AO4840E
40V Dual N-Channel AlphaMOS

General Description
- Advanced trench technology
- Low \( R_{DS(ON)} \)
- Low Gate Charge
- ESD protected
- RoHS and Halogen-Free Compliant

Applications
- Buck Converter
- DC motor drive
- Load switch

Product Summary
- \( V_{DS} \): 40V
- \( I_D \) (at \( V_{GS}=10V \)): 6A
- \( R_{DS(ON)} \) (at \( V_{GS}=10V \)): < 28mΩ
- \( R_{DS(ON)} \) (at \( V_{GS}=4.5V \)): < 35mΩ
- Typical ESD protection: HBM Class 2
- 100% UIS Tested
- 100% Rg Tested

Orderable Part Number | Package Type | Form | Minimum Order Quantity
--- | --- | --- | ---
AO4840E | SO-8 | Tape & Reel | 3000

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>40</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>6</td>
</tr>
<tr>
<td>( T_A=70^\circ C )</td>
<td>( I_D )</td>
<td>5</td>
<td>A</td>
</tr>
<tr>
<td>Pulsed Drain Current (^\text{c})</td>
<td>( I_{DM} )</td>
<td>30</td>
<td>A</td>
</tr>
<tr>
<td>Avalanche Current (^\text{a})</td>
<td>( I_{AS} )</td>
<td>14</td>
<td>A</td>
</tr>
<tr>
<td>Avalanche energy ( L=0.1 \text{mH} ) (^\text{a})</td>
<td>( E_{AS} )</td>
<td>10</td>
<td>mJ</td>
</tr>
<tr>
<td>( V_{DS} ) Spike</td>
<td>10µs</td>
<td>( V_{SPIKE} )</td>
<td>48</td>
</tr>
<tr>
<td>Power Dissipation (^\text{b})</td>
<td>( T_A=25^\circ C )</td>
<td>( P_D )</td>
<td>2</td>
</tr>
<tr>
<td>( T_A=70^\circ C )</td>
<td>( P_D )</td>
<td>1.2</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>°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 (^\text{a})</td>
<td>( t \leq 10s )</td>
<td>( R_{JUA} )</td>
<td>48</td>
<td>62.5</td>
</tr>
<tr>
<td>Maximum Junction-to-Ambient (^\text{b})</td>
<td>Steady-State</td>
<td>( R_{JUL} )</td>
<td>74</td>
<td>90</td>
</tr>
<tr>
<td>Maximum Junction-to-Lead Steady-State</td>
<td>( R_{JUL} )</td>
<td>32</td>
<td>40</td>
<td>°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>BVDSS</td>
<td>Drain-Source Breakdown Voltage</td>
<td>ID=250µA, VGS=0V</td>
<td>40</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>IDSS</td>
<td>Zero Gate Voltage Drain Current</td>
<td>VDS=40V, VGS=0V</td>
<td>1</td>
<td></td>
<td>5</td>
<td>µA</td>
</tr>
<tr>
<td>IGSS</td>
<td>Gate-Body leakage current</td>
<td>VDS=0V, VGS=±20V</td>
<td>±10</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>VGS(th)</td>
<td>Gate Threshold Voltage</td>
<td>VDS=VDS, ID=250µA</td>
<td>1.7</td>
<td>2.1</td>
<td>2.6</td>
<td>V</td>
</tr>
<tr>
<td>RDS(ON)</td>
<td>Static Drain-Source On-Resistance</td>
<td>VGS=10V, IG=6A</td>
<td>23</td>
<td>28</td>
<td></td>
<td>mΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VGS=4.5V, IG=5A</td>
<td>39</td>
<td>47</td>
<td></td>
<td>mΩ</td>
</tr>
<tr>
<td>BFS</td>
<td>Forward Transconductance</td>
<td>VDS=5V, IG=6A</td>
<td>29</td>
<td></td>
<td></td>
<td>S</td>
</tr>
<tr>
<td>VSD</td>
<td>Diode Forward Voltage</td>
<td>ID=1A, VGS=0V</td>
<td>0.75</td>
<td>1</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>ffs</td>
<td>Maximum Body-Diode Continuous Current</td>
<td>3</td>
<td></td>
<td></td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

### STATIC PARAMETERS

**Ciss**  
Input Capacitance  
V<sub>GS</sub>=0V, V<sub>DS</sub>=20V, f=1MHz  
520  
pF

**Coss**  
Output Capacitance  
V<sub>GS</sub>=0V, V<sub>DS</sub>=20V  
65  
pF

**Cgs**  
Reverse Transfer Capacitance  
V<sub>GS</sub>=0V  
32  
pF

**R<sub>gs</sub>**  
Gate resistance  
f=1MHz  
2  
4.2  
6.5  
Ω

### DYNAMIC PARAMETERS

**Qg(10V)**  
Total Gate Charge  
V<sub>GS</sub>=10V, V<sub>DS</sub>=20V, IG=6A  
9  
15  
nC

**Qg(4.5V)**  
Total Gate Charge  
V<sub>GS</sub>=10V, V<sub>DS</sub>=20V  
4.5  
10  
nC

**Qgs**  
Gate Source Charge  
V<sub>GS</sub>=10V, V<sub>DS</sub>=20V, R<sub>L</sub>=3.3Ω,  
2  
nC

**Qgd**  
Gate Drain Charge  
V<sub>GS</sub>=10V, V<sub>DS</sub>=20V, R<sub>L</sub>=3.3Ω,  
1.5  
nC

**t<sub>on</sub>**  
Turn-On Rise Time  
V<sub>GS</sub>=10V, V<sub>DS</sub>=20V, R<sub>L</sub>=3.3Ω,  
5.5  
ns

**t<sub>off</sub>**  
Turn-Off Fall Time  
R<sub>GEN</sub>=3Ω  
7  
ns

**t<sub>f</sub>**  
Body Diode Reverse Recovery Time  
IG=6A, di/dt=500A/µs  
8  
ns

**Qrr**  
Body Diode Reverse Recovery Charge  
IG=6A, di/dt=500A/µs  
13  
nC

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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>j</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>rL</sub> is the sum of the thermal impedance from junction to lead R<sub>jL</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 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)
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 1: Gate-Charge Characteristics

Figure 2: Capacitance Characteristics

Figure 3: Maximum Forward Biased Safe Operating Area (Note F)

Figure 4: Normalized Transient Thermal Impedance (Note F)

Rev.1.0: September 2015
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Figure A: Gate Charge Test Circuit & Waveforms

![Gate Charge Test Circuit & Waveforms](image1)

Figure B: Resistive Switching Test Circuit & Waveforms

![Resistive Switching Test Circuit & Waveforms](image2)

Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

![Unclamped Inductive Switching (UIS) Test Circuit & Waveforms](image3)

Figure D: Diode Recovery Test Circuit & Waveforms

![Diode Recovery Test Circuit & Waveforms](image4)