

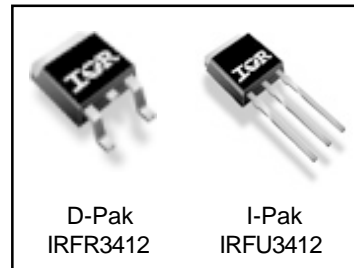
**Applications**

- Switch Mode Power Supply (SMPS)
- Motor Drive
- Bridge Converters
- All Zero Voltage Switching

<b>V<sub>DSS</sub></b>	<b>R<sub>DS(on)</sub> max</b>	<b>I<sub>D</sub></b>
<b>100V</b>	<b>0.025Ω</b>	<b>48A<sup>Ⓞ</sup></b>

**Benefits**

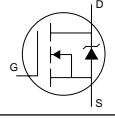
- Low Gate Charge Q<sub>g</sub> results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Enhanced Body Diode dv/dt Capability



**Absolute Maximum Ratings**

	Parameter	Max.	Units
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	48 <sup>Ⓞ</sup>	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	34 <sup>Ⓞ</sup>	
I <sub>DM</sub>	Pulsed Drain Current <sup>Ⓞ</sup>	190	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Power Dissipation	140	W
	Linear Derating Factor	0.95	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery dv/dt <sup>Ⓞ</sup>	6.4	V/ns
T <sub>J</sub> T <sub>STG</sub>	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 second	300(1.6mm from case )	
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

**Diode Characteristics**

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	48 <sup>Ⓞ</sup>	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) <sup>Ⓞ</sup>	—	—	190		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 29A, V <sub>GS</sub> = 0V <sup>Ⓞ</sup>
t <sub>rr</sub>	Reverse Recovery Time	—	68	100	ns	T <sub>J</sub> = 125°C, I <sub>F</sub> = 29A di/dt = 100A/μs <sup>Ⓞ</sup>
Q <sub>rr</sub>	Reverse Recovery Charge	—	160	240	nC	
I <sub>RRM</sub>	Reverse Recovery Current	—	4.5	6.8	A	
t <sub>on</sub>	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> +L <sub>D</sub> )				

## 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	100	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS/ΔT<sub>J</sub></sub>	Breakdown Voltage Temp. Coefficient	—	0.10	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA ⑥
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	—	0.025	Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 29A ④
V <sub>GS(th)</sub>	Gate Threshold Voltage	3.5	—	5.5	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	1.0	μA	V <sub>DS</sub> = 95V, V <sub>GS</sub> = 0V
		—	—	250		V <sub>DS</sub> = 80V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 150°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	100	nA	V <sub>GS</sub> = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V <sub>GS</sub> = -20V

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
g <sub>fs</sub>	Forward Transconductance	25	—	—	S	V <sub>DS</sub> = 50V, I <sub>D</sub> = 29A
Q <sub>g</sub>	Total Gate Charge	—	59	89	nC	I <sub>D</sub> = 29A
Q <sub>gs</sub>	Gate-to-Source Charge	—	21	32		V <sub>DS</sub> = 50V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	17	26		V <sub>GS</sub> = 10V, ④
t <sub>d(on)</sub>	Turn-On Delay Time	—	19	—	ns	V <sub>DD</sub> = 50V
t <sub>r</sub>	Rise Time	—	68	—		I <sub>D</sub> = 29A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	44	—		R <sub>G</sub> = 6.8Ω
t <sub>f</sub>	Fall Time	—	37	—		V <sub>GS</sub> = 10V ④
C <sub>iss</sub>	Input Capacitance	—	3430	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	270	—		V <sub>DS</sub> = 25V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	150	—		f = 1.0MHz
C <sub>oss</sub>	Output Capacitance	—	1040	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 1.0V, f = 1.0MHz
C <sub>oss</sub>	Output Capacitance	—	170	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 80V, f = 1.0MHz
C <sub>oss eff.</sub>	Effective Output Capacitance	—	270	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 80V ⑤

## Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy②	—	160	mJ
I <sub>AR</sub>	Avalanche Current①	—	29	A
E <sub>AR</sub>	Repetitive Avalanche Energy①	—	14	mJ

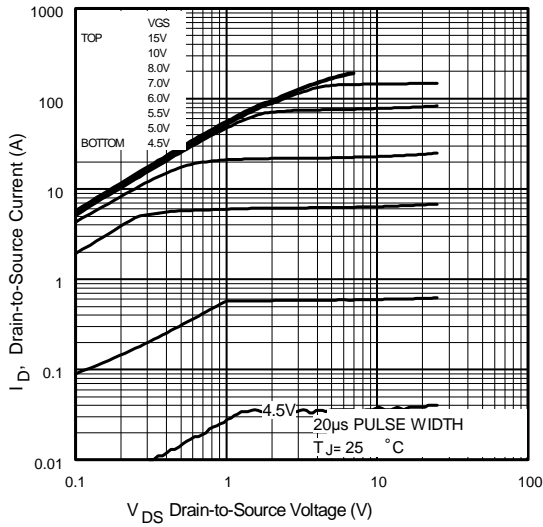
## Thermal Resistance

	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case	—	1.05	°C/W
R <sub>θJA</sub>	Junction-to-Ambient (PCB mount)*	—	50	
R <sub>θJA</sub>	Junction-to-Ambient	—	110	

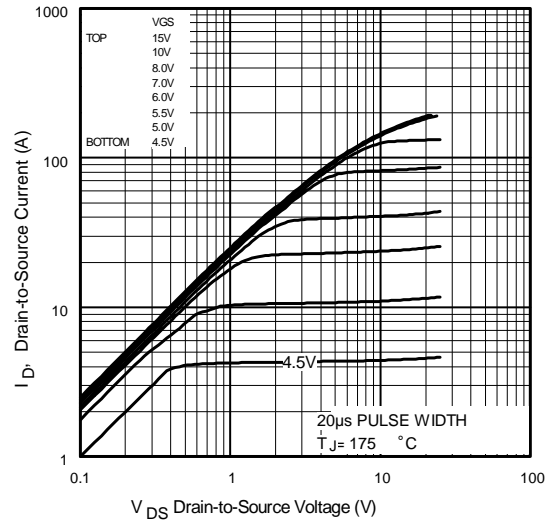
### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See Fig. 11)
- ② Starting T<sub>J</sub> = 25°C, L = 0.38mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 29A. (See Figure 12a)
- ③ I<sub>SD</sub> ≤ 29A, di/dt ≤ 420A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤ 150°C
- ④ Pulse width ≤ 300μs; duty cycle ≤ 2%.
- ⑤ C<sub>oss eff.</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DS</sub>
- ⑥ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 30A.

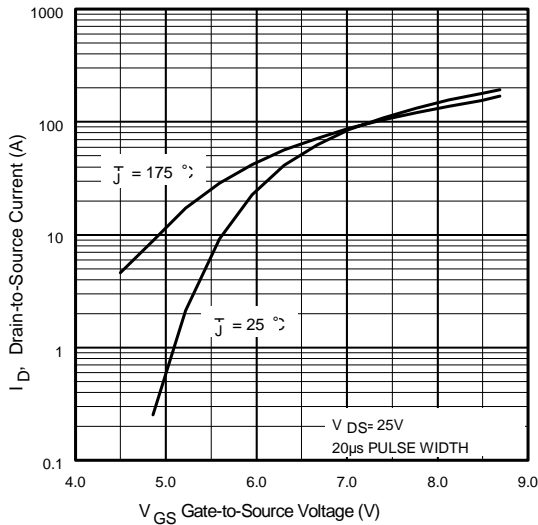
\* When mounted on 1" square PCB (FR-4 or G-10 Material).  
For recommended footprint and soldering techniques refer to application note #AN-994



