



ALPHA & OMEGA
SEMICONDUCTOR

AO7407

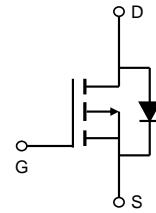
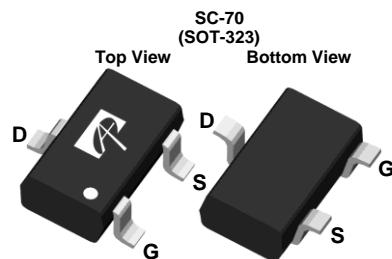
20V P-Channel MOSFET

General Description

The AO7407 uses advanced trench technology to provide excellent RDS(ON), low gate charge and operation with gate voltages as low as 1.8V. This device is suitable for use as a load switch or in PWM applications.

Product Summary

V_{DS}	-20V
I_D (at $V_{GS}=-4.5V$)	-1.2A
$R_{DS(ON)}$ (at $V_{GS}=-4.5V$)	< 135mΩ
$R_{DS(ON)}$ (at $V_{GS}=-2.5V$)	< 170mΩ
$R_{DS(ON)}$ (at $V_{GS}=-1.8V$)	< 220mΩ



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	-20	V
Gate-Source Voltage	V_{GS}	± 8	V
Continuous Drain Current	I_D	-1.2	A
$T_A=70^\circ\text{C}$		-1	
Pulsed Drain Current ^C	I_{DM}	-10	
Power Dissipation ^B	P_D	0.63	W
$T_A=70^\circ\text{C}$		0.4	
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 $t \leq 10\text{s}$	$R_{\theta JA}$	160	200	°C/W
Maximum Junction-to-Ambient ^{A,D} Steady-State		180	220	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	130	°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	$I_D=-250\mu\text{A}, V_{GS}=0\text{V}$	-20			V
$I_{\text{DS}}^{\text{SS}}$	Zero Gate Voltage Drain Current	$V_{DS}=-20\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS} = \pm 8\text{V}$			± 100	nA
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu\text{A}$	-0.4	-0.65	-1	V
$I_{\text{D}(\text{ON})}$	On state drain current	$V_{GS}=-4.5\text{V}, V_{DS}=-5\text{V}$	-10			A
$R_{\text{DS}(\text{ON})}$	Static Drain-Source On-Resistance	$V_{GS}=-4.5\text{V}, I_D=-1.2\text{A}$ $T_J=125^\circ\text{C}$	65	135		$\text{m}\Omega$
		$V_{GS}=-2.5\text{V}, I_D=-1\text{A}$	90	175		$\text{m}\Omega$
		$V_{GS}=-1.8\text{V}, I_D=-1\text{A}$	80	170	220	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}, I_D=-1.2\text{A}$	10			S
V_{SD}	Diode Forward Voltage	$I_S=-1\text{A}, V_{GS}=0\text{V}$	-0.7	-1		V
I_S	Maximum Body-Diode Continuous Current				-1	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=-10\text{V}, f=1\text{MHz}$		560	745	pF
C_{oss}	Output Capacitance		80			pF
C_{rss}	Reverse Transfer Capacitance		70			pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$	15	23.0		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=-4.5\text{V}, V_{DS}=-10\text{V}, I_D=-1.2\text{A}$		8.5	11	nC
Q_{gs}	Gate Source Charge		1.2			nC
Q_{gd}	Gate Drain Charge		2.1			nC
$t_{\text{D}(\text{on})}$	Turn-On DelayTime	$V_{GS}=-4.5\text{V}, V_{DS}=-10\text{V}, R_L=8.3\Omega, R_{\text{GEN}}=3\Omega$	7.2			ns
t_r	Turn-On Rise Time		36			ns
$t_{\text{D}(\text{off})}$	Turn-Off DelayTime		53			ns
t_f	Turn-Off Fall Time		56			ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-1.2\text{A}, dI/dt=100\text{A}/\mu\text{s}$	37	49		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-1.2\text{A}, dI/dt=100\text{A}/\mu\text{s}$	27			nC

A. The value of R_{IJL} 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 $\leq 10\text{s}$ 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 $T_J=25^\circ\text{C}$.

