



**ALPHA & OMEGA**  
SEMICONDUCTOR

**AO4407**

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

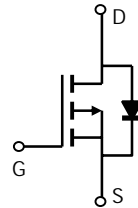
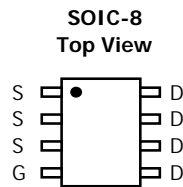


**General Description**

The AO4407 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , and ultra-low low gate charge with a 25V gate rating. This device is suitable for use as a load switch or in PWM applications. *Standard Product AO4407 is Pb-free (meets ROHS & Sony 259 specifications). AO4407L is a Green Product ordering option. AO4407 and AO4407L are electrically identical.*

**Features**

$V_{DS} (V) = -30V$   
 $I_D = -12 A (V_{GS} = -20V)$   
 $R_{DS(ON)} < 13m\Omega (V_{GS} = -20V)$   
 $R_{DS(ON)} < 14m\Omega (V_{GS} = -10V)$



**Absolute Maximum Ratings  $T_A=25^\circ C$  unless otherwise noted**

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 25$	V
Continuous Drain Current <sup>A</sup>	$T_A=25^\circ C$	-12	A
	$T_A=70^\circ C$	-10	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	-60	
Power Dissipation <sup>A</sup>	$T_A=25^\circ C$	3	W
	$T_A=70^\circ C$	2.1	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ C$

**Thermal Characteristics**

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	28	40	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>		Steady-State	54	
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	21	30	$^\circ C/W$

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	$V_{DS}=-24\text{V}$ , $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 25\text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$	-1.7	-2.5	-3	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-10\text{V}$ , $V_{DS}=-5\text{V}$	60			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}$ , $I_D=-10\text{A}$ $T_J=125^\circ\text{C}$		11 15	14 19	$\text{m}\Omega$
		$V_{GS}=-20\text{V}$ , $I_D=-10\text{A}$		10	13	$\text{m}\Omega$
		$V_{GS}=-4.5\text{V}$ , $I_D=-10\text{A}$		24		$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=-5\text{V}$ , $I_D=-10\text{A}$		26		S
$V_{SD}$	Diode Forward Voltage	$I_S=-1\text{A}$ , $V_{GS}=0\text{V}$		-0.72	-1	V
$I_S$	Maximum Body-Diode Continuous Current				-4.2	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=-15\text{V}$ , $f=1\text{MHz}$		2076	2500	pF
$C_{oss}$	Output Capacitance			503		pF
$C_{rSS}$	Reverse Transfer Capacitance			302		pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$		2	3	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g$	Total Gate Charge	$V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $I_D=-12\text{A}$		37.2	45	nC
$Q_{gs}$	Gate Source Charge			7		nC
$Q_{gd}$	Gate Drain Charge			10.4		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $R_L=1.25\Omega$ , $R_{GEN}=3\Omega$		12.4		ns
$t_r$	Turn-On Rise Time			8.2		ns
$t_{D(off)}$	Turn-Off Delay Time			25.6		ns
$t_f$	Turn-Off Fall Time			12		ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=-12\text{A}$ , $di/dt=100\text{A}/\mu\text{s}$		33	40	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=-12\text{A}$ , $di/dt=100\text{A}/\mu\text{s}$		23		nC

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> 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  $t \leq 10\text{s}$  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 $\mu\text{s}$  pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in<sup>2</sup> 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 1 : Sept 2005

