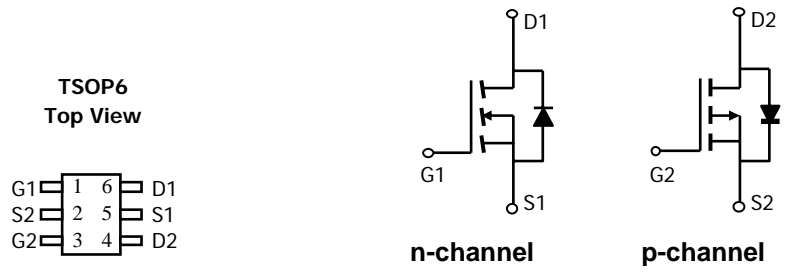# ALPHA & OMEGA SEMICONDUCTOR

AO6602
Complementary Enhancement Mode Field Effect Transistor

General Description

The AO6602 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs form a high-speed power inverter, suitable for a multitude of applications. *Standard Product AO6602 is Pb-free (meets ROHS & Sony 259 specifications). AO6602L is a Green Product ordering option. AO6602 and AO6602L are electrically identical.*

Features

n-channel	p-channel

V_{DS} (V) = 30V   -30V

I_D = 3.1A (V_{GS} = 10V)   -2.7A (V_{GS} = -10V)

$R_{DS(ON)}$

< 75mΩ (V_{GS} = 10V) < 100mΩ (V_{GS} = -10V)

< 115mΩ (V_{GS} = 4.5V) < 180mΩ (V_{GS} = -4.5V)

TSOP6
Top View

G1 — 1 6 — D1
S2 — 2 5 — S1
G2 — 3 4 — D2

n-channel   **p-channel**

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage		V_{DS}	30	-30	V
Gate-Source Voltage		V_{GS}	±20	±20	V
Continuous Drain Current [A]	T_A=25°C	I_D	3.1	-2.7	A
	T_A=70°C		2.4	-2.1	
Pulsed Drain Current [B]		I_{DM}	12	-12	
Power Dissipation	T_A=25°C	P_D	1.15	1.15	W
	T_A=70°C		0.73	0.73	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	°C

Thermal Characteristics: n-channel and p-channel

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	78	110	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		106	150	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	64	80	°C/W

Alpha & Omega Semiconductor, Ltd.

N-Channel 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}=24V, 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	1.9	3	V
$I_{D(ON)}$	On state drain current	V_{GS}=10V, V_{DS}=5V		10			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=3.1A			54	75	mΩ
			T_J=125°C		78		
		V_{GS}=4.5V, I_D=2A			88	115	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=3.1A			4.5		S
V_{SD}	Diode Forward Voltage	I_S=1A			0.79	1	V
I_S	Maximum Body-Diode Continuous Current					2.5	A
DYNAMIC PARAMETERS							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=15V, f=1MHz			200	240	pF
C_{oss}	Output Capacitance				40		pF
C_{rss}	Reverse Transfer Capacitance				20		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz			2.3	3	Ω
SWITCHING PARAMETERS							
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=15V, I_D=3.1A			6.5	8.5	nC
Q_g(4.5V)	Total Gate Charge				3.1	4	nC
Q_{gs}	Gate Source Charge				1.2		nC
Q_{gd}	Gate Drain Charge				1.6		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L=4.7Ω, R_{GEN}=3Ω			3.3		ns
t_r	Turn-On Rise Time				2.5		ns
$t_{D(off)}$	Turn-Off DelayTime				13.2		ns
t_f	Turn-Off Fall Time				1.7		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=3.1A, dI/dt=100A/µs			9.4	12	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=3.1A, dI/dt=100A/µs			3.5		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 value in any given application depends on the user's specific board design. The current rating is based on the t≤ 10s thermal resistance rating.
B: Repetitive rating, pulse width limited by junction temperature.
C. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.
D. The static characteristics in Figures 1 to 6,12,14 are obtained using 80µs pulses, duty cycle 0.5% max.
E. 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. The SOA curve provides a single pulse rating.
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Alpha and Omega Semiconductor, Ltd.