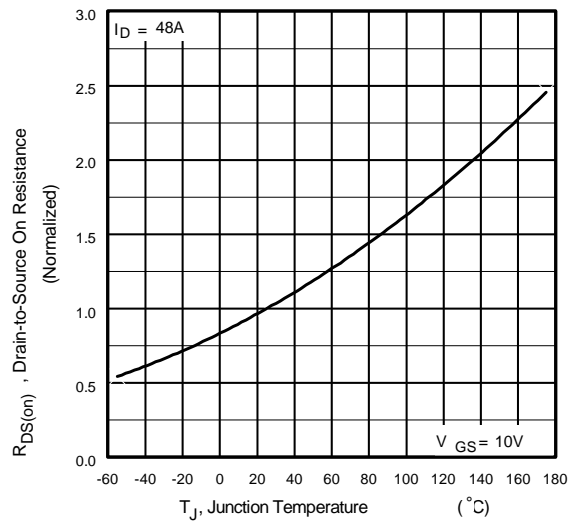
**Fig 1.** Typical Output Characteristics



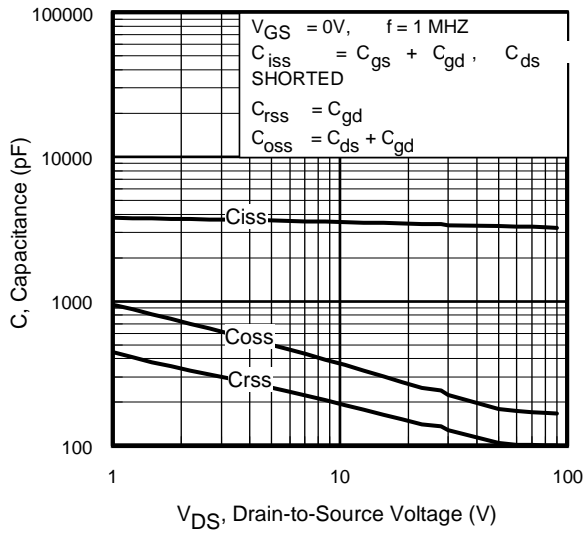
**Fig 2.** Typical Output Characteristics



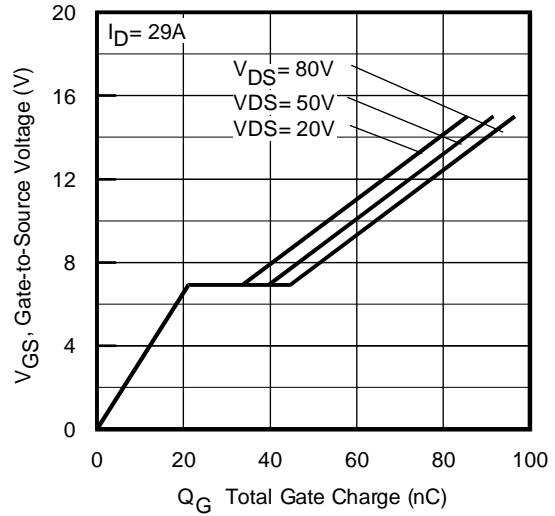
**Fig 3.** Typical Transfer Characteristics



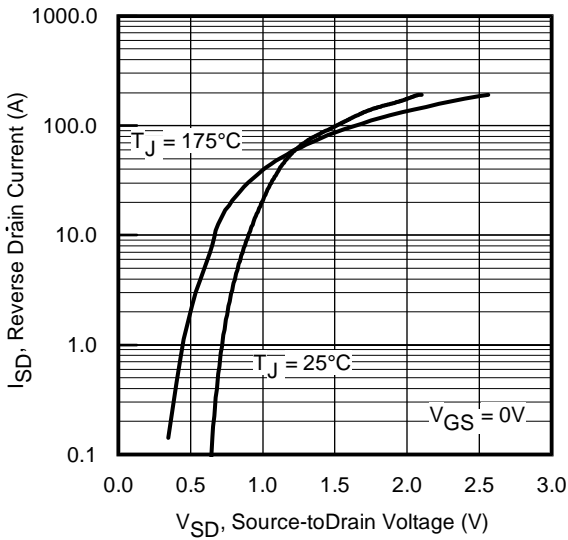
**Fig 4.** Normalized On-Resistance Vs. Temperature



