ALPHA & OMEGA SEMICONDUCTOR

AONP36336

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 and Halogen-Free Compliant

Applications

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

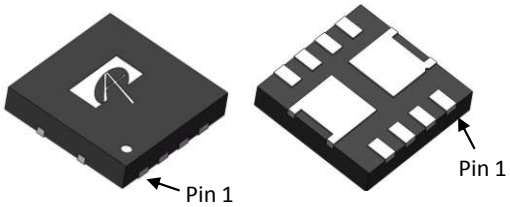
Product Summary

	Q1	Q2
V_{DS}	30V	30V
I_D (at V_{GS}=10V)	21A	18A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 4.7mΩ	< 5.8mΩ
$R_{DS(ON)}$ (at V_{GS}=4.5V)	< 5.7mΩ	< 7.3mΩ

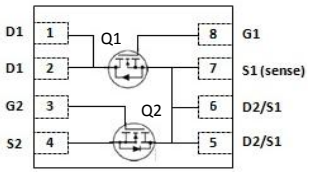
100% UIS Tested
100% Rg Tested

Green Product

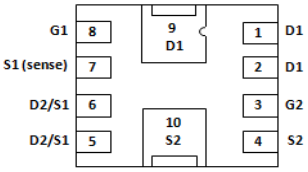
DFN3.3x3.3B



Top View



Bottom View



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AONP36336	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		42	35.5	
Pulsed Drain Current [C]		I_{DM}	110	88	
Continuous Drain Current	T_A=25°C	I_{DSM}	21	18	A
	T_A=70°C		17	14.5	
Avalanche Current [C]		I_{AS}	60	45	A
Avalanche energy	L=0.01mH [C]	E_{AS}	18	10	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 Range		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]	t ≤ 10s	$R_{\theta JA}$	30	33	36	40	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		52	55	63	66	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	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			3.9	4.7	mΩ
			T_J=125°C		5.4	6.5	
		V_{GS}=4.5V, I_D=20A			4.5	5.7	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=20A			100		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			1330		pF
C_{oss}	Output Capacitance				280		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			19	29	nC
Q_g(4.5V)	Total Gate Charge				8	14	nC
Q_{gs}	Gate Source Charge				3		nC
Q_{gd}	Gate Drain Charge				2		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L=0.75Ω, R_{GEN}=3Ω			5.5		ns
t_r	Turn-On Rise Time				2.5		ns
$t_{D(off)}$	Turn-Off DelayTime				21.5		ns
t_f	Turn-Off Fall Time				2		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=20A, di/dt=500A/µs			11		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=20A, di/dt=500A/µs			19		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 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 in² 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

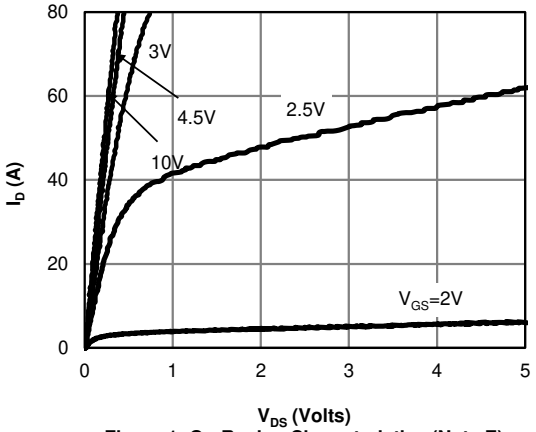


Figure 1: On-Region Characteristics (Note E)

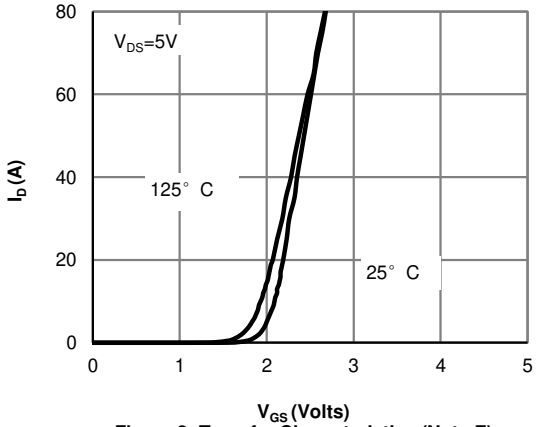


Figure 2: Transfer Characteristics (Note E)

