ALPHA & OMEGA
SEMICONDUCTOR

AO3423
20V P-Channel MOSFET

General Description
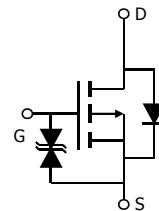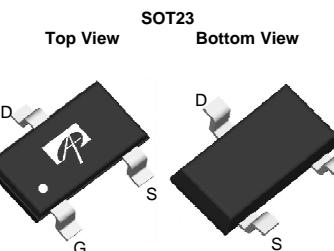
The AO3423 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch applications.

Product Summary

V_{DS}	-20V
I_D (at V_{GS}=-10V)	-2A
$R_{DS(ON)}$ (at V_{GS}= -10V)	< 92mΩ
$R_{DS(ON)}$ (at V_{GS}= -4.5V)	< 118mΩ
$R_{DS(ON)}$ (at V_{GS}= -2.5V)	< 166mΩ

Typical ESD protection   **HBM Class 2**

Green Product

SOT23
Top View   **Bottom View**

D   D
S   G
G   S

D
G
S

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	-20	V
Gate-Source Voltage		V_{GS}	±12	V
Continuous Drain Current	T_A=25°C	I_D	-2	A
	T_A=70°C		-2	
Pulsed Drain Current [C]		I_{DM}	-17	
Power Dissipation [B]	T_A=25°C	P_D	1.4	W
	T_A=70°C		0.9	
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 ≤ 10s	$R_{\theta JA}$	65	90	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		85	125	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	43	60	°C/W

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Electrical Characteristics (T$_J$=25℃ unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
STATIC PARAMETERS							
BV$_{DSS}$	Drain-Source Breakdown Voltage	I$_D$=-250μA, V$_{GS}$=0V		-20			V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=-20V, V$_{GS}$=0V				-1	μA
			T$_J$=55℃			-5	
I$_{GSS}$	Gate-Body leakage current	V$_{DS}$=0V, V$_{GS}$= ±12V				±10	μA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$, I$_D$=-250μA		-0.5	-0.85	-1.2	V
I$_{D(ON)}$	On state drain current	V$_{GS}$=-4.5V, V$_{DS}$=-5V		-17			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=-10V, I$_D$=-2A			76	92	mΩ
			T$_J$=125℃		99	119	
		V$_{GS}$=-4.5V, I$_D$=-2A			94	118	mΩ
		V$_{GS}$=-2.5V, I$_D$=-1A			128	166	mΩ
g$_{FS}$	Forward Transconductance	V$_{DS}$=-5V, I$_D$=-2A			6.8		S
V$_{SD}$	Diode Forward Voltage	I$_S$=-1A,V$_{GS}$=0V			-0.76	-1	V
I$_S$	Maximum Body-Diode Continuous Current					-1.5	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=-10V, f=1MHz		250	325	400	pF
C$_{oss}$	Output Capacitance			40	63	85	pF
C$_{rss}$	Reverse Transfer Capacitance			22	37	52	pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz			11.2	17	Ω
SWITCHING PARAMETERS							
Q$_g$	Total Gate Charge	V$_{GS}$=-4.5V, V$_{DS}$=-10V, I$_D$=-2A			3.2	4.5	nC
Q$_{gs}$	Gate Source Charge				0.6		nC
Q$_{gd}$	Gate Drain Charge				0.9		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=-10V, V$_{DS}$=-10V, R$_L$=5Ω, R$_{GEN}$=3Ω			11		ns
t$_r$	Turn-On Rise Time				5.5		ns
t$_{D(off)}$	Turn-Off DelayTime				22		ns
t$_f$	Turn-Off Fall Time				8		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=-2A, dI/dt=100A/μs			6.1		ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=-2A, dI/dt=100A/μs			1.4		nC

