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**ALPHA & OMEGA**  
SEMICONDUCTOR

**AON6974A**

**30V Dual Asymmetric N-Channel AlphaMOS**

### General Description

- Latest Trench Power AlphaMOS (αMOS LV) technology
- Integrated Schottky Diode (SRFET) on Low-Side
- Very Low RDS(on) at 4.5V<sub>GS</sub>
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

### Application

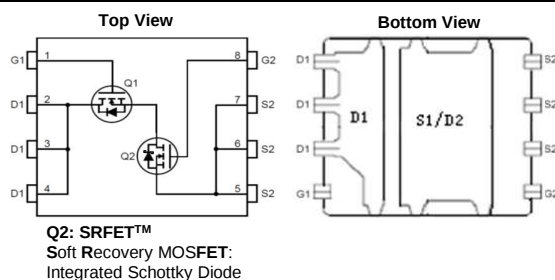
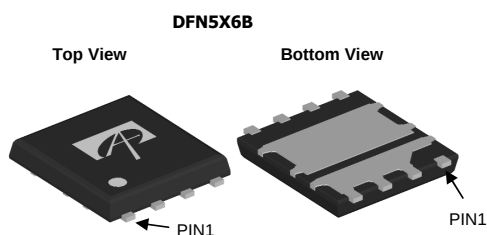
- DC/DC Converters in Computing, Servers, and POL
- Isolated DC/DC Converters in Telecom and Industrial

### Product Summary

|                                                | <b>Q1</b> | <b>Q2</b> |
|------------------------------------------------|-----------|-----------|
| V <sub>DS</sub>                                | 30V       | 30V       |
| I <sub>D</sub> (at V <sub>GS</sub> =10V)       | 28A       | 32A       |
| R <sub>DS(ON)</sub> (at V <sub>GS</sub> =10V)  | <5.2mΩ    | <3.3mΩ    |
| R <sub>DS(ON)</sub> (at V <sub>GS</sub> =4.5V) | <9.5mΩ    | <5.0mΩ    |

100% UIS Tested

100% Rg Tested



### Absolute Maximum Ratings T<sub>A</sub>=25°C unless otherwise noted

| Parameter                              |                       | Symbol                            | Max Q1     | Max Q2 | Units |
|----------------------------------------|-----------------------|-----------------------------------|------------|--------|-------|
| Drain-Source Voltage                   |                       | V <sub>DS</sub>                   | 30         |        | V     |
| Gate-Source Voltage                    |                       | V <sub>GS</sub>                   | ±20        | ±20    | V     |
| Continuous Drain Current <sup>G</sup>  | T <sub>C</sub> =25°C  | I <sub>D</sub>                    | 28         | 32     | A     |
|                                        | T <sub>C</sub> =100°C |                                   | 22         | 25     |       |
| Pulsed Drain Current <sup>C</sup>      |                       | I <sub>DM</sub>                   | 112        | 144    |       |
| Continuous Drain Current               | T <sub>A</sub> =25°C  | I <sub>DSM</sub>                  | 22         | 30     | A     |
|                                        | T <sub>A</sub> =70°C  |                                   | 17         | 24     |       |
| Avalanche Current <sup>C</sup>         |                       | I <sub>AS</sub>                   | 32         | 50     | A     |
| Avalanche Energy L=0.05mH <sup>C</sup> |                       | E <sub>AS</sub>                   | 26         | 63     | mJ    |
| V <sub>DS</sub> Spike                  | 100ns                 | V <sub>SPIKE</sub>                | 36         | 36     | V     |
| Power Dissipation <sup>B</sup>         | T <sub>C</sub> =25°C  | P <sub>D</sub>                    | 31         | 33     | W     |
|                                        | T <sub>C</sub> =100°C |                                   | 12         | 13     |       |
| Power Dissipation <sup>A</sup>         | T <sub>A</sub> =25°C  | P <sub>DSM</sub>                  | 3.6        | 4.3    | W     |
|                                        | T <sub>A</sub> =70°C  |                                   | 2.3        | 2.7    |       |
| Junction and Storage Temperature Range |                       | T <sub>J</sub> , T <sub>STG</sub> | -55 to 150 |        | °C    |

### Thermal Characteristics

| Parameter                                  | Symbol           | Typ Q1 | Typ Q2 | Max Q1 | Max Q2 | Units |
|--------------------------------------------|------------------|--------|--------|--------|--------|-------|
| Maximum Junction-to-Ambient <sup>A</sup>   | R <sub>θJA</sub> | 29     | 24     | 35     | 29     | °C/W  |
| t ≤ 10s                                    |                  |        |        |        |        |       |
| Maximum Junction-to-Ambient <sup>A,D</sup> | R <sub>θJA</sub> | 56     | 50     | 67     | 60     | °C/W  |
| Steady-State                               |                  |        |        |        |        |       |
| Maximum Junction-to-Case                   | R <sub>θJC</sub> | 3.3    | 3      | 4      | 3.8    | °C/W  |
| Steady-State                               |                  |        |        |        |        |       |

