

**AOL1454**
**N-Channel Enhancement Mode Field Effect Transistor**
**General Description**

The AOL1454 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge. It is ESD protected. This device is suitable for use as a low side switch in SMPS and general purpose applications.

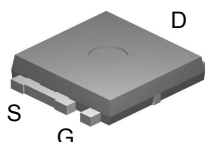
- RoHS Compliant
- Halogen and Antimony Free Green Device\*

**Features**

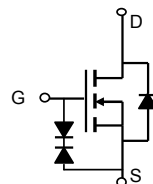
$V_{DS}$  (V) = 40V  
 $I_D$  = 50A ( $V_{GS}$  = 10V)  
 $R_{DS(ON)} < 9m\Omega$  ( $V_{GS}$  = 10V)  
 $R_{DS(ON)} < 13m\Omega$  ( $V_{GS}$  = 4.5V)

ESD Protected  
 UIS Tested  
 $R_g, C_{iss}, C_{oss}, C_{rss}$  Tested

Ultra SO-8™ Top View



Bottom tab connected to drain


**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                            | $V_{GS}$       | $\pm 20$                 | V                |
| Continuous Drain Current <sup>B</sup>          | $I_D$          | $T_C=25^\circ\text{C}^H$ | A                |
|                                                |                | $T_C=100^\circ\text{C}$  |                  |
| Pulsed Drain Current <sup>C</sup>              | $I_{DM}$       | 100                      |                  |
| Continuous Drain Current <sup>A</sup>          | $I_{DSM}$      | $T_A=25^\circ\text{C}$   | A                |
|                                                |                | $T_A=70^\circ\text{C}$   |                  |
| Avalanche Current <sup>C</sup>                 | $I_{AR}$       | 30                       | A                |
| Repetitive avalanche energy $L=0.3\text{mH}^C$ | $E_{AR}$       | 135                      | mJ               |
| Power Dissipation <sup>B</sup>                 | $P_D$          | $T_C=25^\circ\text{C}$   | W                |
|                                                |                | $T_C=100^\circ\text{C}$  |                  |
| Power Dissipation <sup>A</sup>                 | $P_{DSM}$      | $T_A=25^\circ\text{C}$   | 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 <sup>A</sup> | $R_{\theta JA}$ | $t \leq 10\text{s}$ | 20  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient <sup>A</sup> |                 | Steady-State        | 50  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Case <sup>D</sup>    | $R_{\theta JC}$ | Steady-State        | 1.8 | $^\circ\text{C/W}$ |

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                                              | 40  |           |        | V     |
| I <sub>DSS</sub>            | Zero Gate Voltage Drain Current       | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =55°C                       |     |           | 1<br>5 | uA    |
| I <sub>GSS</sub>            | Gate-Body leakage current             | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V                                             |     |           | ±100   | uA    |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage                | V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA                                  | 1   | 2         | 3      | V     |
| I <sub>D(ON)</sub>          | On state drain current                | V <sub>GS</sub> =10V, V <sub>DS</sub> =5V                                               | 100 |           |        | A     |
| R <sub>DS(ON)</sub>         | Static Drain-Source On-Resistance     | V <sub>GS</sub> =10V, I <sub>D</sub> =20A<br>T <sub>J</sub> =125°C                      |     | 7.5<br>10 | 9.0    | mΩ    |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =5V, I <sub>D</sub> =20A                                                |     | 47        |        | 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 |                                                                                         |     |           | 50     | A     |
| <b>DYNAMIC PARAMETERS</b>   |                                       |                                                                                         |     |           |        |       |
| C <sub>iss</sub>            | Input Capacitance                     | V <sub>GS</sub> =0V, V <sub>DS</sub> =20V, f=1MHz                                       |     | 1600      | 1920   | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |                                                                                         |     | 320       |        | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |                                                                                         |     | 100       |        | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                        |     | 3.4       |        | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                       |                                                                                         |     |           |        |       |
| Q <sub>g</sub> (10V)        | Total Gate Charge                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =20V, I <sub>D</sub> =20A                         |     | 22        |        | nC    |
| Q <sub>g</sub> (4.5V)       | Total Gate Charge                     |                                                                                         |     | 10.5      |        | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |                                                                                         |     | 4.2       |        | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |                                                                                         |     | 4.8       |        | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =20V, R <sub>L</sub> =1Ω,<br>R <sub>GEN</sub> =3Ω |     | 6.5       |        | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |                                                                                         |     | 12.5      |        | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |                                                                                         |     | 33        |        | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |                                                                                         |     | 16        |        | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =20A, dI/dt=100A/μs                                                      |     | 31        |        | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =20A, dI/dt=100A/μs                                                      |     | 33        |        | nC    |

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. The power dissipation P<sub>DSM</sub> and current rating I<sub>DSM</sub> are based on T<sub>J(MAX)</sub>=150°C, using steady state junction-to-ambient thermal resistance.

