# AON7934

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

## General Description

• Latest Trench Power AlphaMOS (αMOS LV) technology
• Very Low RDS(on) at 4.5$V_{GS}$
• Low Gate Charge
• High Current Capability
• RoHS and Halogen-Free Compliant

## Application

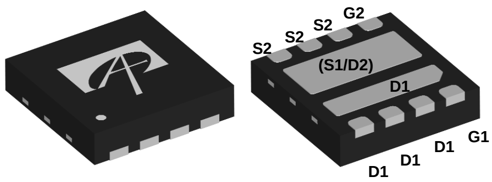
• DC/DC Converters in Computing, Servers, and POL
• Isolated DC/DC Converters in Telecom and Industrial

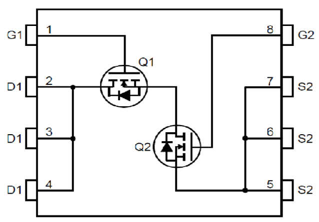
## Product Summary

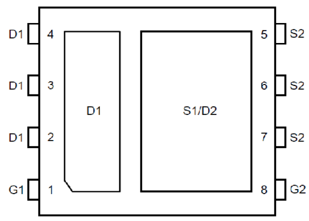
| | Q1 | Q2 |
|---|---|---|
| $V_{DS}$ | 30V | 30V |
| $I_D$ (at $V_{GS}$=10V) | 16A | 18A |
| $R_{DS(ON)}$ (at $V_{GS}$=10V) | <10.2mΩ | <7.7mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$ = 4.5V) | <15.8mΩ | <11.6mΩ |

100% UIS Tested
100% Rg Tested

**Power DFN3x3A**




**Absolute Maximum Ratings $T_A$=25℃ unless otherwise noted**

| Parameter | | Symbol | Max Q1 | Max Q2 | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 30 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | ±20 | V |
| Continuous Drain Current [G] | $T_C$=25℃ | $I_D$ | 16 | 18 | A |
| | $T_C$=100℃ | | 12 | 14 | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 64 | 72 | |
| Continuous Drain Current | $T_A$=25℃ | $I_{DSM}$ | 13 | 15 | A |
| | $T_A$=70℃ | | 7.8 | 9 | |
| Avalanche Current [C] | | $I_{AS}$ | 19 | 25 | A |
| Avalanche Energy L=0.05mH [C] | | $E_{AS}$ | 9 | 16 | mJ |
| $V_{DS}$ Spike | 100ns | $V_{SPIKE}$ | 36 | 36 | V |
| Power Dissipation [B] | $T_C$=25℃ | $P_D$ | 23 | 25 | W |
| | $T_C$=100℃ | | 9 | 10 | |
| Power Dissipation [A] | $T_A$=25℃ | $P_{DSM}$ | 2.5 | 2.5 | W |
| | $T_A$=70℃ | | 0.9 | 0.9 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | | ℃ |

**Thermal Characteristics**

| Parameter | | Symbol | Typ Q1 | Max Q1 | Typ Q2 | Max Q2 | Units |
|---|---|---|---|---|---|---|---|
| Maximum Junction-to-Ambient [A] | t ≤ 10s | $R_{\theta JA}$ | 40 | 50 | 40 | 50 | ℃/W |
| Maximum Junction-to-Ambient [A D] | Steady-State | | 70 | 90 | 70 | 90 | ℃/W |
| Maximum Junction-to-Case | Steady-State | $R_{\theta JC}$ | 4.5 | 5.4 | 4.2 | 5 | ℃/W |

**Q1 Electrical Characteristics ($T_J$=25°C unless otherwise noted)**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **STATIC PARAMETERS** | | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $I_D$=250µA, $V_{GS}$=0V | | 30 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=30V, $V_{GS}$=0V | | | | 1 | µA |
| | | | $T_J$=55°C | | | 5 | |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$=0V, $V_{GS}$= ±20V | | | | 100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ $I_D$=250µA | | 1.2 | 1.8 | 2.2 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=13A | | | 8.3 | 10.2 | mΩ |
| | | | $T_J$=125°C | | 11.2 | 13.7 | |
| | | $V_{GS}$=4.5V, $I_D$=10A | | | 12.4 | 15.8 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=13A | | | 50 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A,$V_{GS}$=0V | | | 0.7 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current[G] | | | | | 16 | A |
| **DYNAMIC PARAMETERS** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=15V, f=1MHz | | | 485 | | pF |
| $C_{oss}$ | Output Capacitance | | | | 235 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | | 32 | | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | | 0.9 | 1.8 | 2.7 | Ω |
| **SWITCHING PARAMETERS** | | | | | | | |
| $Q_g$(10V) | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=15V, $I_D$=13A | | | 8 | 11 | nC |
| $Q_g$(4.5V) | Total Gate Charge | | | | 3.9 | 5.3 | nC |
| $Q_{gs}$ | Gate Source Charge | | | | 1.1 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | | 2.1 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=15V, $R_L$=1.2Ω, $R_{GEN}$=3Ω | | | 3.5 | | ns |
| $t_r$ | Turn-On Rise Time | | | | 2.8 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | | 16.3 | | ns |
| $t_f$ | Turn-Off Fall Time | | | | 3 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=13A, dI/dt=500A/µs | | | 9.9 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=13A, dI/dt=500A/µs | | | 12.9 | | nC |

