AO4702

N-Channel Enhancement Mode Field Effect Transistor with Schottky Diode

General Description

The AO4702 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. A Schottky Diode is packaged in parallel to improve device performance in synchronous rectification applications, or H-bridge configurations. Standard Product AO4702 is Pb-free (meets ROHS & Sony 259 specifications).

Features

$V_{DS} (V) = 30V$
$I_D = 11A \ (V_{GS} = 10V)\$
$R_{DS(ON)} < 16m\Omega \ (V_{GS} = 10V)\$
$R_{DS(ON)} < 25m\Omega \ (V_{GS} = 4.5V)\$

**SCHOTTKY**

$V_{DS} (V) = 30V, I_F = 3A, V_F<0.5V@1A$

UIS TESTED!
$Rg,Ciss,Coss,Crss Tested$

Absolute Maximum Ratings $T_A=25°C$ unless otherwise noted

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>MOSFET</th>
<th>Schottky</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>$V_{DS}$</td>
<td>30</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>$V_{GS}$</td>
<td>±20</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Continuous Drain Current $^A$ $F$</td>
<td>$I_D$</td>
<td>11</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Continuous Drain Current $^B$ $T_A=25°C$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous Drain Current $^B$ $T_A=70°C$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulsed Drain Current $^B$</td>
<td>$I_{DM}$</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schottky reverse voltage</td>
<td>$V_{KA}$</td>
<td>30</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Continuous Forward Current $^A$ $F$</td>
<td>$I_F$</td>
<td>4.4</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Continuous Forward Current $^B$ $T_A=25°C$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous Forward Current $^B$ $T_A=70°C$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulsed Diode Forward Current $^B$</td>
<td>$I_{FM}$</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>$P_D$</td>
<td>3</td>
<td>3</td>
<td>W</td>
</tr>
<tr>
<td>$T_A=25°C$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$T_A=70°C$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avalanche Current $^B$</td>
<td>$I_{AR}$</td>
<td>17</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Repetitive avalanche energy 0.3mH $^B$</td>
<td>$E_{AR}$</td>
<td>43</td>
<td></td>
<td>mJ</td>
</tr>
<tr>
<td>Junction and Storage Temperature Range</td>
<td>$T_J, T_{STG}$</td>
<td>-55 to 150</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Alpha & Omega Semiconductor, Ltd. www.aosmd.com
**Thermal Characteristics: MOSFET**

<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>$R_{\theta JA}$</td>
<td>31</td>
<td>40</td>
<td>°C/W</td>
</tr>
<tr>
<td>Maximum Junction-to-Ambient $^A$</td>
<td>Steady-State</td>
<td>59</td>
<td>75</td>
<td>°C/W</td>
</tr>
<tr>
<td>Maximum Junction-to-Lead $^C$</td>
<td>$R_{\theta JL}$</td>
<td>16</td>
<td>24</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

**Thermal Characteristics: Schottky**

<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>$R_{\theta JA}$</td>
<td>36</td>
<td>40</td>
<td>°C/W</td>
</tr>
<tr>
<td>Maximum Junction-to-Ambient $^A$</td>
<td>Steady-State</td>
<td>67</td>
<td>75</td>
<td>°C/W</td>
</tr>
<tr>
<td>Maximum Junction-to-Lead $^C$</td>
<td>$R_{\theta JL}$</td>
<td>25</td>
<td>30</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ$C. The value in any given application depends on the user’s specific board design.

B: Repetitive rating, pulse width limited by junction temperature.

C: The $R_{\theta JA}$ is the sum of the thermal impedance from junction to lead $R_{\theta JL}$ and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using <300 µs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ$C. The SOA curve provides a single pulse rating.

F: The current rating is based on the $t \leq 10s$ junction to ambient thermal resistance rating.

G: The Schottky appears in parallel with the MOSFET body diode, even though it is a separate chip. Therefore, we provide the net forward drop, capacitance and recovery characteristics of the MOSFET and Schottky. However, the thermal resistance is specified for each chip separately.

