# AONP36332

## *30V Dual Asymmetric N-Channel MOSFET*

## General Description

- Bottom source technology
- Very Low $R_{DS(ON)}$ at Vgs 4.5V
- Low Gate Charge
- High Current Capability
- RoHS 2.0 and Halogen-Free Compliant

## Product Summary

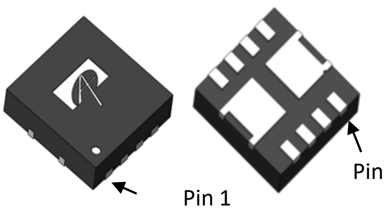
| | Q1 | Q2 |
|---|---|---|
| $V_{DS}$ | 30V | 30V |
| $I_D$ (at $V_{GS}$=10V) | 50A | 50A |
| $R_{DS(ON)}$ (at $V_{GS}$=10V) | < 3.7mΩ | < 4.7mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$=4.5V) | < 4.7mΩ | < 5.9mΩ |

## Applications

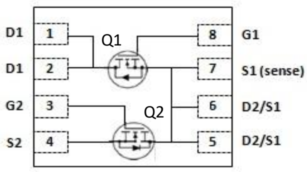
- Buck-boost Converters in Computing
- Point of Load Converter
- See Note I

100% UIS Tested
100% Rg Tested

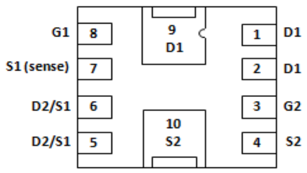
DFN3.3x3.3B




Top View




Bottom View




| Orderable Part Number | Package Type | Form | Minimum Order Quantity |
|---|---|---|---|
| AONP36332 | DFN3.3x3.3B | Tape & Reel | 3000 |

**Absolute Maximum Ratings $T_A$=25°C unless otherwise noted**

| Parameter | | Symbol | Max Q1 | Max Q2 | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 30 | 30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±12 | ±12 | V |
| Continuous Drain Current G | $T_C$=25°C | $I_D$ | 50 | 50 | A |
| | $T_C$=100°C | | 47 | 40 | |
| Pulsed Drain Current C | | $I_{DM}$ | 124 | 98 | |
| Continuous Drain Current | $T_A$=25°C | $I_{DSM}$ | 24 | 20 | A |
| | $T_A$=70°C | | 19 | 16 | |
| Avalanche Current C | | $I_{AS}$ | 60 | 49 | A |
| Avalanche energy | L=0.01mH | $E_{AS}$ | 18 | 12 | mJ |
| Power Dissipation B | $T_C$=25°C | $P_D$ | 33 | 30 | W |
| | $T_C$=100°C | | 13 | 12 | |
| Power Dissipation A | $T_A$=25°C | $P_{DSM}$ | 3.4 | 3.1 | W |
| | $T_A$=70°C | | 2.2 | 2 | |
| Junction and Storage Temperature | | $T_J$, $T_{STG}$ | -55 to 150 | | °C |

**Thermal Characteristics**

| Parameter | Symbol | Typ Q1 | Typ Q2 | Max Q1 | Max Q2 | Units |
|---|---|---|---|---|---|---|
| Maximum Junction-to-Ambient A | $R_{\theta JA}$ | 30 | 33 | 36 | 40 | °C/W |
| Maximum Junction-to-Ambient A D | | 52 | 55 | 63 | 66 | °C/W |
| Maximum Junction-to-Case | $R_{\theta JC}$ | 3 | 3.3 | 3.8 | 4.2 | °C/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, $V_{GS}$=±12V | | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=250µA | | 1.1 | 1.5 | 1.9 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=20A | | | 3.05 | 3.7 | mΩ |
| | | | $T_J$=125°C | | 4.2 | 5.1 | |
| | | $V_{GS}$=4.5V, $I_D$=20A | | | 3.7 | 4.7 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=20A | | | 108 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A, $V_{GS}$=0V | | | 0.7 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | | 40 | A |
| **DYNAMIC PARAMETERS** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=15V, f=1MHz | | | 1520 | | pF |
| $C_{oss}$ | Output Capacitance | | | | 330 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | | 35 | | pF |
| $R_g$ | Gate resistance | f=1MHz | | 0.4 | 0.8 | 1.2 | Ω |
| **SWITCHING PARAMETERS** | | | | | | | |
| $Q_g$(10V) | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=15V, $I_D$=20A | | | 22 | 40 | nC |
| $Q_g$(4.5V) | Total Gate Charge | | | | 10 | 20 | nC |
| $Q_{gs}$ | Gate Source Charge | | | | 4 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | | 2.2 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=15V, $R_L$=0.75Ω, $R_{GEN}$=3Ω | | | 6 | | ns |
| $t_r$ | Turn-On Rise Time | | | | 2.5 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | | 22 | | ns |
| $t_f$ | Turn-Off Fall Time | | | | 2 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=20A, di/dt=500A/µs | | | 12 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=20A, di/dt=500A/µs | | | 21 | | 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 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. Single pulse width limited by junction temperature $T_{J(MAX)}$=150° C.
D. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ 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 $T_{J(MAX)}$=150° 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[2] FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25° C.
I. For application requiring slow >1ms turn-on/turn-off, please consult AOS FAE for proper product selection.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