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in[2] FR-4 board with 2oz. Copper, in a still air environment with $T_A$ =25° C. The Power dissipation $P_{DSM}$ is based on $R_{\theta JA}$ t≤ 10s value 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 $P_D$ is based on $T_{J(MAX)}$=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 $T_{J(MAX)}$=150° C. Ratings are based on low frequency and duty cycles to keep initial $T_J$ =25° C.
D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to case $R_{\theta JC}$ 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 impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=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[2] FR-4 board with 2oz. Copper, in a still air environment with TA=25° C.

## Q1-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

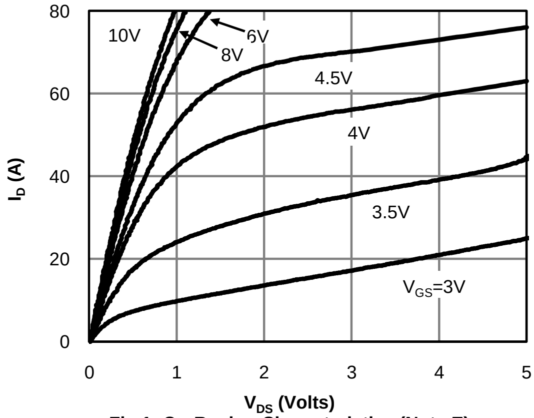


Fig 1: On-Region Characteristics (Note E)

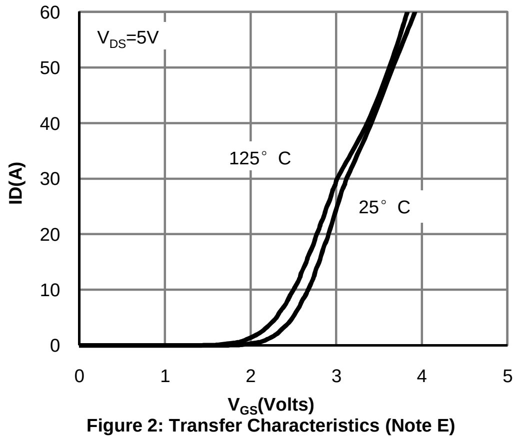


Figure 2: Transfer Characteristics (Note E)

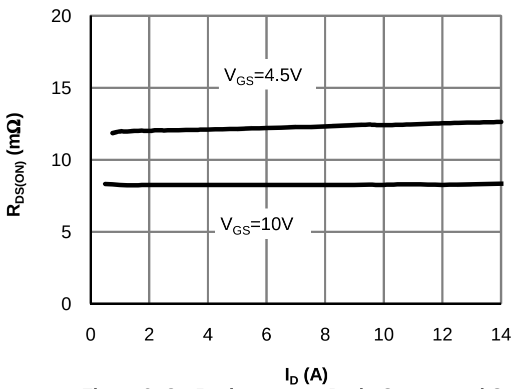


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

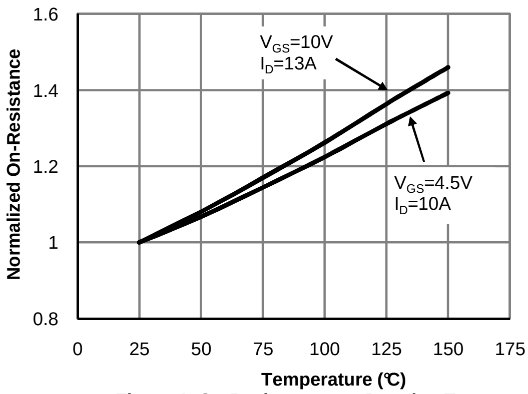


Figure 4: On-Resistance vs. Junction Temperature (Note E)

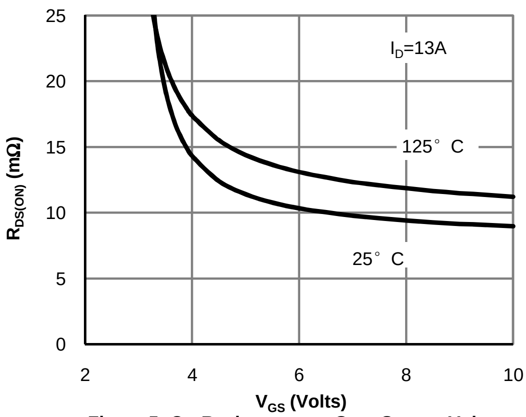


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

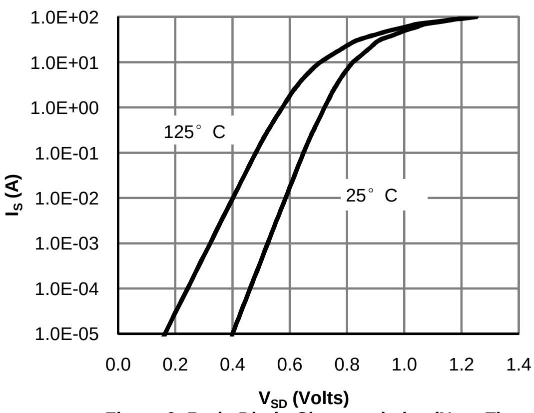


Figure 6: Body-Diode Characteristics (Note E)