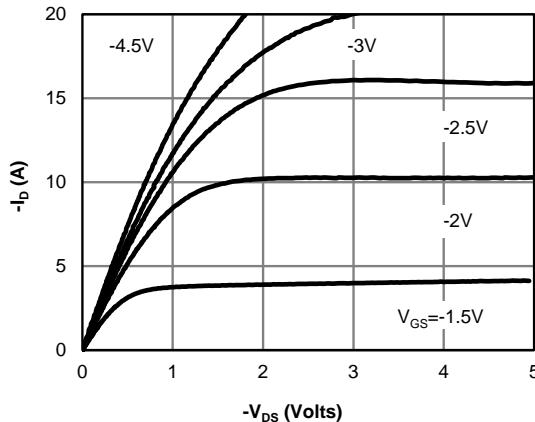
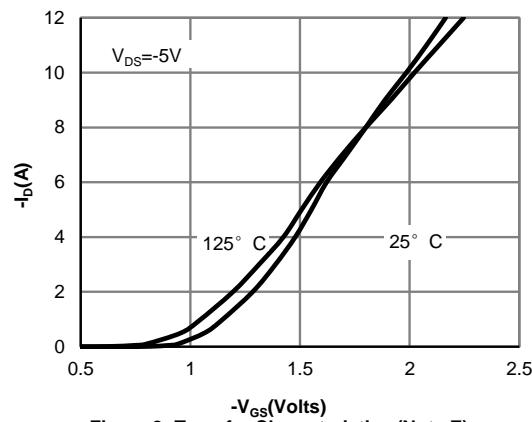
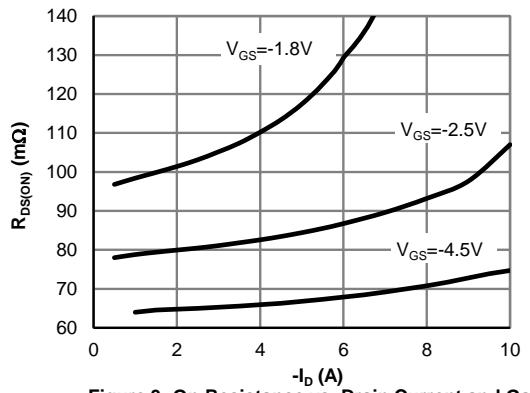
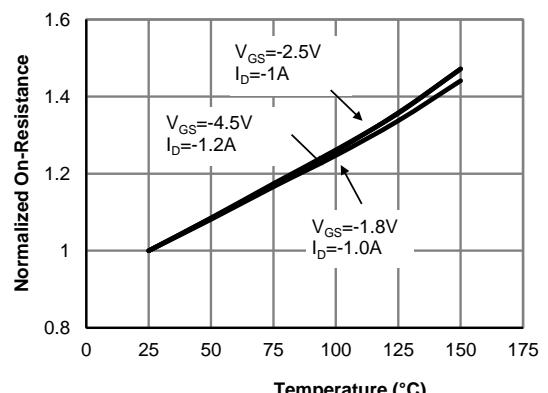
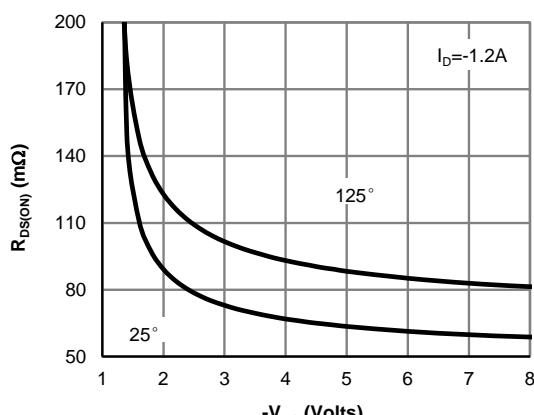
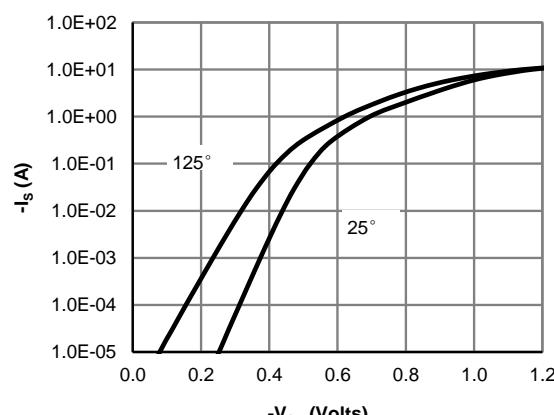
D. The R_{IJL} is the sum of the thermal impedance from junction to lead R_{IJL} and lead to ambient.

