



ALPHA & OMEGA
SEMICONDUCTOR

AO4407

30V P-Channel MOSFET

General Description

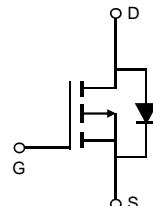
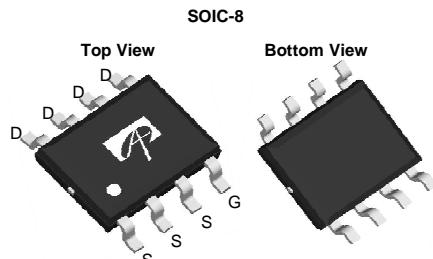
The AO4407 combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. This device is ideal for load switch and battery protection applications.

* RoHS and Halogen-Free Compliant

Product Summary

V_{DS}	-30V
I_D (at $V_{GS}=-20V$)	-12A
$R_{DS(ON)}$ (at $V_{GS}=-20V$)	< 13mΩ
$R_{DS(ON)}$ (at $V_{GS}=-10V$)	< 14mΩ
$R_{DS(ON)}$ (at $V_{GS}=-5V$)	< 30mΩ

100% UIS Tested
100% R_g 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}	± 25	V
Continuous Drain Current	I_D	-12	A
$T_A=70^\circ\text{C}$		-10	
Pulsed Drain Current ^C	I_{DM}	-60	
Avalanche Current ^C	I_{AS}, I_{AR}	26	A
Avalanche energy L=0.3mH ^C	E_{AS}, E_{AR}	101	mJ
Power Dissipation ^B	P_D	3.1	W
$T_A=70^\circ\text{C}$		2	
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 $t \leq 10\text{s}$	$R_{\theta JA}$	31	40	°C/W
Maximum Junction-to-Ambient ^{A,D} Steady-State		59	75	°C/W
Maximum Junction-to-Lead	$R_{\theta JL}$	16	24	°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	$V_{DS}=0\text{V}, V_{GS}= \pm 25\text{V}$			± 100	nA
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu\text{A}$	-1.7	-2.25	-2.8	V
$I_{\text{D(ON)}}$	On state drain current	$V_{GS}=-10\text{V}, V_{DS}=-5\text{V}$	-60			A
$R_{\text{DS(ON)}}$	Static Drain-Source On-Resistance	$V_{GS}=-20\text{V}, I_D=-12\text{A}$		8.5	13	$\text{m}\Omega$
		$V_{GS}=-10\text{V}, I_D=-12\text{A}$ $T_J=125^\circ\text{C}$		10	14	$\text{m}\Omega$
		$V_{GS}=-5\text{V}, I_D=-7\text{A}$		12	19	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}, I_D=-10.5\text{A}$		27		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	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=-15\text{V}, f=1\text{MHz}$		2060	2600	pF
C_{oss}	Output Capacitance			370		pF
C_{rss}	Reverse Transfer Capacitance			295		pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$	1.2	2.4	3.6	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=-10\text{V}, V_{DS}=-15\text{V}, I_D=-12\text{A}$	24	30	36	nC
Q_{gs}	Gate Source Charge			4.6		nC
Q_{gd}	Gate Drain Charge			10		nC
$t_{\text{D(on)}}$	Turn-On Delay Time	$V_{GS}=-10\text{V}, V_{DS}=-15\text{V}, R_L=1.25\Omega, R_{\text{GEN}}=3\Omega$		11		ns
t_r	Turn-On Rise Time			9.4		ns
$t_{\text{D(off)}}$	Turn-Off Delay Time			24		ns
t_f	Turn-Off Fall Time			12		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-12\text{A}, dI/dt=100\text{A}/\mu\text{s}$		30	40	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-12\text{A}, dI/dt=100\text{A}/\mu\text{s}$		22		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.

B. The power dissipation P_D is based on $T_{J(\text{MAX})}=150^\circ\text{C}$, using $\leqslant 10\text{s}$ junction-to-ambient thermal resistance.

