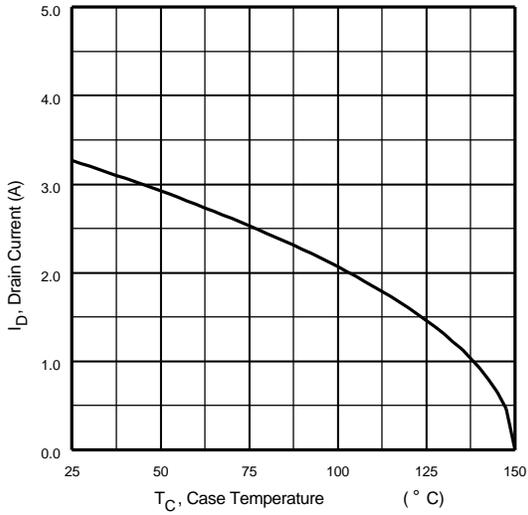
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



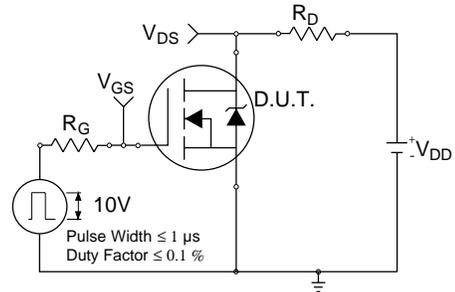
**Fig 7.** Typical Source-Drain Diode Forward Voltage



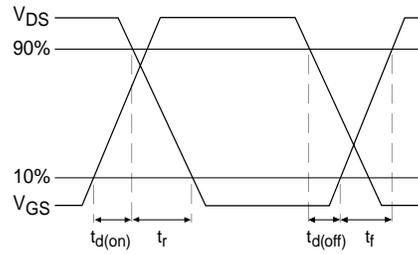
**Fig 8.** Maximum Safe Operating Area



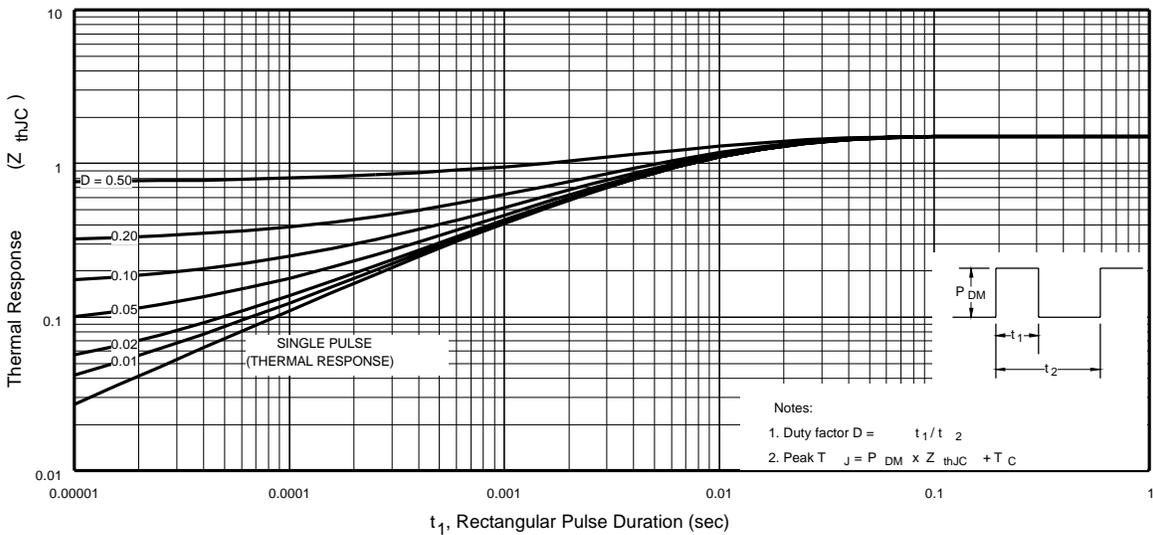
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



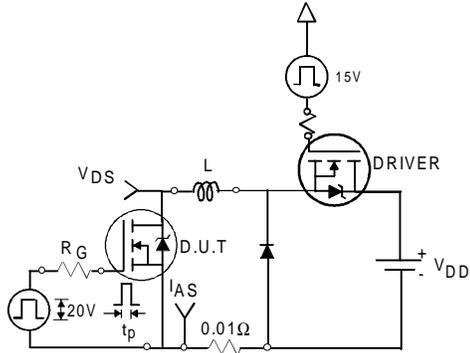
**Fig 10b.** Switching Time Waveforms



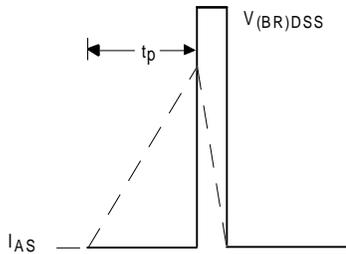
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

