## General Description

- Trench Power AlphaMOS-II technology
- Low $R_{DS(ON)}$
- Low Ciss and Crss
- High Current Capability
- RoHS and Halogen Free Compliant

## Applications

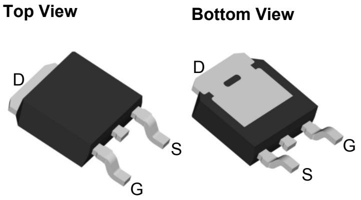
- General Lighting for LED and CCFL
- AC/DC Power supplies for Industrial, Consumer, and Telecom

## Product Summary

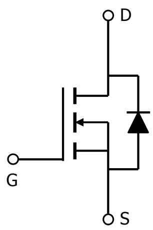
| | |
|---|---|
| $V_{DS}$ @ $T_{j,max}$ | 600V |
| $I_{DM}$ | 12A |
| $R_{DS(ON),max}$ | < 1.4Ω |
| $Q_{g,typ}$ | 12nC |
| $E_{oss}$ @ 400V | 1.5µJ |

100% UIS Tested
100% $R_g$ Tested

**TO-252**
**DPAK**




**AOD3C50**




| Orderable Part Number | Package Type | Form | Minimum Order Quantity |
|---|---|---|---|
| AOD3C50 | TO-252 | Tape & Reel | 2500 |

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

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 500 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | V |
| Continuous Drain Current | $T_C$=25°C | $I_D$ | 3* | A |
| | $T_C$=100°C | | 3 | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 12 | |
| Avalanche Current [C] L=1mH | | $I_{AR}$ | 3 | A |
| Repetitive avalanche energy [C] | | $E_{AR}$ | 4.5 | mJ |
| Single pulsed avalanche energy [H] | | $E_{AS}$ | 152 | mJ |
| MOSFET dv/dt ruggedness | | dv/dt | 100 | V/ns |
| Peak diode recovery dv/dt | | | 20 | |
| Power Dissipation [B] | $T_C$=25°C | $P_D$ | 83 | W |
| | Derate above 25°C | | 0.7 | W/°C |
| 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,D] | $R_{\theta JA}$ | 45 | 55 | °C/W |
| Maximum Case-to-sink [A] | $R_{\theta CS}$ | - | 0.5 | °C/W |
| Maximum Junction-to-Case[D,F] | $R_{\theta JC}$ | 1.2 | 1.5 | °C/W |

* $I_D$ limited by Rated $I_D$

**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 | 500 | | | V |
| | | $I_D$=250µA, $V_{GS}$=0V, $T_J$=150°C | | 600 | | |
| $BV_{DSS}$ /ΔTJ | Breakdown Voltage Temperature Coefficient | $I_D$=250µA, $V_{GS}$=0V | | 0.4 | | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=500V, $V_{GS}$=0V | | | 1 | µA |
| | | $V_{DS}$=400V, $T_J$=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 | 4.1 | 5 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=2.2A | | 1.1 | 1.4 | Ω |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=40V, $I_D$=1.5A | | 2.5 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A,$V_{GS}$=0V | | 0.78 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | 3 | A |
| $I_{SM}$ | Maximum Body-Diode Pulsed Current [C] | | | | 12 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | | 662 | | pF |
| $C_{oss}$ | Output Capacitance | | | 26 | | pF |
| $C_{o(er)}$ | Effective output capacitance, energy related [I] | $V_{GS}$=0V, $V_{DS}$=0 to 400V, f=1MHz | | 19 | | pF |
| $C_{o(tr)}$ | Effective output capacitance, time related [J] | | | 35 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | | 9.7 | | pF |
| $R_g$ | Gate resistance | f=1MHz | | 3 | | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=400V, $I_D$=3A | | 12 | 25 | nC |
| $Q_{gs}$ | Gate Source Charge | | | 3.4 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 4.4 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=250V, $I_D$=3A, $R_G$=25Ω | | 21 | | ns |
| $t_r$ | Turn-On Rise Time | | | 28 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 32 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 21 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=3A,dI/dt=100A/µs,$V_{DS}$=100V | | 260 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=3A,dI/dt=100A/µs,$V_{DS}$=100V | | 2.3 | | µC |

A. The value of $R_{qJA}$ 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 in a TO252 package, 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.
D. The $R_{qJA}$ is the sum of the thermal impedance from junction to case $R_{qJC}$ and case to ambient.
E. The static characteristics in Figures 1 to 6 are obtained using <300 ms 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.
G.These tests are performed with the device mounted on 1 $in^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C.
H. L=60mH, $I_{AS}$=2.25A, $V_{DD}$=150V, $R_G$=10Ω, Starting $T_J$=25°C.
I. $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{(BR)DSS}$.
J. $C_{o(tr)}$ 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