## Q1-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

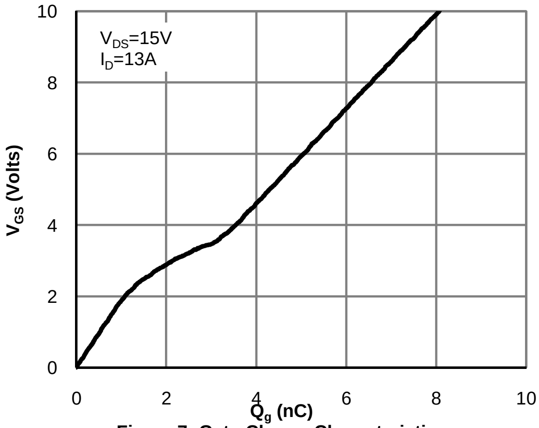


Figure 7: Gate-Charge Characteristics

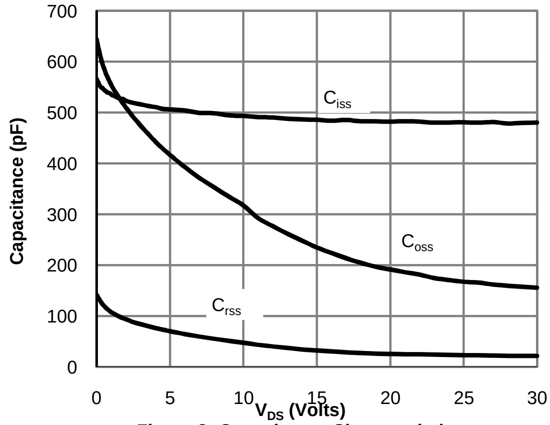


Figure 8: Capacitance Characteristics

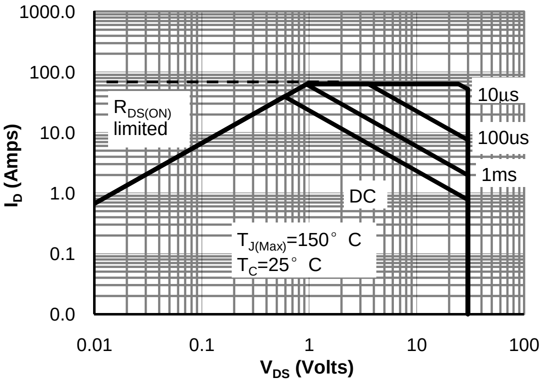


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

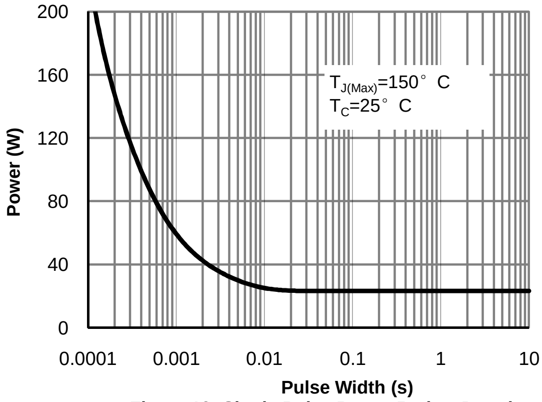


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

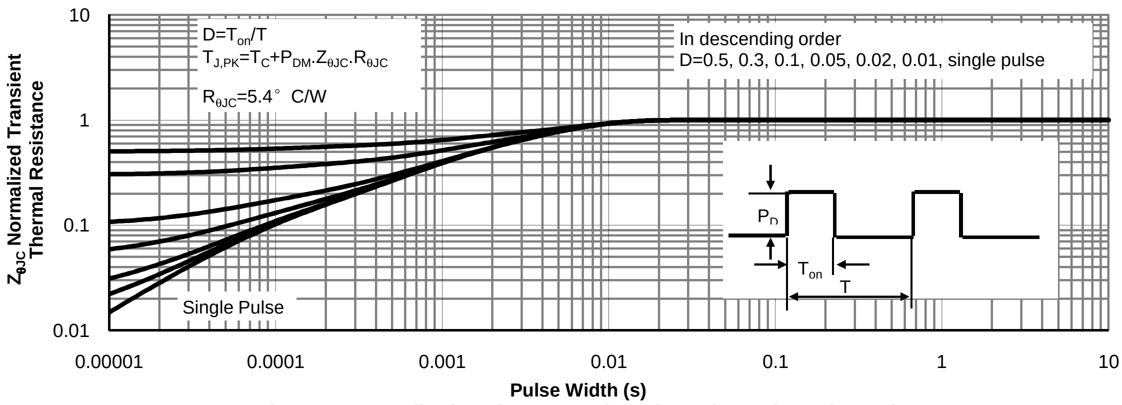


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

## Q1-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

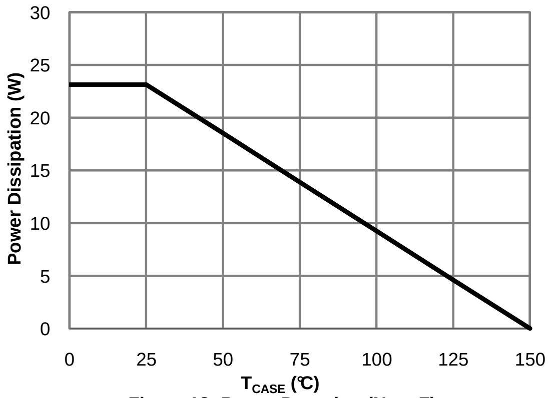


Figure 12: Power De-rating (Note F)

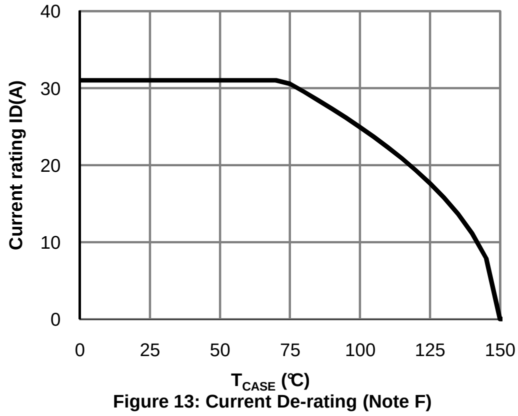


Figure 13: Current De-rating (Note F)