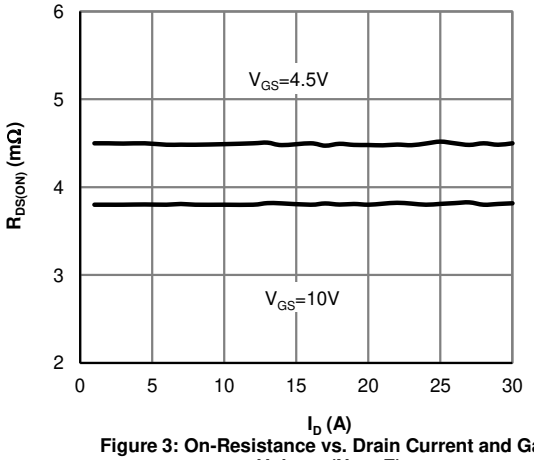


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

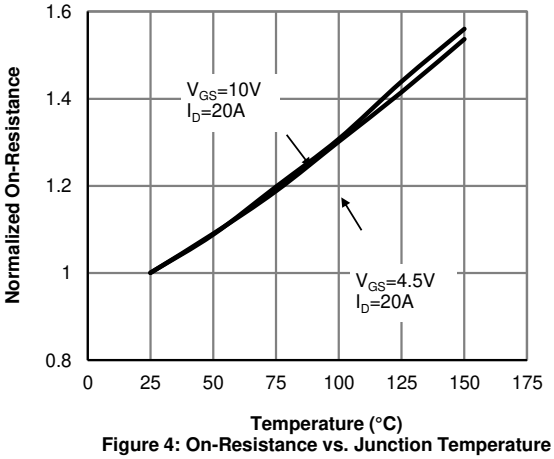


Figure 4: On-Resistance vs. Junction Temperature (Note E)

