**ALPHA & OMEGA SEMICONDUCTOR**

# AOTF600A70L/AOT600A70L/AOB600A70L

**700V, $\alpha$MOS5™ N-Channel Power Transistor**

## General Description

- Proprietary $\alpha$MOS5™ technology
- Low $R_{DS(ON)}$
- Optimized switching parameters for better EMI performance
- Enhanced body diode for robustness and fast reverse recovery

## Applications

- Flyback for SMPS
- Charger ,PD Adapter, TV, lighting.

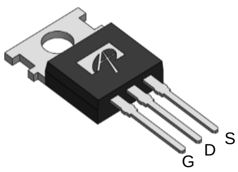
## Product Summary

| | |
|---|---|
| $V_{DS}$ @ $T_{j,max}$ | 800V |
| $I_{DM}$ | 34A |
| $R_{DS(ON),max}$ | < 0.6Ω |
| $Q_{g,typ}$ | 15.5nC |
| $E_{oss}$ @ 400V | 1.8μJ |

100% UIS Tested
100% $R_g$ Tested

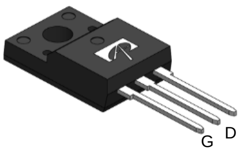
Top View

TO-220



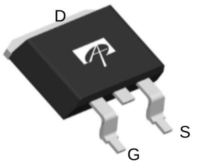

AOT600A70L

TO-220F

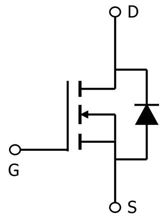



AOTF600A70L

TO-263
D²PAK




AOB600A70L




| Orderable Part Number | Package Type | Form | Minimum Order Quantity |
|---|---|---|---|
| AOTF600A70L | TO220F Green | Tube | 1000 |
| AOT600A70L | TO220 Green | Tube | 1000 |
| AOB600A70L | TO263 | Tape&Reel | 800 |

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

| Parameter | | Symbol | AOT(B)600A70L | AOTF600A70L | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 700 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | | V |
| Gate-Source Voltage (dynamic) AC( f>1Hz) | | $V_{GS}$ | ±30 | | V |
| Continuous Drain Current | $T_C$=25°C | $I_D$ | 8.5 | 8.5* | A |
| | $T_C$=100°C | | 5 | 5* | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 34 | | |
| Avalanche Current [C] L=1mH | | $I_{AR}$ | 2.1 | | A |
| Repetitive avalanche energy [C] | | $E_{AR}$ | 2.2 | | mJ |
| Single pulsed avalanche energy [G] | | $E_{AS}$ | 19 | | mJ |
| MOSFET dv/dt ruggedness | | dv/dt | 100 | | V/ns |
| Peak diode recovery dv/dt | | | 20 | | |
| Power Dissipation [B] | $T_C$=25°C | $P_D$ | 104 | 27 | W |
| | Derate above 25°C | | 0.8 | 0.2 | 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 | AOT(B)600A70L | AOTF600A70L | 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 | $R_{\theta JC}$ | 1.2 | 4.6 | °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 | 700 | | | V |
| | | $I_D$=250µA, $V_{GS}$=0V, $T_J$=150°C | | 800 | | |
| $BV_{DSS}$ /ΔTJ | Breakdown Voltage Temperature Coefficient | $I_D$=250µA, $V_{GS}$=0V | | 0.6 | | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=700V, $V_{GS}$=0V | | | 1 | µA |
| | | $V_{DS}$=560V, $T_J$=125°C | | | 10 | |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$=0V, $V_{GS}$=±20V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=5V, $I_D$=250µA | 2.9 | 3.5 | 4.1 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=2.5A | | 0.51 | 0.6 | Ω |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=10V, $I_D$=4A | | 6.2 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=4A,$V_{GS}$=0V | | 0.86 | 1.2 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | 8.5 | A |
| $I_{SM}$ | Maximum Body-Diode Pulsed Current [C] | | | | 34 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | | 870 | | pF |
| $C_{oss}$ | Output Capacitance | | | 23 | | pF |
| $C_{o(er)}$ | Effective output capacitance, energy related [H] | $V_{GS}$=0V, $V_{DS}$=0 to 480V, f=1MHz | | 20 | | pF |
| $C_{o(tr)}$ | Effective output capacitance, time related [I] | | | 98 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | $V_{GS}$=0V, $V_{DS}$=100V, f=1MHz | | 1.3 | | pF |
| $R_g$ | Gate resistance | f=1MHz | | 5 | | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=480V, $I_D$=4A | | 15.5 | | nC |
| $Q_{gs}$ | Gate Source Charge | | | 5.6 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 4.3 | | nC |
| $T_{d(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=400V, $I_D$=4A, $R_G$=5Ω | | 22 | | ns |
| $T_r$ | Turn-On Rise Time | | | 10 | | ns |
| $T_{d(off)}$ | Turn-Off DelayTime | | | 36 | | ns |
| $T_f$ | Turn-Off Fall Time | | | 8 | | ns |
| $T_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=4A, dI/dt=100A/µs, $V_{DS}$=400V | | 245 | | ns |
| $I_{rm}$ | Peak Reverse Recovery Current | | | 18.6 | | A |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | | | 3 | | 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, $I_{AS}$=0.8A, $R_G$=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

