Applications

- High Frequency Isolated DC-DC Converters with Synchronous Rectification for Telecom and Industrial Use
- High Frequency Buck Converters for Computer Processor Power

Benefits

- Ultra-Low Gate Impedance
- Very Low $R_{DS(on)}$ at 4.5V $V_{GS}$
- Fully Characterized Avalanche Voltage and Current

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DS}$</td>
<td>Drain-Source Voltage</td>
<td>20</td>
<td>V</td>
</tr>
<tr>
<td>$V_{GS}$</td>
<td>Gate-to-Source Voltage</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td>$I_D @ T_C = 25^\circ C$</td>
<td>Continuous Drain Current, $V_{GS} @ 10V$</td>
<td>36</td>
<td>A</td>
</tr>
<tr>
<td>$I_D @ T_C = 70^\circ C$</td>
<td>Continuous Drain Current, $V_{GS} @ 10V$</td>
<td>31</td>
<td>A</td>
</tr>
<tr>
<td>$I_{DM}$</td>
<td>Pulsed Drain Current&lt;sup&gt;④&lt;/sup&gt;</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>$P_D @ T_C = 25^\circ C$</td>
<td>Maximum Power Dissipation&lt;sup&gt;④&lt;/sup&gt;</td>
<td>47</td>
<td>W</td>
</tr>
<tr>
<td>$P_D @ T_C = 70^\circ C$</td>
<td>Maximum Power Dissipation&lt;sup&gt;④&lt;/sup&gt;</td>
<td>33</td>
<td>W</td>
</tr>
<tr>
<td>Linear Derating Factor</td>
<td>0.31</td>
<td>W/$^\circ C$</td>
<td></td>
</tr>
<tr>
<td>$T_J , T_{STG}$</td>
<td>Junction and Storage Temperature Range</td>
<td>-55 to +175</td>
<td>°C</td>
</tr>
</tbody>
</table>

Thermal Resistance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{JIC}$</td>
<td>Junction-to-Case</td>
<td>——</td>
<td>3.2</td>
</tr>
<tr>
<td>$R_{JIA}$</td>
<td>Junction-to-Ambient</td>
<td>——</td>
<td>50</td>
</tr>
<tr>
<td>$R_{JIA}$</td>
<td>Junction-to-Ambient (PCB mount)&lt;sup&gt;⑥&lt;/sup&gt;</td>
<td>——</td>
<td>110</td>
</tr>
</tbody>
</table>

Notes ① through ⑥ are on page 10

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## Static @ T_J = 25°C (unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{BR}DSS</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V_{GS} = 0V, I_D = 250µA</td>
</tr>
<tr>
<td>ΔV_{BR}DSS/AT</td>
<td></td>
<td></td>
<td>0.022</td>
<td>V/°C</td>
<td>Reference to 25°C, I_D = 1mA</td>
</tr>
<tr>
<td>R_{DS(on)}</td>
<td>15</td>
<td>20</td>
<td></td>
<td>mΩ</td>
<td>V_{GS} = 10V, I_D = 18A</td>
</tr>
<tr>
<td>*</td>
<td>21</td>
<td>28</td>
<td></td>
<td></td>
<td>V_{GS} = 4.5V, I_D = 14A</td>
</tr>
<tr>
<td>V_{GS(th)}</td>
<td>1.0</td>
<td>3.0</td>
<td></td>
<td>V</td>
<td>V_{DS} = V_{GS}, I_D = 250µA</td>
</tr>
<tr>
<td>V_{DSS}</td>
<td></td>
<td></td>
<td></td>
<td>µA</td>
<td>V_{DS} = 16V, V_{GS} = 0V</td>
</tr>
<tr>
<td>I_{DSS}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V_{DS} = 16V, V_{GS} = 0V, T_J = 125°C</td>
</tr>
</tbody>
</table>

