ALPHA & OMEGA SEMICONDUCTOR

# AOW10T60/AOWF10T60

## 600V,10A N-Channel MOSFET

### General Description

The AOW10T60 & AOWF10T60 are fabricated using an advanced high voltage MOSFET process that is designed to deliver high levels of performance and robustness in popular AC-DC applications.By providing low $R_{DS(on)}$, $C_{iss}$ and $C_{rss}$ along with guaranteed avalanche capability these parts can be adopted quickly into new and existing offline power supply designs.

### Product Summary

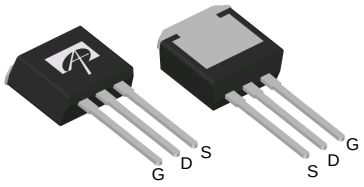
| | |
|---|---|
| $V_{DS}$ @ $T_{j,max}$ | 700 |
| $I_{DM}$ | 40A |
| $R_{DS(ON),max}$ | < 0.7Ω |
| $Q_{g,typ}$ | 23nC |
| $E_{oss}$ @ 400V | 3.4µJ |

100% UIS Tested
100% $R_g$ Tested

Green Product

**TO-262**

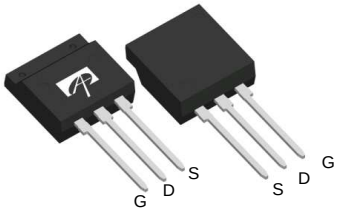
Top View Bottom View



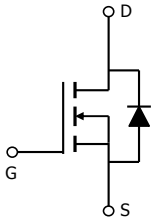

**AOW10T60**

**TO-262F**

Top View Bottom View




**AOWF10T60**




**Absolute Maximum Ratings $T_A$=25℃ unless otherwise noted**

| Parameter | | Symbol | AOW10T60 | AOWF10T60 | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 600 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | | V |
| Continuous Drain Current | $T_C$=25℃ | $I_D$ | 10 | 10* | A |
| | $T_C$=100℃ | | 6.6 | 6.6* | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 40 | | |
| Avalanche Current [C,J] | | $I_{AR}$ | 10 | | A |
| Repetitive avalanche energy [C,J] | | $E_{AR}$ | 50 | | mJ |
| Single pulsed avalanche energy [G] | | $E_{AS}$ | 480 | | mJ |
| MOSFET dv/dt ruggedness | | dv/dt | 50 | | V/ns |
| Peak diode recovery dv/dt | | | 5 | | |
| Power Dissipation [B] | $T_C$=25℃ | $P_D$ | 208 | 28 | W |
| | Derate above 25°C | | 1.7 | 0.2 | W/ °C |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | | ℃ |
| Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | | $T_L$ | 300 | | ℃ |

**Thermal Characteristics**

| Parameter | Symbol | AOW10T60 | AOWF10T60 | Units |
|---|---|---|---|---|
| Maximum Junction-to-Ambient [A,D] | $R_{\theta JA}$ | 65 | 65 | ℃/W |
| Maximum Case-to-sink [A] | $R_{\theta CS}$ | 0.5 | -- | ℃/W |
| Maximum Junction-to-Case | $R_{\theta JC}$ | 0.6 | 4.5 | ℃/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 | | 700 | | |
| $BV_{DSS}$ /ΔTJ | Zero Gate Voltage Drain Current | ID=250µA, VGS=0V | | 0.55 | | V/ °C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=600V, $V_{GS}$=0V | | | 1 | µA |
| | | $V_{DS}$=480V, $T_J$=125°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 | 3 | 4 | 5 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=5A | | 0.6 | 0.7 | Ω |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=40V, $I_D$=5A | | 9 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A,$V_{GS}$=0V | | 0.74 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | 10 | A |
| $I_{SM}$ | Maximum Body-Diode Pulsed Current | | | | 40 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | | 1346 | | pF |
| $C_{oss}$ | Output Capacitance | | | 54 | | pF |
| $C_{o(er)}$ | Effective output capacitance, energy related [H] | $V_{GS}$=0V, $V_{DS}$=0 to 480V, f=1MHz | | 40 | | pF |
| $C_{o(tr)}$ | Effective output capacitance, time related [I] | | | 72 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | | 10 | | pF |
| $R_g$ | Gate resistance | f=1MHz | | 3.8 | | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=480V, $I_D$=10A | | 23 | 35 | nC |
| $Q_{gs}$ | Gate Source Charge | | | 6.9 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 6.7 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=300V, $I_D$=10A, $R_G$=25Ω | | 37 | | ns |
| $t_r$ | Turn-On Rise Time | | | 60 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 53 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 35 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=10A,dI/dt=100A/µs,$V_{DS}$=100V | | 477 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=10A,dI/dt=100A/µs,$V_{DS}$=100V | | 6.7 | | 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 ratin g.

