ALPHA & OMEGA SEMICONDUCTOR

AONX38168

25V Dual Asymmetric N-Channel XSPairFET™

General Description

- Bottom Source Technology
- Very Low $R_{DS(ON)}$
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

Applications

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

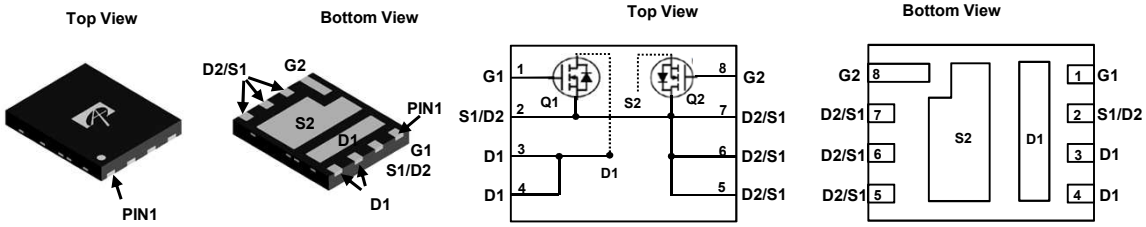
Product Summary

	Q1	Q2
V_{DS}	25V	25V
I_D (at V_{GS}=10V)	60A	85A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 3.6mΩ	< 0.85mΩ
$R_{DS(ON)}$ (at V_{GS}=4.5V)	< 5mΩ	< 1.15mΩ

100% UIS Tested
100% Rg Tested

Green Product

DFN 5X6E



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AONX38168	DFN 5x6E	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}	25	25	V
Gate-Source Voltage		V_{GS}	±12	±12	V
Continuous Drain Current	T_C=25°C	I_D	60	85	A
	T_C=100°C		38	85	
Pulsed Drain Current [C]		I_{DM}	180	340	
Continuous Drain Current	T_A=25°C	I_{DSM}	24	50	A
	T_A=70°C		19	40	
Avalanche Current [C]		I_{AS}	60	80	A
Avalanche energy	L=0.01mH [C]	E_{AS}	18	32	mJ
Power Dissipation [B]	T_C=25°C	P_D	20	69	W
	T_C=100°C		8	27	
Power Dissipation [A]	T_A=25°C	P_{DSM}	3.1	3.2	W
	T_A=70°C		2	2.1	
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	$R_{\theta JA}$	32	30	40	38	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		60	55	75	68	°C/W
Maximum Junction-to-Case (Note)	Steady-State	$R_{\theta JC}$	4.8	1.45	6.2	1.8	°C/W

Note: Bottom S2, D1.

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	ID=250µA, VGS=0V	25			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=25V, 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	1.3	1.7	2.1	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=20A		3	3.6	mΩ
		T_J=125°C		4.1	5	
		V_{GS}=4.5V, I_D=20A		3.9	5	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=20A		145		S
V_{SD}	Diode Forward Voltage	I_S=1A, V_{GS}=0V		0.7	1	V
I_S	Maximum Body-Diode Continuous Current				25	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=12.5V, f=1MHz		1225		pF
C_{oss}	Output Capacitance			370		pF
C_{rss}	Reverse Transfer Capacitance			48		pF
R_g	Gate resistance	f=1MHz	0.6	1.3	2	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=12.5V, I_D=20A		15	24	nC
Q_g(4.5V)	Total Gate Charge			6.5	12	nC
Q_{gs}	Gate Source Charge			2.7		nC
Q_{gd}	Gate Drain Charge			2		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=12.5V, R_L=0.6Ω, R_{GEN}=3Ω		7		ns
t_r	Turn-On Rise Time			3		ns
$t_{D(off)}$	Turn-Off DelayTime			20		ns
t_f	Turn-Off Fall Time			2		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=20A, di/dt=500A/µs		11.5		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=20A, di/dt=500A/µs		17.5		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 <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 $T_{J(MAX)}$=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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

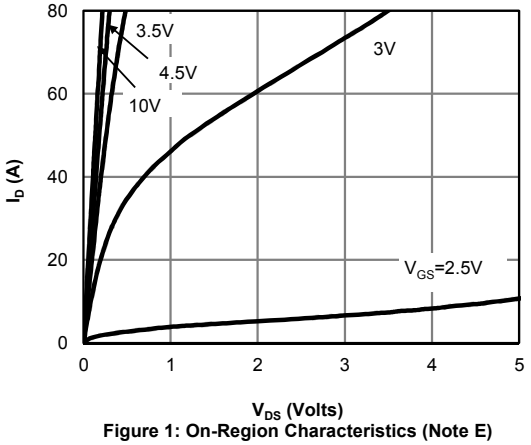


Figure 1: On-Region Characteristics (Note E)