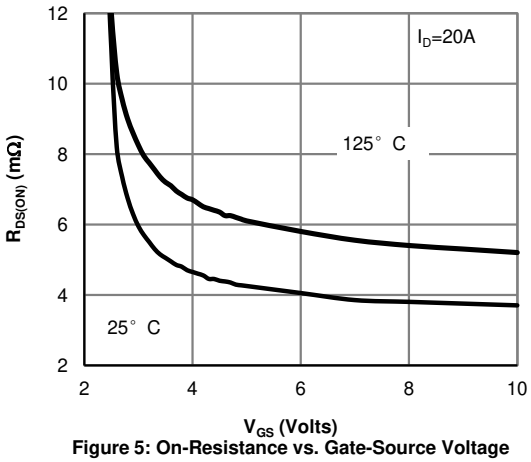


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

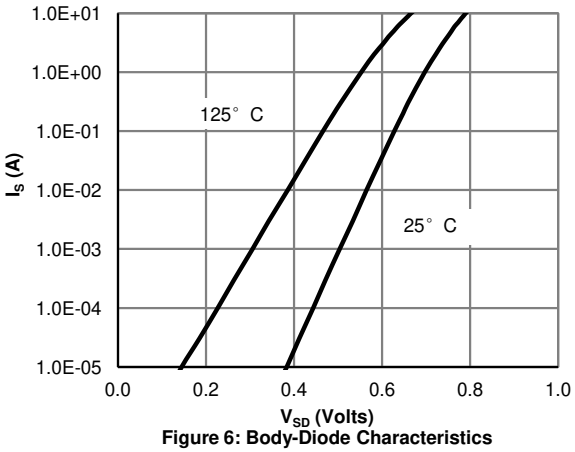


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

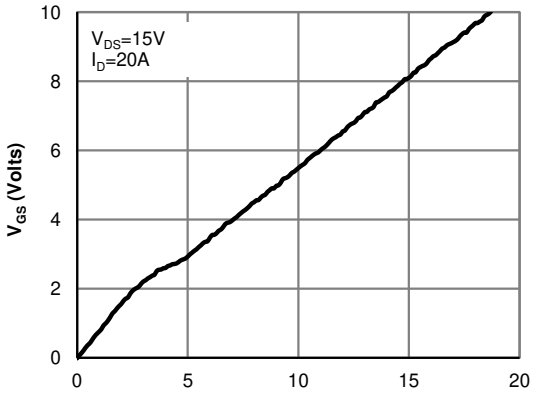


Figure 7: Gate-Charge Characteristics

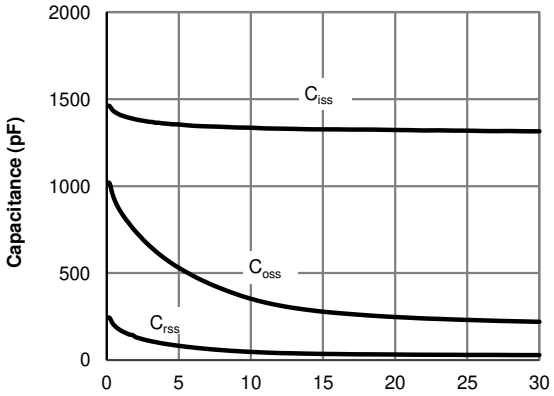
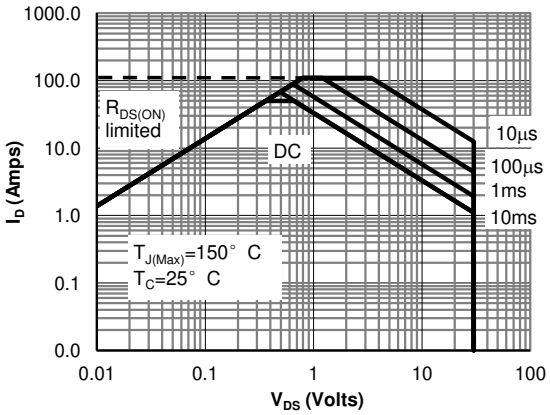


Figure 8: Capacitance Characteristics



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

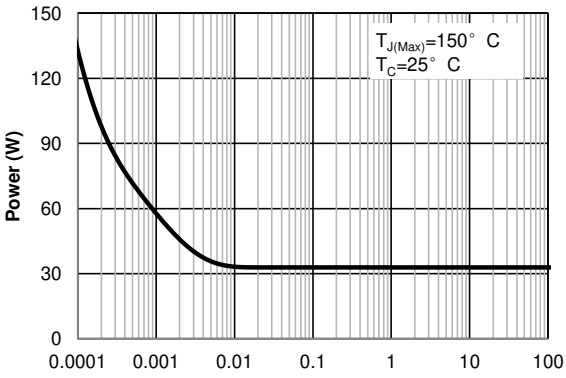


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

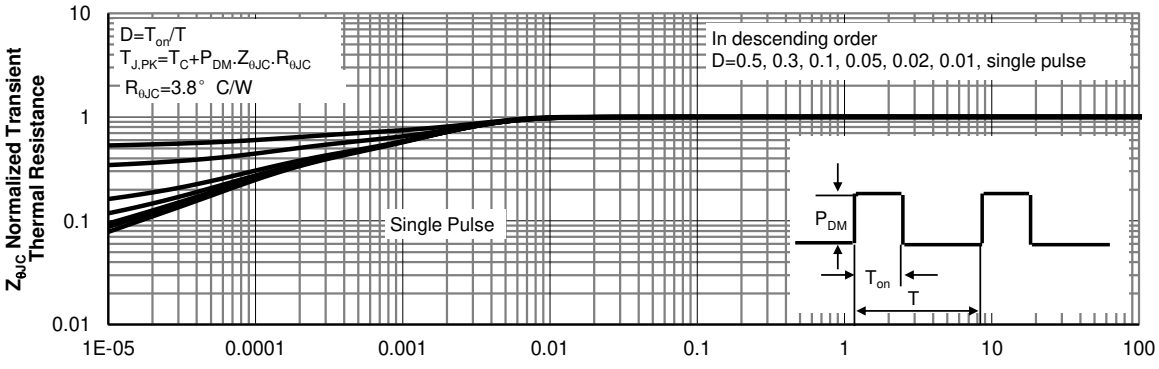


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

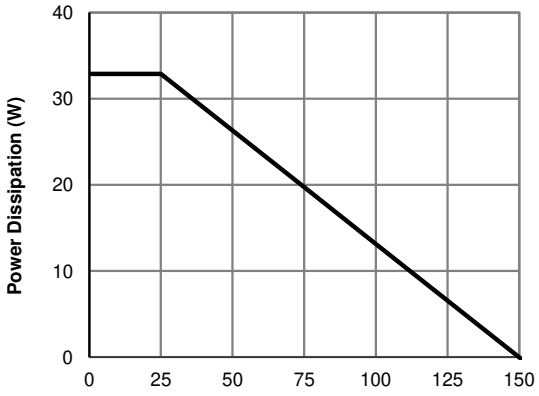


Figure 12: Power De-rating (Note F)