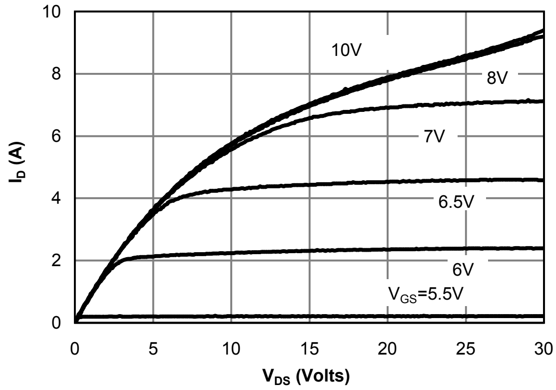



Figure 1: On-Region Characteristics

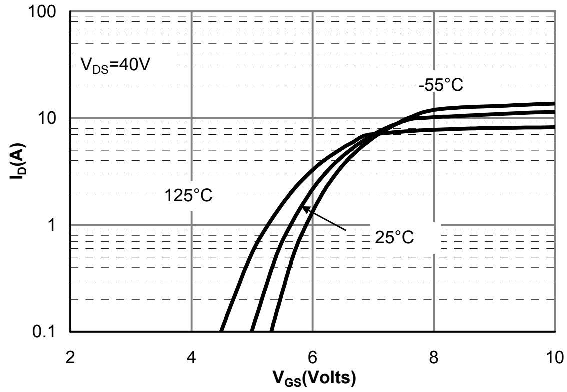



Figure 2: Transfer Characteristics

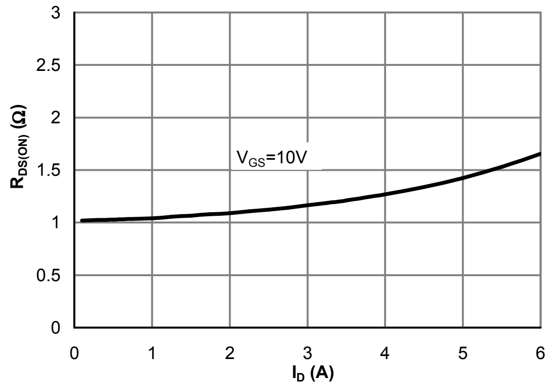



Figure 3: On-Resistance vs. Drain Current and Gate Voltage

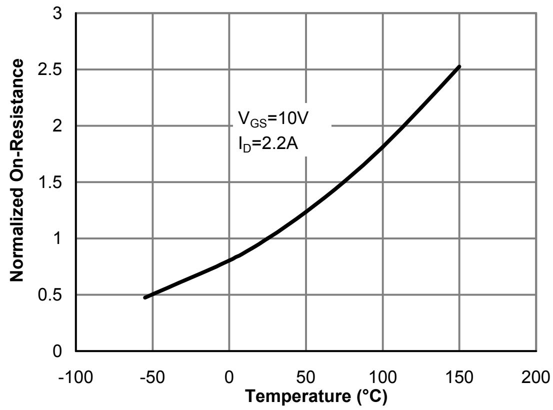



Figure 4: On-Resistance vs. Junction Temperature

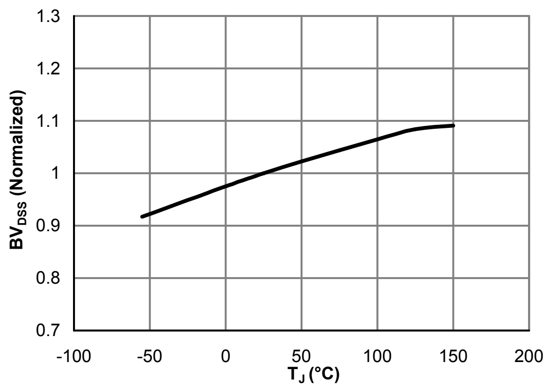



Figure 5: Break Down vs. Junction Temparature

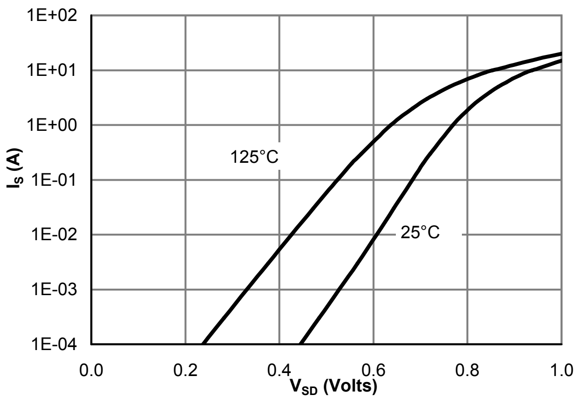



Figure 6: Body-Diode Characteristics

