

# IRFR420A IRFU420A

HEXFET® Power MOSFET

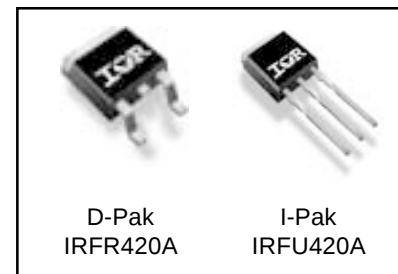
## Applications

- 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                |
| $T_J$<br>$T_{STG}$                | Operating Junction and<br>Storage Temperature Range | -55 to + 150           |                     |
|                                   | Soldering Temperature, for 10 seconds               | 300 (1.6mm from case ) |                     |

## 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  | $^\circ\text{C/W}$ |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.50 | —    |                    |
| $R_{\theta JA}$ | Junction-to-Ambient                 | —    | 62   |                    |

# IRFR420A/IRFU420A

International  
**IR** Rectifier

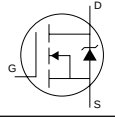
## Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

|                                 | Parameter                            | Min. | Typ. | Max. | Units    | Conditions                                            |
|---------------------------------|--------------------------------------|------|------|------|----------|-------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 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 $25^\circ\text{C}$ , $I_D = 1mA$         |
| $R_{DS(on)}$                    | 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  | —    |       | $f = 1.0MHz$ , See Fig. 5                     |
| $C_{oss}$              | Output Capacitance              | —    | 490  | —    |       | $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$      |
| $C_{oss}$              | Output Capacitance              | —    | 15   | —    |       | $V_{GS} = 0V, V_{DS} = 400V, f = 1.0MHz$      |
| $C_{oss \text{ eff.}}$ | 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 $L_S + L_D$ ) |      |      |       |                                                                                                                                                      |

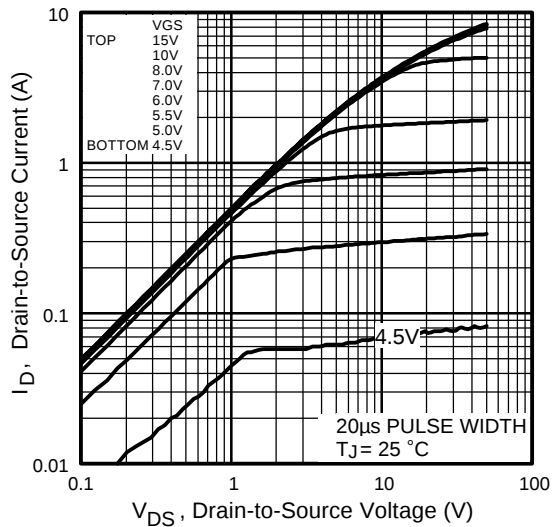
### Notes:

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

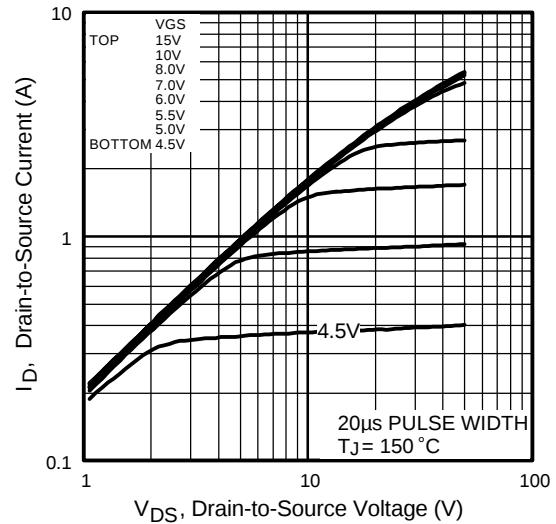
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .

- ⑤  $C_{oss \text{ eff.}}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$

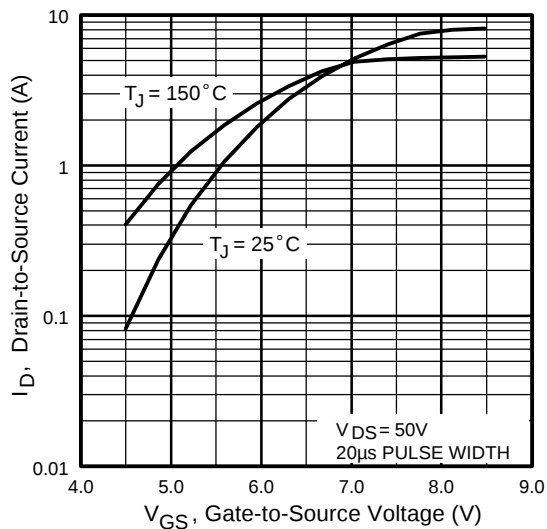
# IRFR420A/IRFU420A



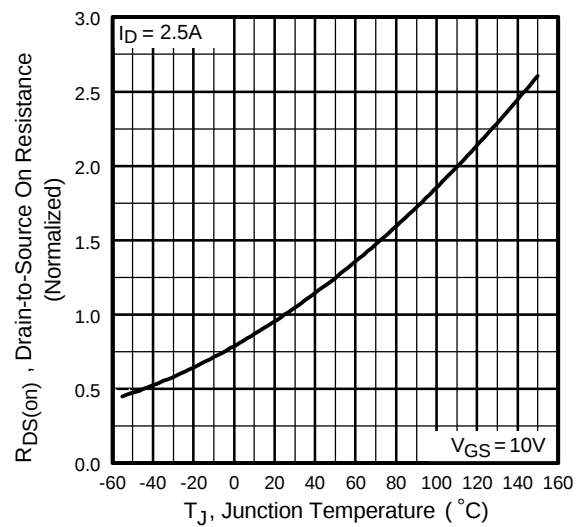
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



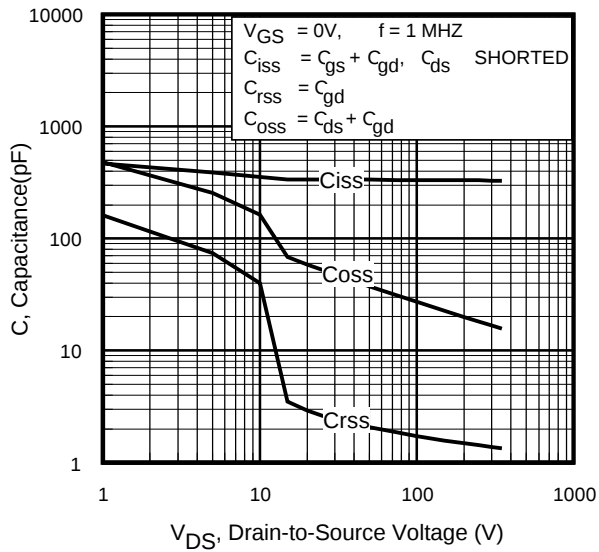
**Fig 3.** Typical Transfer Characteristics



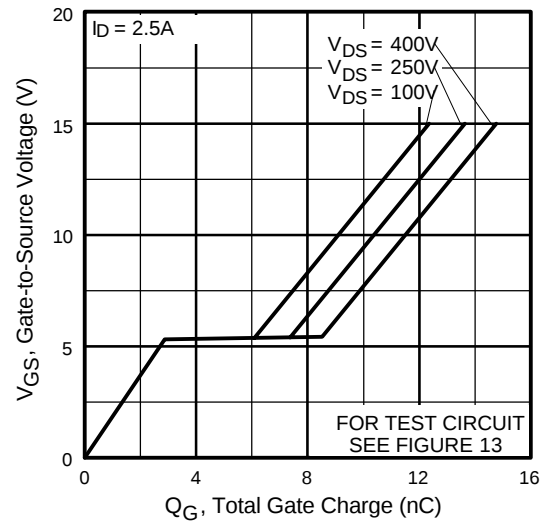
**Fig 4.** Normalized On-Resistance Vs. Temperature

