



AO4433

P-Channel Enhancement Mode Field Effect Transistor

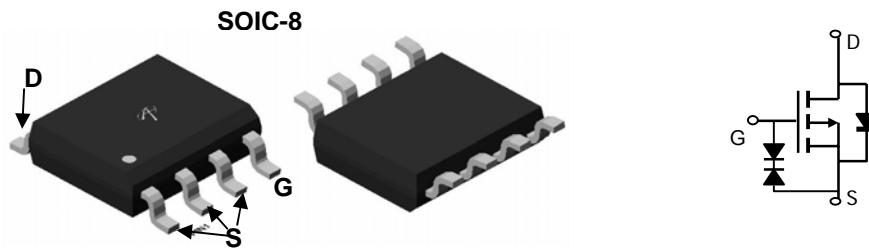
General Description

The AO4433 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.

Features

- V_{DS} (V) = -30V
- I_D = -11 A (V_{GS} = -20V)
- $R_{DS(ON)} < 14m\Omega$ (V_{GS} = -20V)
- $R_{DS(ON)} < 18m\Omega$ (V_{GS} = -10V)
- $R_{DS(ON)} < 36m\Omega$ (V_{GS} = -5V)

- ESD PROTECTED!
- 100% UIS Tested
- 100% Rg 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 ^{AF}	I_D	$T_A=25^\circ\text{C}$	-11
		$T_A=70^\circ\text{C}$	-9.7
Pulsed Drain Current ^B	I_{DM}	-50	A
Power Dissipation ^A	P_D	$T_A=25^\circ\text{C}$	3
		$T_A=70^\circ\text{C}$	2.1
Avalanche Current ^B	I_{AR}	-36	A
Repetitive avalanche energy 0.1mH ^B	E_{AR}	65	mJ
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 ^{AF}	$R_{\theta JA}$	28	40	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A				
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	21	30	$^\circ\text{C/W}$

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	$V_{DS}=0\text{V}$, $V_{GS}=\pm 25\text{V}$			± 10	μA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-1.5	-2.45	-3.5	V
$I_{D(ON)}$	On state drain current	$V_{GS}=-10\text{V}$, $V_{DS}=-5\text{V}$	-50			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-20\text{V}$, $I_D=-11\text{A}$ $T_J=125^\circ\text{C}$		11 15	14 19	$\text{m}\Omega$
		$V_{GS}=-10\text{V}$, $I_D=-10\text{A}$		13.8	18	$\text{m}\Omega$
		$V_{GS}=-5\text{V}$, $I_D=-5\text{A}$		25.8	36	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}$, $I_D=-11\text{A}$		20		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
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=-15\text{V}$, $f=1\text{MHz}$		1760	2200	pF
C_{oss}	Output Capacitance			360		pF
C_{rss}	Reverse Transfer Capacitance			255	357	pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$	3.2	6.4	8	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $I_D=-11\text{A}$		30	38	nC
Q_{gs}	Gate Source Charge			7		nC
Q_{gd}	Gate Drain Charge			8		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $R_L=1.5\Omega$, $R_{GEN}=3\Omega$		11.5		ns
t_r	Turn-On Rise Time			8		ns
$t_{D(off)}$	Turn-Off DelayTime			35		ns
t_f	Turn-Off Fall Time			18.5		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-11\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		24	30	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-11\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		16		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

