

**AOD1N60 / AOU1N60**
**1.3A, 600V N-Channel MOSFET**

formerly engineering part number AOD9600


**General Description**

The AOD1N60 has been 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.

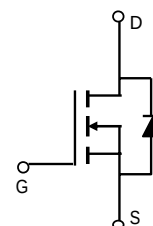
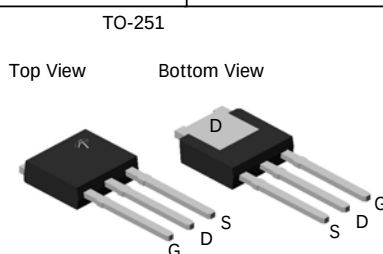
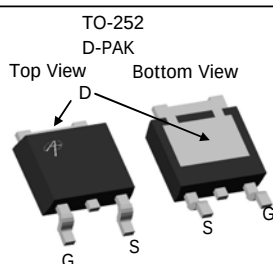
**Features**

$V_{DS}$  (V) = 600V  
 $I_D$  = 1.3A  
 $R_{DS(ON)} < 9\Omega$  ( $V_{GS} = 10V$ )

**100% UIS Tested!**

**100%  $R_g$  Tested!**

**$C_{iss}$ ,  $C_{oss}$ ,  $C_{rss}$  Tested!**


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

| Parameter                                                                    | Symbol         | Maximum    | Units |
|------------------------------------------------------------------------------|----------------|------------|-------|
| Drain-Source Voltage                                                         | $V_{DS}$       | 600        | V     |
| Gate-Source Voltage                                                          | $V_{GS}$       | $\pm 30$   | V     |
| Continuous Drain Current <sup>B</sup>                                        | $I_D$          | 1.3        | A     |
| $T_C=25^\circ\text{C}$                                                       |                |            |       |
| $T_C=100^\circ\text{C}$                                                      |                | 0.8        |       |
| Pulsed Drain Current <sup>C</sup>                                            | $I_{DM}$       | 4.0        |       |
| Avalanche Current <sup>C</sup>                                               | $I_{AR}$       | 1.0        | A     |
| Repetitive avalanche energy <sup>C</sup>                                     | $E_{AR}$       | 15         | mJ    |
| Single pulsed avalanche energy <sup>H</sup>                                  | $E_{AS}$       | 30         | mJ    |
| Peak diode recovery dv/dt                                                    | dv/dt          | 5          | V/ns  |
| Power Dissipation <sup>B</sup>                                               | $P_D$          | 45         | W     |
|                                                                              |                | 0.36       | W/°C  |
| $T_C=25^\circ\text{C}$                                                       |                |            |       |
| Derate above 25°C                                                            |                |            |       |
| Junction and Storage Temperature Range                                       | $T_J, T_{STG}$ | -50 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 <sup>A,G</sup> | $R_{\theta JA}$ | 45      | 55      | °C/W  |
| Maximum Case-to-Sink <sup>A</sup>          | $R_{\theta CS}$ | -       | 0.5     | °C/W  |
| Maximum Junction-to-Case <sup>D,F</sup>    | $R_{\theta JC}$ | 2.3     | 2.8     | °C/W  |

Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

| Symbol                             | Parameter                                 | Conditions                                                                           | Min | Typ  | Max  | Units |
|------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------|-----|------|------|-------|
| <b>STATIC PARAMETERS</b>           |                                           |                                                                                      |     |      |      |       |
| BV <sub>DSS</sub>                  | Drain-Source Breakdown Voltage            | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V                                           | 600 |      |      | V     |
| BV <sub>DSS</sub> /ΔT <sub>J</sub> | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V                                           |     | 0.6  |      | V/°C  |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current           | V <sub>DS</sub> =600V, V <sub>GS</sub> =0V                                           |     |      | 1    | μA    |
|                                    |                                           | V <sub>DS</sub> =480V, T <sub>J</sub> =125°C                                         |     |      | 10   |       |
| I <sub>GSS</sub>                   | Gate-Body leakage current                 | V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V                                           |     |      | 100  | nA    |
| V <sub>GS(th)</sub>                | Gate Threshold Voltage                    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                             | 3   | 4.1  | 5    | V     |
| R <sub>DS(ON)</sub>                | Static Drain-Source On-Resistance         | V <sub>GS</sub> =10V, I <sub>D</sub> =0.65A                                          |     | 7.5  | 9    | Ω     |
| g <sub>FS</sub>                    | Forward Transconductance                  | V <sub>DS</sub> =40V, I <sub>D</sub> =0.65A                                          |     | 0.9  |      | S     |
| V <sub>SD</sub>                    | Diode Forward Voltage                     | I <sub>S</sub> =1A, V <sub>GS</sub> =0V                                              |     | 0.65 | 1    | V     |
| I <sub>S</sub>                     | Maximum Body-Diode Continuous Current     |                                                                                      |     |      | 1    | A     |
| I <sub>SM</sub>                    | Maximum Body-Diode Pulsed Current         |                                                                                      |     |      | 4    | A     |
| <b>DYNAMIC PARAMETERS</b>          |                                           |                                                                                      |     |      |      |       |
| C <sub>iss</sub>                   | Input Capacitance                         | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz                                    | 105 | 130  | 160  | pF    |
| C <sub>oss</sub>                   | Output Capacitance                        |                                                                                      | 12  | 14.5 | 17.5 | pF    |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance              |                                                                                      | 1.5 | 1.8  | 2.2  | pF    |
| R <sub>g</sub>                     | Gate resistance                           | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                     | 2.9 | 3.5  | 5.3  | Ω     |
| <b>SWITCHING PARAMETERS</b>        |                                           |                                                                                      |     |      |      |       |
| Q <sub>g</sub>                     | Total Gate Charge                         | V <sub>GS</sub> =10V, V <sub>DS</sub> =480V, I <sub>D</sub> =1A                      |     | 6.1  | 8    | nC    |
| Q <sub>gs</sub>                    | Gate Source Charge                        |                                                                                      |     | 1.3  | 2    | nC    |
| Q <sub>gd</sub>                    | Gate Drain Charge                         |                                                                                      |     | 3.1  | 4    | nC    |
| t <sub>D(on)</sub>                 | Turn-On DelayTime                         | V <sub>GS</sub> =10V, V <sub>DS</sub> =300V, I <sub>D</sub> =1A, R <sub>G</sub> =25Ω |     | 10   | 13   | ns    |
| t <sub>r</sub>                     | Turn-On Rise Time                         |                                                                                      |     | 6.7  | 13   | ns    |
| t <sub>D(off)</sub>                | Turn-Off DelayTime                        |                                                                                      |     | 20   | 26   | ns    |
| t <sub>f</sub>                     | Turn-Off Fall Time                        |                                                                                      |     | 11.5 | 23   | ns    |
| t <sub>rr</sub>                    | Body Diode Reverse Recovery Time          | I <sub>F</sub> =1.3A, dI/dt=100A/μs, V <sub>DS</sub> =100V                           |     | 114  | 137  | ns    |
| Q <sub>rr</sub>                    | Body Diode Reverse Recovery Charge        | I <sub>F</sub> =1.3A, dI/dt=100A/μs, V <sub>DS</sub> =100V                           |     | 0.63 | 0.76 | μC    |

A: The value of R<sub>θJA</sub> is measured with the device in a still air environment with T<sub>A</sub>=25°C.

B: The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150°C in a TO220 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<sub>J(MAX)</sub>=150°C.

D: The R<sub>θJA</sub> is the sum of the thermal impedance from junction to case R<sub>θJC</sub> 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<sub>J(MAX)</sub>=150°C.

G: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C.

H: L=60mH, I<sub>AS</sub>=1A, V<sub>DD</sub>=150V, R<sub>G</sub>=10Ω, Starting T<sub>J</sub>=25°C

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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

