



**AO4413A**

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



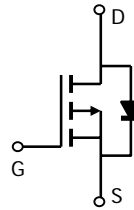
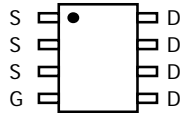
**General Description**

The AO4413A 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 AO4413A is Pb-free (meets ROHS & Sony 259 specifications). AO4413AL is a Green Product ordering option. AO4413A and AO4413AL are electrically identical.*

**Features**

- $V_{DS} (V) = -30V$
- $I_D = -15A \quad (V_{GS} = -10V)$
- $R_{DS(ON)} < 7m\Omega \quad (V_{GS} = -20V)$
- $R_{DS(ON)} < 8.5m\Omega \quad (V_{GS} = -10V)$

SOIC-8  
Top View



**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>	$I_D$	$T_A=25^\circ C$	-15
		$T_A=70^\circ C$	-12.8
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	-80	A
Power Dissipation <sup>A</sup>	$P_D$	$T_A=25^\circ C$	3
		$T_A=70^\circ C$	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>	$R_{\theta JA}$	$t \leq 10s$	32	40
Maximum Junction-to-Ambient <sup>A</sup>		Steady-State	62	75
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	18	24	$^\circ C/W$

Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =-250μA, V <sub>GS</sub> =0V	-30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-24V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			-1 -5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±25V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =-250μA	-1.5	-2.2	-3.5	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-5V	-60			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =-20V, I <sub>D</sub> =-15A T <sub>J</sub> =125°C		5.5	7	mΩ
		V <sub>GS</sub> =-10V, I <sub>D</sub> =-15A		6.6	8.5	
		V <sub>GS</sub> =-6V, I <sub>D</sub> =-10A		8.2		mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-15A		48		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =-1A, V <sub>GS</sub> =0V		-0.72	-1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				5	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-15V, f=1MHz		4245	5500	pF
C <sub>oss</sub>	Output Capacitance			983		pF
C <sub>riss</sub>	Reverse Transfer Capacitance			689		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		12	18	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-15A		69	90	nC
Q <sub>gs</sub>	Gate Source Charge			15.2		nC
Q <sub>gd</sub>	Gate Drain Charge			18.8		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =1.0Ω, R <sub>GEN</sub> =3Ω		16.5		ns
t <sub>r</sub>	Turn-On Rise Time			23.5		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			116		ns
t <sub>f</sub>	Turn-Off Fall Time			82		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =-15A, di/dt=100A/μs		59	77	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =-15A, di/dt=100A/μs		55		nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The value in any a given application depends on the user's specific board design. The current rating is based on the ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

D. The static characteristics in Figures 1 to 6,12,14 are obtained using 80μs 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<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