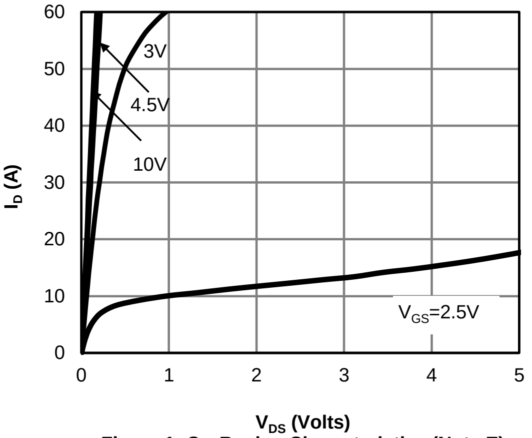



Figure 1: On-Region Characteristics (Note E)

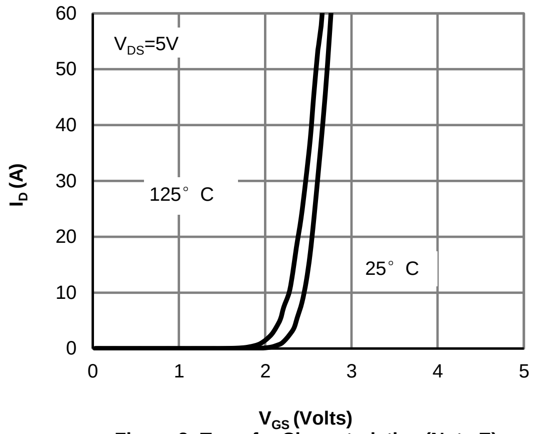



Figure 2: Transfer Characteristics (Note E)

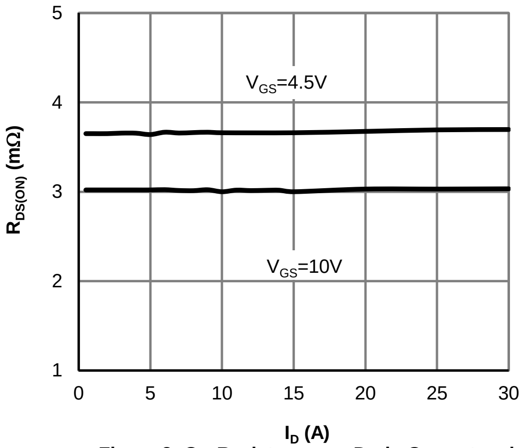



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

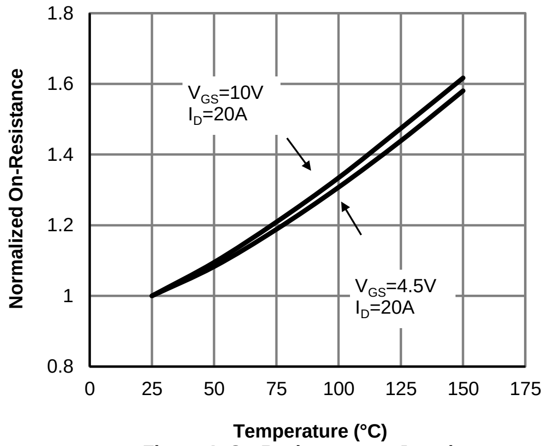



Figure 4: On-Resistance vs. Junction Temperature (Note E)

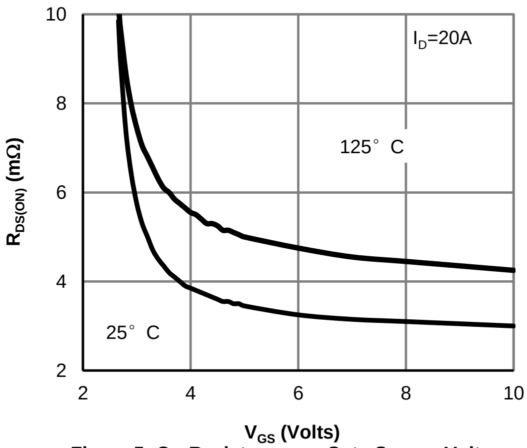



Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

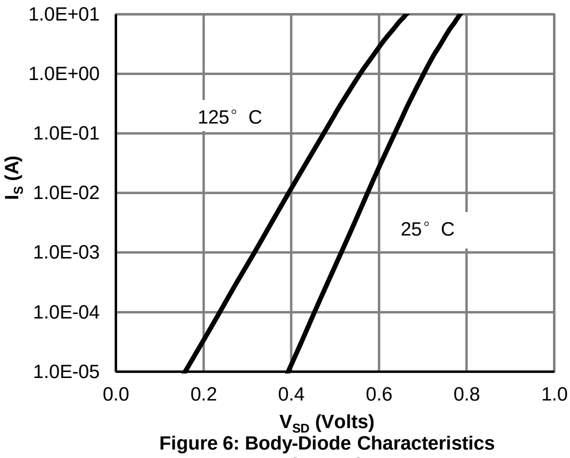



Figure 6: Body-Diode Characteristics (Note E)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