**Q1 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> = ±20V                                                |     |          | ±100       | nA    |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage                             | V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA                                     | 1.4 | 1.8      | 2.2        | V     |
| 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                         |     | 4.3<br>6 | 5.2<br>7.2 | mΩ    |
|                             |                                                    | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A                                                 |     | 7        | 9.5        | mΩ    |
| g <sub>FS</sub>             | Forward Transconductance                           | V <sub>DS</sub> =5V, I <sub>D</sub> =20A                                                   |     | 91       |            | 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>G</sup> |                                                                                            |     |          | 28         | A     |
| <b>DYNAMIC PARAMETERS</b>   |                                                    |                                                                                            |     |          |            |       |
| C <sub>iss</sub>            | Input Capacitance                                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz                                          |     | 1037     |            | pF    |
| C <sub>oss</sub>            | Output Capacitance                                 |                                                                                            |     | 441      |            | 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                                           | 0.7 | 1.5      | 2.3        | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                                    |                                                                                            |     |          |            |       |
| Q <sub>g</sub> (10V)        | Total Gate Charge                                  | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =20A                            |     | 15.5     | 22         | nC    |
| Q <sub>g</sub> (4.5V)       | Total Gate Charge                                  |                                                                                            |     | 6.8      | 10         | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                                 |                                                                                            |     | 3.0      |            | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                                  |                                                                                            |     | 3.6      |            | 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 |     | 5.5      |            | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                                  |                                                                                            |     | 3.3      |            | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                                 |                                                                                            |     | 18       |            | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                                 |                                                                                            |     | 4.3      |            | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time                   | I <sub>F</sub> =20A, dI/dt=500A/μs                                                         |     | 12.7     |            | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge                 | I <sub>F</sub> =20A, dI/dt=500A/μs                                                         |     | 17.2     |            | 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> ≤ 10s and the maximum allowed junction temperature of 150° 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 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. 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.

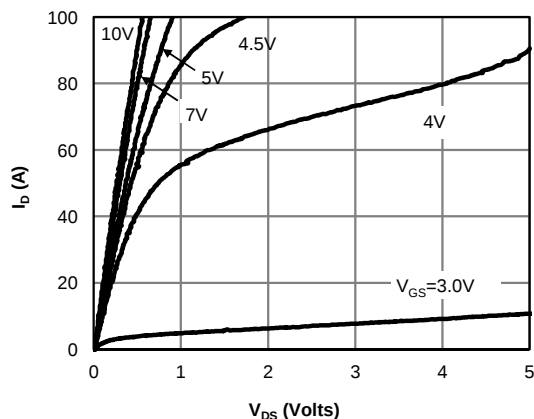
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

G. The maximum current rating is limited by package.

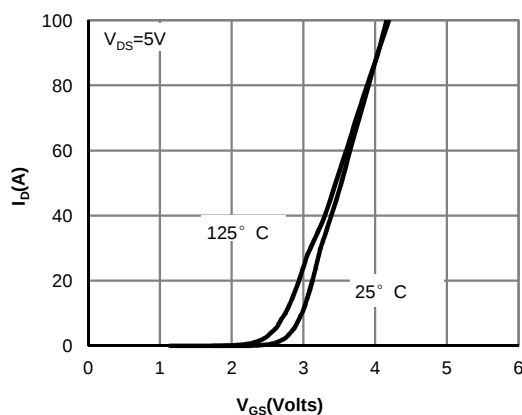
H. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C.

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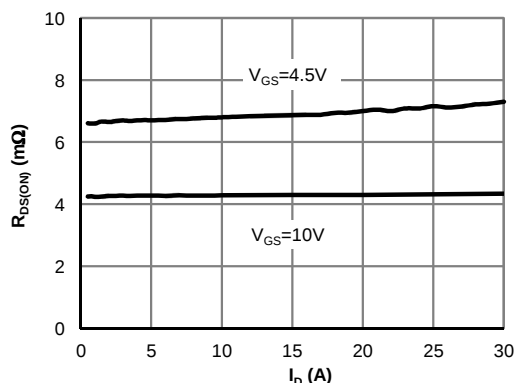
**Q1-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



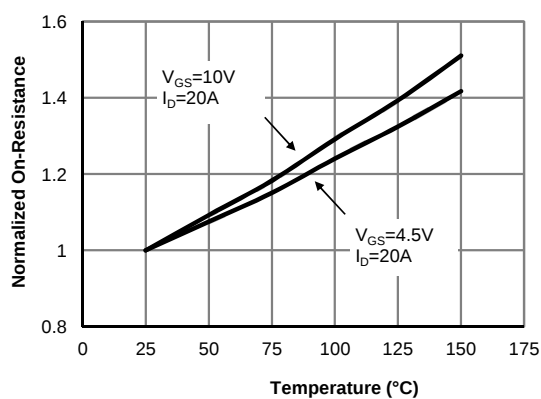
**Figure 1: On-Region Characteristics (Note E)**



