International Rectifier

- Advanced Process Technology
- Surface Mount (IRFZ44NS)
- Low-profile through-hole (IRFZ44NL)
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated

**Description**
Advanced HEXFET® Power MOSFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The D²Pak is a surface mount power package capable of accommodating die sizes up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The D²Pak is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0W in a typical surface mount application.

The through-hole version (IRFZ44NL) is available for low-profile applications.

**Absolute Maximum Ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_D$ @ $T_{C} = 25^\circ C$</td>
<td>Continuous Drain Current, $V_{GS} @ 10V$</td>
<td>49</td>
</tr>
<tr>
<td>$I_D$ @ $T_{C} = 100^\circ C$</td>
<td>Continuous Drain Current, $V_{GS} @ 10V$</td>
<td>35</td>
</tr>
<tr>
<td>$I_{DM}$</td>
<td>Pulsed Drain Current</td>
<td>160</td>
</tr>
<tr>
<td>$P_D @T_A = 25^\circ C$</td>
<td>Power Dissipation</td>
<td>3.8</td>
</tr>
<tr>
<td>$P_D @T_C = 25^\circ C$</td>
<td>Power Dissipation</td>
<td>94</td>
</tr>
<tr>
<td>$V_{GS}$</td>
<td>Gate-to-Source Voltage</td>
<td>± 20</td>
</tr>
<tr>
<td>$I_{AR}$</td>
<td>Avalanche Current</td>
<td>25</td>
</tr>
<tr>
<td>$E_{AR}$</td>
<td>Repetitive Avalanche Energy</td>
<td>9.4</td>
</tr>
<tr>
<td>$dv/dt$</td>
<td>Peak Diode Recovery $dv/dt$</td>
<td>5.0</td>
</tr>
<tr>
<td>$T_J$</td>
<td>Operating Junction and Storage Temperature Range</td>
<td>-55 to + 175</td>
</tr>
<tr>
<td>$T_{STG}$</td>
<td>Soldering Temperature, for 10 seconds</td>
<td>300 (1.6mm from case)</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>$R_{JUC}$</td>
<td>Junction-to-Case</td>
<td>——</td>
<td>1.5</td>
</tr>
<tr>
<td>$R_{JUA}$</td>
<td>Junction-to-Ambient</td>
<td>——</td>
<td>40</td>
</tr>
</tbody>
</table>

www.irf.com
**Electrical Characteristics @ 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_{BRDSS}</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>V</td>
<td>V_{DS} = 0V, I_D = 250µA</td>
</tr>
<tr>
<td>(\Delta V_{BRDSS}/\Delta T_{J})</td>
<td>0.058</td>
<td>0.058</td>
<td>0.058</td>
<td>V/°C</td>
<td>Reference to 25°C, I_D = 1mA</td>
</tr>
<tr>
<td>R_{DS(on)}</td>
<td>17.5</td>
<td>17.5</td>
<td>17.5</td>
<td>mΩ</td>
<td>V_{DS} = 10V, I_D = 25A</td>
</tr>
<tr>
<td>V_{GS(th)}</td>
<td>2.0</td>
<td>4.0</td>
<td>4.0</td>
<td>V</td>
<td>V_{DS} = V_{GS}, I_D = 250µA</td>
</tr>
<tr>
<td>g_s</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>S</td>
<td>V_{DS} = 25V, I_D = 25A</td>
</tr>
<tr>
<td>I_{DSS}</td>
<td>——</td>
<td>——</td>
<td>25</td>
<td>µA</td>
<td>V_{DS} = 55V, V_{GS} = 0V</td>
</tr>
<tr>
<td>I_{GSS}</td>
<td>——</td>
<td>100</td>
<td>——</td>
<td>nA</td>
<td>V_{DS} = 20V</td>
</tr>
<tr>
<td>Q_g</td>
<td>——</td>
<td>63</td>
<td>——</td>
<td>nC</td>
<td>I_D = 25A</td>
</tr>
<tr>
<td>Q_{gs}</td>
<td>——</td>
<td>14</td>
<td>——</td>
<td>nC</td>
<td>V_{DS} = 44V</td>
</tr>
<tr>
<td>Q_{gd}</td>
<td>——</td>
<td>23</td>
<td>——</td>
<td>nC</td>
<td>V_{DS} = 10V, See Fig. 6 and 13</td>
</tr>
<tr>
<td>I_{(on)}</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>ns</td>
<td>V_{DD} = 28V</td>
</tr>
<tr>
<td>T_r</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>ns</td>
<td>I_D = 25A</td>
</tr>
<tr>
<td>T_{off}</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>ns</td>
<td>R_G = 12Ω</td>
</tr>
<tr>
<td>I_F</td>
<td>45</td>
<td>45</td>
<td>45</td>
<td>ns</td>
<td>V_{GS} = 10V, See Fig. 10</td>
</tr>
<tr>
<td>L_s</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>nH</td>
<td>Between lead, and center of die contact</td>
</tr>
<tr>
<td>C_{iss}</td>
<td>1470</td>
<td>1470</td>
<td>1470</td>
<td>V GS = 0V</td>
<td></td>
</tr>
<tr>
<td>C_{oss}</td>
<td>360</td>
<td>360</td>
<td>360</td>
<td>V GS = 25V</td>
<td></td>
</tr>
<tr>
<td>C_{rss}</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>pF</td>
<td>f = 1.0MHz, See Fig. 5</td>
</tr>
<tr>
<td>E_A</td>
<td>530</td>
<td>530</td>
<td>530</td>
<td>mJ</td>
<td>I_{AS} = 25A, L = 0.47mH</td>
</tr>
</tbody>
</table>

