AO4606
30V Complementary MOSFET

General Description
The AO4606 uses advanced trench technology MOSFETs to provide excellent $R_{DS(on)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

Product Summary

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Max n-channel</th>
<th>Max p-channel</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>$V_{DS}$</td>
<td>30</td>
<td>-30</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>$V_{GS}$</td>
<td>±20</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Drain Current</td>
<td>$I_{D}$</td>
<td>6</td>
<td>-6.5</td>
<td>A</td>
</tr>
<tr>
<td>$T_{A}=25^\circ C$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_{A}=70^\circ C$</td>
<td>5</td>
<td>-5.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulsed Drain Current</td>
<td>$I_{DM}$</td>
<td>30</td>
<td>-30</td>
<td>A</td>
</tr>
<tr>
<td>Avalanche Current</td>
<td>$I_{AS}, I_{AR}$</td>
<td>10</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Avalanche energy</td>
<td>$E_{AS}, E_{AR}$</td>
<td>5</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>$P_{D}$</td>
<td>2</td>
<td>2</td>
<td>W</td>
</tr>
<tr>
<td>$T_{A}=25^\circ C$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_{A}=70^\circ C$</td>
<td>1.3</td>
<td>1.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction and Storage Temperature Range</td>
<td>$T_{J}, T_{STG}$</td>
<td>-55 to 150</td>
<td></td>
<td>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</td>
<td>$R_{JA}$</td>
<td>48</td>
<td>62.5</td>
<td>C/W</td>
</tr>
<tr>
<td>$t \leq 10s$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Junction-to-Ambient</td>
<td>$R_{JA}$</td>
<td>Steady-State</td>
<td>74</td>
<td>90</td>
</tr>
<tr>
<td>$t \leq 10s$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Junction-to-Lead</td>
<td>$R_{PL}$</td>
<td>Steady-State</td>
<td>32</td>
<td>40</td>
</tr>
</tbody>
</table>
# N-Channel Electrical Characteristics (T<sub>J=25°C</sub> 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>BVDSS</td>
<td>Drain-Source Breakdown Voltage</td>
<td>I&lt;sub&gt;DSS&lt;/sub&gt;=250µA, V&lt;sub&gt;GS&lt;/sub&gt;=0V</td>
<td>30</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>IDS</td>
<td>Zero Gate Voltage Drain Current</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=30V, V&lt;sub&gt;GS&lt;/sub&gt;=0V</td>
<td>1</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>IGSS</td>
<td>Gate-Body leakage current</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=0V, V&lt;sub&gt;GS&lt;/sub&gt;=±20V</td>
<td>±100</td>
<td></td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>VGS(th)</td>
<td>Gate Threshold Voltage</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=V&lt;sub&gt;GS&lt;/sub&gt; I&lt;sub&gt;DSS&lt;/sub&gt;=250µA</td>
<td>1.2</td>
<td>1.8</td>
<td>2.4</td>
<td>V</td>
</tr>
<tr>
<td>IDON</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>30</td>
<td></td>
<td></td>
<td>A</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;GS&lt;/sub&gt;=10V, I&lt;sub&gt;D&lt;/sub&gt;=6A</td>
<td>25</td>
<td>30</td>
<td>48</td>
<td>mΩ</td>
</tr>
<tr>
<td>g&lt;sub&gt;B&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;=6A</td>
<td>15</td>
<td></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;S&lt;/sub&gt;=1A, V&lt;sub&gt;GS&lt;/sub&gt;=0V</td>
<td>0.76</td>
<td></td>
<td>1</td>
<td>V</td>
</tr>
<tr>
<td>IS</td>
<td>Maximum Body-Diode Continuous Current</td>
<td></td>
<td>2.5</td>
<td>2.5</td>
<td>3.5</td>
<td>A</td>
</tr>
</tbody>
</table>

## STATIC PARAMETERS

### Dynamic Parameters

- **C<sub>iss</sub>** Input Capacitance
- **C<sub>oss</sub>** Output Capacitance
- **C<sub>rss</sub>** Reverse Transfer Capacitance
- **R<sub>g</sub>** Gate resistance

## Switching Parameters

- **Q<sub>p</sub> (10V)** Total Gate Charge
- **Q<sub>p</sub> (6V)** Total Gate Charge
- **Q<sub>gs</sub>** Gate Source Charge
- **Q<sub>gd</sub>** Gate Drain Charge
- **t<sub>D(on)</sub>** Turn-On Delay Time
- **t<sub>r</sub>** Turn-On Rise Time
- **t<sub>off</sub>** Turn-Off Delay Time
- **t<sub>r</sub>** Turn-Off Fall Time
- **t<sub>b</sub>** Body Diode Reverse Recovery Time
- **Q<sub>b</sub>** Body Diode Reverse Recovery Charge

---

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 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 impedence 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.