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

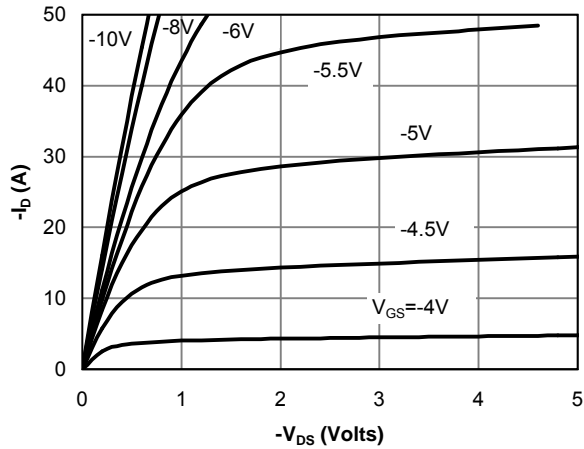


Fig 1: On-Region Characteristics

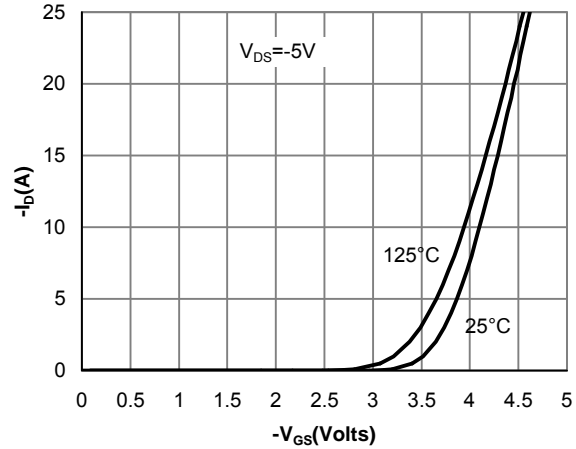


Figure 2: Transfer Characteristics

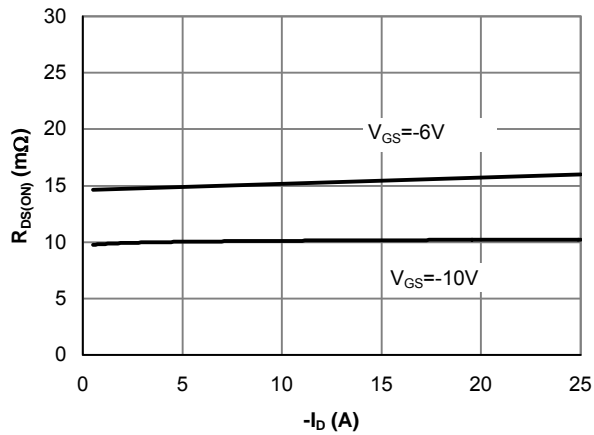


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

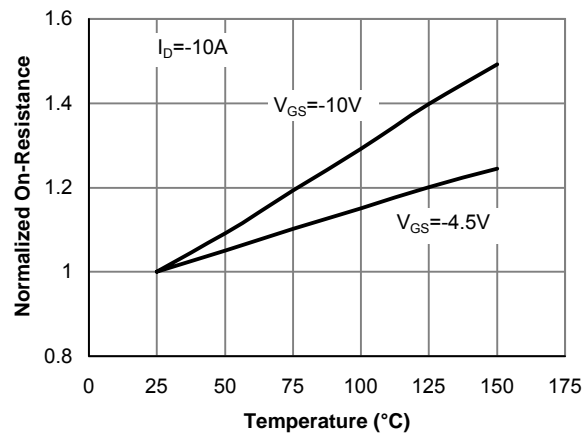


Figure 4: On-Resistance vs. Junction Temperature

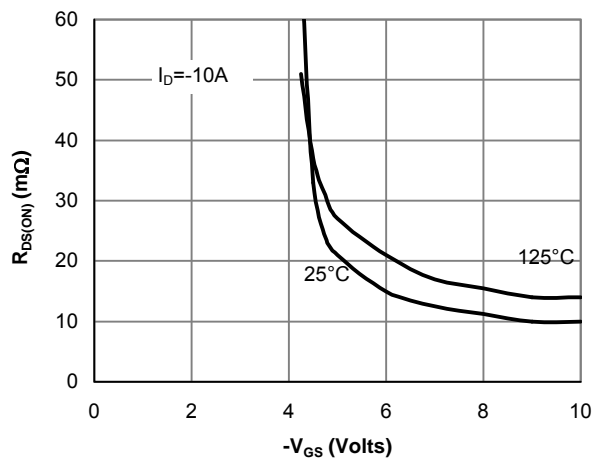


Figure 5: On-Resistance vs. Gate-Source Voltage

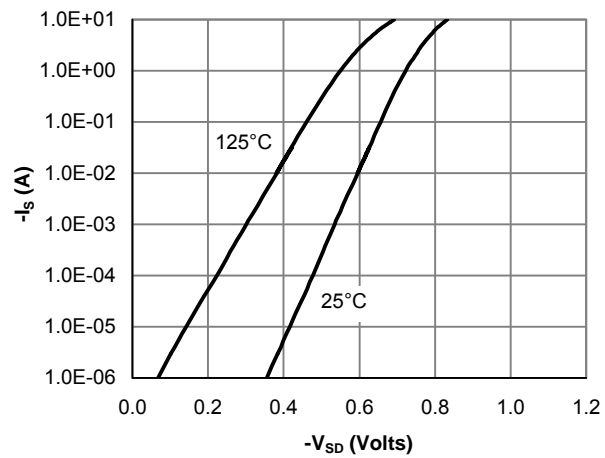