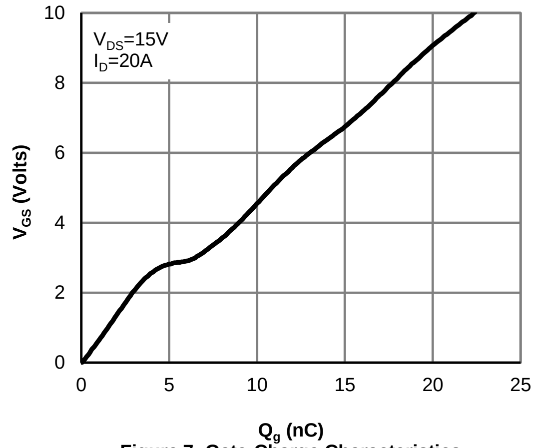



Figure 7: Gate-Charge Characteristics

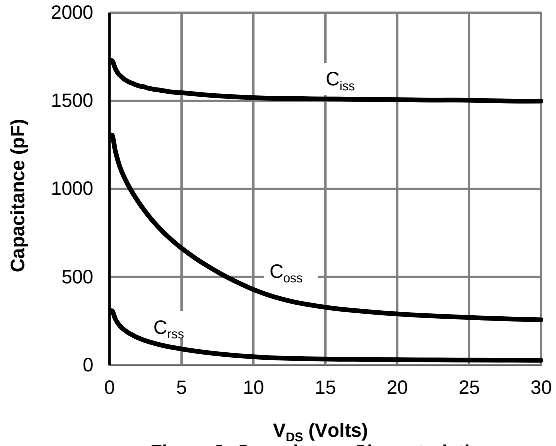
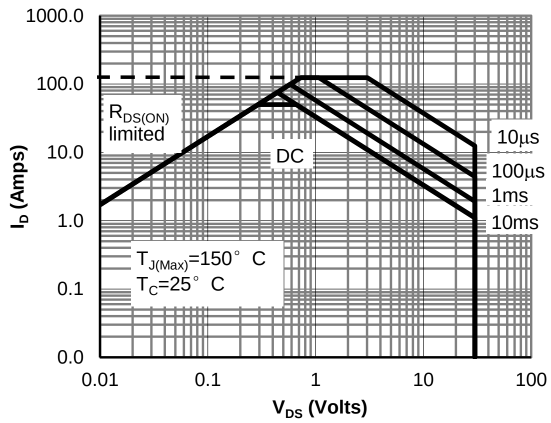