# IRFR420A/IRFU420A

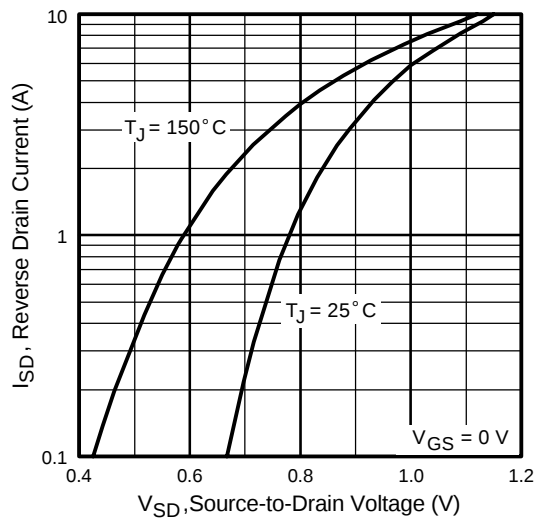
International  
**IR** Rectifier



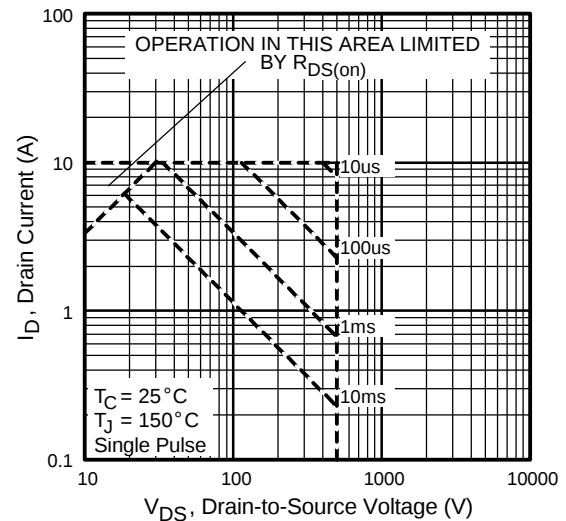
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



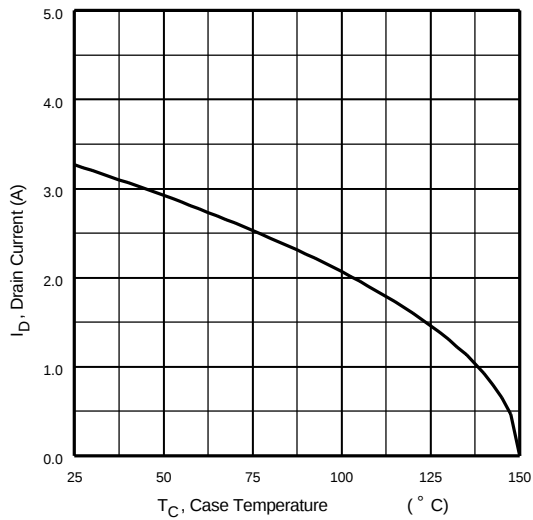
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



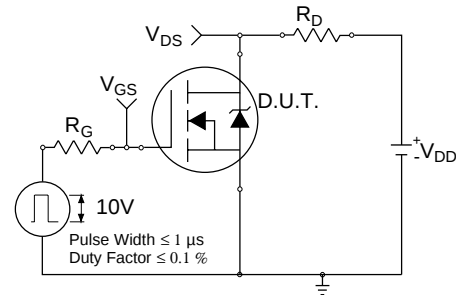
**Fig 7.** Typical Source-Drain Diode Forward Voltage