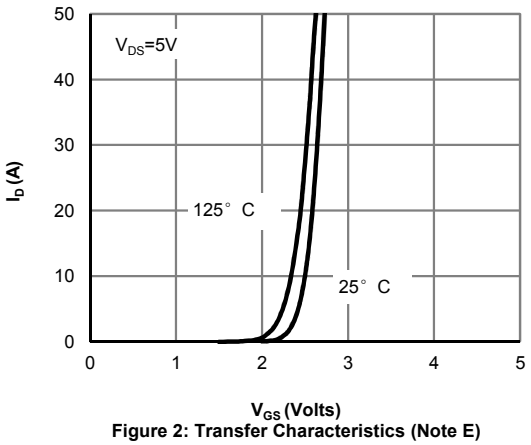


Figure 2: Transfer Characteristics (Note E)

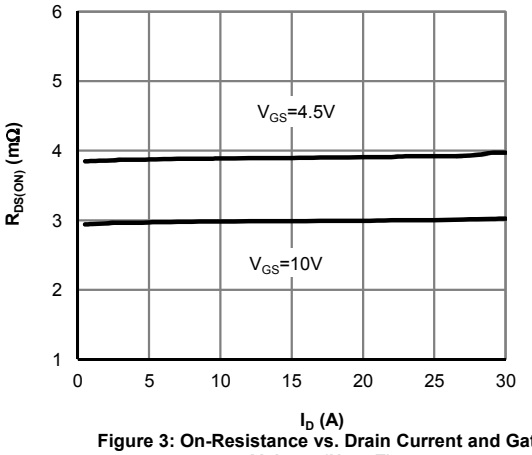


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

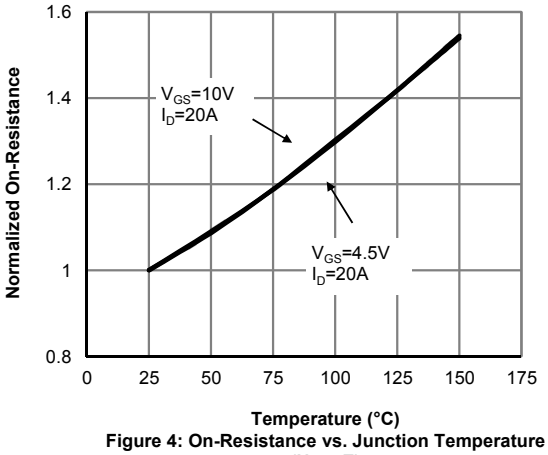


Figure 4: On-Resistance vs. Junction Temperature (Note E)