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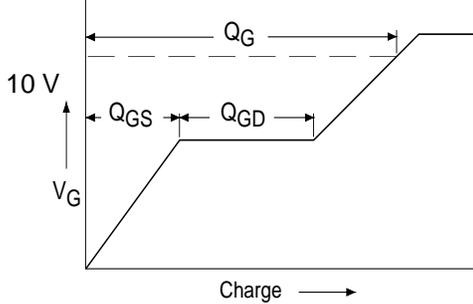
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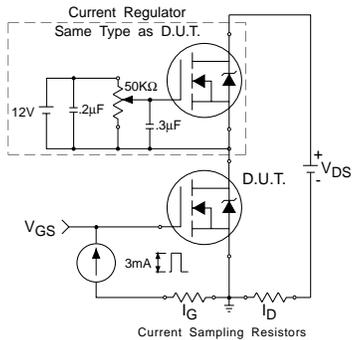
**Fig 12a.** Unclamped Inductive Test Circuit



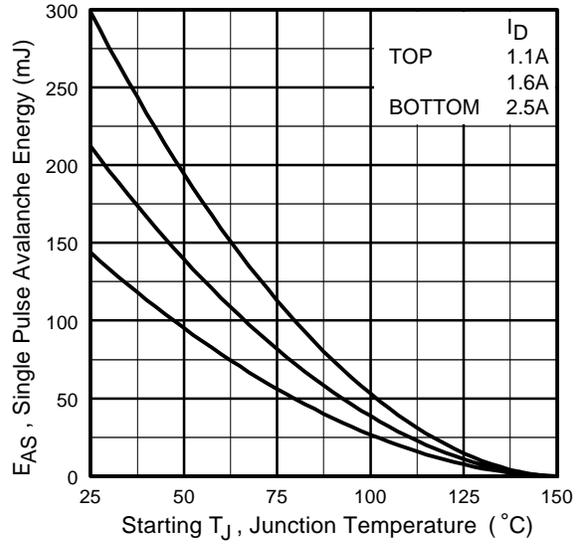
**Fig 12b.** Unclamped Inductive Waveforms



