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With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

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Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



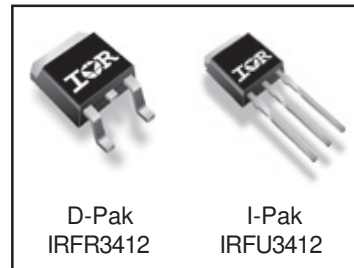
**Applications**

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

|                        |                               |                        |
|------------------------|-------------------------------|------------------------|
| <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**

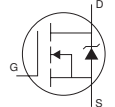
- Low Gate Charge Q<sub>g</sub> results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Enhanced Body Diode dv/dt Capability



**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><br>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<br>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> ) |      |                 |       |  |

# IRFR/U3412PbF

International  
IR Rectifier

## 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</sub> /ΔT <sub>J</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    |

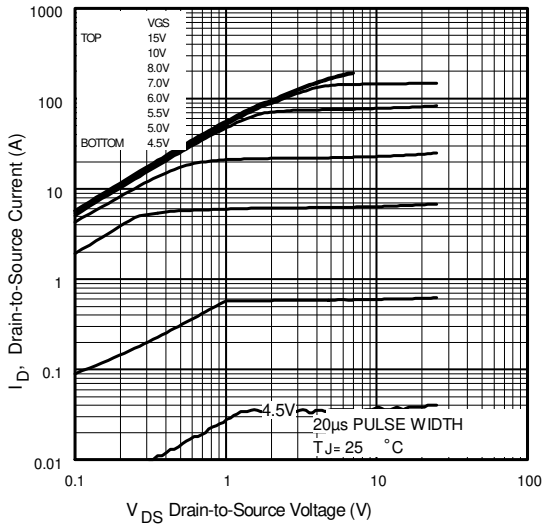
## Thermal Resistance

|                  | 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  |       |

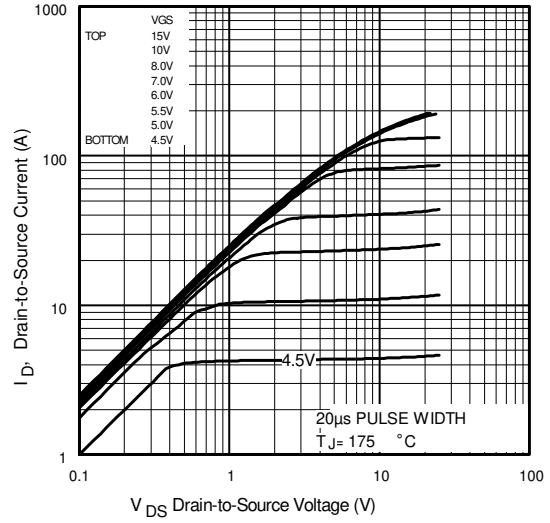
### Notes:

- 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.

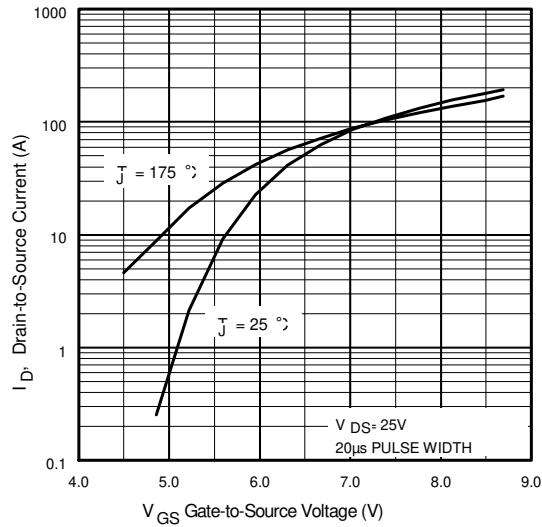
\* When mounted on 1" square PCB (FR-4 or G-10 Material).  
For recommended footprint and soldering techniques refer to application note #AN-994