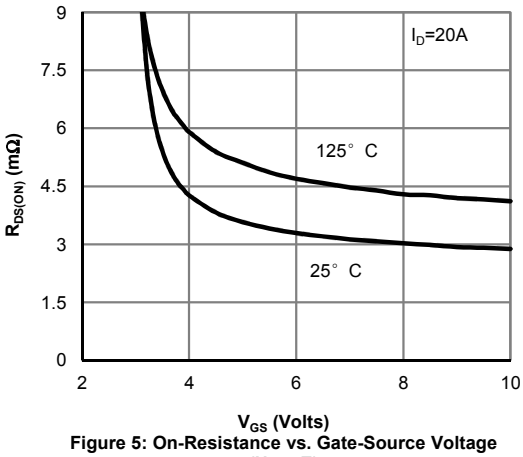


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

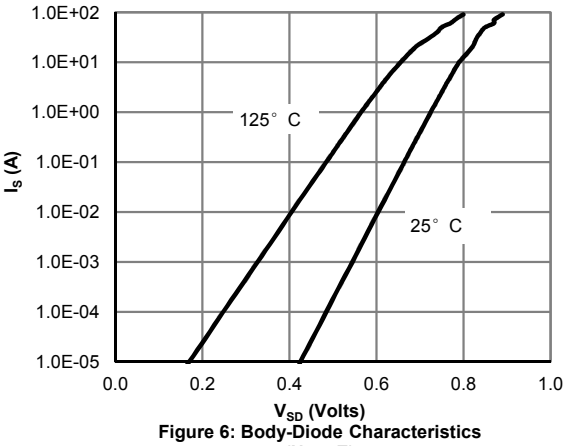


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

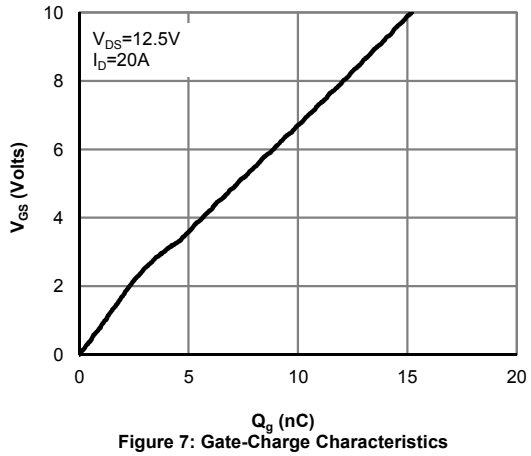


Figure 7: Gate-Charge Characteristics

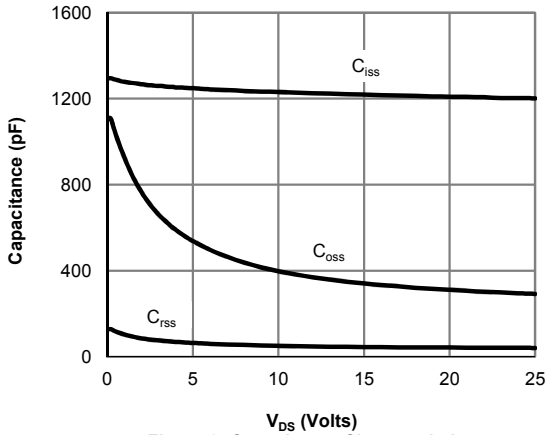
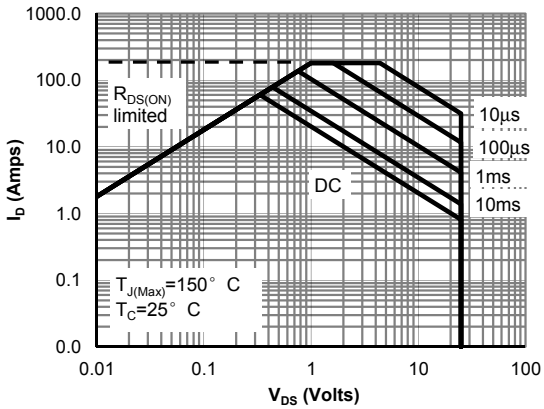


Figure 8: Capacitance Characteristics



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

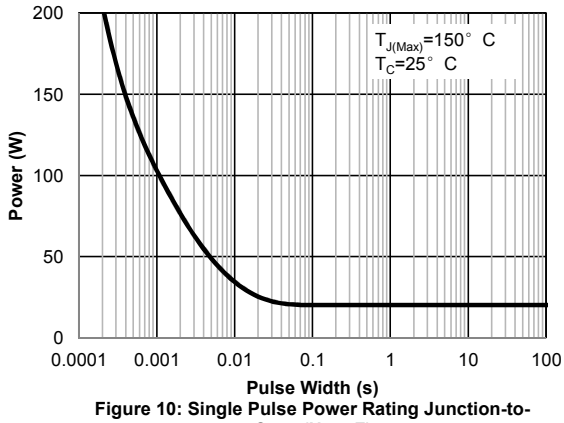


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

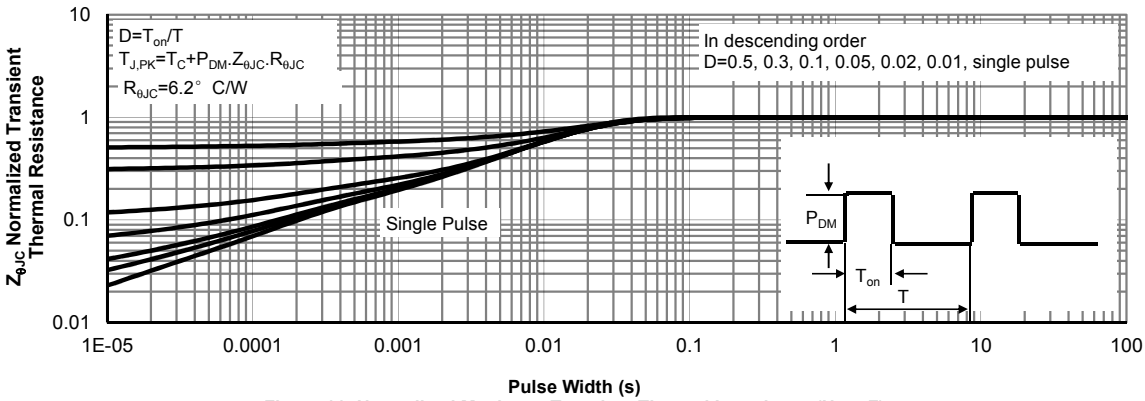


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

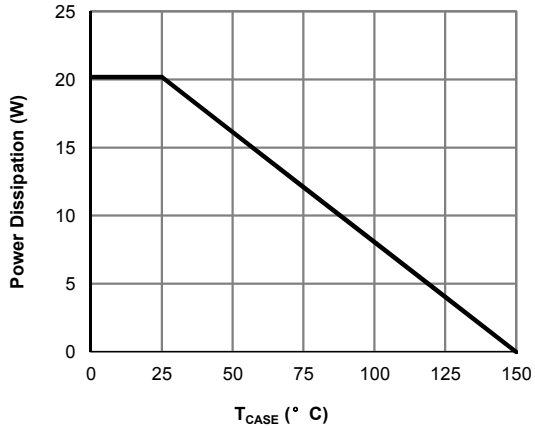


Figure 12: Power De-rating (Note F)

