Fifth Generation HEXFET® power MOSFETs from International Rectifier utilize advanced processing techniques to achieve the lowest possible 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 device for use in a wide variety of applications.

The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.

### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_D$ @ $T_C = 25°C$</td>
<td>17 A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_D$ @ $T_C = 100°C$</td>
<td>12 A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{OM}$</td>
<td>68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P_D$ @ $T_C = 25°C$</td>
<td>45 W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{GS}$</td>
<td>±20 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$E_A$</td>
<td>71 mJ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{AR}$</td>
<td>10 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$dv/dt$</td>
<td>5.0 V/ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_J$</td>
<td>-55 to +175 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_{STG}$</td>
<td>300 °C (1.6mm from case)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting torque, 6-32 or M3 screw</td>
<td>10 lb•in (1.1N•m)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Thermal Resistance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{JIC}$</td>
<td></td>
<td></td>
<td>3.3 °C/W</td>
<td></td>
</tr>
<tr>
<td>$R_{JCS}$</td>
<td></td>
<td>0.50</td>
<td></td>
<td>°C/W</td>
</tr>
<tr>
<td>$R_{JUA}$</td>
<td></td>
<td></td>
<td>62 °C/W</td>
<td></td>
</tr>
</tbody>
</table>
**IRFZ24N**

**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} (V)</td>
<td>55</td>
<td></td>
<td></td>
<td>V</td>
<td>V_{GS} = 0V, I_D = 250µA</td>
</tr>
<tr>
<td>ΔV_{BRDSS}/ΔT_J (V/°C)</td>
<td>0.052</td>
<td></td>
<td></td>
<td>V/°C</td>
<td>Reference to 25°C, I_D = 1mA</td>
</tr>
<tr>
<td>R_{DS(on)} (Ω)</td>
<td></td>
<td>4.0</td>
<td></td>
<td>µΩ</td>
<td>V_{DS} = 25V, I_D = 10A</td>
</tr>
<tr>
<td>I_{GS(th)} (V)</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>V_{DS} = V_{GS}, I_D = 250µA</td>
</tr>
<tr>
<td>g_f (S)</td>
<td>4.5</td>
<td></td>
<td></td>
<td>S</td>
<td>V_{GS} = 10V, I_D = 10A</td>
</tr>
<tr>
<td>R_{DS(on)} (Ω)</td>
<td></td>
<td>25</td>
<td></td>
<td>µΩ</td>
<td>V_{DS} = 55V, I_D = 10A</td>
</tr>
<tr>
<td>I_{GSS} (nA)</td>
<td></td>
<td>100</td>
<td></td>
<td>nA</td>
<td>V_{GS} = 20V</td>
</tr>
<tr>
<td>Q_f (nC)</td>
<td></td>
<td>5.3</td>
<td></td>
<td>nC</td>
<td>I_D = 10A</td>
</tr>
<tr>
<td>Q_{gs} (nC)</td>
<td></td>
<td>5.3</td>
<td></td>
<td>nC</td>
<td>V_{DS} = 25V, I_D = 10A</td>
</tr>
<tr>
<td>Q_{gd} (nC)</td>
<td></td>
<td>5.3</td>
<td></td>
<td>nC</td>
<td>R_G = 25Ω</td>
</tr>
<tr>
<td>I_I (10A)</td>
<td></td>
<td></td>
<td></td>
<td>µA</td>
<td>V_{GS} = 0V</td>
</tr>
<tr>
<td>C_{iss} (pF)</td>
<td></td>
<td>370</td>
<td></td>
<td>pF</td>
<td>V_{DD} = 25V</td>
</tr>
<tr>
<td>C_{oss} (pF)</td>
<td></td>
<td>140</td>
<td></td>
<td>pF</td>
<td>f = 1.0MHz, See Fig. 5</td>
</tr>
<tr>
<td>C_{rss} (nH)</td>
<td></td>
<td>65</td>
<td></td>
<td>nH</td>
<td></td>
</tr>
<tr>
<td>I_{SD} (A)</td>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>V_{SD} (V)</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I_{rr} (ns)</td>
<td></td>
<td>56</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Q_{rr} (nC)</td>
<td></td>
<td>120</td>
<td></td>
<td>nC</td>
<td></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} (A)</td>
<td></td>
<td>17</td>
<td></td>
<td>A</td>
<td>MOSFET symbol showing the integral reverse p-n junction diode.</td>
</tr>
<tr>
<td>I_{SM} (A)</td>
<td></td>
<td>68</td>
<td></td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>V_{SD} (V)</td>
<td></td>
<td>1.3</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I_{rr} (ns)</td>
<td></td>
<td>56</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Q_{rr} (nC)</td>
<td></td>
<td>120</td>
<td></td>
<td>nC</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. Repetitive rating: pulse width limited by max. junction temperature. (See fig. 11)
2. V_{DD} = 25V, starting T_J = 25°C, L = 1.0mH, R_G = 25Ω, I_{AS} = 10A. (See Figure 12)
3. I_{GD} ≤ 10A, di/dt ≤ 280A/µs, V_{DD} ≤ V_{BRDSS}, T_J ≤ 175°C
4. Pulse width ≤ 300µs; duty cycle ≤ 2%.  