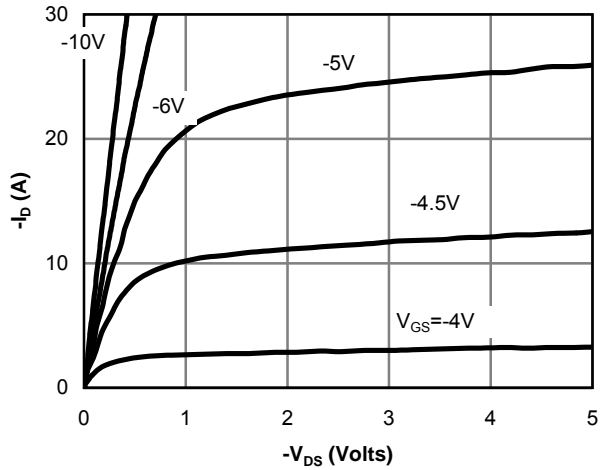


Fig 1: On-Region Characteristics

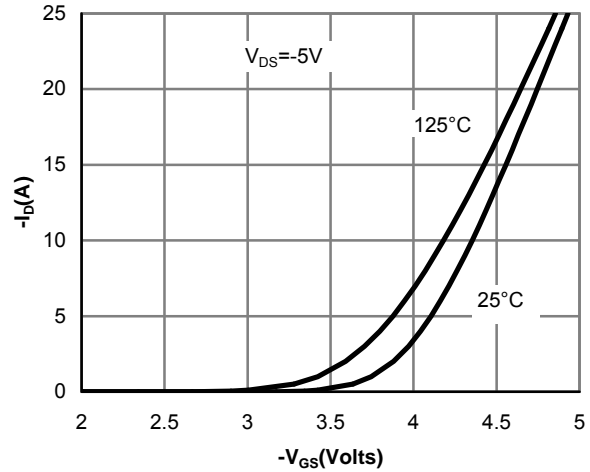


Figure 2: Transfer Characteristics

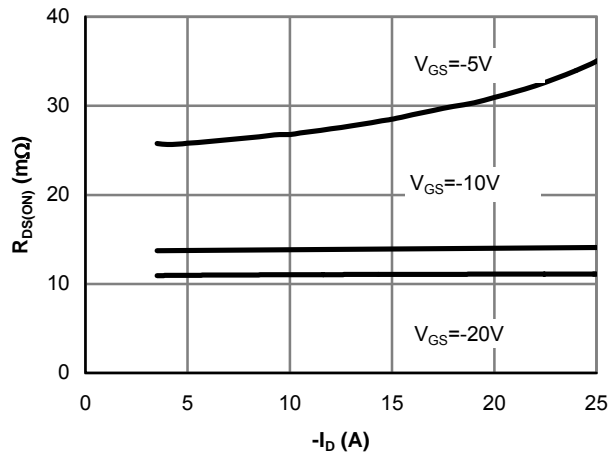


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

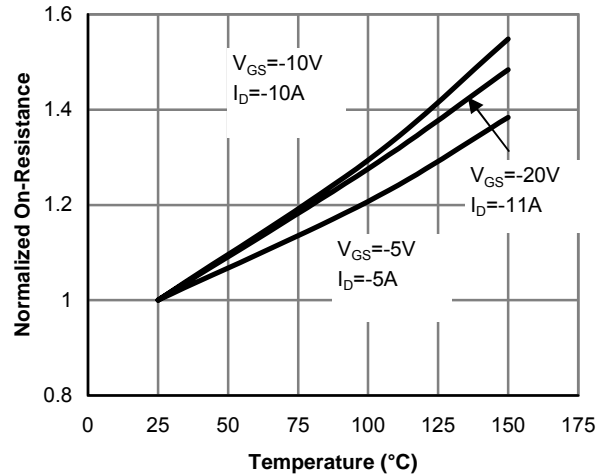


Figure 4: On-Resistance vs. Junction Temperature

