



**THE DATASHEET OF
AOD4186**



AOD4186
N-Channel Enhancement Mode Field Effect Transistor
General Description

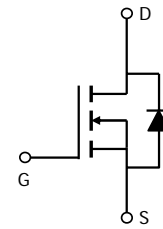
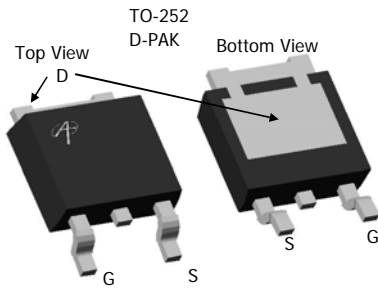
The AOD4186 combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. This device is ideal for low voltage inverter applications.

- RoHS Compliant
- Halogen Free

Features

V_{DS} (V) =40V
 I_D = 35A (V_{GS} = 10V)
 $R_{DS(ON)}$ < 15m Ω (V_{GS} = 10V)
 $R_{DS(ON)}$ < 19m Ω (V_{GS} = 4.5V)

100% UIS Tested!
100% R_g Tested!


Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

| Parameter | Symbol | Maximum | Units |
|---|----------------|-------------------------|------------------|
| Drain-Source Voltage | V_{DS} | 40 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Continuous Drain Current ^G | I_D | $T_C=25^\circ\text{C}$ | A |
| | | $T_C=100^\circ\text{C}$ | |
| Pulsed Drain Current ^C | I_{DM} | 70 | |
| Continuous Drain Current | I_{DSM} | $T_A=25^\circ\text{C}$ | A |
| | | $T_A=70^\circ\text{C}$ | 8 |
| Avalanche Current ^C | I_{AR} | 24 | A |
| Repetitive avalanche energy $L=0.1\text{mH}$ ^C | E_{AR} | 29 | mJ |
| Power Dissipation ^B | P_D | $T_C=25^\circ\text{C}$ | W |
| | | $T_C=100^\circ\text{C}$ | |
| Power Dissipation ^A | P_{DSM} | $T_A=25^\circ\text{C}$ | W |
| | | $T_A=70^\circ\text{C}$ | |
| Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 175 | $^\circ\text{C}$ |

Thermal Characteristics

| Parameter | Symbol | Typ | Max | Units |
|--|-----------------|---------------------|------|--------------------|
| Maximum Junction-to-Ambient ^A | $R_{\theta JA}$ | $t \leq 10\text{s}$ | 16.7 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient ^{A,D} | | Steady-State | 40 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Case | $R_{\theta JC}$ | 2.5 | 3 | $^\circ\text{C/W}$ |

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------------------------|---------------------------------------|--|------|------------|----------|------------------|
| STATIC PARAMETERS | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$ | 40 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=40\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$ | | | 1 5 | μA |
| I_{GSS} | Gate-Body leakage current | $V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$ | | | 100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$ | 1.7 | 2.2 | 2.7 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}=10\text{V}$, $V_{DS}=5\text{V}$ | 100 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=10\text{V}$, $I_D=20\text{A}$ $T_J=125^\circ\text{C}$ | | 12.4 20 | 15 24 | $\text{m}\Omega$ |
| | | $V_{GS}=4.5\text{V}$, $I_D=15\text{A}$ | | 14.5 | 19 | $\text{m}\Omega$ |
| g_{FS} | Forward Transconductance | $V_{DS}=5\text{V}$, $I_D=20\text{A}$ | | 60 | | S |
| V_{SD} | Diode Forward Voltage | $I_S=1\text{A}$, $V_{GS}=0\text{V}$ | | 0.75 | 1 | V |
| I_S | Maximum Body-Diode Continuous Current | | | | 60 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C_{iss} | Input Capacitance | | 780 | 980 | 1200 | pF |
| C_{oss} | Output Capacitance | $V_{GS}=0\text{V}$, $V_{DS}=20\text{V}$, $f=1\text{MHz}$ | 90 | 130 | 170 | pF |
| C_{rss} | Reverse Transfer Capacitance | | 48 | 80 | 110 | pF |
| R_g | Gate resistance | $V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$ | 1.9 | 3.8 | 5.7 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| $Q_g(10\text{V})$ | Total Gate Charge | | 13.5 | 17 | 20 | nC |
| $Q_g(4.5\text{V})$ | Total Gate Charge | $V_{GS}=10\text{V}$, $V_{DS}=20\text{V}$, $I_D=20\text{A}$ | 7 | 9 | 11 | nC |
| Q_{gs} | Gate Source Charge | | 2 | 2.5 | 3 | nC |
| Q_{gd} | Gate Drain Charge | | 2.7 | 4.5 | 6.3 | nC |
| $t_{D(on)}$ | Turn-On Delay Time | | | 6 | | ns |
| t_r | Turn-On Rise Time | $V_{GS}=10\text{V}$, $V_{DS}=20\text{V}$, $R_L=1.0\Omega$, $R_{GEN}=3\Omega$ | | 12 | | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | 26 | | ns |
| t_f | Turn-Off Fall Time | | | 7 | | ns |
| t_{rr} | Body Diode Reverse Recovery Time | $I_F=20\text{A}$, $dI/dt=500\text{A}/\mu\text{s}$ | 9 | 12 | 15 | ns |
| Q_{rr} | Body Diode Reverse Recovery Charge | $I_F=20\text{A}$, $dI/dt=500\text{A}/\mu\text{s}$ | 24 | 31 | 38 | nC |

