

Description

The LM2309 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

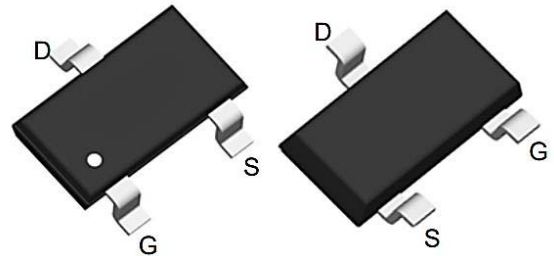
$V_{DS} = -60V$ $I_D = -2.8A$

$R_{DS(ON)} < 200m\Omega$ @ $V_{GS} = -10V$ (Type: 165m Ω)

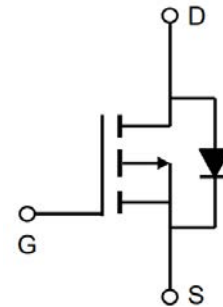
Application

- Battery protection
- Load switch
- Uninterruptible power supply

Dimensions SOT-23



Pin Configuration



Package Marking and Ordering Information

Device	Device Marking	Device Package	Reel Size	Tape width	Quantity
LM2309	3P06AP	SOT-23	Ø180mm	8 mm	3000 units

Absolute Maximum Ratings (TC=25 °C unless otherwise noted)

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	-60	V
V_{GS}	Gate-Source Voltage	± 20	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V^1$	-2.8	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ -10V^1$	-1.8	A
I_{DM}	Pulsed Drain Current ²	-8.4	A
$P_D @ T_A = 25^\circ C$	Total Power Dissipation ³	1.5	W
T_{STG}	Storage Temperature Range	-55 to 150	°C
T_J	Operating Junction Temperature Range	-55 to 150	°C
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹	125	°C/W
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	80	°C/W

Electrical Characteristics (T_J=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =-250uA	-60	-67	---	V
ΔBV _{DSS} /ΔT _J	BV _{DSS} Temperature Coefficient	Reference to 25°C, I _D =-1mA	---	-0.021	---	V/°C
R _{DS(on)}	Static Drain-Source On-Resistance ²	V _{GS} =-10V, I _D =-1.5A	---	165	200	mΩ
		V _{GS} =-4.5V, I _D =-1A	---	200	250	
V _{GS(th)}	Gate Threshold Voltage	V _{GS} =V _{DS} , I _D =-250uA	-1.0	1.7	-2.5	V
ΔV _{GS(th)}	V _{GS(th)} Temperature Coefficient		---	4.08	---	mV/°C
I _{DSS}	Drain-Source Leakage Current	V _{DS} =-48V, V _{GS} =0V, T _J =25°C	---	---	1	uA
		V _{DS} =-48V, V _{GS} =0V, T _J =55°C	---	---	5	
I _{GSS}	Gate-Source Leakage Current	V _{GS} =±20V, V _{DS} =0V	---	---	±100	nA
g _{fs}	Forward Transconductance	V _{DS} =-5V, I _D =-1.5A	---	5.9	---	S
Q _g	Total Gate Charge (-4.5V)	V _{DS} =-20V, V _{GS} =-4.5V, I _D =-1.5A	---	4.6	---	nC
Q _{gs}	Gate-Source Charge		---	1.4	---	
Q _{gd}	Gate-Drain Charge		---	1.62	---	
T _{d(on)}	Turn-On Delay Time	V _{DS} =-15V, V _{GS} =-10V, R _G =3.3Ω, I _D =-1A	---	17.4	---	ns
T _r	Rise Time		---	5.4	---	
T _{d(off)}	Turn-Off Delay Time		---	37.2	---	
T _f	Fall Time		---	2.4	---	
C _{iss}	Input Capacitance	V _{DS} =-15V, V _{GS} =0V, f=1MHz	---	453	---	pF
C _{oss}	Output Capacitance		---	59	---	
C _{rss}	Reverse Transfer Capacitance		---	38	---	
I _s	Continuous Source Current ^{1,4}	V _G =V _D =0V, Force Current	---	---	-1.7	A
I _{SM}	Pulsed Source Current ^{2,4}		---	---	-7	A
V _{SD}	Diode Forward Voltage ²	V _{GS} =0V, I _S =-1A, T _J =25°C	---	---	-1.2	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 ≦ 300us, duty cycle ≦ 2%
- 3、 The power dissipation is limited by 150°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