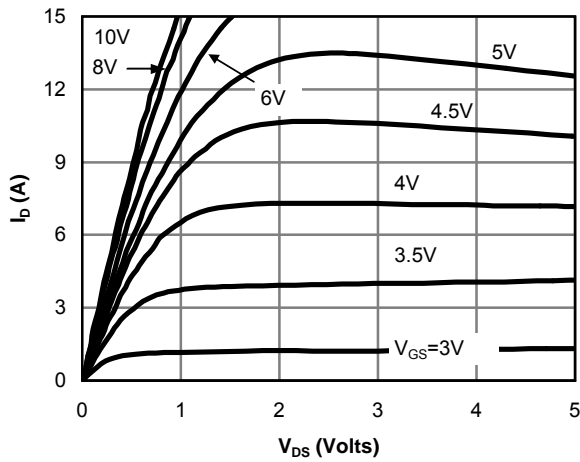**N-Channel Electrical Characteristics (T$_J$=25°C unless otherwise noted)**
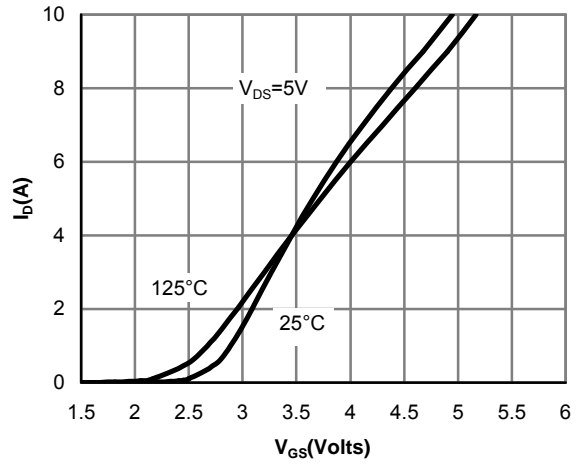
Fig 1: On-Region Characteristics

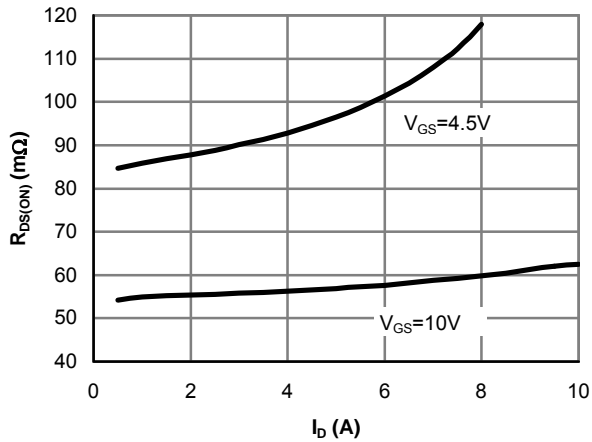**Figure 2: Transfer Characteristics**

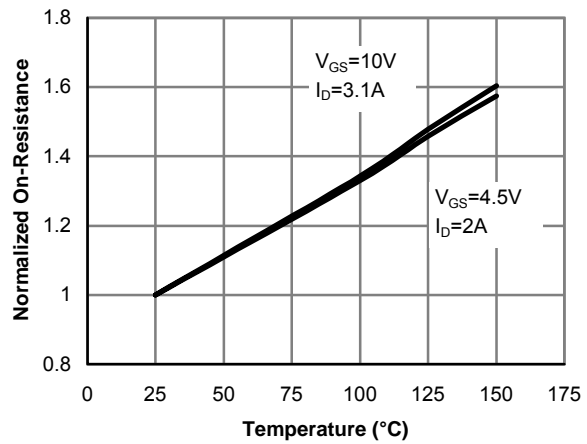**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**
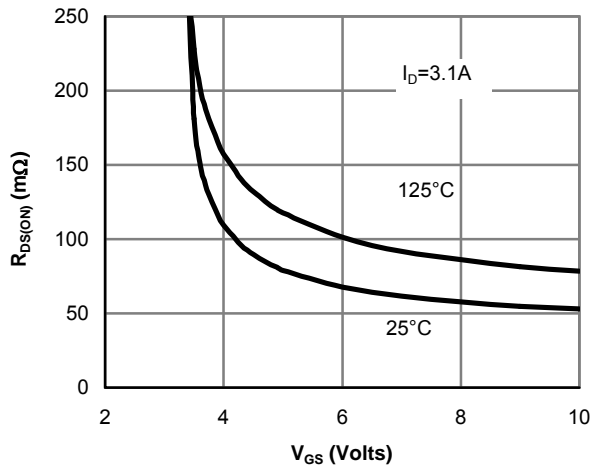
Figure 4: On-Resistance vs. Junction Temperature
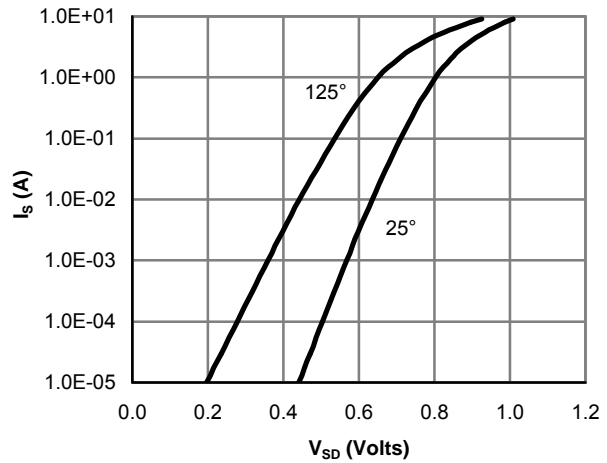
Figure 5: On-Resistance vs. Gate-Source Voltage

Figure 6: Body-Diode Characteristics

Alpha and Omega Semiconductor, Ltd.

N-Channel Electrical Characteristics (T$_J$=25°C unless otherwise noted)

V$_{DS}$=15V
I$_D$=3.1A

Q$_g$ (nC)

V$_{GS}$ (Volts)

Figure 7: Gate-Charge Characteristics

C$_{iss}$

C$_{oss}$

C$_{rss}$

Capacitance (pF)

V$_{DS}$ (Volts)

Figure 8: Capacitance Characteristics

T$_{J(Max)}$=150°C
T$_A$=25°C

R$_{DS(ON)}$
limited

10μs
100μs
1ms
10ms
0.1s
1s
10s
DC

I$_D$ (Amps)

V$_{DS}$ (Volts)

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

T$_{J(Max)}$=150°C
T$_A$=25°C

Power (W)

Pulse Width (s)

**Figure 10: Single Pulse Power Rating Junction-to-
Ambient (Note E)**

D=T$_{on}$/T
T$_{J,PK}$=T$_A$+P$_{DM}$·Z$_{θJA}$·R$_{θJA}$
R$_{θJA}$=90°C/W

In descending order
D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse

Single Pulse

P$_D$

T$_{on}$

T

**Z$_{θJA}$ Normalized Transient
Thermal Resistance**

Pulse Width (s)

Figure 11: Normalized Maximum Transient Thermal Impedance

Alpha and Omega Semiconductor, Ltd.

P-Channel 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$_{DS}$=-24V, 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	-1.9	-3	V
I$_{D(ON)}$	On state drain current	V$_{GS}$=-4.5V, V$_{DS}$=-5V		-5			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=-10V, I$_D$=-2.7A			77	100	mΩ
			T$_J$=125°C		110		
		V$_{GS}$=-4.5V, I$_D$=-2A			130	180	mΩ
g$_{FS}$	Forward Transconductance	V$_{DS}$=-5V, I$_D$=-2.7A			4.1		S
V$_{SD}$	Diode Forward Voltage	I$_S$=-1A,V$_{GS}$=0V			-0.81	-1	V
I$_S$	Maximum Body-Diode Continuous Current					-2	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=-15V, f=1MHz			260	312	pF
C$_{oss}$	Output Capacitance				55		pF
C$_{rss}$	Reverse Transfer Capacitance				44		pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz			4.3	5	Ω
SWITCHING PARAMETERS							
Q$_g$(10)	Total Gate Charge(10V)	V$_{GS}$=-10V, V$_{DS}$=-15V, I$_D$=-2.7A			5.8	7	nC
Q$_g$(4.5)	Total Gate Charge(4.5V)				3	4	nC
Q$_{gs}$	Gate Source Charge				0.78		nC
Q$_{gd}$	Gate Drain Charge				1.6		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=-10V, V$_{DS}$=-15V, R$_L$=5.6Ω, R$_{GEN}$=3Ω			7		ns
t$_r$	Turn-On Rise Time				6		ns
t$_{D(off)}$	Turn-Off DelayTime				15		ns
t$_f$	Turn-Off Fall Time				7.5		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=-2.7A, dI/dt=100A/μs			12.5	15	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=-2.7A, dI/dt=100A/μs			5.5		nC

A: The value of R$_{θJA}$ 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 value in any a given application depends on the user's specific board design. The current rating is based on the ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C. The R$_{θJA}$ is the sum of the thermal impedance from junction to lead R$_{θJL}$ and lead to ambient.

D. The static characteristics in Figures 1 to 6,12,14 are obtained using 80μs pulses, duty cycle 0.5% max.

E. 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. The SOA curve provides a single pulse rating.

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Alpha & Omega Semiconductor, Ltd.

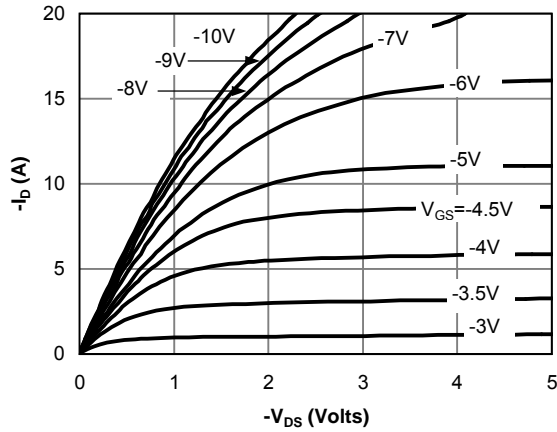**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL**
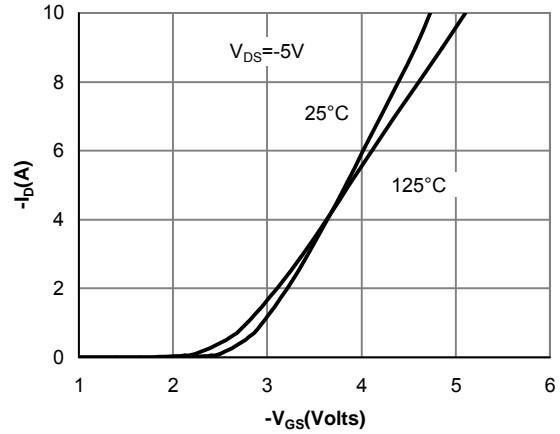
Fig 1: On-Region Characteristics
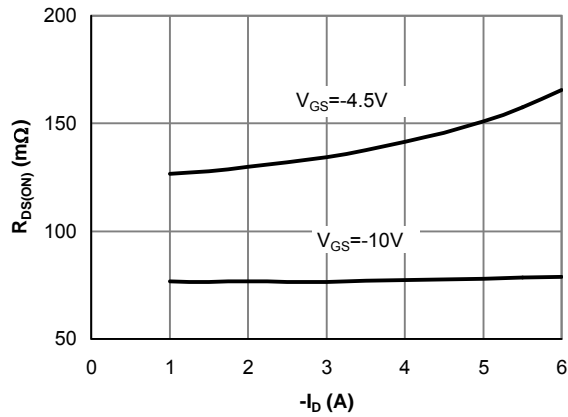
Figure 2: Transfer Characteristics

Figure 3: On-Resistance vs. Drain Current and Gate Voltage
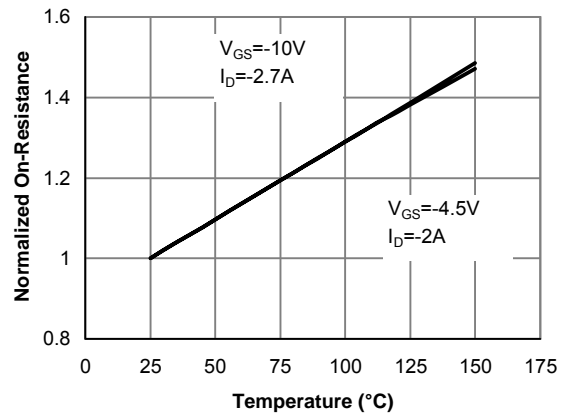
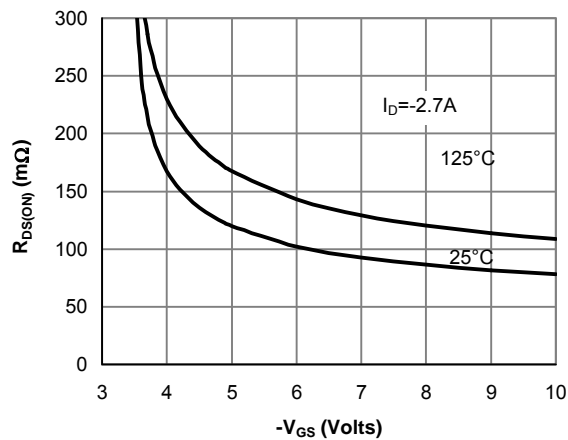**Figure 4: On-Resistance vs. Junction Temperature**
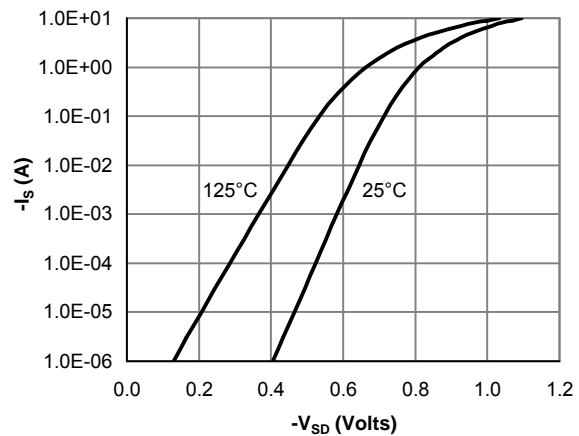
Figure 5: On-Resistance vs. Gate-Source Voltage