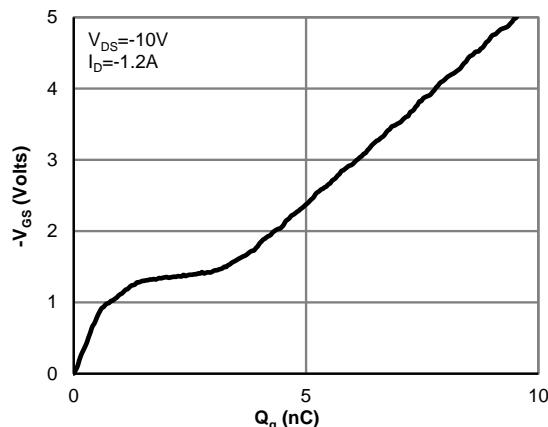
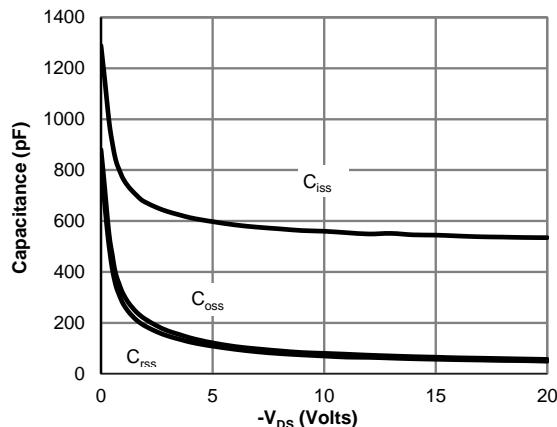
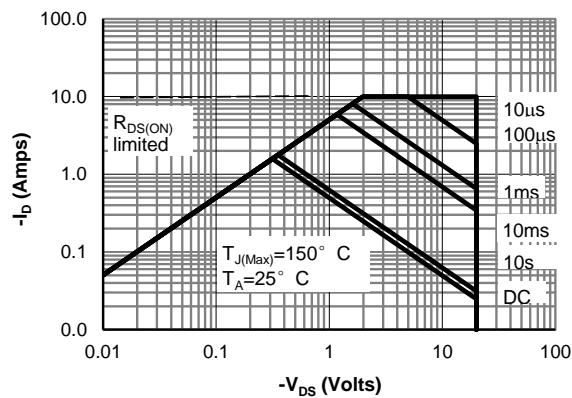
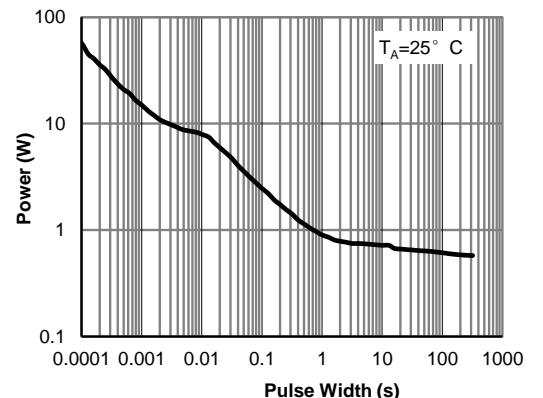
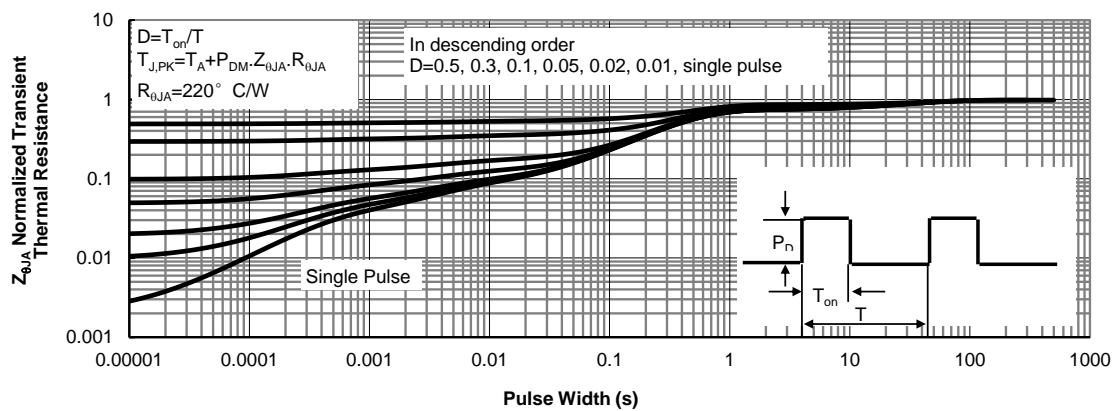
E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