Figure 8: Capacitance Characteristics




$V_{GS}$> or equal to 4.5V
Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

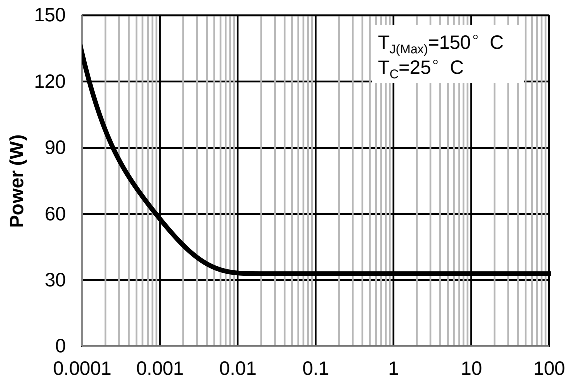



Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

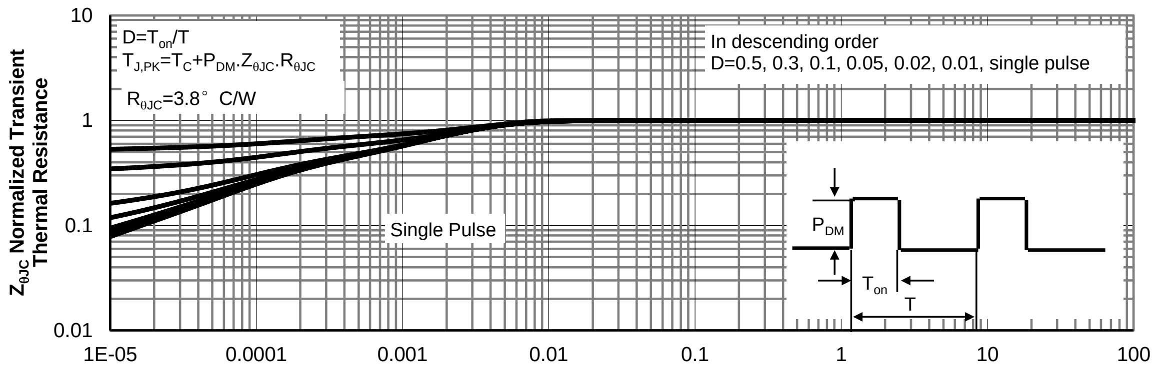



Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

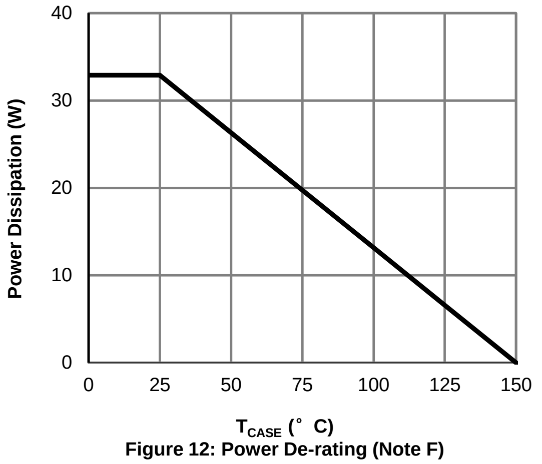



**Figure 12: Power De-rating (Note F)**

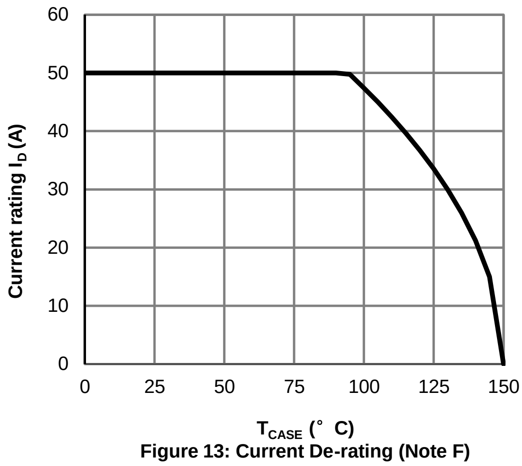



**Figure 13: Current De-rating (Note F)**

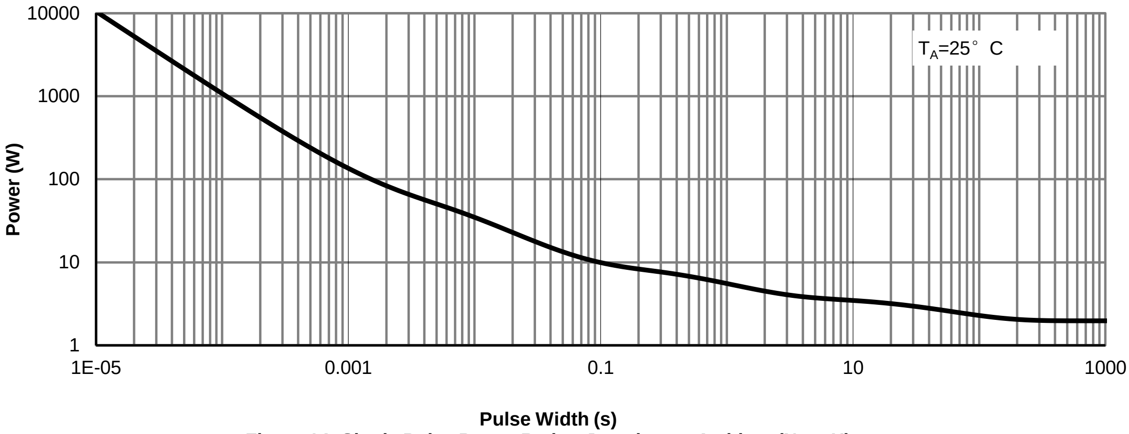



**Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)**

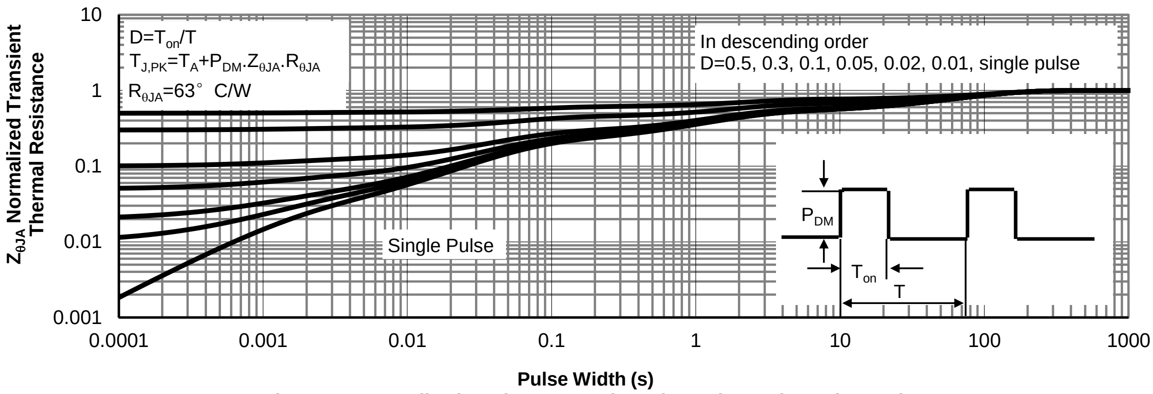



**Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)**

## 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, $V_{GS}$=±12V | | | | ±10 | µA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS,}$ $I_D$=250µA | | 1.1 | 1.5 | 1.9 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=20A | | | 3.9 | 4.7 | mΩ |
| | | | $T_J$=125°C | | 5.5 | 6.6 | |
| | | $V_{GS}$=4.5V, $I_D$=20A | | | 4.7 | 5.9 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=20A | | | 125 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A, $V_{GS}$=0V | | | 0.7 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | | 40 | A |
| **DYNAMIC PARAMETERS** | | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=15V, f=1MHz | | | 1220 | | pF |
| $C_{oss}$ | Output Capacitance | | | | 260 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | | 30 | | pF |
| $R_g$ | Gate resistance | f=1MHz | | 0.9 | 1.9 | 2.9 | Ω |
| **SWITCHING PARAMETERS** | | | | | | | |