B. The power dissipation PD 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.

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>=175°C. The SOA curve provides a single pulse rating.

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

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

\* This device is guaranteed green after date code 8P11 (June 1<sup>ST</sup> 2008)

Rev1: June 2008

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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

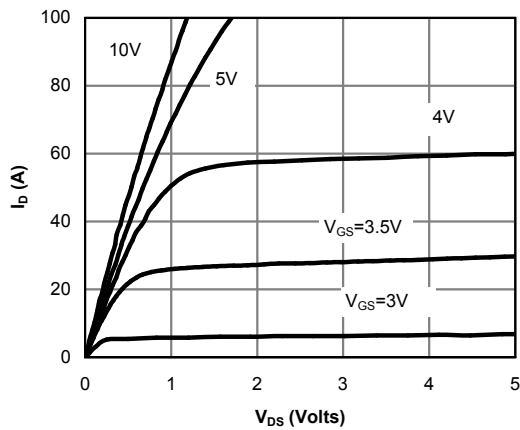


Figure 1: On-Region Characteristics

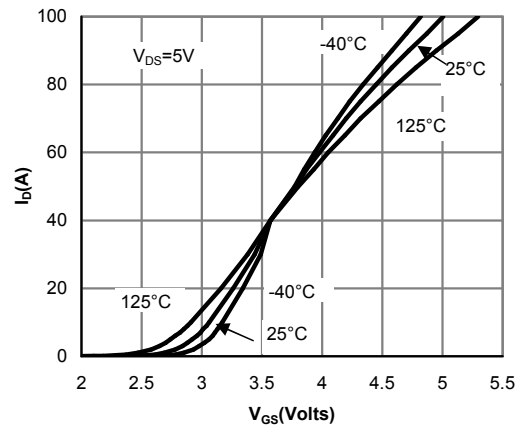


Figure 2: Transfer Characteristics

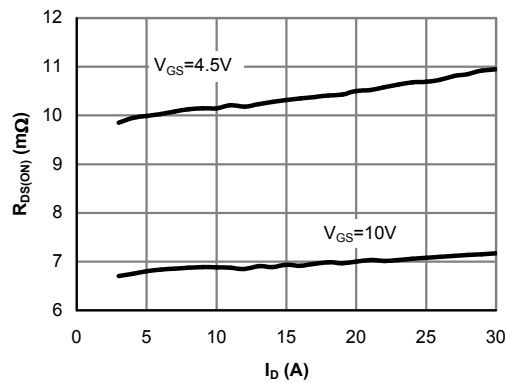


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

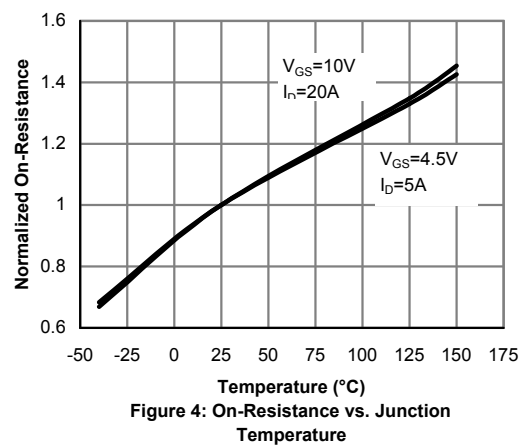


Figure 4: On-Resistance vs. Junction Temperature

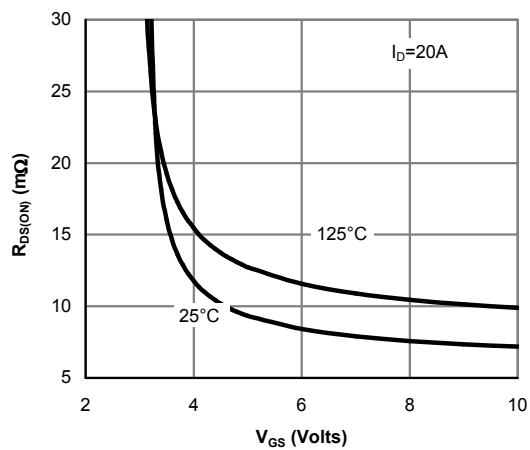


Figure 5: On-Resistance vs. Gate-Source Voltage

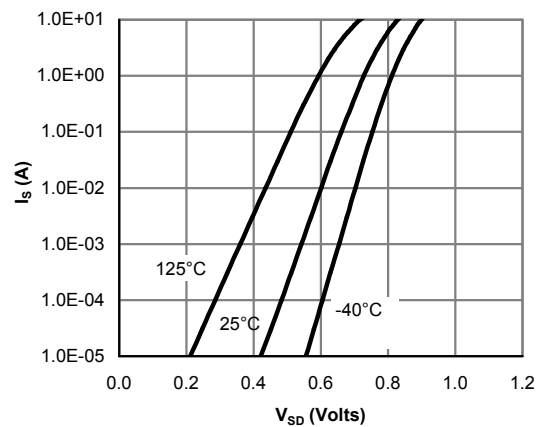


Figure 6: Body-Diode Characteristics

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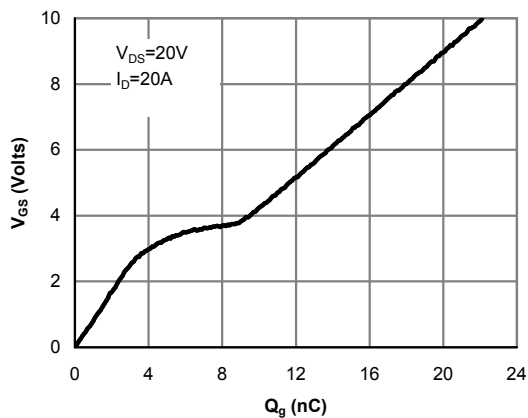


