



**AO4406**

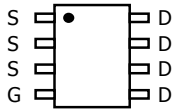
**N-Channel Enhancement Mode Field Effect Transistor**

**General Description**

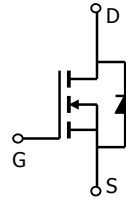
The AO4406/L uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device makes an excellent high side switch for notebook CPU core DC-DC conversion. *AO4406 and AO4406L are electrically identical.*  
-RoHS Compliant  
-AO4406L is Halogen Free

**Features**

$V_{DS}$  (V) = 30V  
 $I_D$  = 11.5A ( $V_{GS}$  = 10V)  
 $R_{DS(ON)} < 14m\Omega$  ( $V_{GS}$  = 10V)  
 $R_{DS(ON)} < 16.5m\Omega$  ( $V_{GS}$  = 4.5V)  
 $R_{DS(ON)} < 26m\Omega$  ( $V_{GS}$  = 2.5V)  
  
UIS TESTED!  
Rg,Ciss,Coss,Crss Tested



SOIC-8



**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	$V_{GS}$	$\pm 12$	V
Continuous Drain Current <sup>AF</sup>	$I_D$	$T_A=25^\circ\text{C}$	A
		$T_A=70^\circ\text{C}$	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	80	
Avalanche Current <sup>B</sup>	$I_{AV}$	25	A
Repetitive Avalanche Energy <sup>B</sup> L=0.3mH	$E_{AV}$	94	mJ
Power Dissipation	$P_D$	$T_A=25^\circ\text{C}$	W
		$T_A=70^\circ\text{C}$	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$

**Thermal Characteristics**

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>AF</sup>	$R_{\theta JA}$	$t \leq 10s$	23	$^\circ\text{C/W}$
Maximum Junction-to-Ambient <sup>A</sup>		Steady-State	48	
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	12	16	$^\circ\text{C/W}$

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	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	$\mu\text{A}$
					5	
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 12\text{V}$			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	0.8	1	1.5	V
$I_{D(ON)}$	On state drain current	$V_{GS}=4.5\text{V}$ , $V_{DS}=5\text{V}$	60			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}$ , $I_D=12\text{A}$ $T_J=125^\circ\text{C}$		11.5	14	m $\Omega$
				16	19.2	
		$V_{GS}=4.5\text{V}$ , $I_D=10\text{A}$ $V_{GS}=2.5\text{V}$ , $I_D=8\text{A}$		13.5	16.5	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=5\text{V}$ , $I_D=10\text{A}$	25	38		S
$V_{SD}$	Diode Forward Voltage	$I_S=10\text{A}$ , $V_{GS}=0\text{V}$		0.83	1	V
$I_S$	Maximum Body-Diode Continuous Current				4.5	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=15\text{V}$ , $f=1\text{MHz}$		1630	2300	pF
$C_{oss}$	Output Capacitance			201		pF
$C_{rss}$	Reverse Transfer Capacitance			142	200	pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$	0.4	0.8	1.8	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g$	Total Gate Charge	$V_{GS}=4.5\text{V}$ , $V_{DS}=15\text{V}$ , $I_D=11.5\text{A}$	13.5	18	24	nC
$Q_{gs}$	Gate Source Charge			2.5		nC
$Q_{gd}$	Gate Drain Charge			5.5		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=10\text{V}$ , $V_{DS}=15\text{V}$ , $R_L=1.2\Omega$ , $R_{GEN}=3\Omega$		4	6	ns
$t_r$	Turn-On Rise Time			5	7.5	ns
$t_{D(off)}$	Turn-Off Delay Time			32	50	ns
$t_f$	Turn-Off Fall Time			5	10	ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=10\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		18.7	24	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=10\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		12.5	15	nC

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1 in 2 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.

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  $<300\mu\text{s}$  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  $T_A=25^\circ\text{C}$ . The SOA curve provides a single pulse rating.

F: The current rating is based on the  $t \leq 10\text{s}$  junction to ambient thermal resistance rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

