# AOW15S60/AOWF15S60

## 600V 15A $\alpha$MOS$^{TM}$ Power Transistor

## General Description

The AOW15S60 & AOWF15S60 have been fabricated using the advanced $\alpha$MOS$^{TM}$ 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 these parts can be adopted quickly into new and existing offline power supply designs.

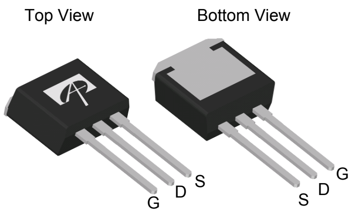
## Product Summary

| | |
|---|---|
| $V_{DS}$ @ $T_{j,max}$ | 700V |
| $I_{DM}$ | 63A |
| $R_{DS(ON),max}$ | 0.29Ω |
| $Q_{g,typ}$ | 16nC |
| $E_{oss}$ @ 400V | 3.6µJ |

100% UIS Tested
100% $R_g$ Tested

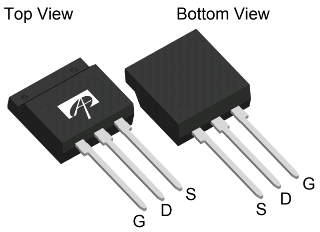
Green Product

TO-262

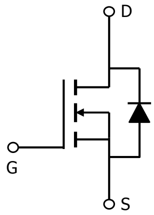


AOW15S60

TO-262F



AOWF15S60



| Absolute Maximum Ratings $T_A$=25°C unless otherwise noted | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **AOW15S60** | **AOWF15S60** | **Units** |
| Drain-Source Voltage | | $V_{DS}$ | 600 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | | V |
| Continuous Drain Current | $T_C$=25°C | $I_D$ | 15 | 15* | A |
| | $T_C$=100°C | | 10 | 10* | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 63 | | |
| Avalanche Current [C] | | $I_{AR}$ | 2.4 | | A |
| Repetitive avalanche energy [C] | | $E_{AR}$ | 86 | | mJ |
| Single pulsed avalanche energy [G] | | $E_{AS}$ | 173 | | mJ |
| Power Dissipation [B] | $T_C$=25°C | $P_D$ | 208 | 27.8 | W |
| | Derate above 25°C | | 1.67 | 0.22 | W/ °C |
| MOSFET dv/dt ruggedness | | dv/dt | 100 | | V/ns |
| Peak diode recovery dv/dt [H] | | | 20 | | |
| 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 [J] | | $T_L$ | 300 | | °C |

| Thermal Characteristics | | | | |
|---|---|---|---|---|
| **Parameter** | **Symbol** | **AOW15S60** | **AOWF15S60** | **Units** |
| Maximum Junction-to-Ambient [A,D] | $R_{\theta JA}$ | 65 | 65 | °C/W |
| Maximum Case-to-sink [A] | $R_{\theta CS}$ | 0.5 | -- | °C/W |
| Maximum Junction-to-Case | $R_{\theta JC}$ | 0.6 | 4.5 | °C/W |

* Drain current limited by maximum junction temperature.