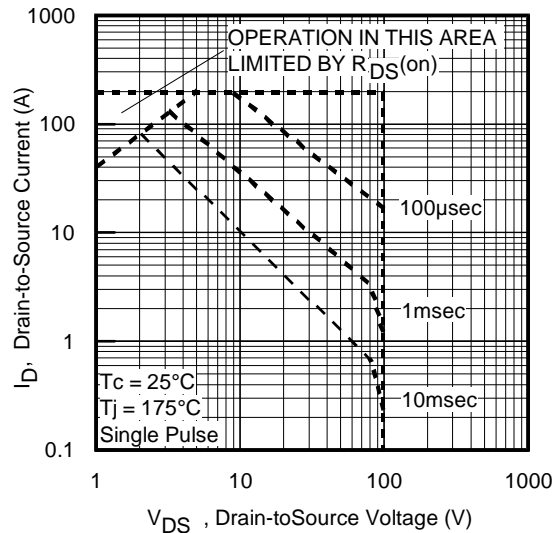
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



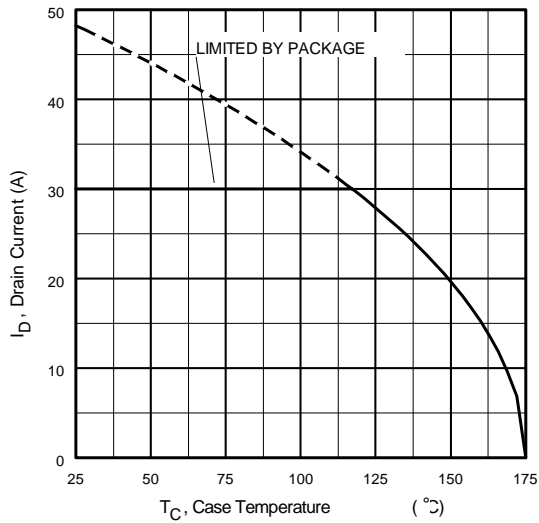
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



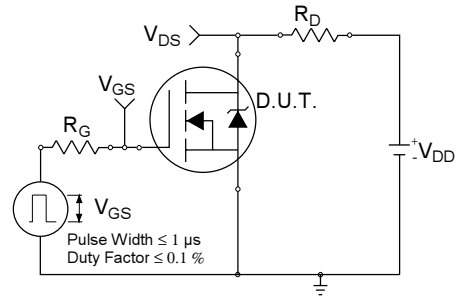
**Fig 7.** Typical Source-Drain Diode Forward Voltage



