

-20V P-Channel Enhancement Mode MOSFET

Description

The AP2301AI uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

General Features

$V_{DS} = -20V$ $I_D = -3.3A$

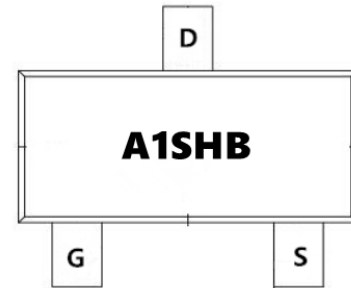
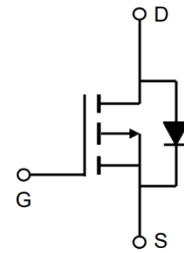
$R_{DS(ON)} < 80m\Omega$ @ $V_{GS} = -4.5V$ (Type: 55m Ω)

Application

Battery protection

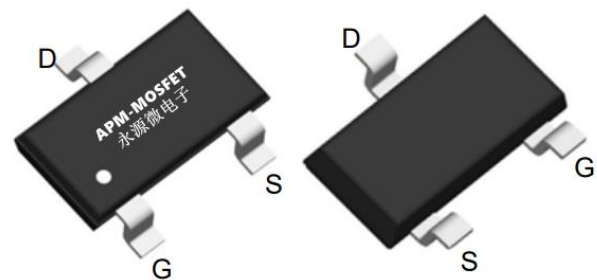
Load switch

Uninterruptible power supply



Top View

Bottom View



Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP2301AI	SOT23L	A1SHB	3000

Absolute Maximum Ratings ($T_C = 25^\circ C$ unless otherwise noted)

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	-20	V
V_{GS}	Gate-Source Voltage	± 12	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V^1$	-3.3	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ -4.5V^1$	-2.6	A
I_{DM}	Pulsed Drain Current ²	-13	A
$P_D @ T_A = 25^\circ C$	Total Power Dissipation ³	1.4	W
T_{STG}	Storage Temperature Range	-55 to 150	$^\circ C$
T_J	Operating Junction Temperature Range	-55 to 150	$^\circ C$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹	125	$^\circ C/W$
$R_{\theta JC}$	Thermal resistance, junction-case	90	$^\circ C/W$

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Electrical Characteristics ($T_J=25^{\circ}\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-20	-22	---	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-4.5V, I_D=-3A$	---	55	80	$m\Omega$
		$V_{GS}=-2.5V, I_D=-2A$	---	75	100	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-0.45	-0.6	-1.0	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-20V, V_{GS}=0V, T_J=25^{\circ}\text{C}$	---	---	-1	μA
		$V_{DS}=-20V, V_{GS}=0V, T_J=55^{\circ}\text{C}$	---	---	-5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 12V, V_{DS}=0V$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=-5V, I_D=-3A$	---	12.2	---	S
Q_g	Total Gate Charge (-4.5V)	$V_{DS}=-15V, V_{GS}=-4.5V, I_D=-3A$	---	10.1	---	nC
Q_{gs}	Gate-Source Charge		---	1.21	---	
Q_{gd}	Gate-Drain Charge		---	2.46	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-10V, V_{GS}=-4.5V, R_G=3.3\Omega, I_D=-3A$	---	5.6	---	ns
T_r	Rise Time		---	32.2	---	
$T_{d(off)}$	Turn-Off Delay Time		---	45.6	---	
T_f	Fall Time		---	29.2	---	
C_{iss}	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$	---	677	---	pF
C_{oss}	Output Capacitance		---	82	---	
C_{rss}	Reverse Transfer Capacitance		---	73	---	
I_S	Continuous Source Current ^{1,4}	$V_G=V_D=0V, \text{Force Current}$	---	---	-3	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=-1A, T_J=25^{\circ}\text{C}$	---	---	-1	V

Note :

- 1、The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2、The data tested by pulsed , pulse width $\Delta 300\mu s$, duty cycle $\Delta 2\%$
- 3、The power dissipation is limited by 150 $^{\circ}\text{C}$ junction temperature
- 4、The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.