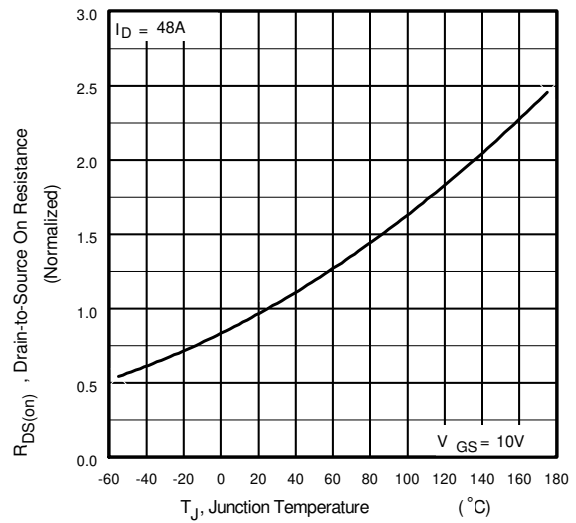
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics

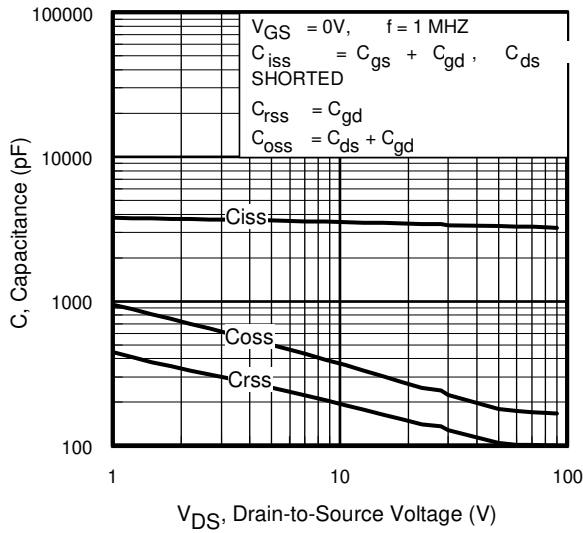


**Fig 3.** Typical Transfer Characteristics

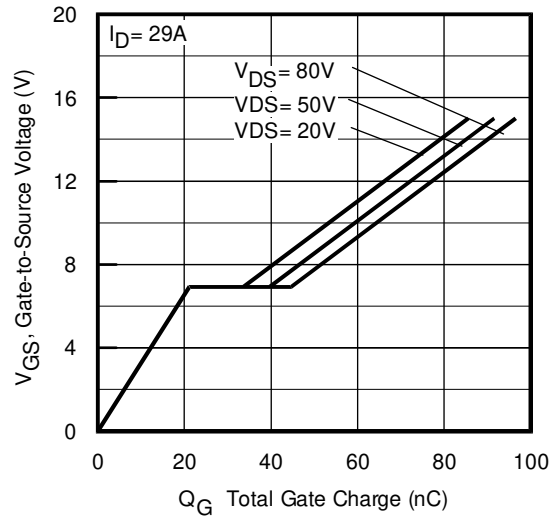


**Fig 4.** Normalized On-Resistance Vs. Temperature

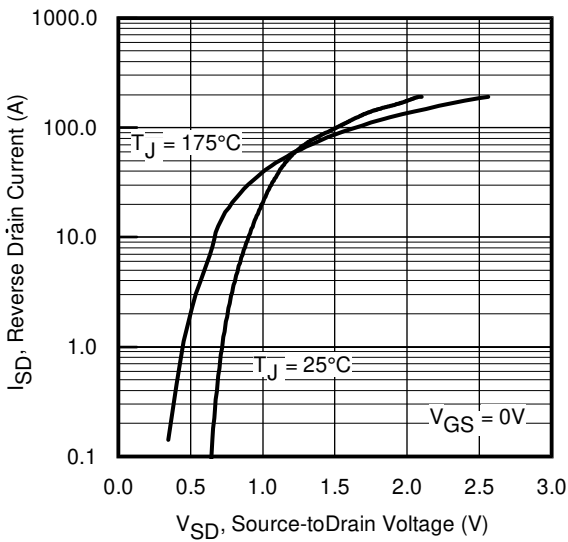
# IRFR/U3412PbF



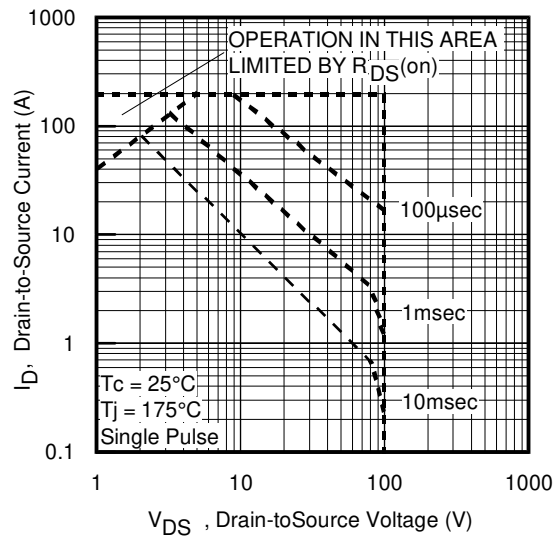