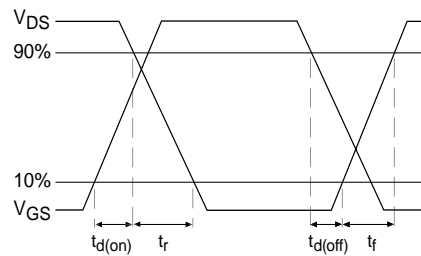
**Fig 8.** Maximum Safe Operating Area



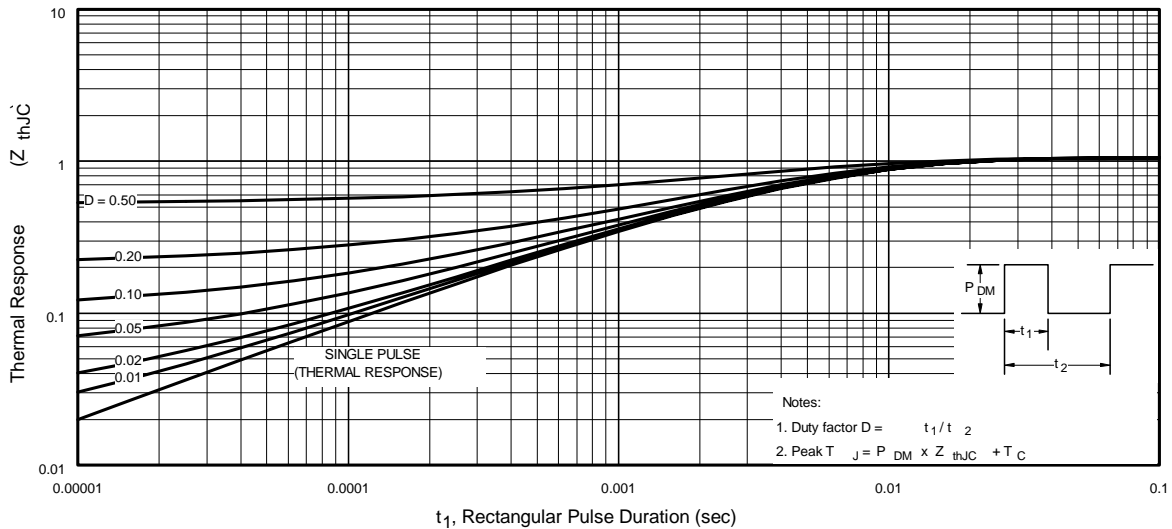
**Fig 9.** Maximum Drain Current Vs. Case Temperature



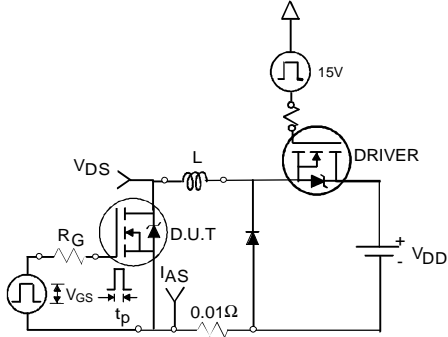
**Fig 10a.** Switching Time Test Circuit



**Fig 10b.** Switching Time Waveforms



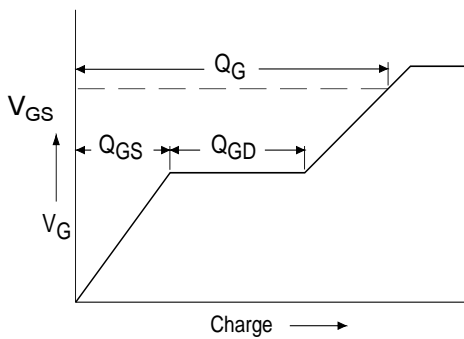
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



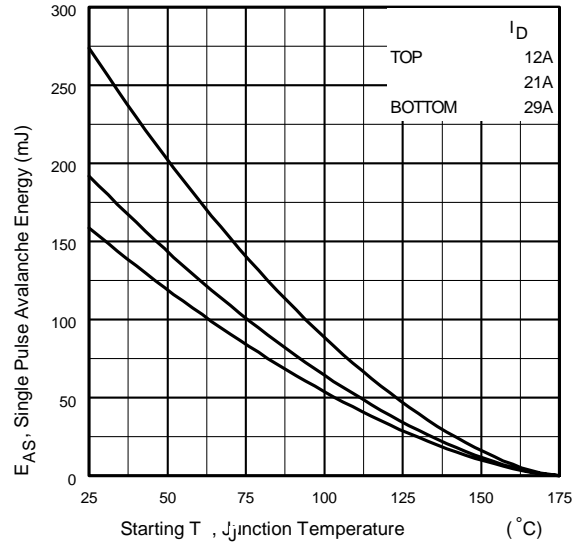
**Fig 12a.** Unclamped Inductive Test Circuit