G. L=60mH, $I_{AS}$=4A, $V_{DD}$=150V, $R_G$=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% $V_{(BR)DSS}$.

J. L=1.0mH, $V_{DD}$=150V, $R_G$=25Ω, Starting $T_J$=25°C.

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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

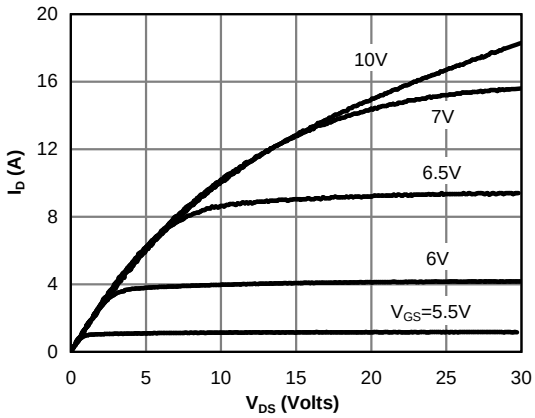



Fig 1: On-Region Characteristics

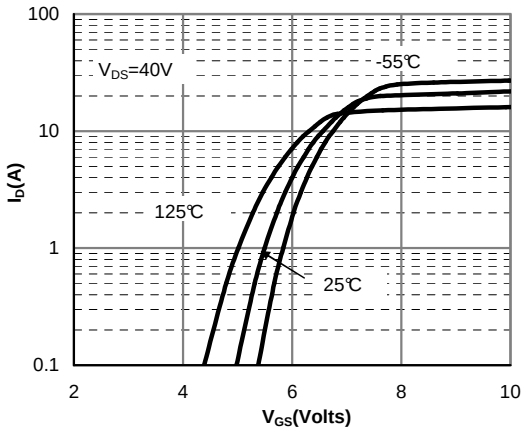



Figure 2: Transfer Characteristics

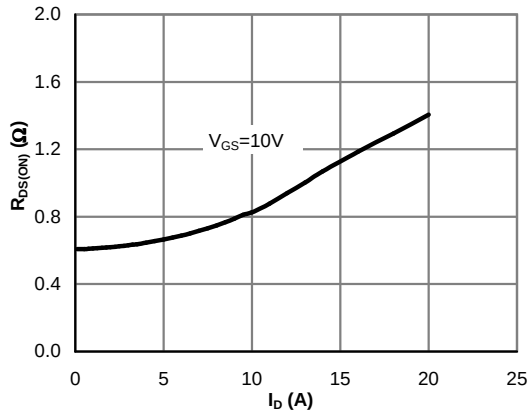



Figure 3: On-Resistance vs. Drain Current and Gate Voltage

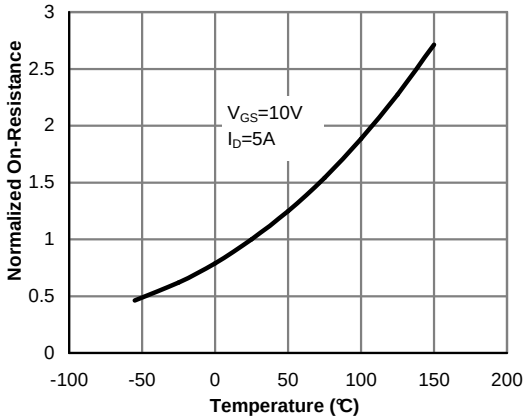