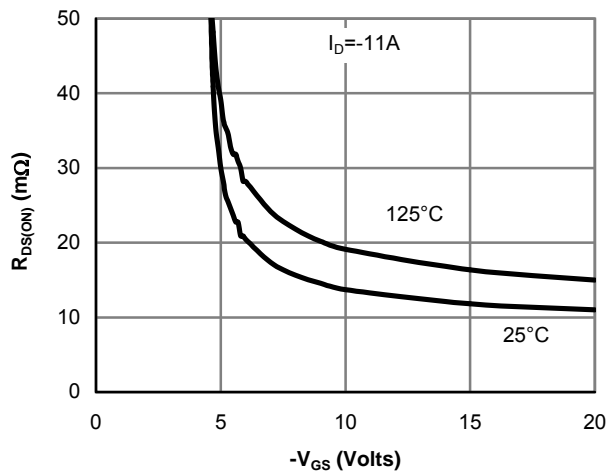


Figure 5: On-Resistance vs. Gate-Source Voltage

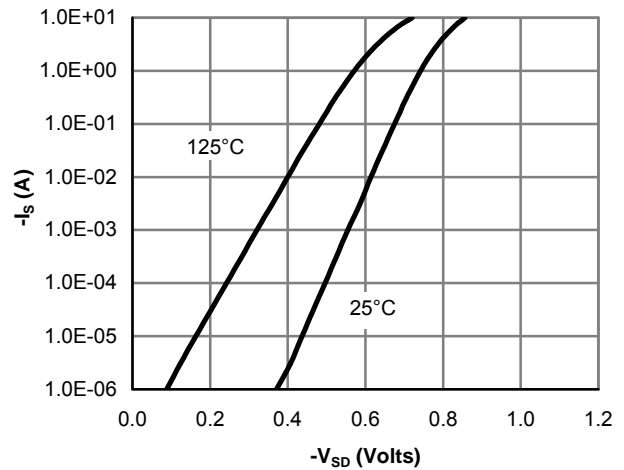


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

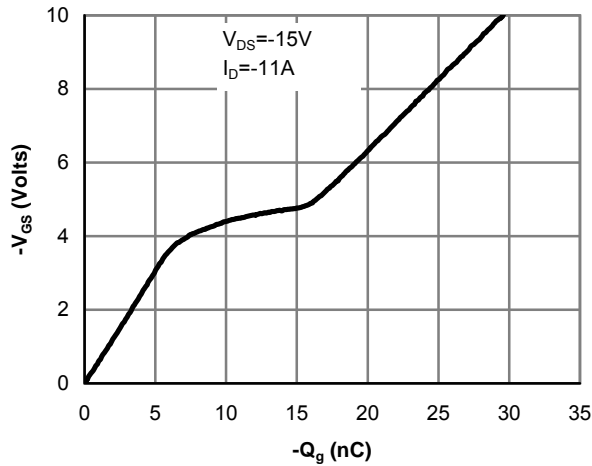


Figure 7: Gate-Charge Characteristics

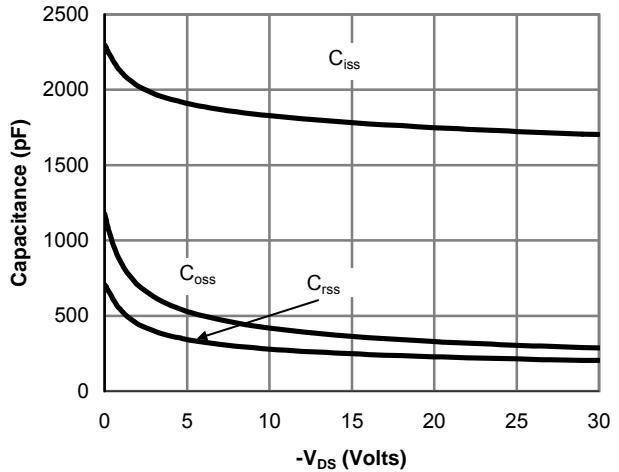


Figure 8: Capacitance Characteristics

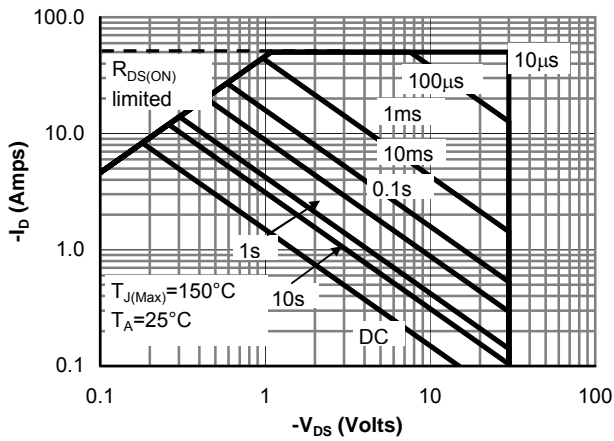