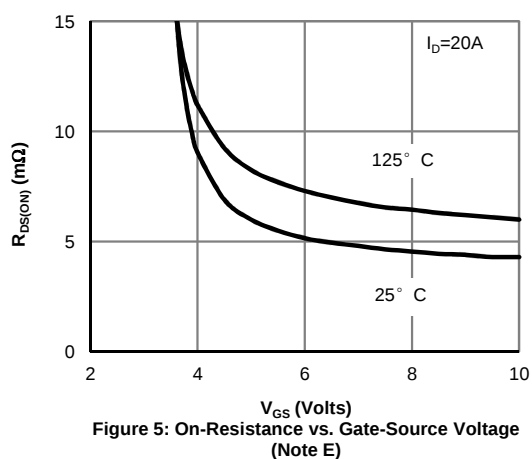
**Figure 2: Transfer Characteristics (Note E)**



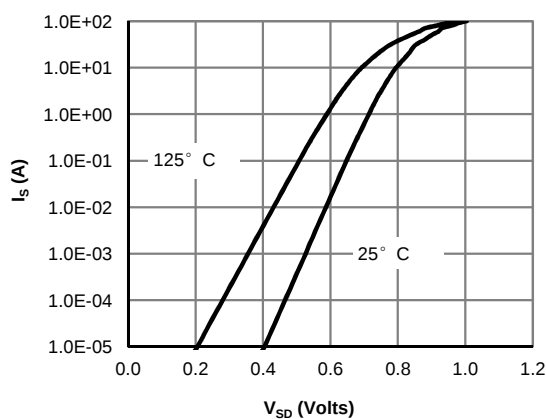
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**