TY Semicondutor®



## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

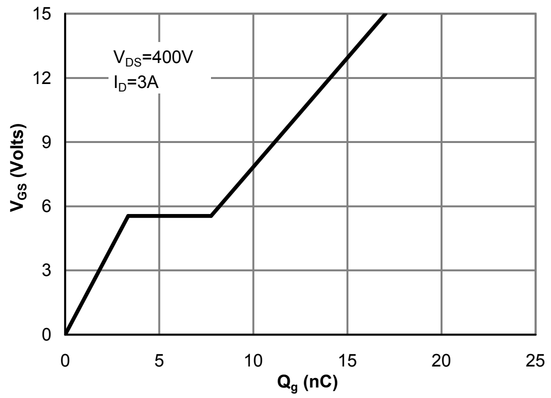



Figure 7: Gate-Charge Characteristics

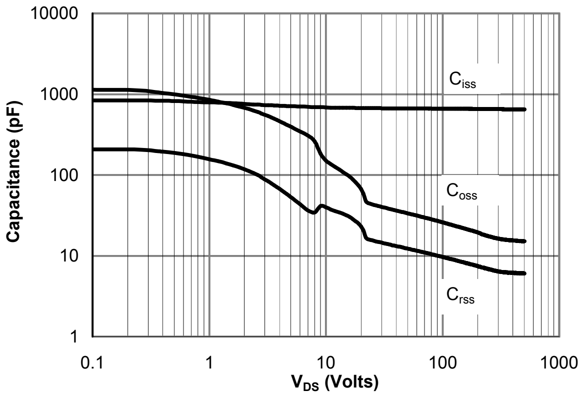



Figure 8: Capacitance Characteristics

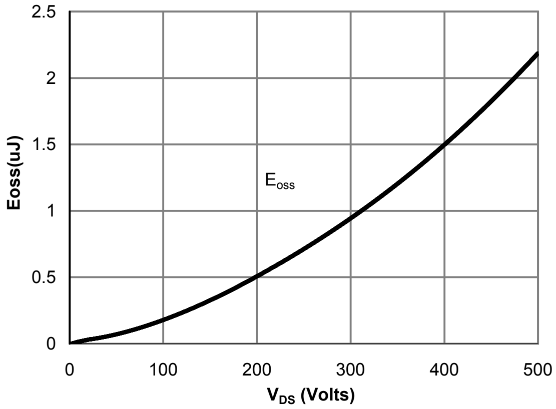



Figure 9: Coss stored Energy

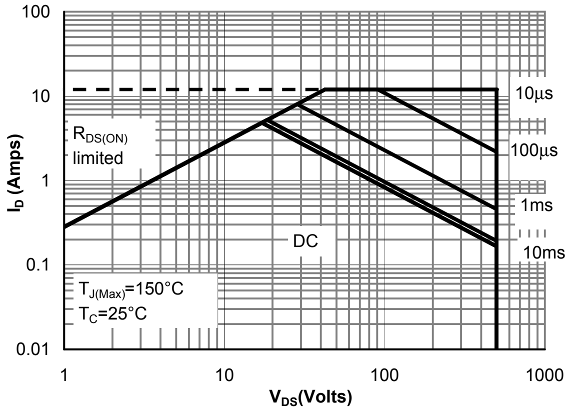



Figure 10: Maximum Forward Biased Safe Operating Area (Note F)

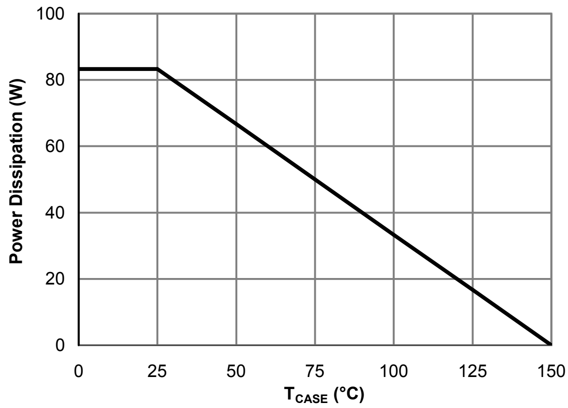



Figure 11: Power De-rating (Note B)