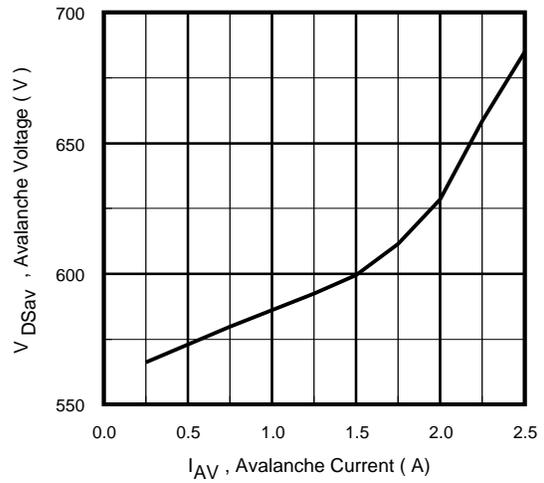
**Fig 13a.** Basic Gate Charge Waveform



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

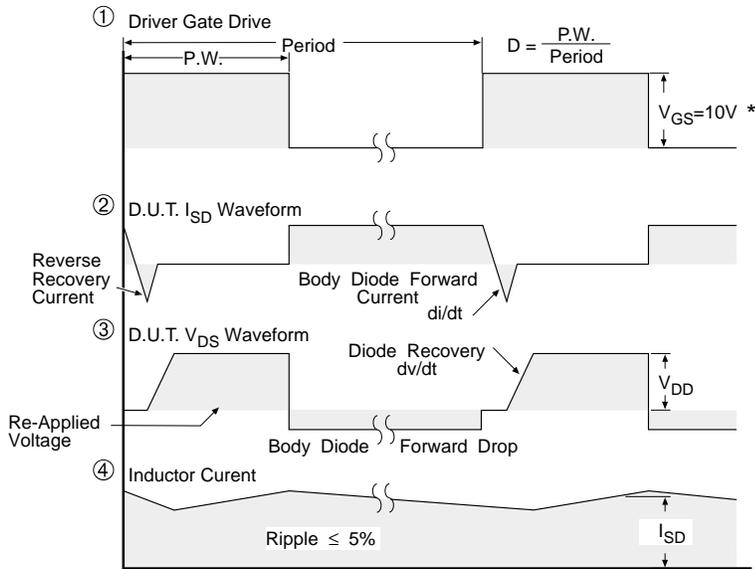
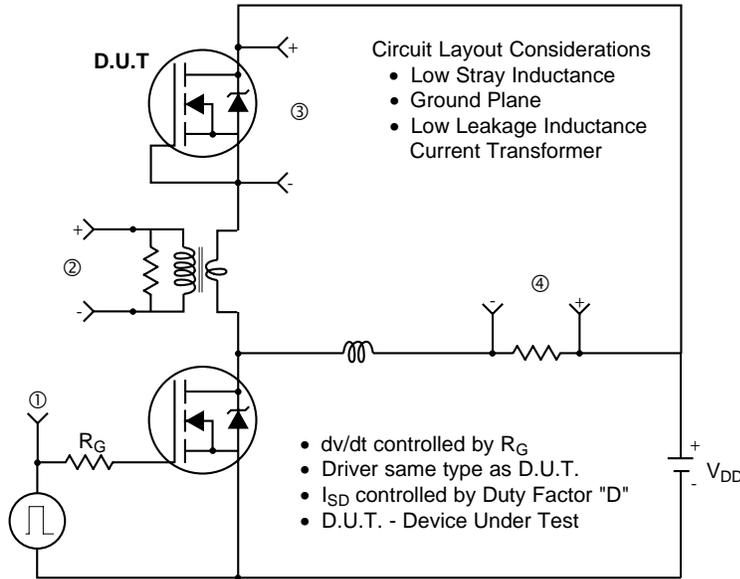


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



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

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



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

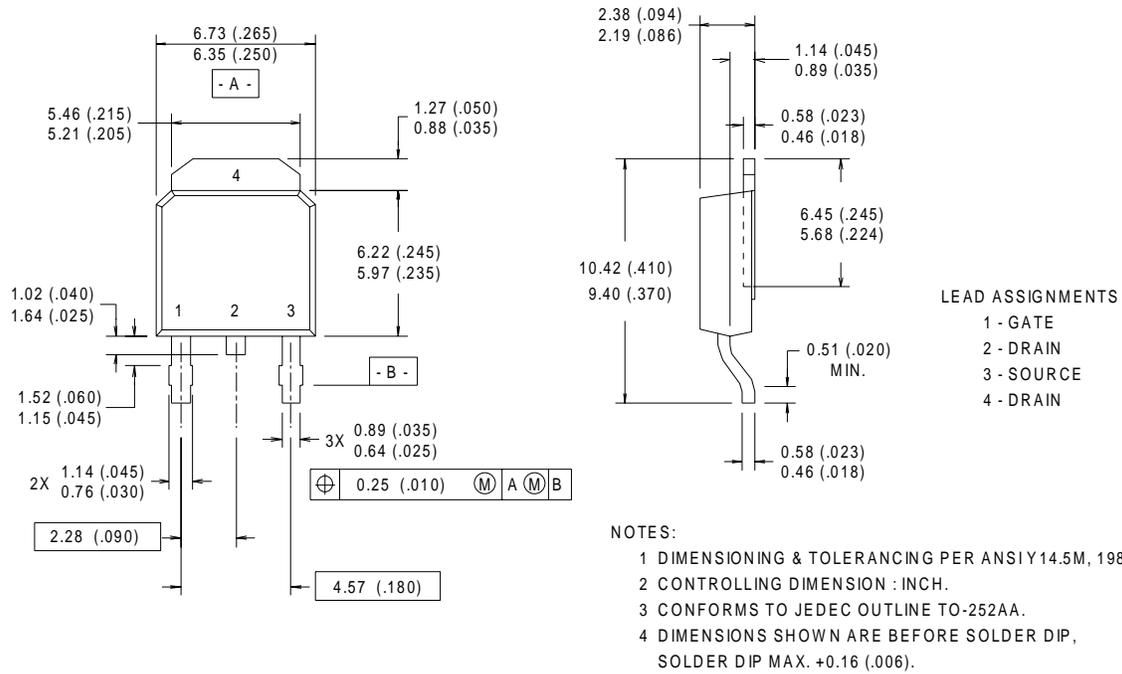
**Fig 14.** For N-Channel HEXFET® Power MOSFETs

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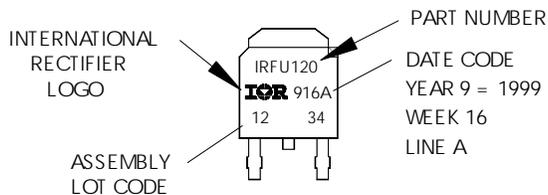
## D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



