General Description

- Trench Power MOSFET - AlphaSGT™ technology
- Low $R_{\text{DS(ON)}}$
- Excellent Gate Charge x $R_{\text{DS(ON)}}$ Product (FOM)
- RoHS and Halogen-Free Compliant

Product Summary

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{\text{DS}}$</td>
<td></td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>$I_{\text{D}}$ (at $V_{\text{GS}}=10\text{V}$)</td>
<td>$I_{\text{D}}$</td>
<td>140</td>
<td>A</td>
</tr>
<tr>
<td>$R_{\text{DS(ON)}}$ (at $V_{\text{GS}}=10\text{V}$)</td>
<td>$R_{\text{DS(ON)}}$</td>
<td>&lt; 3.2mΩ</td>
<td></td>
</tr>
<tr>
<td>$R_{\text{DS(ON)}}$ (at $V_{\text{GS}}=6\text{V}$)</td>
<td>$R_{\text{DS(ON)}}$</td>
<td>&lt; 4.6mΩ</td>
<td></td>
</tr>
</tbody>
</table>

Applications

- Synchronous Rectification in DC/DC and AC/DC Converters
- Industrial and Motor Drive applications

Orderable Part Number | Package Type | Form | Minimum Order Quantity
AOT66616L          | TO-220      | Tube | 1000
AOB66616L          | TO-263      | Tape & Reel | 800

Absolute Maximum Ratings $T_{\text{A}}=25\text{°C}$ 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>$V_{\text{DS}}$</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>$V_{\text{GS}}$</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Drain Current $^a$</td>
<td>$I_{\text{D}}$ ($T_{\text{C}}=25\text{°C}$)</td>
<td>140</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>$I_{\text{D}}$ ($T_{\text{C}}=100\text{°C}$)</td>
<td>95</td>
<td>A</td>
</tr>
<tr>
<td>Pulsed Drain Current $^c$</td>
<td>$I_{\text{DM}}$</td>
<td>330</td>
<td>A</td>
</tr>
<tr>
<td>Continuous Drain Current $^c$</td>
<td>$I_{\text{DSM}}$ ($T_{\text{A}}=25\text{°C}$)</td>
<td>38.5</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>$I_{\text{DSM}}$ ($T_{\text{A}}=70\text{°C}$)</td>
<td>30.5</td>
<td>A</td>
</tr>
<tr>
<td>Avalanche Current $^c$</td>
<td>$I_{\text{AS}}$</td>
<td>35</td>
<td>A</td>
</tr>
<tr>
<td>Avalanche energy</td>
<td>$E_{\text{AS}}$  ($L=0.3\text{mH}$)</td>
<td>184</td>
<td>mJ</td>
</tr>
<tr>
<td>Power Dissipation $^b$</td>
<td>$P_{\text{D}}$ ($T_{\text{C}}=25\text{°C}$)</td>
<td>125</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>$P_{\text{D}}$ ($T_{\text{C}}=100\text{°C}$)</td>
<td>50</td>
<td>W</td>
</tr>
<tr>
<td>Power Dissipation $^a$</td>
<td>$P_{\text{DSM}}$ ($T_{\text{A}}=25\text{°C}$)</td>
<td>8.3</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>$P_{\text{DSM}}$ ($T_{\text{A}}=70\text{°C}$)</td>
<td>5.3</td>
<td>W</td>
</tr>
<tr>
<td>Junction and Storage Temperature Range</td>
<td>$T_{J}, T_{\text{STG}}$</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 $^a$</td>
<td>$R_{\text{UA}}$</td>
<td>12</td>
<td>15</td>
<td>°C/W</td>
</tr>
<tr>
<td>Maximum Junction-to-Ambient $^b$</td>
<td>Steady-State</td>
<td>50</td>
<td>60</td>
<td>°C/W</td>
</tr>
<tr>
<td>Maximum Junction-to-Case</td>
<td>Steady-State</td>
<td>0.8</td>
<td>1.0</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>(B_V \text{DSS})</td>
<td>Drain-Source Breakdown Voltage</td>
<td>(I_D=250\mu A, V_{GS}=0)</td>
<td>60</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>(I_{DSS})</td>
<td>Zero Gate Voltage Drain Current</td>
<td>(V_{DS}=60V, V_{GS}=0)</td>
<td></td>
<td></td>
<td></td>
<td>(\mu A)</td>
</tr>
<tr>
<td>(I_{GS})</td>
<td>Gate-Body leakage current</td>
<td>(V_{DS}=0V, V_{GS}=\pm 20V)</td>
<td></td>
<td>(\pm 100)</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>(V_{GS(th)})</td>
<td>Gate Threshold Voltage</td>
<td>(V_{DS}=V_{GS}, I_D=250\mu A)</td>
<td>2.4</td>
<td>2.9</td>
<td>3.4</td>
<td>V</td>
</tr>
<tr>
<td>(R_{DS(on)})</td>
<td>Static Drain-Source On-Resistance</td>
<td>(V_{GS}=10V, I_D=20A)</td>
<td>2.5</td>
<td>3.2</td>
<td></td>
<td>mΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(V_{GS}=6V, I_D=20A)</td>
<td>3.4</td>
<td>4.6</td>
<td></td>
<td>mΩ</td>
</tr>
<tr>
<td>(g_{fs})</td>
<td>Forward Transconductance</td>
<td>(V_{DS}=5V, I_D=20A)</td>
<td>100</td>
<td></td>
<td></td>
<td>S</td>
</tr>
<tr>
<td>(I_{SD})</td>
<td>Diode Forward Voltage</td>
<td>(I_D=1A, V_{GS}=0)</td>
<td>0.7</td>
<td>1</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>(I_{gs})</td>
<td>Maximum Body-Diode Continuous Current</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>135 A</td>
</tr>
</tbody>
</table>