---

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.
N-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 1: On-Region Characteristics (Note E)

Figure 2: Transfer Characteristics (Note E)

Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

Figure 4: On-Resistance vs. Junction Temperature (Note E)

Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

Figure 6: Body-Diode Characteristics (Note E)
N-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 7: Gate-Charge Characteristics

Figure 8: Capacitance Characteristics

Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

Figure 11: 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
# P-Channel 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>BV&lt;sub&gt;DS&lt;/sub&gt;</td>
<td>Drain-Source Breakdown Voltage</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=250V, V&lt;sub&gt;GS&lt;/sub&gt;=0V</td>
<td>-30</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS</td>
<td>Zero Gate Voltage Drain Current</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=30V, V&lt;sub&gt;GS&lt;/sub&gt;=0V</td>
<td>-1</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IDS</td>
<td>Gate-Body leakage current</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=0V, V&lt;sub&gt;GS&lt;/sub&gt;±20V</td>
<td>±100</td>
<td>nA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VG(S/H)</td>
<td>Gate Threshold Voltage</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=V&lt;sub&gt;GS&lt;/sub&gt;, I&lt;sub&gt;D&lt;/sub&gt;=-250µA</td>
<td>-1.3</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IDON</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>-30</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;GS&lt;/sub&gt;=-10V, I&lt;sub&gt;D&lt;/sub&gt;=6.5A</td>
<td>22</td>
<td>80</td>
<td>20</td>
<td>mΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=-5V, I&lt;sub&gt;D&lt;/sub&gt;=5A</td>
<td>34</td>
<td>50</td>
<td>30</td>
<td>mΩ</td>
</tr>
<tr>
<td>g&lt;sub&gt;FS&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;=6.5A</td>
<td>18</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;SSD&lt;/sub&gt;</td>
<td>Diode Forward Voltage</td>
<td>I&lt;sub&gt;S&lt;/sub&gt;=-1A, V&lt;sub&gt;DS&lt;/sub&gt;=0V</td>
<td>-0.8</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS</td>
<td>Maximum Body-Diode Continuous Current</td>
<td></td>
<td>-2.5</td>
<td>A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## STATIC PARAMETERS

**Symbol**
- BV<sub>DS</sub>
- IS
- IDS
- VG(S/H)
- IDON
- R<sub>DS(ON)</sub>
- g<sub>FS</sub>
- V<sub>SSD</sub>
- IS

**Parameter**
- Drain-Source Breakdown Voltage
- Zero Gate Voltage Drain Current
- Gate-Body leakage current
- Gate Threshold Voltage
- On state drain current
- Static Drain-Source On-Resistance
- Forward Transconductance
- Diode Forward Voltage
- Maximum Body-Diode Continuous Current

**Conditions**
- V<sub>DS</sub>=250V, V<sub>GS</sub>=0V
- V<sub>DS</sub>=30V, V<sub>GS</sub>=0V
- V<sub>DS</sub>=0V, V<sub>GS</sub>±20V
- V<sub>DS</sub>=V<sub>GS</sub>, I<sub>D</sub>=-250µA
- V<sub>GS</sub>=10V, V<sub>DS</sub>=5V
- V<sub>GS</sub>=-10V, I<sub>D</sub>=6.5A
- V<sub>DS</sub>=5V, I<sub>D</sub>=6.5A
- I<sub>S</sub>=-1A, V<sub>DS</sub>=0V
- | I<sub>S</sub>=-1A, dI/dt=100A/µs |

**Units**
- V
- µA
- nA
- V
- A
- mΩ
- S
- V
- A

## DYNAMIC PARAMETERS

**Symbol**
- C<sub>iss</sub>
- C<sub>oss</sub>
- C<sub>rss</sub>
- R<sub>G</sub>
- g<sub>FS</sub>
- g<sub>SS</sub>
- Q<sub>GD</sub>
- Q<sub>GS</sub>
- Q<sub>GS</sub>(10V)
- Q<sub>GD</sub>(4.5V)
- Q<sub>GS</sub>(4.5V)
- t<sub>rr</sub>
- t<sub>on</sub>
- t<sub>off</sub>
- t<sub>rr</sub>
- t<sub>on</sub>
- t<sub>off</sub>
- Q<sub>GD</sub>

**Parameter**
- Input Capacitance
- Output Capacitance
- Reverse Transfer Capacitance
- Gate resistance
- Total Gate Charge
- Gate Source Charge
- Gate Drain Charge
- Total Gate Delay Time
- Turn-On Delay Time
- Turn-On Rise Time
- Turn-Off Delay Time
- Turn-Off Fall Time
- Body Diode Reverse Recovery Time
- Body Diode Reverse Recovery Charge

**Conditions**
- V<sub>GS</sub>=0V, V<sub>DS</sub>=15V, f=1MHz
- V<sub>GS</sub>=0V, V<sub>DS</sub>=-10V, f=1MHz
- V<sub>GS</sub>=10V, V<sub>DS</sub>=-15V, I<sub>D</sub>=6.5A
- V<sub>GS</sub>=10V, V<sub>DS</sub>=-15V, R<sub>L</sub>=2.3Ω
- V<sub>GS</sub>=-10V, I<sub>D</sub>=6.5A
- I<sub>D</sub>=-6.5A, dI/dt=100A/µs
- I<sub>D</sub>=-6.5A, dI/dt=100A/µs

**Units**
- pF
- nF
- nA
- nC
- ns
- nC
- nC
- nC
- nC

### Notes

A. The value of R<sub>θJA</sub> is measured with the device mounted on 1in² 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 impedence 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 impedence which is measured with the device mounted on 1in² 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.

---

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.
P-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

**Figure 1:** On-Region Characteristics (Note E)

**Figure 2:** Transfer Characteristics (Note E)

**Figure 3:** On-Resistance vs. Drain Current and Gate Voltage (Note E)

**Figure 4:** On-Resistance vs. Junction Temperature (Note E)

**Figure 5:** On-Resistance vs. Gate-Source Voltage (Note E)

**Figure 6:** Body-Diode Characteristics (Note E)
P-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 7: Gate-Charge Characteristics

Figure 8: Capacitance Characteristics

Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)