ALPHA & OMEGA
SEMICONDUCTOR

Pb Free

AOU400
# N-Channel Enhancement Mode Field Effect Transistor

General Description

The AOU400 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. This device is suitable for use as a load switch or in PWM applications. *Standard Product AOU400 is Pb-free (meets ROHS & Sony 259 specifications). AOU400L is a Green Product ordering option. AOU400 and AOU400L are electrically identical.*

Features

V_{DS} (V) = 60V
I_D = 38A (V_{GS} = 10V)
$R_{DS(ON)}$ < 20mΩ (V_{GS} = 10V)
$R_{DS(ON)}$ < 25mΩ (V_{GS} = 4.5V)

TO-251
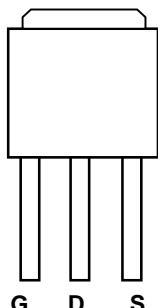
Top View
Drain Connected to Tab

G   D   S

D

G

S
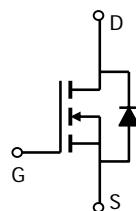
Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	60	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current [B]	T_C=25°C [G]	I_D	38	A
	T_C=100°C [B]		27	
Pulsed Drain Current		I_{DM}	60	
Avalanche Current [C]		I_{AR}	30	A
Repetitive avalanche energy L=0.1mH [C]		E_{AR}	140	mJ
Power Dissipation [B]	T_C=25°C	P_D	60	W
	T_C=100°C		30	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	°C

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	Steady-State	$R_{\theta JA}$	51	60	°C/W
Maximum Junction-to-Case [B]	Steady-State	$R_{\theta JC}$	1.4	2.5	°C/W

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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		60			V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=48V, 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	2.1	3	V
I$_{D(ON)}$	On state drain current	V$_{GS}$=10V, V$_{DS}$=5V		60			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=20A			16	20	mΩ
			T$_J$=125°C		31		
		V$_{GS}$=4.5V, I$_D$=20A			20	25	mΩ
g$_{FS}$	Forward Transconductance	V$_{DS}$=5V, I$_D$=20A			5.6		S
V$_{SD}$	Diode Forward Voltage	I$_S$=1A,V$_{GS}$=0V			0.74	1	V
I$_S$	Maximum Body-Diode Continuous Current					4	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=30V, f=1MHz			1920	2300	pF
C$_{oss}$	Output Capacitance				155		pF
C$_{rss}$	Reverse Transfer Capacitance				116		pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz			0.65	0.8	Ω
SWITCHING PARAMETERS							
Q$_g$(10V)	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=30V, I$_D$=20A			47.6	68	nC
Q$_g$(4.5V)	Total Gate Charge				24.2	30	nC
Q$_{gs}$	Gate Source Charge				6		nC
Q$_{gd}$	Gate Drain Charge				14.4		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=30V, R$_L$=1.5Ω, R$_{GEN}$=3Ω			7.4		ns
t$_r$	Turn-On Rise Time				5.1		ns
t$_{D(off)}$	Turn-Off DelayTime				28.2		ns
t$_f$	Turn-Off Fall Time				5.5		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=20A, dI/dt=100A/μs			34	41	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=20A, dI/dt=100A/μs			46		nC

A: The value of R$_{θJA}$ is measured with the device in a still air environment with T$_A$=25°C.

B. The power dissipation P$_D$ is based on T$_{J(MAX)}$=175°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: Repetitive rating, pulse width limited by junction temperature T$_{J(MAX)}$=175°C.

D. The R$_{θJA}$ is the sum of the thermal impedance from junction to case R$_{θJC}$ and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300 μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T$_{J(MAX)}$=175°C.

G. The maximum current rating is limited by bond-wires.

Rev2: August 2005

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
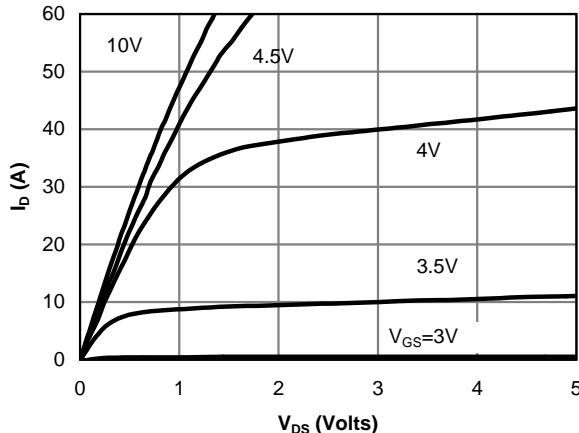