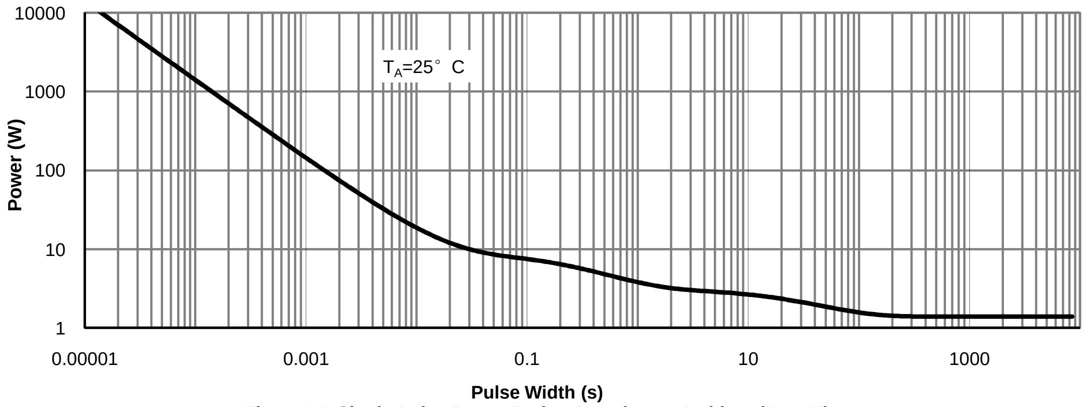


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

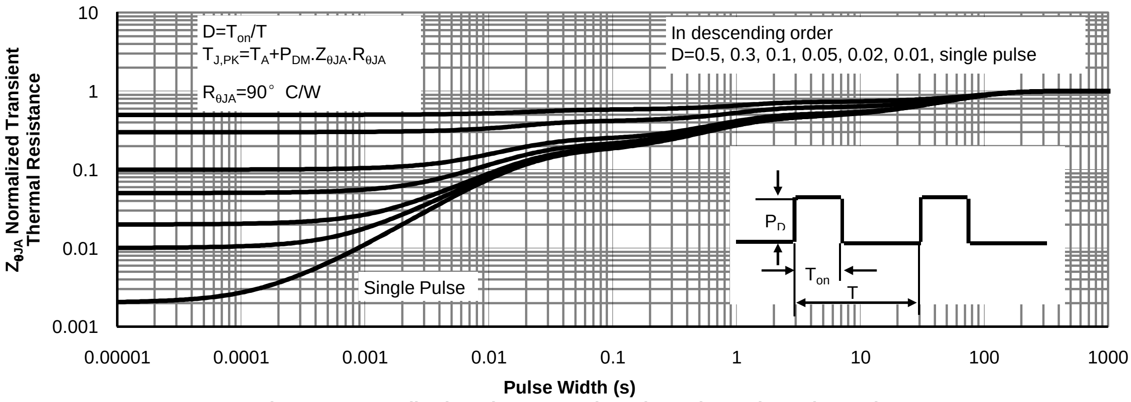


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

**Q2 Electrical Characteristics ($T_J$=25°C unless otherwise noted)**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **STATIC PARAMETERS** | | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $I_D$=250µA, $V_{GS}$=0V | | 30 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=30V, $V_{GS}$=0V | | | | 1 | µA |
| | | | $T_J$=55°C | | | 5 | |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$=0V, $V_{GS}$= ±20V | | | | 100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ $I_D$=250µA | | 1.2 | 1.8 | 2.2 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=15A | | | 6.3 | 7.7 | mΩ |
| | | | $T_J$=125°C | | 8.4 | 10.3 | |
| | | $V_{GS}$=4.5V, $I_D$=10A | | | 9.1 | 11.6 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=15A | | | 100 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A,$V_{GS}$=0V | | | 0.7 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current[G] | | | | | 18 | A |
| **DYNAMIC PARAMETERS** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=15V, f=1MHz | | | 807 | | pF |
| $C_{oss}$ | Output Capacitance | | | | 314 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | | 40 | | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | | 0.6 | 1.3 | 2 | Ω |
| **SWITCHING PARAMETERS** | | | | | | | |
| $Q_g$(10V) | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=15V, $I_D$=15A | | | 12.9 | 17.5 | nC |
| $Q_g$(4.5V) | Total Gate Charge | | | | 6 | 8.5 | nC |