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

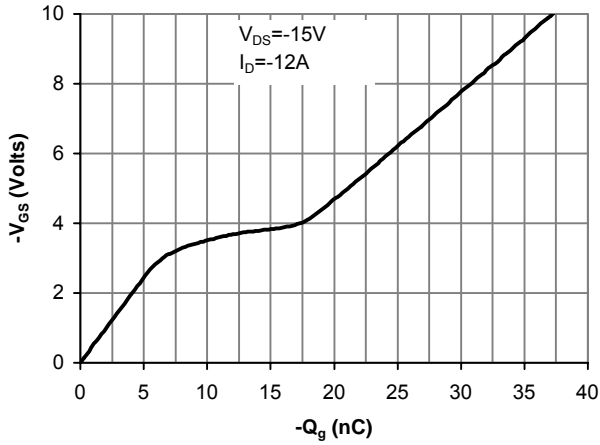


Figure 7: Gate-Charge Characteristics

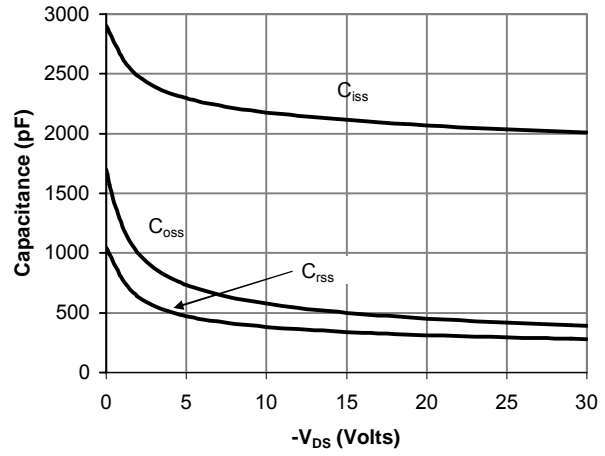


Figure 8: Capacitance Characteristics

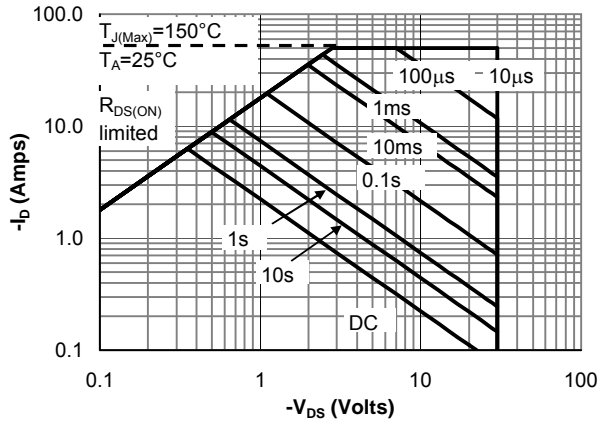


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

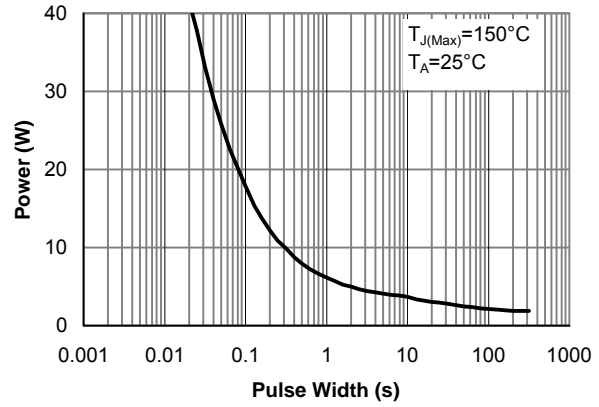


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

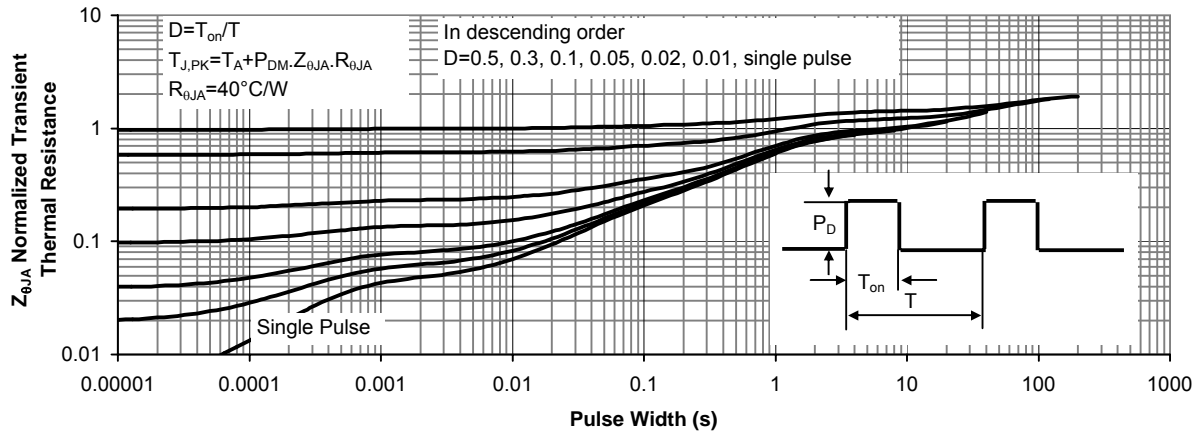


Figure 11: Normalized Maximum Transient Thermal Impedance