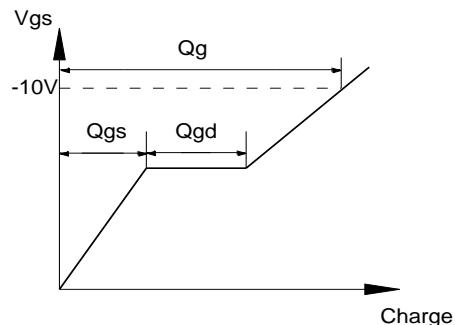
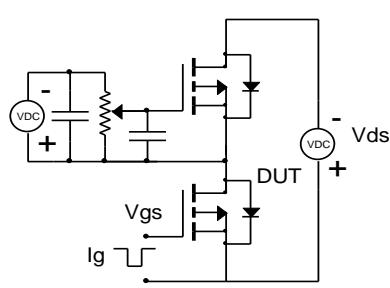
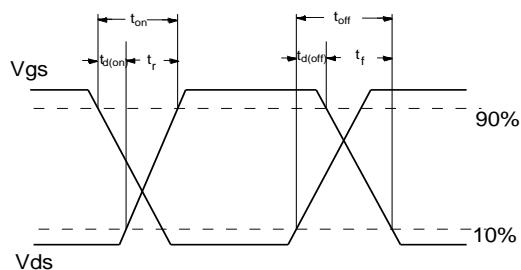
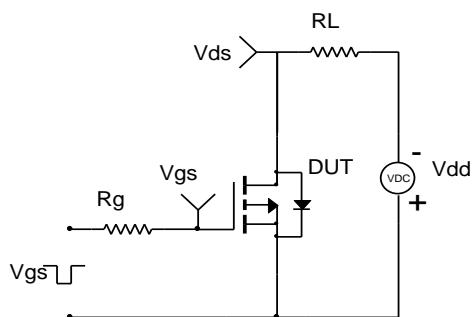
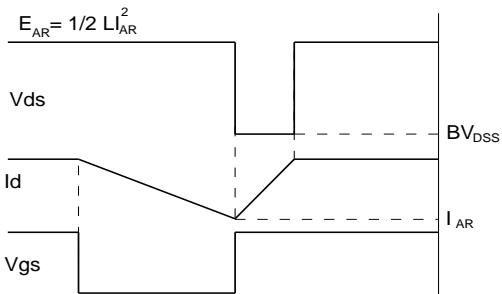
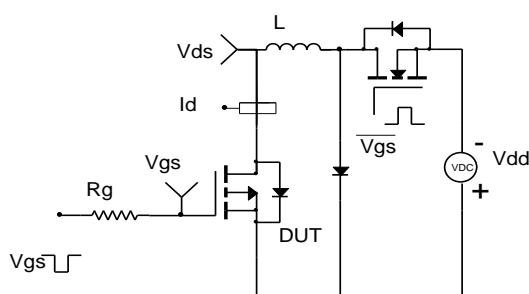
F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(\text{MAX})}=150^\circ\text{C}$. The SOA curve provides a single pulse rating.

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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