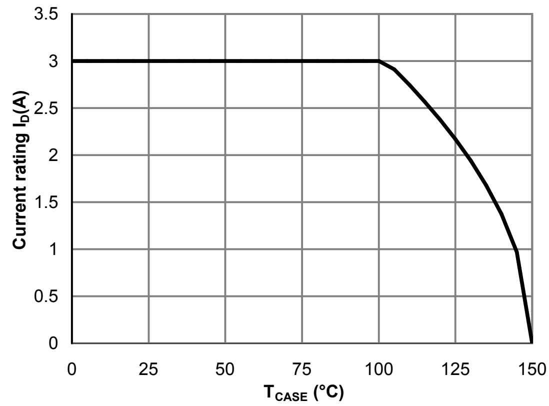



Figure 12: Current De-rating (Note F)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

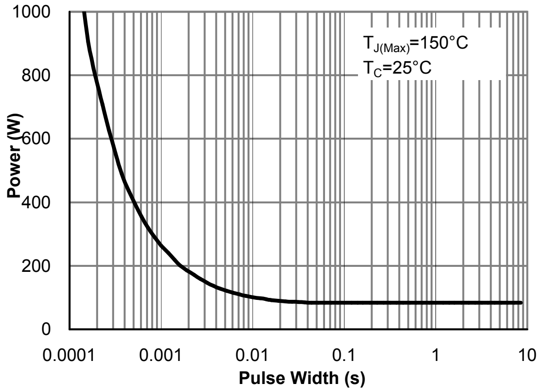



Figure 13: Single Pulse Power Rating Junction-to-Case (Note F)

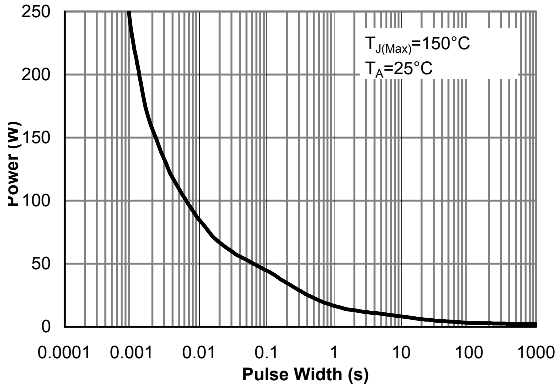



Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note G)

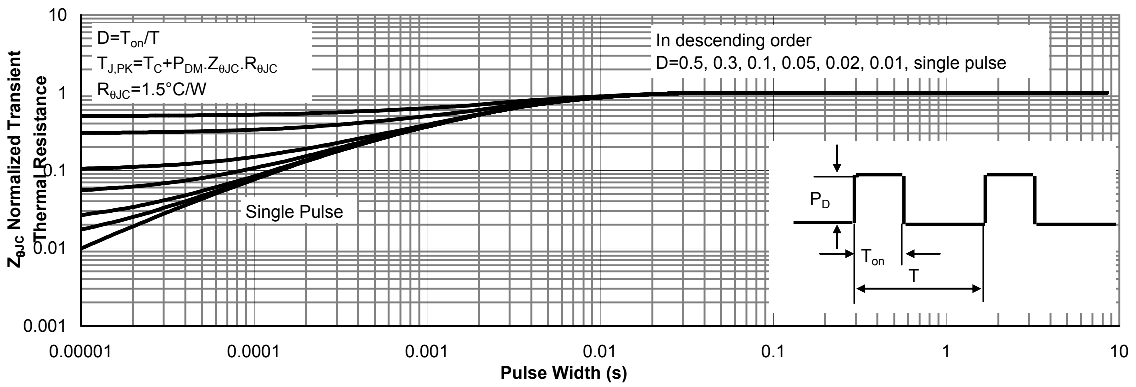



Figure 15: Normalized Maximum Transient Thermal Impedance (Note F)

