



ALPHA & OMEGA
SEMICONDUCTOR

AO6401

P-Channel Enhancement Mode Field Effect Transistor



General Description

The AO6401/L 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. AO6401 and AO6401L are electrically identical.

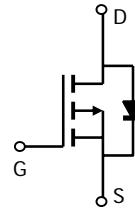
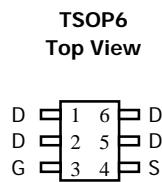
-RoHS Compliant

-AO6401L is Halogen Free

Features

V_{DS} (V) = -30V
 I_D = -5 A (V_{GS} = -10V)
 $R_{DS(ON)} < 49m\Omega$ (V_{GS} = -10V)
 $R_{DS(ON)} < 64m\Omega$ (V_{GS} = -4.5V)
 $R_{DS(ON)} < 119m\Omega$ (V_{GS} = -2.5V)

Rg, Ciss, Coss, Crss Tested



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum		Units
Drain-Source Voltage	V_{DS}	-30		V
Gate-Source Voltage	V_{GS}	± 12		V
Continuous Drain Current ^A	I_D	-5		A
$T_A=70^\circ\text{C}$		-4.2		
Pulsed Drain Current ^B	I_{DM}	-30		
Power Dissipation ^A	P_D	2		W
$T_A=70^\circ\text{C}$		1.44		
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	$R_{\theta JA}$	47.5	62.5	°C/W
Steady-State		74	110	°C/W
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	37	50	°C/W

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	$V_{DS}=-30\text{V}, V_{GS}=0\text{V}$	$T_J=55^\circ\text{C}$	-1	-5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 12\text{V}$			± 100	nA
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu\text{A}$	-0.7	-1	-1.3	V
$I_{\text{D(ON)}}$	On state drain current	$V_{GS}=-4.5\text{V}, V_{DS}=-5\text{V}$	-25			A
$R_{\text{DS(ON)}}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}, I_D=-5\text{A}$		42	49	$\text{m}\Omega$
			$T_J=125^\circ\text{C}$		74	
		$V_{GS}=-4.5\text{V}, I_D=-4\text{A}$		53	64	$\text{m}\Omega$
		$V_{GS}=-2.5\text{V}, I_D=-1\text{A}$		81	119	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}, I_D=-5\text{A}$	7	11		S
V_{SD}	Diode Forward Voltage	$I_S=-1\text{A}, V_{GS}=0\text{V}$		-0.75	-1	V
I_S	Maximum Body-Diode Continuous Current				-3	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=-15\text{V}, f=1\text{MHz}$		943	1130	pF
C_{oss}	Output Capacitance			108		pF
C_{rss}	Reverse Transfer Capacitance			73	102	pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$	3	6	12	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=-4.5\text{V}, V_{DS}=-15\text{V}, I_D=-5\text{A}$		9.5	12.4	nC
Q_{gs}	Gate Source Charge			2.1	2.7	nC
Q_{gd}	Gate Drain Charge			2.9		nC
$t_{\text{D(on)}}$	Turn-On DelayTime	$V_{GS}=-10\text{V}, V_{DS}=-15\text{V}, R_L=3\Omega, R_{\text{GEN}}=6\Omega$		6		ns
t_r	Turn-On Rise Time			3		ns
$t_{\text{D(off)}}$	Turn-Off DelayTime			40		ns
t_f	Turn-Off Fall Time			11		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-5\text{A}, dI/dt=100\text{A}/\mu\text{s}$		21.2	25.5	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-5\text{A}, dI/dt=100\text{A}/\mu\text{s}$		12.8		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 $T_A=25^\circ\text{C}$. The value in any given application depends on the user's specific board design. The current rating is based on the $\leq 10\text{s}$ 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 <300μs 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.

