

AOP604

Complementary Enhancement Mode Field Effect Transistor

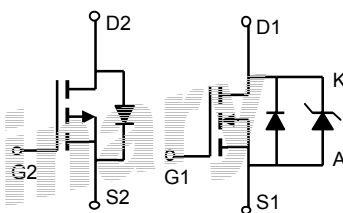
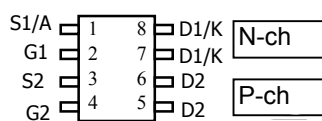
General Description

The AOP604 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. A Schottky diode in parallel with the n-channel FET reduces body diode related losses.

Features

n-channel	p-channel
V_{DS} (V) = 30V	-30V
I_D = 7.5A	-6.6A
$R_{DS(ON)}$ < 28m Ω	< 35m Ω (V_{GS} = 10V)
< 43m Ω	< 58m Ω (V_{GS} = 4.5V)
Schottky	
$V_{DS}=30V, I_F=3A, V_F<0.5V@1A$	

PDIP-8



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ 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	I_D	$T_A=25^\circ\text{C}$	7.5	A
		$T_A=70^\circ\text{C}$	6	
Pulsed Drain Current ^B	I_{DM}	30	-30	
Power Dissipation	P_D	$T_A=25^\circ\text{C}$	2.5	W
		$T_A=70^\circ\text{C}$	1.6	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	-55 to 150	$^\circ\text{C}$

Parameter	Symbol	Maximum Schottky	Units
Reverse Voltage	V_{DS}	30	V
Continuous Forward Current ^A	I_D	$T_A=25^\circ\text{C}$	A
		$T_A=70^\circ\text{C}$	
Pulsed Forward Current ^B	I_{DM}	20	
Power Dissipation ^A	P_D	$T_A=25^\circ\text{C}$	W
		$T_A=70^\circ\text{C}$	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Characteristics: n-channel					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	40	50	$^{\circ}C/W$
Maximum Junction-to-Ambient ^A	Steady-State		67	80	$^{\circ}C/W$
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	33	40	$^{\circ}C/W$

Thermal Characteristics: p-channel					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	38	50	$^{\circ}C/W$
Maximum Junction-to-Ambient ^A	Steady-State		66	80	$^{\circ}C/W$
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	30	40	$^{\circ}C/W$

Thermal Characteristics: Schottky					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	42	50	$^{\circ}C/W$
Maximum Junction-to-Ambient ^A	Steady-State		70	80	$^{\circ}C/W$
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	34	40	$^{\circ}C/W$

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^{\circ}C$. The value in any a given application depends on the user's specific board design. The current rating is based on the $t \leq 10s$ thermal resistance rating.

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

C. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to lead $R_{\theta JL}$ and lead to ambient.

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

E. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^{\circ}C$. The SOA curve provides a single pulse rating.

n-channel MOSFET 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 T _J =55°C			1 5	μA
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	1.8	3	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	30			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =7.5A T _J =125°C		22.6	28	mΩ
		V _{GS} =4.5V, I _D =6.0A		33	43	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =7.5A	12	16		S
V _{SD}	Schottky+ Body Diode Forward Voltage	I _S =1A		0.45	0.5	V
I _S	Maximum Body-Diode+Schottky Continuous Current				4	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		680		pF
C _{oss}	Output Capacitance. (Schottky+FET)			102		pF
C _{rss}	Reverse Transfer Capacitance			77		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		3		Ω
SWITCHING PARAMETERS						
Q _{g(10V)}	Total Gate Charge	V _{GS} =4.5V, V _{DS} =15V, I _D =7.5A		13.84		nC
Q _g	Total Gate Charge			6.74		nC
Q _{gs}	Gate Source Charge			1.82		nC
Q _{gd}	Gate Drain Charge			3.2		nC
t _{D(on)}	Turn-On Delay Time	V _{GS} =10V, V _{DS} =15V, R _L =2.0Ω, R _{GEN} =6Ω		4.6		ns
t _r	Turn-On Rise Time			4.1		ns
t _{D(off)}	Turn-Off Delay Time			20.6		ns
t _f	Turn-Off Fall Time			5.2		ns
t _{rr}	Body Diode Reverse Recovery time	I _F =7.5A, di/dt=100A/μs		16.5		ns
Q _{rr}	Body Diode Reverse Recovery charge	I _F =7.5A, di/dt=100A/μs		7.8		nC
SCHOTTKY PARAMETERS						
V _F	Forward Voltage Drop	I _F =1.0A		0.45	0.5	V
I _{rm}	Maximum reverse leakage current	V _R =30V		0.007	0.05	mA
		V _R =30V, T _J =125°C		3.2	10	
		V _R =30V, T _J =150°C		12	20	
C _T	Junction Capacitance	V _R =15V		37		pF

A: The value of R_{θJA} 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 value in any a 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_{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 are obtained using 80 μs pulses, duty cycle 0.5% max.