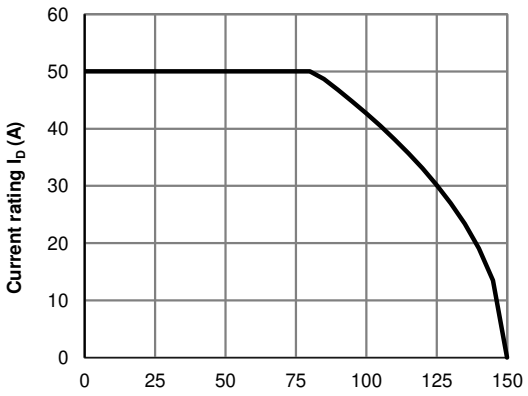


Figure 13: Current De-rating (Note F)

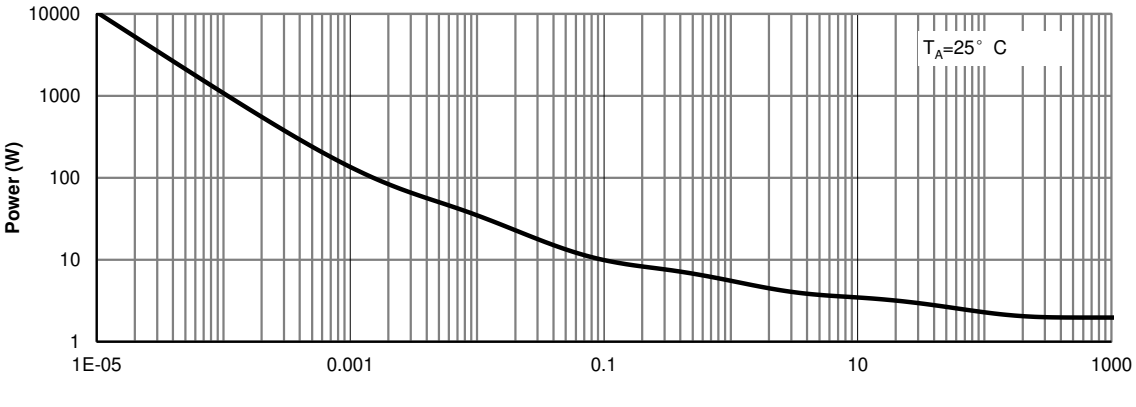


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

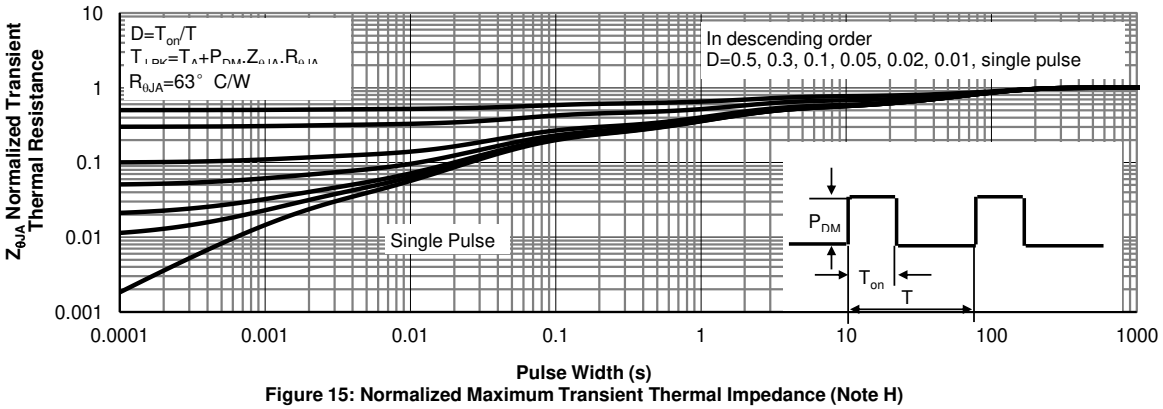


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

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			±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=18A		4.8	5.8	mΩ
		T_J=125°C		7	8.5	
		V_{GS}=4.5V, I_D=18A		5.8	7.3	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=18A		100		S
V_{SD}	Diode Forward Voltage	I_S=1A, V_{GS}=0V		0.7	1	V
I_S	Maximum Body-Diode Continuous Current				30	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=15V, f=1MHz		940		pF
C_{oss}	Output Capacitance			210		pF
C_{rss}	Reverse Transfer Capacitance			30		pF
R_g	Gate resistance	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=18A		14	23	nC
Q_g(4.5V)	Total Gate Charge			6	12	nC
Q_{gs}	Gate Source Charge			2.2		nC
Q_{gd}	Gate Drain Charge			1.6		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L=0.83Ω, R_{GEN}=3Ω		3.5		ns
t_r	Turn-On Rise Time			15		ns
$t_{D(off)}$	Turn-Off DelayTime			21.5		ns
t_f	Turn-Off Fall Time			2.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=18A, di/dt=500A/µs		10		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=18A, di/dt=500A/µs		14		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 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 in² 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