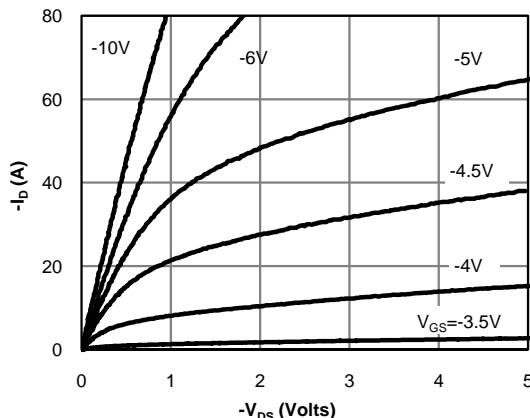
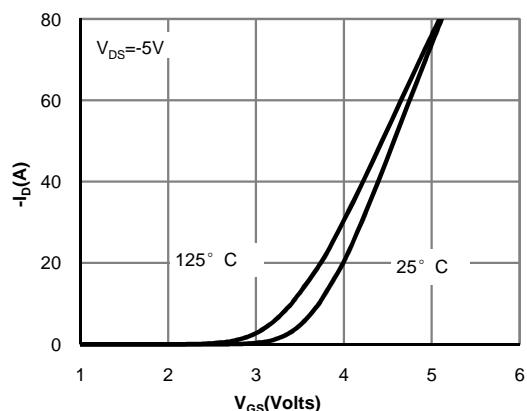
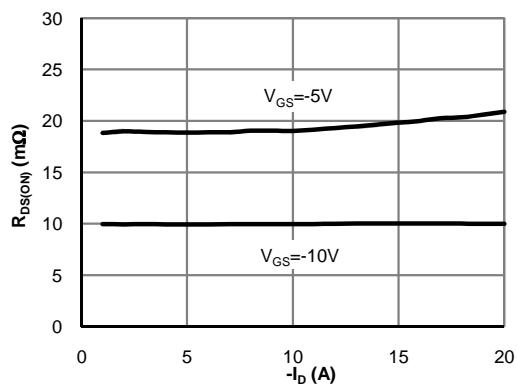
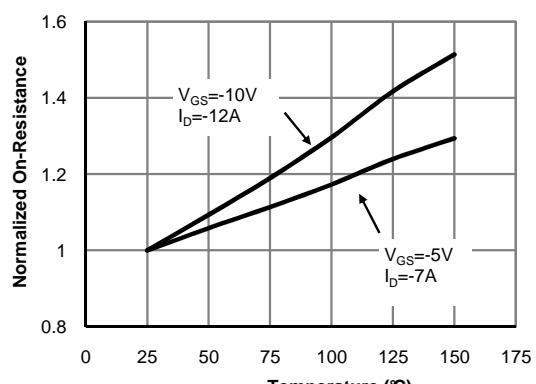
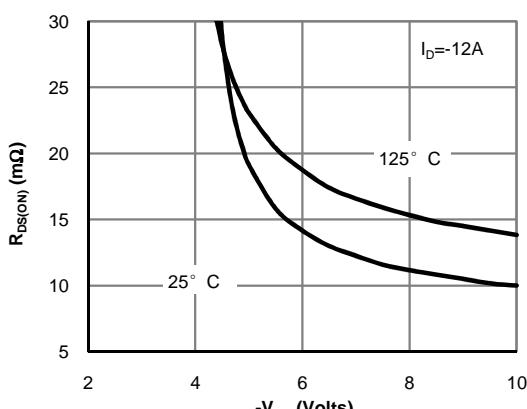
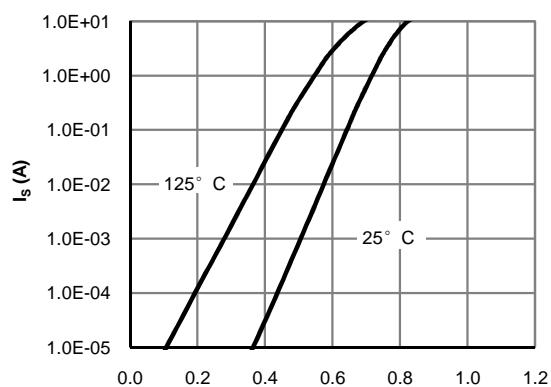
C. Repetitive rating, pulse width limited by junction temperature $T_{J(\text{MAX})}=150^\circ\text{C}$. Ratings are based on low frequency and duty cycles to keep initial $T_J=25^\circ\text{C}$.