Figure 7: Gate-Charge Characteristics

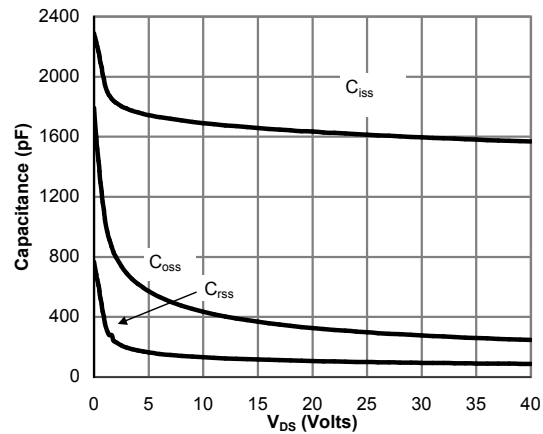


Figure 8: Capacitance Characteristics

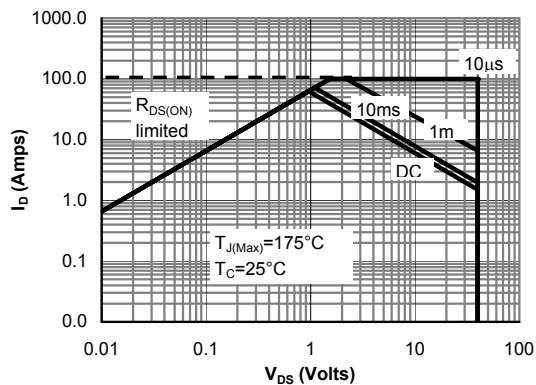


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

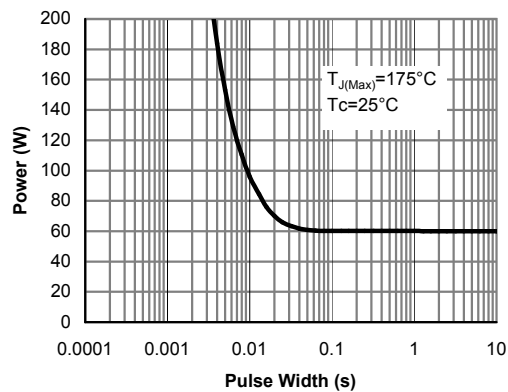


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

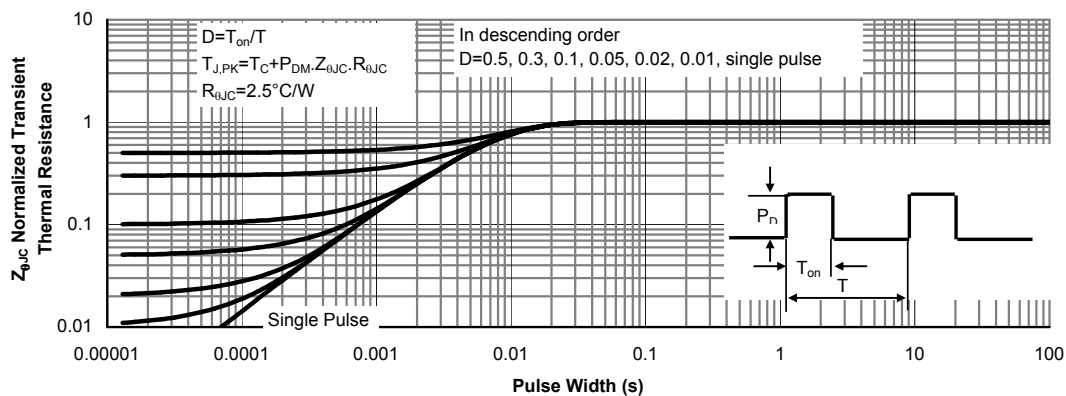