F. Rev 0: July 2005

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

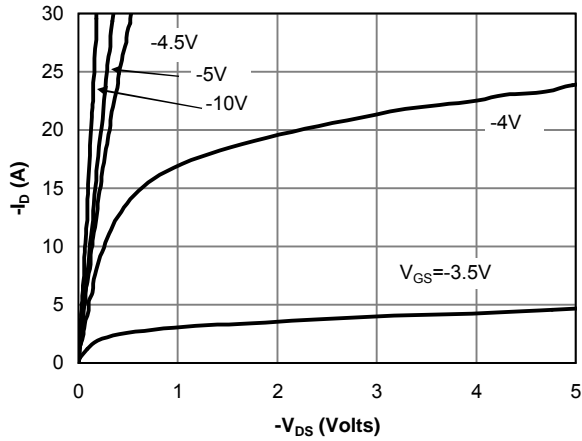


Fig 1: On-Region Characteristics

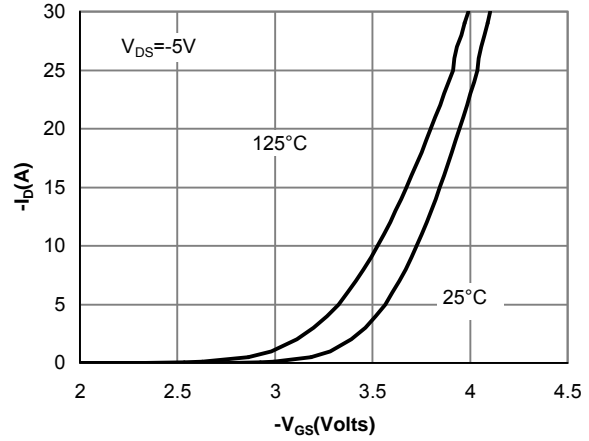


Figure 2: Transfer Characteristics

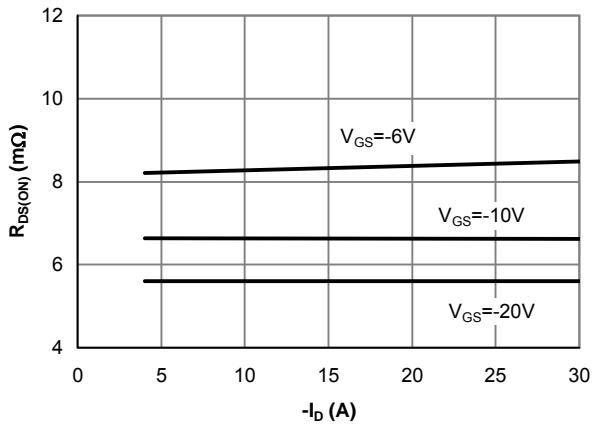


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

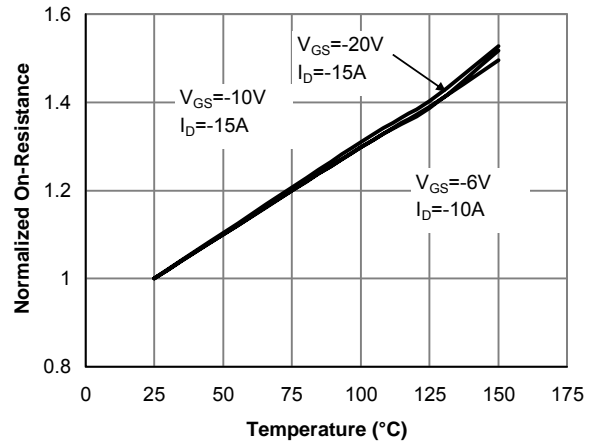


Figure 4: On-Resistance vs. Junction Temperature

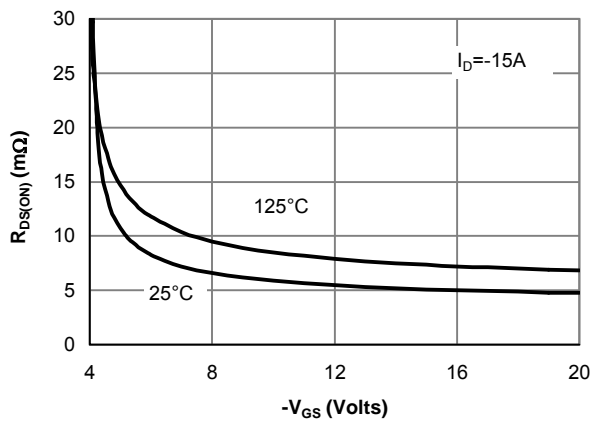


Figure 5: On-Resistance vs. Gate-Source Voltage

