

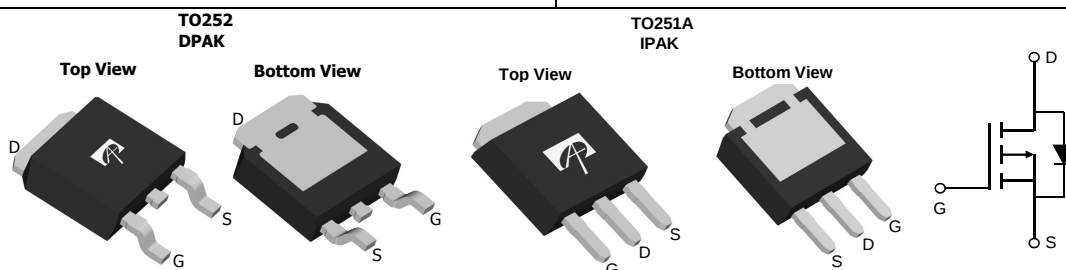
### General Description

The AOD403/AOI403 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and low gate resistance. With the excellent thermal resistance of the DPAK/IPAK package, this device is well suited for high current load applications.

### Product Summary

|                                    |                                      |
|------------------------------------|--------------------------------------|
| $V_{DS}$                           | -30V                                 |
| $I_D$ (at $V_{GS} = -20V$ )        | -70A                                 |
| $R_{DS(ON)}$ (at $V_{GS} = -20V$ ) | < 6.2m $\Omega$ (< 6.7m $\Omega^*$ ) |
| $R_{DS(ON)}$ (at $V_{GS} = -10V$ ) | < 8m $\Omega$ (< 8.5m $\Omega^*$ )   |

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                           | $V_{DS}$         | -30        | V                |
| Gate-Source Voltage                            | $V_{GS}$         | $\pm 25$   | V                |
| Continuous Drain Current <sup>G</sup>          | $I_D$            | -70        | A                |
| $T_C=25^\circ\text{C}$                         |                  | -55        |                  |
| $T_C=100^\circ\text{C}$                        |                  |            |                  |
| Pulsed Drain Current <sup>C</sup>              | $I_{DM}$         | -200       |                  |
| Continuous Drain Current                       | $I_{DSM}$        | -15        | A                |
| $T_A=25^\circ\text{C}$                         |                  | -12        |                  |
| $T_A=70^\circ\text{C}$                         |                  |            |                  |
| Avalanche Current <sup>C</sup>                 | $I_{AS}, I_{AR}$ | -50        | A                |
| Avalanche energy $L=0.1\text{mH}$ <sup>C</sup> | $E_{AS}, E_{AR}$ | 125        | mJ               |
| Power Dissipation <sup>B</sup>                 | $P_D$            | 90         | W                |
| $T_C=25^\circ\text{C}$                         |                  | 45         |                  |
| $T_C=100^\circ\text{C}$                        |                  |            |                  |
| Power Dissipation <sup>A</sup>                 | $P_{DSM}$        | 2.5        | W                |
| $T_A=25^\circ\text{C}$                         |                  | 1.6        |                  |
| $T_A=70^\circ\text{C}$                         |                  |            |                  |
| 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 <sup>A</sup>   | $R_{\theta JA}$ | 16  | 20  | $^\circ\text{C/W}$ |
| $t \leq 10\text{s}$                        |                 |     |     |                    |
| Maximum Junction-to-Ambient <sup>A D</sup> | $R_{\theta JC}$ | 41  | 50  | $^\circ\text{C/W}$ |
| Steady-State                               |                 |     |     |                    |
| Maximum Junction-to-Case                   |                 | 0.9 | 1.6 | $^\circ\text{C/W}$ |
| Steady-State                               |                 |     |     |                    |