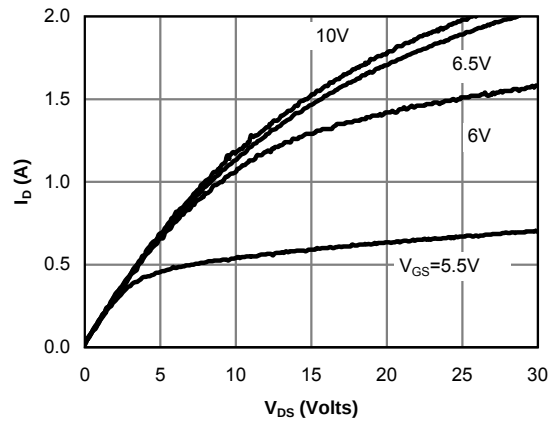


Fig 1: On-Region Characteristics

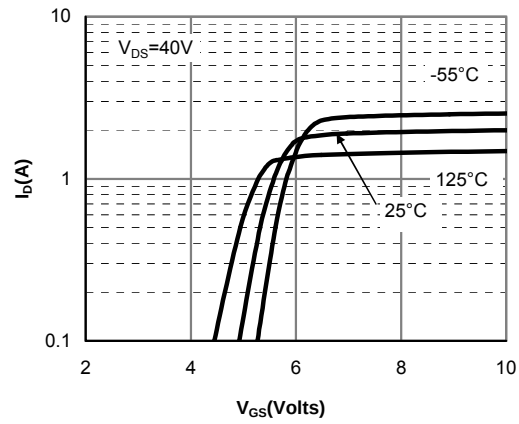


Figure 2: Transfer Characteristics

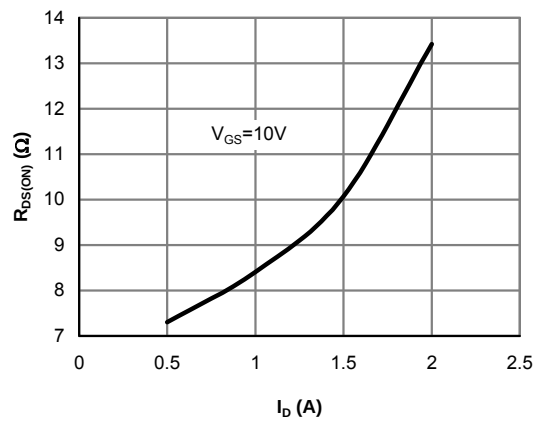


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

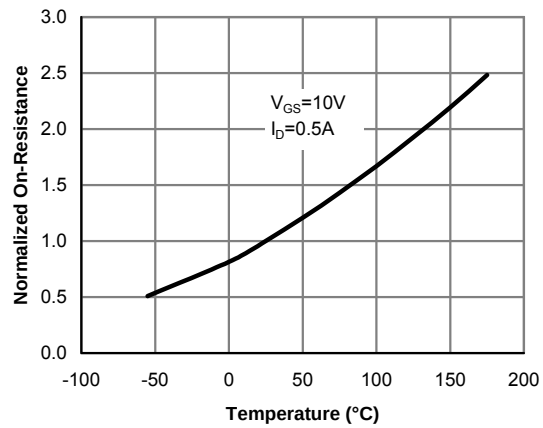


Figure 4: On-Resistance vs. Junction Temperature

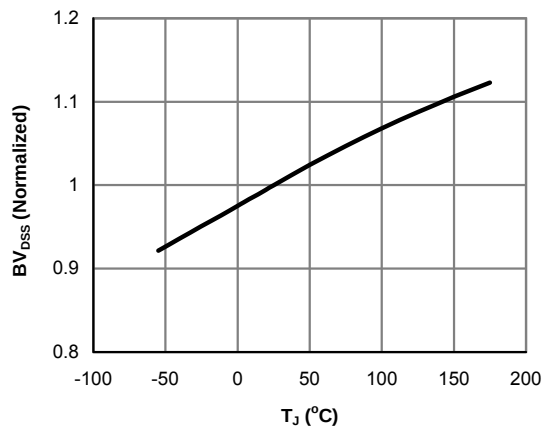


Figure 5: Break Down vs. Junction Temperature

