General Description

The AOV20S60 has been fabricated using the advanced αMOS™ high voltage process that is designed to deliver high levels of performance and robustness in switching applications. By providing low R_{DS(ON)}, Q_g and E_{OSS} along with guaranteed avalanche capability this part can be adopted quickly into new and existing offline power supply designs.

Product Summary

- V_{DS} @ T_{J,max} = 700V
- I_{DM} = 80A
- R_{DS(ON)},_{max} = 0.25Ω
- Q_g,_{typ} = 20nC
- E_{OSS} @ 400V = 4.9µJ

100% UIS Tested
100% R_g Tested

Absolute Maximum Ratings T_{A}=25°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>600</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>V_{GS}</td>
<td>±30</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Drain Current</td>
<td>I_{D}</td>
<td>18</td>
<td>A</td>
</tr>
<tr>
<td>Continuous Drain Current</td>
<td>I_{DM}</td>
<td>13</td>
<td>A</td>
</tr>
<tr>
<td>Pulsed Drain Current °C</td>
<td>I_{PM}</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Avalanche Current °C</td>
<td>I_{AR}</td>
<td>3.4</td>
<td>A</td>
</tr>
<tr>
<td>Repetitive avalanche energy °C</td>
<td>E_{AR}</td>
<td>23</td>
<td>mJ</td>
</tr>
<tr>
<td>Single pulsed avalanche energy °C</td>
<td>E_{AS}</td>
<td>188</td>
<td>mJ</td>
</tr>
<tr>
<td>Power Dissipation °C Derate above 25°C</td>
<td>P_{D}</td>
<td>278</td>
<td>W</td>
</tr>
<tr>
<td>Power Dissipation °C</td>
<td>P_{DSM}</td>
<td>8.3</td>
<td>W</td>
</tr>
<tr>
<td>MOSFET dv/dt ruggedness</td>
<td>dv/dt</td>
<td>100</td>
<td>V/ns</td>
</tr>
<tr>
<td>Peak diode recovery dv/dt °C</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Junction and Storage Temperature Range</td>
<td>T_J, T_{STG}</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
<tr>
<td>Maximum lead temperature for soldering purpose, 1/8&quot; from case for 5 seconds °C</td>
<td>T_L</td>
<td>300</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 °C ≤ 10s</td>
<td>R_{UJA}</td>
<td>12</td>
<td>15</td>
<td>°C/W</td>
</tr>
<tr>
<td>Maximum Junction-to-Ambient °C Steady-State</td>
<td>R_{UJC}</td>
<td>40</td>
<td>50</td>
<td>°C/W</td>
</tr>
<tr>
<td>Maximum Junction-to-Case Steady-State</td>
<td>R_{UC}</td>
<td>0.35</td>
<td>0.45</td>
<td>°C/W</td>
</tr>
</tbody>
</table>
## 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></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_{DS} )</td>
<td>Drain-Source Breakdown Voltage</td>
<td>( I_{D} = 250 \mu A, V_{GS} = 0 \text{V}, T_{J} = 25°C )</td>
<td>600</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{D} = 250 \mu A, V_{GS} = 0 \text{V}, T_{J} = 150°C )</td>
<td>650</td>
<td>700</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Zero Gate Voltage Drain Current</td>
<td>( V_{DS} = 600 \text{V}, V_{GS} = 0 \text{V} )</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>( \mu A )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{DS} = 480 \text{V}, T_{J} = 150°C )</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Gate-Body leakage current</td>
<td>( V_{DS} = 50 \text{V}, V_{GS} = 0 \text{V} )</td>
<td>-</td>
<td>-</td>
<td>±100</td>
<td>nA</td>
</tr>
<tr>
<td>( V_{GS(th)} )</td>
<td>Gate Threshold Voltage</td>
<td>( V_{DS} = 5 \text{V}, I_{D} = 250 \mu A )</td>
<td>2.8</td>
<td>3.4</td>
<td>4.1</td>
<td>V</td>
</tr>
<tr>
<td>( R_{DS(on)} )</td>
<td>Static Drain-Source On-Resistance</td>
<td>( V_{GS} = 10 \text{V}, I_{D} = 10 \text{A}, T_{J} = 25°C )</td>
<td>-</td>
<td>0.21</td>
<td>0.25</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{GS} = 10 \text{V}, I_{D} = 10 \text{A}, T_{J} = 150°C )</td>
<td>-</td>
<td>0.53</td>
<td>0.66</td>
<td>Ω</td>
</tr>
<tr>
<td>( V_{SD} )</td>
<td>Diode Forward Voltage</td>
<td>( I_{D} = 10 \text{A}, V_{GS} = 0 \text{V}, T_{J} = 25°C )</td>
<td>-</td>
<td>0.84</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>( I_{DS} )</td>
<td>Maximum Body-Diode Continuous Current</td>
<td>-</td>
<td>-</td>
<td>18</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>( I_{max} )</td>
<td>Maximum Body-Diode Pulsed Current&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
<td>80</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

### STATIC PARAMETERS

- **Input Capacitance**
  \( V_{GS} = 0 \text{V}, V_{DS} = 100 \text{V}, f = 1 \text{MHz} \)
  - 1038 nF

- **Output Capacitance**
  - 68 nF

- **Effective output capacitance, energy related<sup>H</sup>**
  \( V_{GS} = 0 \text{V}, V_{DS} = 0 \text{ to } 480 \text{V}, f = 1 \text{MHz} \)
  - 56.6 nF

