International Rectifier

HEXFET® Power MOSFET

- Advanced Process Technology
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Lead-Free

Description
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>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDS</td>
<td>55V</td>
<td></td>
</tr>
<tr>
<td>RDS(on)</td>
<td>0.07Ω</td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>17A</td>
<td></td>
</tr>
</tbody>
</table>

PD - 94990

IRFZ24NPbF

TO-220AB

VDS = 55V
RDS(on) = 0.07Ω
ID = 17A

www.irf.com 1
**IRFZ24NPbF**

### 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_{BR(DSS)}</td>
<td>55</td>
<td>—</td>
<td>—</td>
<td>V</td>
<td>V_{DS} = 0V, I_D = 250µA</td>
</tr>
<tr>
<td>g_{m}</td>
<td>—</td>
<td>4.5</td>
<td>—</td>
<td>S</td>
<td>Reference to 25°C, I_D = 1mA</td>
</tr>
<tr>
<td>V_{th}</td>
<td>2.0</td>
<td>—</td>
<td>4.0</td>
<td>V</td>
<td>V_{DS} = V_{GS}, I_D = 250µA</td>
</tr>
<tr>
<td>I_{SS}</td>
<td>—</td>
<td>—</td>
<td>25</td>
<td>µA</td>
<td>V_{DS} = 55V, V_{GS} = 0V</td>
</tr>
<tr>
<td>I_{GS}</td>
<td>—</td>
<td>—</td>
<td>100</td>
<td>nA</td>
<td>V_{GS} = 20V</td>
</tr>
<tr>
<td>Q_{G}</td>
<td>—</td>
<td>—</td>
<td>20</td>
<td>nC</td>
<td>I_D = 10A</td>
</tr>
<tr>
<td>Q_{GS}</td>
<td>—</td>
<td>—</td>
<td>5.3</td>
<td>nC</td>
<td>V_{DS} = 44V</td>
</tr>
<tr>
<td>V_{rid}(on)</td>
<td>—</td>
<td>—</td>
<td>7.6</td>
<td>V</td>
<td>V_{GS} = 10V, See Fig. 6 and 13</td>
</tr>
<tr>
<td>t_{r}</td>
<td>4.9</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td>V_{DD} = 28V</td>
</tr>
<tr>
<td>t_{f}</td>
<td>34</td>
<td>—</td>
<td>34</td>
<td>ns</td>
<td>I_D = 10A</td>
</tr>
<tr>
<td>L_{D}</td>
<td>4.5</td>
<td>—</td>
<td>—</td>
<td>nH</td>
<td>R_D = 24Ω</td>
</tr>
<tr>
<td>L_{S}</td>
<td>7.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>R_D = 2.6Ω, See Fig. 10</td>
</tr>
<tr>
<td>C_{iss}</td>
<td>370</td>
<td>—</td>
<td>—</td>
<td>pF</td>
<td>Between lead, 6mm (0.25sin.)</td>
</tr>
<tr>
<td>C_{oss}</td>
<td>140</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>from package</td>
</tr>
<tr>
<td>C_{rss}</td>
<td>65</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>and center of die contact</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>Continuous Source Current (Body Diode)</td>
<td>—</td>
<td>—</td>
<td>17</td>
<td>A</td>
</tr>
<tr>
<td>I_{SM}</td>
<td>Pulsed Source Current (Body Diode)</td>
<td>—</td>
<td>—</td>
<td>68</td>
<td>I</td>
</tr>
<tr>
<td>V_{DD}</td>
<td>Diode Forward Voltage</td>
<td>—</td>
<td>—</td>
<td>1.3</td>
<td>V</td>
</tr>
<tr>
<td>t_{rr}</td>
<td>Reverse Recovery Time</td>
<td>—</td>
<td>56</td>
<td>83</td>
<td>ns</td>
</tr>
<tr>
<td>Q_{rr}</td>
<td>Reverse RecoveryCharge</td>
<td>—</td>
<td>120</td>
<td>180</td>
<td>nC</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_{BR(DSS)}, T_J ≤ 175°C

4. Pulse width ≤ 300µs; duty cycle ≤ 2%.
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


**IRFZ24NPbF**

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

- $V_{GS} = 0V$, $f = 1MHz$
- $C_{iss} = C_{gs} + C_{gd}$, $C_{oss} = C_{gd}$
- $C_{iss} = C_{ds} + C_{gd}$

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### Fig 6. Typical Gate Charge Vs. Drain-to-Source Voltage

- $V_{DS} = 44V$
- $V_{DS} = 28V$

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

- $I_{SD}$, Reverse Drain Current (A)
- $V_{SD}$, Source-to-Drain Voltage (V)
- $T_J = 175^\circ C$
- $T_J = 25^\circ C$
- $V_{GS} = 0V$

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### Fig 8. Maximum Safe Operating Area

- Operation in this area limited by $R_D\text{(on)}$
- $T_J = 25^\circ C$
- $T_J = 175^\circ C$
- Single Pulse
**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
**Fig 14.** For N-Channel HEXFET® power MOSFETs
TO-220AB Package Outline
Dimensions are shown in millimeters (inches)

LEAD ASSIGNMENTS
1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

- B -
1.32 (.052)
1.22 (.048)
3X 0.55 (.022)
0.46 (.018)
2.92 (.115)
2.64 (.104)

- A -
10.54 (.415)
10.29 (.405)
2.87 (.113)
2.62 (.103)

MIN
6.47 (.255)
6.10 (.240)

NOTE:
2. CONTROLLING DIMENSION: INCH
3. OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
4. HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"
Note: "P" in assembly line position indicates "Lead-Free"

Data and specifications subject to change without notice.

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