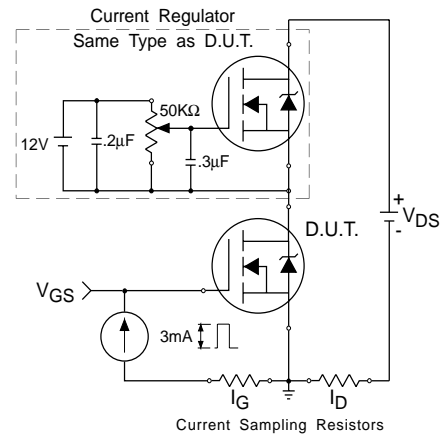
**Fig 12b.** Unclamped Inductive Waveforms



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

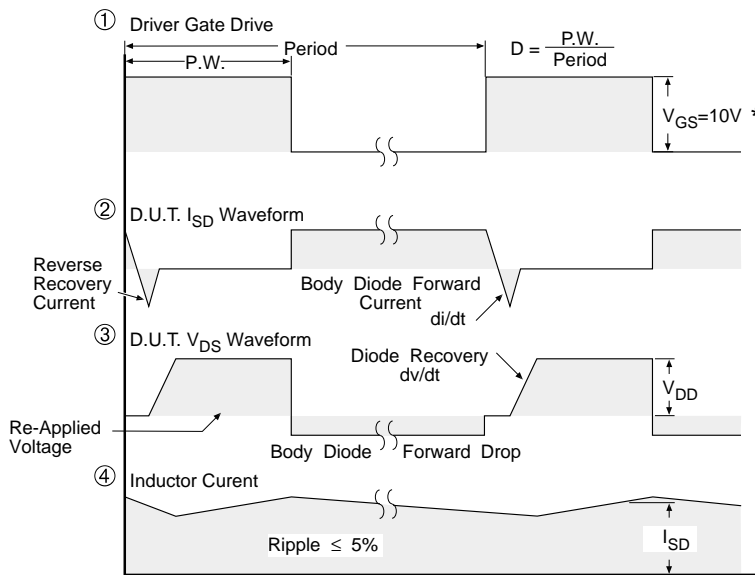
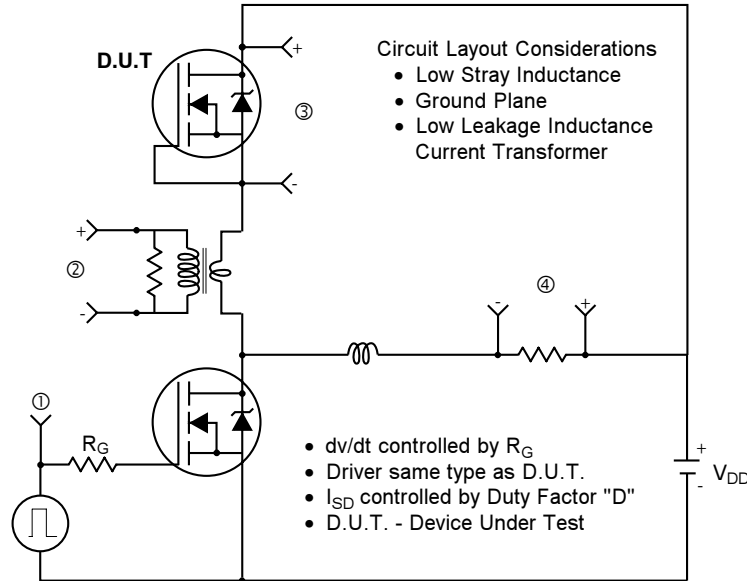