## 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 |
| | | $I_D$=250µA, $V_{GS}$=0V, $T_J$=150°C | 650 | 700 | - | |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=600V, $V_{GS}$=0V | - | - | 1 | µA |
| | | $V_{DS}$=480V, $T_J$=150°C | - | 10 | - | |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$=0V, $V_{GS}$=±30V | - | - | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=5V,$I_D$=250µA | 2.5 | 3.2 | 3.8 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=7.5A, $T_J$=25°C | - | 0.254 | 0.29 | Ω |
| | | $V_{GS}$=10V, $I_D$=7.5A, $T_J$=150°C | - | 0.68 | 0.78 | Ω |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=7.5A,$V_{GS}$=0V, $T_J$=25°C | - | 0.83 | - | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | - | - | 15 | A |
| $I_{SM}$ | Maximum Body-Diode Pulsed Current[C] | | - | - | 63 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | - | 717 | - | pF |
| $C_{oss}$ | Output Capacitance | | - | 58 | - | pF |
| $C_{o(er)}$ | Effective output capacitance, energy related [H] | VGS=0V, $V_{DS}$=0 to 480V, f=1MHz | - | 41.2 | - | pF |
| $C_{o(tr)}$ | Effective output capacitance, time related [I] | | - | 125.2 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | VGS=0V, $V_{DS}$=100V, f=1MHz | - | 1.3 | - | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | - | 13.4 | - | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=480V, $I_D$=7.5A | - | 15.6 | - | nC |
| $Q_{gs}$ | Gate Source Charge | | - | 3.5 | - | nC |
| $Q_{gd}$ | Gate Drain Charge | | - | 6.0 | - | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=400V, $I_D$=7.5A, $R_G$=25Ω | - | 24.5 | - | ns |
| $t_r$ | Turn-On Rise Time | | - | 22 | - | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | - | 84 | - | ns |
| $t_f$ | Turn-Off Fall Time | | - | 24 | - | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=7.5A,dI/dt=100A/µs,$V_{DS}$=400V | - | 282 | - | ns |
| $I_{rm}$ | Peak Reverse Recovery Current | $I_F$=7.5A,dI/dt=100A/µs,$V_{DS}$=400V | - | 26 | - | A |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=7.5A,dI/dt=100A/µs,$V_{DS}$=400V | - | 4.5 | - | 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 <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 $T_{J(MAX)}$=150°C. The SOA curve provides a single pulse rating.