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. The Power dissipation P_{DSM} is based on $R_{\theta JA}$ and the maximum allowed junction temperature of 150°C . The value in any given application depends on the user's specific board design, and the maximum temperature of 175°C may be used if the PCB allows it.

B. The power dissipation P_D is based on $T_{J(MAX)}=175^\circ\text{C}$, 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 $T_{J(MAX)}=175^\circ\text{C}$. Ratings are based on low frequency and duty cycles to keep initial $T_J=25^\circ\text{C}$.

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 $<30\mu\text{s}$ 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 $T_{J(MAX)}=175^\circ\text{C}$. The SOA curve provides a single pulse rating.

G. The maximum current rating is limited by bond-wires.

H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

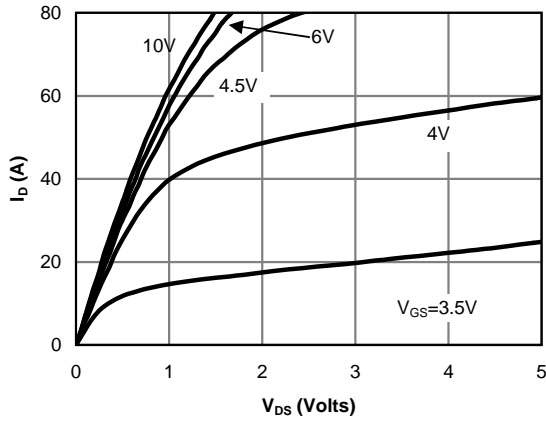


Fig 1: On-Region Characteristics (Note E)

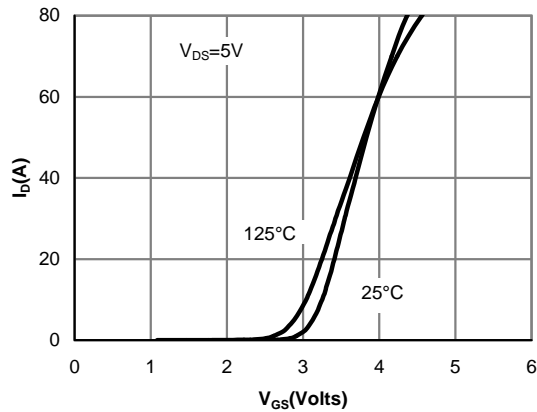


Figure 2: Transfer Characteristics (Note E)