Figure 4: On-Resistance vs. Junction Temperature

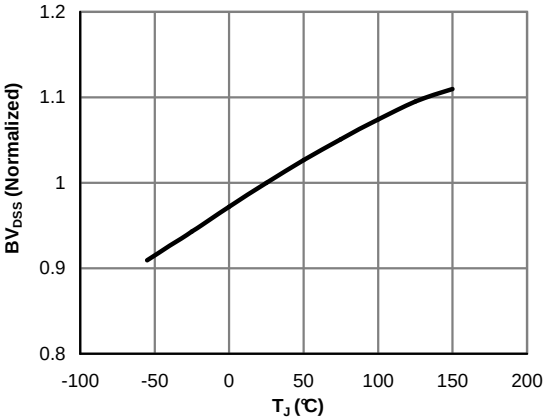



Figure 5:Break Down vs. Junction Temparature

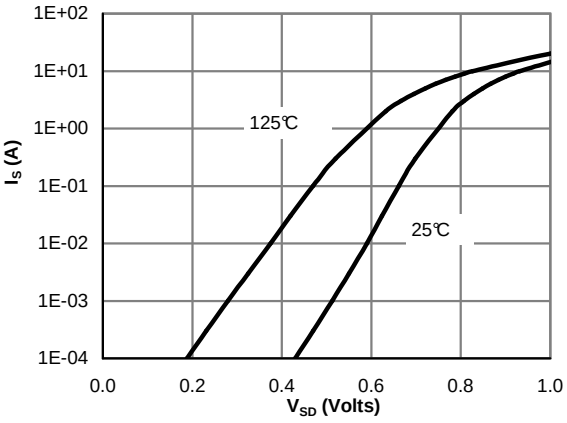



Figure 6: Body-Diode Characteristics (Note E)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

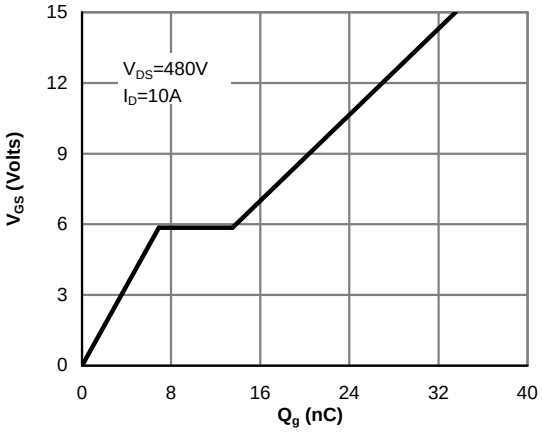



Figure 7: Gate-Charge Characteristics

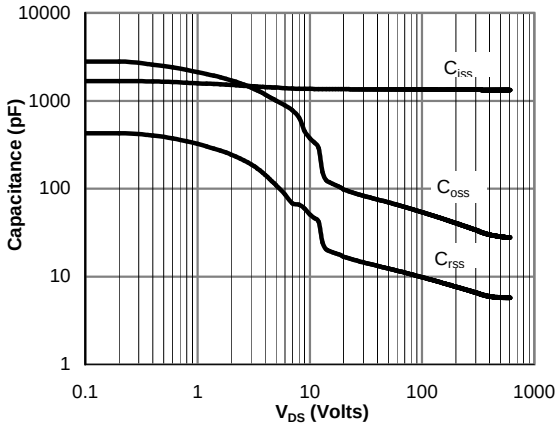



Figure 8: Capacitance Characteristics

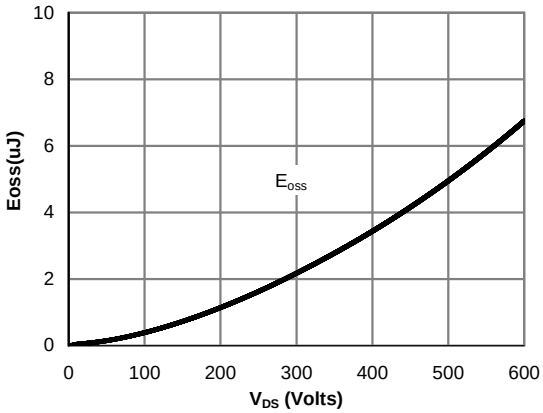



Figure 9: Coss stored Energy

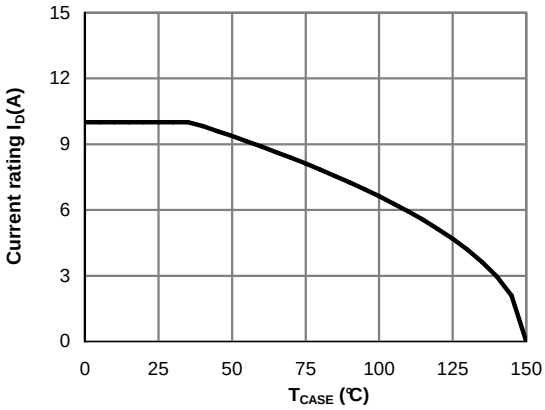



Figure 10: Current De-rating (Note B)