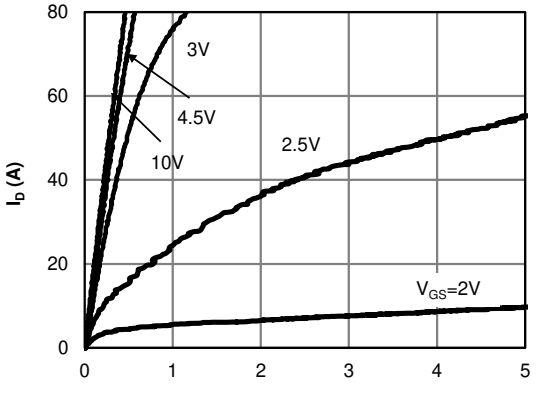


Figure 1: On-Region Characteristics (Note E)

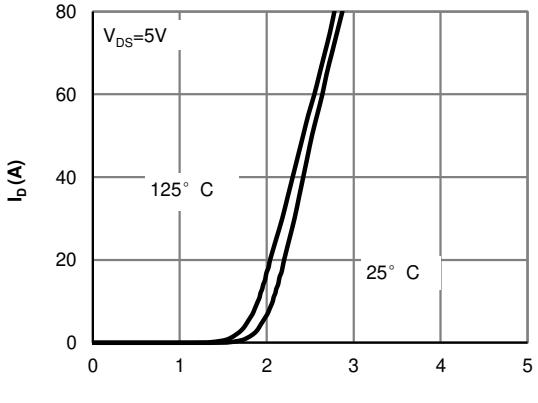


Figure 2: Transfer Characteristics (Note E)

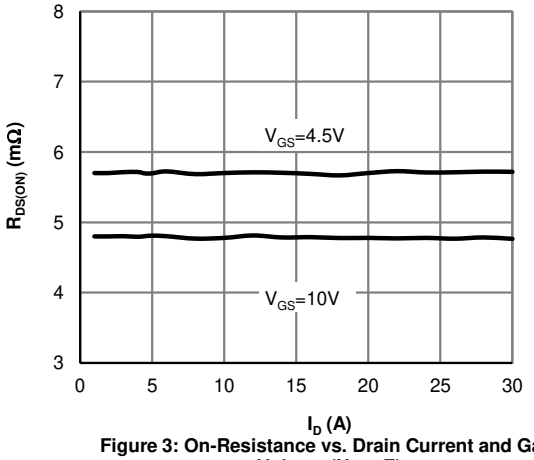


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

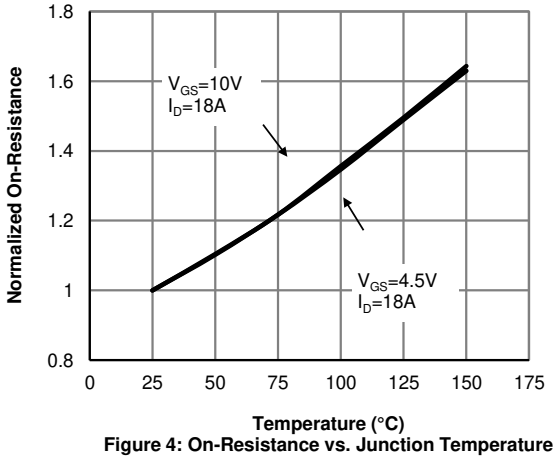


Figure 4: On-Resistance vs. Junction Temperature (Note E)