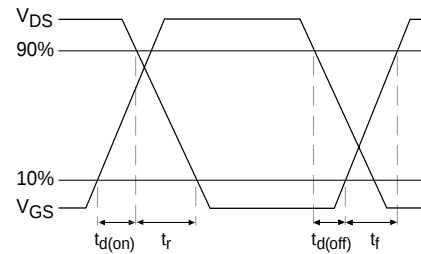
**Fig 8.** Maximum Safe Operating Area



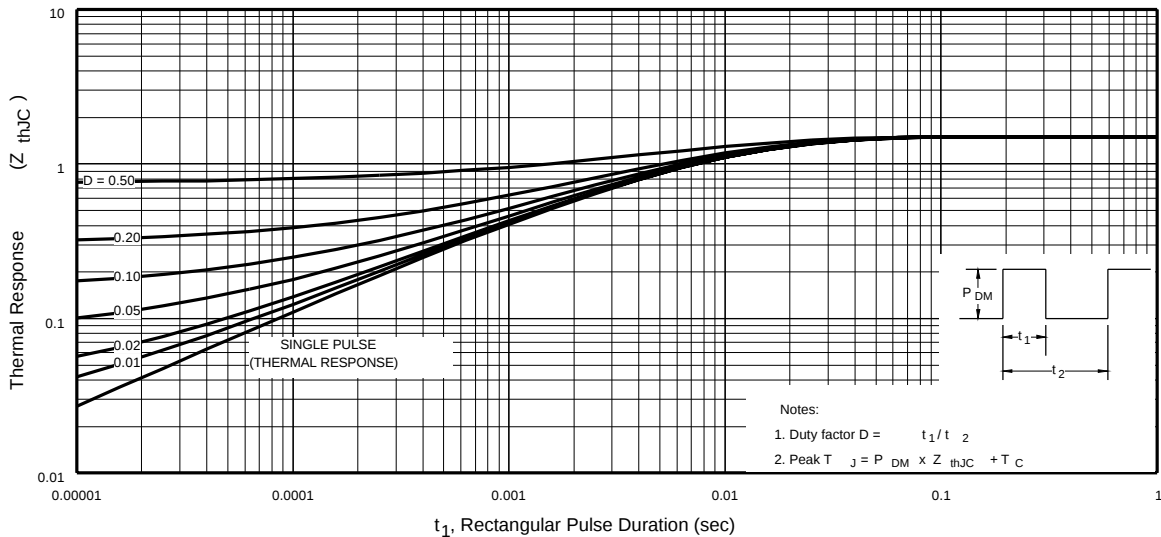
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



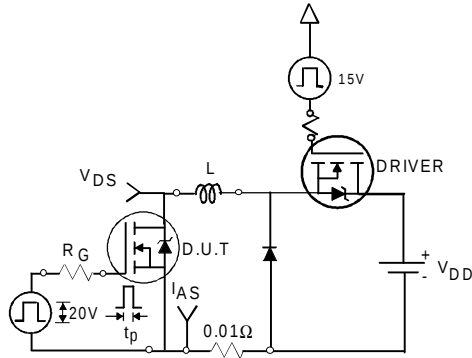
**Fig 10b.** Switching Time Waveforms



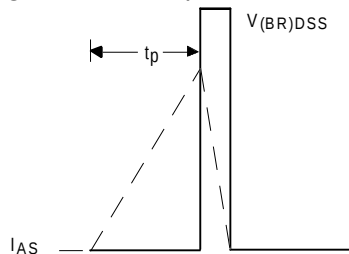
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

# IRFR420A/IRFU420A

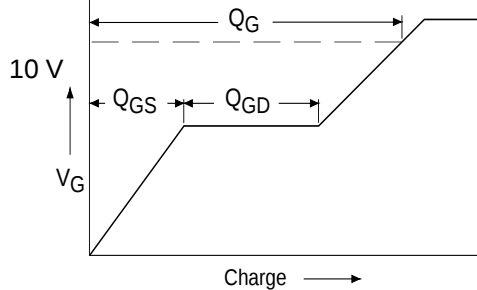
International  
**IR** Rectifier



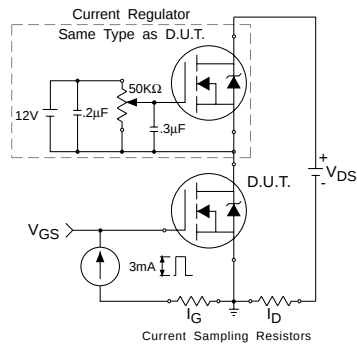
**Fig 12a.** Unclamped Inductive Test Circuit