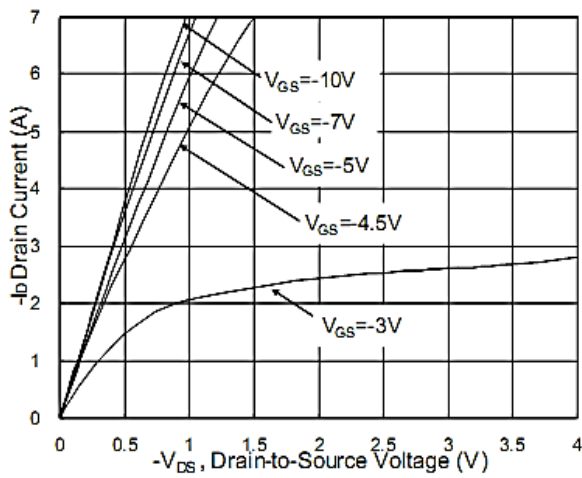


Fig.1 Typical Output Characteristics

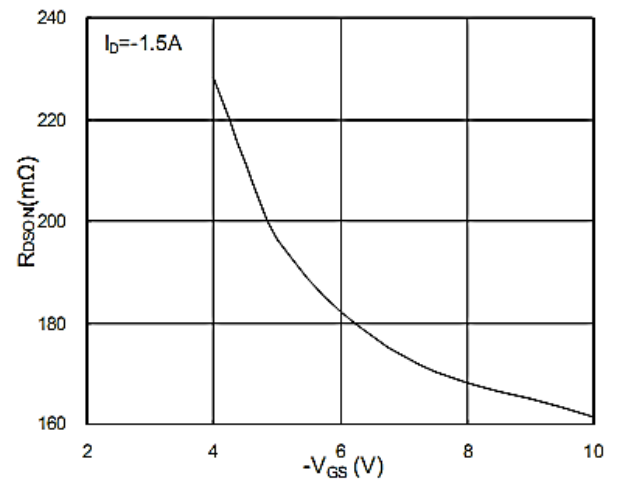


Fig.2 On-Resistance v.s Gate-Source

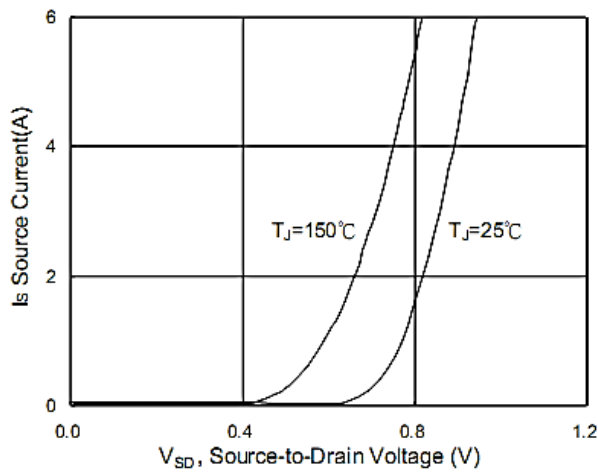


Fig.3 Forward Characteristics Of Reverse

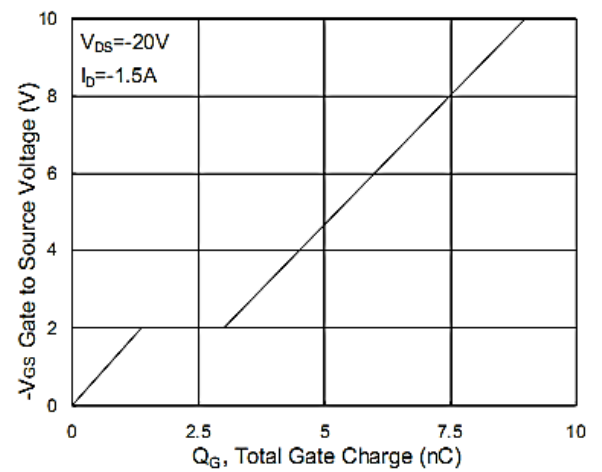