| $Q_g$(10V) | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=15V, $I_D$=20A | | | 17 | 30 | nC |
| $Q_g$(4.5V) | Total Gate Charge | | | | 7.5 | 16 | nC |
| $Q_{gs}$ | Gate Source Charge | | | | 3.2 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | | 1 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=15V, $R_L$=0.75Ω, $R_{GEN}$=3Ω | | | 5 | | ns |
| $t_r$ | Turn-On Rise Time | | | | 18 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | | 23 | | ns |
| $t_f$ | Turn-Off Fall Time | | | | 2 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=20A, di/dt=500A/µs | | | 10 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=20A, di/dt=500A/µs | | | 15 | | 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 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. Single pulse width limited by junction temperature $T_{J(MAX)}$=150° C.
D. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ 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 $T_{J(MAX)}$=150° 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$^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25° C.
I. For application requiring slow >1ms turn-on/turn-off, please consult AOS FAE for proper product selection.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

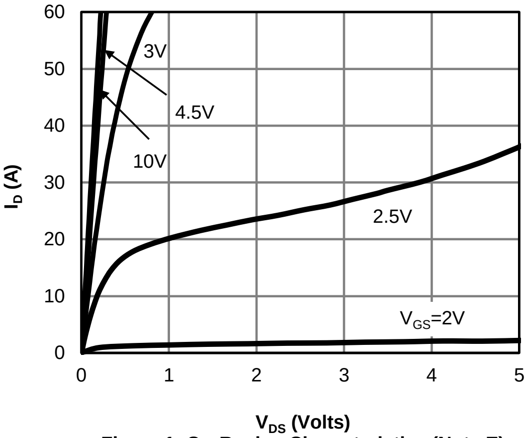


Figure 1: On-Region Characteristics (Note E)

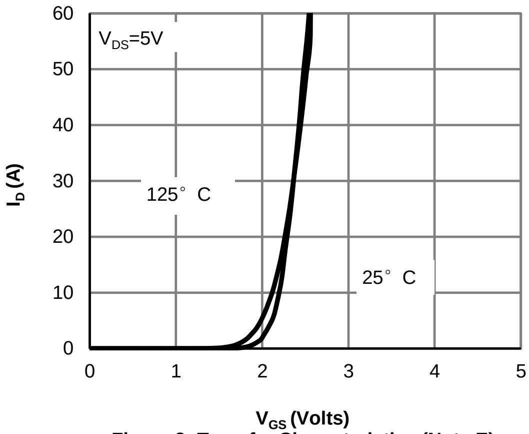


Figure 2: Transfer Characteristics (Note E)

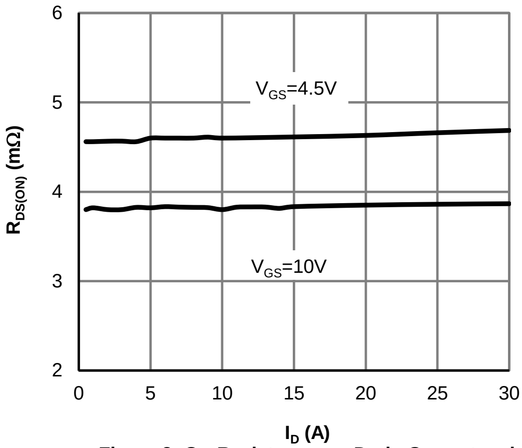


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

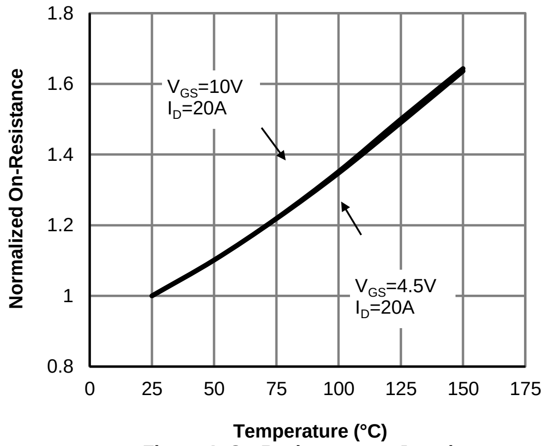


Figure 4: On-Resistance vs. Junction Temperature (Note E)