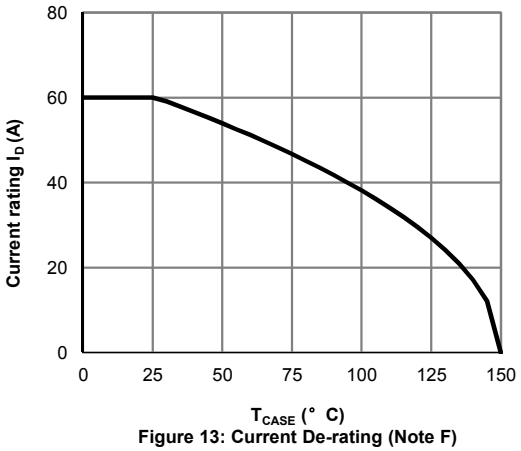


Figure 13: Current De-rating (Note F)

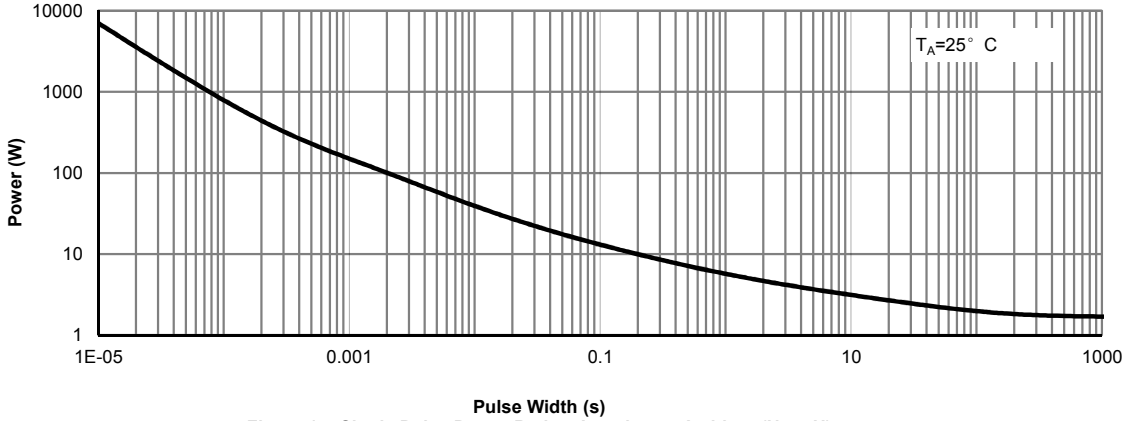


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

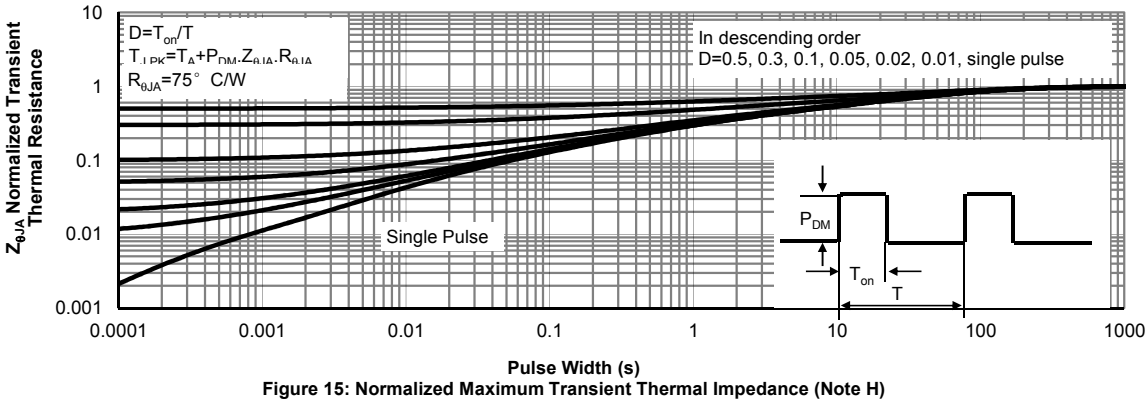


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

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	ID=250µA, VGS=0V	25			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=25V, 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	1.0	1.4	1.8	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=20A		0.7	0.85	mΩ
		T_J=125°C		1	1.2	
		V_{GS}=4.5V, I_D=20A		0.9	1.15	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=20A		120		S
V_{SD}	Diode Forward Voltage	I_S=1A, V_{GS}=0V		0.67	1	V
I_S	Maximum Body-Diode Continuous Current [G]				85	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=12.5V, f=1MHz		4860		pF
C_{oss}	Output Capacitance			1325		pF
C_{rss}	Reverse Transfer Capacitance			145		pF
R_g	Gate resistance	f=1MHz	0.6	1.3	2	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=12.5V, I_D=20A		60.6	85	nC
Q_g(4.5V)	Total Gate Charge			25	35	nC
Q_{gs}	Gate Source Charge			11.8		nC
Q_{gd}	Gate Drain Charge			4.4		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=12.5V, R_L=0.6Ω, R_{GEN}=3Ω		11		ns
t_r	Turn-On Rise Time			7		ns
$t_{D(off)}$	Turn-Off DelayTime			48		ns
t_f	Turn-Off Fall Time			8.5		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=20A, di/dt=500A/µs		20.5		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=20A, di/dt=500A/µs		55		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 <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 $T_{J(MAX)}$=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.