## Dynamic @ T_J = 25°C (unless otherwise specified)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>g_m</td>
<td>Forward Transconductance</td>
<td>17</td>
<td>9.7</td>
<td></td>
<td>S</td>
<td>V_{DS} = 10V, I_D = 14A</td>
</tr>
<tr>
<td>Q_g</td>
<td>Total Gate Charge</td>
<td></td>
<td></td>
<td></td>
<td>nC</td>
<td>I_D = 14A</td>
</tr>
<tr>
<td>Q_{gs}</td>
<td>Gate-to-Source Charge</td>
<td>1.8</td>
<td></td>
<td></td>
<td></td>
<td>V_{DS} = 10V</td>
</tr>
<tr>
<td>Q_{gd}</td>
<td>Gate-to-Drain (&quot;Miller&quot;) Charge</td>
<td>2.9</td>
<td></td>
<td></td>
<td>µA</td>
<td>V_{GS} = 4.5V</td>
</tr>
<tr>
<td>Q_{oss}</td>
<td>Output Gate Charge</td>
<td>7.1</td>
<td></td>
<td></td>
<td>µC</td>
<td>V_{GS} = 0V, V_{DS} = 10V</td>
</tr>
<tr>
<td>t_{on}</td>
<td>Turn-On Delay Time</td>
<td>8.7</td>
<td></td>
<td></td>
<td>ns</td>
<td>V_{DD} = 10V</td>
</tr>
<tr>
<td>t_r</td>
<td>Rise Time</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
<td>I_D = 14A</td>
</tr>
<tr>
<td>t_{off}</td>
<td>Turn-Off Delay Time</td>
<td>10</td>
<td></td>
<td></td>
<td>ns</td>
<td>R_G = 1.8Ω</td>
</tr>
<tr>
<td>C_{iss}</td>
<td>Input Capacitance</td>
<td>670</td>
<td></td>
<td></td>
<td>pF</td>
<td>V_{GS} = 0V</td>
</tr>
<tr>
<td>C_{oss}</td>
<td>Output Capacitance</td>
<td>470</td>
<td></td>
<td></td>
<td></td>
<td>V_{DS} = 10V</td>
</tr>
<tr>
<td>C_{rss}</td>
<td>Reverse Transfer Capacitance</td>
<td>68</td>
<td></td>
<td></td>
<td>pF</td>
<td>f = 1.0MHz</td>
</tr>
</tbody>
</table>

## Avalanche Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>E_{AS}</td>
<td>Single Pulse Avalanche Energy</td>
<td></td>
<td>72</td>
<td>mJ</td>
</tr>
<tr>
<td>I_{AR}</td>
<td>Avalanche Current</td>
<td></td>
<td>14</td>
<td>A</td>
</tr>
</tbody>
</table>

## Diode Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_S</td>
<td>Continuous Source Current (Body Diode)</td>
<td></td>
<td>36(3)</td>
<td></td>
<td>µA</td>
<td>MOSFET symbol showing the integral reverse p-n junction diode.</td>
</tr>
<tr>
<td>I_{SM}</td>
<td>Pulsed Source Current (Body Diode)</td>
<td></td>
<td>140</td>
<td></td>
<td>µA</td>
<td>T_J = 25°C, I_f = 18A, V_{GS} = 0V</td>
</tr>
<tr>
<td>V_{SD}</td>
<td>Diode Forward Voltage</td>
<td></td>
<td>0.88</td>
<td></td>
<td>V</td>
<td>T_J = 125°C, I_f = 18A, V_{R}=10V</td>
</tr>
<tr>
<td>t_{rr}</td>
<td>Reverse Recovery Time</td>
<td>35</td>
<td>53</td>
<td>ns</td>
<td></td>
<td>T_J = 25°C, I_f = 16A, V_{R}=10V</td>
</tr>
<tr>
<td>Q_{rr}</td>
<td>Reverse Recovery Charge</td>
<td>34</td>
<td>51</td>
<td>nC</td>
<td></td>
<td>di/dt = 100A/µs</td>
</tr>
<tr>
<td>t_{rr}</td>
<td>Reverse Recovery Time</td>
<td>35</td>
<td>53</td>
<td>ns</td>
<td></td>
<td>T_J = 125°C, I_f = 18A, V_{R}=10V</td>
</tr>
<tr>
<td>Q_{rr}</td>
<td>Reverse Recovery Charge</td>
<td>35</td>
<td>53</td>
<td>nC</td>
<td></td>
<td>di/dt = 100A/µs</td>
</tr>
</tbody>
</table>
**IRLR3714/IRLU3714**