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



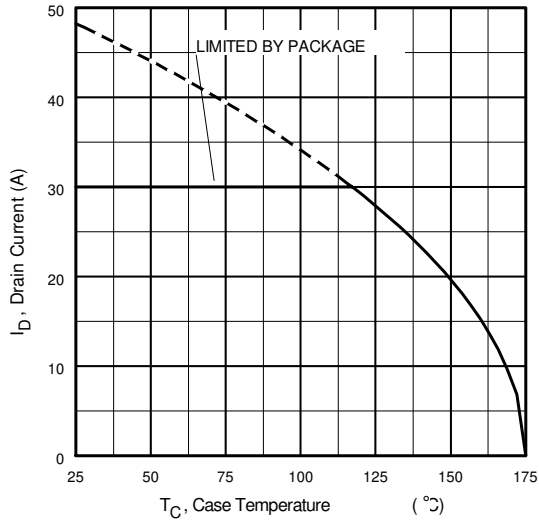
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



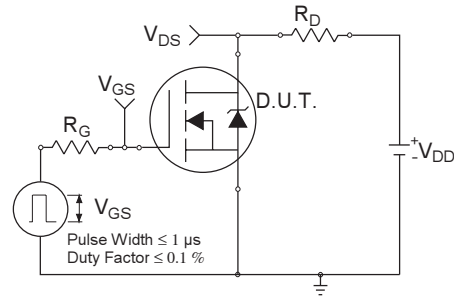
**Fig 7.** Typical Source-Drain Diode Forward Voltage



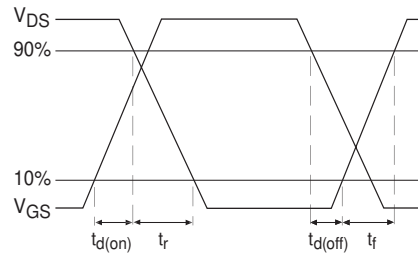
**Fig 8.** Maximum Safe Operating Area



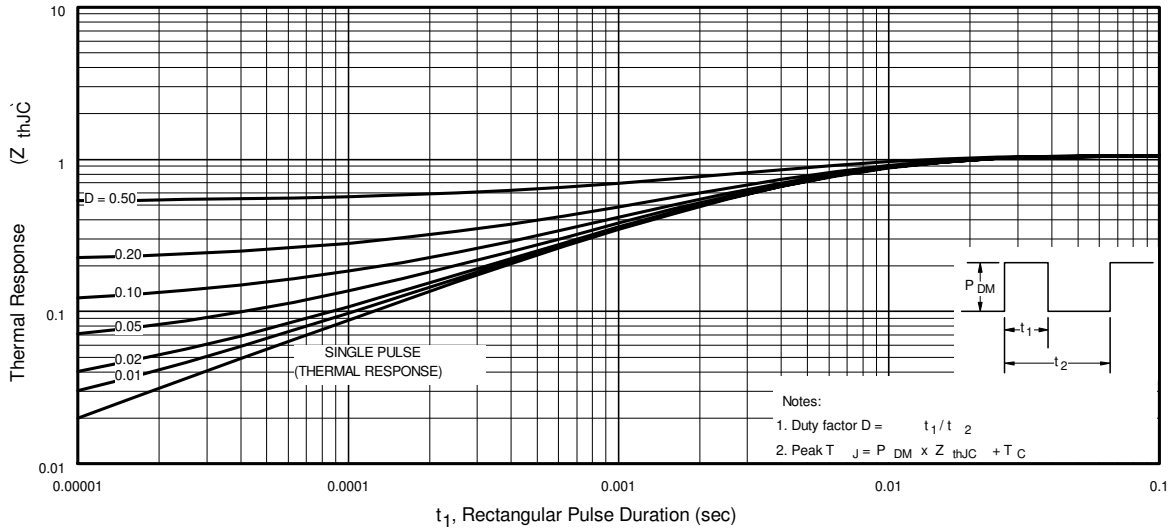
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