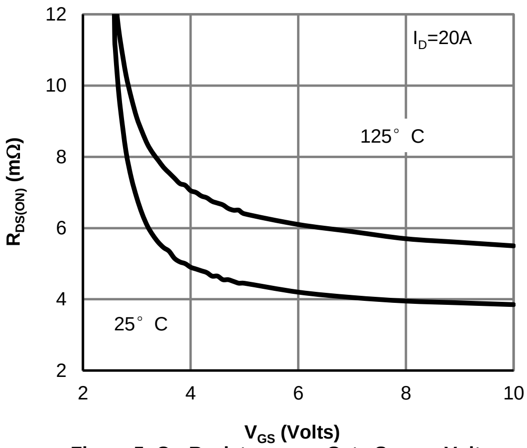


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

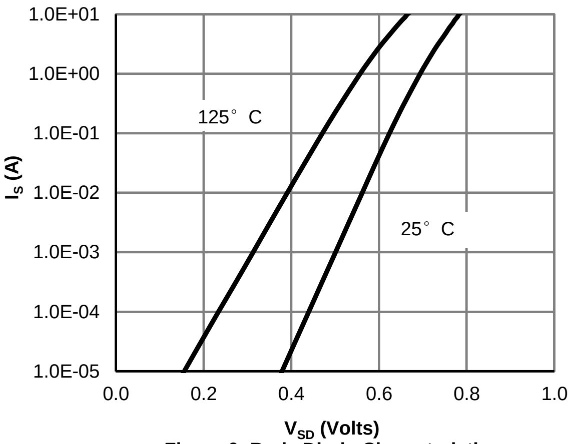


Figure 6: Body-Diode Characteristics (Note E)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

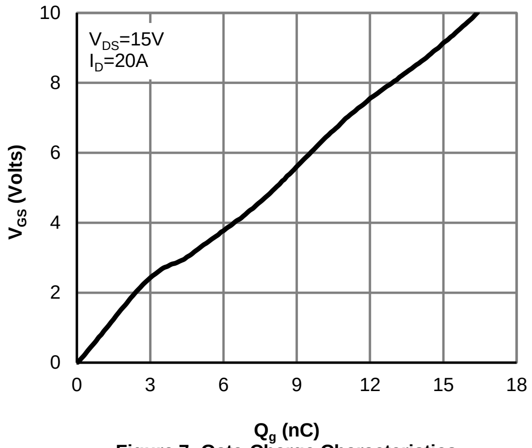



Figure 7: Gate-Charge Characteristics

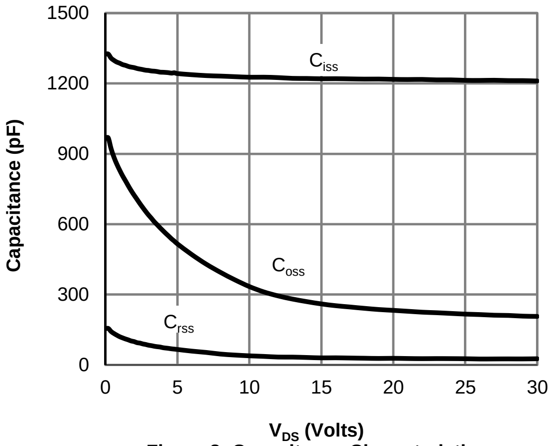
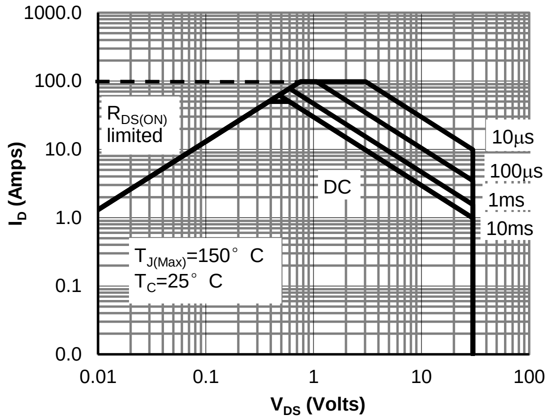