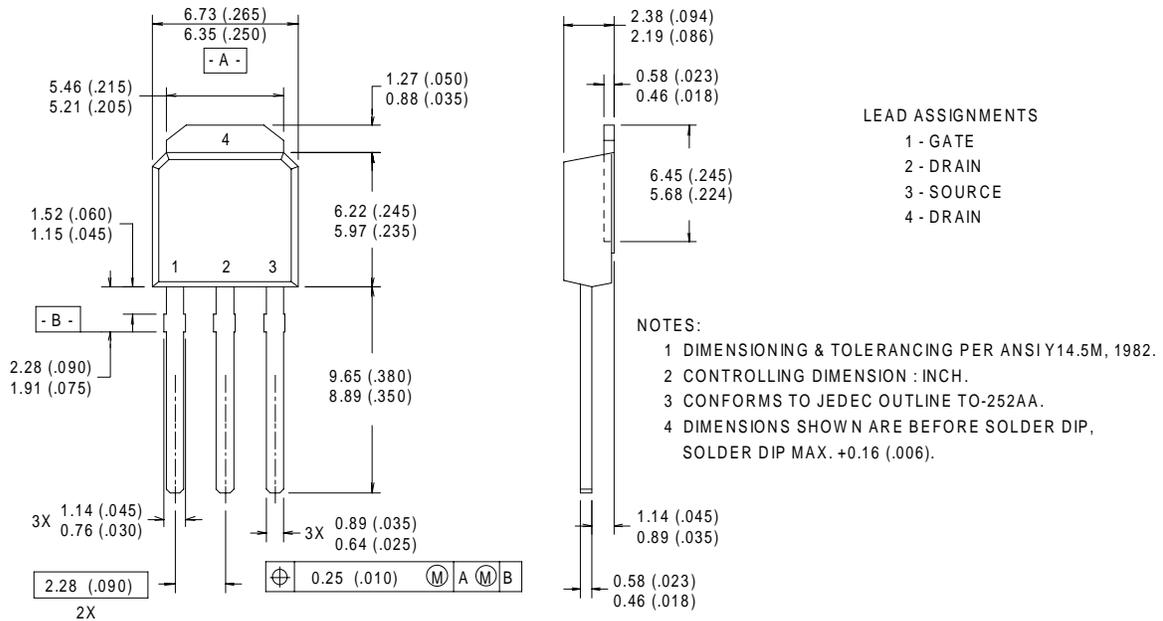
## D-Pak (TO-252AA) Part Marking Information

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



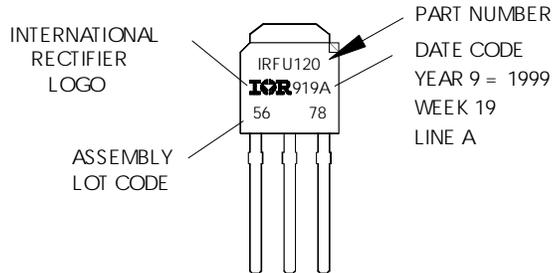
## I-Pak (TO-251AA) Package Outline

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"

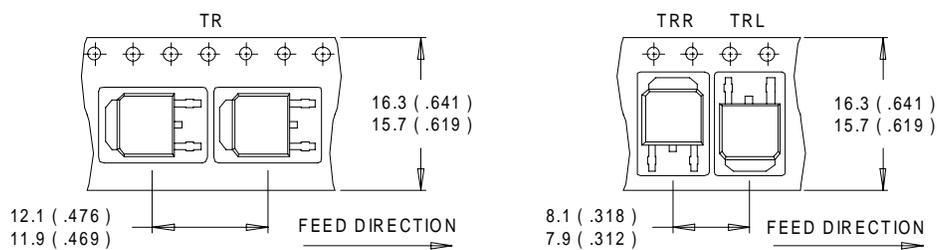


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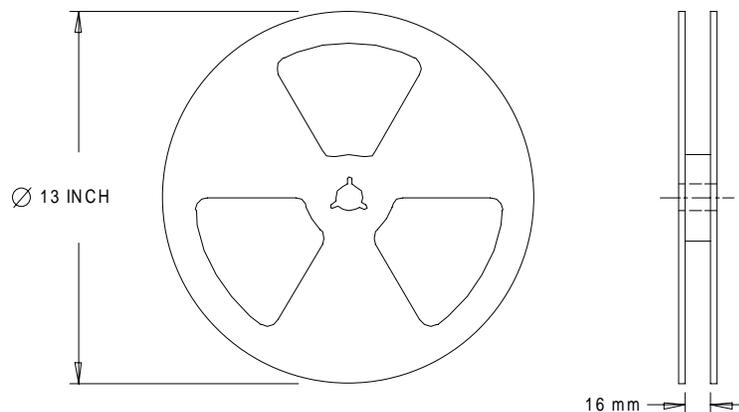
## D-Pak (TO-252AA) Tape & Reel Information

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.

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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