**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)**

**Q1-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

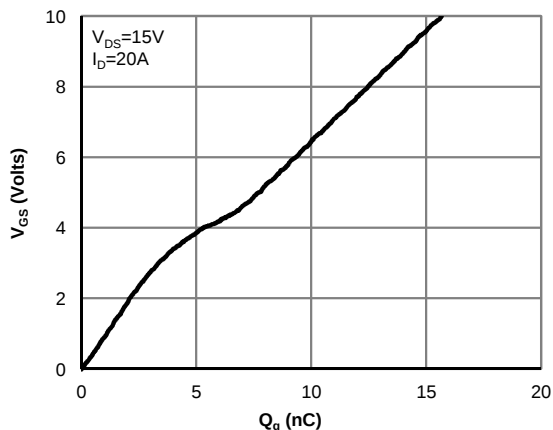


Figure 7: Gate-Charge Characteristics

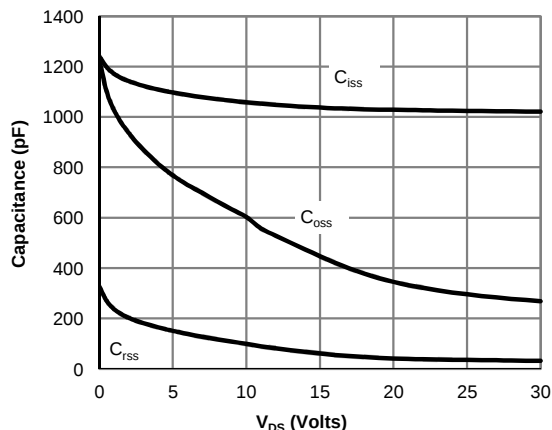


Figure 8: Capacitance Characteristics

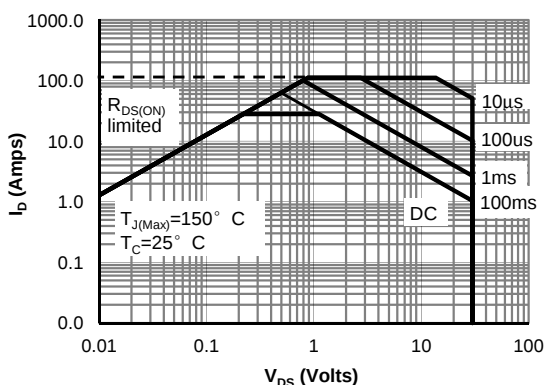


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

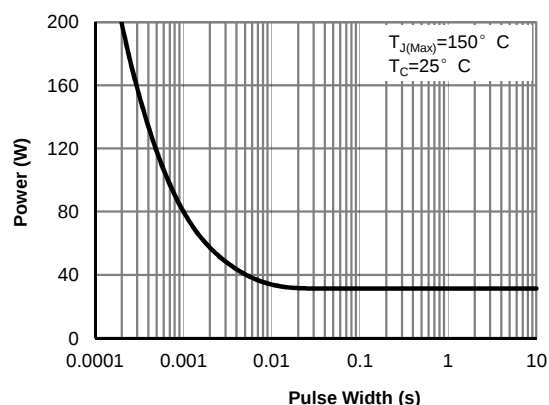


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

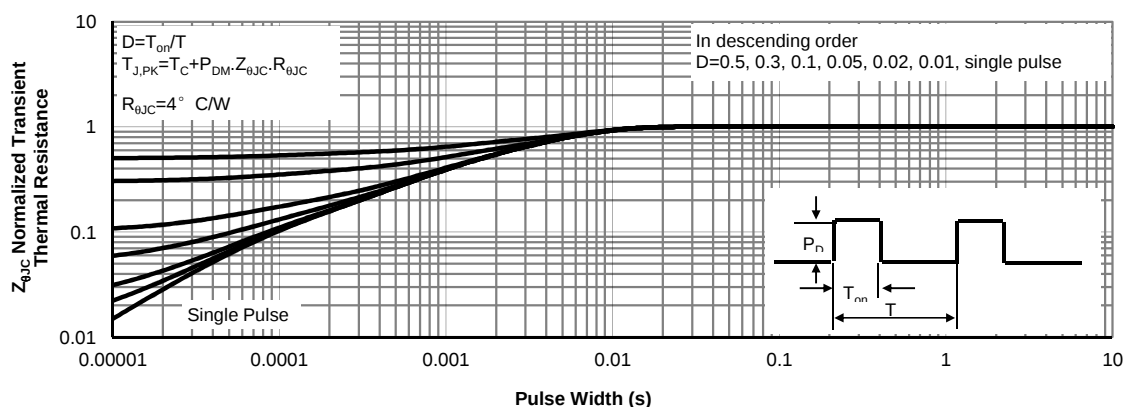


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

**Q1-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

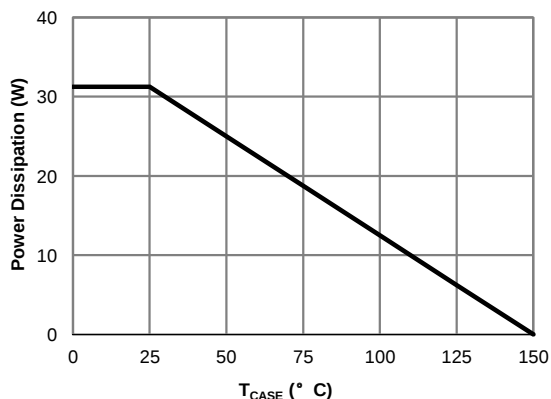


Figure 12: Power De-rating (Note F)

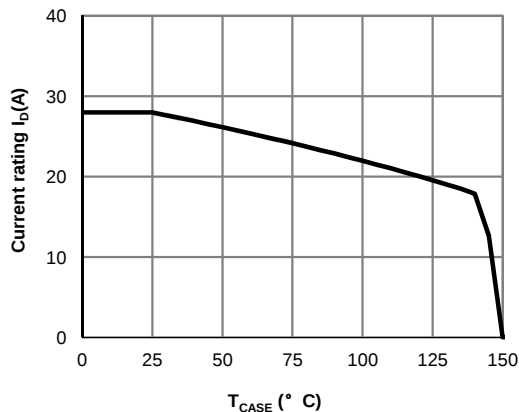


Figure 13: Current De-rating (Note F)