| $Q_{gs}$ | Gate Source Charge | | | | 2.1 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | | 3 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=15V, $R_L$=1Ω, $R_{GEN}$=3Ω | | | 4.8 | | ns |
| $t_r$ | Turn-On Rise Time | | | | 3.3 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | | 18.8 | | ns |
| $t_f$ | Turn-Off Fall Time | | | | 3.3 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=15A, dI/dt=500A/µs | | | 11.3 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=15A, dI/dt=500A/µs | | | 15 | | nC |

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A$ =25° C. The Power dissipation $P_{DSM}$ is based on R $_{\theta JA}$ t≤ 10s value 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 $P_D$ is based on $T_{J(MAX)}$=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 $T_{J(MAX)}$=150° C. Ratings are based on low frequency and duty cycles to keep initial $T_J$ =25° C.
D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to case $R_{\theta JC}$ 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 impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.
G. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25° C.

## Q2-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

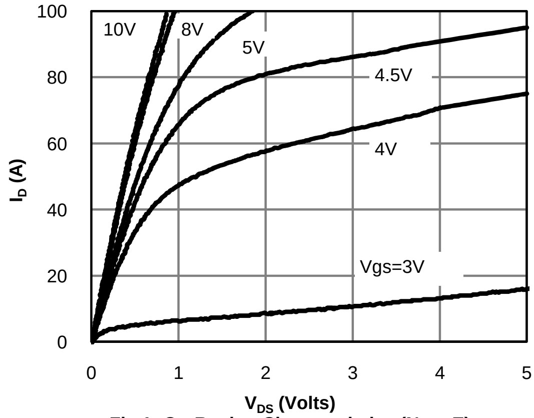



Fig 1: On-Region Characteristics (Note E)

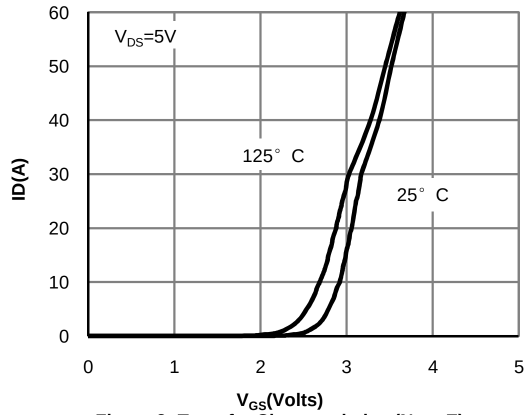



Figure 2: Transfer Characteristics (Note E)

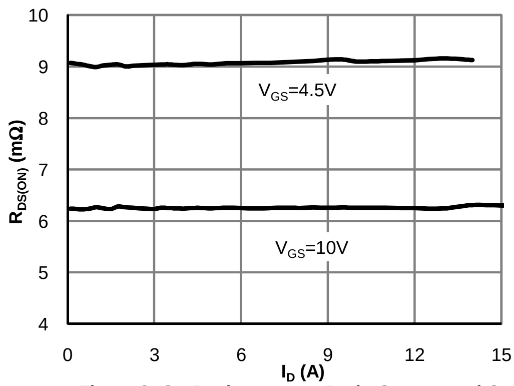



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

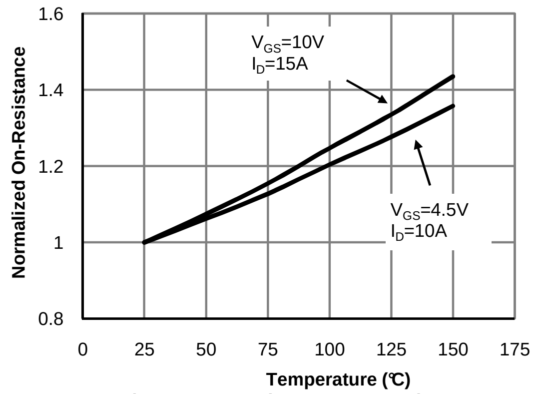



Figure 4: On-Resistance vs. Junction Temperature (Note E)