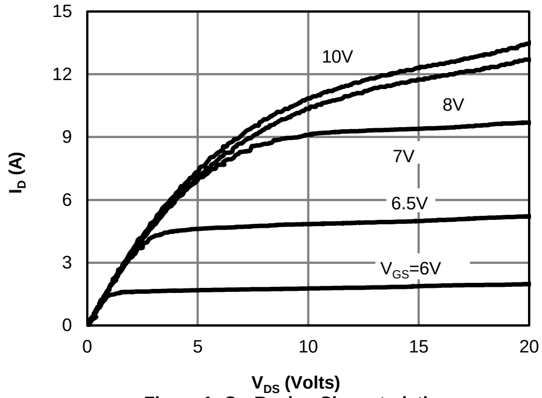



Figure 1: On-Region Characteristics

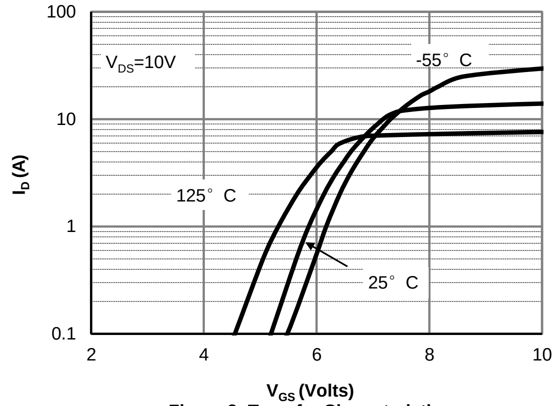



Figure 2: Transfer Characteristics

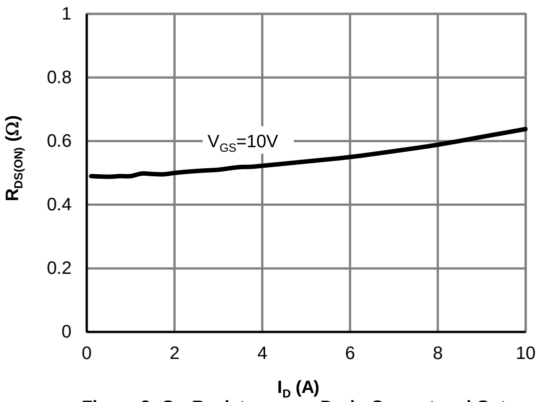



Figure 3: On-Resistance vs. Drain Current and Gate Voltage

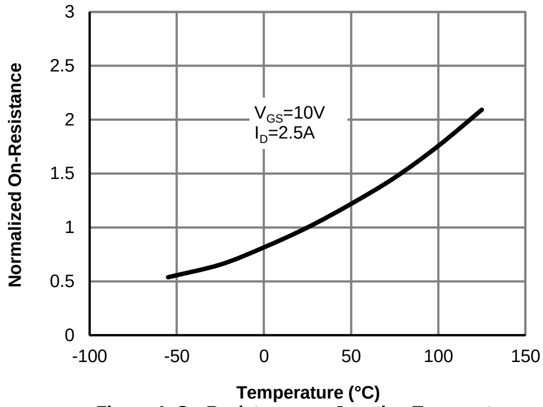



Figure 4: On-Resistance vs. Junction Temperature

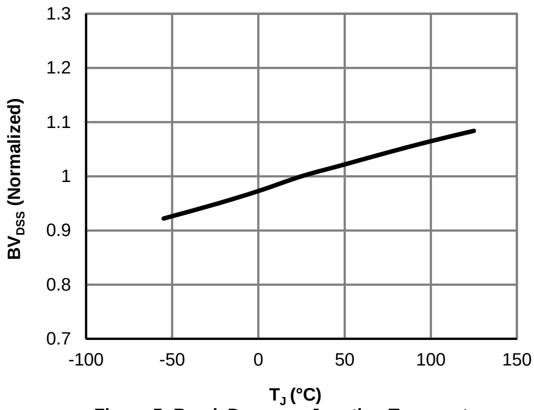



Figure 5: Break Down vs. Junction Temparature