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



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

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



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

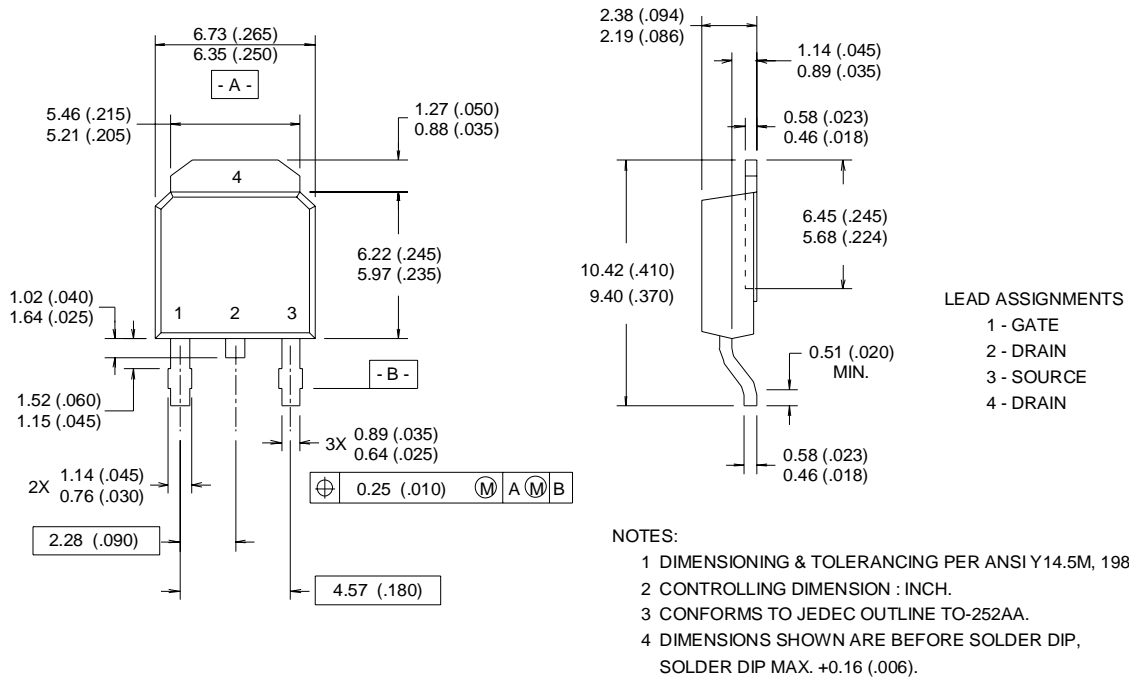
**Fig 14.** For N-Channel HEXFET® Power MOSFETs

# IRFR/U3412



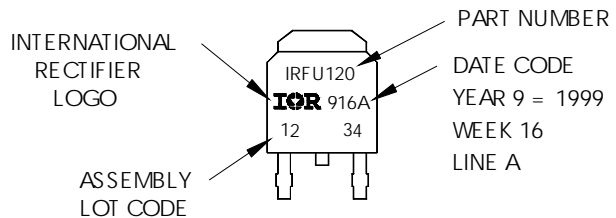
## TO-252AA (D-Pak) Package Outline

Dimensions are shown in millimeters (inches)