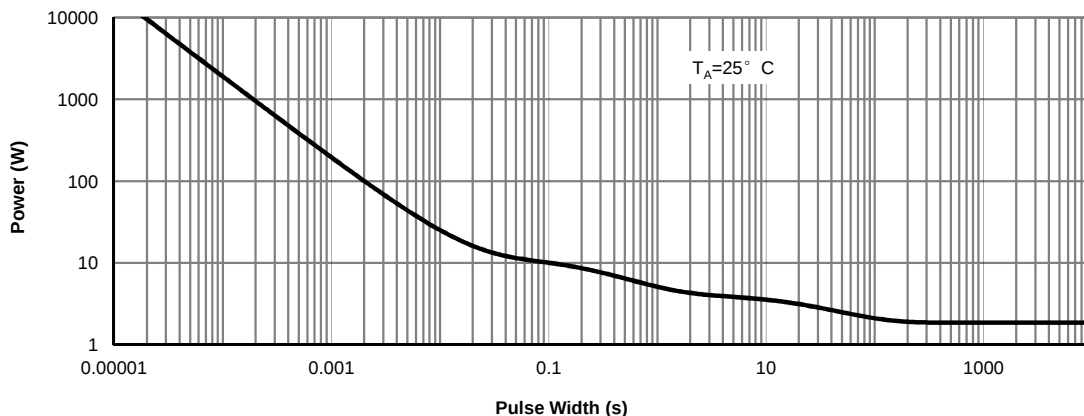


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

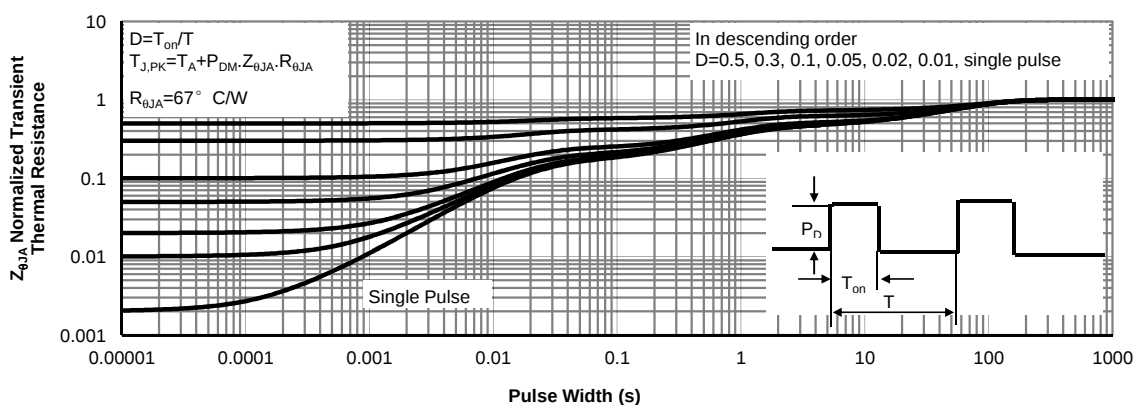


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

**Q2 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> =10mA, 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                          |     |            | 0.5<br>100 | mA    |
| I <sub>GSS</sub>            | Gate-Body leakage current                          | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                                 |     |            | ±100       | nA    |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage                             | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                   | 1.4 | 1.8        | 2.2        | V     |
| 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                         |     | 2.7<br>3.7 | 3.3<br>4.5 | mΩ    |
|                             |                                                    | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A                                                 |     | 3.9        | 5          | mΩ    |
| g <sub>FS</sub>             | Forward Transconductance                           | V <sub>DS</sub> =5V, I <sub>D</sub> =20A                                                   |     | 85         |            | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                              | I <sub>S</sub> =1A, V <sub>GS</sub> =0V                                                    |     | 0.48       | 0.6        | V     |
| I <sub>S</sub>              | Maximum Body-Diode Continuous Current <sup>G</sup> |                                                                                            |     |            | 36         | A     |
| <b>DYNAMIC PARAMETERS</b>   |                                                    |                                                                                            |     |            |            |       |
| C <sub>iss</sub>            | Input Capacitance                                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz                                          |     | 1975       |            | pF    |
| C <sub>oss</sub>            | Output Capacitance                                 |                                                                                            |     | 913        |            | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance                       |                                                                                            |     | 92         |            | pF    |
| R <sub>g</sub>              | Gate resistance                                    | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                           | 0.7 | 1.5        | 2.3        | 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> =20A                            |     | 29         | 40         | nC    |
| Q <sub>g(4.5V)</sub>        | Total Gate Charge                                  |                                                                                            |     | 13.6       | 19         | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                                 |                                                                                            |     | 5.8        |            | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                                  |                                                                                            |     | 5.3        |            | 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 |     | 7.9        |            | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                                  |                                                                                            |     | 4.0        |            | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                                 |                                                                                            |     | 27.3       |            | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                                 |                                                                                            |     | 6.5        |            | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time                   | I <sub>F</sub> =20A, dI/dt=500A/μs                                                         |     | 19         |            | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge                 | I <sub>F</sub> =20A, dI/dt=500A/μs                                                         |     | 36.7       |            | 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> ≤ 10s and the maximum allowed junction temperature of 150° 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 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. 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.

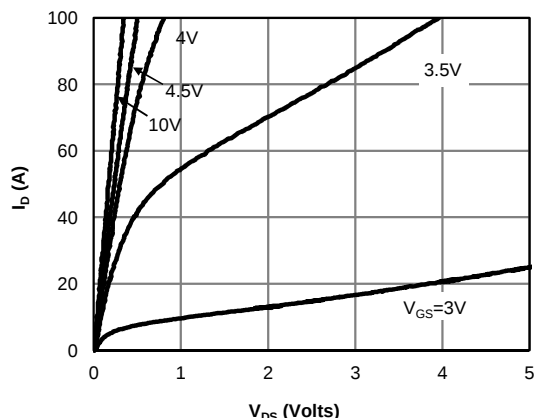
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

G. The maximum current rating is limited by package.

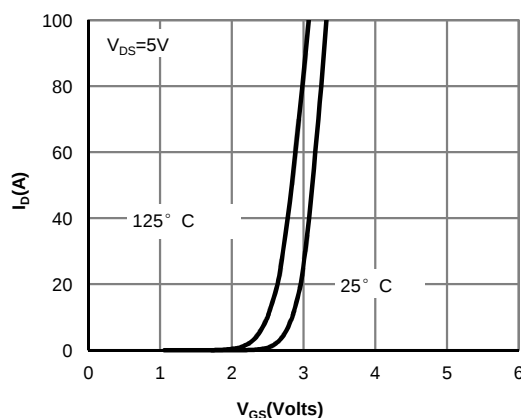
H. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C.