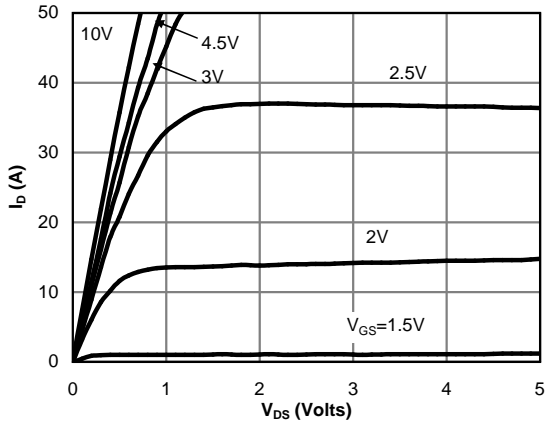


Fig 1: On-Region Characteristics

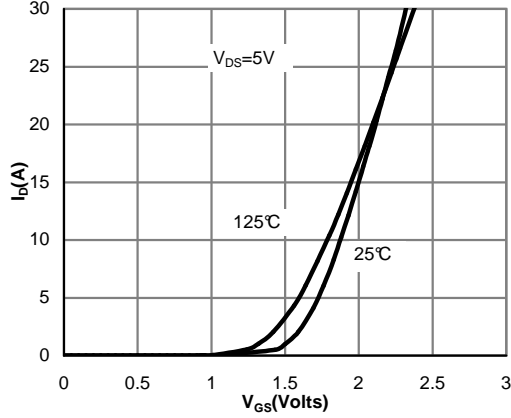


Figure 2: Transfer Characteristics

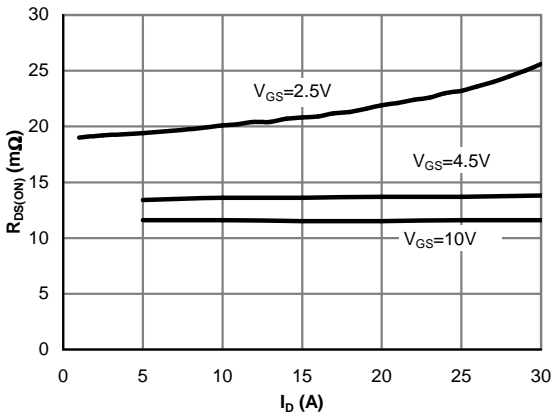


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

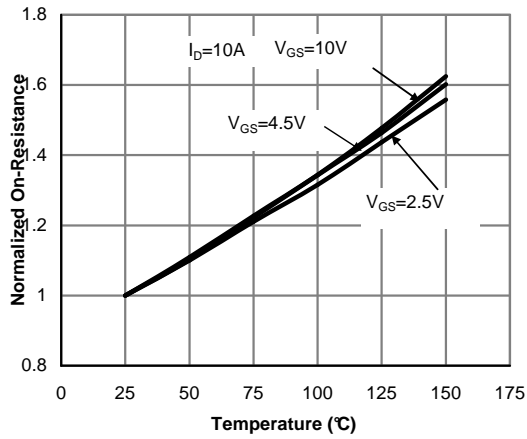


Figure 4: On-Resistance vs. Junction Temperature

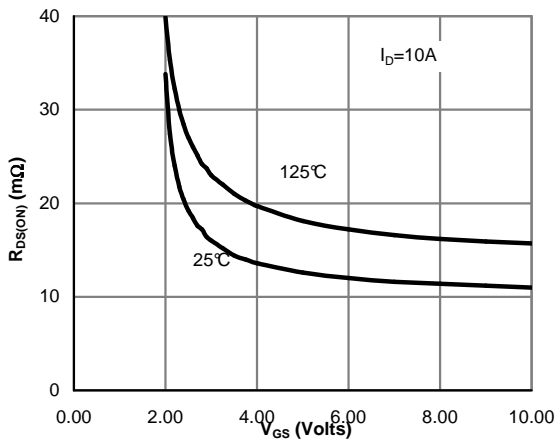


Figure 5: On-Resistance vs. Gate-Source Voltage

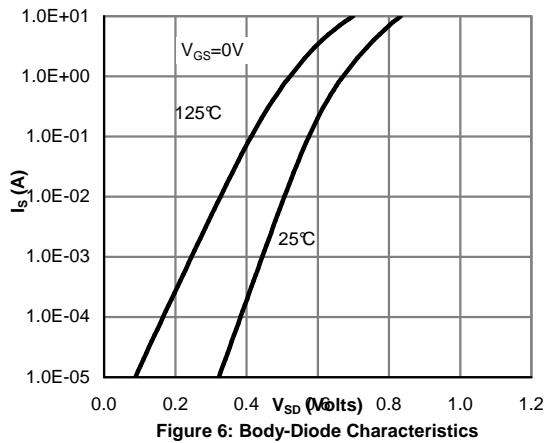