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

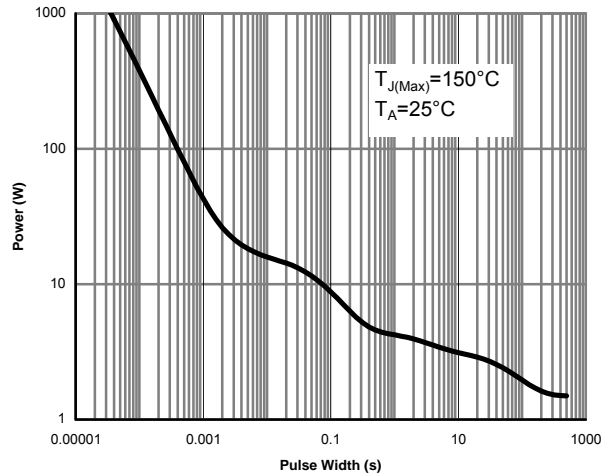


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

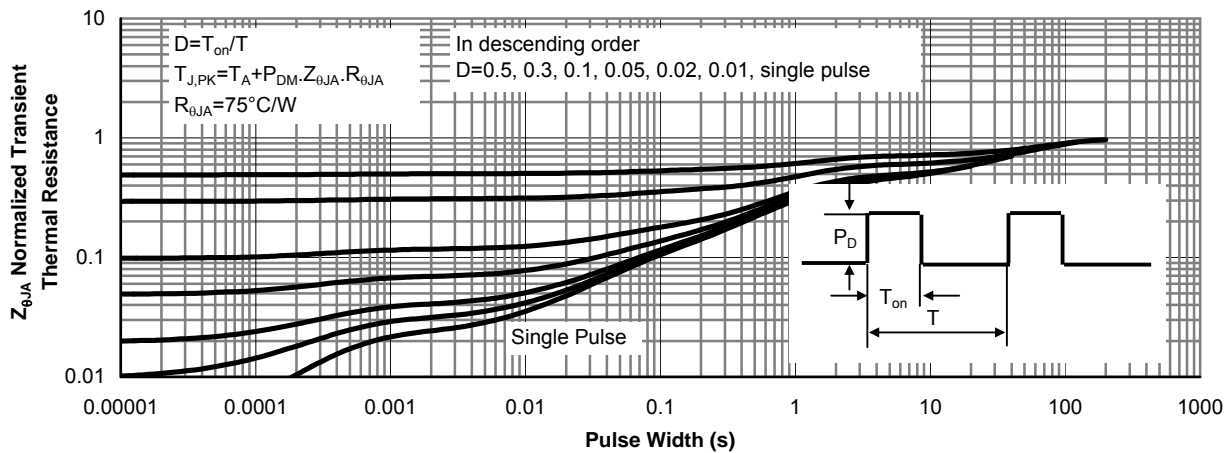
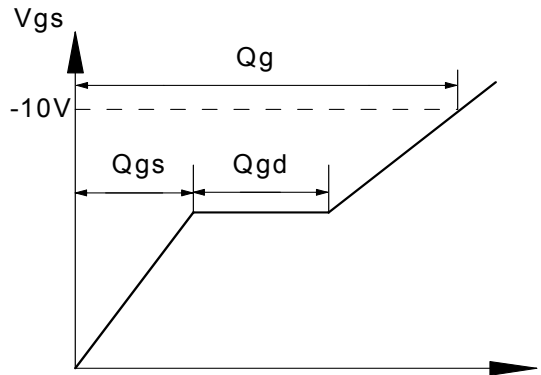
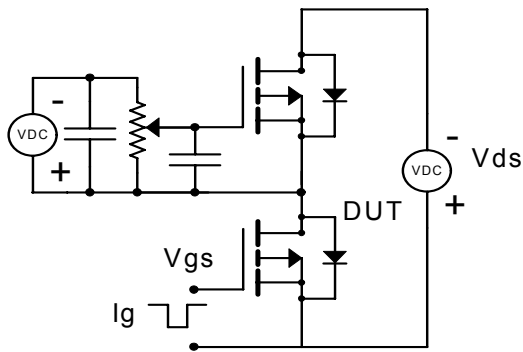
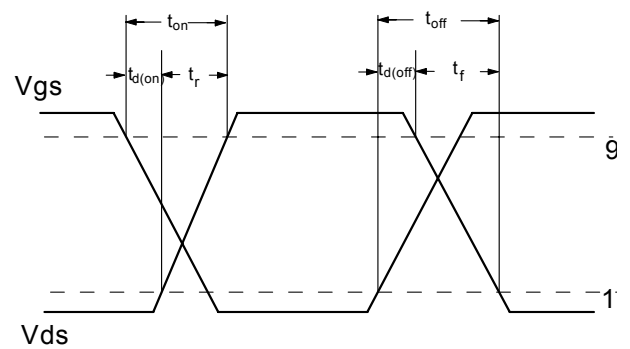
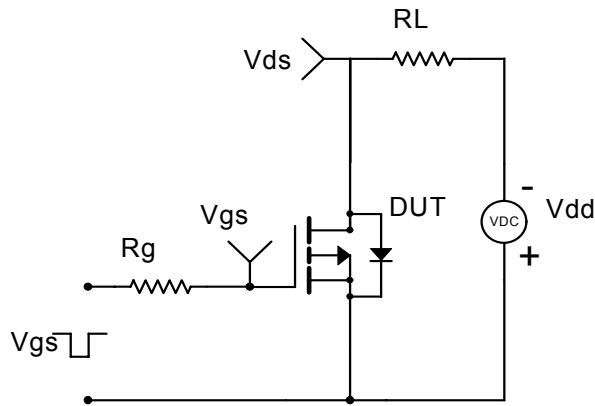


