AO3404
30V N-Channel MOSFET

General Description
The AO3404 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. This device may be used as a load switch or in PWM applications.

Product Summary

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DS}$</td>
<td>$V_{DS}$</td>
<td>30</td>
<td>V</td>
</tr>
<tr>
<td>$I_D$ (at $V_{GS}$=10V)</td>
<td>$I_D$</td>
<td>5</td>
<td>A</td>
</tr>
<tr>
<td>$R_{DS(ON)}$ (at $V_{GS}$=10V)</td>
<td>$R_{DS(ON)}$</td>
<td>&lt; 31$\Omega$</td>
<td></td>
</tr>
<tr>
<td>$R_{DS(ON)}$ (at $V_{GS}$=4.5V)</td>
<td>$R_{DS(ON)}$</td>
<td>&lt; 43$\Omega$</td>
<td></td>
</tr>
</tbody>
</table>

Absolute Maximum Ratings $T_A$=25$^\circ$C unless otherwise noted

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>$V_{DS}$</td>
<td>30</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>$V_{GS}$</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Drain Current</td>
<td>$T_A$=25$^\circ$C</td>
<td>$I_D$</td>
<td>5</td>
</tr>
<tr>
<td>$T_A$=70$^\circ$C</td>
<td>$I_D$</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>Pulsed Drain Current$^C$</td>
<td>$I_{DM}$</td>
<td>20</td>
<td>A</td>
</tr>
<tr>
<td>Power Dissipation$^B$</td>
<td>$P_D$</td>
<td>1.4</td>
<td>W</td>
</tr>
<tr>
<td>$T_A$=25$^\circ$C</td>
<td>$P_D$</td>
<td>0.9</td>
<td>W</td>
</tr>
<tr>
<td>$T_A$=70$^\circ$C</td>
<td>$P_D$</td>
<td>0.9</td>
<td>W</td>
</tr>
<tr>
<td>Junction and Storage Temperature Range</td>
<td>$T_J$, $T_{STG}$</td>
<td>-55 to 150</td>
<td>$^\circ$C</td>
</tr>
</tbody>
</table>

Thermal Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Junction-to-Ambient$^A$</td>
<td>$R_{JA}$</td>
<td>70</td>
<td>90</td>
<td>$^\circ$C/W</td>
</tr>
<tr>
<td>Maximum Junction-to-Ambient$^B$ Steady-State</td>
<td>$R_{JA}$</td>
<td>100</td>
<td>125</td>
<td>$^\circ$C/W</td>
</tr>
<tr>
<td>Maximum Junction-to-Lead Steady-State</td>
<td>$R_{JL}$</td>
<td>63</td>
<td>80</td>
<td>$^\circ$C/W</td>
</tr>
</tbody>
</table>