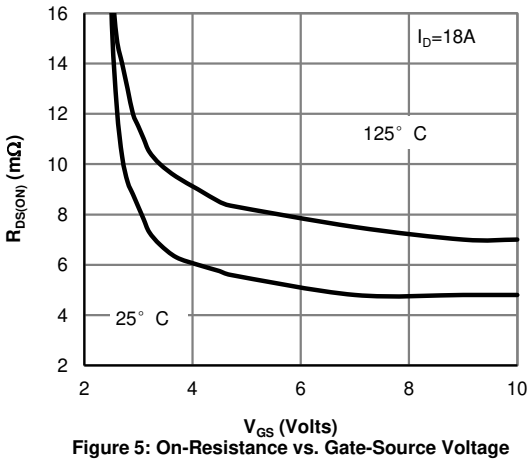


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

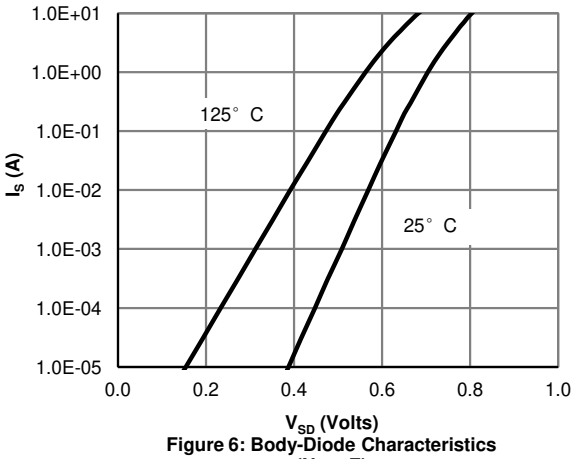


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

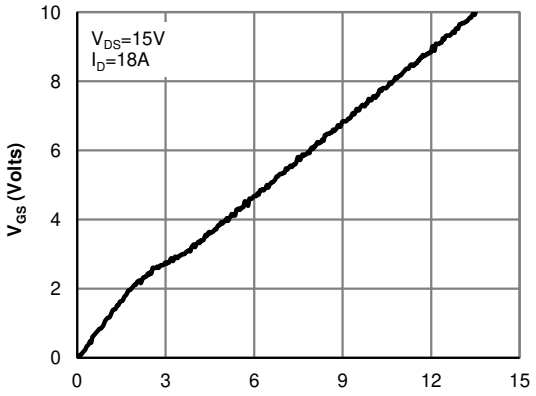


Figure 7: Gate-Charge Characteristics

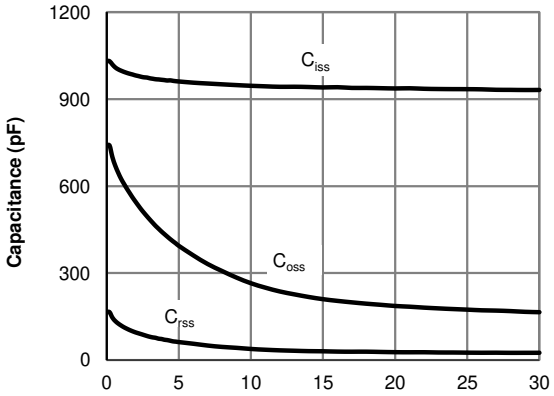
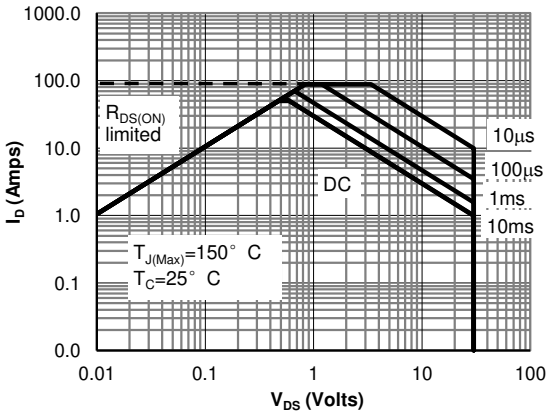