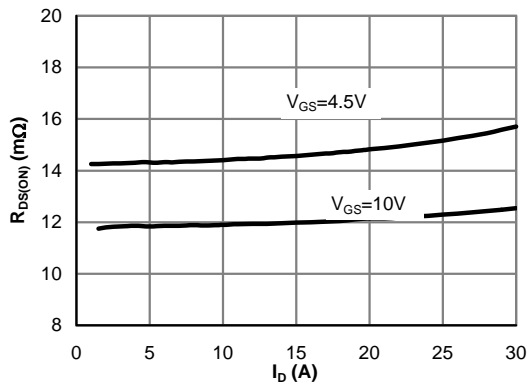


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

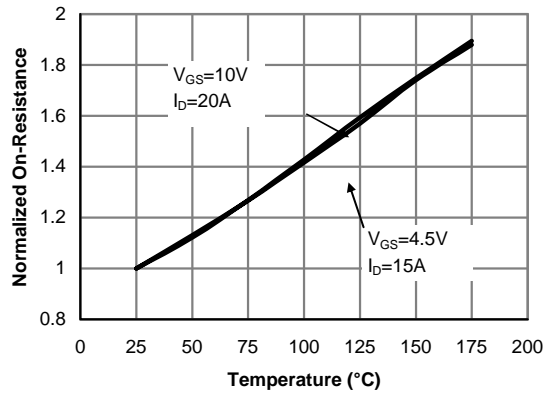


Figure 4: On-Resistance vs. Junction Temperature (Note E)

