**Power MOSFET**

**FEATURES**
- Dynamic dV/dt Rating
- 175 °C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Compliant to RoHS Directive 2002/95/EC

**DESCRIPTION**
Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness. The TO-220AB package is universally preferred for commercial-industrial applications at power dissipation levels to approximately 50 W. The low thermal resistance and low package cost of the TO-220AB contribute to its wide acceptance throughout the industry.

**PRODUCT SUMMARY**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Limit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>VDS</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>VGS</td>
<td>± 20</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Drain Current</td>
<td>ID</td>
<td>50</td>
<td>A</td>
</tr>
<tr>
<td>Linear Derating Factor</td>
<td>IDM</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Single Pulse Avalanche Energy</td>
<td>EAS</td>
<td>100</td>
<td>mJ</td>
</tr>
<tr>
<td>Maximum Power Dissipation</td>
<td>PD</td>
<td>150</td>
<td>W</td>
</tr>
<tr>
<td>Peak Diode Recovery dV/dt</td>
<td>dV/dt</td>
<td>4.5</td>
<td>V/ns</td>
</tr>
<tr>
<td>Operating Junction and Storage Temperature Range</td>
<td>TJ, Tstg</td>
<td>-55 to +175</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering Recommendations (Peak Temperature)</td>
<td></td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Mounting Torque</td>
<td></td>
<td>10</td>
<td>lbf · in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.1</td>
<td>N · m</td>
</tr>
</tbody>
</table>

**Notes**
- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- VDD = 25 V, starting TJ = 25 °C, L = 44 μH, Rg = 25 Ω, IDSS = 51 A (see fig. 12).
- ISD ≤ 51 A, di/dt ≤ 250 A/μs, VDS ≤ VDS, TJ ≤ 175 °C.
- 1.6 mm from case.
- Current limited by the package, (die current = 51 A).

* Pb containing terminations are not RoHS compliant, exemptions may apply
IRFZ44, SiHFZ44
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THERMAL RESISTANCE RATINGS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Junction-to-Ambient</td>
<td>$R_{thJA}$</td>
<td>-</td>
<td>62</td>
<td>°C/W</td>
</tr>
<tr>
<td>Case-to-Sink, Flat, Greased Surface</td>
<td>$R_{thCS}$</td>
<td>0.50</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Maximum Junction-to-Case (Drain)</td>
<td>$R_{thJC}$</td>
<td>-</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITIONS</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Breakdown Voltage</td>
<td>$V_{DS}$</td>
<td>$V_{GS} = 0 \text{ V, } I_D = 250 \mu\text{A}$</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>V_DS Temperature Coefficient</td>
<td>$\Delta V_{DS}/T_J$</td>
<td>Reference to 25 °C, $I_D = 1 \text{ mA}$</td>
<td>-</td>
<td>0.060</td>
<td>-</td>
<td>°C/V</td>
</tr>
<tr>
<td>Gate-Source Threshold Voltage</td>
<td>$V_{GS(th)}$</td>
<td>$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$</td>
<td>2.0</td>
<td>-</td>
<td>4.0</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Leakage</td>
<td>$I_{GS}$</td>
<td>$V_{GS} = \pm 20 \text{ V}$</td>
<td>-</td>
<td>-</td>
<td>$\pm 100$</td>
<td>nA</td>
</tr>
<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>$I_{DSS}$</td>
<td>$V_{DS} = 60 \text{ V, } V_{GS} = 0 \text{ V}$</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>μA</td>
</tr>
<tr>
<td>Drain-Source On-State Resistance</td>
<td>$R_{DS(on)}$</td>
<td>$V_{GS} = 10 \text{ V}$</td>
<td>-</td>
<td>-</td>
<td>$0.028$</td>
<td>Ω</td>
</tr>
<tr>
<td>Forward Transconductance</td>
<td>$g_f$</td>
<td>$V_{DS} = 25 \text{ V, } I_D = 31 \text{ A}$</td>
<td>15</td>
<td>-</td>
<td>-</td>
<td>S</td>
</tr>
</tbody>
</table>

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Pulse width ≤ 300 μs; duty cycle ≤ 2 %.

drain-source body diode characteristics
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Fig. 1 Typical Output Characteristics, $T_C = 25 \, ^\circ C$

Fig. 2 - Typical Output Characteristics, $T_C = 175 \, ^\circ C$

Fig. 3 - Typical Transfer Characteristics

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

Pulse width ≤ 1 µs
Duty factor ≤ 0.1%

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**Figures and Notes**

Vary \( t_p \) to obtain required \( I_{AS} \)

1. Duty factor, \( D = t_f/12 \)
2. Peak \( T_J = P_{ON} \times T_{JJC} + T_c \)
IRFZ44, SiHFZ44
Vishay Siliconix

Fig. 12c - Maximum Avalanche Energy vs. Drain Current

Fig. 13a - Basic Gate Charge Waveform

Fig. 13b - Gate Charge Test
Peak Diode Recovery dV/dt Test Circuit

- D.U.T. (Device Under Test)
- D.U.T. V_{GD} waveform
- Re-applied voltage
- Inductor current
- Body diode forward drop
- Ripple ≤ 5%
- I_{SO}
- Diode recovery dV/dt
- Body diode forward current dI/dt
- Reverse recovery current
- D.U.T. I_{SO} waveform
- D.U.T. V_{DD} waveform
- Period
- D = P.W. / Period
- \( V_{GD} = 10 \, V \)
- \( V_{GD} = 5 \, V \) for logic level devices

Circuit layout considerations:
- Low stray inductance
- Ground plane
- Low leakage inductance current transformer

- D.V.dt controlled by \( R_g \)
- Driver same type as D.U.T.
- \( I_{SO} \) controlled by duty factor “D”
- D.U.T. - device under test

Fig. 14 - For N-Channel
TO-220AB

**Notes**

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heat sink hole for HVM

- Xi’an and Mingxin actual photo

**Package Information**

**MILLIMETERS** | **INCHES**
--- | ---
A | 4.25 - 4.65 | 0.167 - 0.183
b | 0.69 - 1.01 | 0.027 - 0.040
b(1) | 1.20 - 1.73 | 0.047 - 0.068
c | 0.36 - 0.61 | 0.014 - 0.024
D | 14.85 - 15.49 | 0.585 - 0.610
E | 10.04 - 10.51 | 0.395 - 0.414
e | 2.41 - 2.67 | 0.095 - 0.105
e(1) | 4.88 - 5.28 | 0.192 - 0.208
F | 1.14 - 1.40 | 0.045 - 0.055
H(1) | 6.09 - 6.48 | 0.240 - 0.255
J(1) | 2.41 - 2.92 | 0.095 - 0.115
L | 13.35 - 14.02 | 0.526 - 0.552
L(1) | 3.32 - 3.82 | 0.131 - 0.150
Ø P | 3.54 - 3.94 | 0.139 - 0.155
Q | 2.60 - 3.00 | 0.102 - 0.118

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