Figure 8: Capacitance Characteristics



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

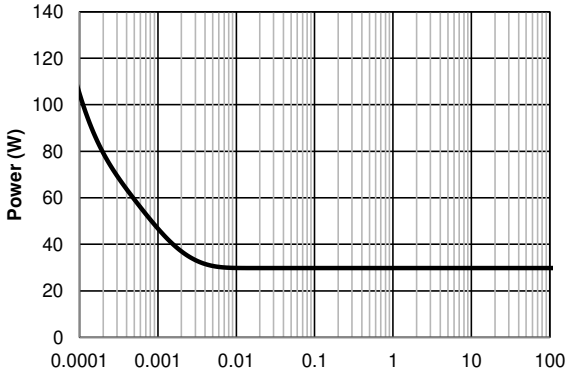


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

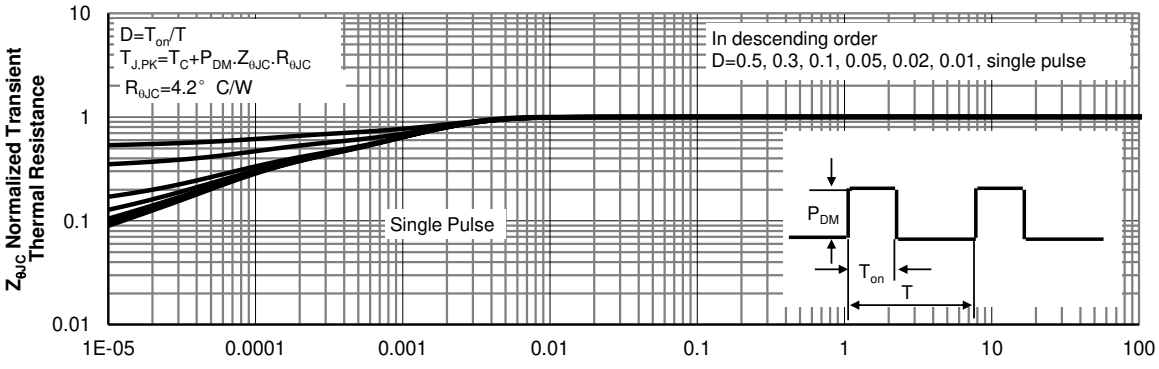


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

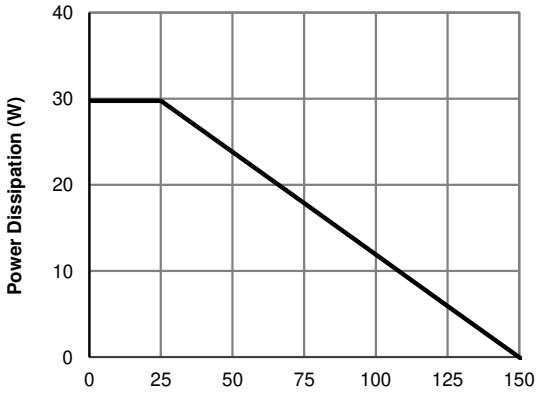


Figure 12: Power De-rating (Note F)

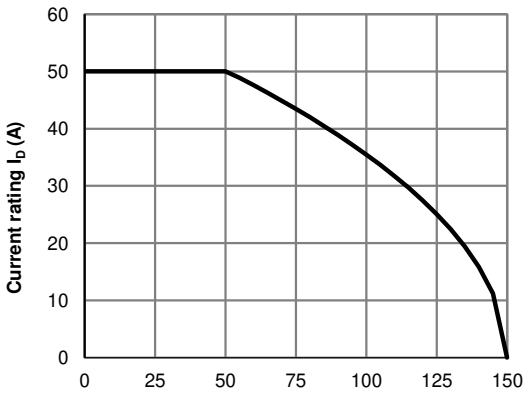


Figure 13: Current De-rating (Note F)

