ALPHA & OMEGA SEMICONDUCTOR

# AOTL080A60

## 600V, αMOS5™ N-Channel Power Transistor

## General Description

- Proprietary αMOS5™ technology
- Low $R_{DS(ON)}$
- Optimized switching parameters for better EMI performance
- Enhanced body diode for robustness and fast reverse recovery
- RoHS 2.0 and Halogen-Free Compliant

## Applications

- PFC and PWM stages (LLC, PSFB,TTF) of Server, Telecom, Industrial, UPS, and Solar Inverters.

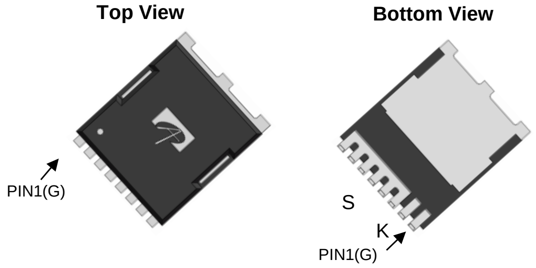
## Product Summary

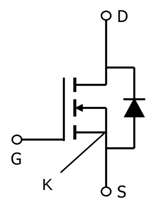
| | |
|---|---|
| $V_{DS}$ @ $T_{j,max}$ | 700V |
| $I_{DM}$ | 184A |
| $R_{DS(ON),max}$ | < 0.08Ω |
| $Q_{g,typ}$ | 70nC |
| $E_{oss}$ @ 400V | 9.1μJ |

100% UIS Tested
100% $R_g$ Tested

GREEN Product

### TOLLB




| Orderable Part Number | Package Type | Form | Minimum Order Quantity |
|---|---|---|---|
| AOTL080A60 | TOLLB | Tape &Reel | 2000 |

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

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 600 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current | $T_C$=25°C | $I_D$ | 46 | A |
| | $T_C$=100°C | | 30 | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 184 | |
| Continuous Drain Current | $T_A$=25°C | $I_{DSM}$ | 6.3 | A |
| | $T_A$=70°C | | 5 | |
| Avalanche Current [C] | | $I_{AR}$ | 11 | A |
| Repetitive avalanche energy [C] | | $E_{AR}$ | 60 | mJ |
| Single pulsed avalanche energy [G] | | $E_{AS}$ | 690 | mJ |
| MOSFET dv/dt ruggedness | | dv/dt | 100 | V/ns |
| Diode reverse recovery $V_{DS}$=0 to 400V,$I_F$<=37A,$T_j$=25°C | | dv/dt | 20 | V/ns |
| | | di/dt | 1000 | A/us |
| Power Dissipation [B] | $T_C$=25°C | $P_D$ | 480 | W |
| | Derate above 25°C | | 3.8 | W/°C |
| Power Dissipation [A] | $T_A$=25°C | $P_{DSM}$ | 8.3 | W |
| | $T_A$=70°C | | 5.3 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |
| Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | | $T_L$ | 300 | °C |

**Thermal Characteristics**

| Parameter | | Symbol | Typical | Maximum | Units |
|---|---|---|---|---|---|
| Maximum Junction-to-Ambient [A] | t ≤ 10s | $R_{θJA}$ | 10 | 15 | °C/W |
| Maximum Junction-to-Ambient [A,D] | Steady-State | | 40 | 50 | °C/W |
| Maximum Junction-to-Case | | $R_{θJC}$ | 0.22 | 0.26 | °C/W |