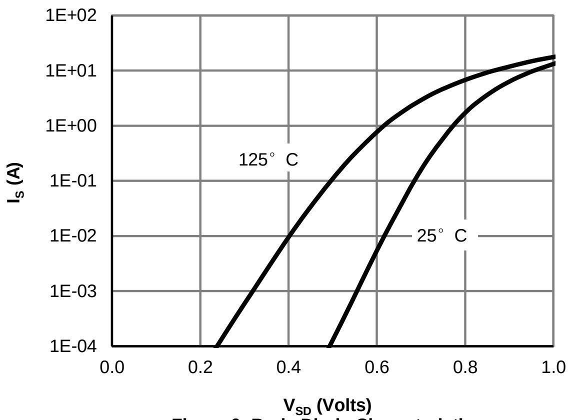



Figure 6: Body-Diode Characteristics

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

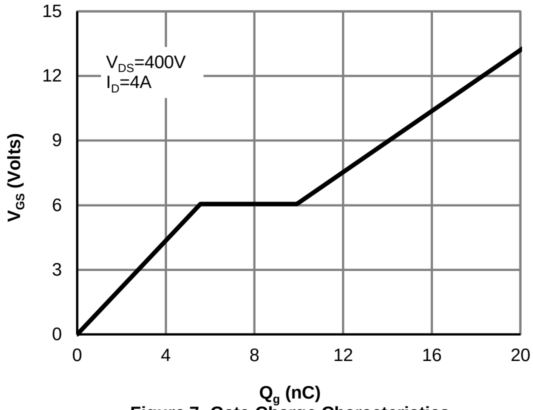



Figure 7: Gate-Charge Characteristics

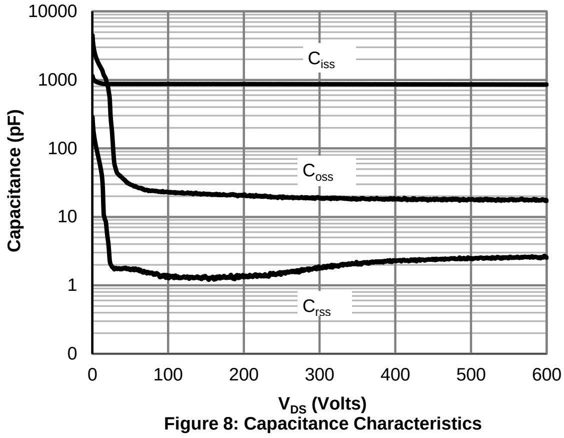



Figure 8: Capacitance Characteristics

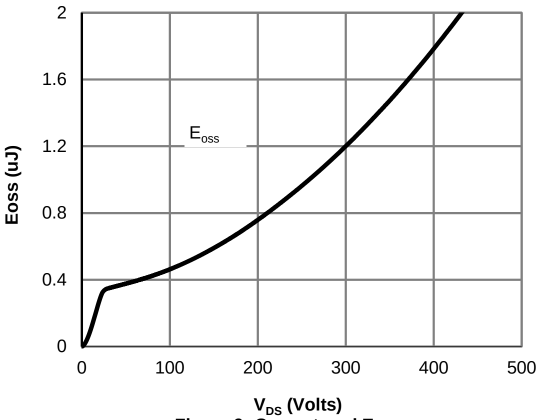



Figure 9: Coss stored Energy

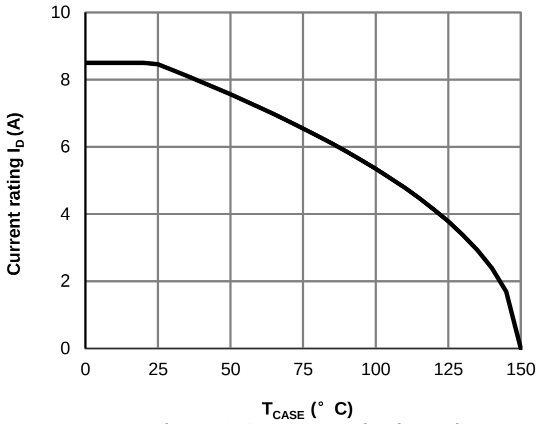



Figure 10: Current De-rating (Note F)