**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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**Typical Output Characteristics**

- **V_{DS}, Drain-to-Source Voltage (V):**
  - 0.1, 1, 10, 100
  - 0.01, 1, 10, 100
  - 0.1, 1, 10, 100
- **I_{D}, Drain-to-Source Current (A):**
  - 2.0V
  - 20µs PULSE WIDTH
  - T_j = 25°C
- **V_{GS}**, Gate-to-Source Voltage (V):
  - 4.5V
  - 3.0V
  - 2.7V
  - 2.5V
  - 2.2V
  - BOTTOM 2.0V

**Typical Transfer Characteristics**

- **V_{DS}, Drain-to-Source Voltage (V):**
  - 2.0, 4.0, 6.0, 8.0, 10.0
- **I_{D}, Drain-to-Source Current (A):**
  - 1.00, 10.00, 100.00, 1000.00
- **T_j = 25°C**
- **T_j = 175°C**
- **V_{DS} = 15V**
  - 20µs PULSE WIDTH

**Normalized On-Resistance**

- **R_{D(on)}**, Drain-to-Source On-Resistance (Normalized):
  - V_{GS} = 10V
  - 0.0, 0.5, 1.0, 1.5, 2.0, 2.5
- **T_{j}, Junction Temperature (°C):**
  - 60, 40, 20, 0, -20, -40, -60

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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
IRLR3714/IRLU3714

**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

Circuit Layout Considerations
- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance
- Current Transformer

- $dv/dt$ controlled by $R_G$
- Driver same type as D.U.T.
- $I_{SD}$ controlled by Duty Factor “D”
- D.U.T. - Device Under Test

Driver Gate Drive

$V_{GS} = 10V$ *

D.U.T. $I_{SD}$ Waveform

Reverse Recovery Current

D.U.T. $V_{DS}$ Waveform

Re-Applied Voltage

Inductor Current

Ripple ≤ 5%

Driver Gate Drive

$D = P.W.$

$V_{DD}$

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

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

INTERNATIONAL RECTIFIER LOGO
PART NUMBER
DATE CODE
YEAR 9 = 1999
WEEK 16
LINE A

PART NUMBER
DATE CODE
YEAR 9 = 1999
WEEK 16
LINE A

INTERNATIONAL RECTIFIER LOGO
PART NUMBER
DATE CODE
YEAR 9 = 1999
WEEK 16
LINE A

INTERNATIONAL RECTIFIER LOGO
PART NUMBER
DATE CODE
YEAR 9 = 1999
WEEK 16
LINE A

INTERNATIONAL RECTIFIER LOGO
PART NUMBER
DATE CODE
YEAR 9 = 1999
WEEK 16
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 IRFU120
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

FIRST PORTION OF PART NUMBER
INTERNATIONAL RECTIFIER LOGO
DATE CODE
YEAR 7 = 1997
WEEK 19
LINE C
Repetitive rating; pulse width limited by max. junction temperature.

Starting $T_J = 25^\circ C$, $L = 0.69$ mH

$R_G = 25\Omega$, $I_{AS} = 14A$.

Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.

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

Calculated continuous current based on maximum allowable junction temperature; Package limitation current is 30A.

Notes:
1. Repetitive rating; pulse width limited by max. junction temperature.
2. Starting $T_J = 25^\circ C$, $L = 0.69$ mH
3. When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.
4. Calculated continuous current based on maximum allowable junction temperature; Package limitation current is 30A.

Data and specifications subject to change without notice.

These products have been designed and qualified for the Industrial market. Qualification Standards can be found on IR’s Web site.

**Notes:**
1. OUTLINE CONFORMS TO EIA-481.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. CONTROLLING DIMENSION: MILLIMETER.

**Notes:**
1. CONTROLLING DIMENSION: MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.
4. OUTLINE CONFORMS TO EIA-481.

**Notes:**
1. CONTROLLING DIMENSION: MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.

Data and specifications subject to change without notice.

These products have been designed and qualified for the Industrial market. Qualification Standards can be found on IR’s Web site.
Note: For the most current drawings please refer to the IR website at:
http://www.irf.com/package/