#### STATIC PARAMETERS

- **Input Capacitance**
  - \(C_{iss}\): 2870 pF
- **Output Capacitance**
  - \(C_{oss}\): 940 pF
- **Reverse Transfer Capacitance**
  - \(C_{rss}\): 38 pF
- **Gate resistance**
  - \(R_{g}\): 0.6 μΩ, 1.25 μΩ, 1.9 μΩ

#### DYNAMIC PARAMETERS

- **Total Gate Charge**
  - \(Q_{G(10V)}\): 42.5 nC, 60 nC
- **Gate Source Charge**
  - \(Q_{gs}\): 12 nC
- **Gate Drain Charge**
  - \(Q_{gd}\): 10 nC
- **Output Charge**
  - \(Q_{oss}\): 54 nC
- **Turn-On Delay Time**
  - \(t_{D(on)}\): 14.5 ns
- **Turn-On Rise Time**
  - \(t_{r}\): 15.5 ns
- **Turn-Off Delay Time**
  - \(t_{D(off)}\): 33 ns
- **Turn-Off Fall Time**
  - \(t_{f}\): 12.5 ns
- **Body Diode Reverse Recovery Time**
  - \(t_{rr}\): 26 ns
- **Body Diode Reverse Recovery Charge**
  - \(Q_{rr}\): 87 nC

#### SWITCHING PARAMETERS

- **Gate Source Charge**
  - \(Q_{gs}\): 12 nC
- **Gate Drain Charge**
  - \(Q_{gd}\): 10 nC
- **Output Charge**
  - \(Q_{oss}\): 54 nC
- **Turn-On Delay Time**
  - \(t_{D(on)}\): 14.5 ns
- **Turn-On Rise Time**
  - \(t_{r}\): 15.5 ns
- **Turn-Off Delay Time**
  - \(t_{D(off)}\): 33 ns
- **Turn-Off Fall Time**
  - \(t_{f}\): 12.5 ns
- **Body Diode Reverse Recovery Time**
  - \(t_{rr}\): 26 ns
- **Body Diode Reverse Recovery Charge**
  - \(Q_{rr}\): 87 nC

### Notes

- A. The value of \(R_{q(\text{JA})}\) is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with \(T_A=25°C\). The Power dissipation \(P_{DSM}\) is based on \(R_{q(\text{JA})}\leq 10s\) and the maximum allowed junction temperature of 150°C. The value in any given application depends on the user's specific board design.
- 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. Single pulse width limited by junction temperature \(T_{J(MAX)}\leq 150°C\).
- D. The \(R_{q(\text{JA})}\) is the sum of the thermal impedance from junction to case \(R_{q(\text{JC})}\) and case to ambient.
- E. The static characteristics in Figures 1 to 6 are obtained using <300 μs 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 \(T_{J(MAX)}\leq 150°C\). The SOA curve provides a single pulse rating.
- G. The maximum current rating is package limited.
- H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with \(T_A=25°C\).

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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 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-Case (Note F)

Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

**Figure 12: Power De-rating (Note F)**

- Power Dissipation (W)
- $T_{CASE}$ (°C)

**Figure 13: Current De-rating (Note F)**

- Current rating $I_A$ (A)
- $T_{CASE}$ (°C)

**Figure 14: Coss stored Energy**

- $E_{oss}$ (uJ)
- $V_{DS}$ (Volts)

**Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)**

- Power (W)
- $P_{DM}$
- $T_{on}$
- Pulse Width (s)

**Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)**

- Normalized Transient Thermal Resistance
- $Z_{qJA}$
- Pulse Width (s)

In descending order

$D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01$, single pulse

$D=T_{on}/T$

$T_{on}=T_A+P_{DM}Z_{qJA}R_{JA}$

$R_{JA}=80^\circ$ C/W
Figure A: Gate Charge Test Circuit & Waveforms

Figure B: Resistive Switching Test Circuit & Waveforms

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

Figure D: Diode Recovery Test Circuit & Waveforms