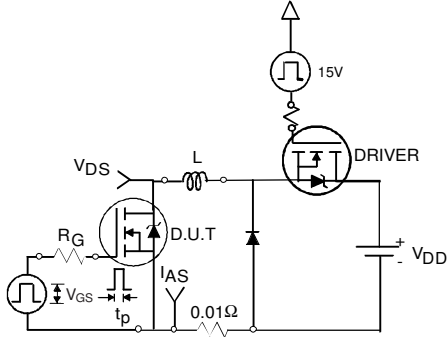
**Fig 10b.** Switching Time Waveforms



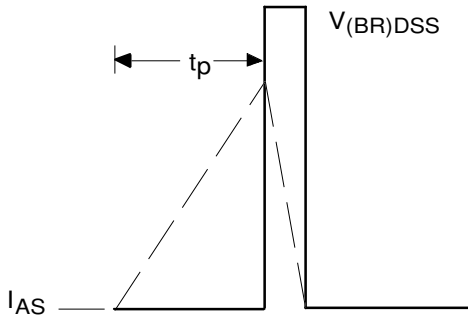
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

# IRFR/U3412PbF

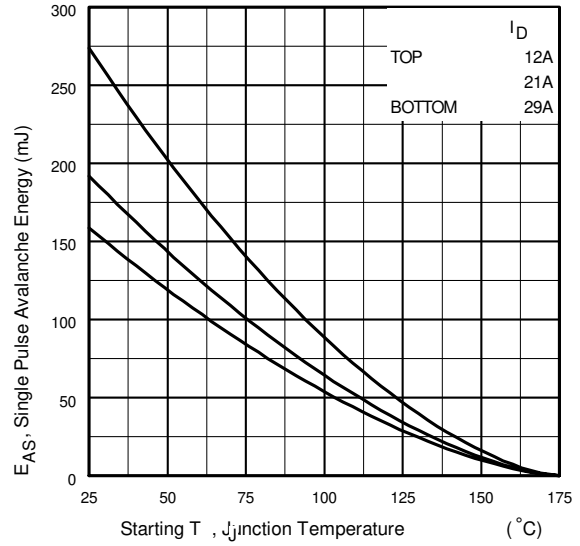
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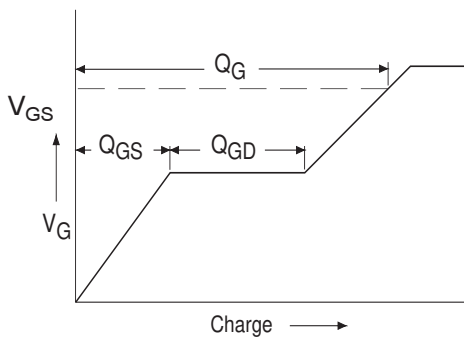
**Fig 12a.** Unclamped Inductive Test Circuit



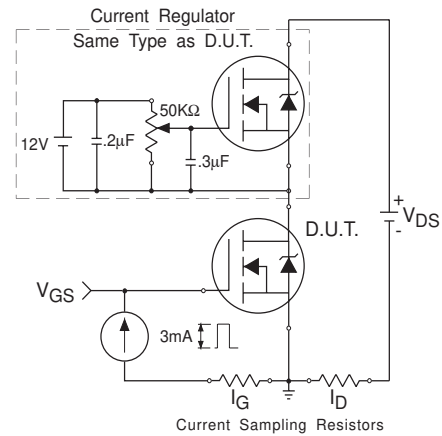
**Fig 12b.** Unclamped Inductive Waveforms