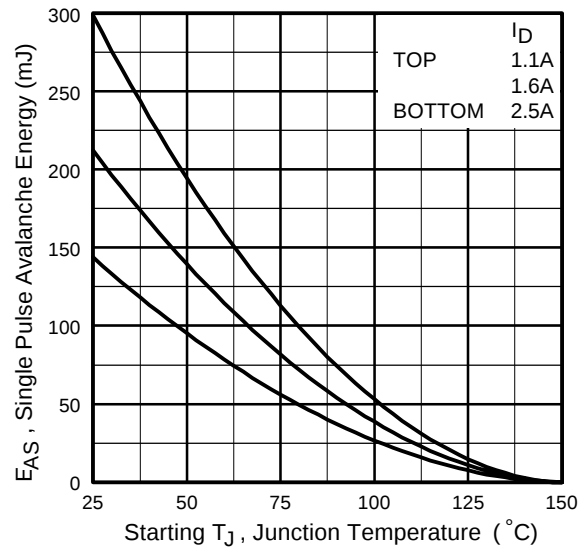
**Fig 12b.** Unclamped Inductive Waveforms



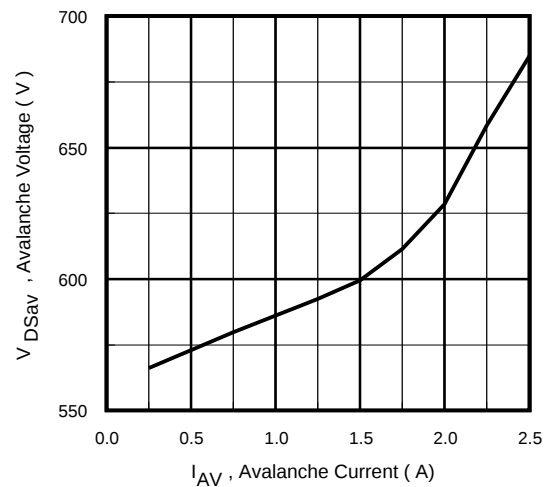
**Fig 13a.** Basic Gate Charge Test Circuit



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



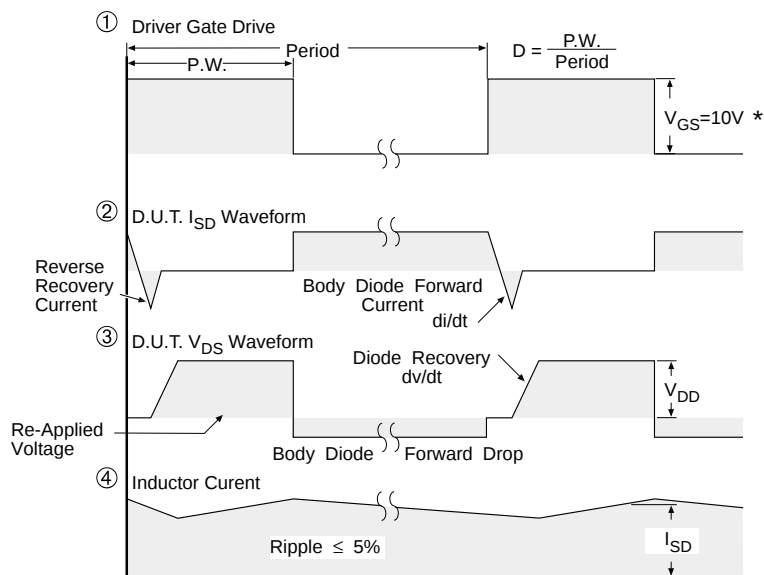
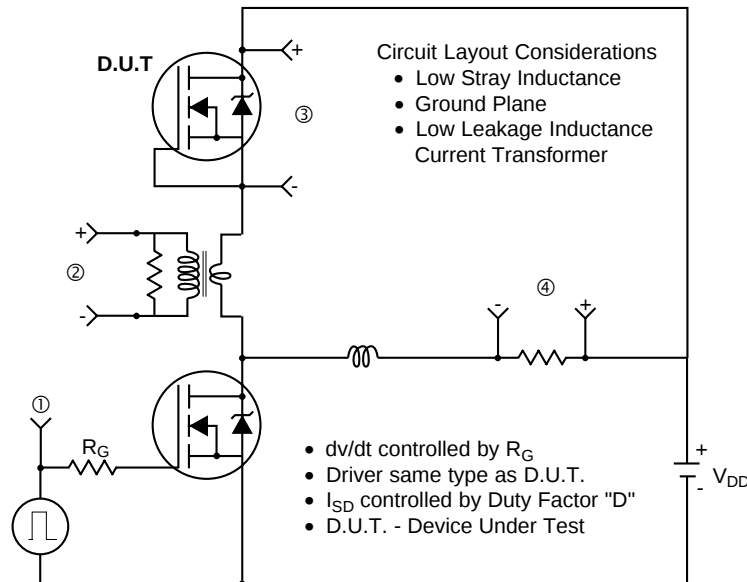
**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