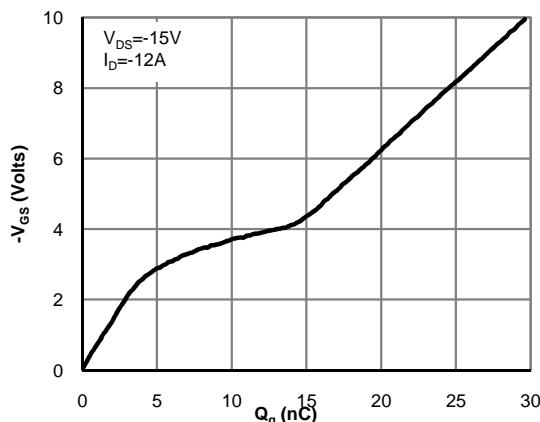
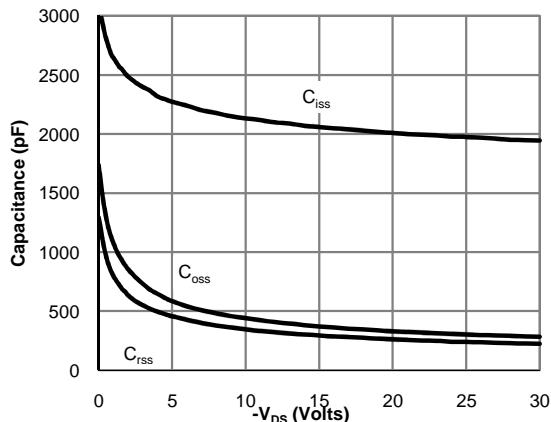
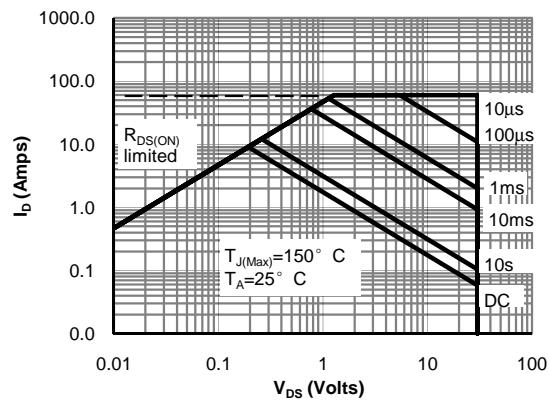
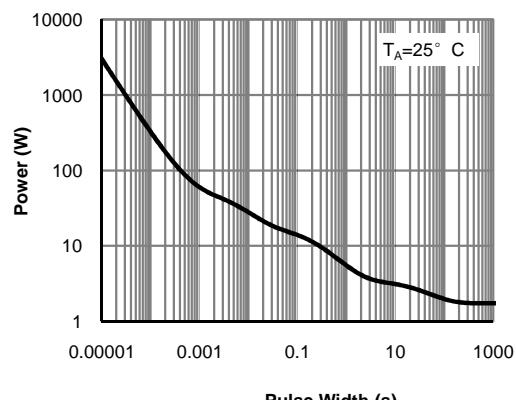
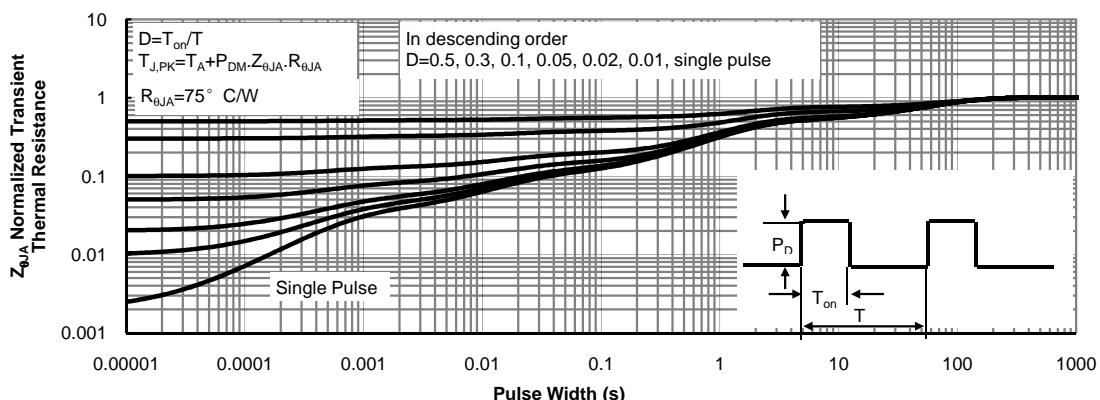
D. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to lead $R_{\theta JL}$ and lead to ambient.