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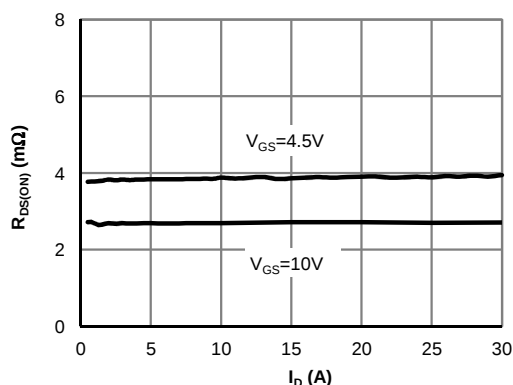
**Q2-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



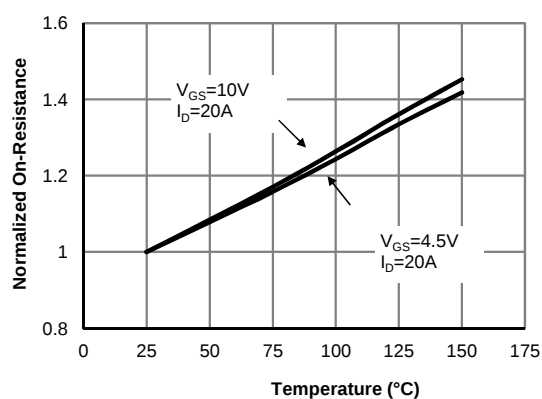
**Fig 1: On-Region Characteristics (Note E)**



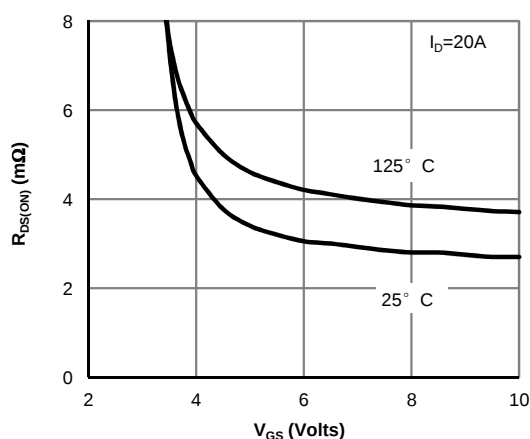
**Figure 2: Transfer Characteristics (Note E)**



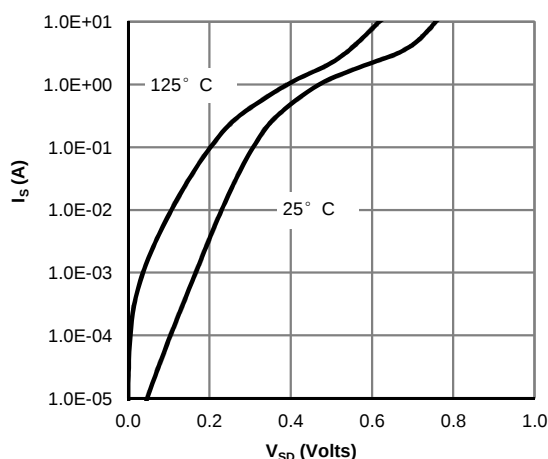
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**