**Electrical Characteristics ($T_J$=25°C unless otherwise noted)**

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **STATIC PARAMETERS** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $I_D$=250µA, $V_{GS}$=0V, $T_J$=25°C | 600 | | | V |
| | | $I_D$=1mA, $V_{GS}$=0V, $T_J$=150°C | | 700 | | |
| $BV_{DSS}$ /∆TJ | Breakdown Voltage Temperature Coefficient | $I_D$=1mA, $V_{GS}$=0V | | 0.51 | | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=600V, $V_{GS}$=0V | | | 1 | µA |
| | | $V_{DS}$=480V, $T_J$=125°C | | 3.2 | | |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$=0V, $V_{GS}$=±20V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=5V, $I_D$=250µA | 3 | 3.6 | 4.2 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=20A | | 0.07 | 0.08 | Ω |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=10V, $I_D$=20A | | 39 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=20A,$V_{GS}$=0V | | 0.85 | 1.2 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | 46 | A |
| $I_{SM}$ | Maximum Body-Diode Pulsed Current [C] | | | | 184 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | | 3960 | | pF |
| $C_{oss}$ | Output Capacitance | | | 116 | | pF |
| $C_{o(er)}$ | Effective output capacitance, energy related [H] | $V_{GS}$=0V, $V_{DS}$=0 to 480V, f=1MHz | | 104 | | pF |
| $C_{o(tr)}$ | Effective output capacitance, time related [I] | | | 470 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | | 0.9 | | pF |
| $R_g$ | Gate resistance | f=1MHz | | 2.1 | | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=480V, $I_D$=20A | | 70 | | nC |
| $Q_{gs}$ | Gate Source Charge | | | 18 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 20 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=400V, $I_D$=20A, $R_G$=5Ω | | 32 | | ns |
| $t_r$ | Turn-On Rise Time | | | 34 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 88 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 25 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=20A, dI/dt=100A/µs, $V_{DS}$=400V | | 450 | | ns |
| $I_{rm}$ | Peak Reverse Recovery Current | | | 35 | | A |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | | | 10.6 | | µC |

A. The value of $R_{\theta JA}$ 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 $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case 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-case thermal impedance which is measured with the device mounted to a large heatsin k, assuming a maximum junction temperature of $T_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.
G. L=60mH, $I_{AS}$=4.8 A, $R_G$=25Ω, Starting $T_J$=25° C.
H. $C_{o(er)}$ 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. $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{(BR)DSS}$.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