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

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## Peak Diode Recovery dv/dt Test Circuit



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

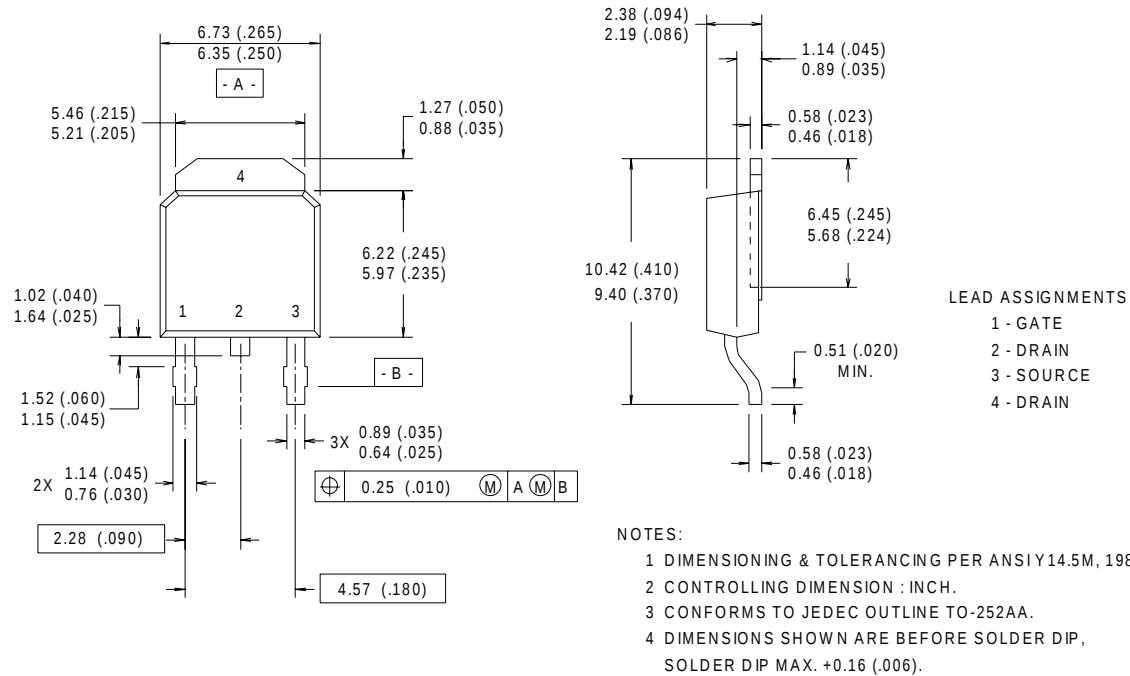
**Fig 14.** For N-Channel HEXFET® Power MOSFETs

# IRFR420A/IRFU420A

International  
**IR** Rectifier

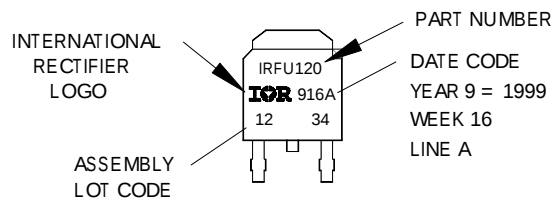
## D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