- **Effective output capacitance, time related<sup>I</sup>**
  - 176.5 nF

- **Reverse Transfer Capacitance**
  \( V_{GS} = 0 \text{V}, V_{DS} = 100 \text{V}, f = 1 \text{MHz} \)
  - 2.1 nF

- **Gate resistance**
  \( f = 1 \text{MHz} \)
  - 9.3 Ω

### DYNAMIC PARAMETERS

#### Input Capacitance
\( V_{GS} = 0 \text{V}, V_{DS} = 100 \text{V}, f = 1 \text{MHz} \)
- 1038 nF

#### Output Capacitance
- 68 nF

#### Effective output capacitance, energy related<sup>H</sup>
\( V_{GS} = 0 \text{V}, V_{DS} = 0 \text{ to } 480 \text{V}, f = 1 \text{MHz} \)
- 56.6 nF

#### Effective output capacitance, time related<sup>I</sup>
- 176.5 nF

#### Reverse Transfer Capacitance
\( V_{GS} = 0 \text{V}, V_{DS} = 100 \text{V}, f = 1 \text{MHz} \)
- 2.1 nF

#### Gate resistance
\( f = 1 \text{MHz} \)
- 9.3 Ω

### SWITCHING PARAMETERS

#### Total Gate Charge
\( V_{GS} = 10 \text{V}, V_{DS} = 480 \text{V}, I_{D} = 10 \text{A} \)
- 20 nC

#### Gate Source Charge
\( V_{GS} = 10 \text{V}, V_{DS} = 480 \text{V}, I_{D} = 10 \text{A} \)
- 4.6 nC

#### Gate Drain Charge
- 7.6 nC

#### Turn-On Delay Time
\( V_{GS} = 10 \text{V}, V_{DS} = 400 \text{V}, I_{D} = 10 \text{A} \)
- 27.5 ns

#### Turn-On Rise Time
\( V_{GS} = 10 \text{V}, V_{DS} = 400 \text{V}, I_{D} = 10 \text{A} \)
- 32 ns

#### Turn-Off Delay Time
\( R_{D} = 25 \Omega \)
- 87.5 ns

#### Turn-Off Fall Time
- 30 ns

#### Body Diode Reverse Recovery Time
\( I_{R} = 10 \text{A}, dI/dt = 100 \text{A/µs}, V_{DS} = 400 \text{V} \)
- 350 ns

#### Peak Reverse Recovery Current
\( I_{P} = 10 \text{A}, dI/dt = 100 \text{A/µs}, V_{DS} = 400 \text{V} \)
- 27 A

#### Body Diode Reverse Recovery Charge
\( I_{R} = 10 \text{A}, dI/dt = 100 \text{A/µs}, V_{DS} = 400 \text{V} \)
- 5.7 μC

---

**A.** The value of \( R_{JA} \) is measured with the device in a still air environment with \( T_{A} = 25°C \).

**B.** The power dissipation \( P_{D} \) is based on \( T_{J(MAX)} = 150°C \), using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

**C.** Repetitive rating, pulse width limited by junction temperature \( T_{J(MAX)} = 150°C \). Ratings are based on low frequency and duty cycles to keep initial \( T_{J} = 25°C \).

**D.** The \( R_{JA} \) is the sum of the thermal impedance from junction to case \( R_{JC} \) and case to ambient.

**E.** The static characteristics in Figures 1 to 6 are obtained using \(<300 \mu s \) pulses, duty cycle 0.5% max.

**F.** These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of \( T_{J(MAX)} = 150°C \). The SOA curve provides a single pulse rating.

**G.** \( L = 60 \text{mH}, I_{AS} = 2.5 \text{A}, V_{DD} = 150 \text{V}, \) Starting \( T_{J} = 25°C \)

**H.** \( C_{oss} \) is a fixed capacitance that gives the same stored energy as \( C_{oss} \) while \( V_{DS} \) is rising from 0 to 80% \( V_{(BR)DSS} \).

**I.** \( C_{oss} \) is a fixed capacitance that gives the same charging time as \( C_{oss} \) while \( V_{DS} \) is rising from 0 to 80% \( V_{(BR)DSS} \).

**J.** Wavesoldering only allowed at leads.

---

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 @ 25°C

**Figure 2:** On-Region Characteristics @ 125°C

**Figure 3:** Transfer Characteristics

**Figure 4:** On-Resistance vs. Drain Current and Gate Voltage

**Figure 5:** On-Resistance vs. Junction Temperature

**Figure 6:** Break Down vs. Junction Temperature
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 7: Body-Diode Characteristics (Note E)

Figure 8: Gate-Charge Characteristics

Figure 9: Capacitance Characteristics

Figure 10: Coss stored Energy

Figure 11: Maximum Forward Biased Safe Operating Area for (Note F)

Figure 12: Avalanche energy
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 13: Current De-rating (Note B)

Figure 14: Single Pulse Power Rating Junction-to-Case (Note F)

Figure 15: Normalized Maximum Transient Thermal Impedance (Note F)
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 16: Single Pulse Power Rating Junction-to-Ambient (Note G)

Figure 17: Normalized Maximum Transient Thermal Impedance (Note G)
Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

Diode Recovery Test Circuit & Waveforms