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

p-channel MOSFET Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$	-30			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-24\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-1.2	-2	-2.4	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-10\text{V}$, $V_{DS}=-5\text{V}$	30			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$, $I_D=-6.6\text{A}$ $T_J=125^\circ\text{C}$		28 37	35 45	$\text{m}\Omega$
		$V_{GS}=-4.5\text{V}$, $I_D=-5\text{A}$		44	58	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}$, $I_D=-6.6\text{A}$		13		S
V_{SD}	Diode Forward Voltage	$I_S=-1\text{A}$, $V_{GS}=0\text{V}$		-0.76	-1	V
I_S	Maximum Body-Diode Continuous Current				-4.2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=-15\text{V}$, $f=1\text{MHz}$		920		pF
C_{oss}	Output Capacitance			190		pF
C_{rss}	Reverse Transfer Capacitance			122		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		3.6		Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge (10V)	$V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $I_D=-6.6\text{A}$		18.5		nC
$Q_g(4.5\text{V})$	Total Gate Charge (4.5V)			9.6		nC
Q_{gs}	Gate Source Charge			2.7		nC
Q_{gd}	Gate Drain Charge			4.5		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $R_L=2.3\Omega$, $R_{GEN}=3\Omega$		7.7		ns
t_r	Turn-On Rise Time			5.7		ns
$t_{D(off)}$	Turn-Off Delay Time			20.2		ns
t_f	Turn-Off Fall Time			9.5		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-6.6\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		20		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-6.6\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		8.8		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. The value in any a given application depends on the user's specific board design. The current rating is based on the $t \leq 10\text{s}$ thermal resistance rating.

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

C: The $R_{\theta JA}$ is the sum of the thermal impedance 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 80 μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. The SOA curve provides a single pulse rating.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CANNEL