Fig 1: On-Region Characteristics
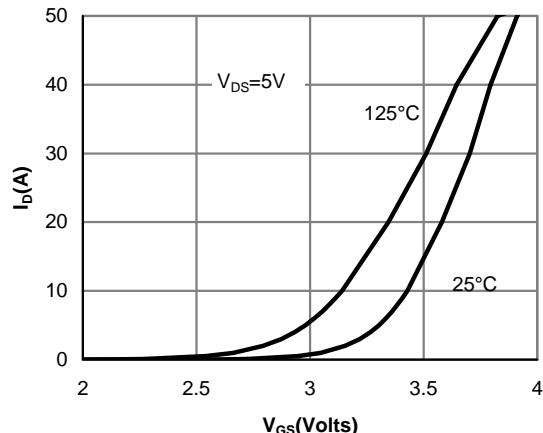
**Figure 2: Transfer Characteristics**
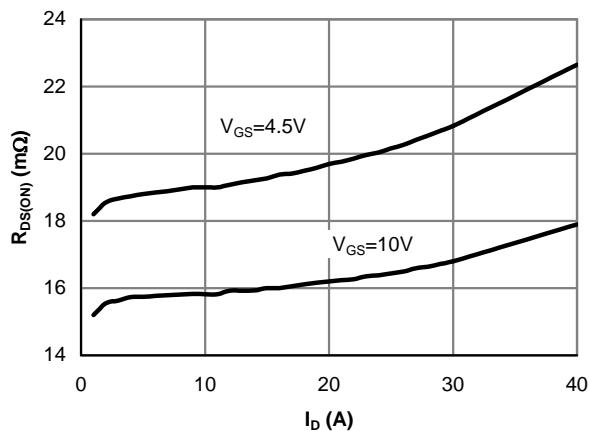
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**
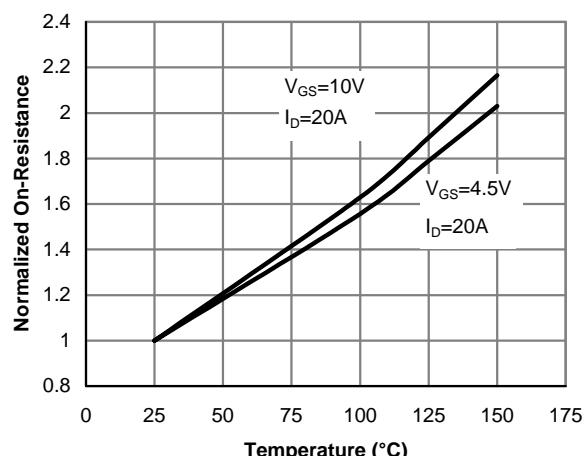

Figure 4: On-Resistance vs. Junction Temperature
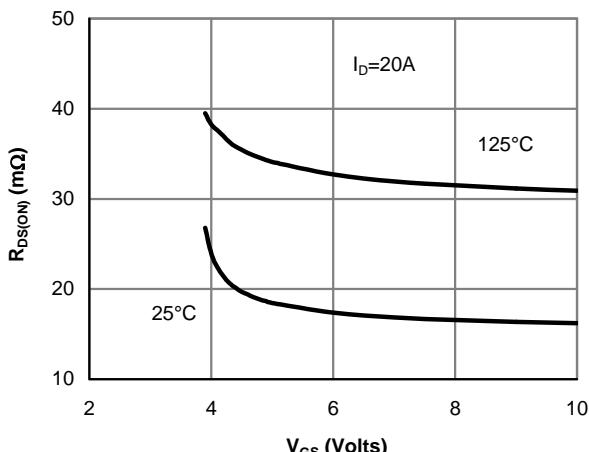
**Figure 5: On-Resistance vs. Gate-Source Voltage**
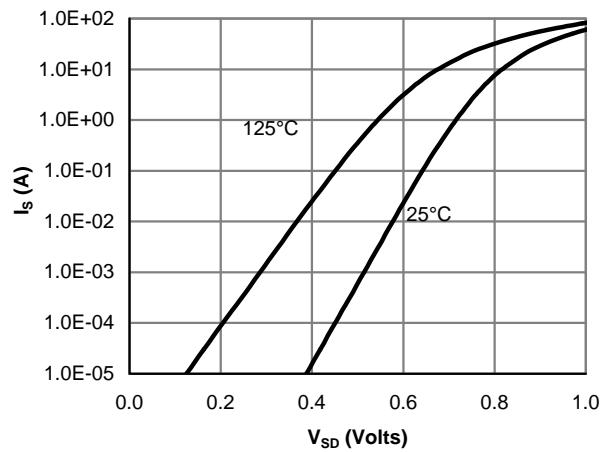
Figure 6: Body-Diode Characteristics