Figure 11: Normalized Maximum Transient Thermal Impedance

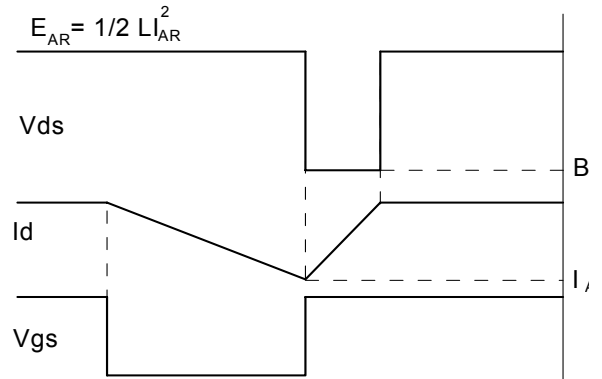
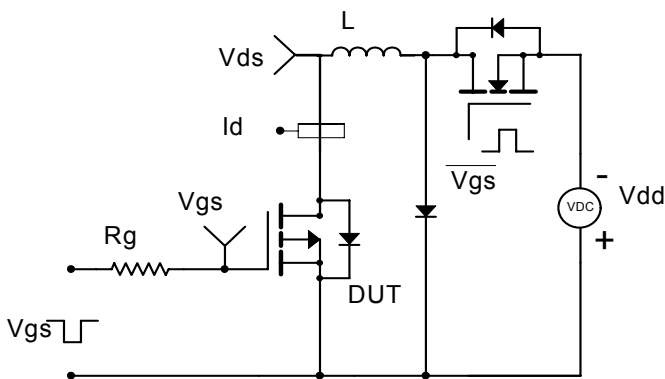
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