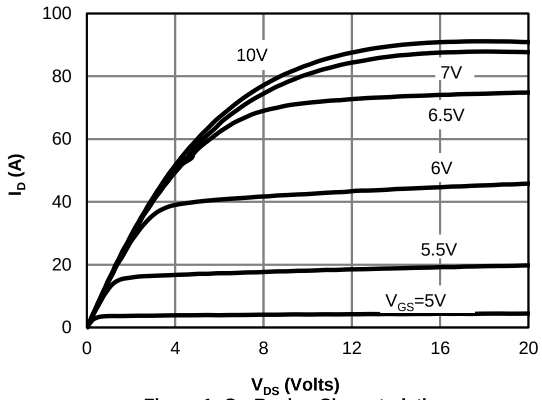


**Figure 1: On-Region Characteristics**

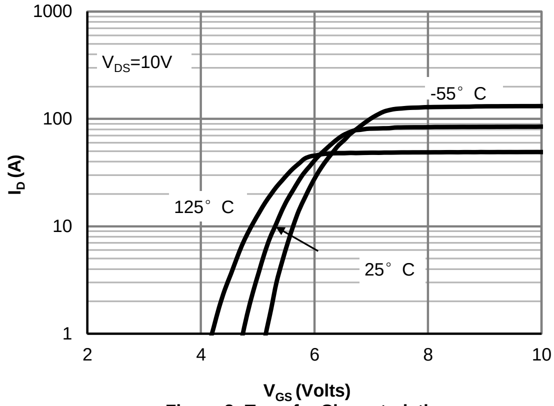


**Figure 2: Transfer Characteristics**

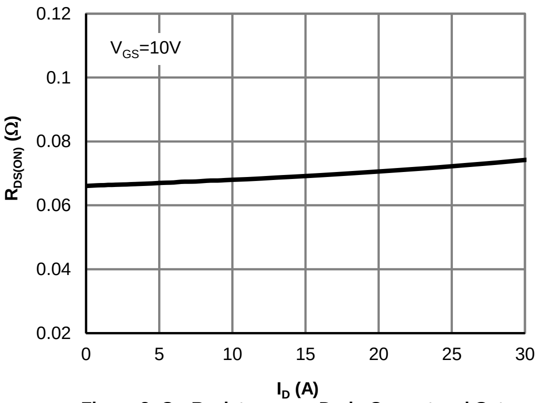


**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**

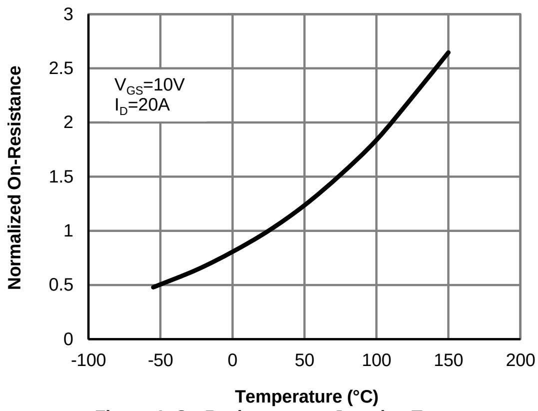


**Figure 4: On-Resistance vs. Junction Temperature**

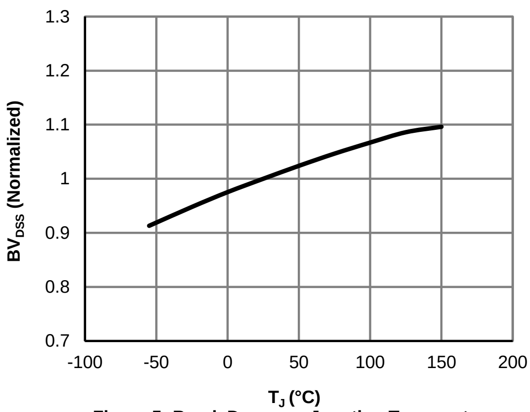


**Figure 5: Break Down vs. Junction Temparature**

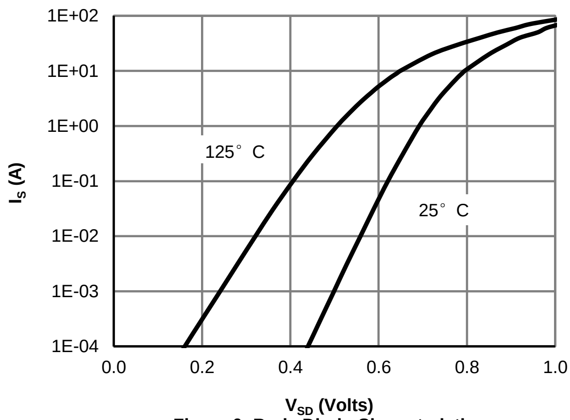