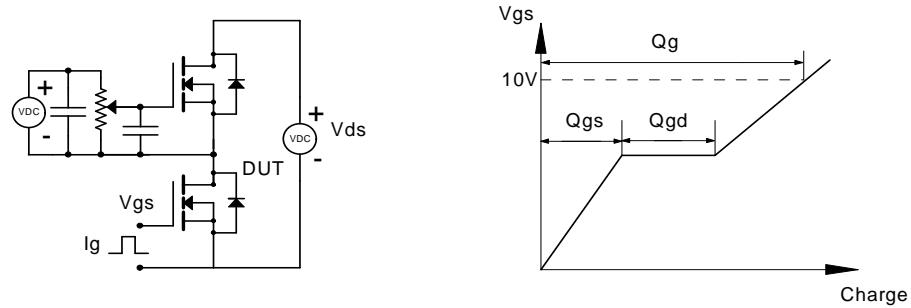
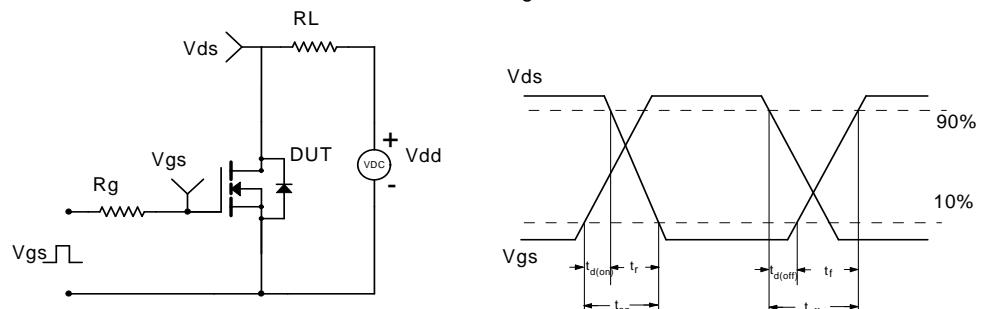
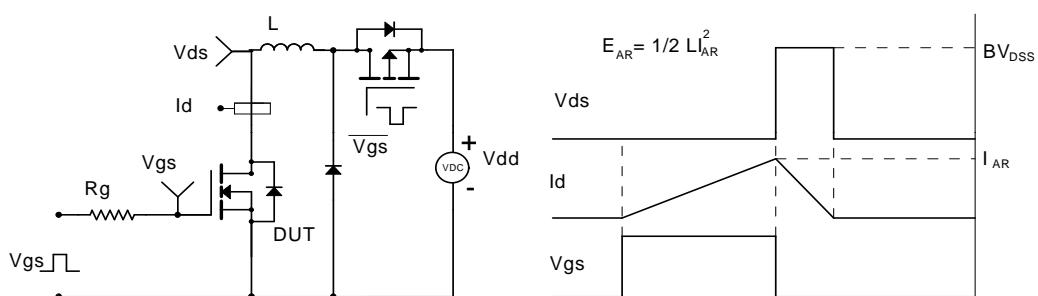
E. The static characteristics in Figures 1 to 6 are obtained using $<300\mu\text{s}$ pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(\text{MAX})}=150^\circ\text{C}$. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Fig 1: On-Region Characteristics (Note E)

Figure 2: Transfer Characteristics (Note E)

Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

Figure 4: On-Resistance vs. Junction Temperature (Note E)

Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

Figure 6: Body-Diode Characteristics (Note E)

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 F)

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

Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

Diode Recovery Test Circuit & Waveforms