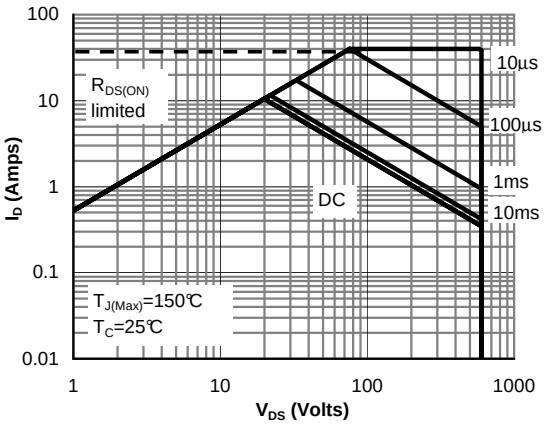



Figure 11: Maximum Forward Biased Safe Operating Area for AOW10T60 (Note F)

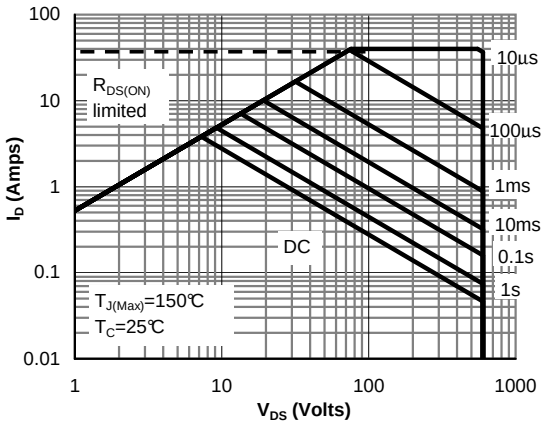



Figure 12: Maximum Forward Biased Safe Operating Area for AOWF10T60 (Note F)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