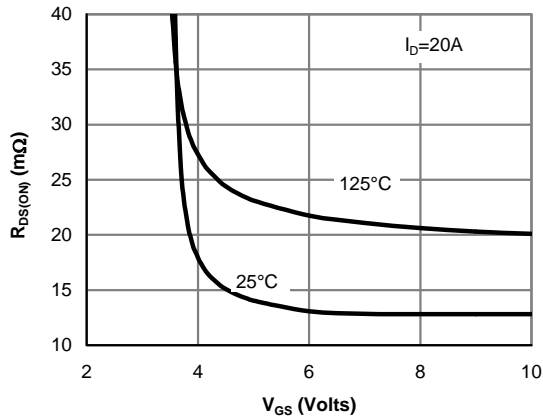


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

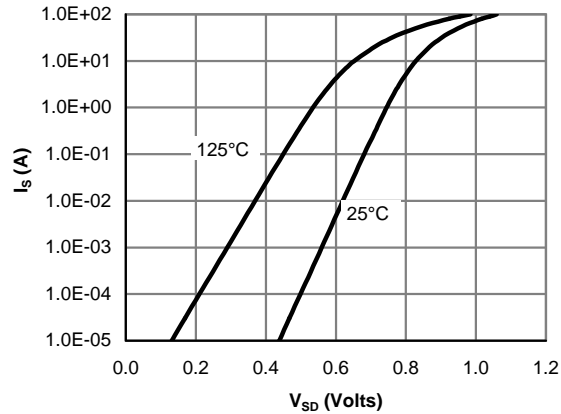


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

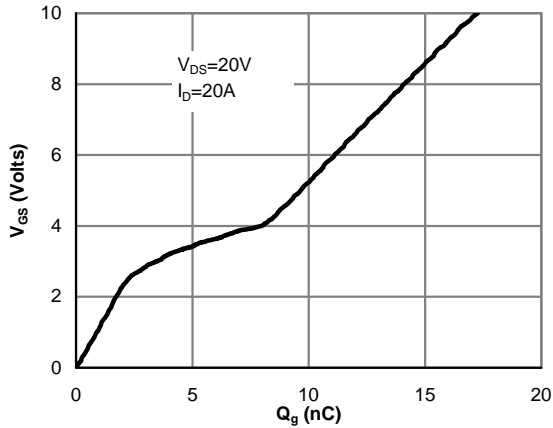


Figure 7: Gate-Charge Characteristics

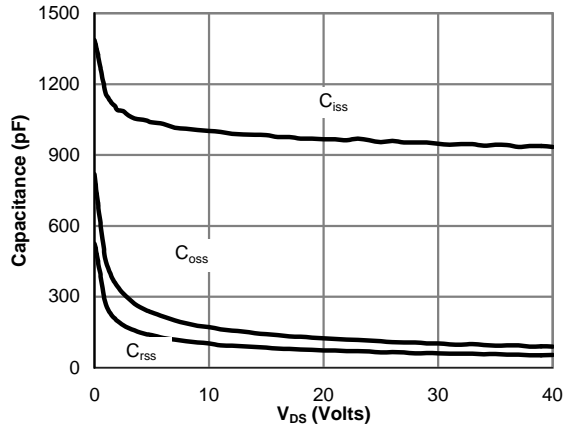


Figure 8: Capacitance Characteristics

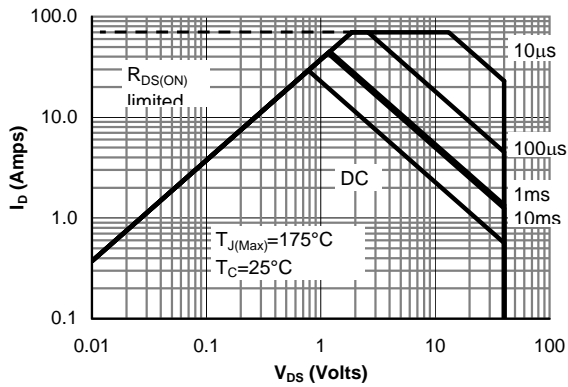


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

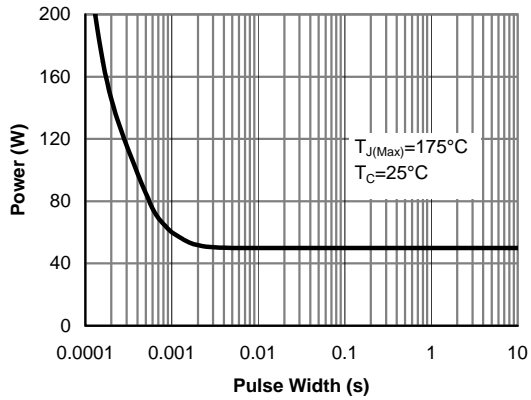


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

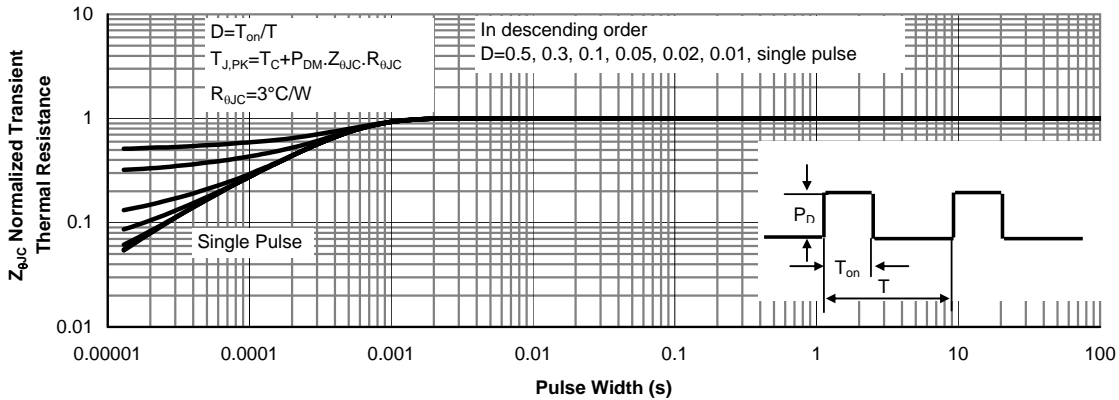


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

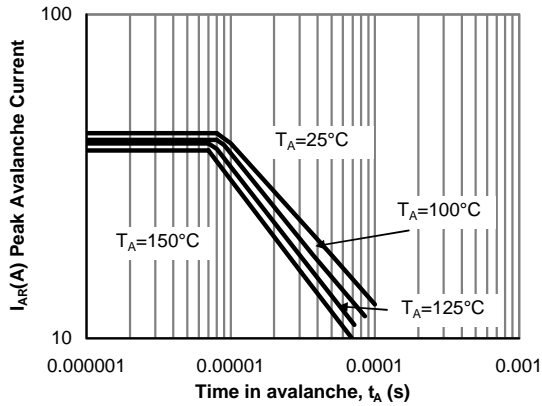


Figure 12: Single Pulse Avalanche capability (Note C)