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

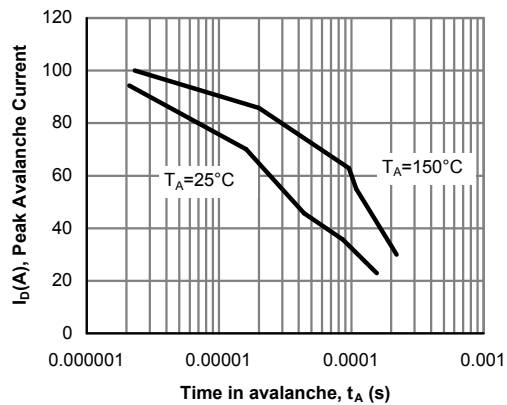


Figure 12: Single Pulse Avalanche capability

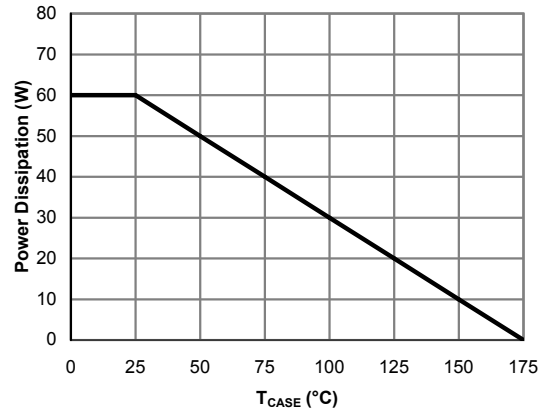


Figure 13: Power De-rating (Note B)

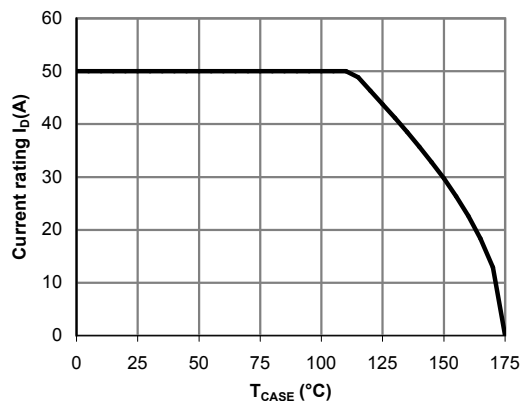


Figure 14: Current De-rating (Note B)

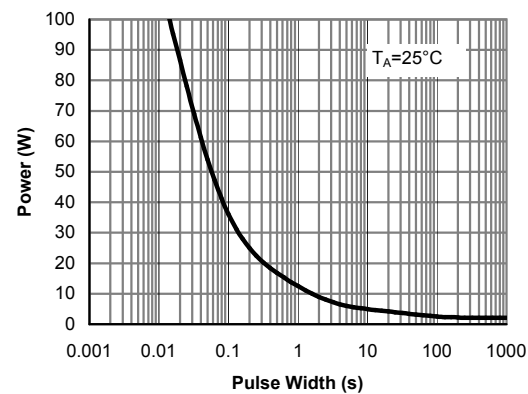


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note G)

