

### General Description

The AO4478 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge. This device is suitable for use as general purpose, PWM and a load switch applications.

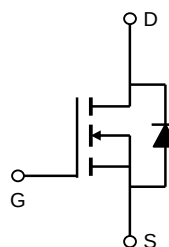
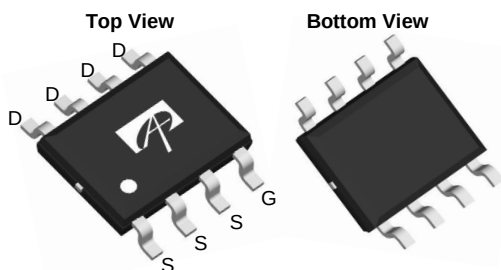
### Product Summary

$V_{DS}$  (V) = 30V  
 $I_D$  = 9A ( $V_{GS}$  = 10V)  
 $R_{DS(ON)}$  <19m $\Omega$  ( $V_{GS}$  = 10V)  
 $R_{DS(ON)}$  <26m $\Omega$  ( $V_{GS}$  = 4.5V)

100% UIS Tested  
 100% Rg Tested



SOIC-8



### 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                       | $I_D$          | 9.0        | A                |
|                                                |                | 7.0        |                  |
| Pulsed Drain Current <sup>C</sup>              | $I_{DM}$       | 60         |                  |
| Avalanche Current <sup>C</sup>                 | $I_{AR}$       | 17         |                  |
| Repetitive avalanche energy $L=0.1\text{mH}^C$ | $E_{AR}$       | 14         | mJ               |
| Power Dissipation <sup>B</sup>                 | $P_D$          | 3.1        | W                |
|                                                |                | 2.0        |                  |
| Junction and Storage Temperature Range         | $T_J, T_{STG}$ | -55 to 150 | $^\circ\text{C}$ |

### Thermal Characteristics

| Parameter                                 | Symbol          | Typ | Max | Units              |
|-------------------------------------------|-----------------|-----|-----|--------------------|
| Maximum Junction-to-Ambient <sup>A</sup>  | $R_{\theta JA}$ | 31  | 40  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient <sup>AD</sup> |                 | 59  | 75  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Lead <sup>C</sup>     | $R_{\theta JL}$ | 16  | 24  | $^\circ\text{C/W}$ |

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                                                 | 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   | 1.6      | 2        | V     |
| I <sub>D(ON)</sub>          | On state drain current                | V <sub>GS</sub> =10V, V <sub>DS</sub> =5V                                                  | 60  |          |          | A     |
| R <sub>DS(ON)</sub>         | Static Drain-Source On-Resistance     | V <sub>GS</sub> =10V, I <sub>D</sub> =9A<br>T <sub>J</sub> =125°C                          |     | 16<br>25 | 19<br>30 | mΩ    |
|                             |                                       | V <sub>GS</sub> =4.5V, I <sub>D</sub> =8A                                                  |     | 21       | 26       | mΩ    |
|                             |                                       |                                                                                            |     |          |          |       |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =5V, I <sub>D</sub> =10A                                                   |     | 24       |          | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =1A, V <sub>GS</sub> =0V                                                    |     | 0.70     | 1        | V     |
| I <sub>S</sub>              | Maximum Body-Diode Continuous Current |                                                                                            |     |          | 4        | A     |
| <b>DYNAMIC PARAMETERS</b>   |                                       |                                                                                            |     |          |          |       |
| C <sub>iss</sub>            | Input Capacitance                     | V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz                                          |     | 466      | 560      | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |                                                                                            |     | 90       |          | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |                                                                                            |     | 61       |          | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                           |     | 3.7      | 5.6      | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                       |                                                                                            |     |          |          |       |
| Q <sub>g(10V)</sub>         | Total Gate Charge                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =9A                             |     | 9.3      | 11       | nC    |
| Q <sub>g(4.5V)</sub>        | Total Gate Charge                     |                                                                                            |     | 4.3      | 5.2      | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |                                                                                            |     | 1        |          | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |                                                                                            |     | 2.3      |          | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =1.65Ω,<br>R <sub>GEN</sub> =3Ω |     | 5        |          | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |                                                                                            |     | 8        |          | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |                                                                                            |     | 20       |          | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |                                                                                            |     | 5        |          | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =9A, dI/dt=500A/μs                                                          |     | 7.5      | 9        | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =9A, dI/dt=500A/μs                                                          |     | 9.8      |          | 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 value in any given application depends on the user's specific board design.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150°C, using ≤ 10s junction-to-ambient thermal resistance.