G. L=60mH, $I_{AS}$=2.4A, $V_{DD}$=150V, 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% $V_{(BR)DSS}$.

J. Wavesoldering only allowed at leads.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

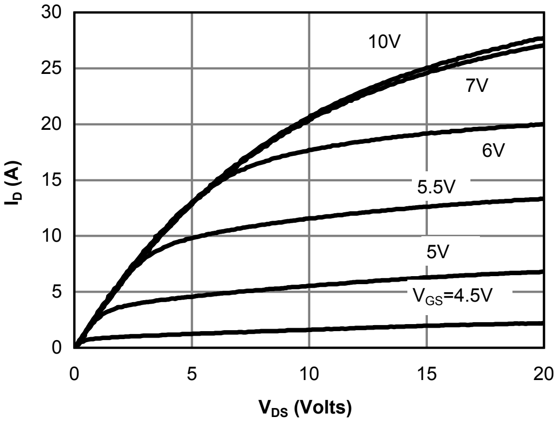


Figure 1: On-Region Characteristics@25°C

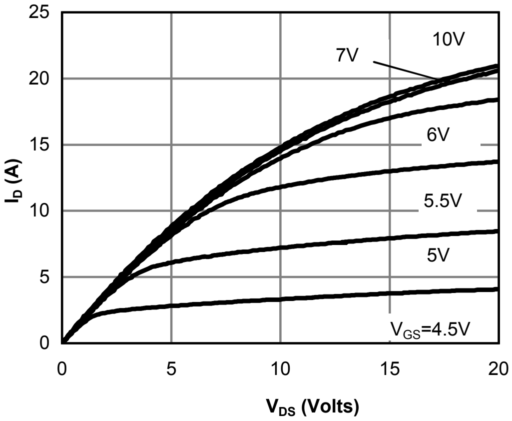


Figure 2: On-Region Characteristics@125°C

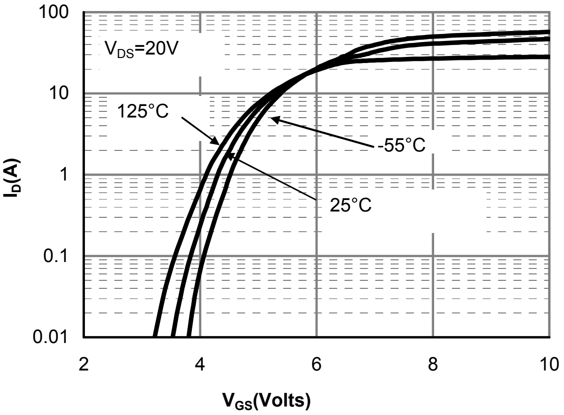


Figure 3: Transfer Characteristics

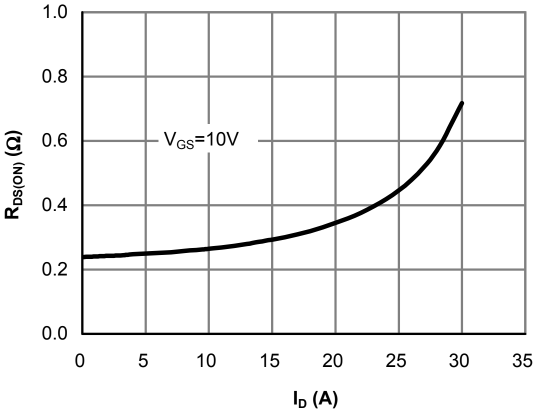


Figure 4: On-Resistance vs. Drain Current and Gate Voltage

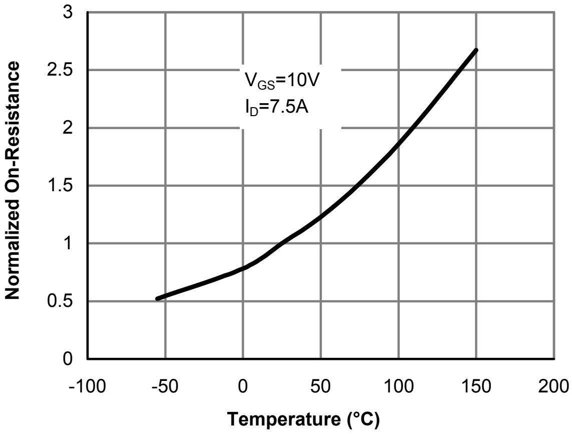


Figure 5: On-Resistance vs. Junction Temperature

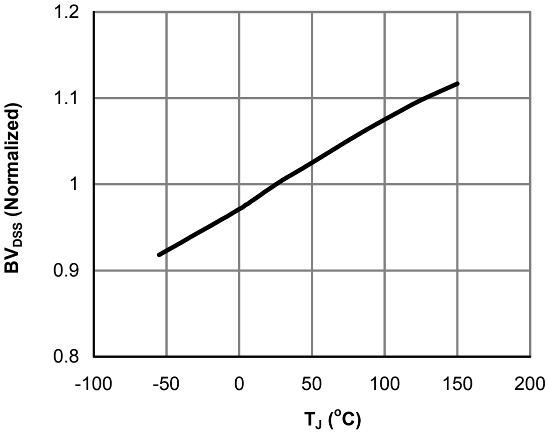


Figure 6: Break Down vs. Junction Temperature