Rev 6 :Feb 2008

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

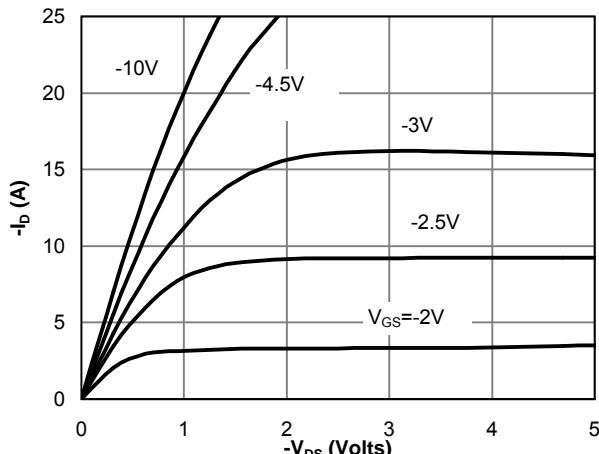


Fig 1: On-Region Characteristics

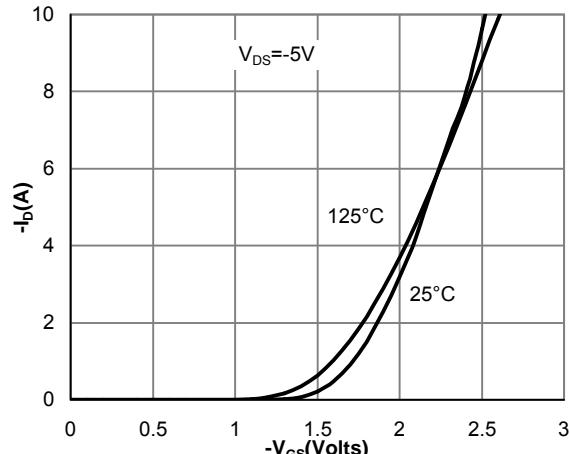


Figure 2: Transfer Characteristics

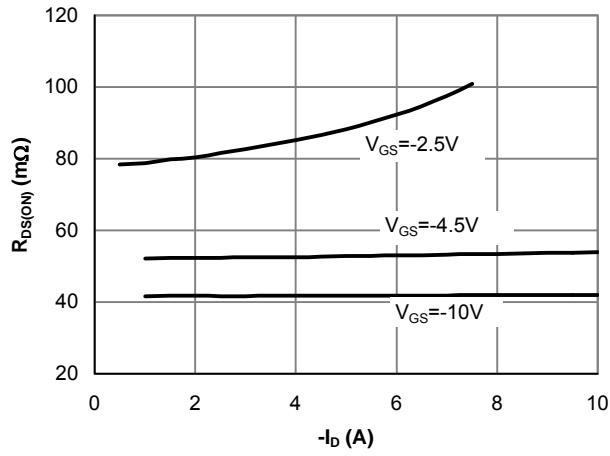


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

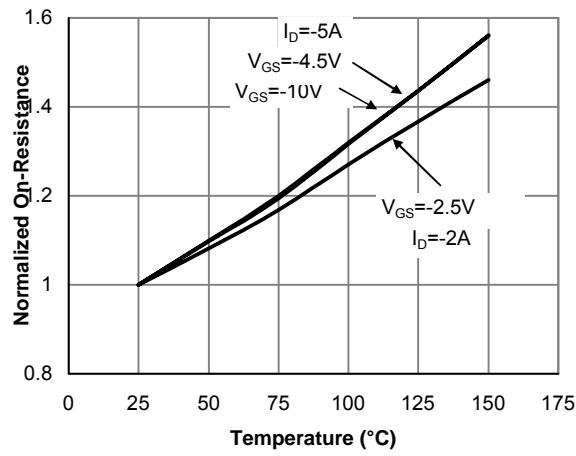


Figure 4: On-Resistance vs. Junction Temperature

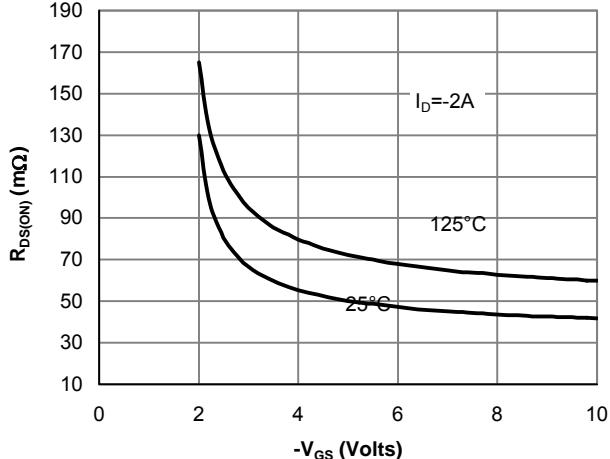


Figure 5: On-Resistance vs. Gate-Source Voltage

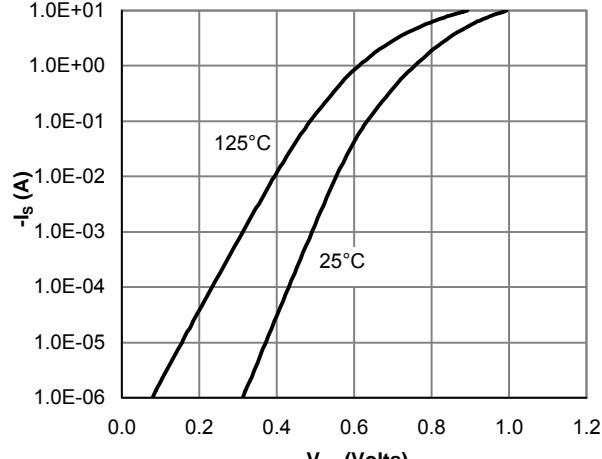


Figure 6: Body-Diode Characteristics

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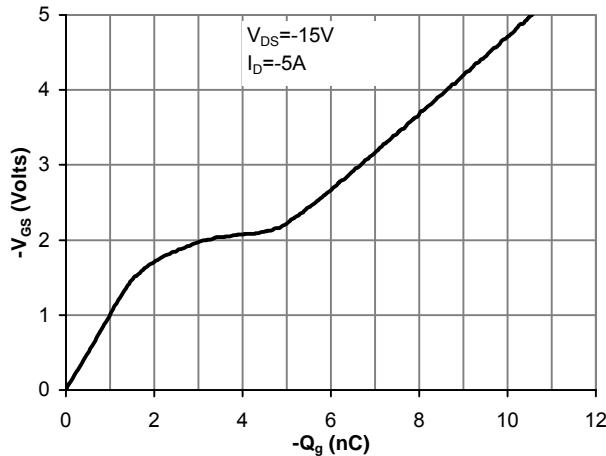