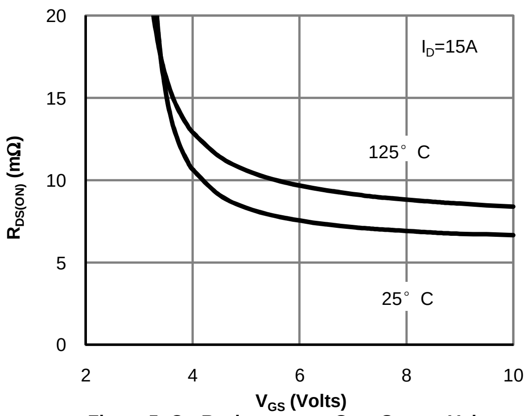



Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

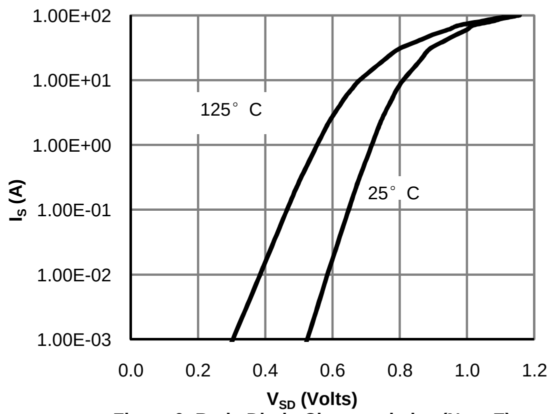



Figure 6: Body-Diode Characteristics (Note E)