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 lead R<sub>θJL</sub> and lead to ambient.

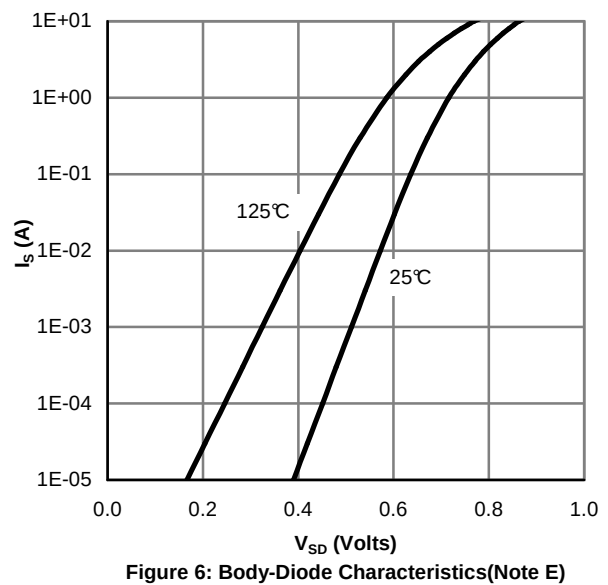
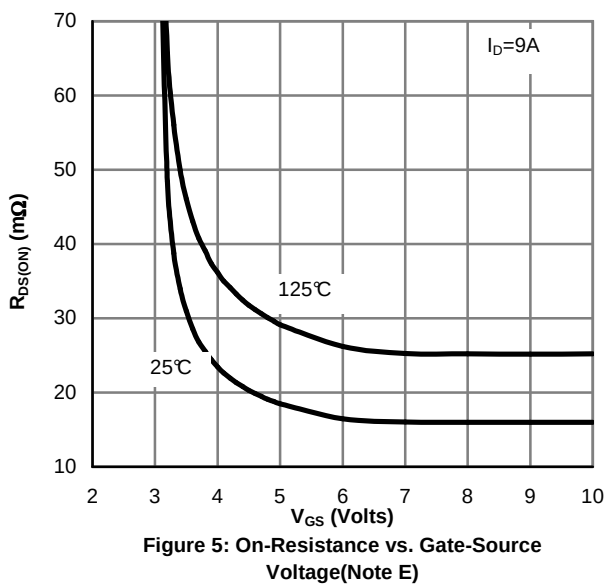
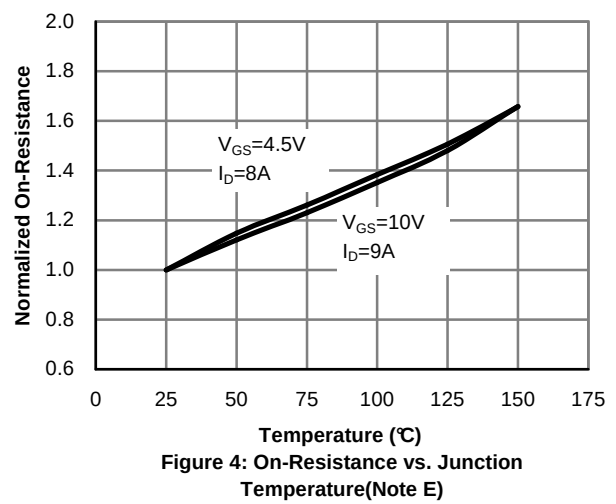
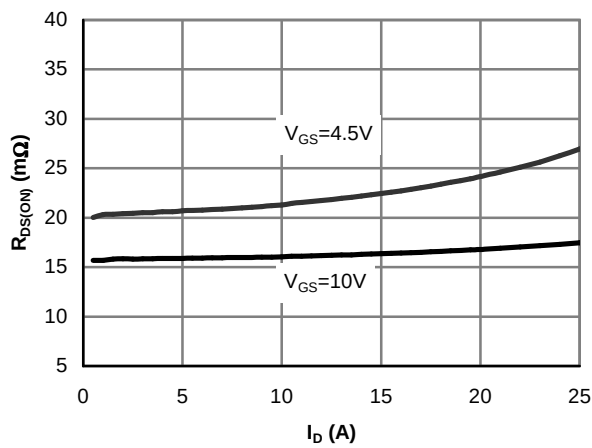
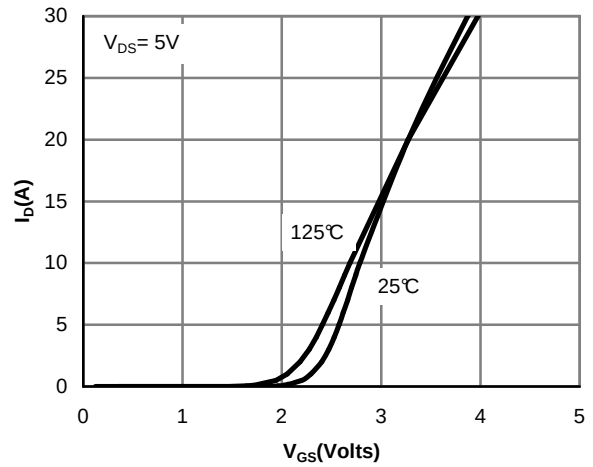
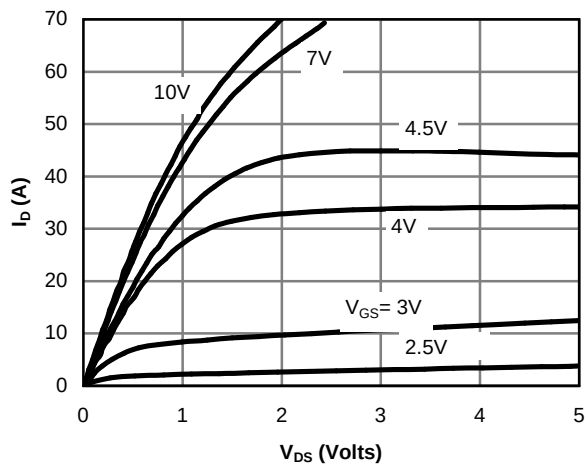
E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150°C. The SOA curve provides a single pulse rating.