**Figure 6: Body-Diode Characteristics**

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

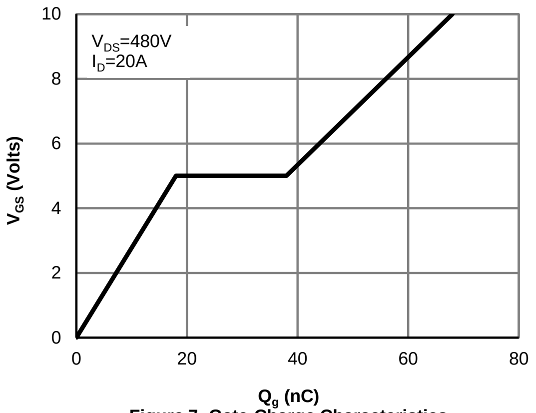



**Figure 7: Gate-Charge Characteristics**

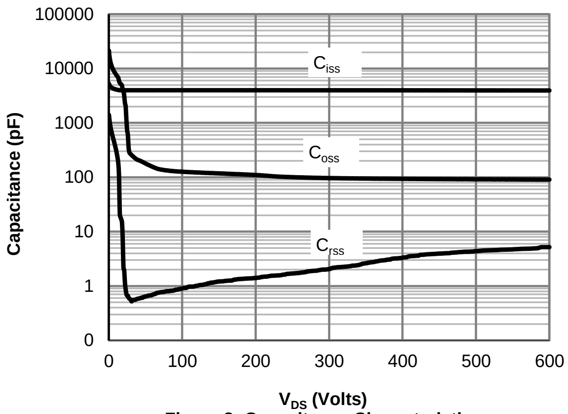



**Figure 8: Capacitance Characteristics**

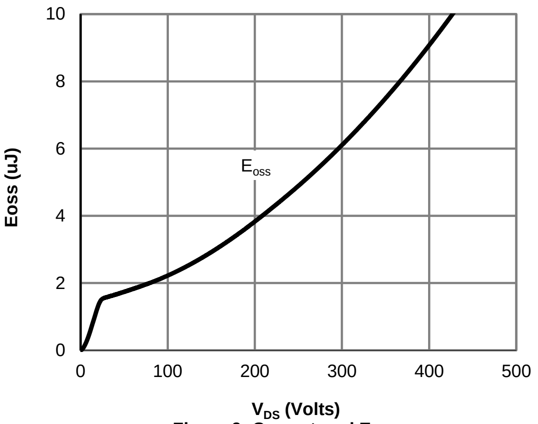



**Figure 9: Coss stored Energy**

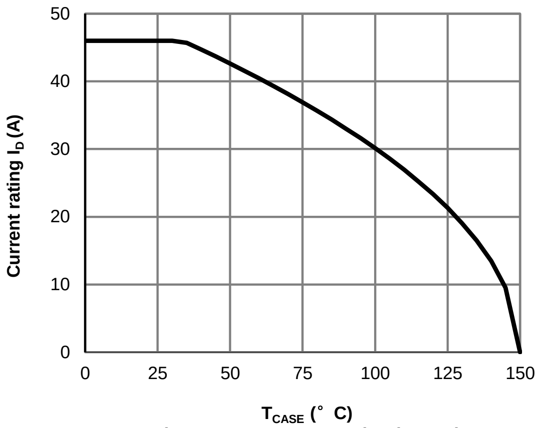



**Figure 10: Current De-rating (Note F)**

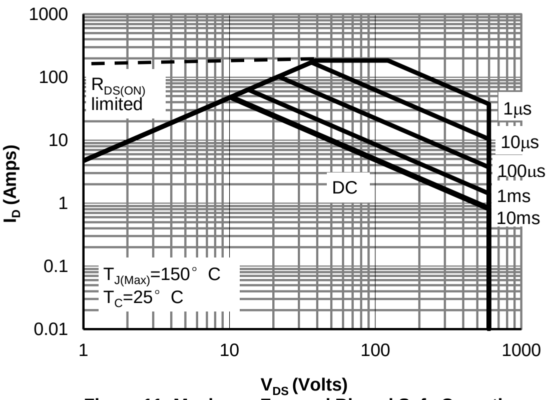