\* package TO251A

**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                                                  | -30  |            |            | V     |
| I <sub>DSS</sub>            | Zero Gate Voltage Drain Current                    | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =55°C                           |      |            | -1<br>-5   | μA    |
| I <sub>GSS</sub>            | Gate-Body leakage current                          | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±25V                                                  |      |            | ±100       | nA    |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage                             | V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =-250μA                                      | -1.5 | -2.5       | -3.5       | V     |
| I <sub>D(ON)</sub>          | On state drain current                             | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-5V                                                  | -200 |            |            | A     |
| R <sub>DS(ON)</sub>         | Static Drain-Source On-Resistance                  | V <sub>GS</sub> =-20V, I <sub>D</sub> =-20A<br>TO252 T <sub>J</sub> =125°C                   |      | 5.1<br>7.6 | 6.2<br>9.2 | mΩ    |
|                             |                                                    | V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A<br>TO252                                         |      | 6.2        | 8          | mΩ    |
|                             |                                                    | V <sub>GS</sub> =-20V, I <sub>D</sub> =-20A<br>TO251A                                        |      | 5.6        | 6.7        | mΩ    |
|                             |                                                    | V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A<br>TO251A                                        |      | 6.7        | 8.5        | mΩ    |
| g <sub>FS</sub>             | Forward Transconductance                           | V <sub>DS</sub> =-5V, I <sub>D</sub> =-20A                                                   |      | 42         |            | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                              | I <sub>S</sub> =-1A, V <sub>GS</sub> =0V                                                     |      | -0.7       | -1         | V     |
| I <sub>S</sub>              | Maximum Body-Diode Continuous Current <sup>6</sup> |                                                                                              |      |            | -70        | A     |
| <b>DYNAMIC PARAMETERS</b>   |                                                    |                                                                                              |      |            |            |       |
| C <sub>iss</sub>            | Input Capacitance                                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =-15V, f=1MHz                                           | 2310 | 2890       | 3500       | pF    |
| C <sub>oss</sub>            | Output Capacitance                                 |                                                                                              | 410  | 585        | 760        | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance                       |                                                                                              | 280  | 470        | 660        | pF    |
| R <sub>g</sub>              | Gate resistance                                    | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                             | 1.9  | 3.8        | 5.7        | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                                    |                                                                                              |      |            |            |       |
| Q <sub>g</sub>              | Total Gate Charge                                  | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-20A                           | 40   | 51         | 61         | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                                 |                                                                                              | 10   | 12         | 14         | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                                  |                                                                                              | 10   | 16         | 22         | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                                  | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =0.75Ω,<br>R <sub>GEN</sub> =3Ω |      | 16         |            | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                                  |                                                                                              |      | 12         |            | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                                 |                                                                                              |      | 45         |            | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                                 |                                                                                              |      | 22         |            | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time                   | I <sub>F</sub> =-20A, dI/dt=100A/μs                                                          | 14   | 18         | 22         | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge                 | I <sub>F</sub> =-20A, dI/dt=100A/μs                                                          | 9    | 11         | 13         | nC    |

A. The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The Power dissipation P<sub>DSM</sub> is based on R<sub>θJA</sub> 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<sub>D</sub> is based on T<sub>J(MAX)</sub>=175° 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<sub>J(MAX)</sub>=175° C. Ratings are based on low frequency and duty cycles to keep initial T<sub>J</sub>=25° 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 <300μs pulses, duty cycle 0.5% max.

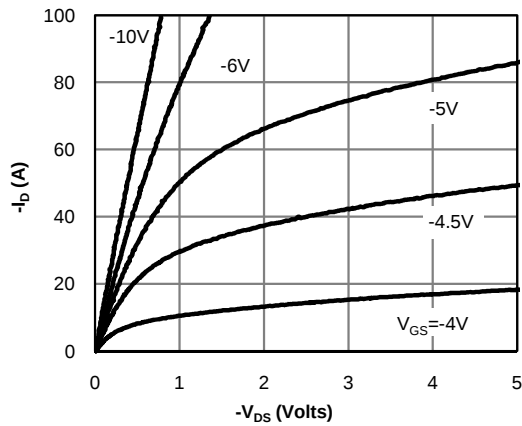
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=175° C. The SOA curve provides a single pulse rating.