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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



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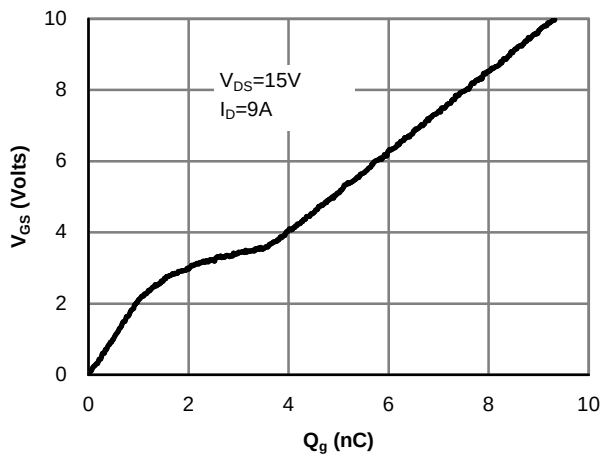


Figure 7: Gate-Charge Characteristics

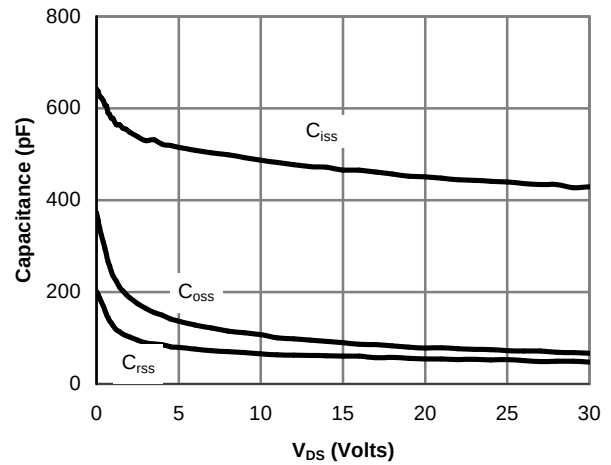


Figure 8: Capacitance Characteristics

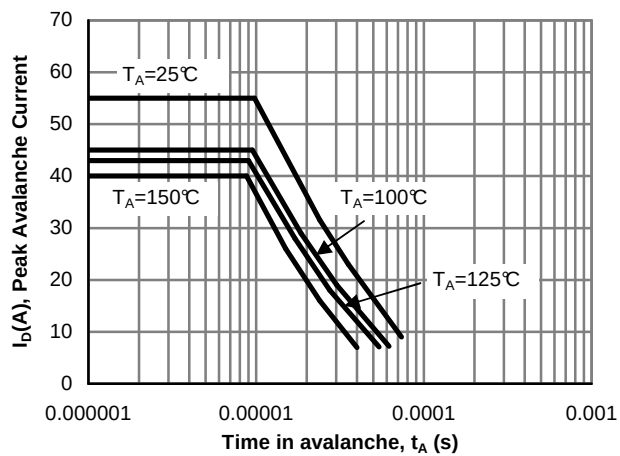


Figure 9: Single Pulse Avalanche capability (Note C)