Rev 6 : Dec 2006

---

**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.**
### 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;DS&lt;/sub&gt;</td>
<td>Drain-Source Breakdown Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>IOSS</td>
<td>Zero Gate Voltage Drain Current (Set by Schottky leakage)</td>
<td>V&lt;sub&gt;G&lt;/sub&gt;=30V</td>
<td>0.007</td>
<td>0.05</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V&lt;sub&gt;G&lt;/sub&gt;=30V, T&lt;sub&gt;J&lt;/sub&gt;=125°C</td>
<td>3.2</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V&lt;sub&gt;G&lt;/sub&gt;=30V, T&lt;sub&gt;J&lt;/sub&gt;=150°C</td>
<td>12</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;GSS&lt;/sub&gt;</td>
<td>Gate-Body leakage current</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=0V, V&lt;sub&gt;G&lt;/sub&gt;= ±20V</td>
<td>100</td>
<td></td>
<td>nA</td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;GS(th)&lt;/sub&gt;</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;DS&lt;/sub&gt;=250µA</td>
<td>1</td>
<td>1.8</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>ID&lt;sub&gt;(ON)&lt;/sub&gt;</td>
<td>On state drain current</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt;=4.5V, V&lt;sub&gt;DS&lt;/sub&gt;=5V</td>
<td>13.4</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>mΩ</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;=0, I&lt;sub&gt;D&lt;/sub&gt;=11A</td>
<td>16.8</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>mΩ</td>
<td></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;=11A</td>
<td>25</td>
<td></td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;SD&lt;/sub&gt;</td>
<td>Diode + Schottky Forward Voltage</td>
<td>I&lt;sub&gt;S&lt;/sub&gt;=1A, V&lt;sub&gt;GS&lt;/sub&gt;=0V</td>
<td>0.45</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Id</td>
<td>Maximum Body-Diode + Schottky Continuous Current</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>A</td>
</tr>
<tr>
<td><strong>DYNAMIC PARAMETERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C&lt;sub&gt;iss&lt;/sub&gt;</td>
<td>Input Capacitance</td>
<td></td>
<td></td>
<td>1040</td>
<td>1250</td>
<td>pF</td>
</tr>
<tr>
<td>C&lt;sub&gt;oss&lt;/sub&gt;</td>
<td>Output Capacitance (FET+Schottky)</td>
<td>V&lt;sub&gt;GS&lt;/sub&gt;=0V, V&lt;sub&gt;DS&lt;/sub&gt;=15V, f=1MHz</td>
<td></td>
<td></td>
<td>212</td>
<td>pF</td>
</tr>
<tr>
<td>C&lt;sub&gt;rss&lt;/sub&gt;</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td></td>
<td>121</td>
<td>170</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>0.35</td>
<td>0.7</td>
<td>0.85</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;T(10V)&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;=11A</td>
<td>19.8</td>
<td>24</td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td>Q&lt;sub&gt;T(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;=11A</td>
<td>9.8</td>
<td>12</td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td>Q&lt;sub&gt;gs&lt;/sub&gt;</td>
<td>Gate Source Charge</td>
<td></td>
<td></td>
<td>2.5</td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td>Q&lt;sub&gt;gd&lt;/sub&gt;</td>
<td>Gate Drain Charge</td>
<td></td>
<td></td>
<td>3.5</td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td>t&lt;sub&gt;o(on)&lt;/sub&gt;</td>
<td>Turn-On Delay 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;G&lt;/sub&gt;=1.35Ω</td>
<td>4.5</td>
<td>7</td>
<td></td>
<td>ns</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;G&lt;/sub&gt;=1.35Ω</td>
<td>3.9</td>
<td>7</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>t&lt;sub&gt;o(off)&lt;/sub&gt;</td>
<td>Turn-Off Delay Time</td>
<td>R&lt;sub&gt;G&lt;/sub&gt;=3Ω</td>
<td>17.4</td>
<td>30</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>t&lt;sub&gt;f&lt;/sub&gt;</td>
<td>Turn-Off Fall Time</td>
<td>R&lt;sub&gt;G&lt;/sub&gt;=3Ω</td>
<td>3.2</td>
<td>5.7</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>t&lt;sub&gt;r&lt;/sub&gt;</td>
<td>Body Diode + Schottky Reverse Recovery Time</td>
<td>I&lt;sub&gt;D&lt;/sub&gt;=11A, dI/dt=100A/µs</td>
<td>19</td>
<td>23</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Q&lt;sub&gt;rr&lt;/sub&gt;</td>
<td>Body Diode + Schottky Reverse Recovery Charge</td>
<td>I&lt;sub&gt;D&lt;/sub&gt;=11A, dI/dt=100A/µs</td>
<td>9</td>
<td>11</td>
<td></td>
<td>nC</td>
</tr>
</tbody>
</table>

A: The value of R<sub>JA</sub> is measured with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>J</sub>=25°C. The value in any given application depends on the user’s specific board design.

B: Repetitive rating, pulse width limited by junction temperature.

C: The R<sub>JA</sub> is the sum of the thermal impedance from junction to lead R<sub>JE</sub> and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using <300 µs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>J</sub>=25°C. The SOA curve provides a single pulse rating.

F: The current rating is based on the t<sub>F</sub> 10s junction to ambient thermal resistance rating.

G: The Schottky appears in parallel with the MOSFET body diode, even though it is a separate chip. Therefore, we provide the net forward drop, capacitance and recovery characteristics of the MOSFET and Schottky. However, the thermal resistance is specified for each chip separately.

Rev 6 : Dec 2006

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.
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 1: On-Region Characteristics

Figure 2: Transfer Characteristics

Figure 3: On-Resistance vs. Drain Current and Gate Voltage

Figure 4: On-Resistance vs. Junction Temperature

Figure 5: On-Resistance vs. Gate-Source Voltage

Figure 6: Body-Diode Characteristics
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 7: Gate-Charge Characteristics

Figure 8: Capacitance Characteristics

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

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

Figure 11: Normalized Maximum Transient Thermal Impedance