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

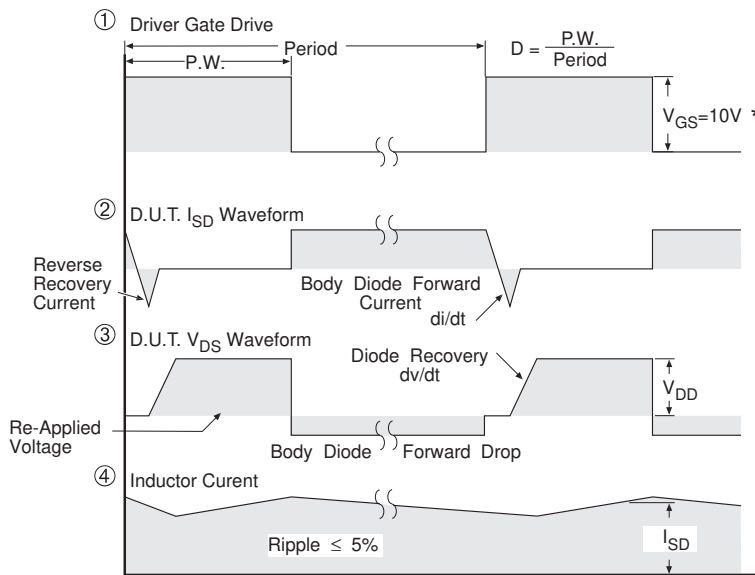
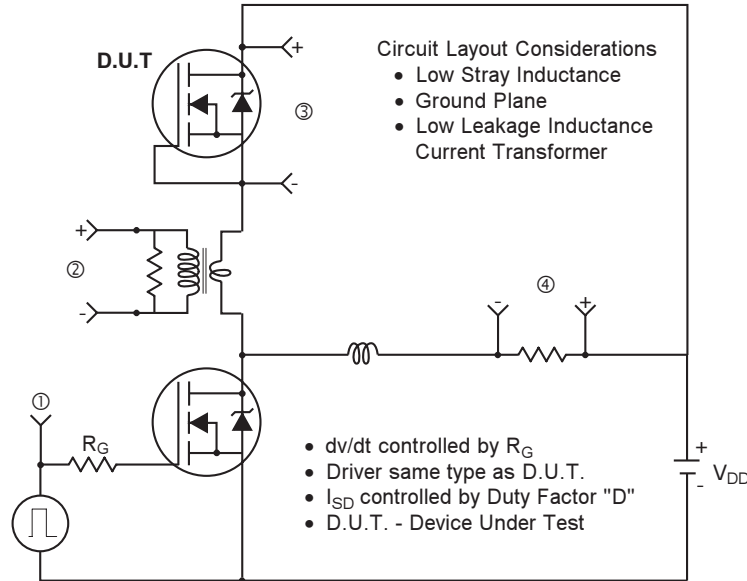


**Fig 13a.** Basic Gate Charge Waveform



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

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



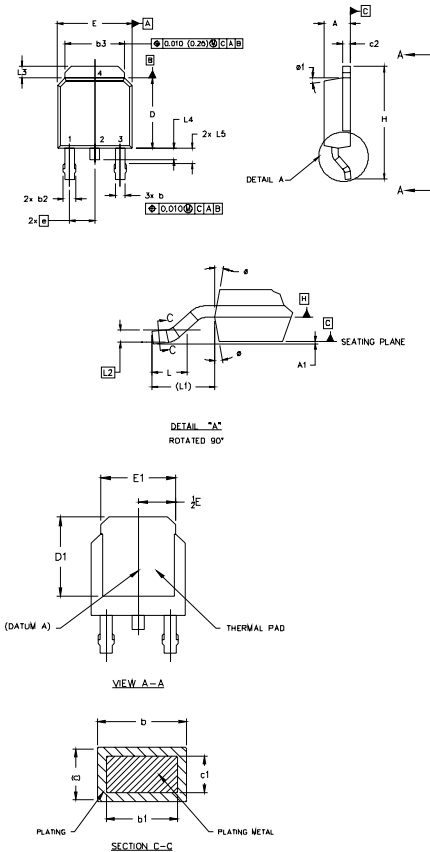
\*  $V_{GS} = 5V$  for Logic Level Devices