**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)**

**Q2-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

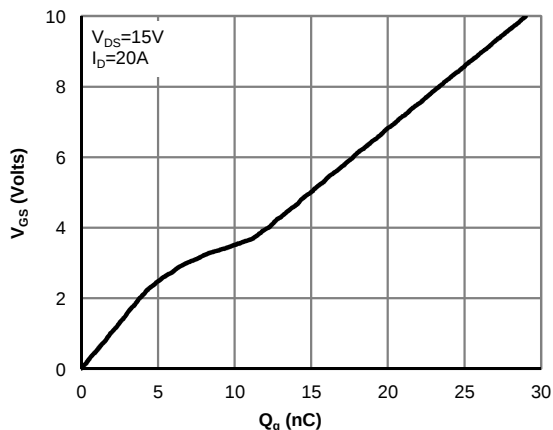


Figure 7: Gate-Charge Characteristics

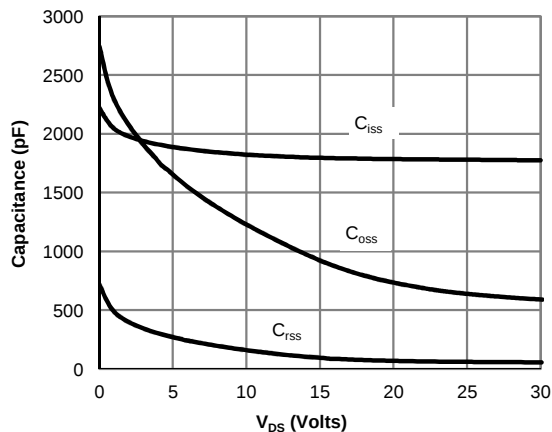


Figure 8: Capacitance Characteristics

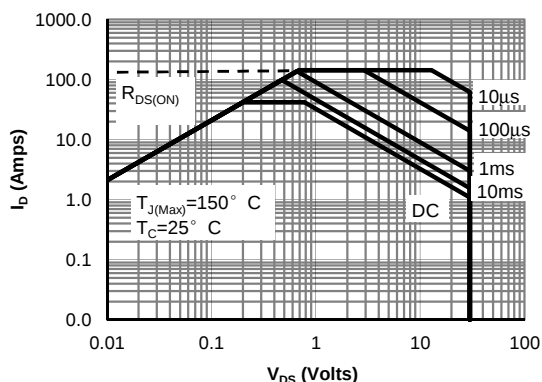


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

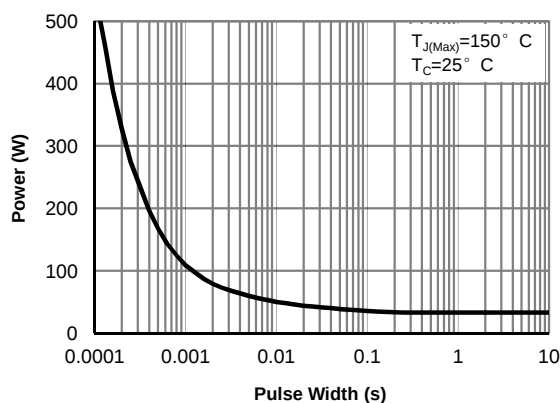


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

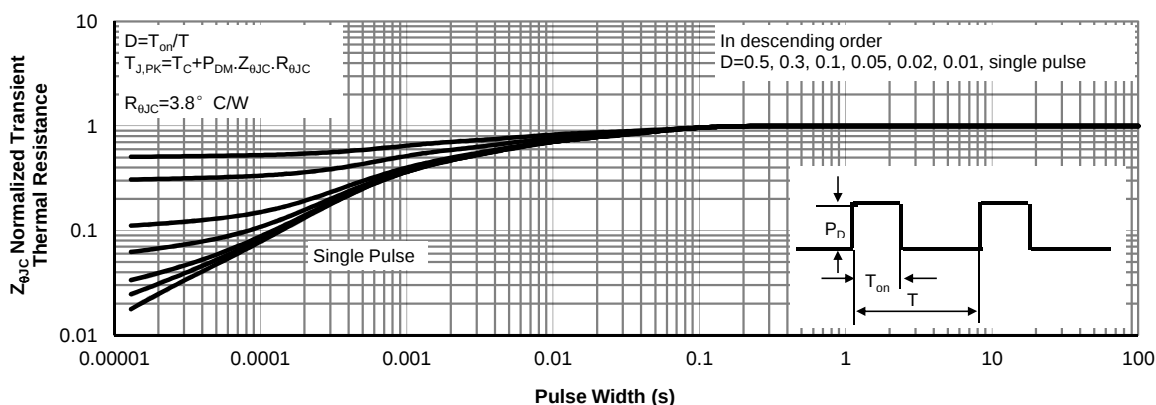


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

**Q2-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

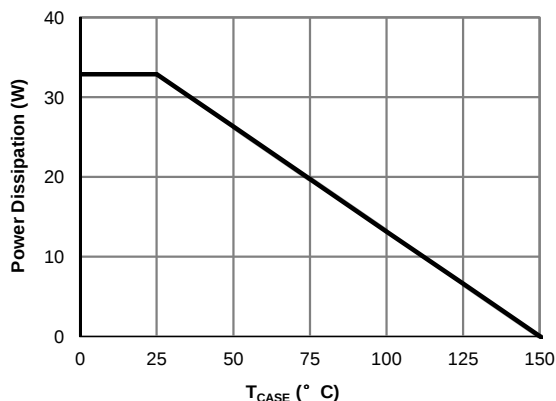


Figure 12: Power De-rating (Note F)

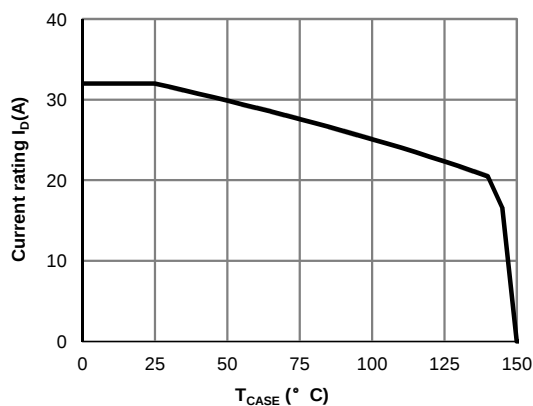


Figure 13: Current De-rating (Note F)