## Q2-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

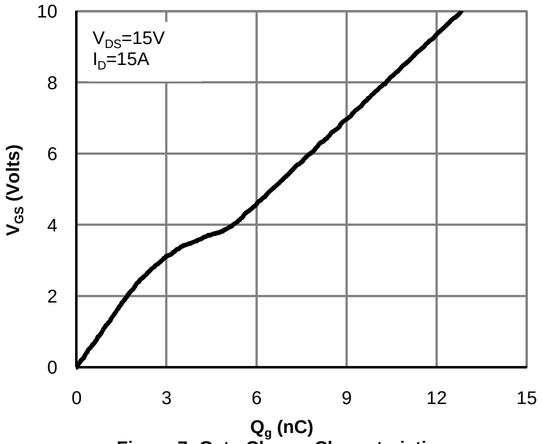


Figure 7: Gate-Charge Characteristics

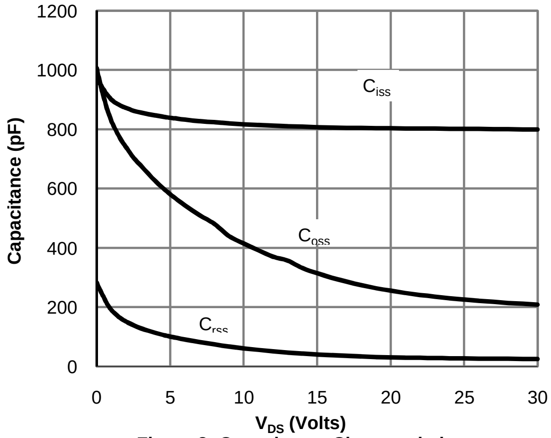


Figure 8: Capacitance Characteristics

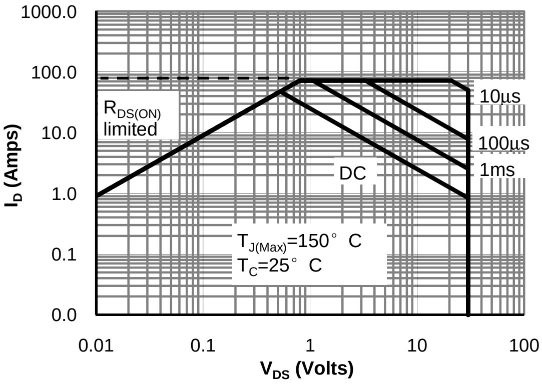


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

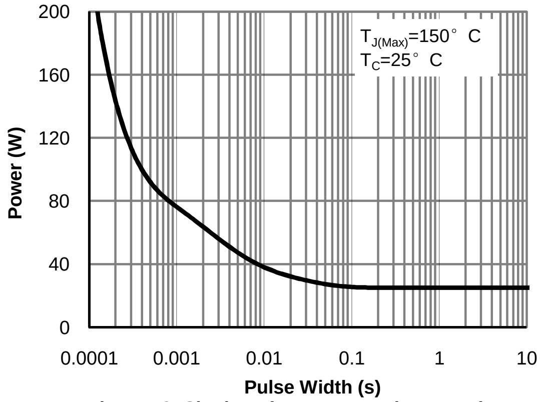


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

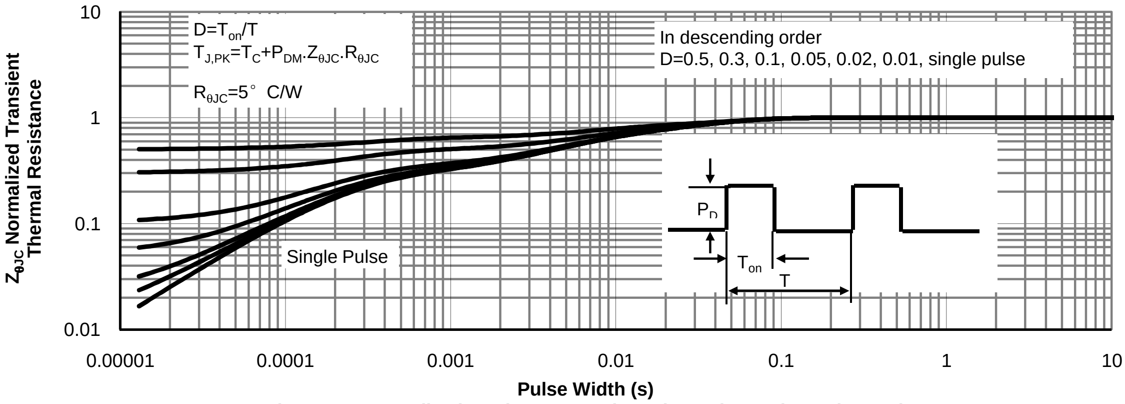


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

## Q2-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

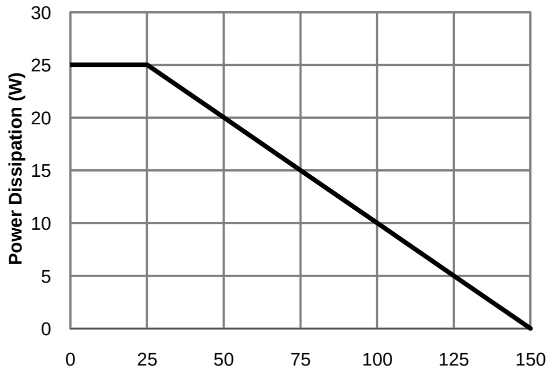



Figure 12: Power De-rating (Note F)

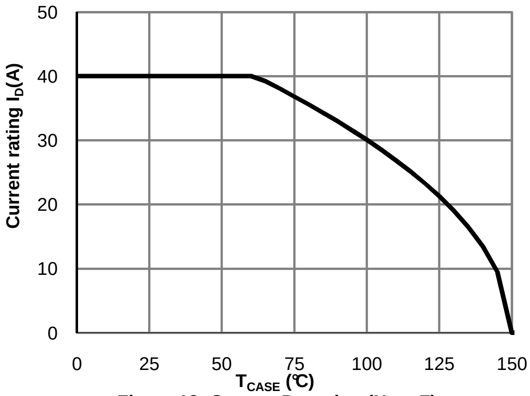



Figure 13: Current De-rating (Note F)

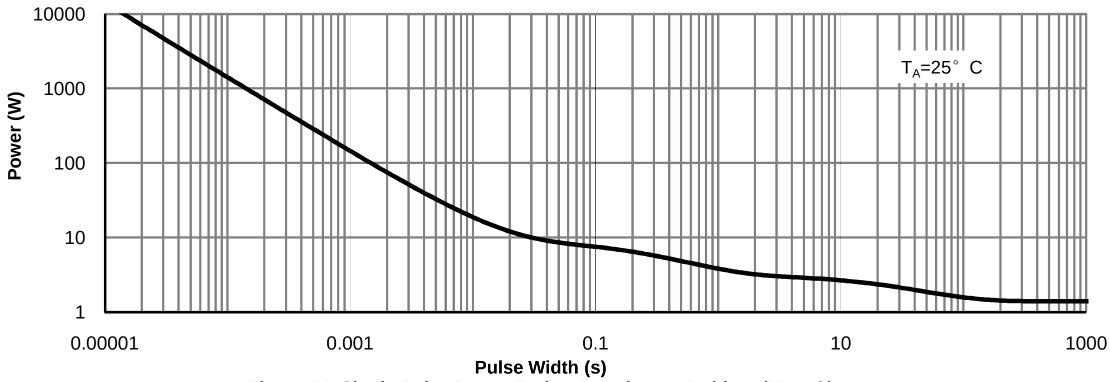



Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note G)