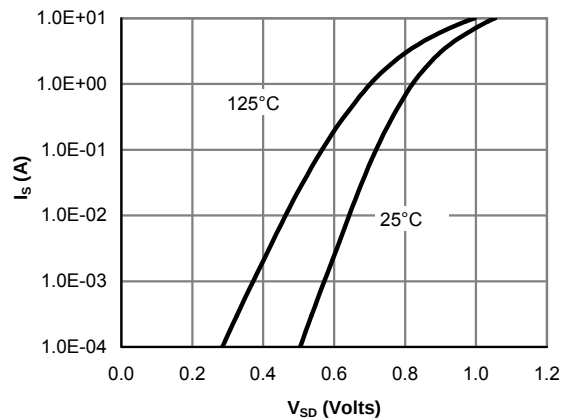


Figure 6: Body-Diode Characteristics

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

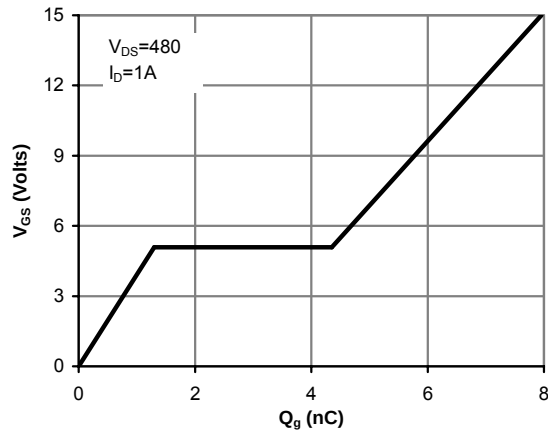


Figure 7: Gate-Charge Characteristics

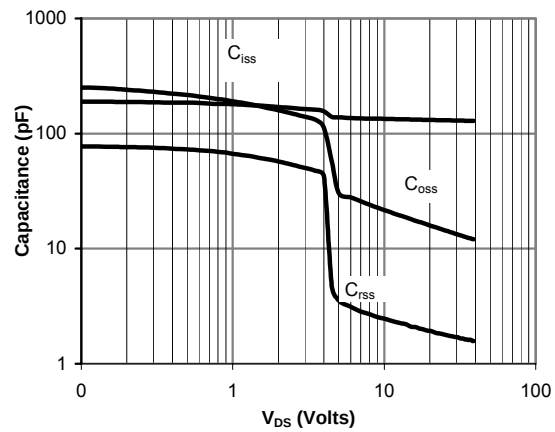


Figure 8: Capacitance Characteristics

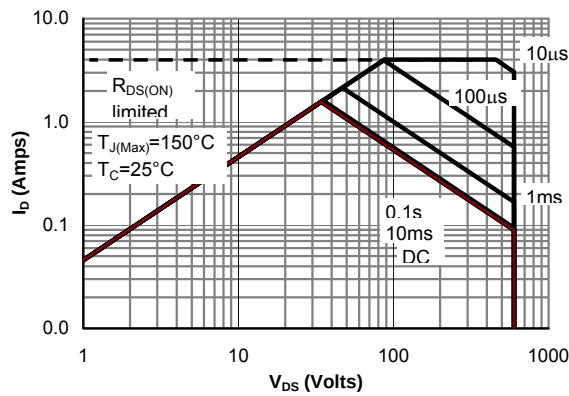


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

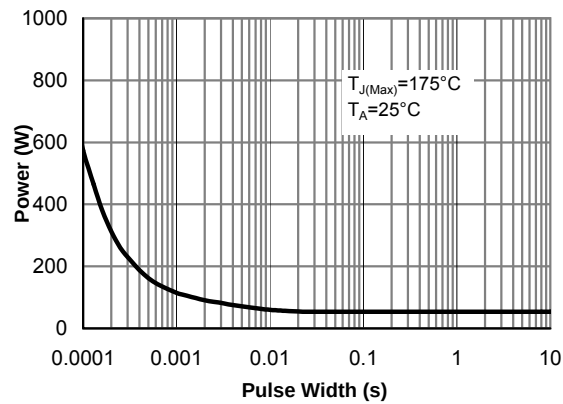