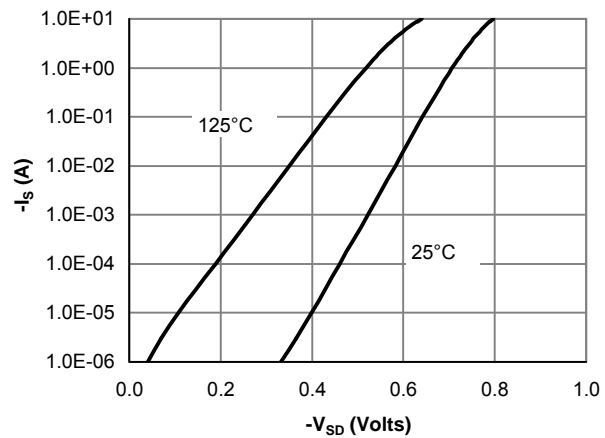


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

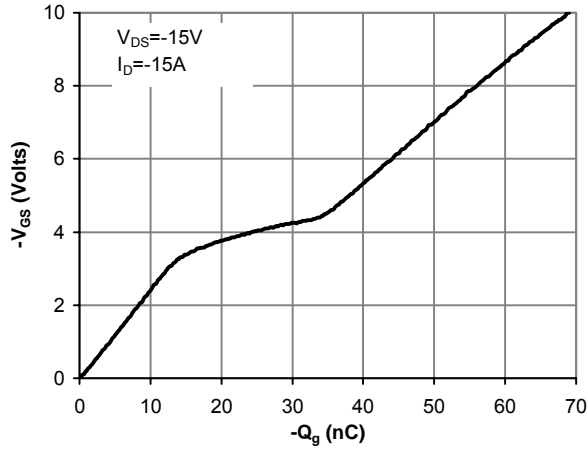


Figure 7: Gate-Charge Characteristics

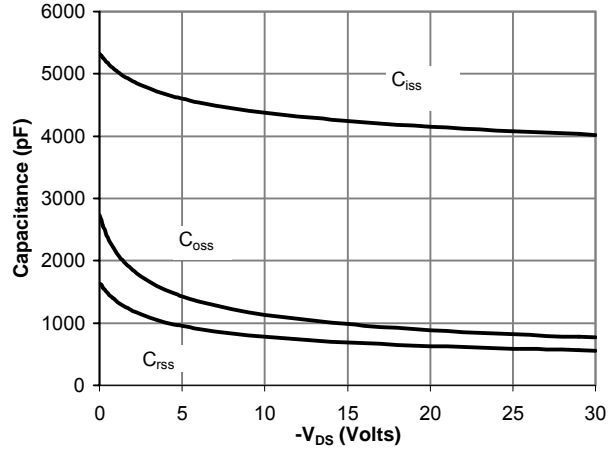


Figure 8: Capacitance Characteristics

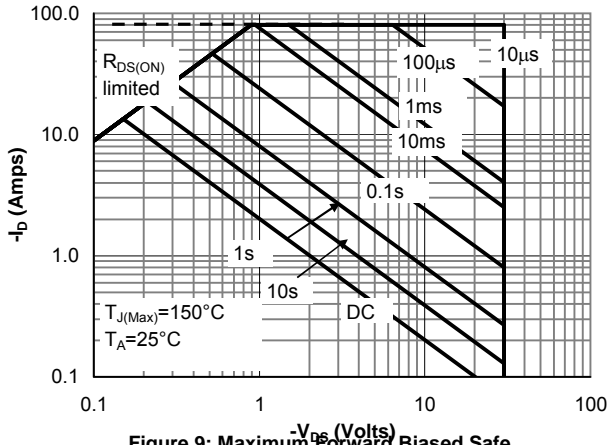


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

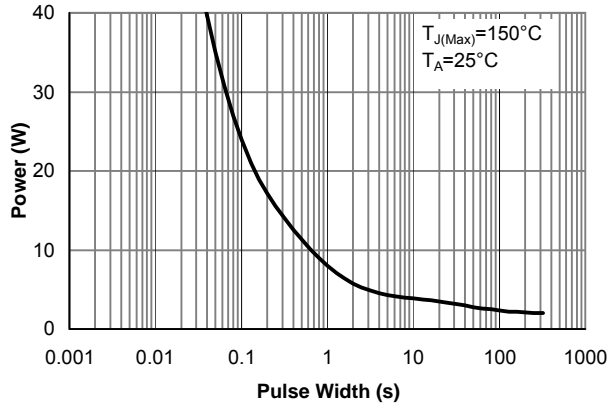


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

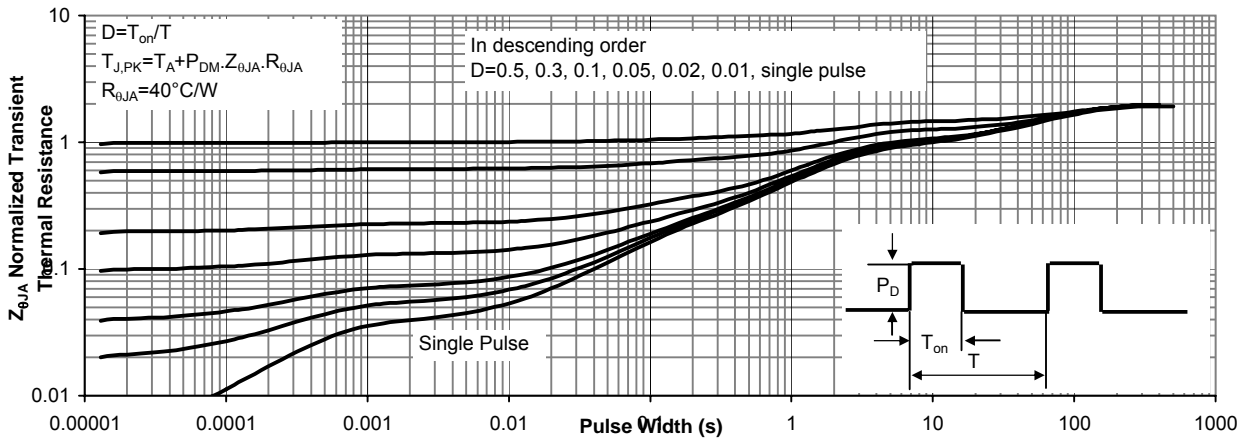


Figure 11: Normalized Maximum Transient Thermal Impedance