Fig.4 Gate-Charge Characteristics

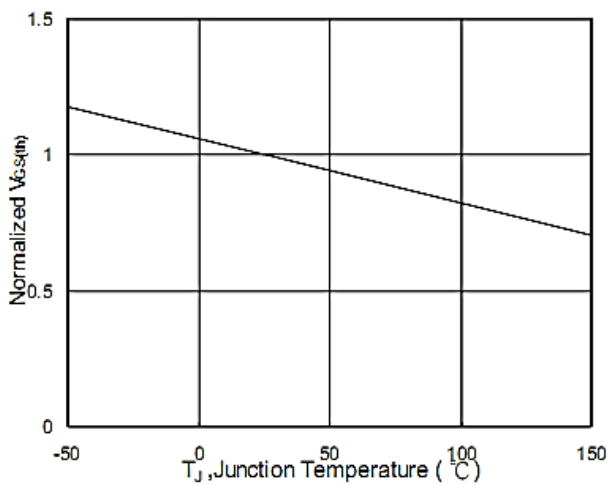


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

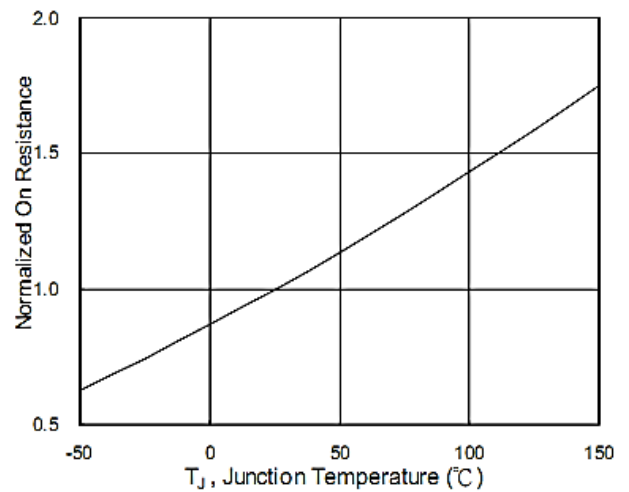


Fig.6 Normalized $R_{DS(on)}$ v.s T_J

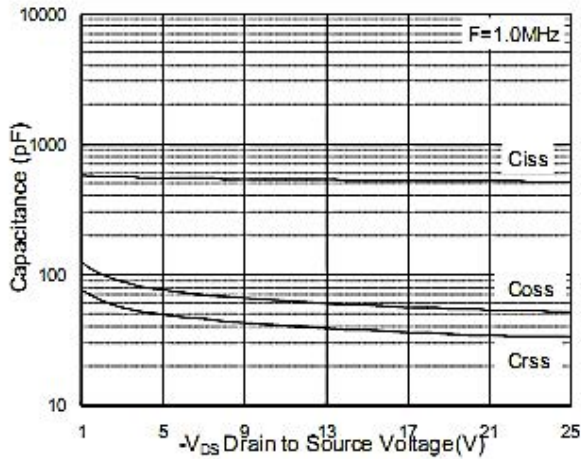


Fig.7 Capacitance

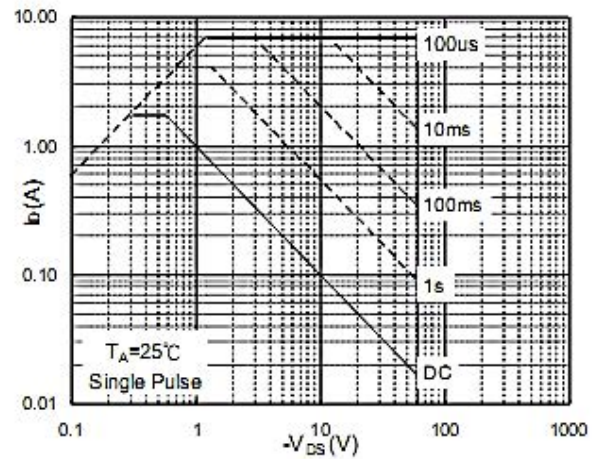