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

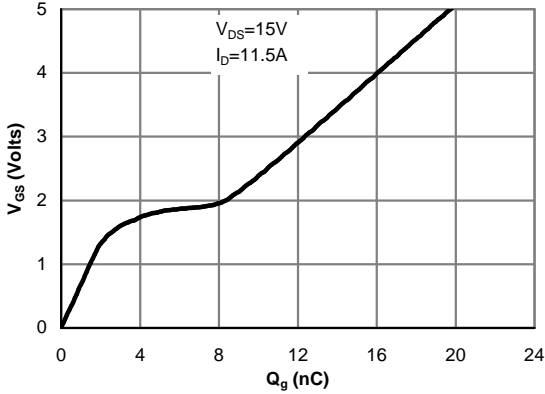


Figure 7: Gate-Charge Characteristics

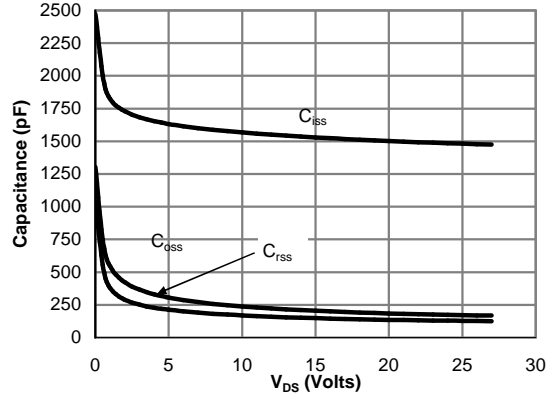


Figure 8: Capacitance Characteristics

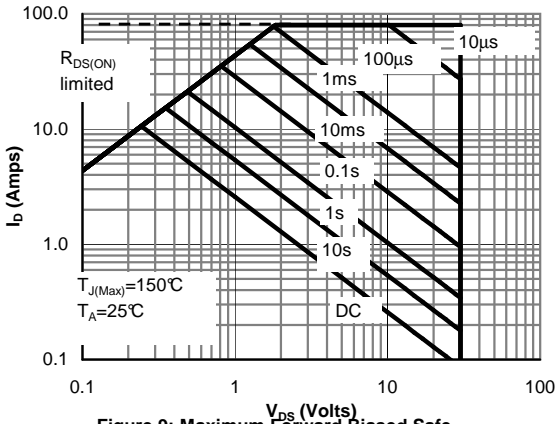


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

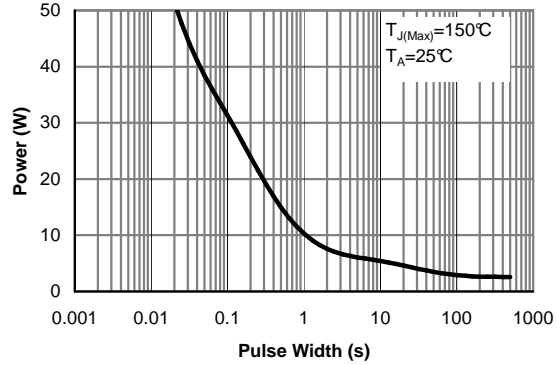


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

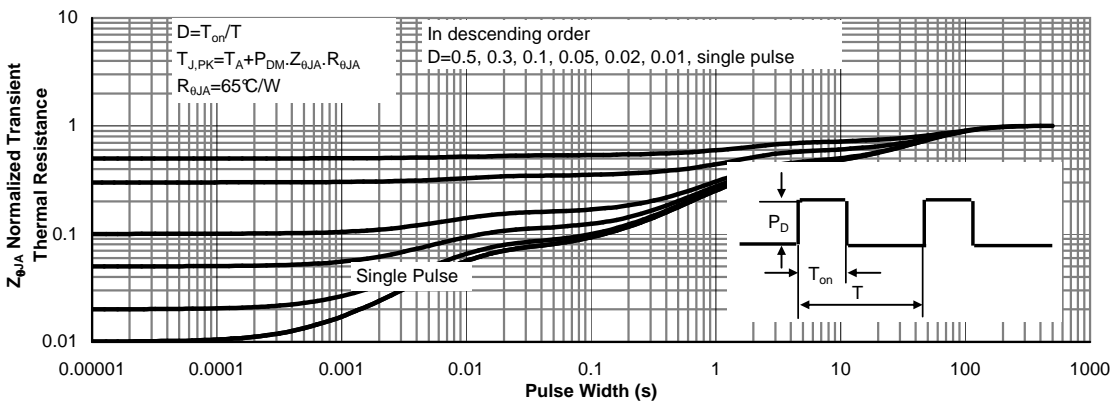


Figure 11: Normalized Maximum Transient Thermal Impedance