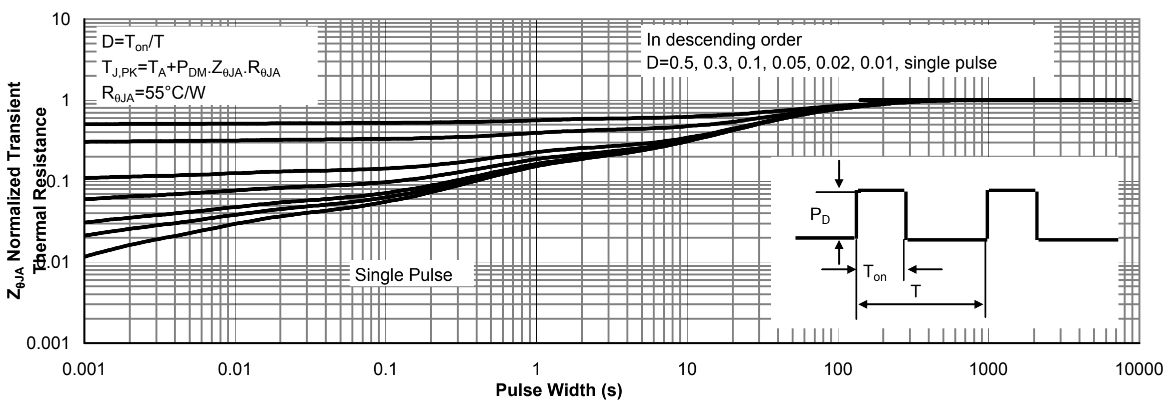
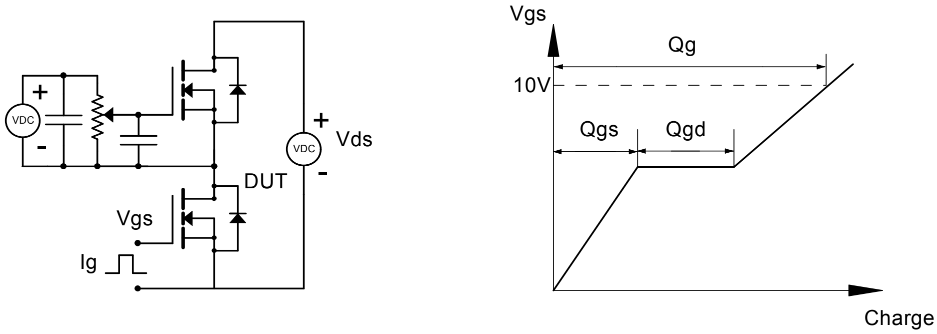
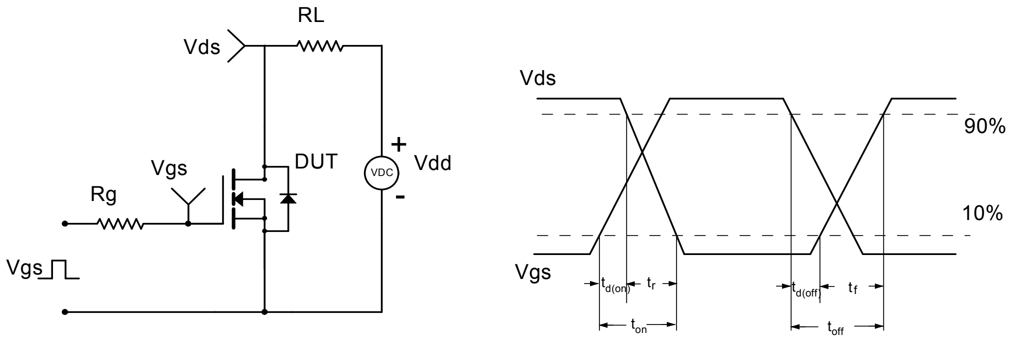



Figure 16: Normalized Maximum Transient Thermal Impedance (Note G)

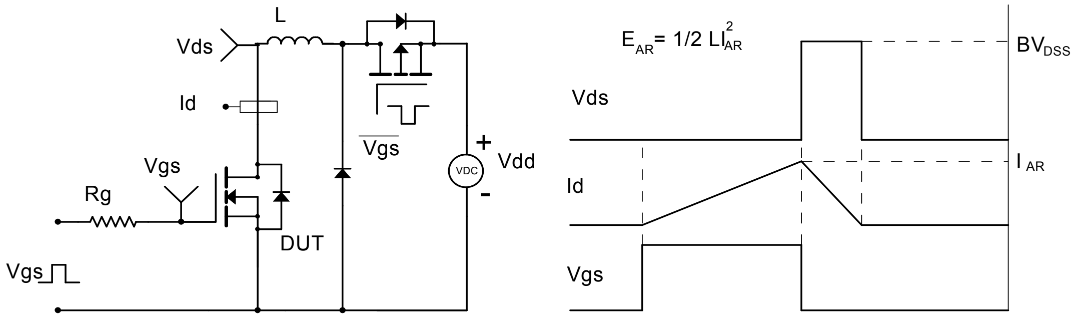
## Gate Charge Test Circuit & Waveform




## Resistive Switching Test Circuit & Waveforms




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




## Diode Recovery Test Circuit & Waveforms