A. The value of R$_{θJA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T$_A$ =25° 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$_{J(MAX)}$=150° C, using ≤ 10s junction-to-ambient thermal resistance.
C. Repetitive rating, pulse width limited by junction temperature T$_{J(MAX)}$=150° C. Ratings are based on low frequency and duty cycles to keep initialT$_J$=25° C.
D. The R$_{θJA}$ is the sum of the thermal impedance from junction to lead R$_{θJL}$ 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$_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.
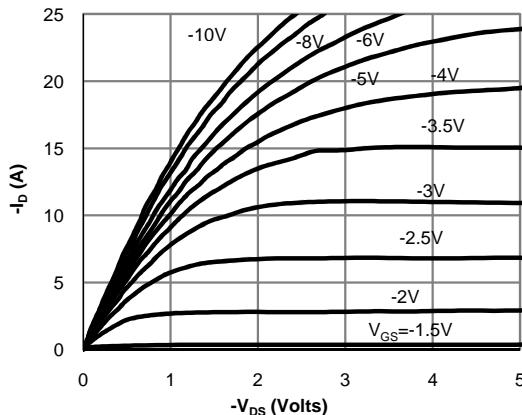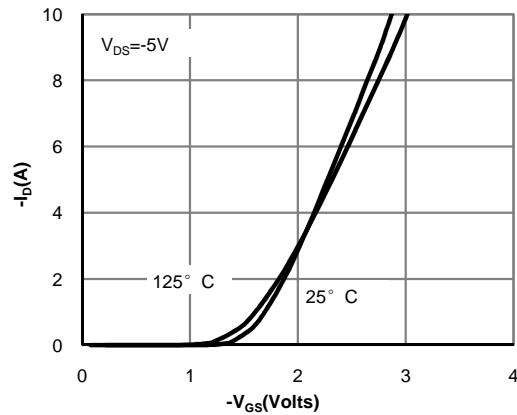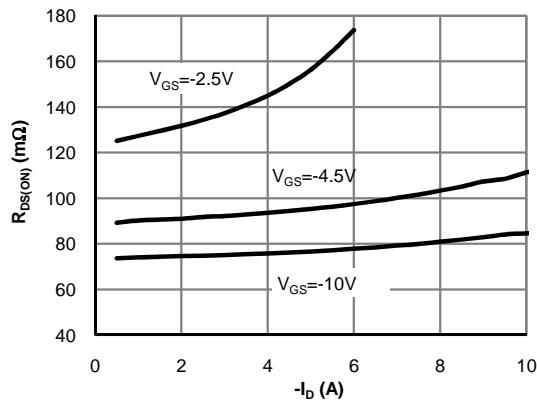