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### Electrical Characteristics (T<sub>j</sub>=25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATIC PARAMETERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BV&lt;sub&gt;DSS&lt;/sub&gt;</td>
<td>Drain-Source Breakdown Voltage</td>
<td>V&lt;sub&gt;DSS&lt;/sub&gt;=30V, V&lt;sub&gt;GS&lt;/sub&gt;=0V</td>
<td>30</td>
<td>1</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>I&lt;sub&gt;DS(on)&lt;/sub&gt;</td>
<td>On state drain current</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=10V, V&lt;sub&gt;DS&lt;/sub&gt;=5V</td>
<td>20</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R&lt;sub&gt;DS(on)&lt;/sub&gt;</td>
<td>Static Drain-Source On-Resistance</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=10V, I&lt;sub&gt;D&lt;/sub&gt;=5A</td>
<td>25.5</td>
<td>31</td>
<td></td>
<td>mΩ</td>
</tr>
<tr>
<td>R&lt;sub&gt;SS&lt;/sub&gt;</td>
<td>Forward Transconductance</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=5V, I&lt;sub&gt;D&lt;/sub&gt;=5A</td>
<td>15</td>
<td>15</td>
<td></td>
<td>S</td>
</tr>
<tr>
<td>V&lt;sub&gt;SD&lt;/sub&gt;</td>
<td>Diode Forward Voltage</td>
<td>I&lt;sub&gt;DS&lt;/sub&gt;=1A, V&lt;sub&gt;GS&lt;/sub&gt;=0V</td>
<td>0.76</td>
<td>1</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>I&lt;sub&gt;g&lt;/sub&gt;</td>
<td>Maximum Body-Diode Continuous Current</td>
<td></td>
<td>1.5</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DYNAMIC PARAMETERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>C&lt;sub&gt;gs&lt;/sub&gt;</td>
<td>Input Capacitance</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=0V, V&lt;sub&gt;DS&lt;/sub&gt;=15V, f=1MHz</td>
<td>255</td>
<td>31</td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>C&lt;sub&gt;oss&lt;/sub&gt;</td>
<td>Output Capacitance</td>
<td></td>
<td>45</td>
<td>45</td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>C&lt;sub&gt;rss&lt;/sub&gt;</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td>35</td>
<td>50</td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>R&lt;sub&gt;g&lt;/sub&gt;</td>
<td>Gate resistance</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=0V, V&lt;sub&gt;DS&lt;/sub&gt;=0V, f=1MHz</td>
<td>1.6</td>
<td>3.25</td>
<td>4.9</td>
<td>Ω</td>
</tr>
<tr>
<td><strong>SWITCHING PARAMETERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q&lt;sub&gt;G(4.5V)&lt;/sub&gt;</td>
<td>Total Gate Charge</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=10V, V&lt;sub&gt;DS&lt;/sub&gt;=15V, I&lt;sub&gt;D&lt;/sub&gt;=5A</td>
<td>5.2</td>
<td>6.3</td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td>Q&lt;sub&gt;gs&lt;/sub&gt;</td>
<td>Gate Source Charge</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=10V, V&lt;sub&gt;DS&lt;/sub&gt;=15V, I&lt;sub&gt;D&lt;/sub&gt;=5A</td>
<td>2.55</td>
<td>3.2</td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td>Q&lt;sub&gt;dr&lt;/sub&gt;</td>
<td>Gate Drain Charge</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=0V, V&lt;sub&gt;DS&lt;/sub&gt;=15V</td>
<td>0.85</td>
<td>1</td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td>t&lt;sub&gt;on&lt;/sub&gt;</td>
<td>Turn-On DelayTime</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=10V, V&lt;sub&gt;DS&lt;/sub&gt;=15V</td>
<td>1.3</td>
<td>nC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t&lt;sub&gt;r&lt;/sub&gt;</td>
<td>Turn-On Rise Time</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=10V, V&lt;sub&gt;DS&lt;/sub&gt;=15V, R&lt;sub&gt;L&lt;/sub&gt;=3Ω, V&lt;sub&gt;DS&lt;/sub&gt;=5V</td>
<td>4.5</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t&lt;sub&gt;off&lt;/sub&gt;</td>
<td>Turn-Off DelayTime</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=10V, V&lt;sub&gt;DS&lt;/sub&gt;=15V</td>
<td>2.5</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t&lt;sub&gt;f&lt;/sub&gt;</td>
<td>Turn-Off Fall Time</td>
<td>R&lt;sub&gt;GEN&lt;/sub&gt;=3Ω</td>
<td>14.5</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t&lt;sub&gt;r&lt;/sub&gt;</td>
<td>Body Diode Reverse Recovery Time</td>
<td>I&lt;sub&gt;D&lt;/sub&gt;=5A, dI/dt=100A/µs</td>
<td>3.5</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q&lt;sub&gt;r&lt;/sub&gt;</td>
<td>Body Diode Reverse Recovery Charge</td>
<td>I&lt;sub&gt;D&lt;/sub&gt;=5A, dI/dt=100A/µs</td>
<td>8.5</td>
<td>ns</td>
<td></td>
<td>nC</td>
</tr>
</tbody>
</table>

A. The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>a</sub>=25°C. The value in any given application depends on the user’s specific board design.
B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150°C, using ≤ 10s junction-to-ambient thermal resistance.
C. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150°C. Ratings are based on low frequency and duty cycles to keep initial T<sub>J</sub>=25°C.
D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.
E. The static characteristics in Figures 1 to 6 are obtained using <300µs pulses, duty cycle 0.5% max.
F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150°C. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 7: Gate-Charge Characteristics

Figure 8: Capacitance Characteristics

Figure 10: Maximum Forward Biased Safe Operating Area (Note F)

Figure 11: Single Pulse Power Rating Junction-to-Ambient (Note F)

Figure 12: Normalized Maximum Transient Thermal Impedance (Note F)
Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

Diode Recovery Test Circuit & Waveforms