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



# IRFR/U3412PbF

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



- NOTES:
- 1.0 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
  - 2.0 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
  - 3.0 LEAD DIMENSION UNCONTROLLED IN L5.
  - 4.0 DIMENSION D1 AND E1 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
  - 5.0 SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 [0.127] AND .010 [0.2540] FROM THE LEAD TIP.
  - 6.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005\* [0.127] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
  - 7.0 OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

| SYMBOL | DIMENSIONS  |       |          |      | NOTES |
|--------|-------------|-------|----------|------|-------|
|        | MILLIMETERS |       | INCHES   |      |       |
|        | MIN.        | MAX.  | MIN.     | MAX. |       |
| A      | 2.18        | 2.39  | .086     | .094 |       |
| A1     |             | 0.13  |          | .005 |       |
| b      | 0.64        | 0.89  | .025     | .035 | 5     |
| b1     | 0.64        | 0.79  | .025     | .031 | 5     |
| b2     | 0.76        | 1.14  | .030     | .045 |       |
| b3     | 4.95        | 5.46  | .195     | .215 |       |
| c      | 0.46        | 0.61  | .018     | .024 | 5     |
| c1     | 0.41        | 0.56  | .016     | .022 | 5     |
| c2     | .046        | 0.89  | .018     | .035 | 5     |
| D      | 5.97        | 6.22  | .235     | .245 | 6     |
| D1     | 5.21        | -     | .205     | -    | 4     |
| E      | 6.35        | 6.73  | .250     | .265 | 6     |
| E1     | 4.32        | -     | .170     | -    | 4     |
| e      | 2.29        |       | .090 BSC |      |       |
| H      | 9.40        | 10.41 | .370     | .410 |       |
| L      | 1.40        | 1.78  | .055     | .070 |       |
| L1     | 2.74 REF    |       | .108 REF |      |       |
| L2     | 0.051 BSC   |       | .020 BSC |      |       |
| L3     | 0.89        | 1.27  | .035     | .050 |       |
| L4     |             | 1.02  |          | .040 |       |
| L5     | 1.14        | 1.52  | .045     | .060 | 3     |
| e      | 0"          | 10"   | 0"       | 10"  |       |
| ø1     | 0"          | 15"   | 0"       | 15"  |       |

**LEAD ASSIGNMENTS**

**HEXFET**

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

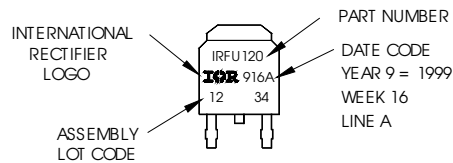
**IGBTs, CoPACK**

- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

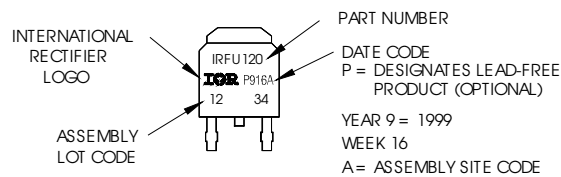
## D-Pak (TO-252AA) Part Marking Information

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

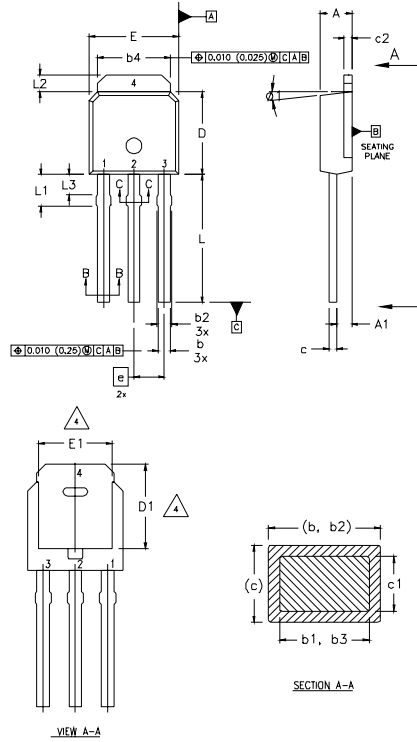
Notes: "P" in assembly line position  
indicates "Lead-Free"