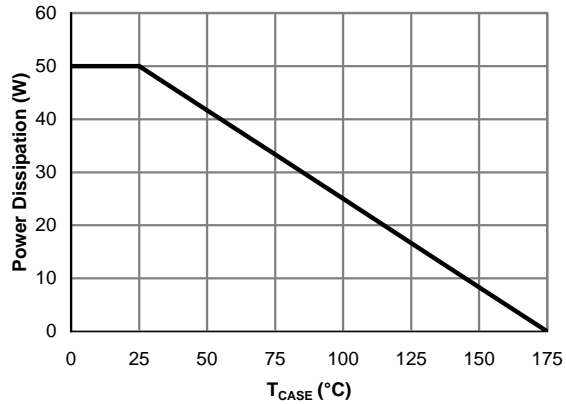


Figure 13: Power De-rating (Note F)

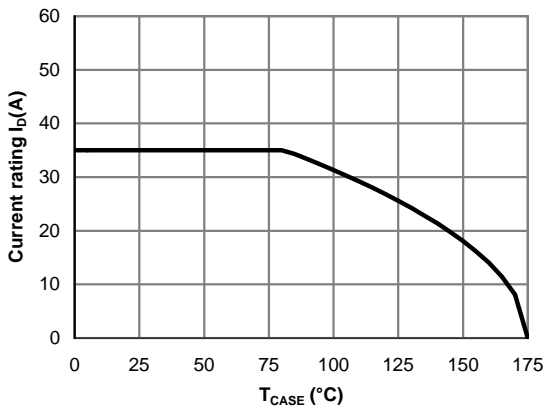


Figure 14: Current De-rating (Note F)

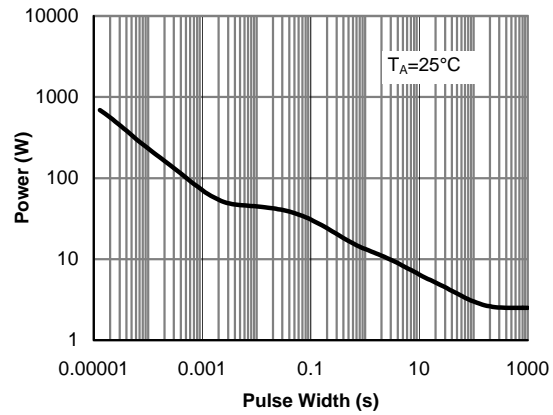


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

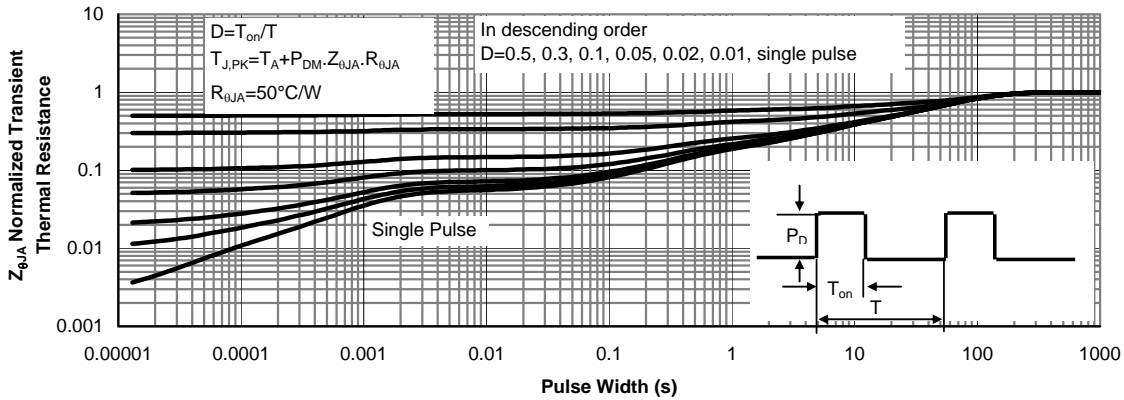
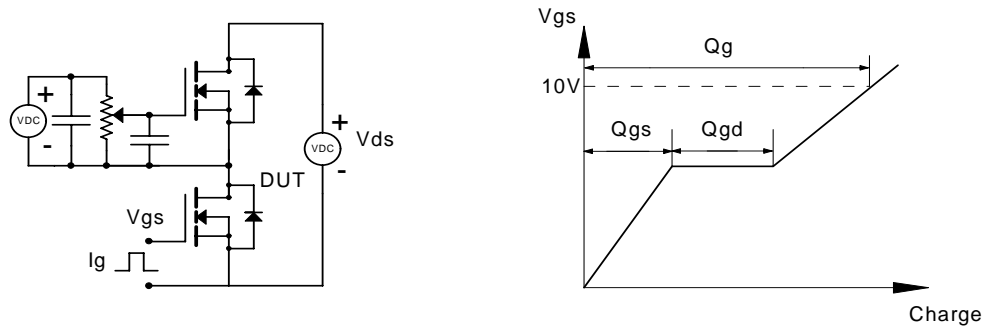
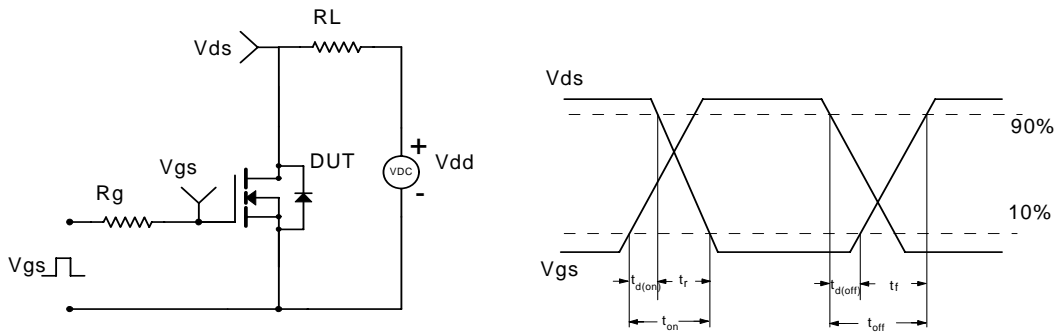