Fig.8 Safe Operating Area

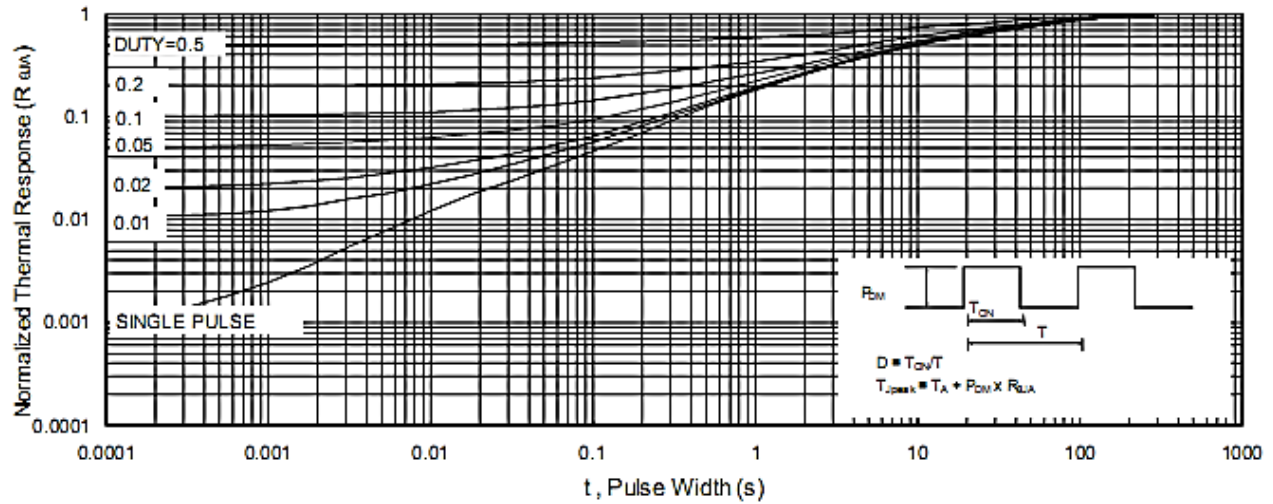


Fig.9 Normalized Maximum Transient Thermal Impedance

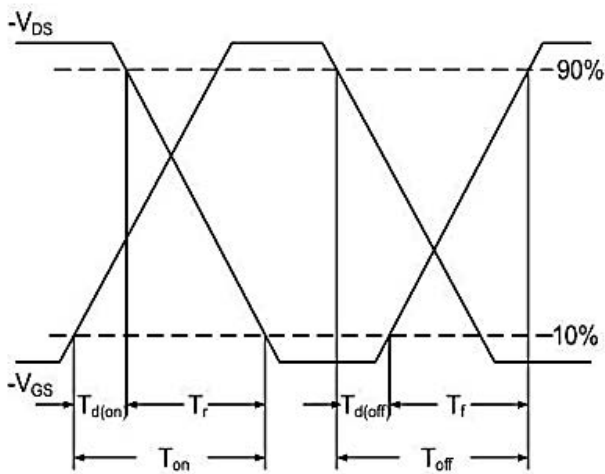


Fig.10 Switching Time Waveform

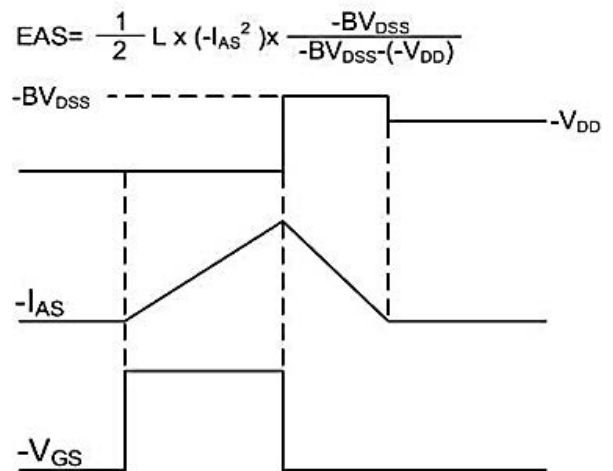
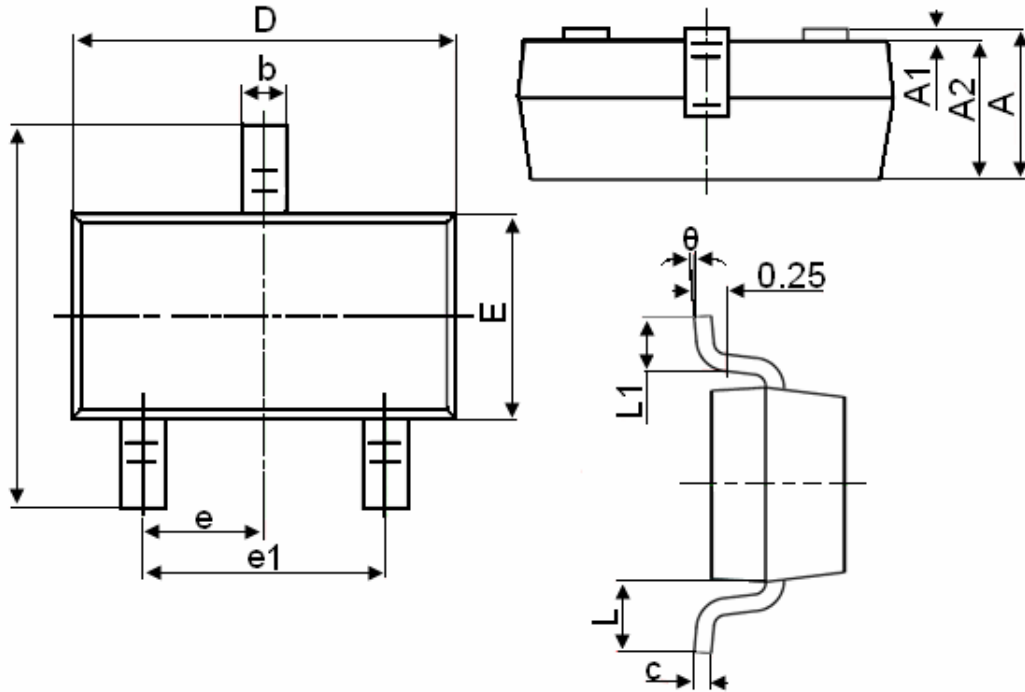


Fig.11 Unclamped Inductive Waveform

SOT-23 Package Information



Symbol	Dimensions in Millimeters	
	MIN.	MAX.
A	0.900	1.150
A1	0.000	0.100
A2	0.900	1.050
b	0.300	0.500
c	0.080	0.150
D	2.800	3.000
E	1.200	1.400
E1	2.250	2.550
e	0.950TYP	
e1	1.800	2.000
L	0.550REF	
L1	0.300	0.500
θ	0°	8°