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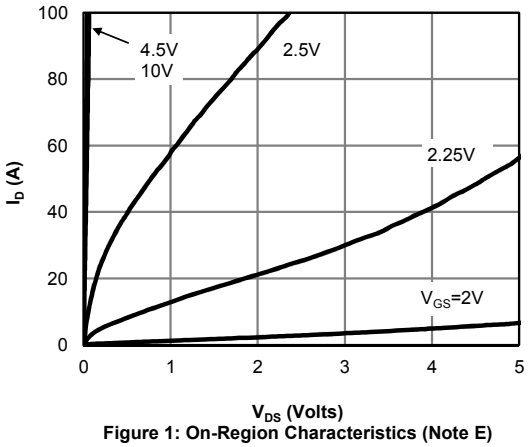


Figure 1: On-Region Characteristics (Note E)

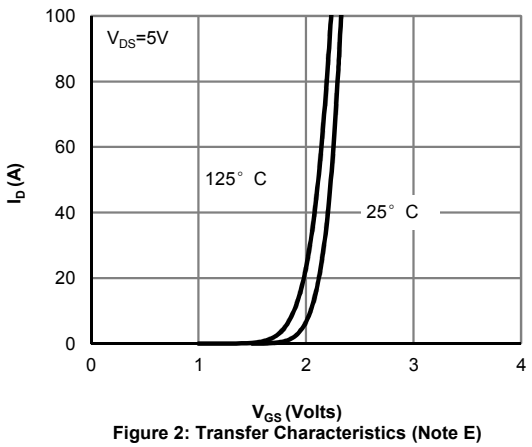


Figure 2: Transfer Characteristics (Note E)

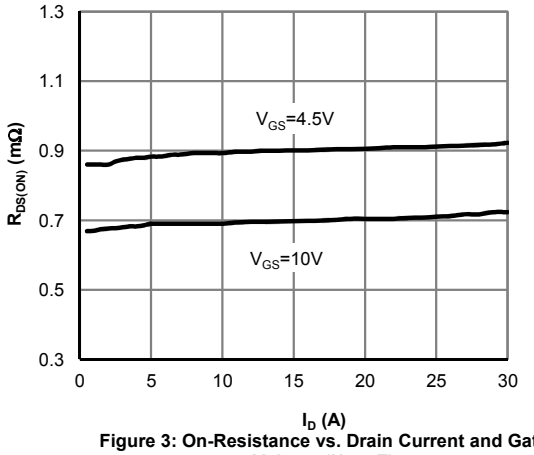


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

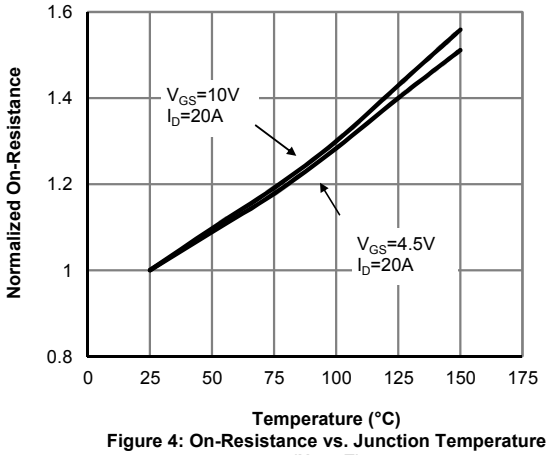


Figure 4: On-Resistance vs. Junction Temperature (Note E)