Figure 6: Body-Diode Characteristics

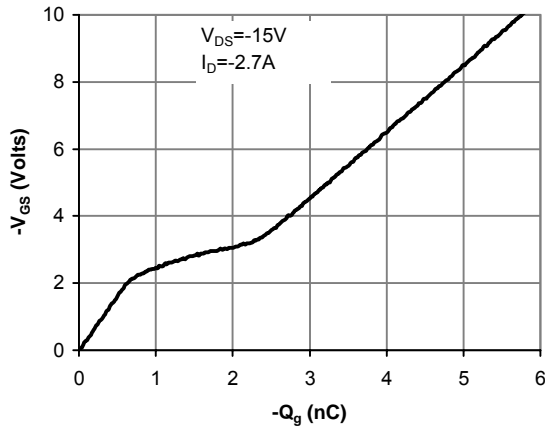**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL**
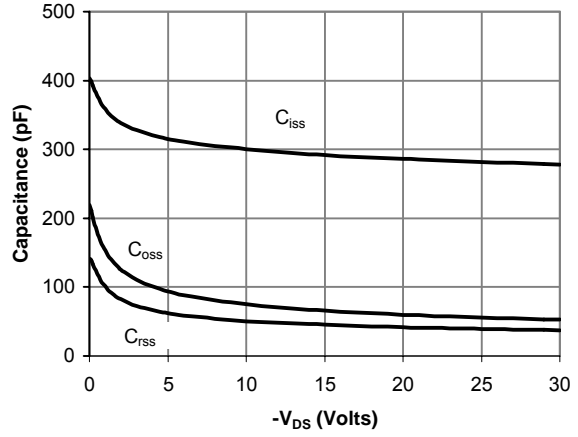
Figure 7: Gate-Charge Characteristics
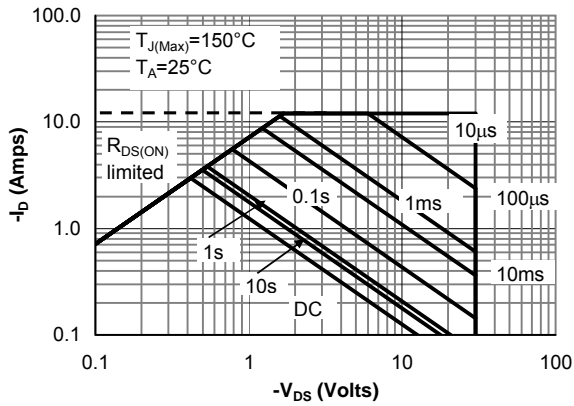
Figure 8: Capacitance Characteristics

Figure 9: Maximum Forward Biased Safe Operating Area (Note E)
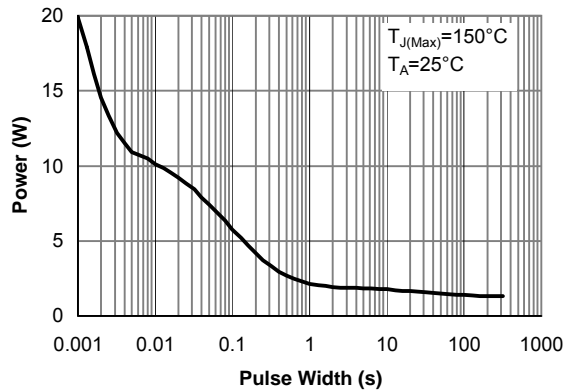
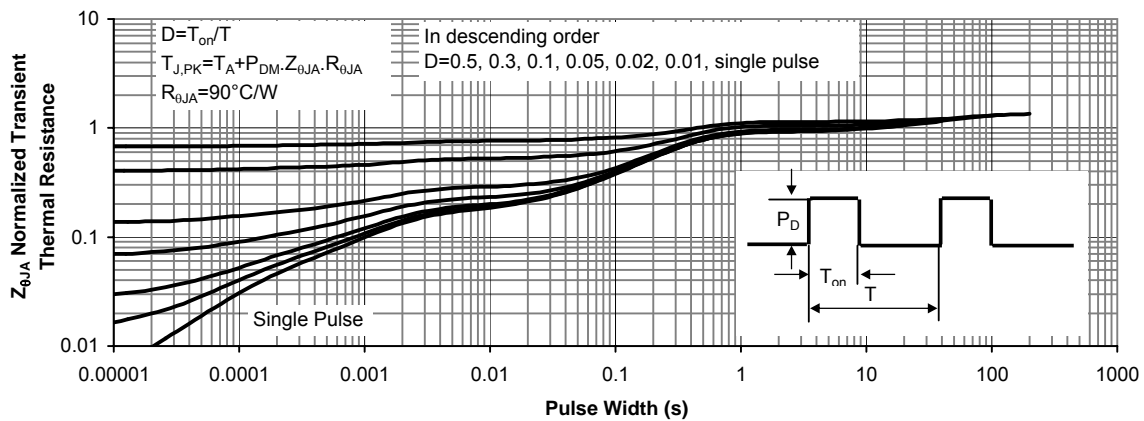Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

Figure 11: Normalized Maximum Transient Thermal Impedance

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