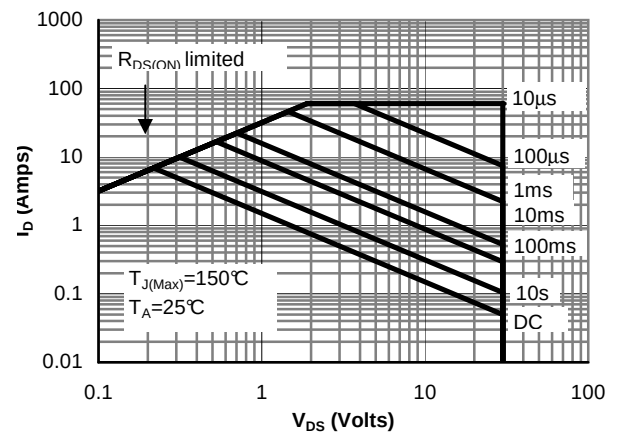


Figure 10: Maximum Forward Biased Safe Operating Area (Note F)

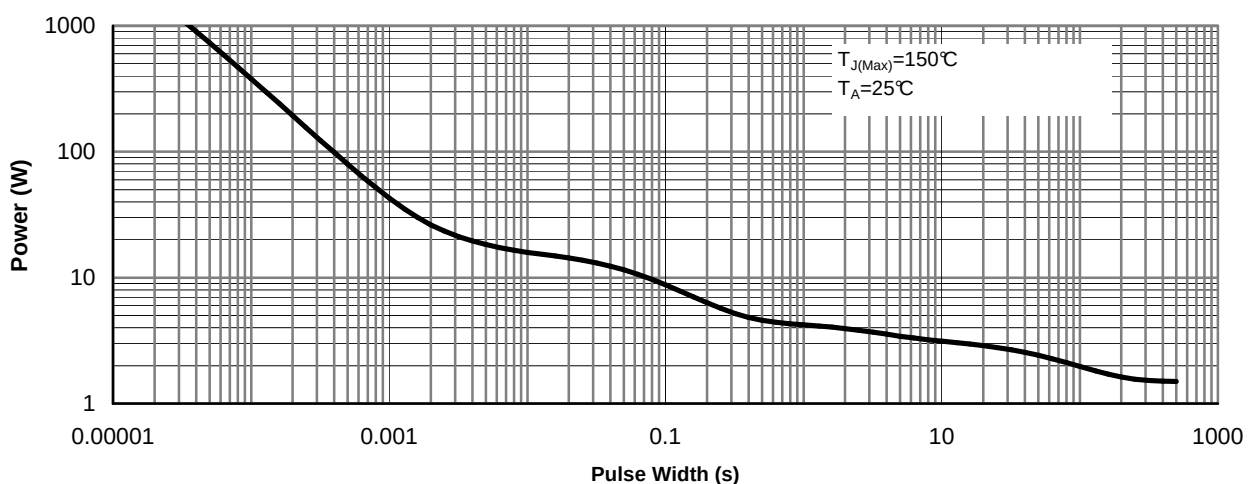


Figure 11: Single Pulse Power Rating Junction-to-Ambient (Note F)