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

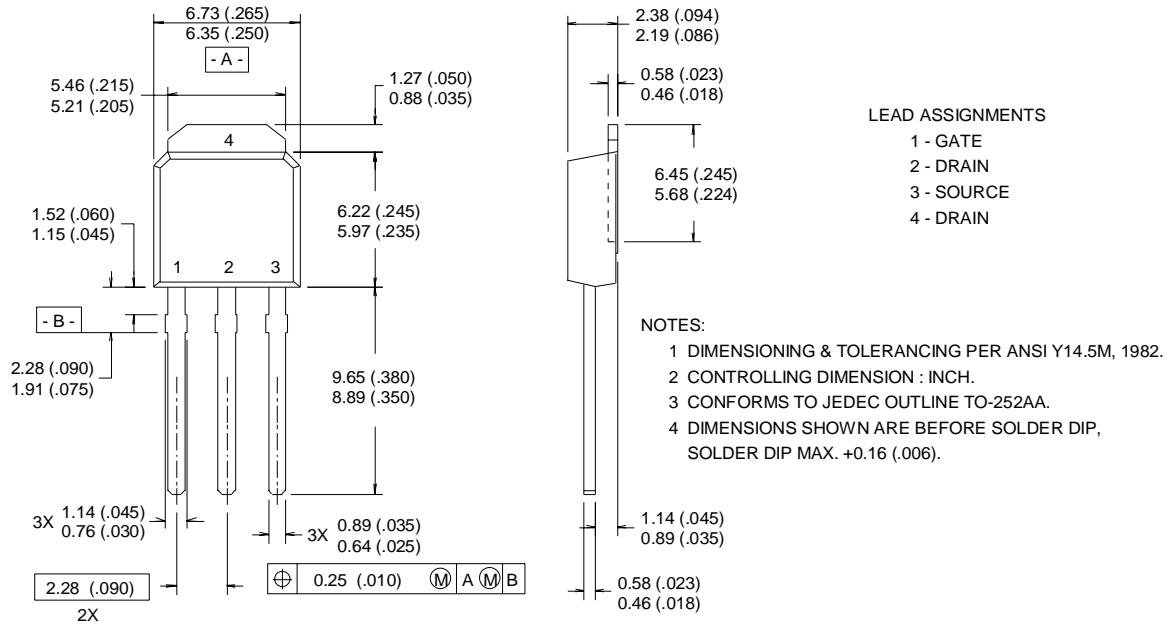
EXAMPLE: THIS IS AN IRFR120  
WITH ASSEMBLY  
LOT CODE 1234  
ASSEMBLED ON WW 16, 1999  
IN THE ASSEMBLY LINE "A"





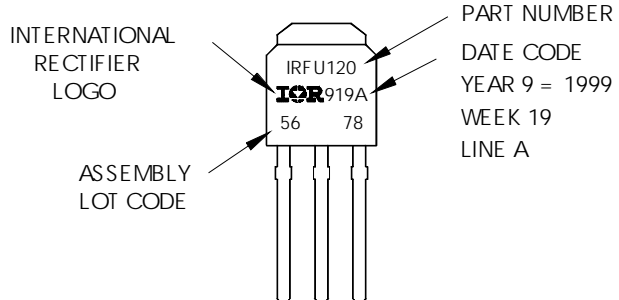
## TO-251AA (I-Pak) Package Outline

Dimensions are shown in millimeters (inches)



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

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

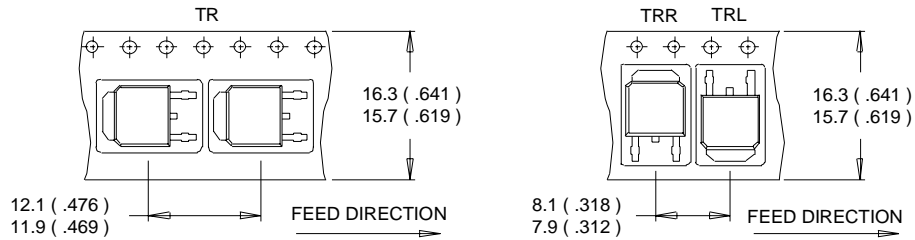


# IRFR/U3412

International  
**IR** Rectifier

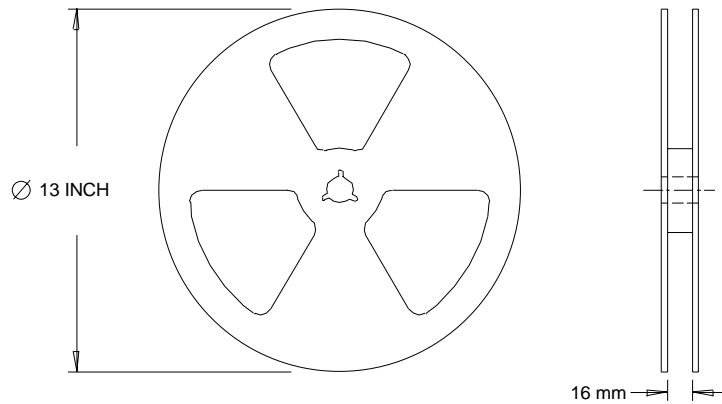
## D-Pak (TO-252AA) Tape & Reel Information

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

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