Typical Characteristics

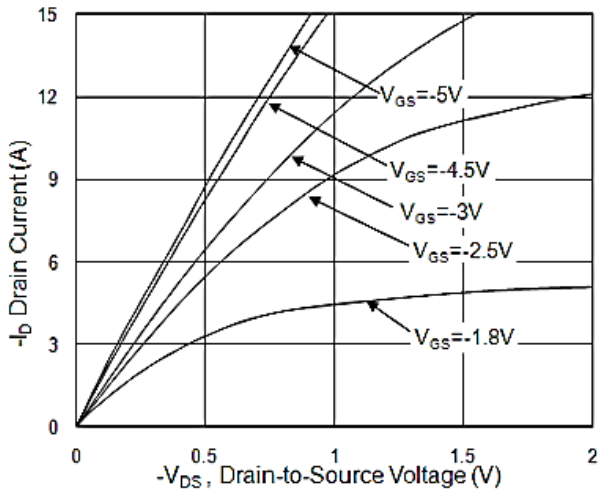


Fig.1 Typical Output Characteristics

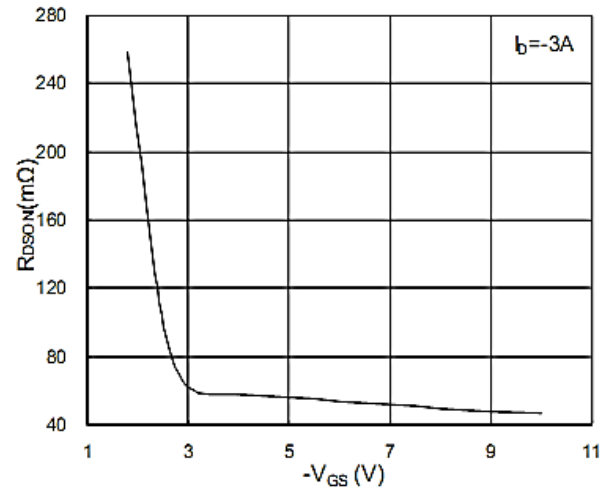


Fig.2 On-Resistance vs. Gate-Source

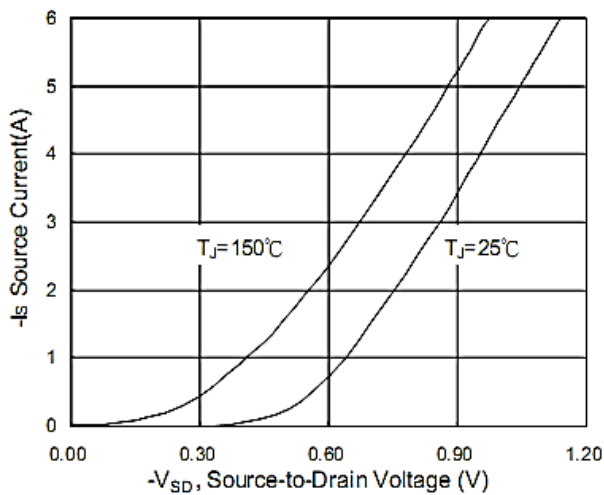


Fig.3 Forward Characteristics Of Reverse

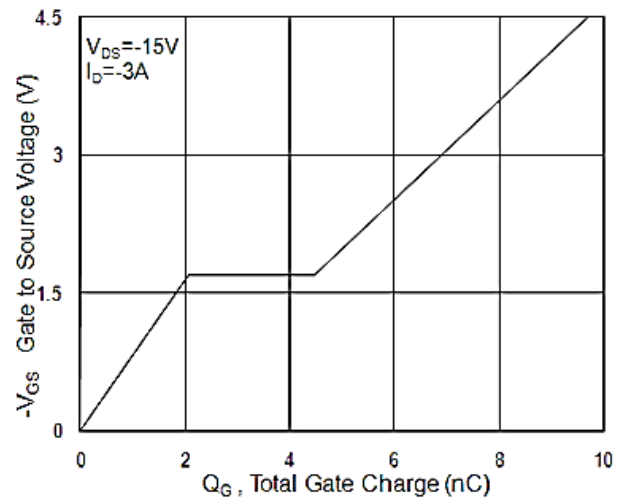