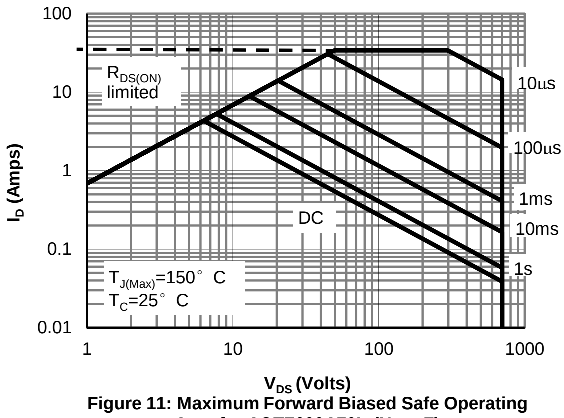



Figure 11: Maximum Forward Biased Safe Operating Area for AOTF600A70L (Note F)

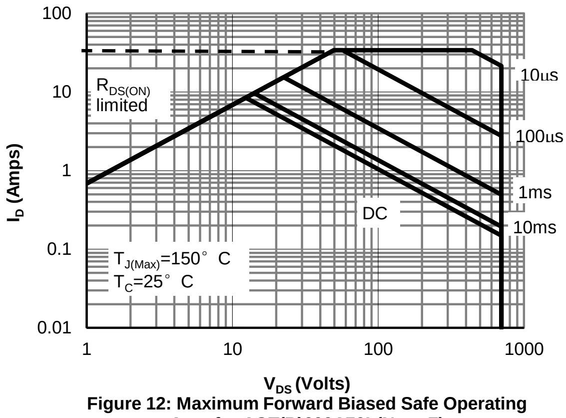



Figure 12: Maximum Forward Biased Safe Operating Area for AOT(B)600A70L(Note F)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