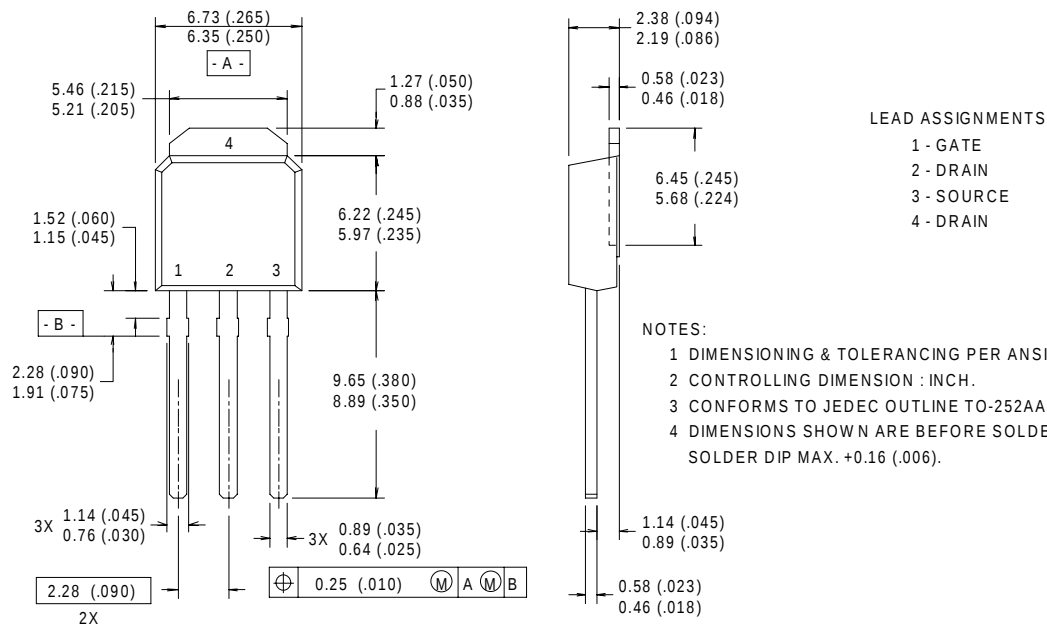
## D-Pak (TO-252AA) Part Marking Information

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



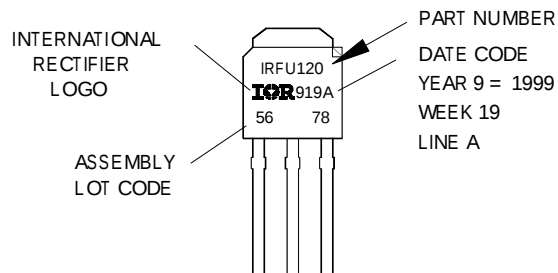
## I-Pak (TO-251AA) Package Outline

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"

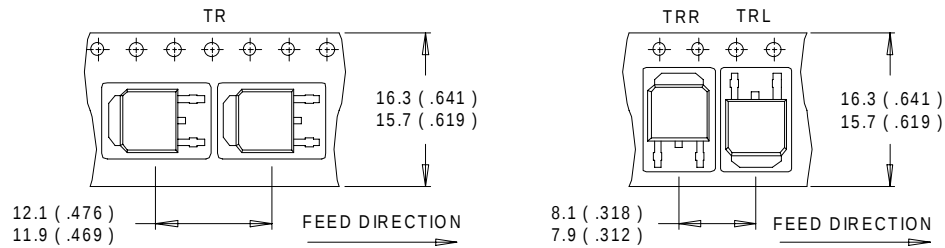


# IRFR420A/IRFU420A

International  
**IR** Rectifier

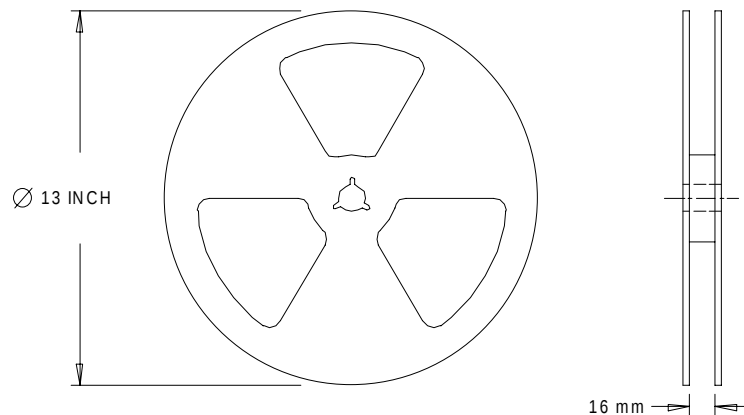
## D-Pak (TO-252AA) Tape & Reel Information

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

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