Figure 7: Gate-Charge Characteristics

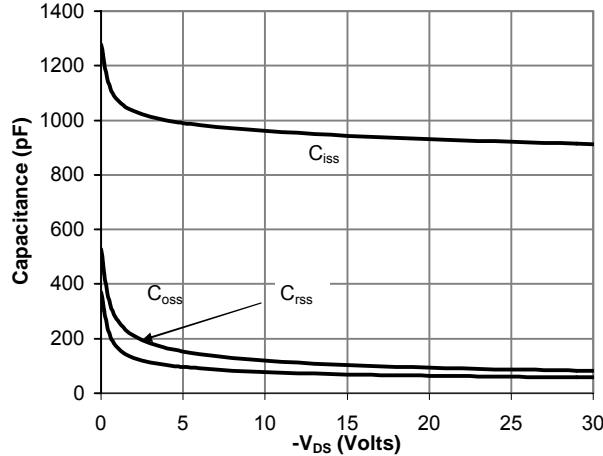


Figure 8: Capacitance Characteristics

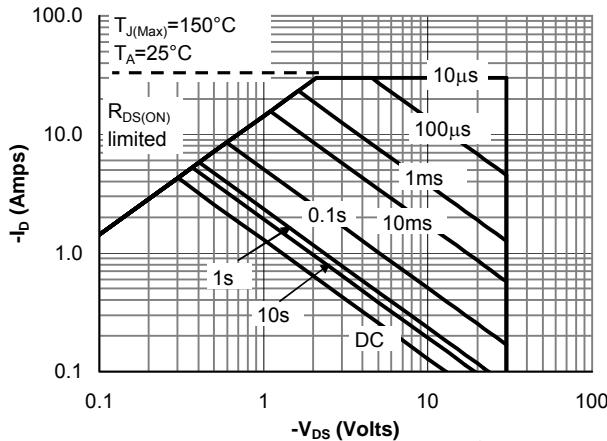


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

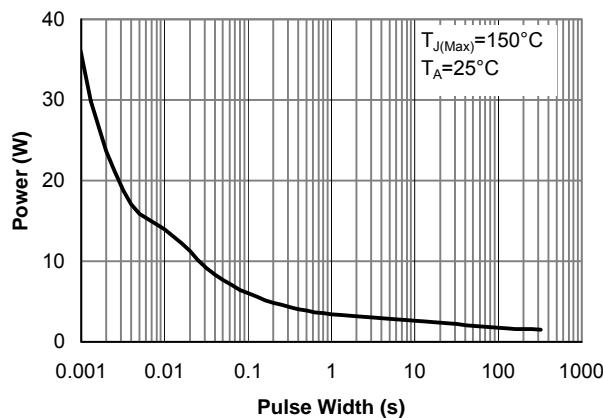


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

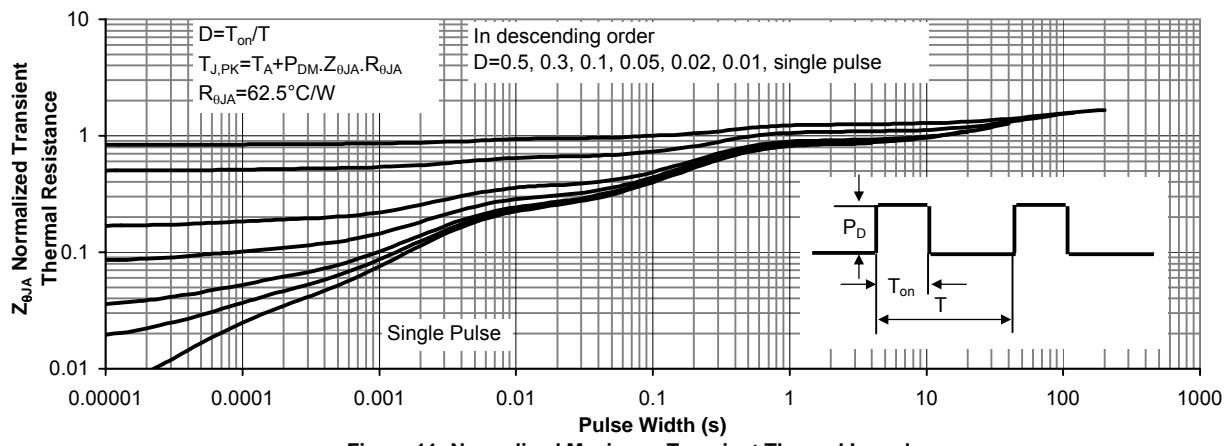


Figure 11: Normalized Maximum Transient Thermal Impedance