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

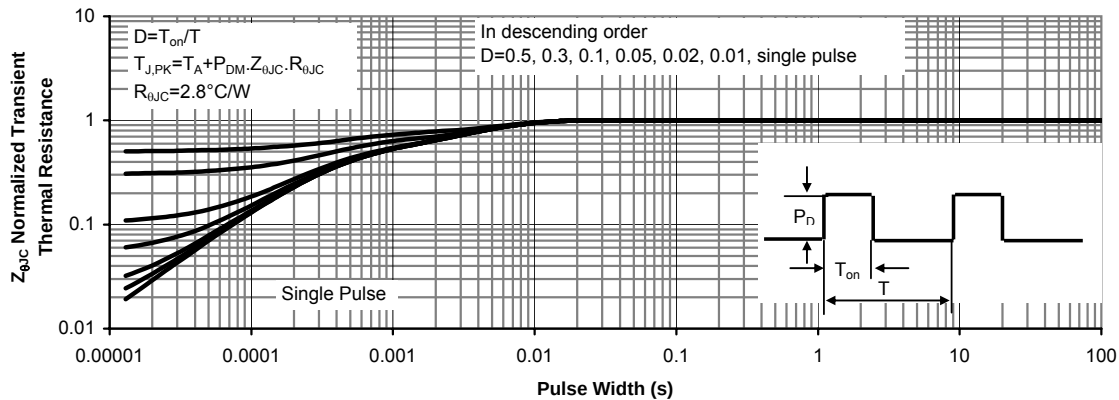


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

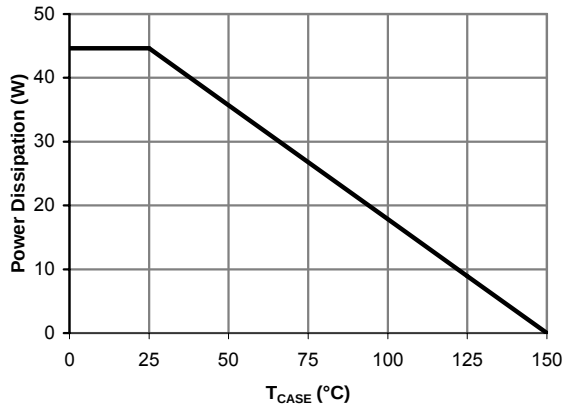


Figure 12: Power De-rating (Note B)

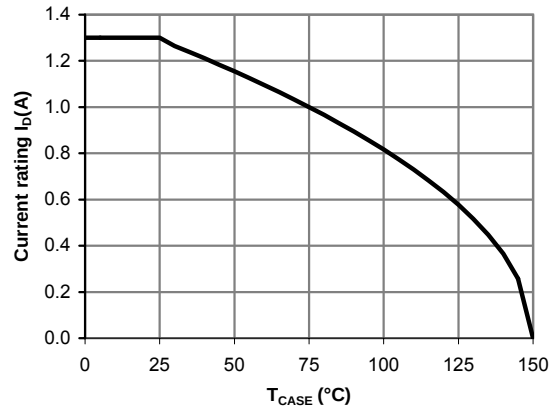


Figure 13: Current De-rating (Note B)

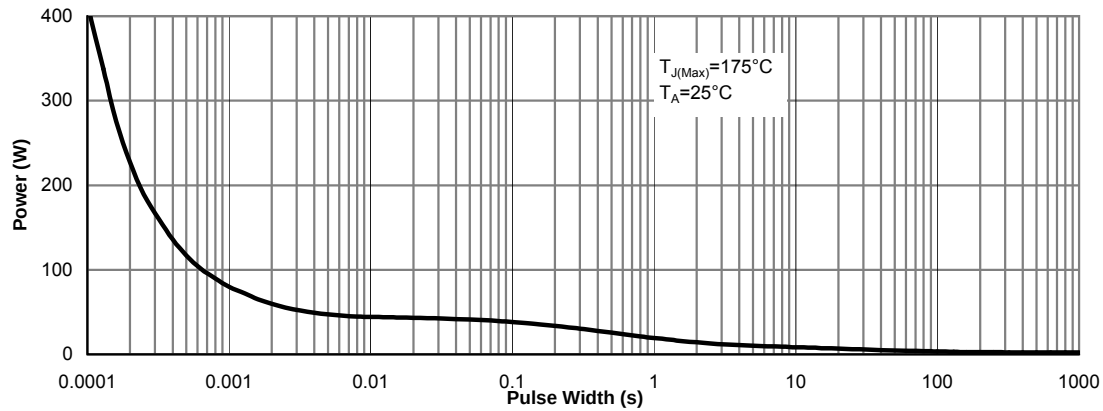


Figure 14: Single Pulse Power Rating Junction-to-Case (Note G)