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**Fig 1.** Typical Output Characteristics, \( T_J = 25^\circ C \)

**Fig 2.** Typical Output Characteristics, \( T_J = 175^\circ C \)

**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

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IRFZ24N

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**C, Capacitance (pF)**

**DSV, Drain-to-Source Voltage (V)**

**A, Capacitance (pF)**

**GS, Gate-to-Source Voltage (V)**

**V = 0V, f = 1MHz**

**Ciss = Cgs + Cgd, Cds SHORTED**

**Coss = Cgd**

**Crss = Cgs + Cgd**

**VGS = 0V, VDS = 0V, VDS = 100V, f = 1MHz**

**QG, Total Gate Charge (nC)**

**VGS, Gate-to-Source Voltage (V)**

**VDS, Drain-to-Source Voltage (V)**

**FOR TEST CIRCUIT SEE FIGURE 13**

**I_{DS(on)}**

**I_{DD} = 10A**

**VDS = 44V, VDS = 28V**

**I_{DD} = 10A**

**V_{DS} = 44V, V_{DS} = 28V**

**V_{GS} = 0V**

**T = 25°C, T = 175°C**

**T_{J} = 25°C, T_{J} = 175°C**

**I_{DS} = 10 A**

**Operation in this area limited by R_{DS(on)}**

**T = 25°C, T = 175°C**

**I_{D} = 10 A**

**I_{D} = 10 A**

**T = 25°C, T = 175°C**

**I_{D} = 10 A**

**T = 25°C, T = 175°C**

**I_{D} = 10 A**

**T = 25°C, T = 175°C**

**I_{D} = 10 A**

**T = 25°C, T = 175°C**
**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 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

- **D.U.T.** - Device Under Test
- **Ripple** $\leq 5\%$
- **Re-Applied Voltage**
- **Inductor Current**
- **Body Diode Forward Drop**
- **Body Diode Forward Current**
- **Diode Recovery $dv/dt$**

**Driver Gate Drive**

- Driver Gate Drive
- $P.W. = P.W. \cdot Period$
- $D = \frac{P.W.}{\text{Period}}$
- $V_{GS} = 10V$
- $V_{DD}$

**Reverse Recovery Current**

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

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

- Re-Applied Voltage

**Inductor Current**

- Ripple $\leq 5\%$

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

- $dv/dt$ 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 Layout Considerations**

- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance
- Current Transformer

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**Fig 14.** For N-Channel HEXFET® power MOSFETs
IRFZ24N

Package Outline
TO-220AB
Dimensions are shown in millimeters (inches)

**Part Marking Information**
TO-220AB

EXAMPLE: THIS IS AN IRF1010 WITH ASSEMBLY LOT CODE 9B1M

INTERNATIONAL RECTIFIER LOGO

PART NUMBER

INTERNATIONAL RECTIFIER

DATE CODE

(YYWW)

YY = YEAR

WW = WEEK

ASSEMBLY LOT CODE

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IR GREAT BRITAIN: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020
IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111
IR FAR EAST: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo Japan 171 Tel: 81 3 3983 0086
IR SOUTHEAST ASIA: 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 838 4630
IR TAIWAN: 16 Fl. Suite D. 207. Sec. 2, Tun Haw South Road, Taipei, 10673, Taiwan Tel: 886-2-2377-9936

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