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

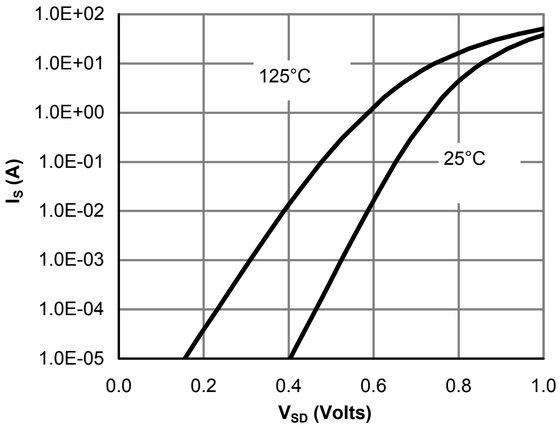


**Figure 7: Body-Diode Characteristics (Note E)**

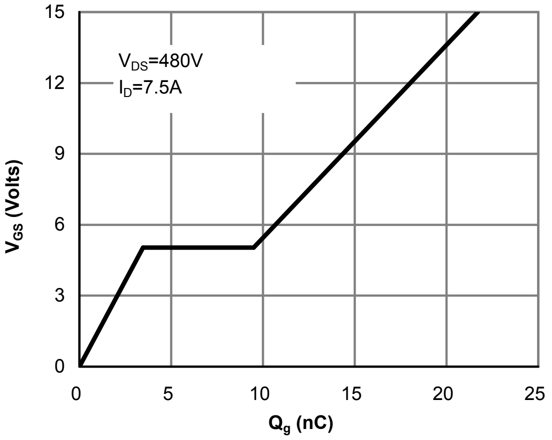


**Figure 8: Gate-Charge Characteristics**

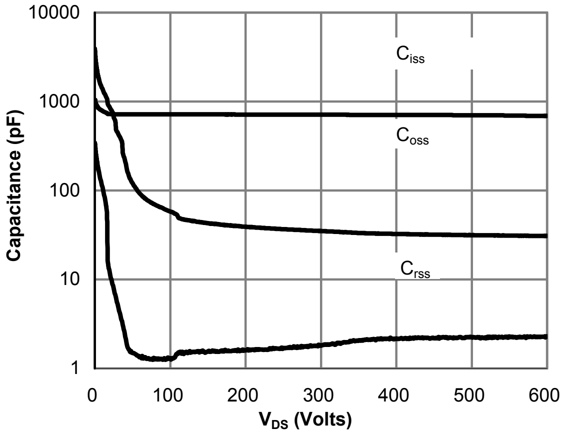


**Figure 9: Capacitance Characteristics**

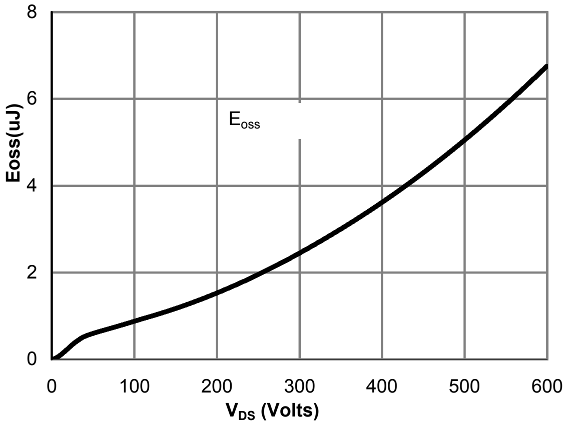


**Figure 10: Coss stroed Energy**

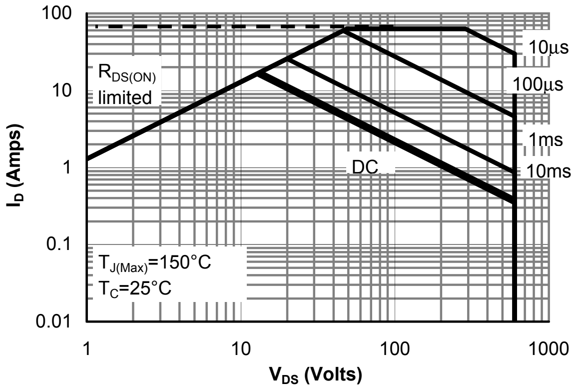


**Figure 11: Maximum Forward Biased Safe Operating Area for AOW15S60 (Note F)**

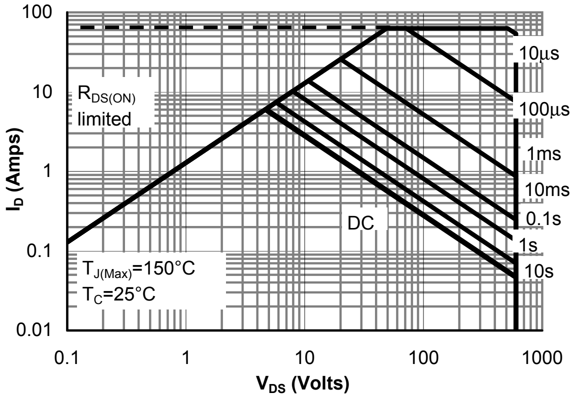


**Figure 12: Maximum Forward Biased Safe Operating Area for AOWF15S60(Note F)**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTIC