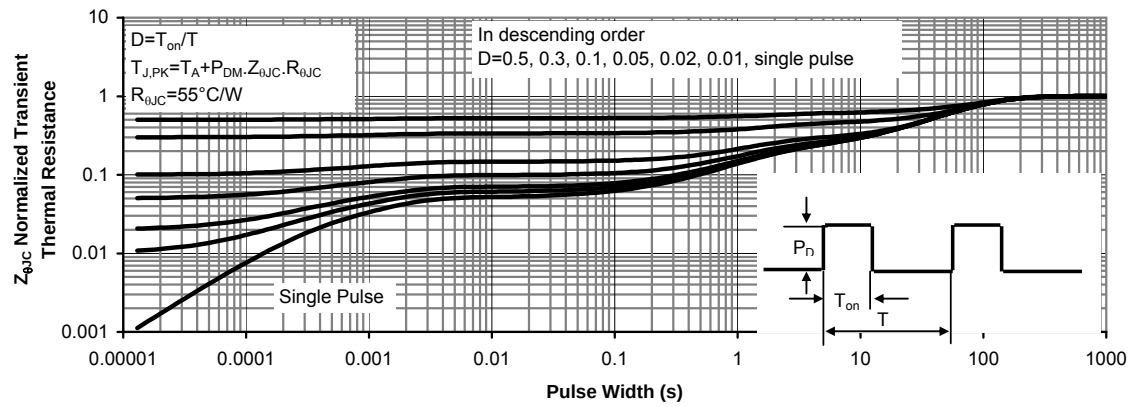
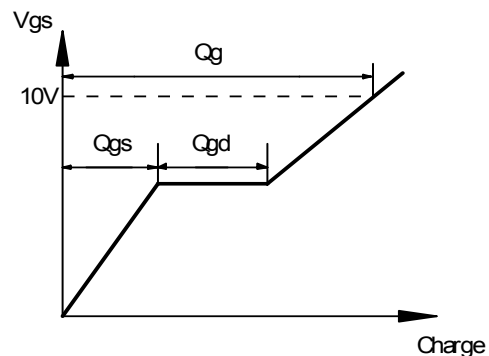
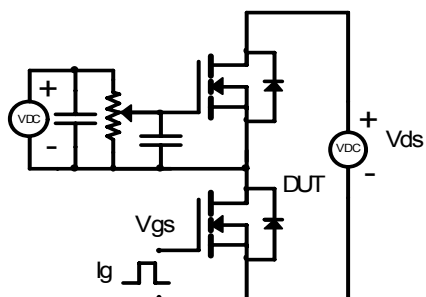
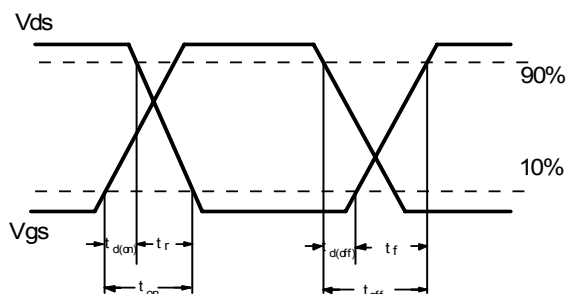
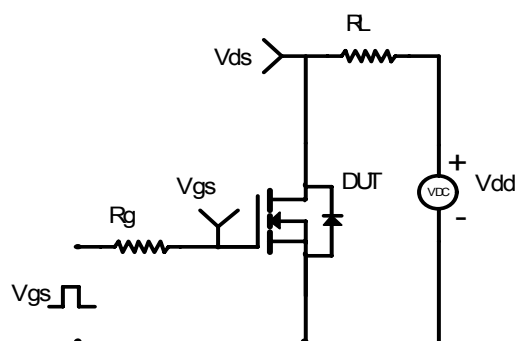


Figure 15: Normalized Maximum Transient Thermal Impedance (Note G)

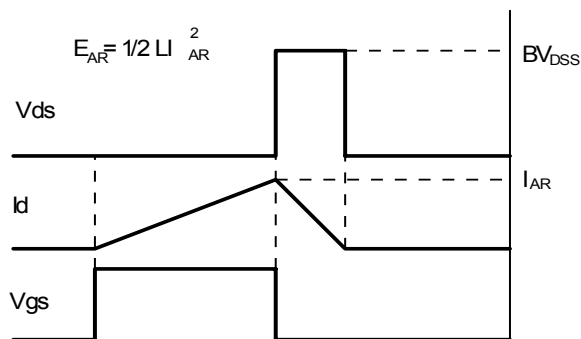
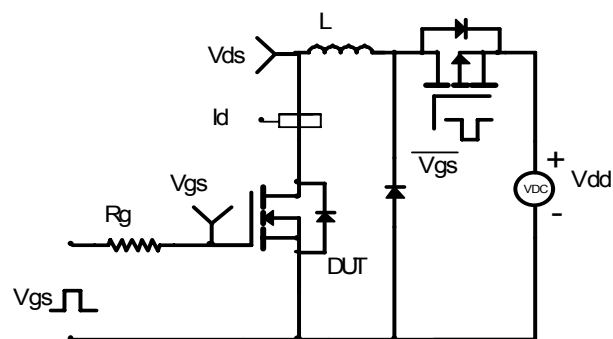
Gate Charge Test Circuit &amp; Waveform



Resistive Switching Test Circuit &amp; Waveforms



Unclamped Inductive Switching (UIS) Test Circuit &amp; Waveforms



Diode Recovery Test Circuit &amp; Waveforms