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

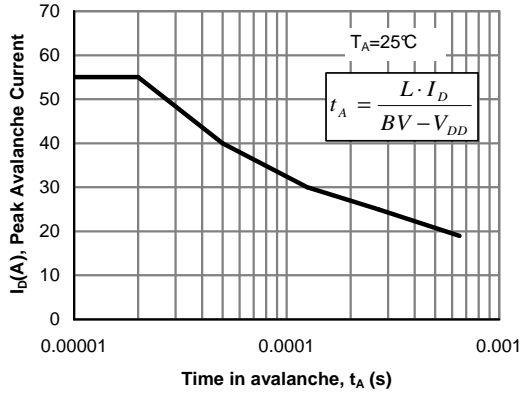


Figure 12: Avalanche capability

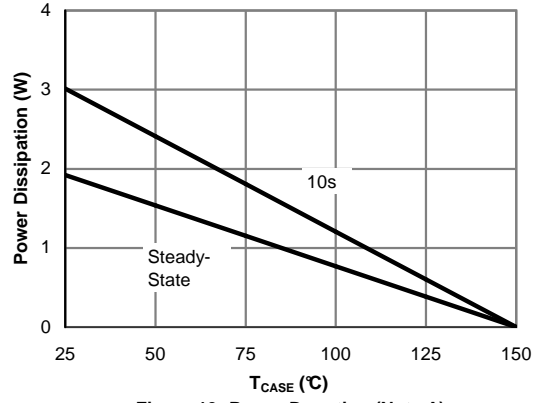
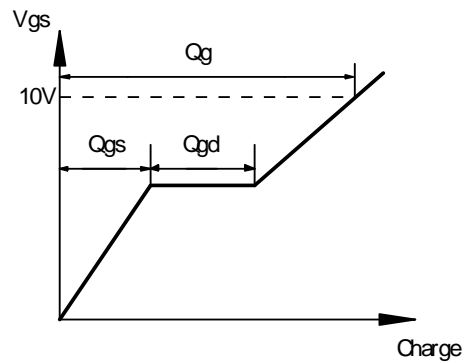
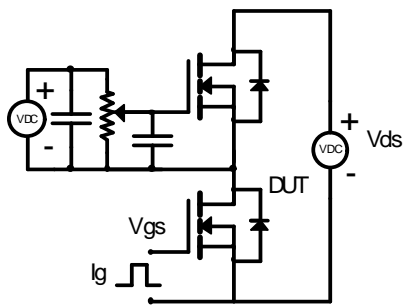
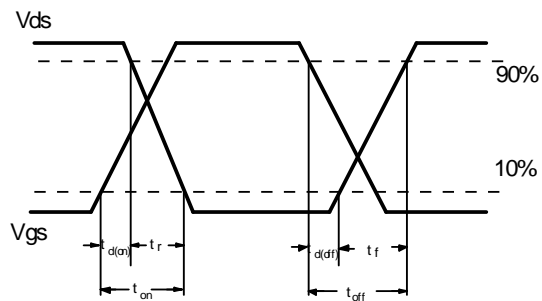
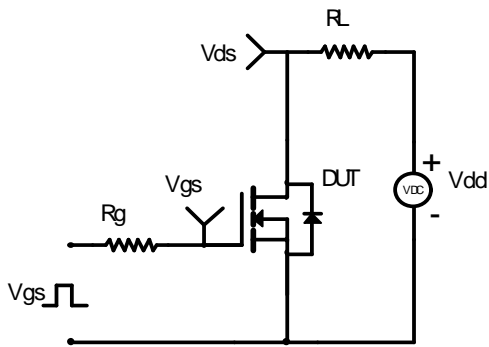


Figure 13: Power De-rating (Note A)

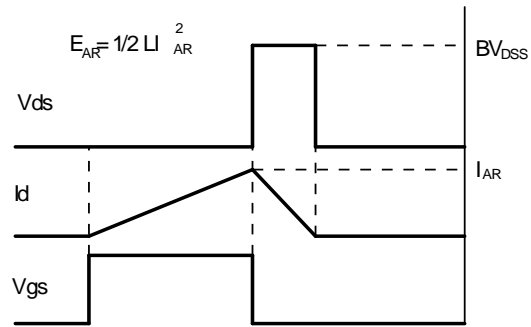
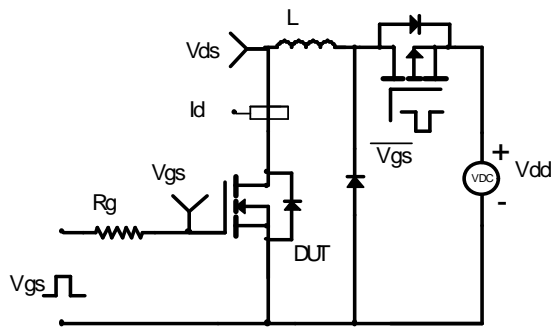
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