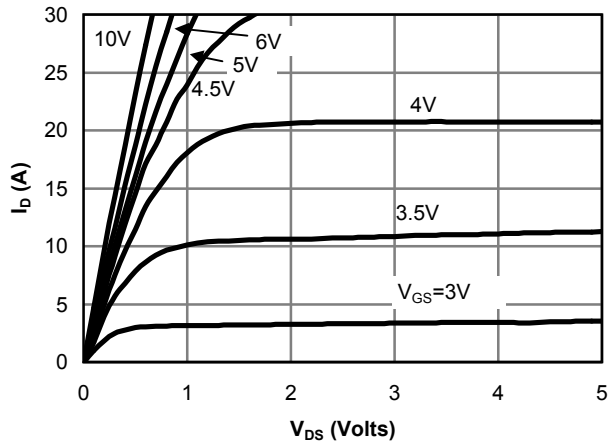


Fig 1: On-Region Characteristics

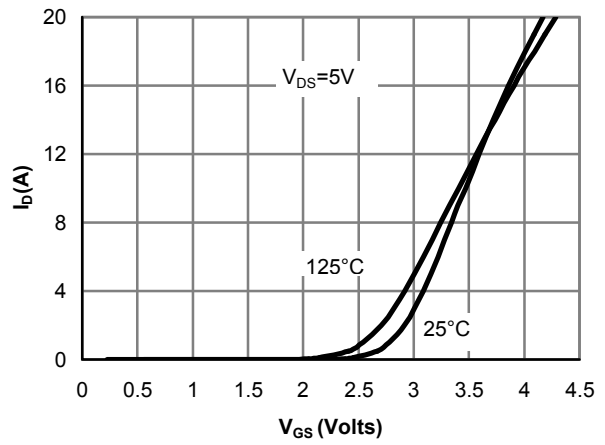


Figure 2: Transfer Characteristics

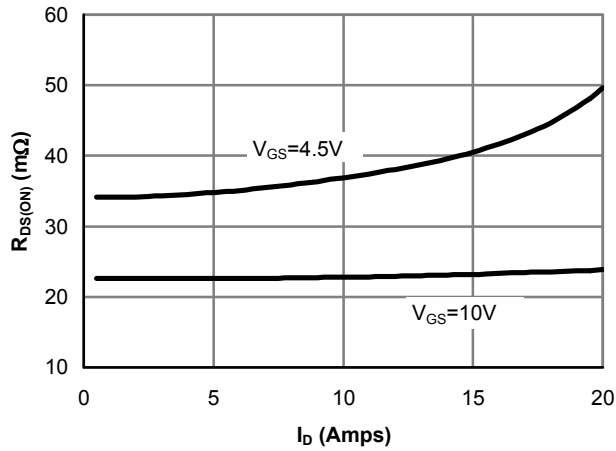


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

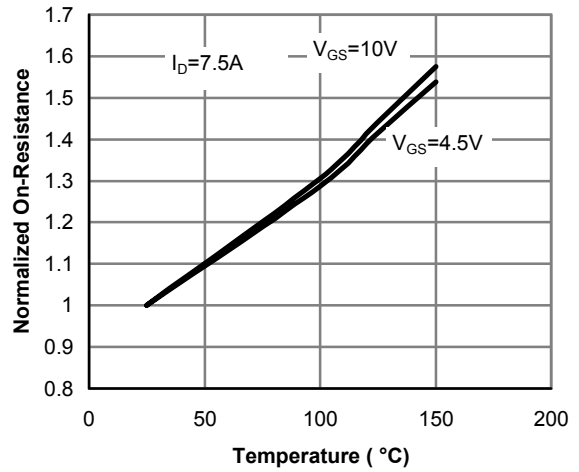


Figure 4: On-Resistance vs. Junction Temperature

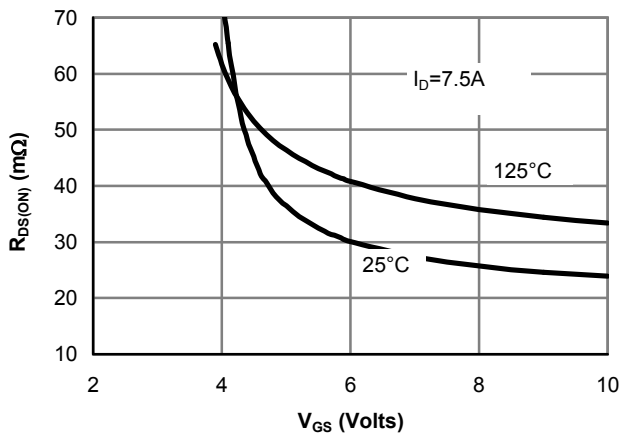


Figure 5: On-Resistance vs. Gate-Source Voltage

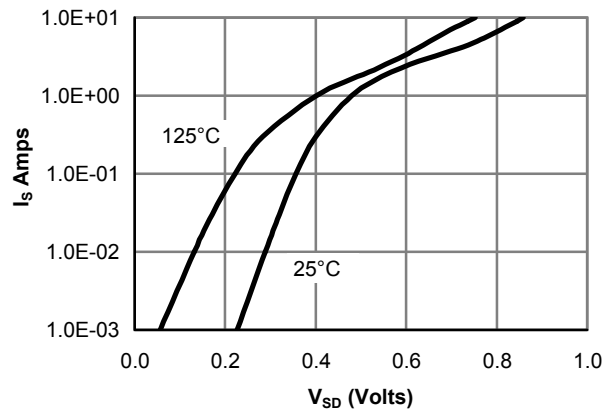


Figure 6: Body diode characteristics MOSFET+Schottky

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

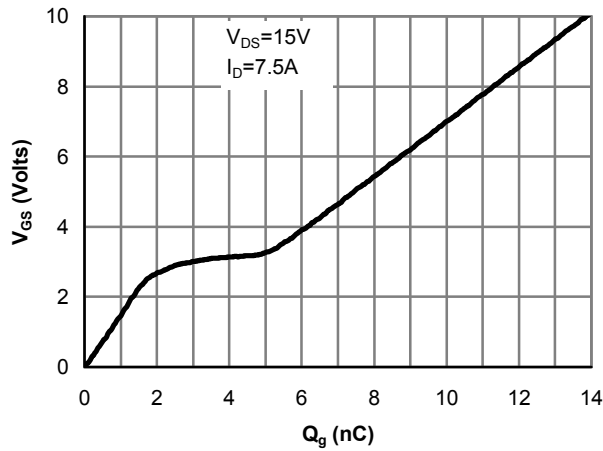


Figure 7: Gate-Charge characteristics

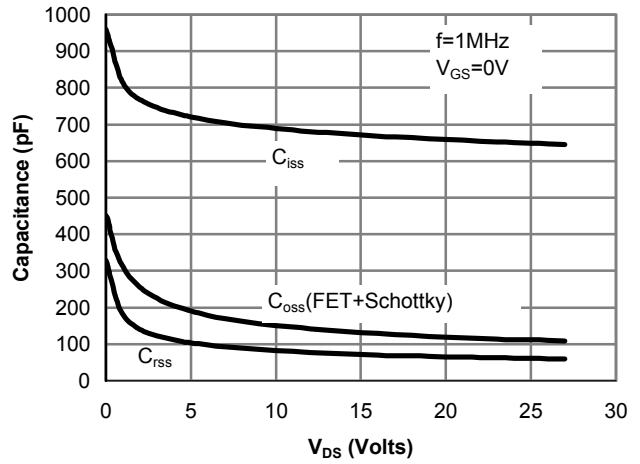


Figure 8: Capacitance Characteristics

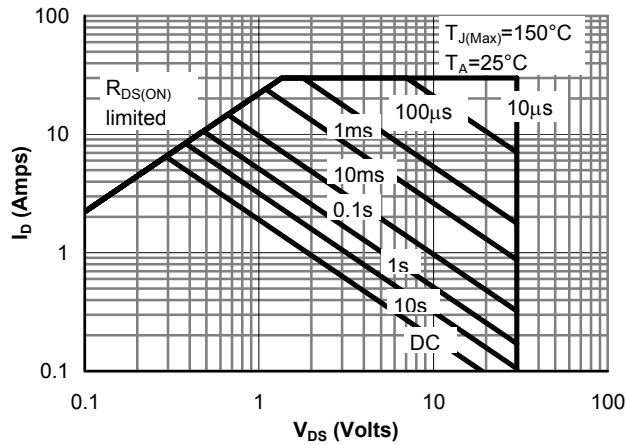


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

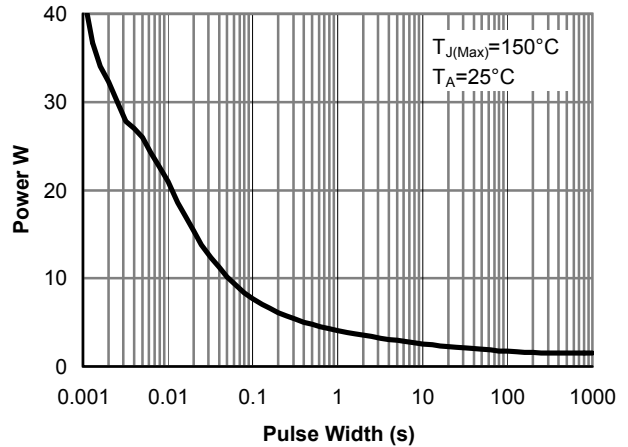


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

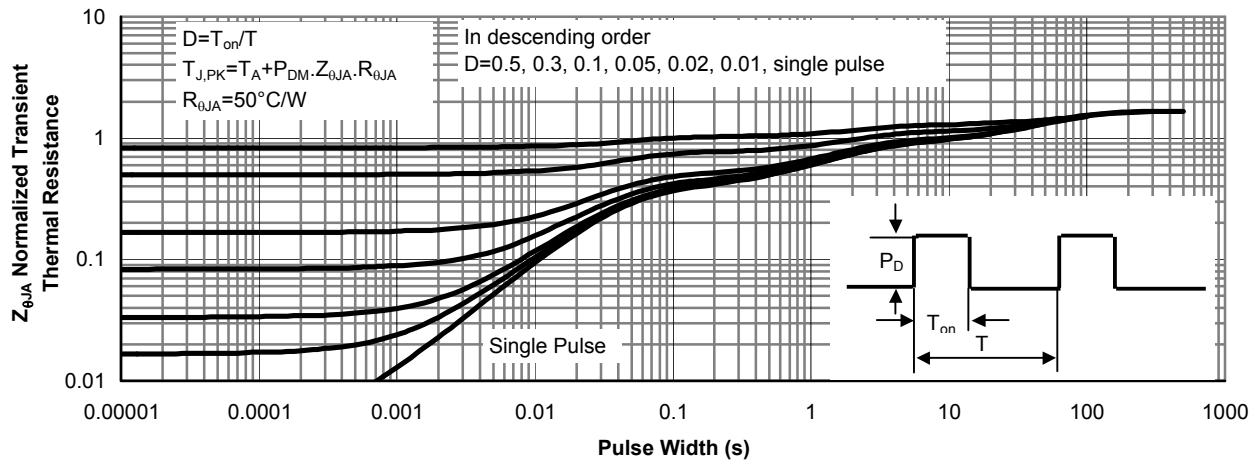


Figure 11: Normalized Maximum Transient Thermal Impedance

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

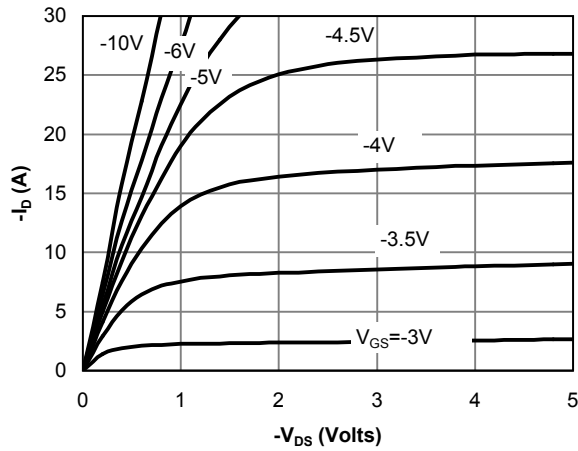


Fig 1: On-Region Characteristics

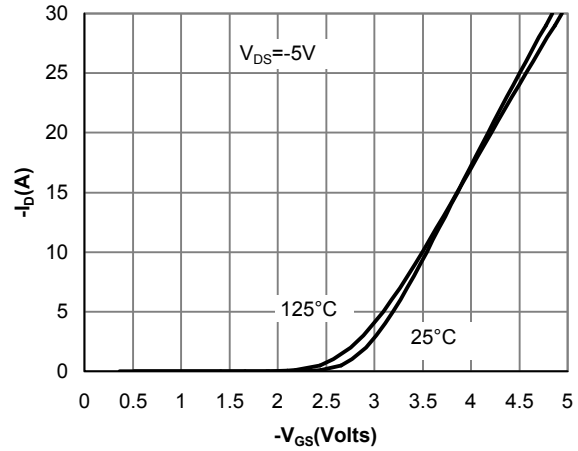


Figure 2: Transfer Characteristics

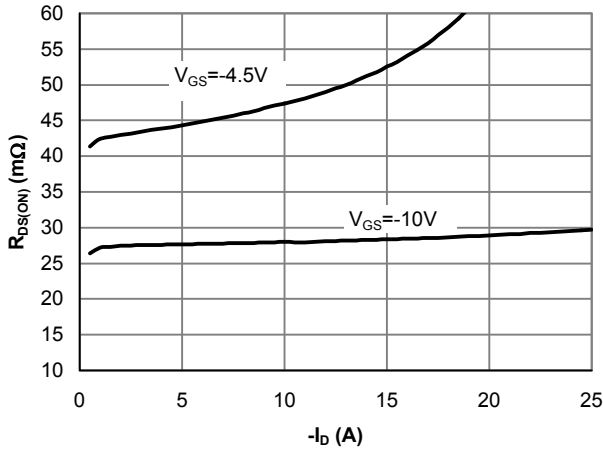


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

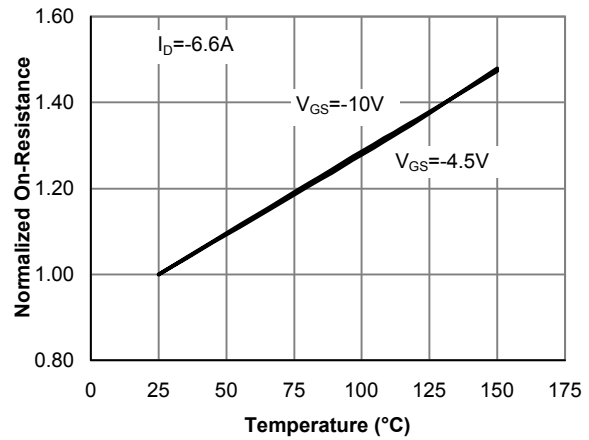


Figure 4: On-Resistance vs. Junction Temperature

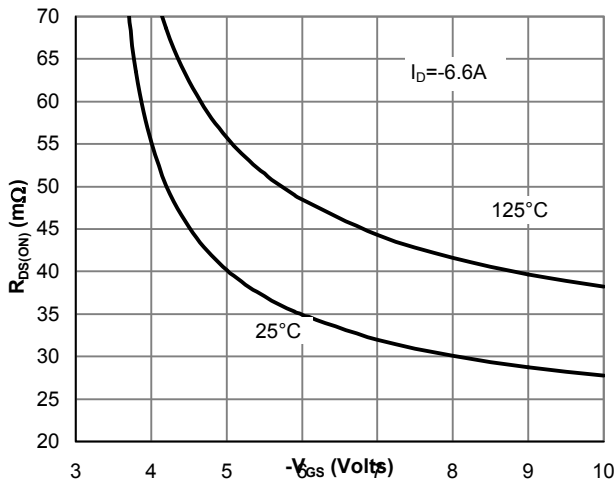


Figure 5: On-Resistance vs. Gate-Source Voltage

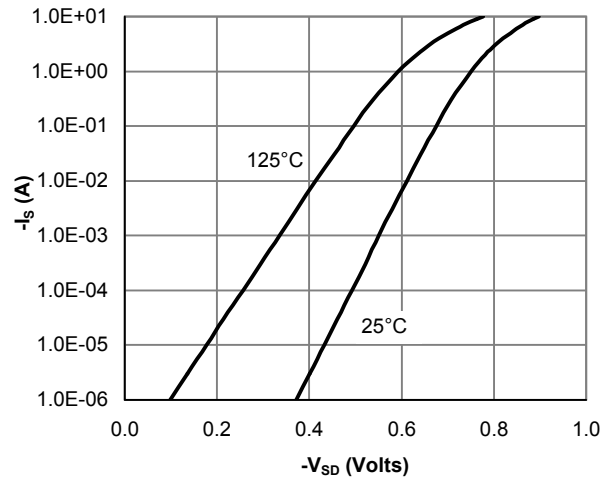


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

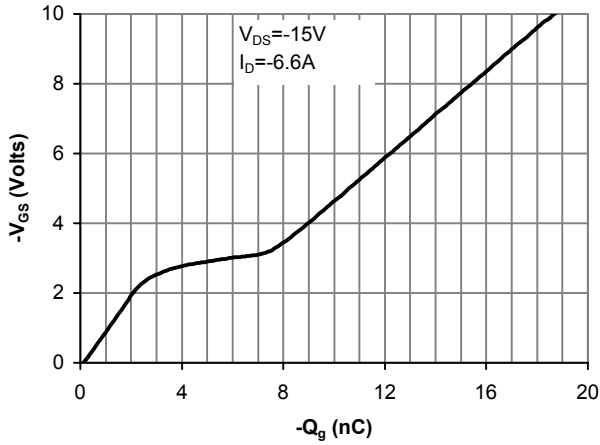


Figure 7: Gate-Charge Characteristics

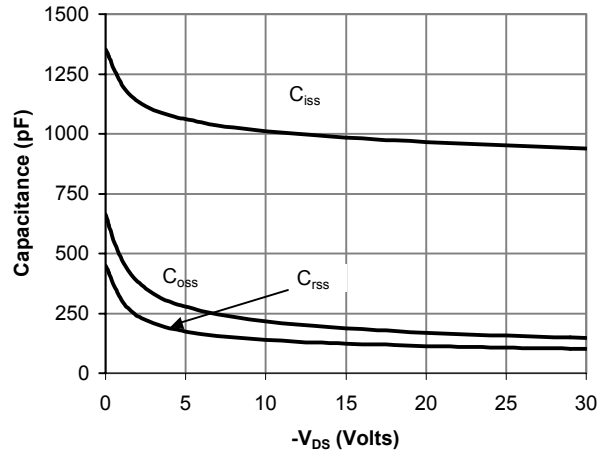


Figure 8: Capacitance Characteristics

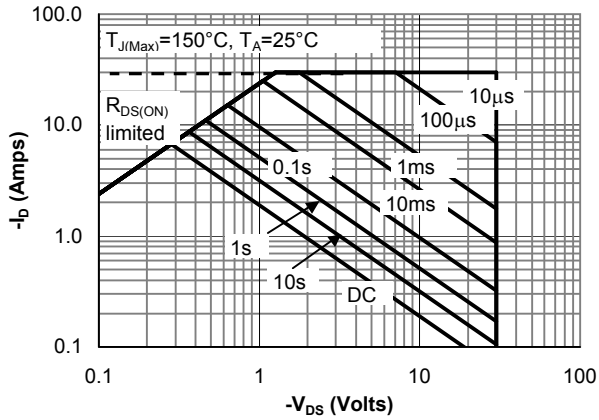


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

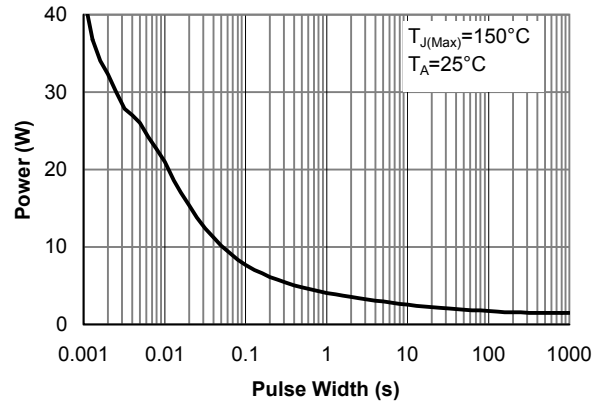


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

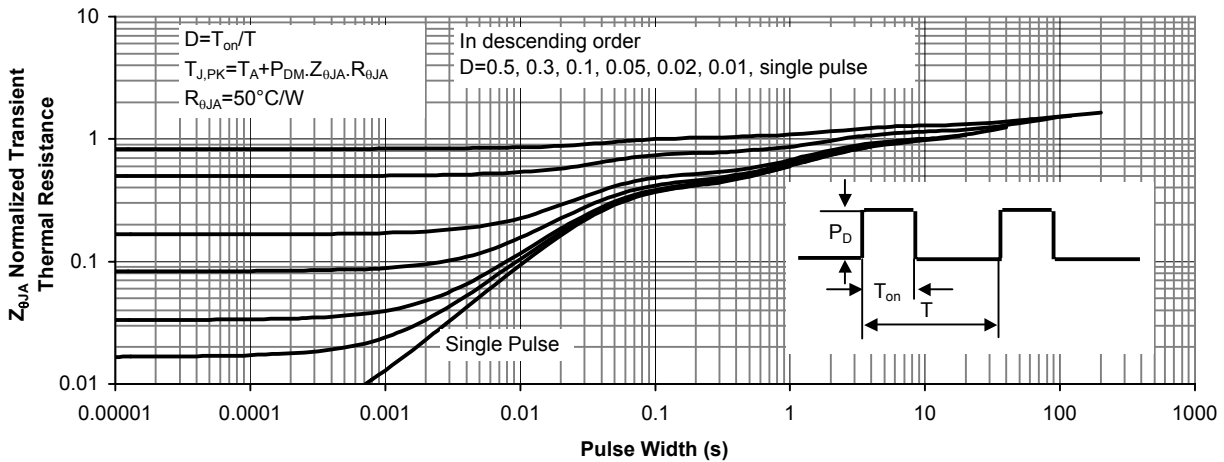


Figure 11: Normalized Maximum Transient Thermal Impedance

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

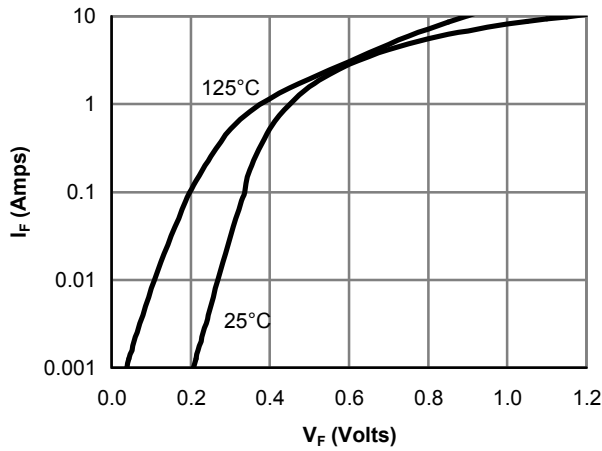


Figure 12: Schottky Forward Characteristics

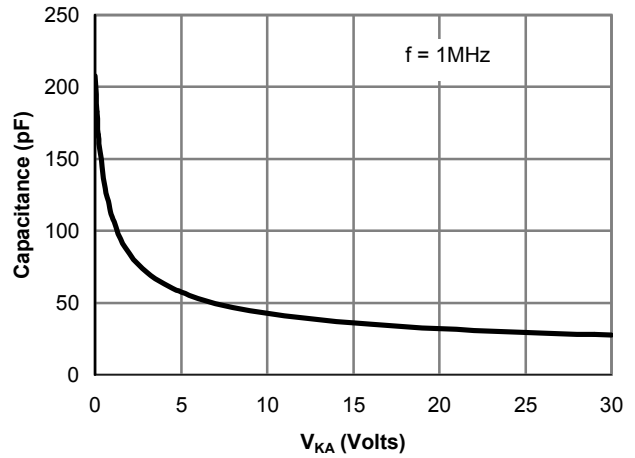


Figure 13: Schottky Capacitance Characteristics

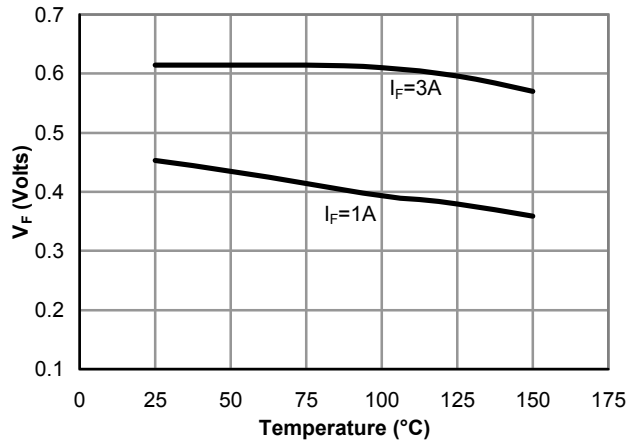


Figure 14: Schottky Forward Drop vs. Junction Temperature

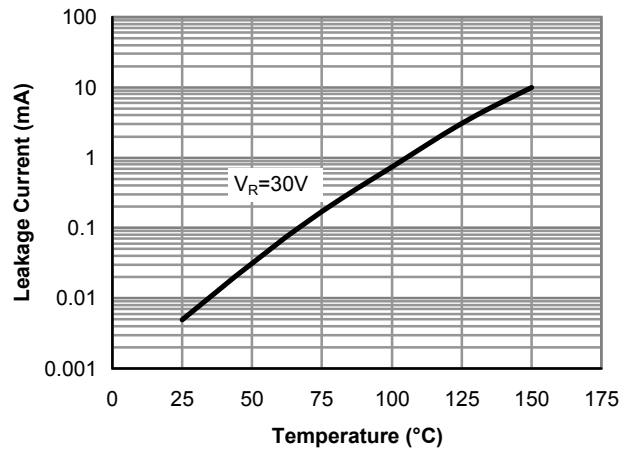


Figure 15: Schottky Leakage current vs. Junction Temperature

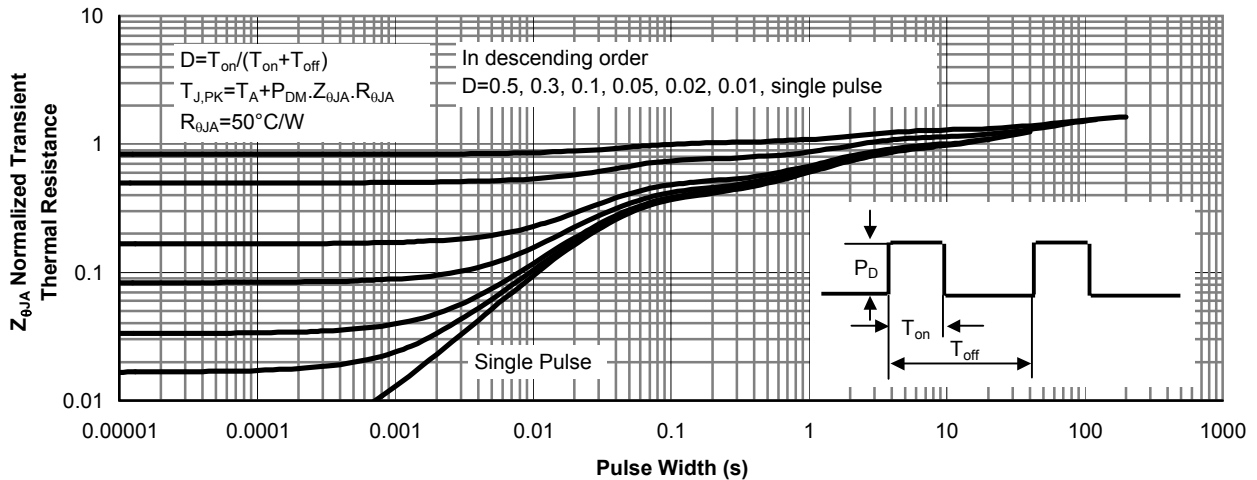


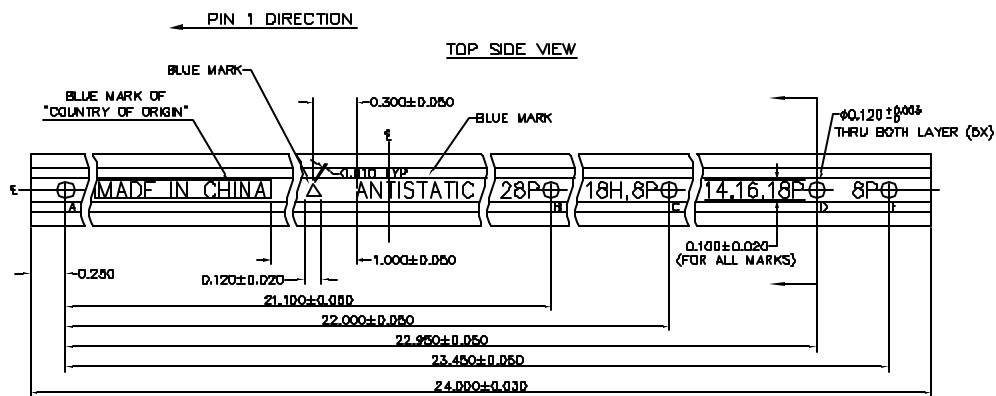
Figure 15: Schottky Normalized Maximum Transient Thermal Impedance



ALPHA & OMEGA
SEMICONDUCTOR, INC.

PDIP-8 (300) Tube Data

PDIP-8 Tube



NOTES:

1. PLASTIC CARRIER THERMAL REQUIREMENTS TO 125F WITHOUT DISTORTION OR DETERIORATION IN ANTI-STATIC PROPERTIES.
2. CLARITY : PARTS IN TUBE TO BE CLEARLY VISIBLE IN DAYLIGHT TO THE NAKED EYE.
3. TUBE TO BE COATED (INSIDE AND OUT) WITH ANTI-STATIC AGENTS (PI-23820) AND THE SURFACE RESISTIVITY SHALL BE BETWEEN 10^8 TO 10^{12} OHM/CM².
4. MATL : MODIFIED ACRYLIC OR RIGID PVC.
5. FLATNESS : TUBE TO BE FLAT WITH 1/32 INCH.
6. BLUE MARK OF "Δ ANTISTATIC 28P 8P 14, 16, 18P" SHALL BE PUT ON TOP SURFACE OF TUBE AND SHALL PASS COTTON BRUSH TEST. (5 CYCLES)*
7. TUBE WITH RIPPLE SURFACE AT PACKAGE LOADING AREA THAT AFFECT PACKAGE VISIBILITY SHALL BE REJECTABLE.
8. ALL DIMENSION ARE IN INCH.