Fig.4 Gate-Charge Characteristics

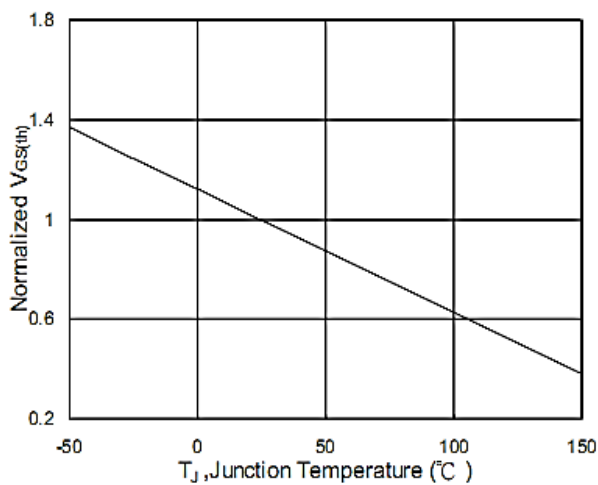


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

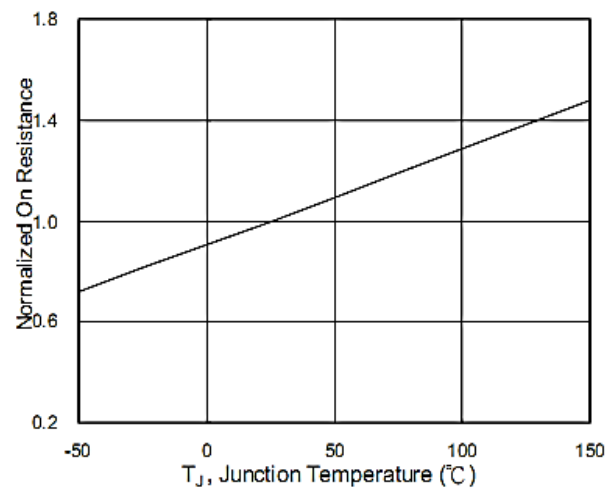


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

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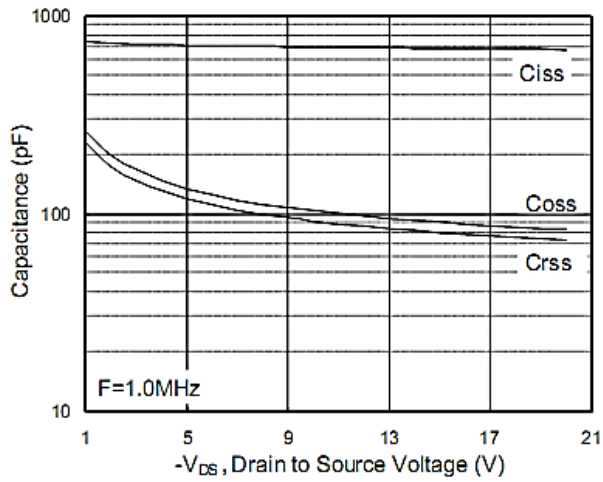