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

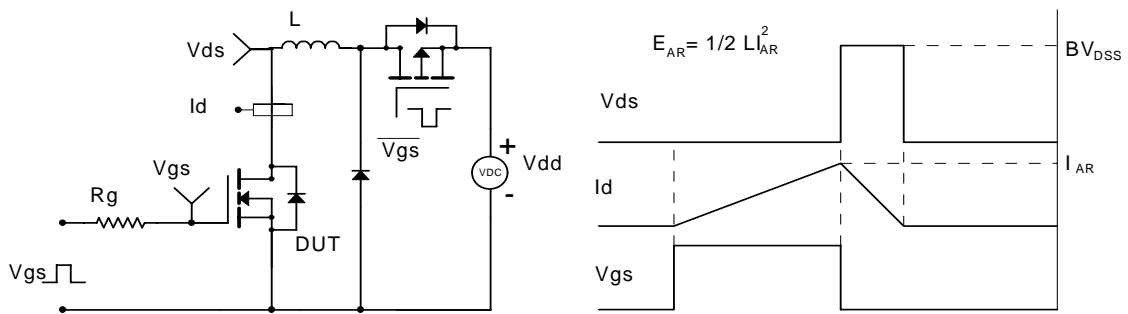
Gate Charge Test Circuit & Waveform



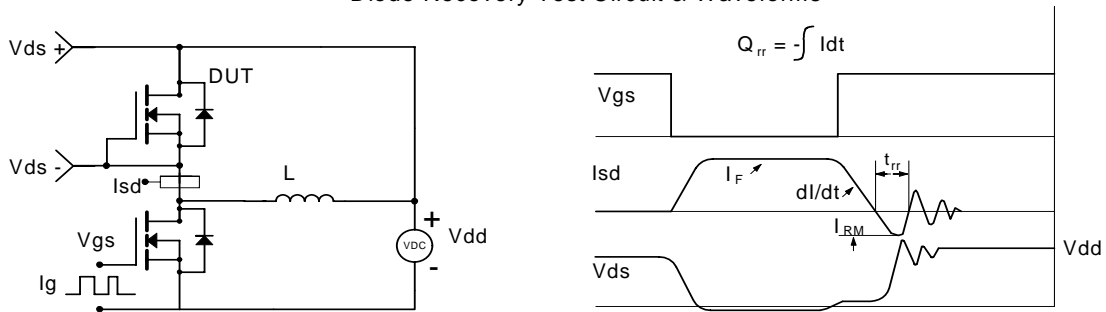
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



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