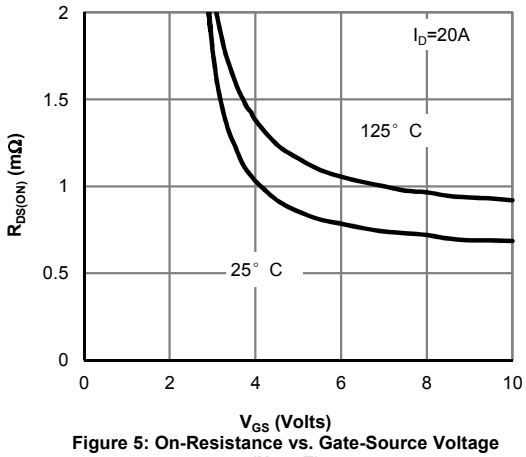


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

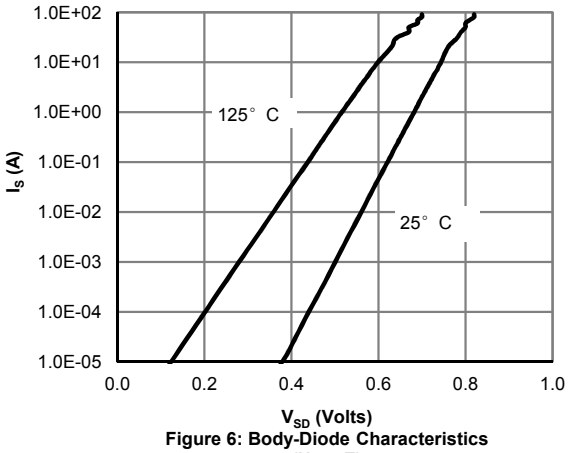


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

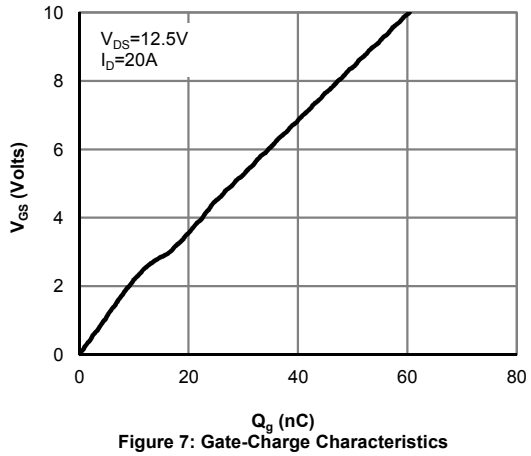


Figure 7: Gate-Charge Characteristics

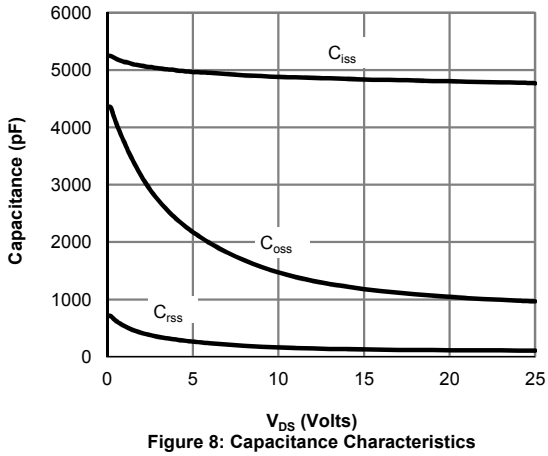
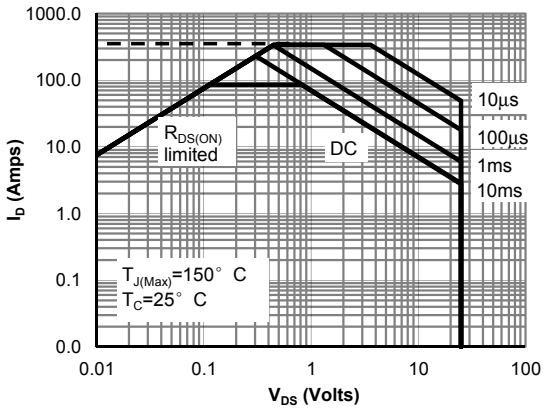


Figure 8: Capacitance Characteristics



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

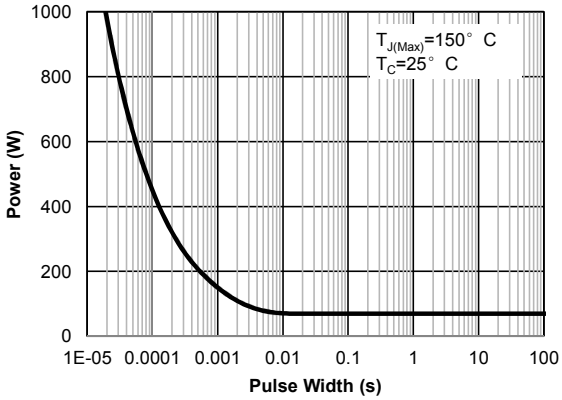


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

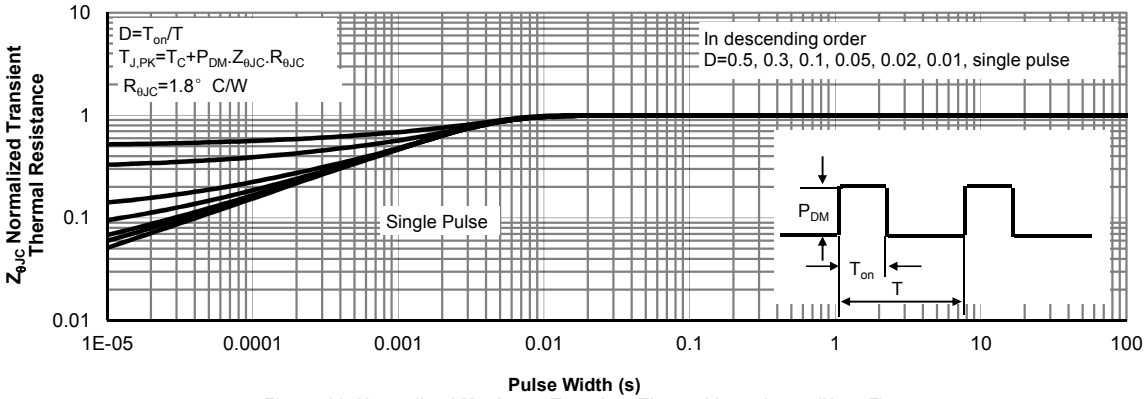


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

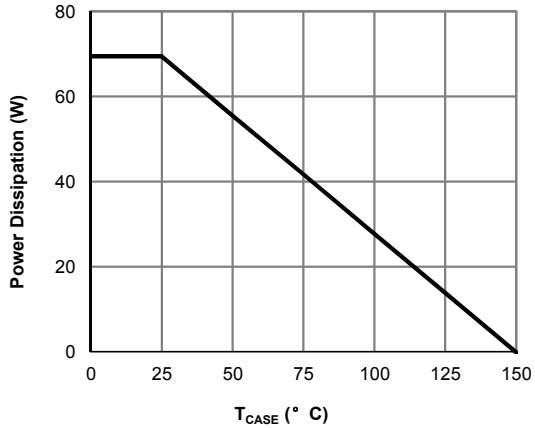


Figure 12: Power De-rating (Note F)

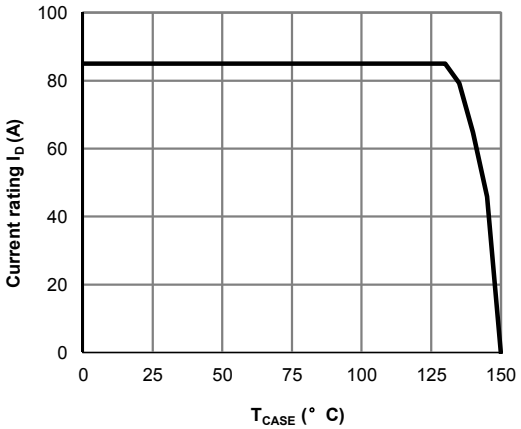


Figure 13: Current De-rating (Note F)

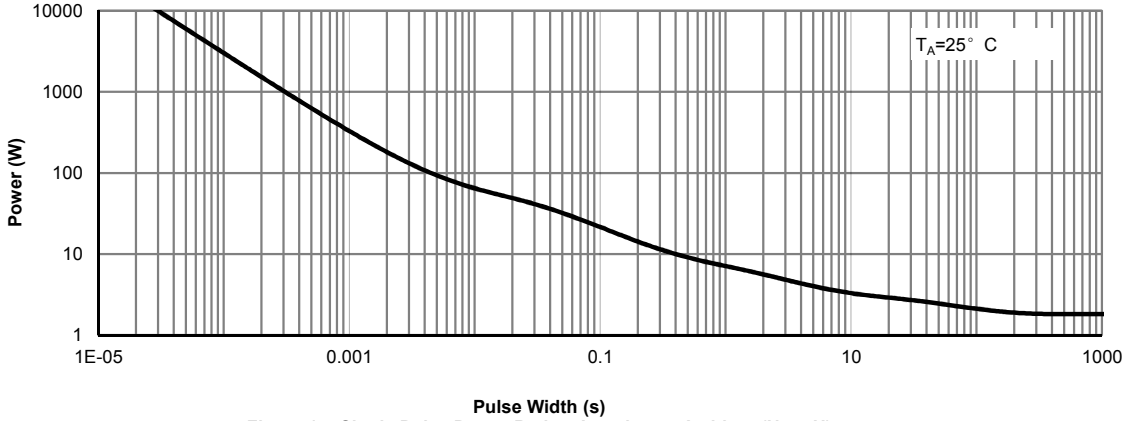


Figure 14: Single Pulse Power Rating Junction-to-Ambient (Note H)

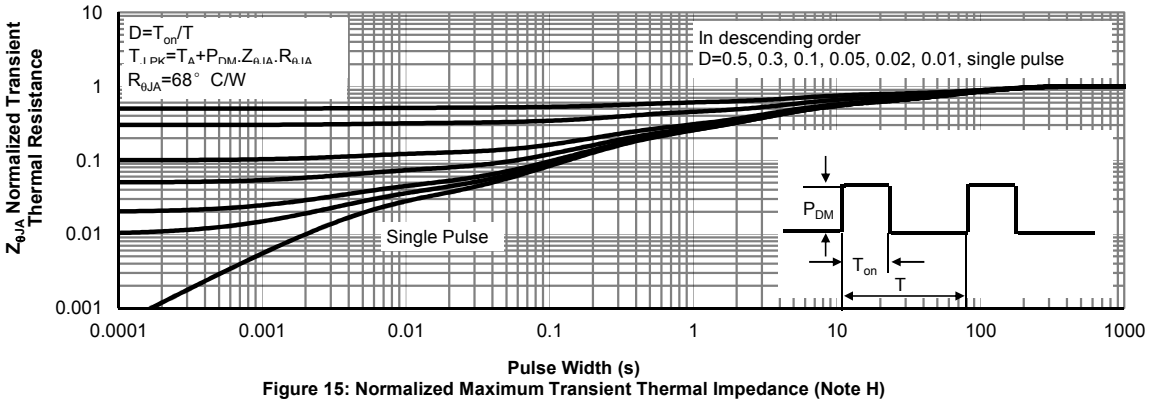


Figure 15: Normalized Maximum Transient Thermal Impedance (Note H)