Figure 8: Capacitance Characteristics




$V_{GS}$> or equal to 4.5V
Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

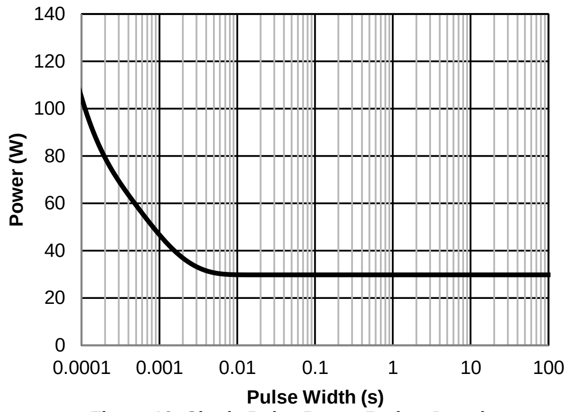



Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

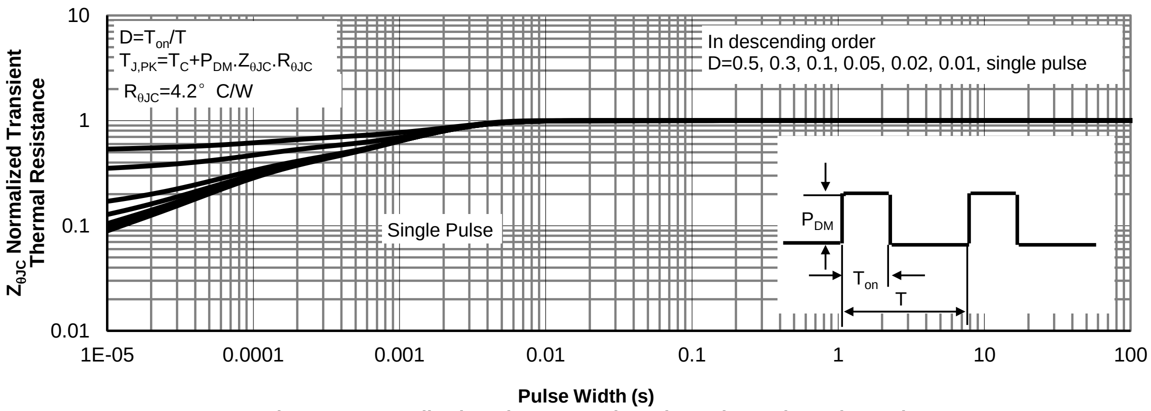



Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

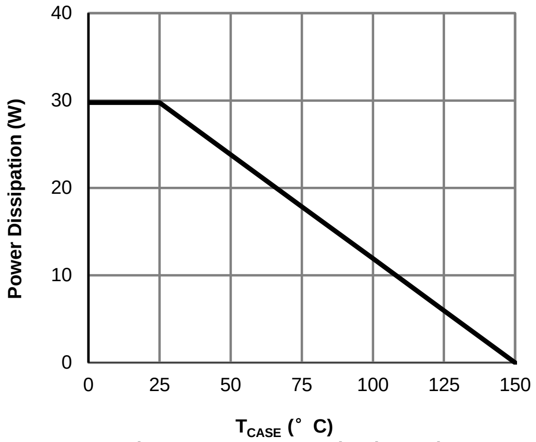



**Figure 12: Power De-rating (Note F)**

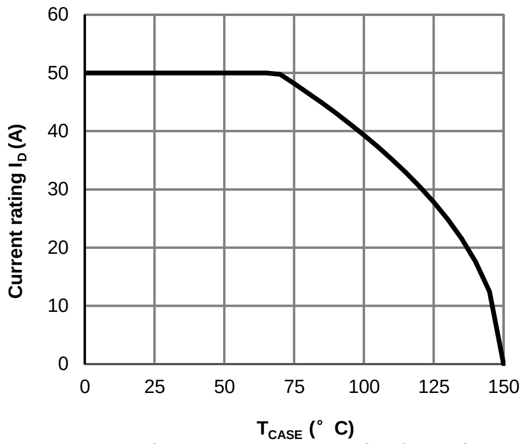



**Figure 13: Current De-rating (Note F)**

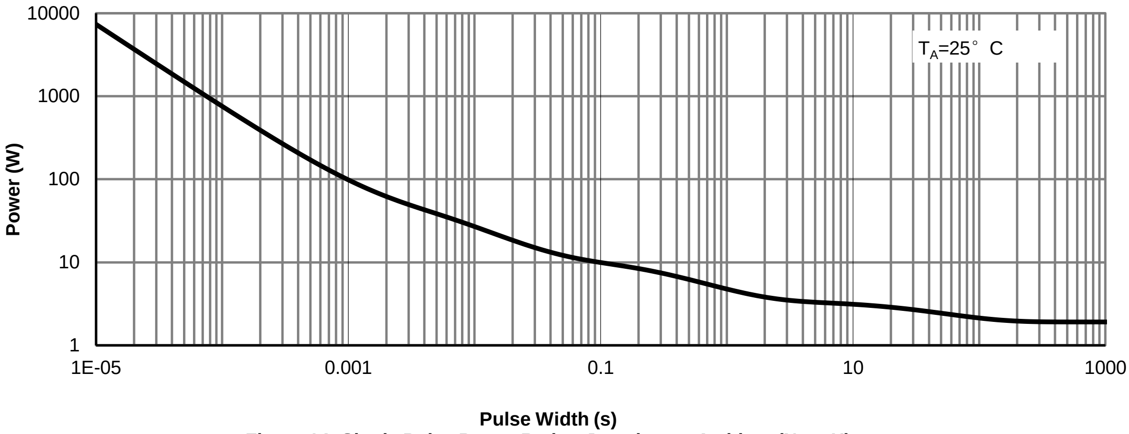



**Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)**

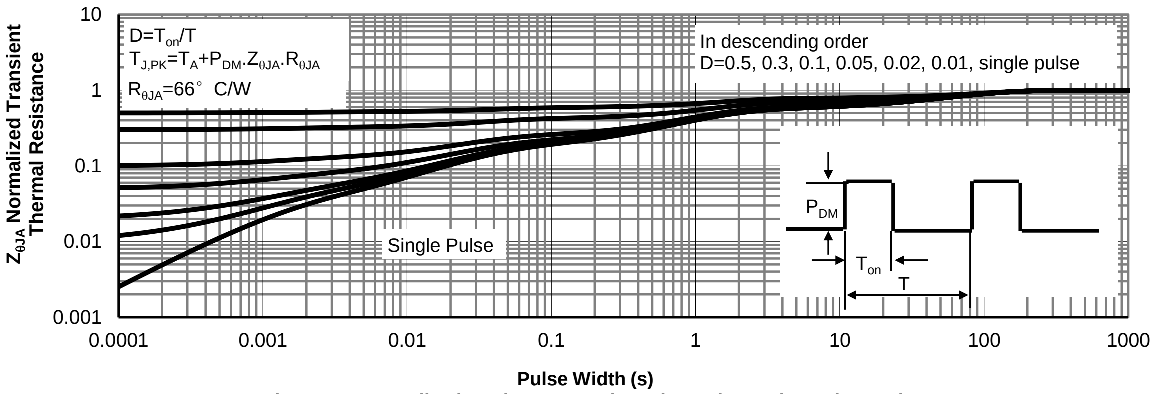



**Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)**

Figure A: Gate Charge Test Circuit & Waveforms

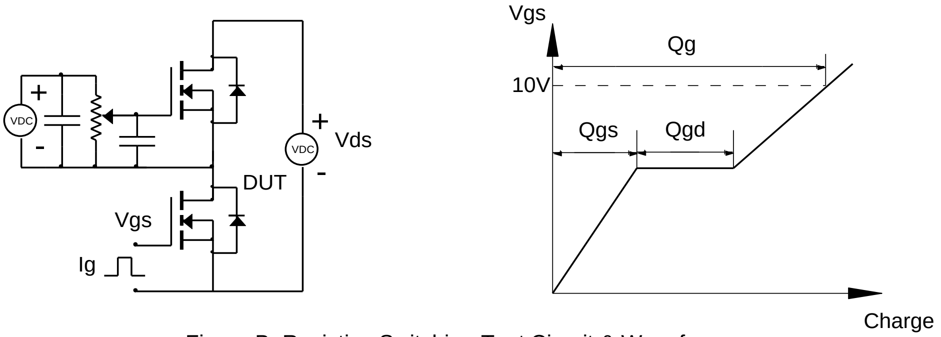



Figure B: Resistive Switching Test Circuit & Waveforms

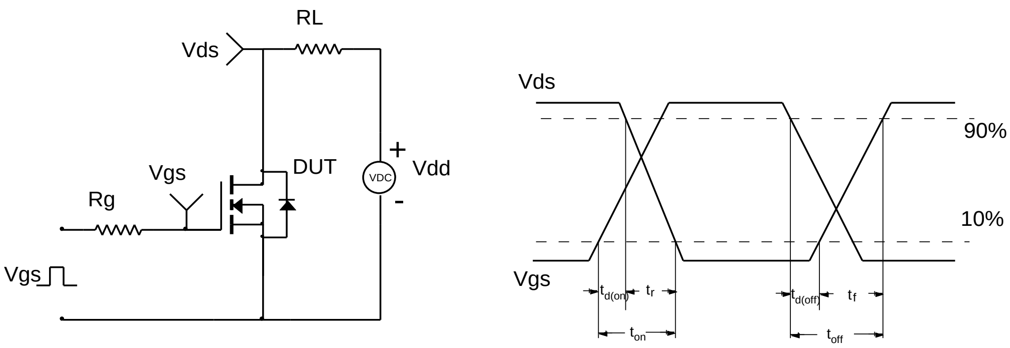



Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

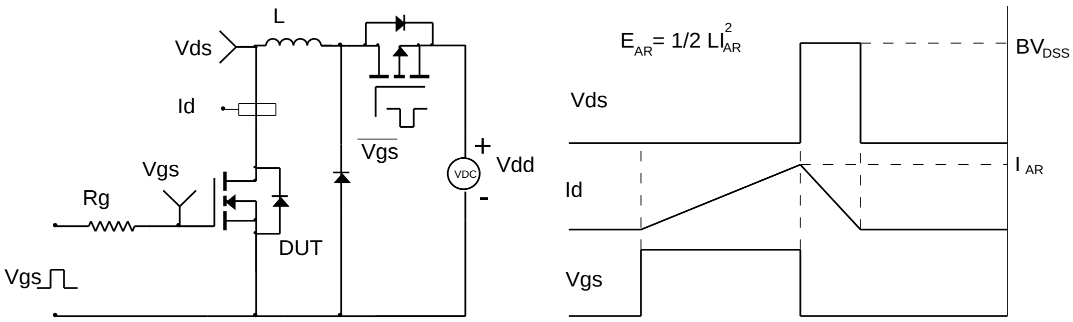



Figure D: Diode Recovery Test Circuit & Waveforms