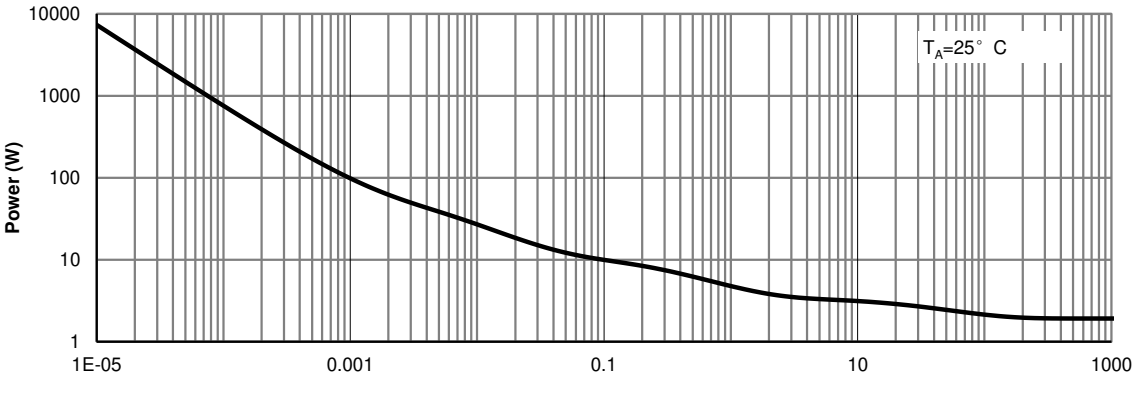


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

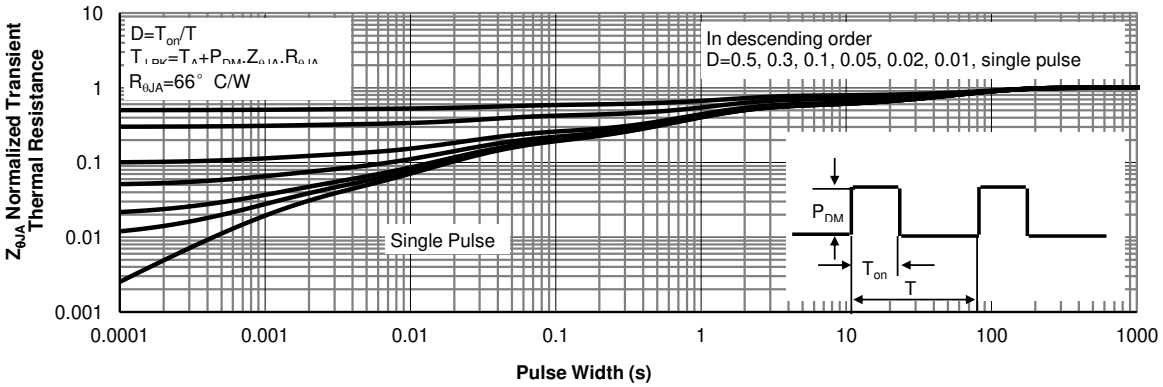


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

Figure A: Gate Charge Test Circuit & Waveforms

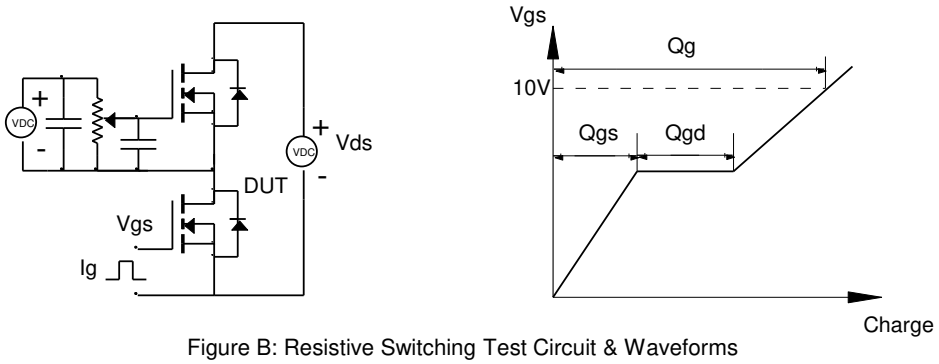


Figure B: Resistive Switching Test Circuit & Waveforms

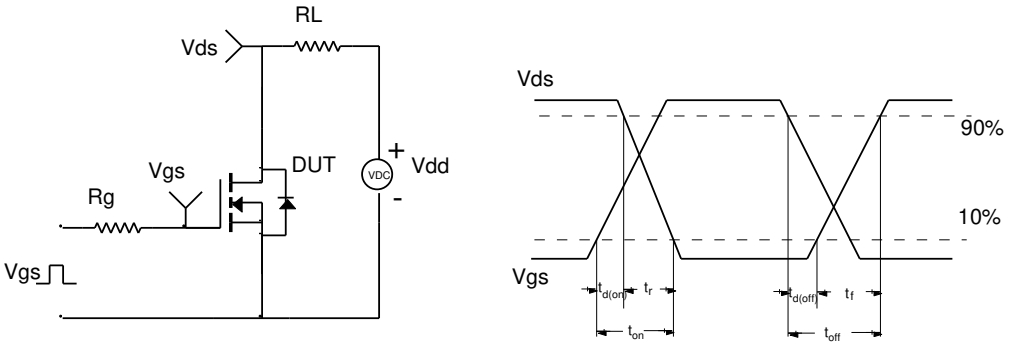


Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

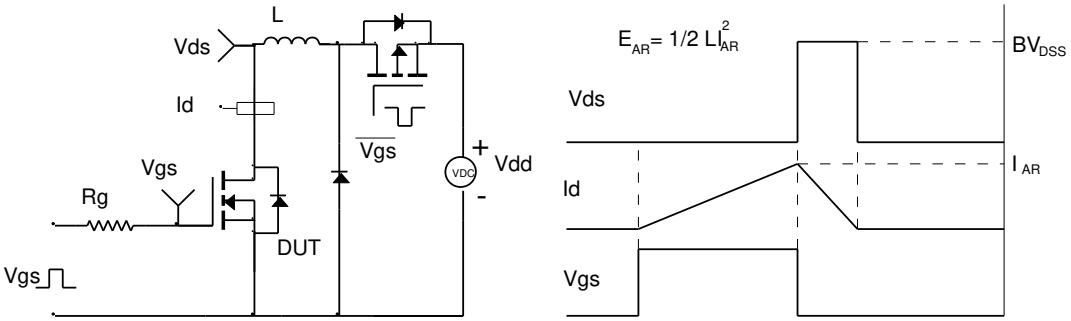


Figure D: Diode Recovery Test Circuit & Waveforms