**Source-Drain Ratings and Characteristics**

<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>I_s</td>
<td>——</td>
<td>——</td>
<td>49</td>
<td>A</td>
<td>MOSFET symbol showing the integral reverse p-n junction diode.</td>
</tr>
<tr>
<td>I_{SM}</td>
<td>——</td>
<td>——</td>
<td>160</td>
<td>——</td>
<td>V_{DS} = 25°C, I_S = 25A, V_{GS} = 0V</td>
</tr>
<tr>
<td>V_{SD}</td>
<td>——</td>
<td>1.3</td>
<td>1.3</td>
<td>V</td>
<td>T_J = 25°C, I_S = 25A</td>
</tr>
<tr>
<td>T_{rr}</td>
<td>——</td>
<td>63</td>
<td>63</td>
<td>ns</td>
<td>T_J = 25°C, I_F = 25A</td>
</tr>
<tr>
<td>Q_{rr}</td>
<td>——</td>
<td>170</td>
<td>170</td>
<td>nC</td>
<td>di/dt = 100A/µs</td>
</tr>
<tr>
<td>I_{on}</td>
<td>——</td>
<td>——</td>
<td>260</td>
<td>nC</td>
<td>Intrinsic turn-on time is negligible (turn-on is dominated by L_S + L_D)</td>
</tr>
</tbody>
</table>

**Notes:**

1. Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)
2. Starting T_J = 25°C, L = 0.48mH, R_G = 25Ω, I_{AS} = 25A. (See Figure 12)
3. I_{SD} ≤ 25A, di/dt ≤ 230A/µs, V_{DD} ≤ V_{BRDSS}, T_J ≤ 175°C
4. Pulse width ≤ 400µs; duty cycle ≤ 2%.
5. This is a typical value at device destruction and represents operation outside rated limits.
6. This is a calculated value limited to T_J = 175°C.

**When mounted on 1" square PCB (FR-4 or G-10 Material).**

For recommended footprint and soldering techniques refer to application note #AN-994.

2 www.irf.com
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

Notes:
1. Duty factor \( D = t_1 / t_2 \)
2. Peak \( T_J = P_{DMM} x Z_{thJC} + T_C \)
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
IRFZ44NS/IRFZ44NL

Peak Diode Recovery dv/dt Test Circuit

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

- \( \text{dv/dt} \) controlled by \( R_G \)
- Driver same type as D.U.T.
- \( I_{SD} \) controlled by Duty Factor "D"
- D.U.T. - Device Under Test

Fig 14. For N-Channel HEXFETS

* \( V_{GS} = 5 \text{V} \) for Logic Level Devices
IRFZ44NS/IRFZ44NL

D2Pak Package Outline

NOTES:
1 DIMENSIONS AFTER SOLDER DIP.
3 CONTROLLING DIMENSION: INCH.
4 HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

Part Marking Information

D2Pak

INTERNATIONAL RECTIFIER LOGO

ASSEMBLY LOT CODE

PART NUMBER

DATE CODE (YYWW)
YY = YEAR
WW = WEEK

MINIMUM RECOMMENDED FOOTPRINT

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Package Outline

TO-262 Outline

Part Marking Information

TO-262

EXAMPLE: THIS IS AN IRL3103L
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

IRFZ44NS/IRFZ44NL

INTERNATIONAL
RECTIFIER
LOGO

IRL3103L
179C
17
89

PART NUMBER

DATE CODE
YEAR 7 = 1997
WEEK 19
LINE C

www.irf.com
Tape & Reel Information

D²Pak

NOTES:
1. CONFORMS TO EIA-418.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION MEASURED @ HUB.
4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.

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