**Figure 11: Maximum Forward Biased Safe Operating Area (Note F)**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

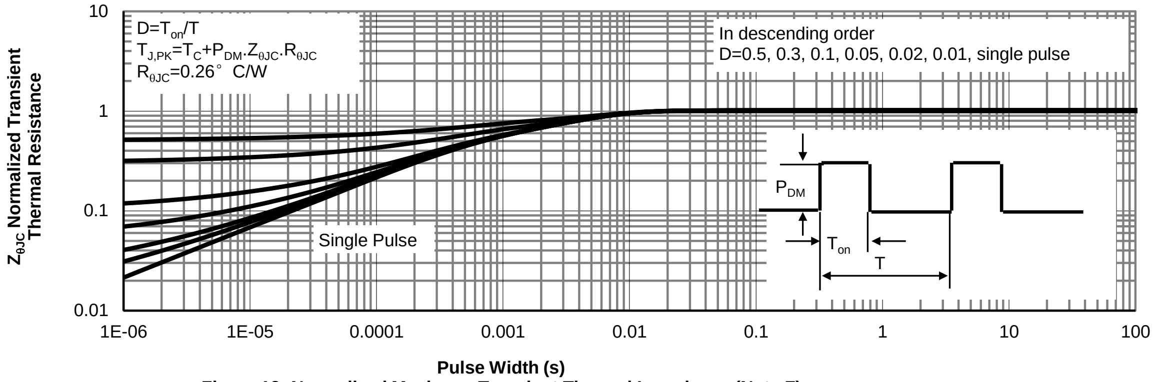
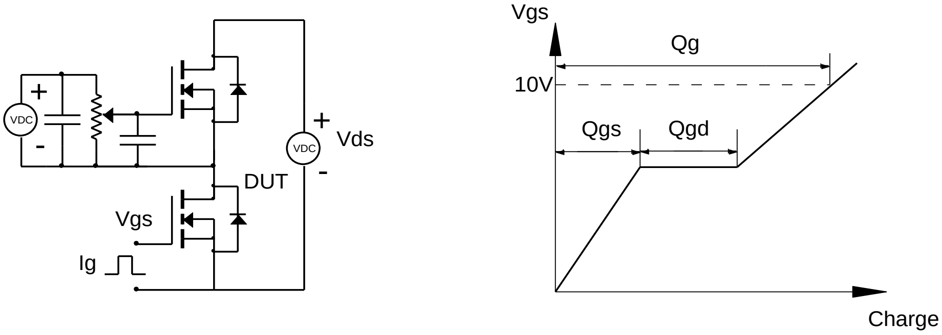
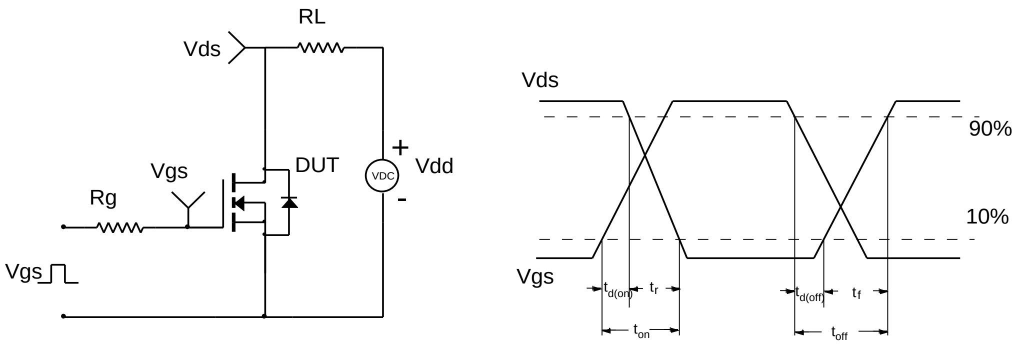



**Figure 12: Normalized Maximum Transient Thermal Impedance (Note F)**

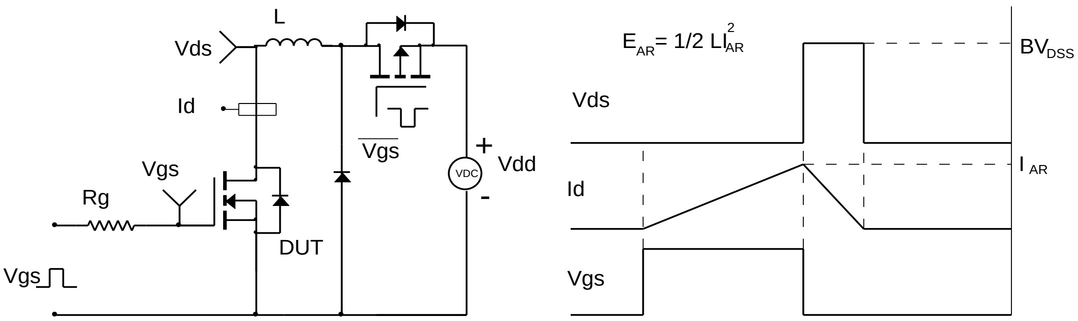
## Gate Charge Test Circuit & Waveform




## Resistive Switching Test Circuit & Waveforms




## Unclamped Inductive Switching (UIS) Test Circuit & Waveforms




## Diode Recovery Test Circuit & Waveforms