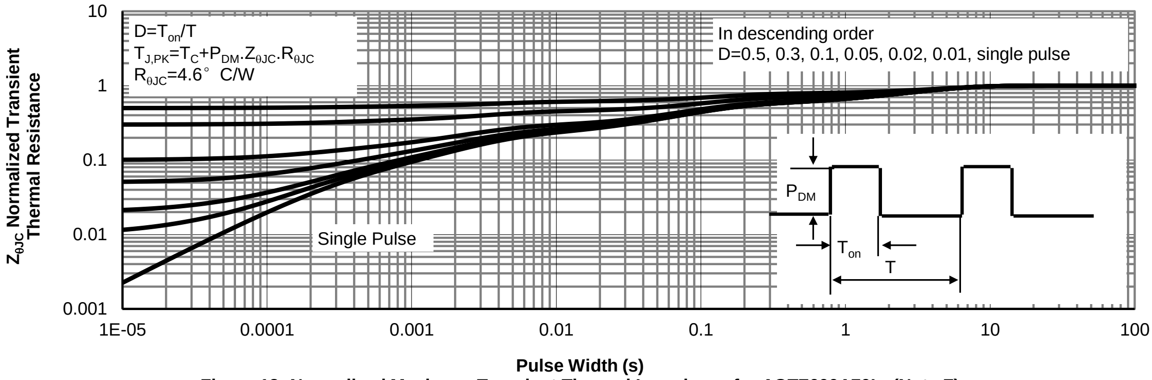



**Figure 13: Normalized Maximum Transient Thermal Impedance for AOTF600A70L (Note F)**

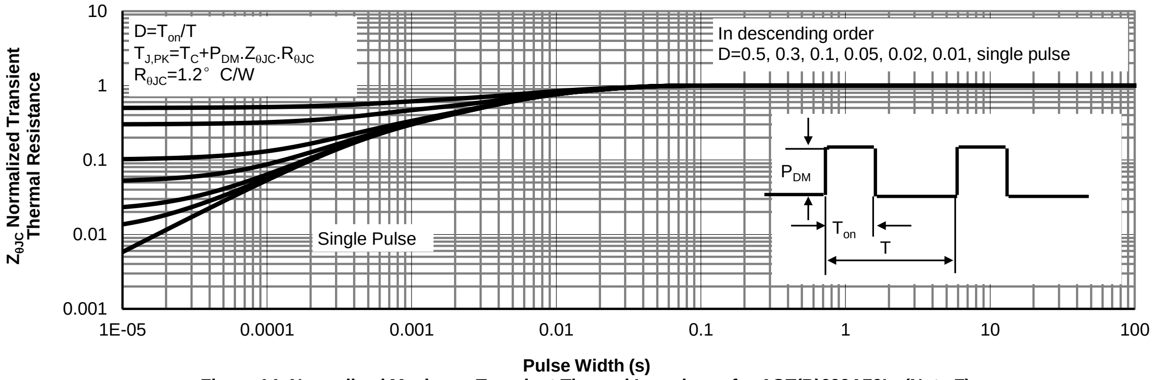
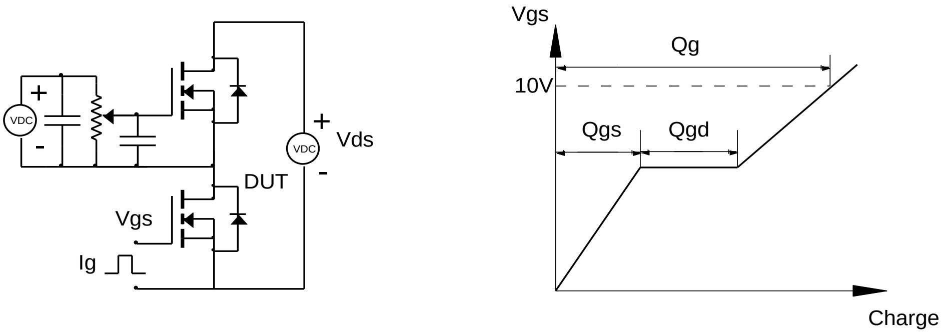
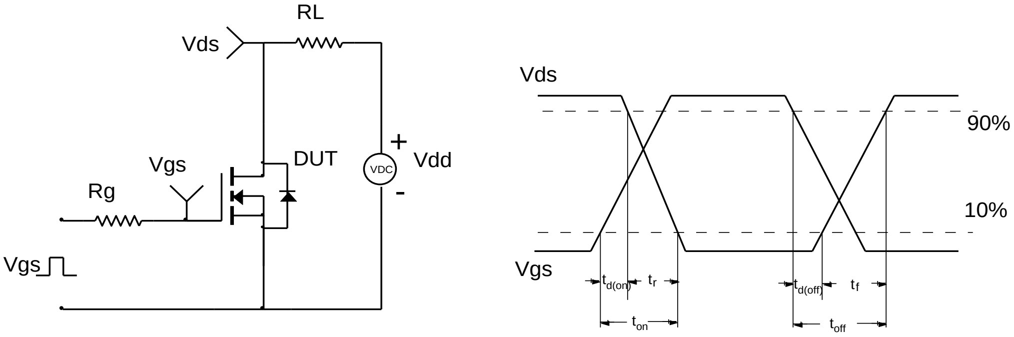



**Figure 14: Normalized Maximum Transient Thermal Impedance for AOT(B)600A70L (Note F)**

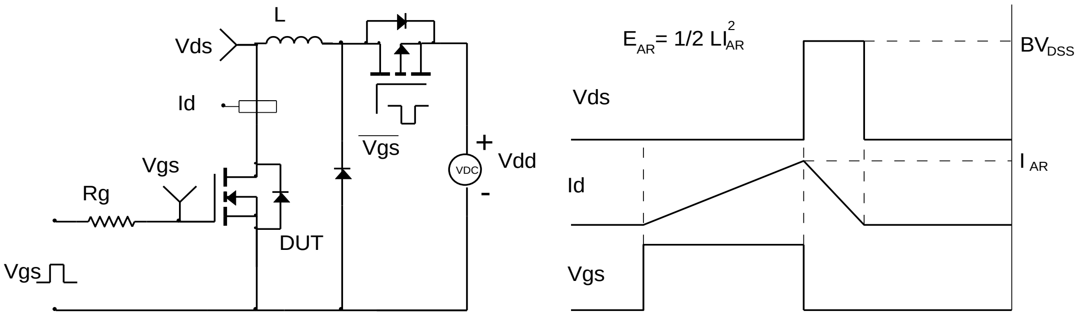
Gate Charge Test Circuit & Waveform




Resistive Switching Test Circuit & Waveforms




Unclamped Inductive Switching (UIS) Test Circuit & Waveforms




Diode Recovery Test Circuit & Waveforms