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

$V_{DS}=30V$
$I_D=20A$
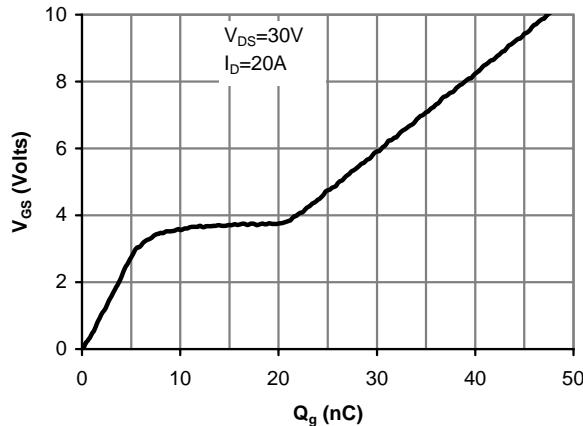
Figure 7: Gate-Charge Characteristics

C_{iss}

C_{oss}

C_{rss}
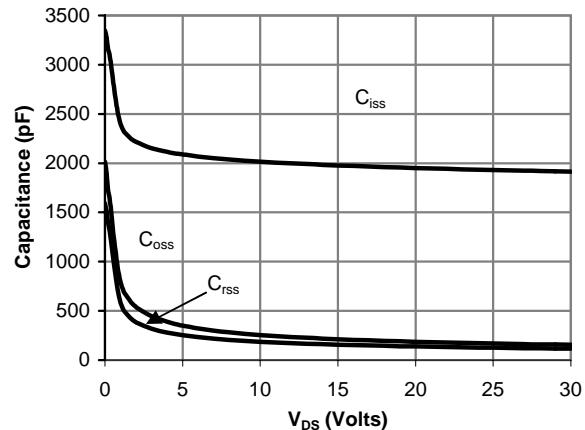
Figure 8: Capacitance Characteristics

$R_{DS(ON)}$ limited

100μs   10μs

1ms

DC

$T_{J(Max)}=175°C$
$T_A=25°C$
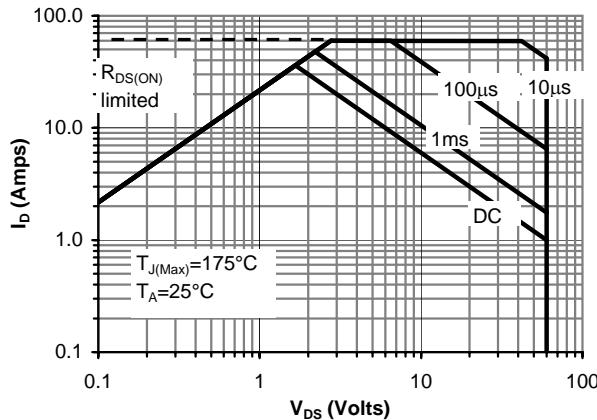
Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

$T_{J(Max)}=175°C$
$T_A=25°C$
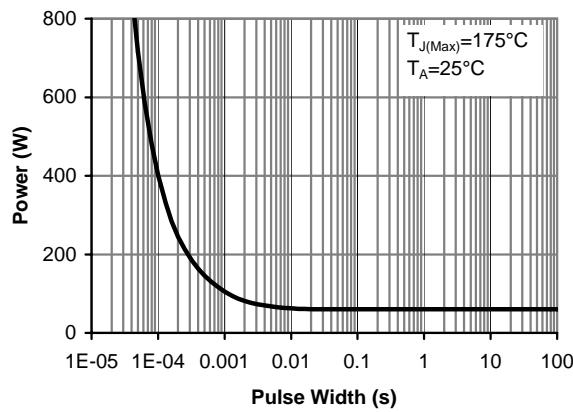
Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

$D=T_{on}/T$
$T_{J,PK}=T_c+P_{DM}.Z_{\theta Jc}.R_{\theta Jc}$
$R_{\theta JC}=2.5°C/W$