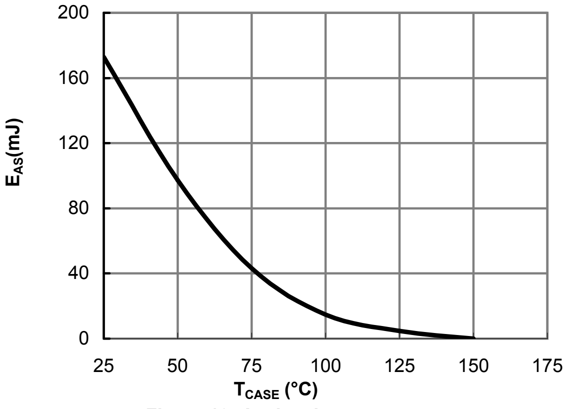


**Figure 13: Avalanche energy**

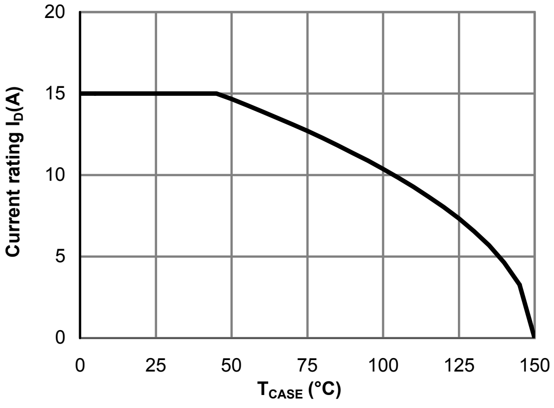


**Figure 14: Current De-rating (Note B)**

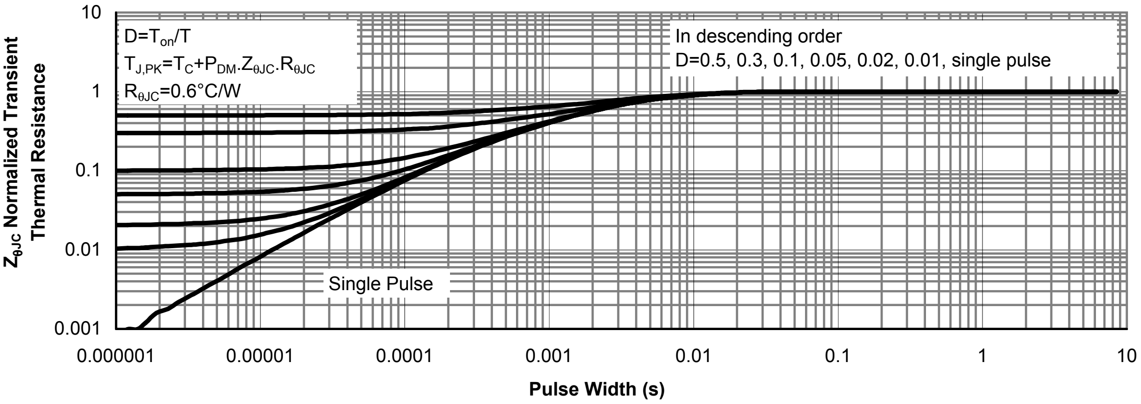


**Figure 15: Normalized Maximum Transient Thermal Impedance for AOW15S60 (Note F)**

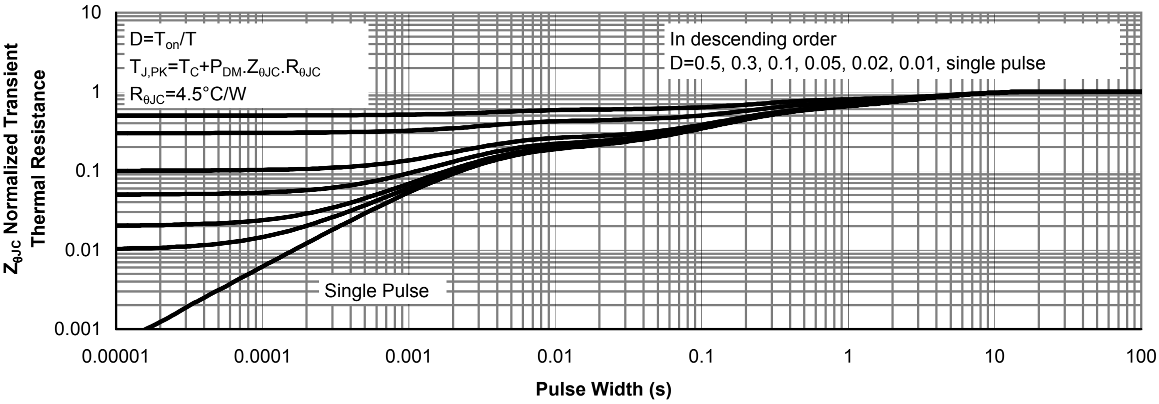