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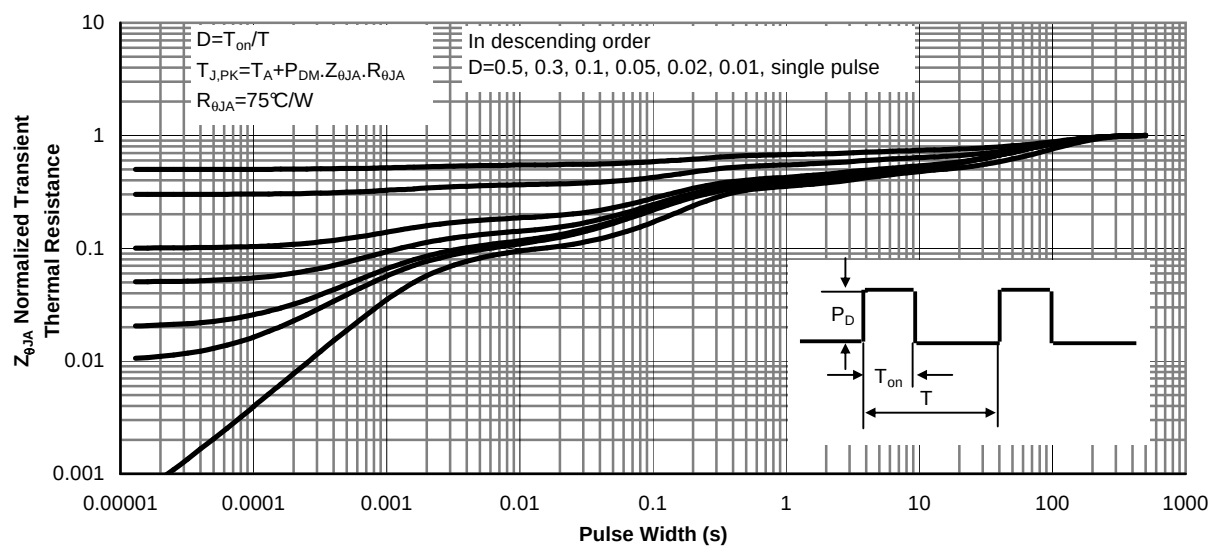
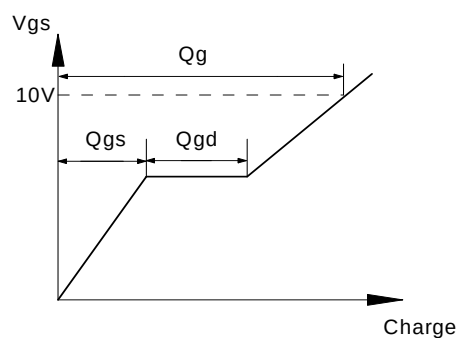
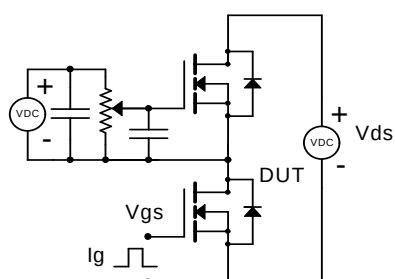
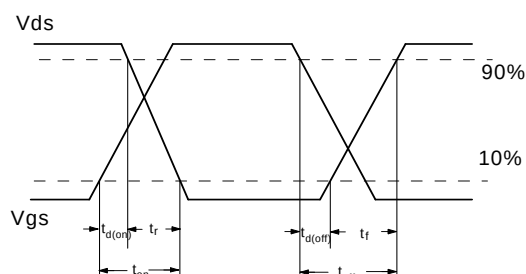
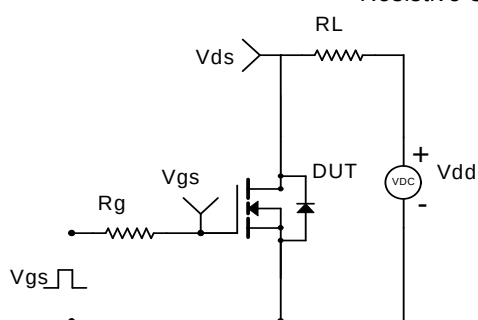


Figure 12: Normalized Maximum Transient Thermal Impedance (Note F)

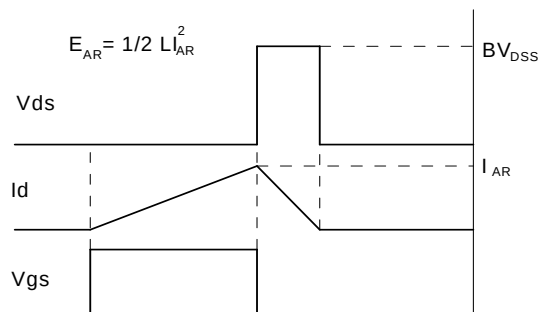
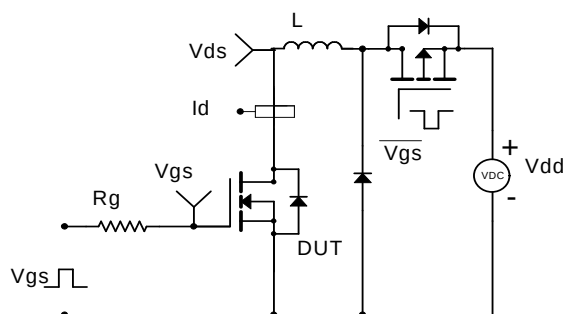
Gate Charge Test Circuit &amp; Waveform



Resistive Switching Test Circuit &amp; Waveforms



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



Diode Recovery Test Circuit &amp; Waveforms