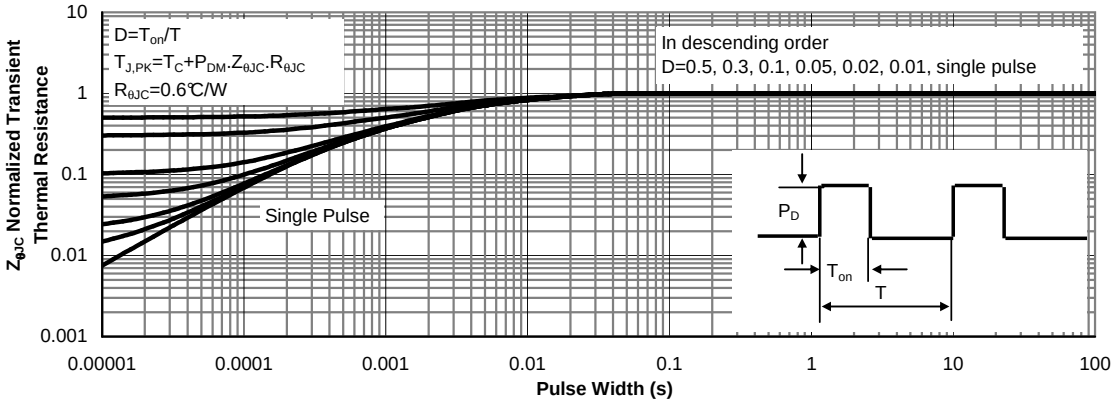



**Figure 13: Normalized Maximum Transient Thermal Impedance for AOW10T60 (Note F)**

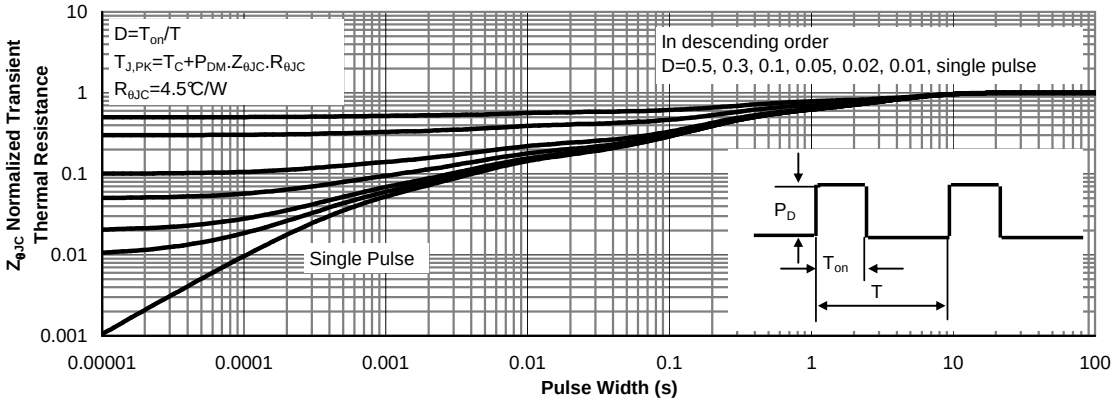
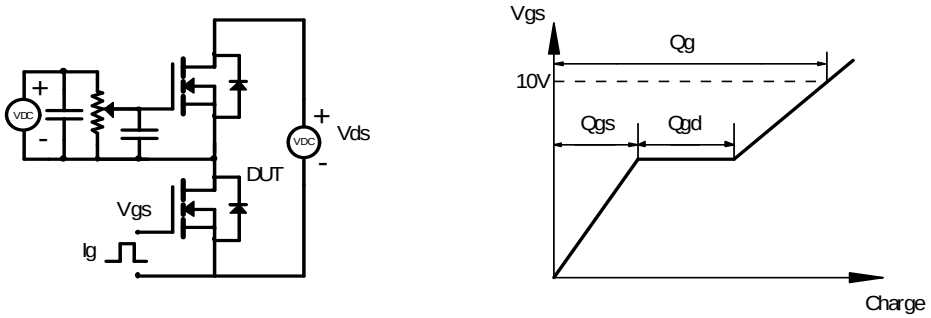
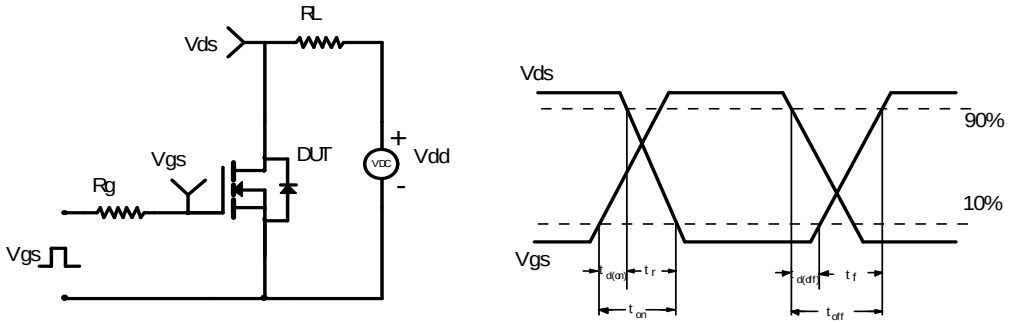



**Figure 14: Normalized Maximum Transient Thermal Impedance for AOWF10T60 (Note F)**

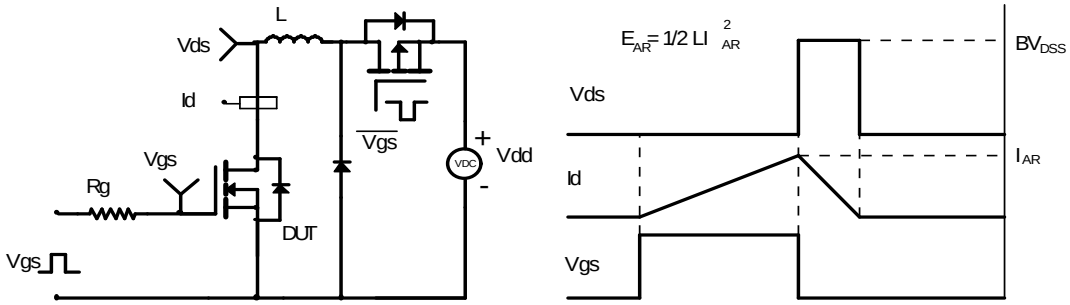
## Gate Charge Test Circuit & Waveform




## Resistive Switching Test Circuit & Waveforms




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




## Diode Recovery Test Circuit & Waveforms