Figure A: Gate Charge Test Circuit & Waveforms

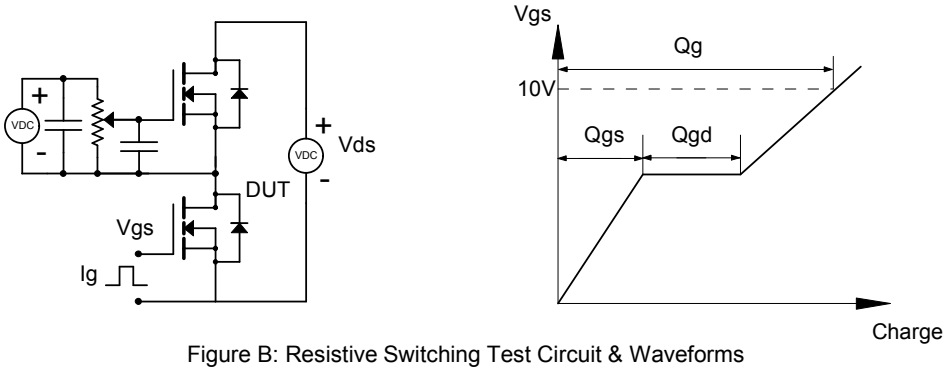


Figure B: Resistive Switching Test Circuit & Waveforms

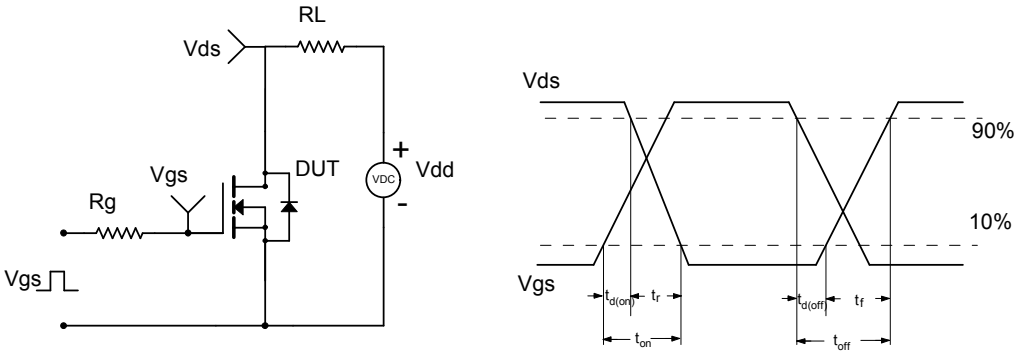


Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

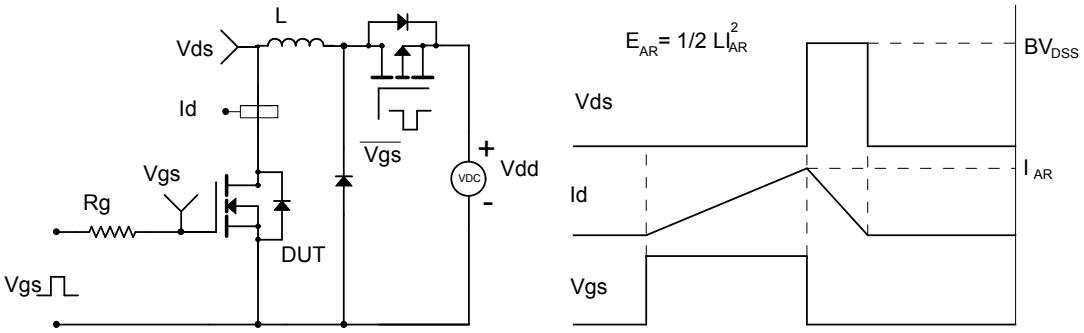
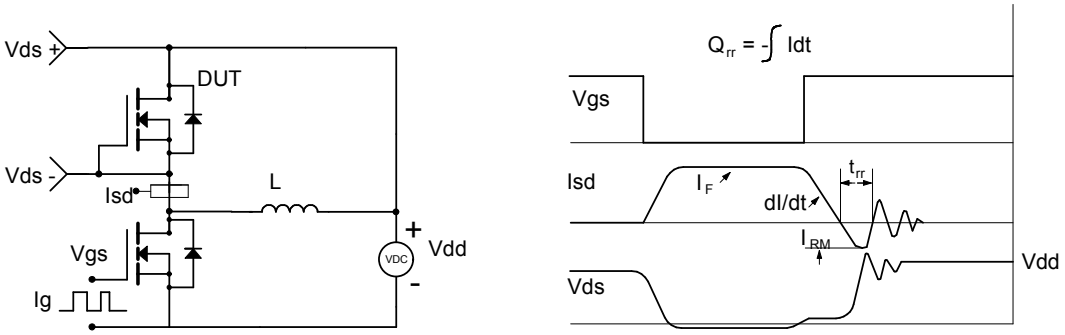



Figure D: Diode Recovery Test Circuit & Waveforms