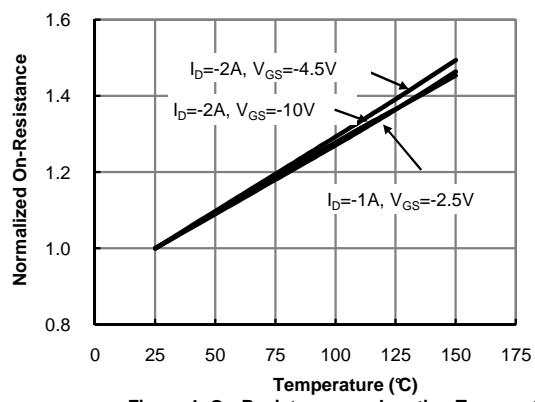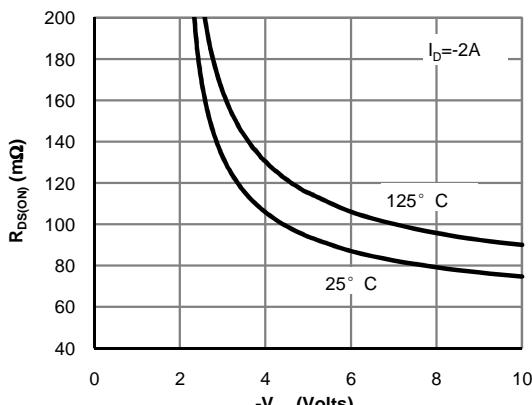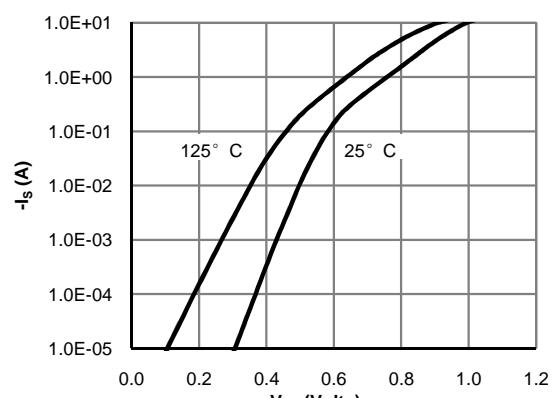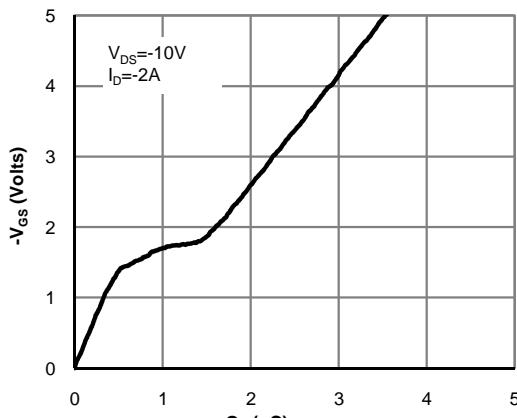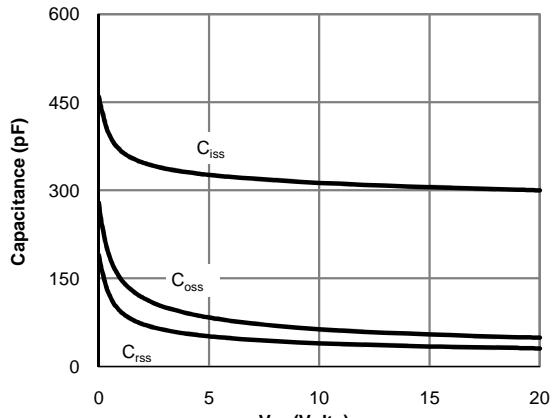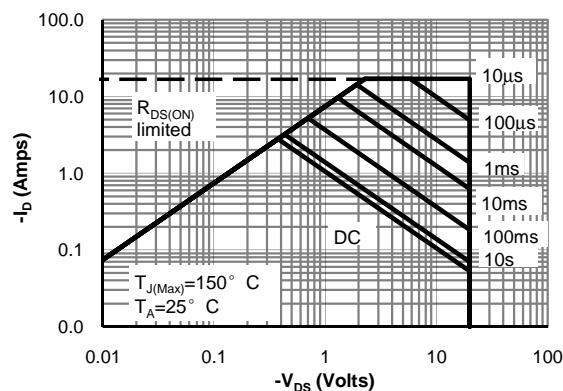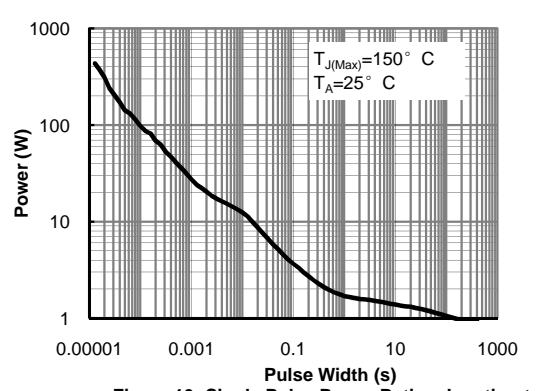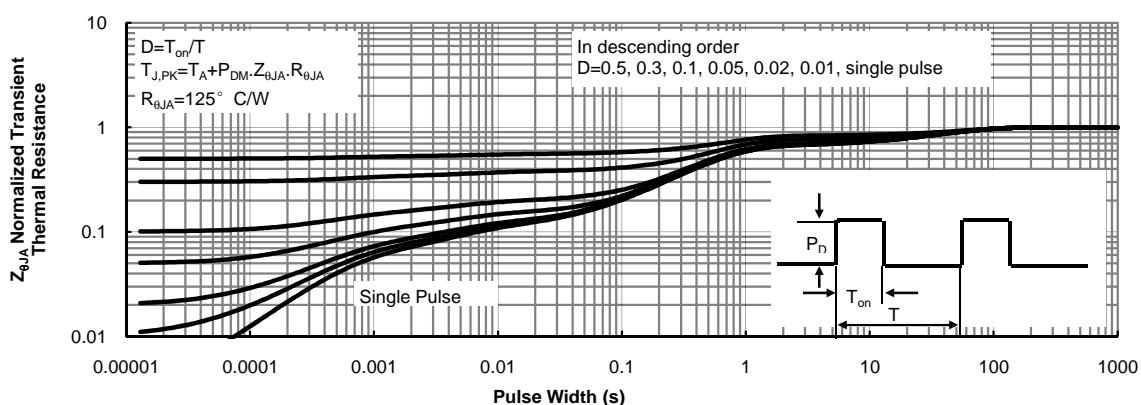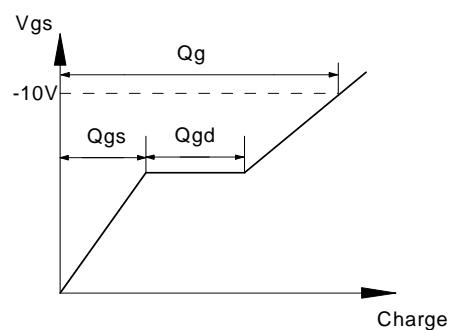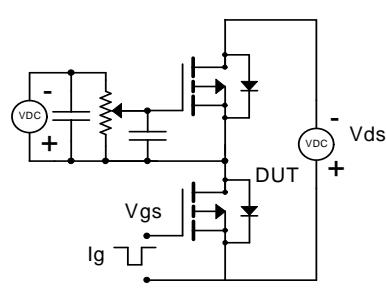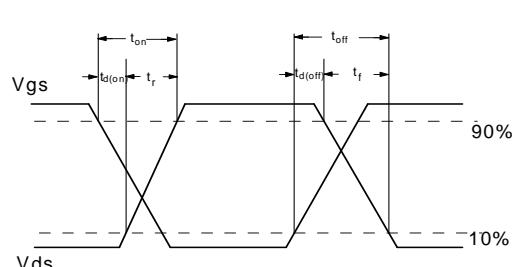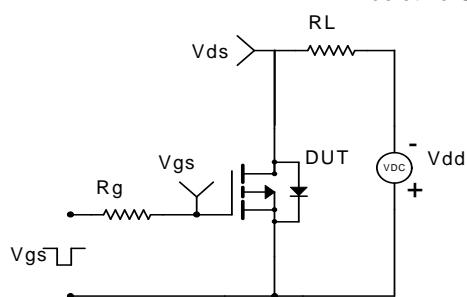
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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

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)

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 7: Gate-Charge Characteristics

V_{DS}=-10V
I_D=-2A

Figure 8: Capacitance Characteristics

C_{iss}

C_{oss}

C_{rss}

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

$R_{DS(ON)}$ limited

10µs
100µs
1ms
10ms
100ms
10s
DC

$T_{J(Max)}$=150°C
T_A=25°C

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

$T_{J(Max)}$=150°C
T_A=25°C

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

D=T_{on}/T
$T_{J,PK}$=T_A+P_{DM}·$Z_{θJA}$·$R_{θJA}$
$R_{θJA}$=125°C/W

In descending order
D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse

Single Pulse

P_D

T_{on}
T

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Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Diode Recovery Test Circuit & Waveforms

$$Q_{rr} = -\int Idt$$