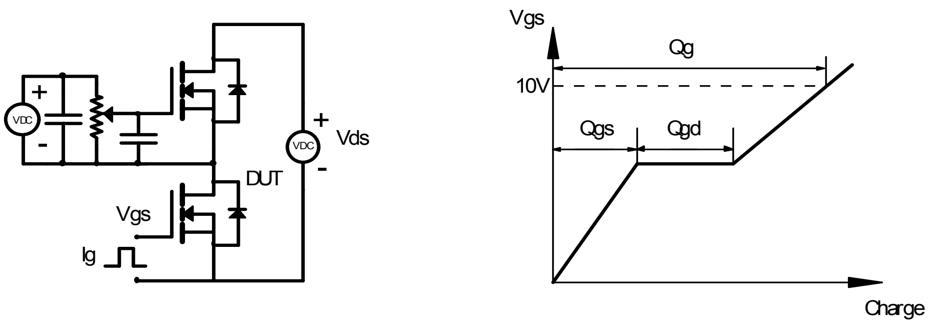
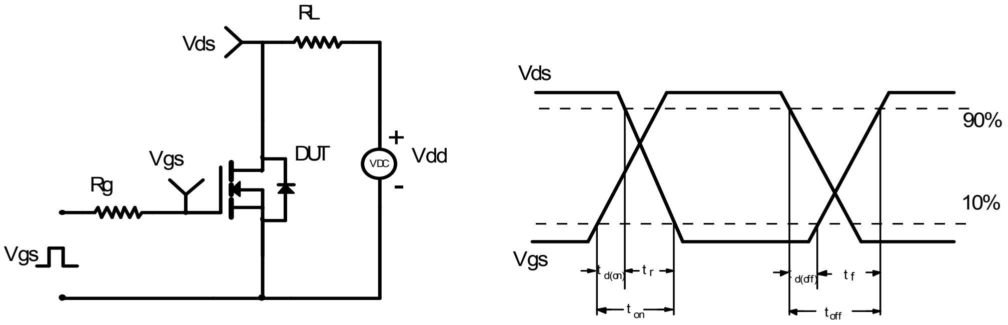


**Figure 16: Normalized Maximum Transient Thermal Impedance for AOWF15S60 (Note F)**

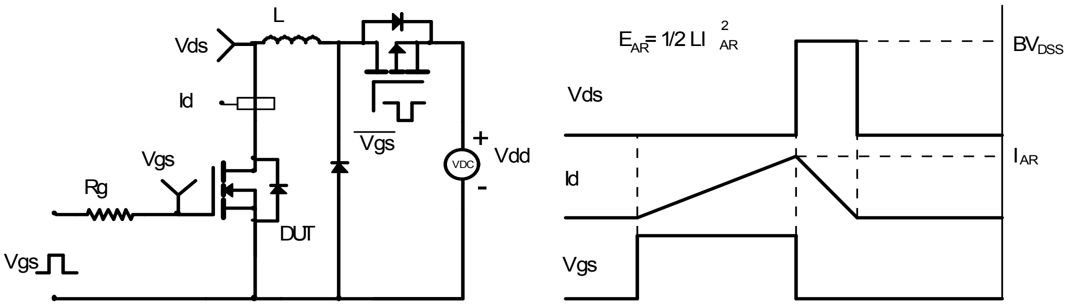
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms