ALPHA & OMEGA
SEMICONDUCTOR, LTD

AO6401A
P-Channel Enhancement Mode Field Effect Transistor

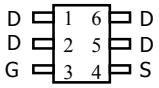
General Description

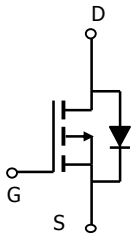
The AO6401A uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications. AO6401A is Pb-free (meets ROHS & Sony 259 specifications).

Features

V_{DS} = -30V
I_D = -5.0A (V_{GS} = -10V)
$R_{DS(ON)}$ < 44mΩ (V_{GS} = -10V)
$R_{DS(ON)}$ < 55mΩ (V_{GS} = -4.5V)
$R_{DS(ON)}$ < 82mΩ (V_{GS} = -2.5V)

TSOP6
Top View





Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	10 Sec	Steady State	Units
Drain-Source Voltage		V_{DS}	-30		V
Gate-Source Voltage		V_{GS}	±12		V
Continuous Drain Current [A]	T_A=25°C	I_D	-5	-3.7	A
	T_A=70°C		-3.7	-3.2	
Pulsed Drain Current [B]		I_{DM}	-25		
Power Dissipation [A]	T_A=25°C	P_D	1.6	1.0	W
	T_A=70°C		1.0	0.7	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150		°C

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	58	80	°C/W
Maximum Junction-to-Ambient [A]	Steady State		94	120	°C/W
Maximum Junction-to-Lead [C]	Steady State	$R_{\theta JL}$	37	50	°C/W

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	-0.5	-1	-1.5	V
$I_{D(ON)}$	On state drain current	V_{GS} = -4.5V, V_{DS} = -5V	-25			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = -10V, I_D = -5.0A		35	44	mΩ
		T_J=125°C		49	62	
		V_{GS} = -4.5V, I_D = -4.0A		44	55	mΩ
		V_{GS} = -2.5V, I_D = -3.5A		66	82	mΩ
g_{FS}	Forward Transconductance	V_{DS} = -5V, I_D = -5.0A		13		S
V_{SD}	Diode Forward Voltage	I_S = -1A,V_{GS} = 0V		-0.73	-1	V
I_S	Maximum Body-Diode Continuous Current				-1.6	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}= 0V, V_{DS}= -15V, f=1MHz		943	1180	pF
C_{oss}	Output Capacitance			108		pF
C_{rss}	Reverse Transfer Capacitance			73		pF
R_g	Gate resistance	V_{GS}= 0V, V_{DS}= 0V, f=1MHz	3	6	12	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}= -4.5V, V_{DS}= -15V, I_D= -5A		9.8	13	nC
Q_{gs}	Gate Source Charge			2.0		nC
Q_{gd}	Gate Drain Charge			3.3		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}= -10V, V_{DS}= -15V, R_L=3Ω, R_{GEN}=3Ω		5.2		ns
t_r	Turn-On Rise Time			6.8		ns
$t_{D(off)}$	Turn-Off DelayTime			42		ns
t_f	Turn-Off Fall Time			15		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F= -5A, dI/dt=100A/µs		21	28	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F= -5A, dI/dt=100A/µs		14.3		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. 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 are obtained using < 300 µs 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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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