G. The maximum current rating is package limited.

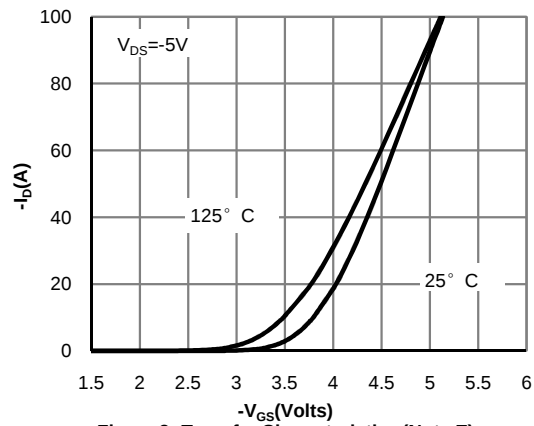
H. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C.

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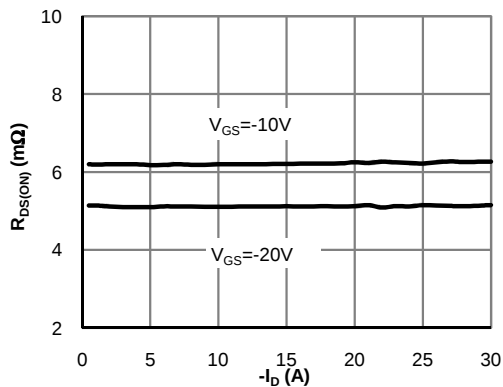
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



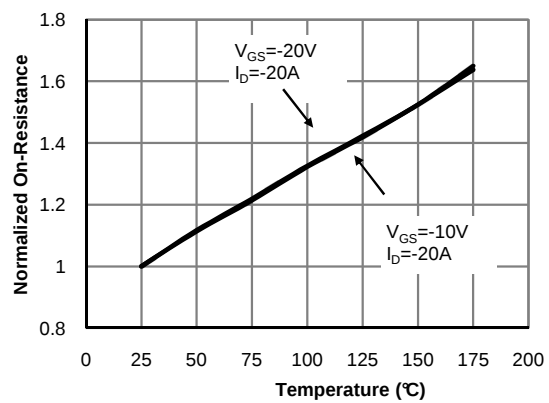
**Fig 1: On-Region Characteristics (Note E)**



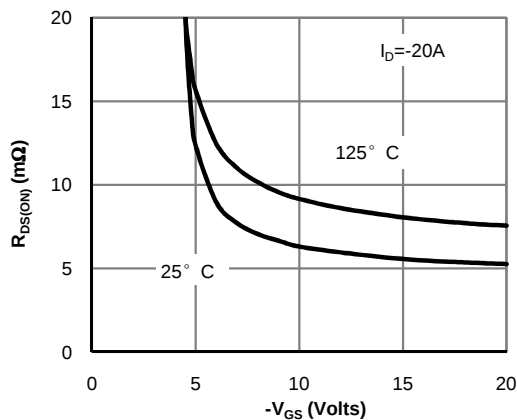
**Figure 2: Transfer Characteristics (Note E)**



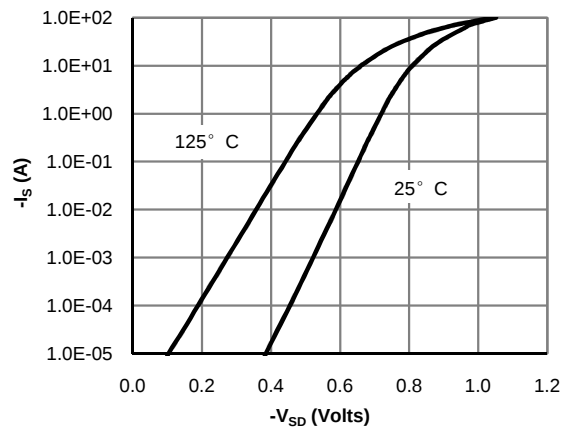
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**



**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**

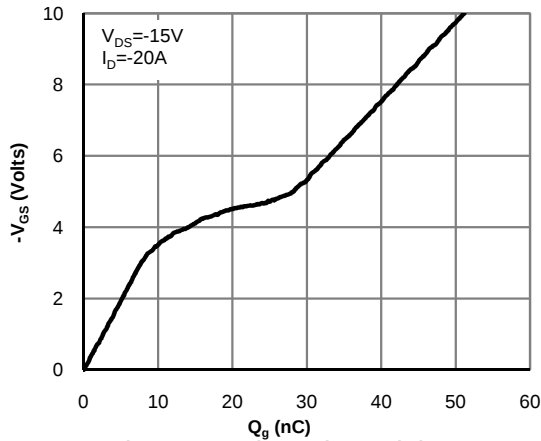


Figure 7: Gate-Charge Characteristics

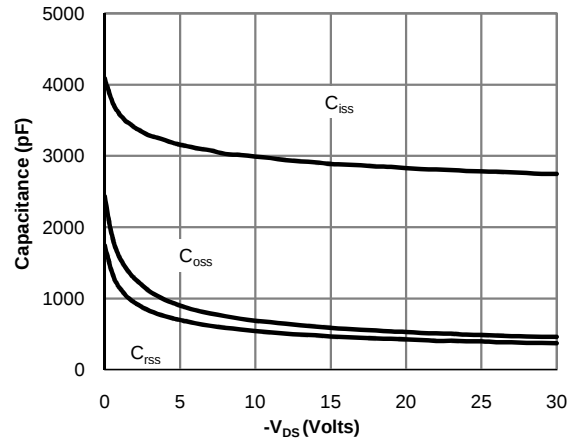


Figure 8: Capacitance Characteristics

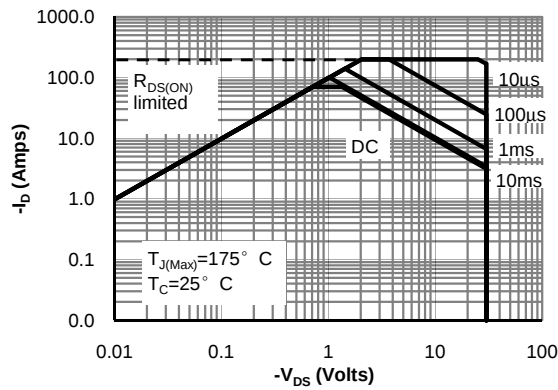


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

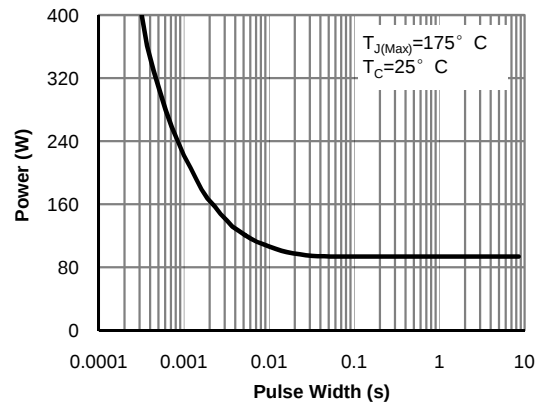


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

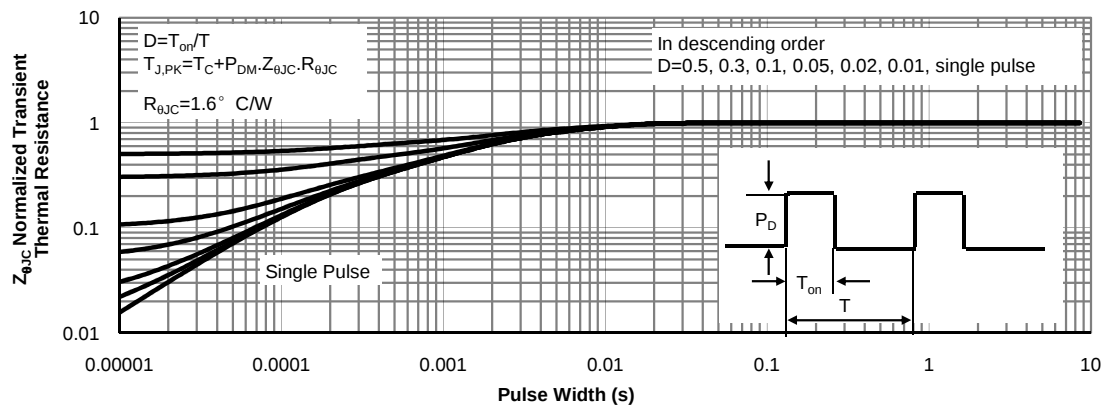


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

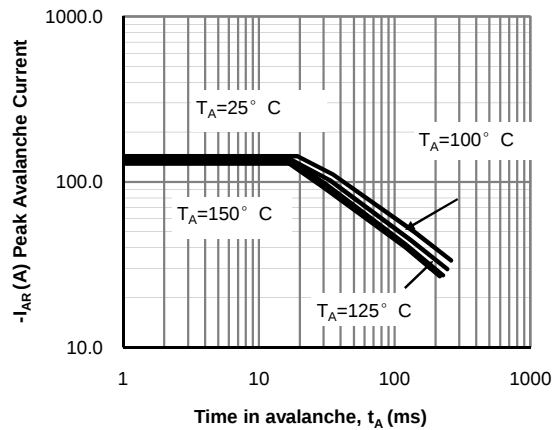


Figure 12: Single Pulse Avalanche capability (Note C)

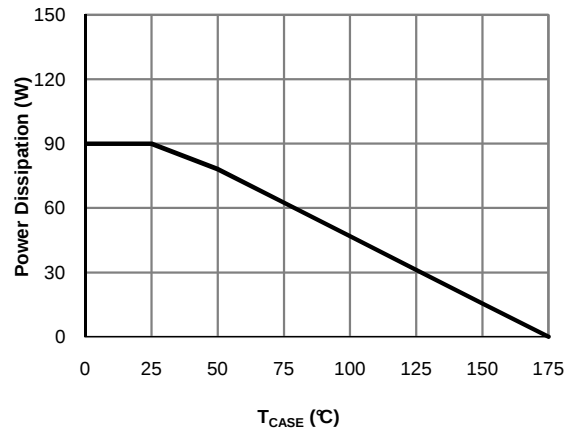


Figure 13: Power De-rating (Note F)

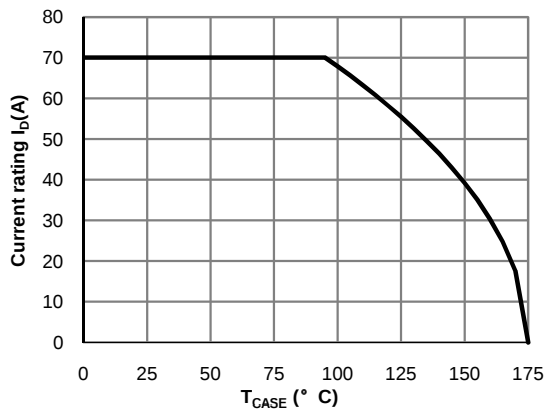


Figure 14: Current De-rating (Note F)

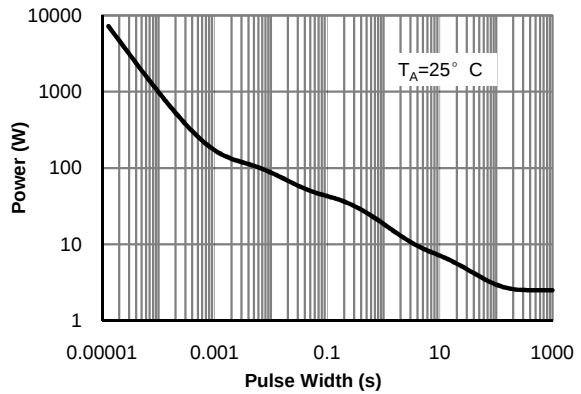


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

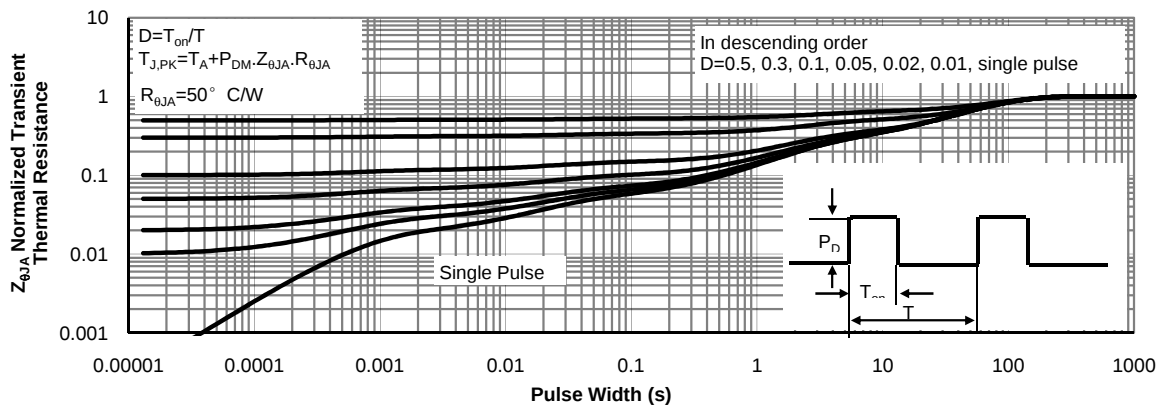
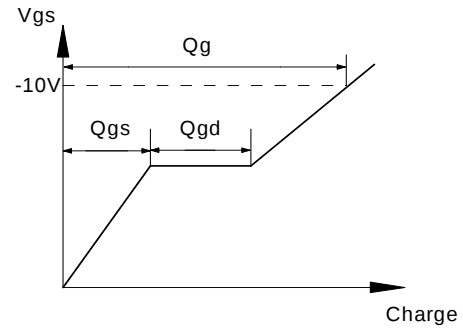
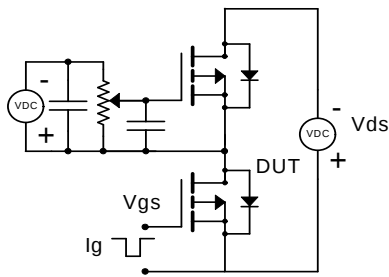
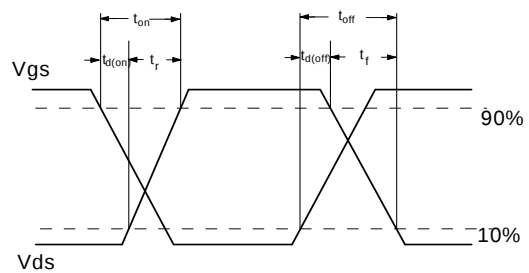
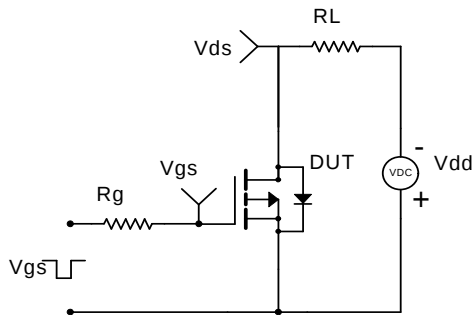


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

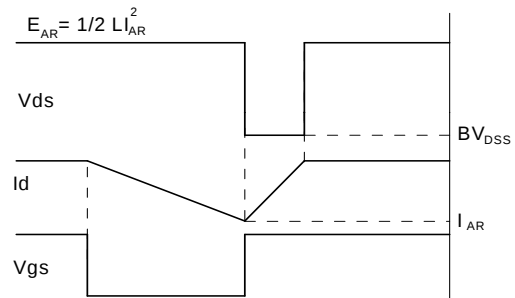
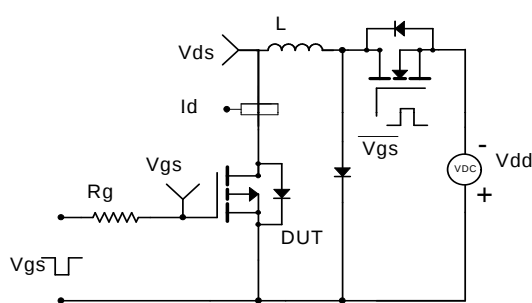
### Gate Charge Test Circuit & Waveform



### Resistive Switching Test Circuit & Waveforms



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



### Diode Recovery Test Circuit & Waveforms