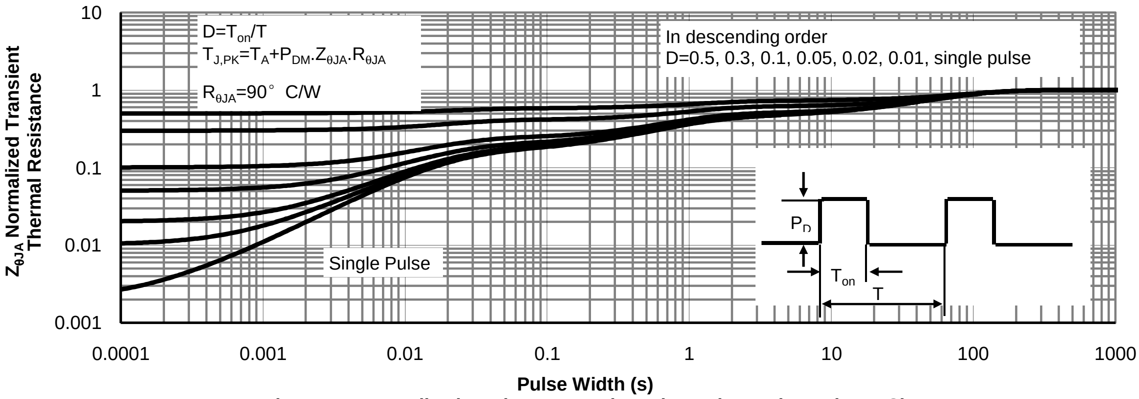
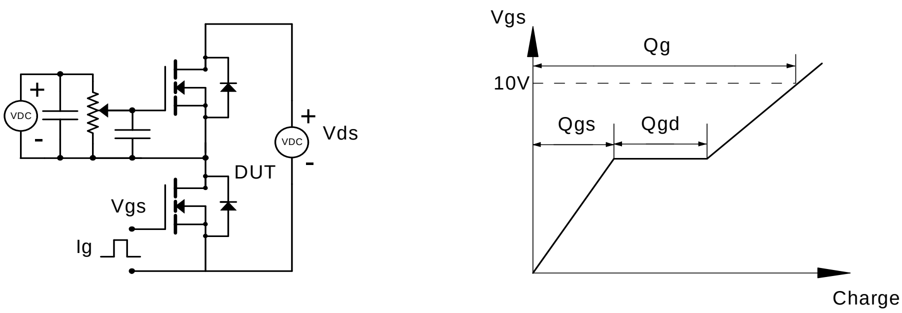
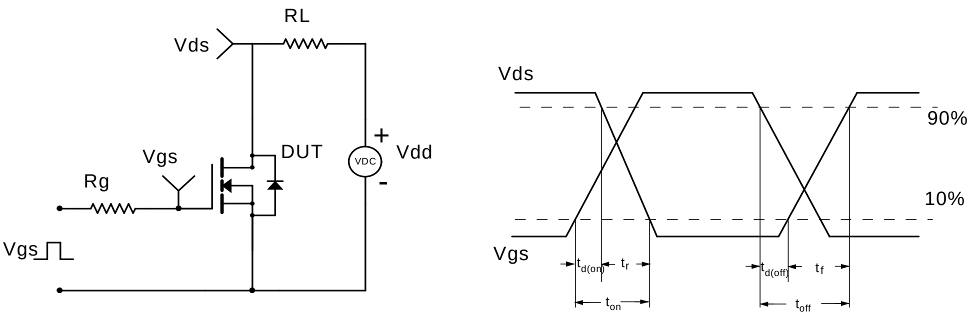



Figure 15: Normalized Maximum Transient Thermal Impedance (Note G)

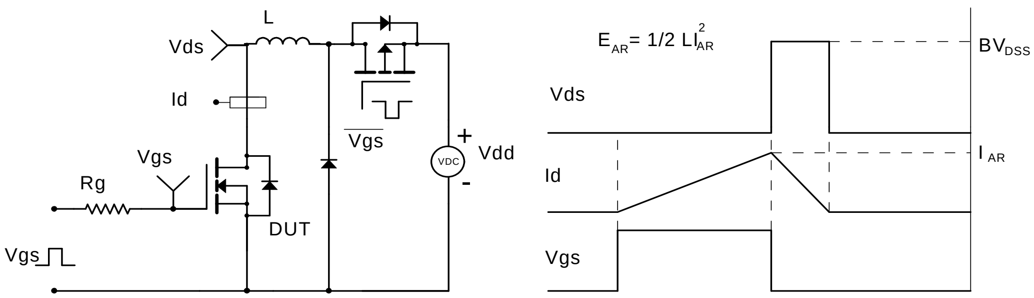
Gate Charge Test Circuit & Waveform




Resistive Switching Test Circuit & Waveforms




Unclamped Inductive Switching (UIS) Test Circuit & Waveforms




Diode Recovery Test Circuit & Waveforms