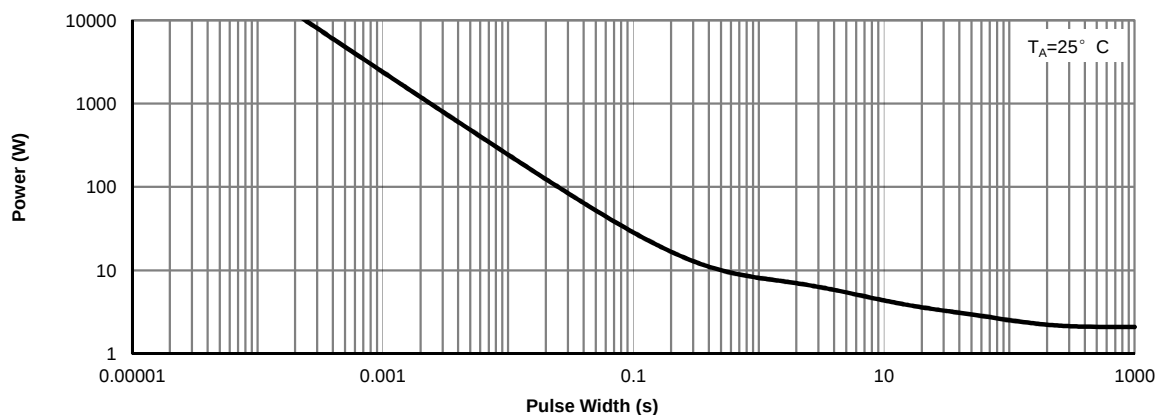


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

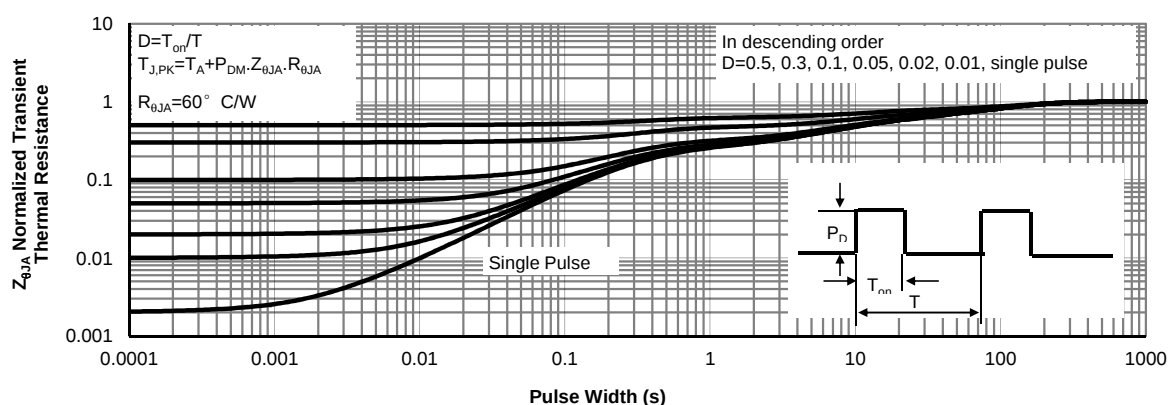
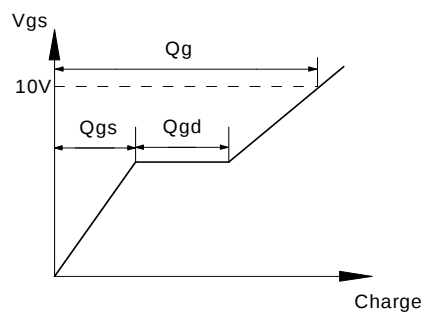
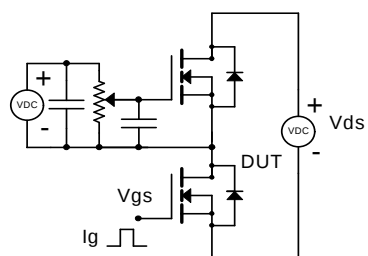
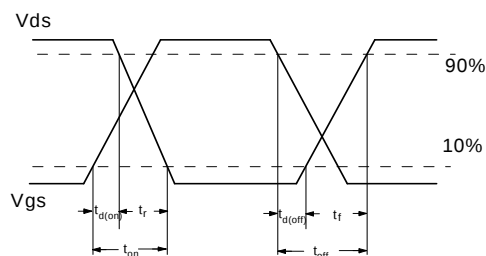
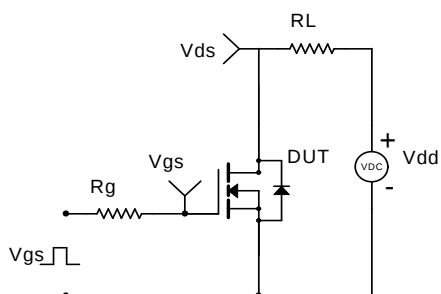


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

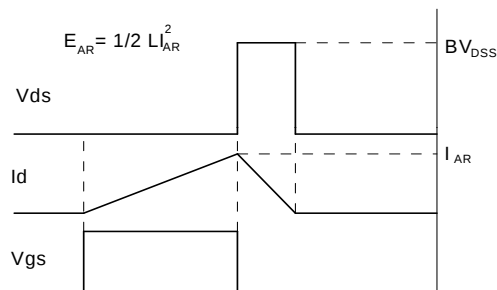
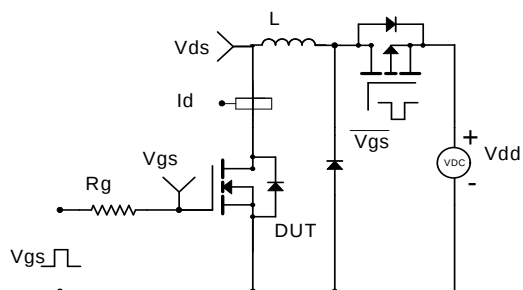
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