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**

**HEXFET**

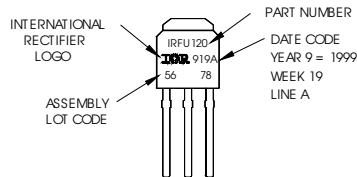
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

| 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 | 0.195     | 0.215 | 4     |
| c      | 0.46        | 0.61 | 0.018     | 0.024 |       |
| c1     | 0.41        | 0.56 | 0.016     | 0.022 |       |
| c2     | .046        | 0.86 | 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 | 0.260     | 0.265 | 3, 4  |
| E1     | 4.32        | -    | 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     |
| ø1     | 0"          | 15"  | 0"        | 15"   |       |

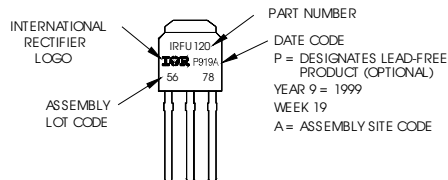
## I-Pak (TO-251AA) Part Marking Information

EXAMPLE: THIS IS AN IRFU120  
WITH ASSEMBLY  
LOT CODE 5678  
ASSEMBLED ON WW 19, 1999  
IN THE ASSEMBLY LINE "A"

**Note:** "P" in assembly line  
position indicates "Lead-Free"



**OR**

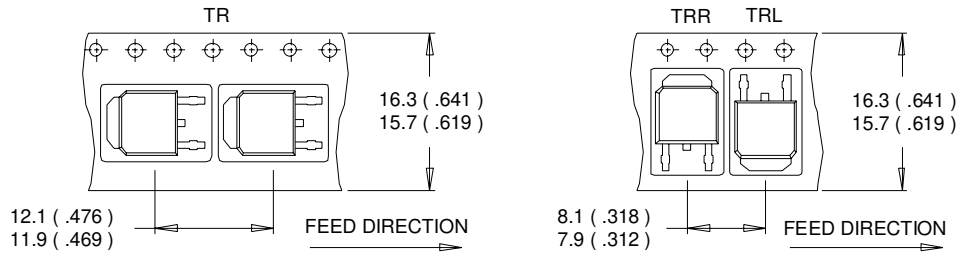


# IRFR/U3412PbF

International  
**IR** Rectifier

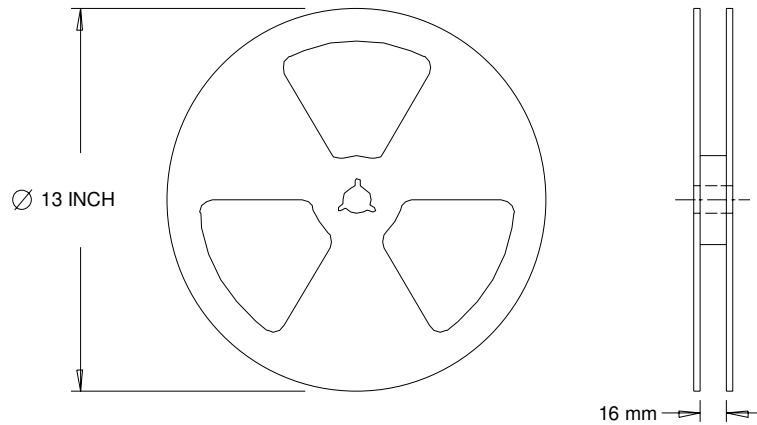
## D-Pak (TO-252AA) Tape & Reel Information

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.

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Visit us at [www.irf.com](http://www.irf.com) for sales contact information.12/04

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Note: For the most current drawings please refer to the IR website at:  
<http://www.irf.com/package/>