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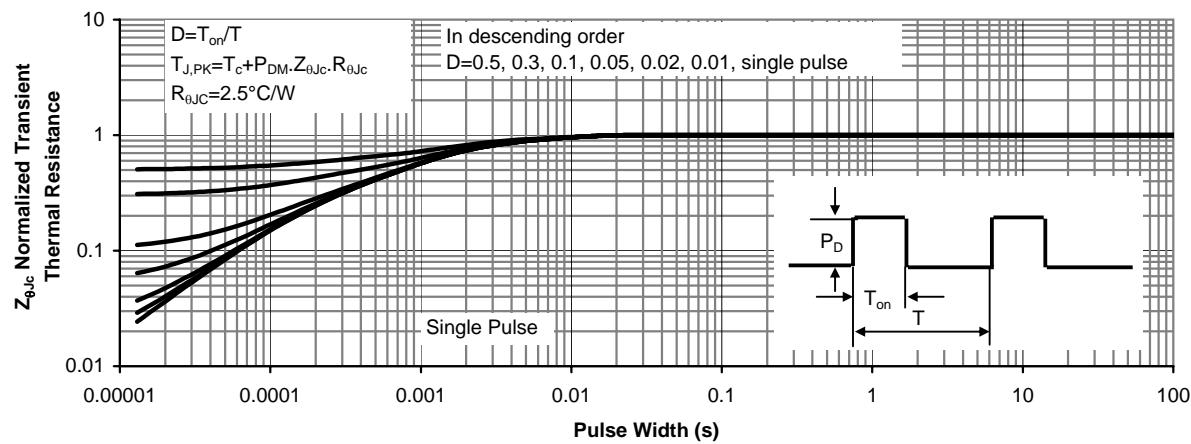
Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

$$t_A = \frac{L \cdot I_D}{BV - V_{DD}}$$
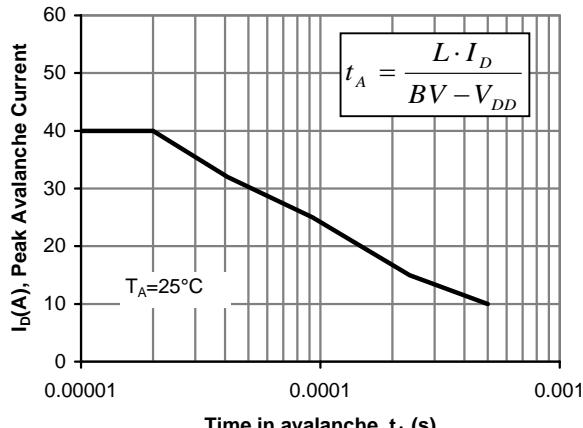
Figure 12: Single Pulse Avalanche capability
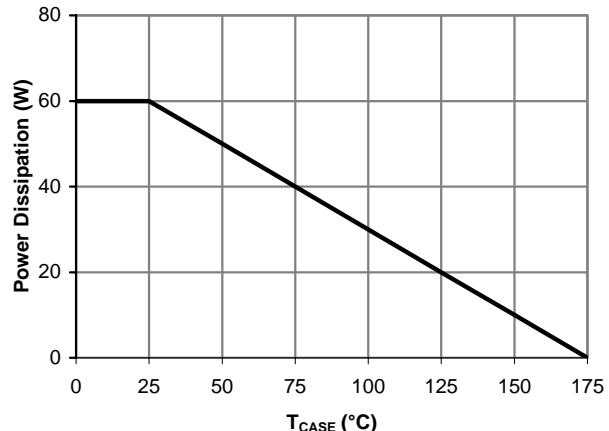
Figure 13: Power De-rating (Note B)
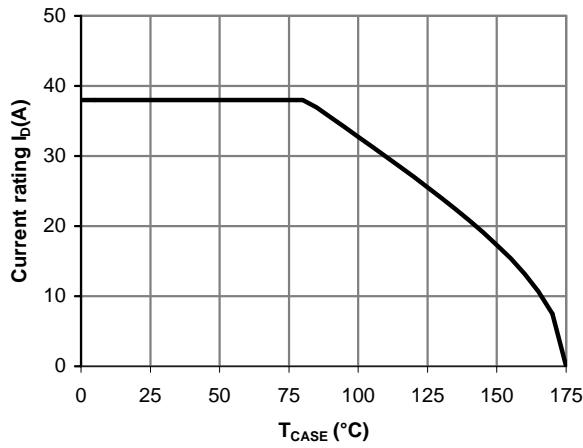
Figure 14: Current De-rating (Note B)

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