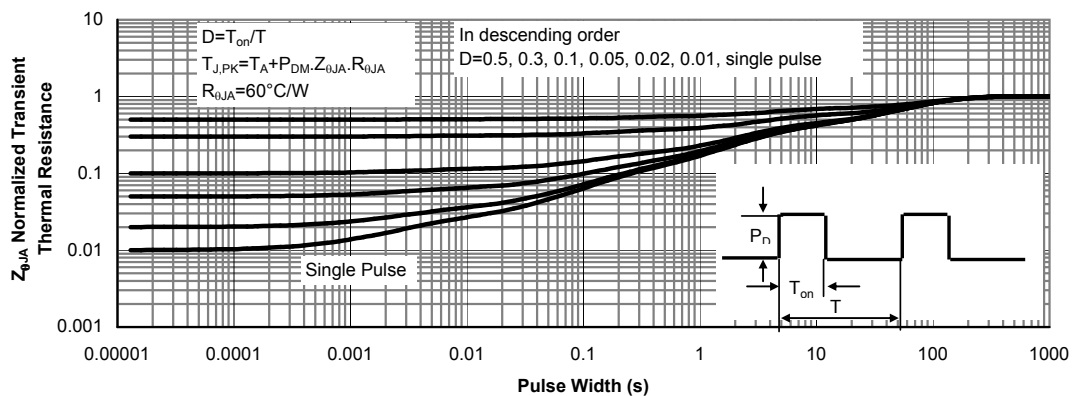
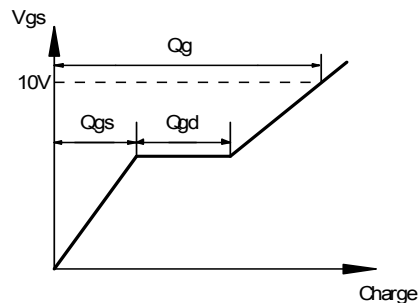
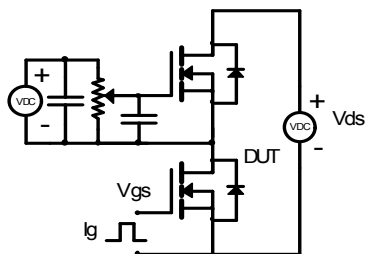
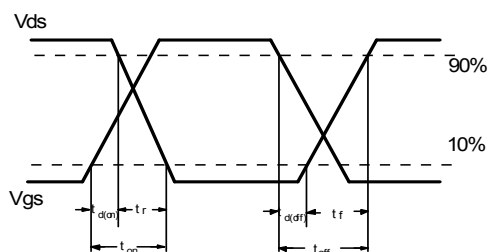
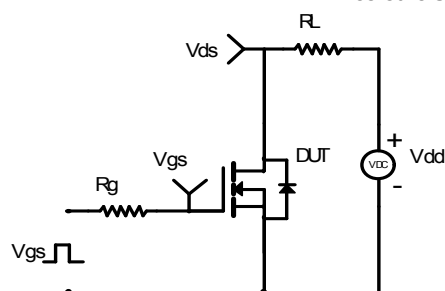


Figure 16: Normalized Maximum Transient Thermal Impedance (Note G)

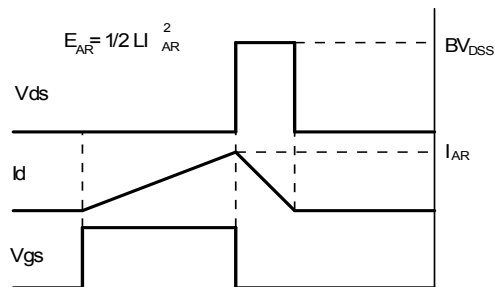
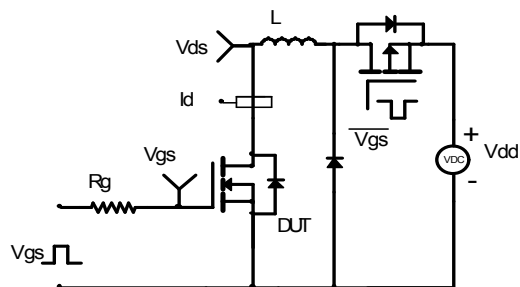
Gate Charge Test Circuit &amp; Waveform



Resistive Switching Test Circuit &amp; Waveforms



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



Diode Recovery Test Circuit &amp; Waveforms