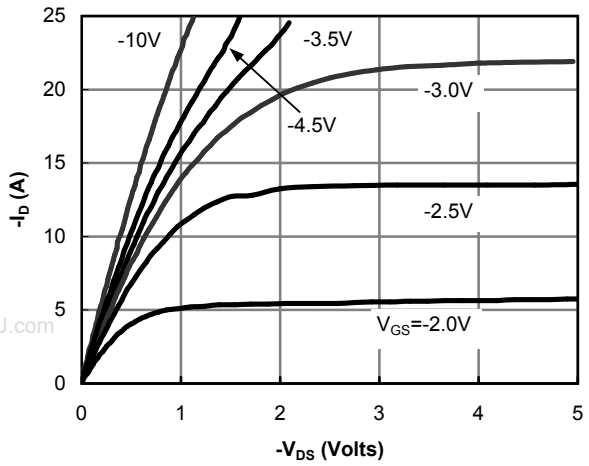

Figure 1: On-Region Characteristics

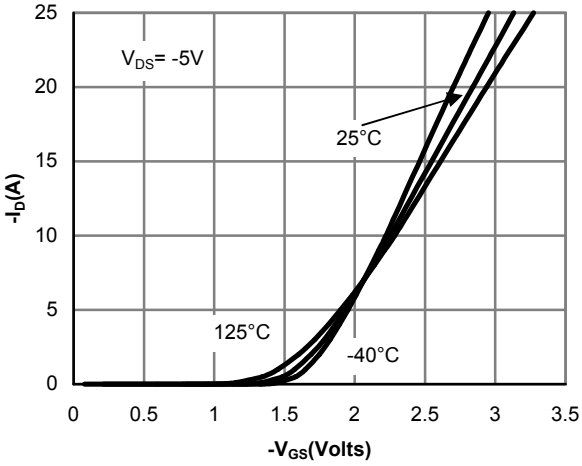

Figure 2: Transfer Characteristics

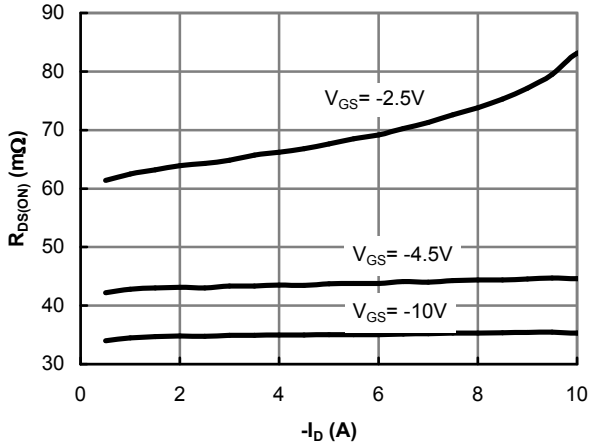

Figure 3: On-Resistance vs. Drain Current and Gate Voltage

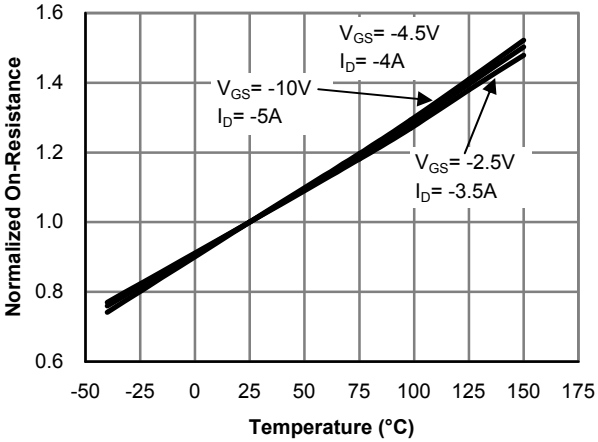

Figure 4: On-Resistance vs. Junction Temperature

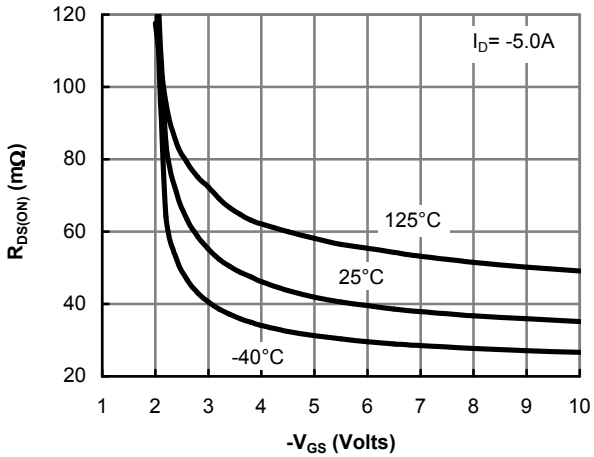

Figure 5: On-Resistance vs. Gate-Source Voltage

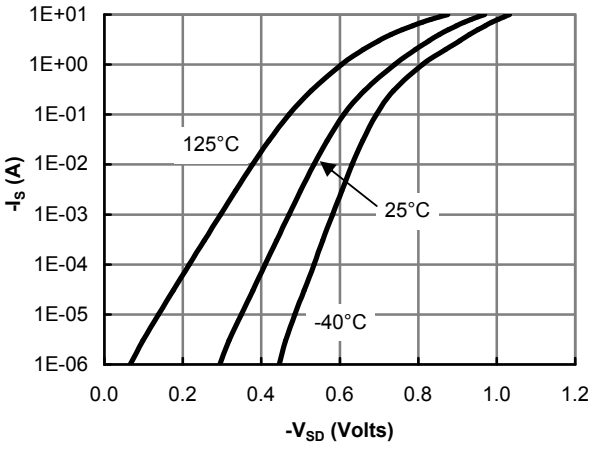

Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

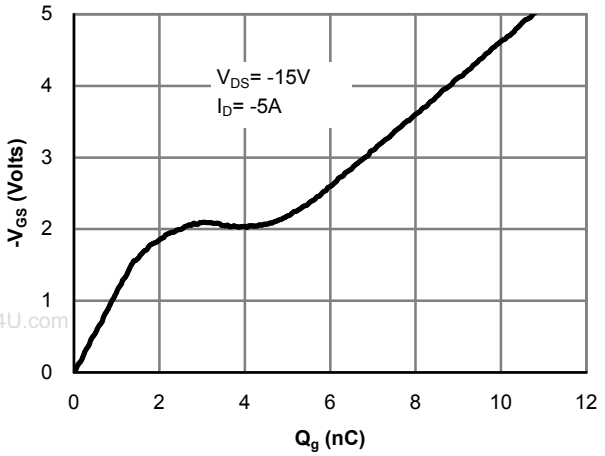

Figure 7: Gate-Charge Characteristics

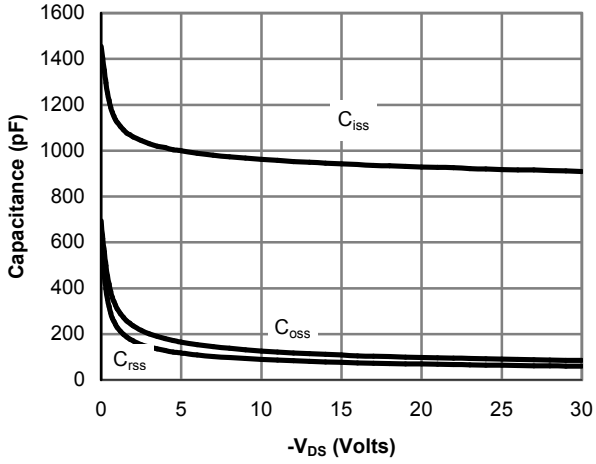

Figure 8: Capacitance Characteristics

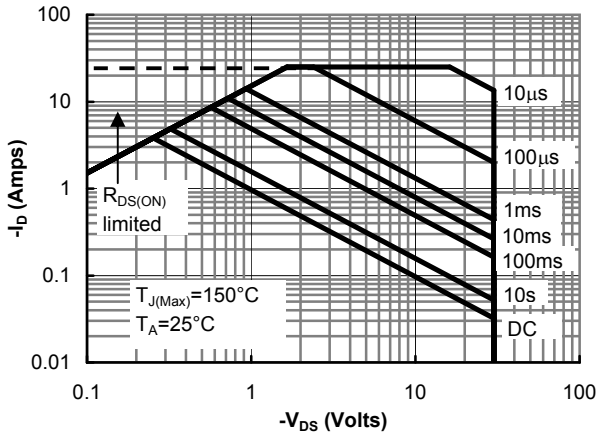

Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

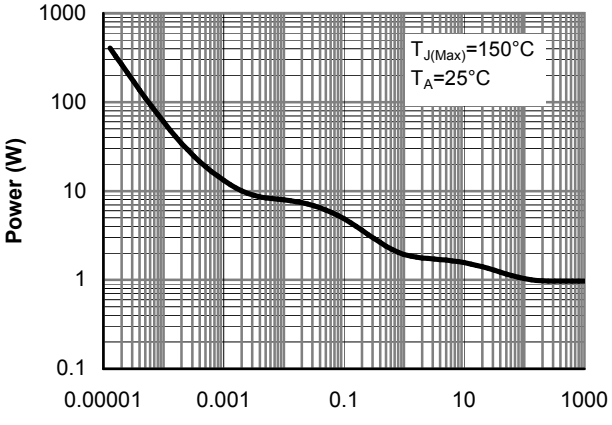

Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

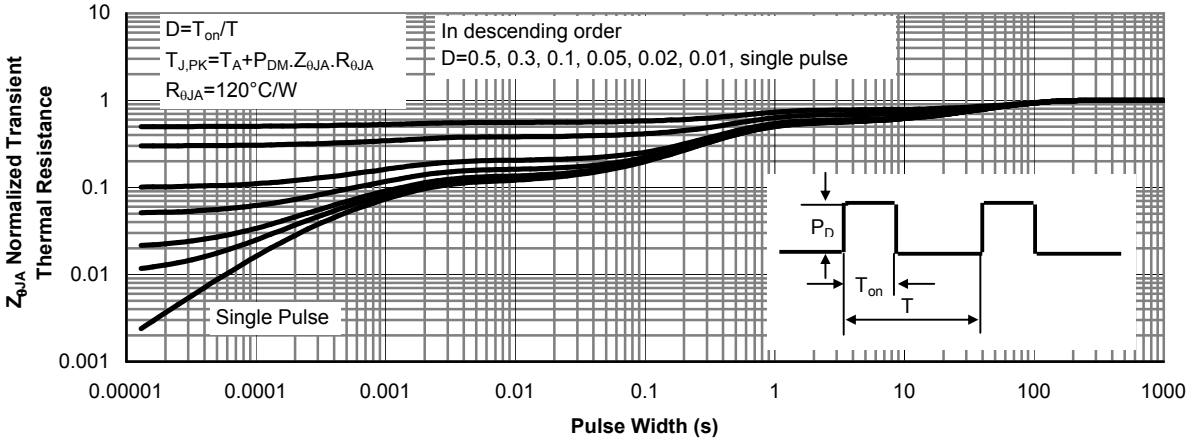

Figure 11: Normalized Maximum Transient Thermal Impedance(Note E)