Fig.7 Capacitance

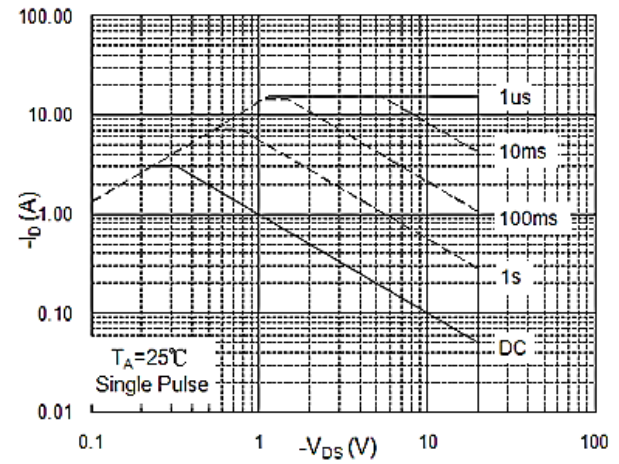


Fig.8 Safe Operating Area

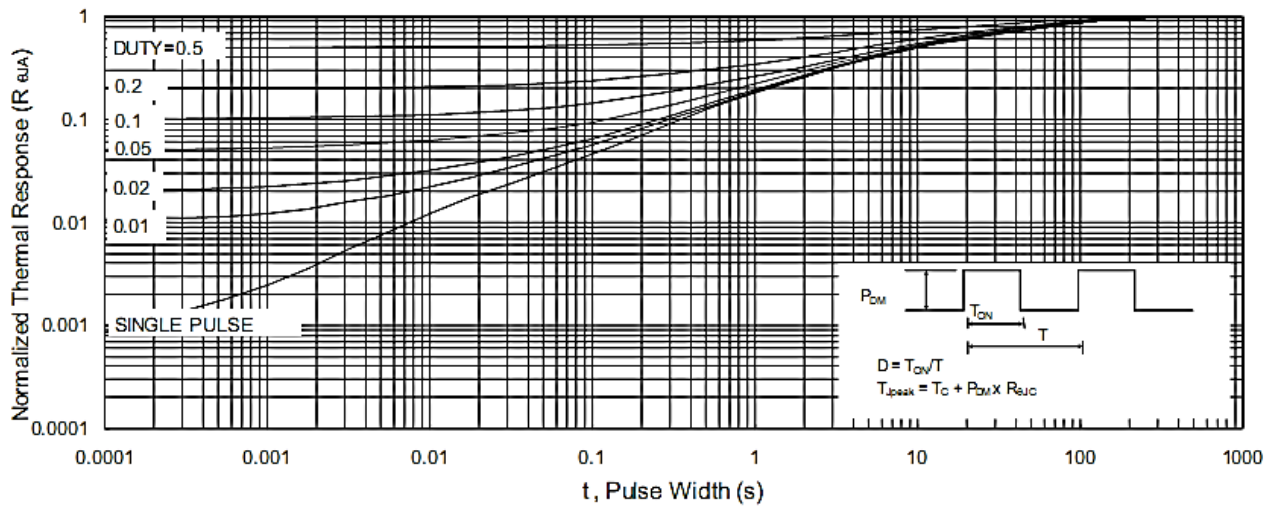


Fig.9 Normalized Maximum Transient Thermal Impedance

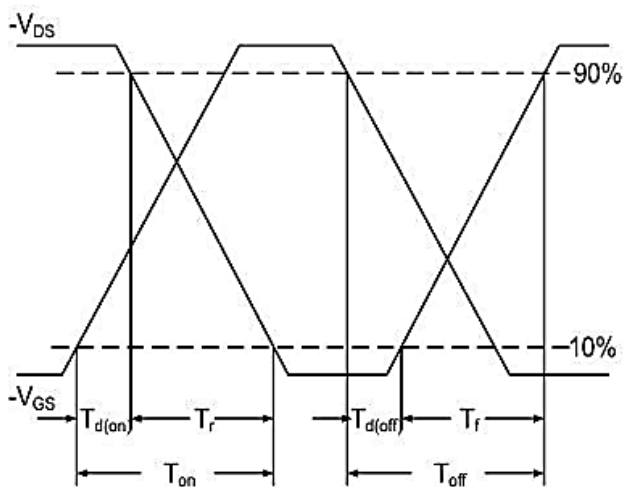


Fig.10 Switching Time Waveform

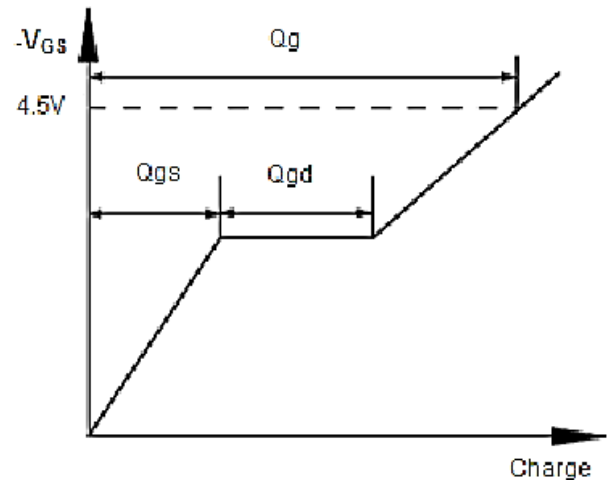
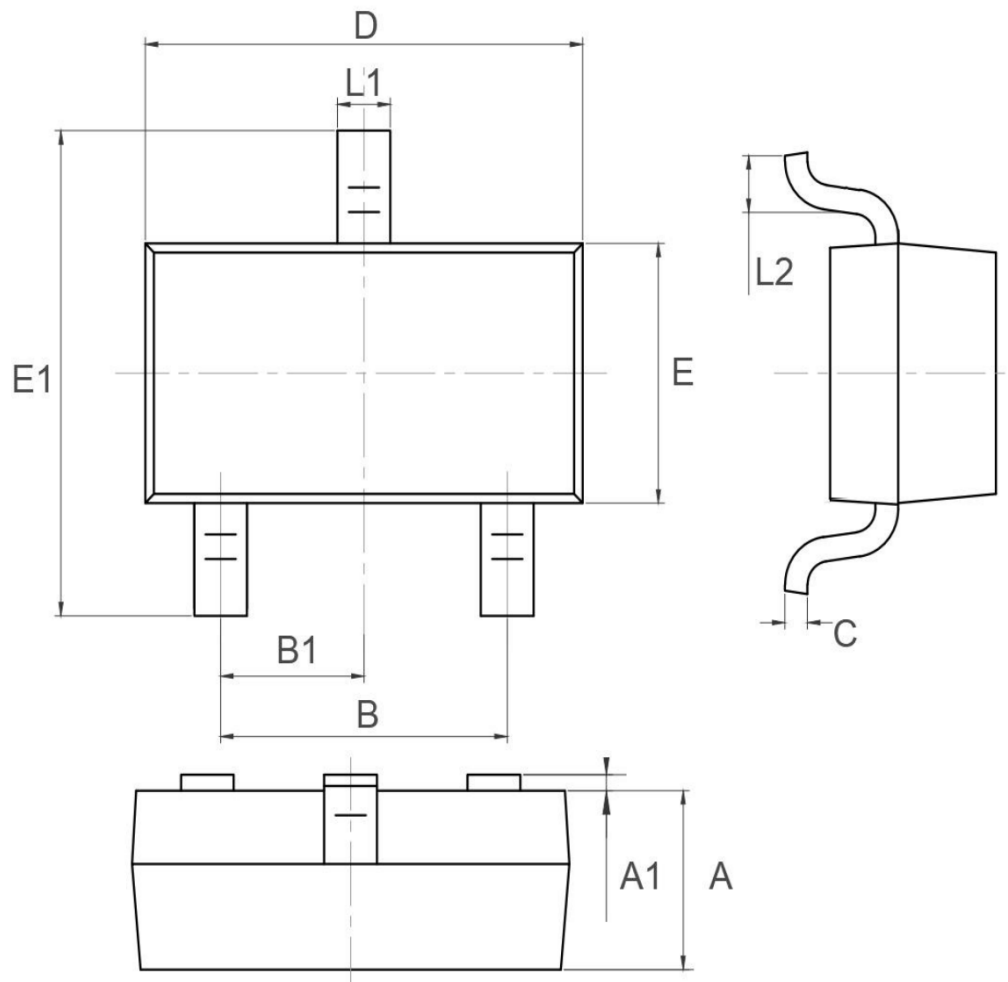


Fig.11 Gate Charge Waveform

Package Mechanical Data-SOT23L-Single



Symbol	Dim in mm		
	min.	tpy.	max.
A	0.9	1	1.1
A1	0	0.05	0.1
B	1.8	1.9	2
B1	0.95TYP		
C	0.08	0.115	0.15
D	2.8	2.9	3
E	1.2	1.3	1.4
E1	2.25	2.4	2.55
L1	0.3	0.4	0.5
L2	0.2	0.35	0.5

-20V P-Channel Enhancement Mode MOSFET**Attention**

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Edition	Date	Change
REV1.2	2017/6/19	Initial release
REV1.3	2020/8/19	Reduce RDS(on)
REV1.4	2023/3/10	Change layout format
REV1.4	2025/4/15	Update LOGO

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