24V 4A Sourcing Current and 8A Sinking Current Single-channel Driver

1. Characteristics

- 6-pin SOT-23 packaging;
- 4A peak sourcing current and 8A peak sinking current
- Wide-range VDD power supply as high as 24V
- VDD under-voltage protection, 4.5V to 20V recommended working voltage
- Dual-input design with both configuration of positive input and that of inverted input. The not used input pin can be used for enabling or disenabling control.
- Negative voltage input as low as -5V
- Compatible to TTL and CMOS input level
- Low propagation delay (with the typical value lower than 20ns)
- Output low level during input floating;
- Separated output, and connecting speed and disconnecting speed can be regulated separately
- Working temperature ranges of -40℃ to 125℃

2. Applications

- Switching power supply
- Motor control
- AC/DC and DC/DC converter
- Server and rectifier for communication equipment
- EV/HEV inverter and DC/DC convertor
- PV voltage rise and inverter
- UPS
- Applied to emerging broad-band gap power element driver

3. Description

As a single-channel high-speed low-side grid driver with the peak sourcing current of 4A and the peak sinking current of 8A, SL27511 can drive MOSFET, IGBT and emerging broad-band gap power devices efficiently and safely. With characteristics of low propagation delay and compact SOT-23, it can achieve the MOSFET switching frequency of hundreds of kHz. The chip is applicable to synchronous rectification driving of servers and communication power supply. In this condition, the dead time of the synchronous tube MOSFET leads to direct influence on efficiency of the converter.

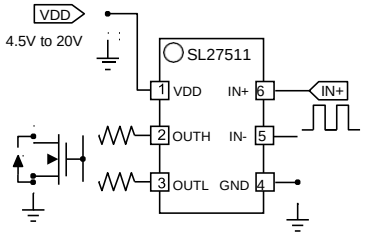
The 4.5V to 20V wide ranges VDD supply voltage can drive MOSFET or GaN power devices effectively. The integrated UVLO protective function can ensure the output low level in abnormal conditions.

The -5V to 24V independent input pin voltage ranges can ensure stable working in condition of over-shoot caused by stray inductance. The voltage threshold value of the input pin is compatible to the TTL level input.

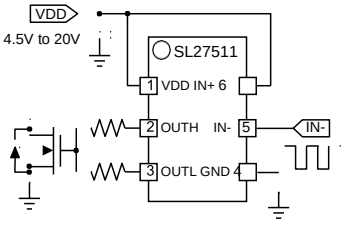
Information of the device

Information of the device	Package Information of the devising	Package
SL27511	SOT-23-6	Tape and Reel

Typical application drawing



Positive-going input

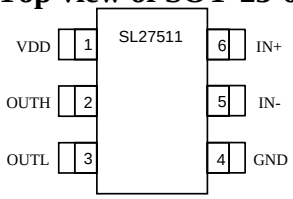


Inverted input

Contents

4. Configuration and functions of pins

Top view of SOT-23-6



Functions of pins

Pin	Name	I/O	Description
1	VDD	P	Supply voltage
2	OUTH	O	High output
3	OUTL	O	Low output
4	GND	G	Ground
5	IN-	I	Inverted input
6	IN+	I	Positive-going input

Truth-value table

The voltage of VDD is higher than the threshold voltage of UVLO

IN+	IN-	OUTH/L
Low or floating	Any level	Low
Any level	High or floating	Low
High	Low	High

5. Technical indexes

5.1 Absolute Max. rated value

Within the ranges of indoor temperature (unless otherwise specified) (1)

		MIN	MAX	Unit
V_{DD}	Supply voltage (relative to ground)	-0.3	24	V
OUTH	grid driving output voltage		V_{DD}+0.3	V
OUTL	grid driving output voltage	-0.3		V
IN+, IN-	signal input voltage	-5.0	24	V
T_J	Junction temperature	-40	150	°C
T_{STG}	storage temperature	-65	150	°C

(1) If the operation exceeds the ranges listed in the "absolute maximum rated value", it may lead to permanent damages to the device. Long-term exposure to the absolute maximum rated value conditions may lead to influences on reliability of the device.

5.2 Anti-static level

		Value	Unit
$V_{(ESD)}$	Human body model(HBM)， ANSI/ESDA/JEDEC JS-001(1)	+/-2000	V
	Charged device model (CDM)， JEDEC specification JESD22-C101(2)	+/-500	

(1) As specified in JEDEC document JEP155, the standard ESD control process is allowed for safe manufacturing for 500V HBM. As specified in JEDEC document JEP155, the standard ESD control process is allowed for safe manufacturing for 250V CDM.

5.3 Recommended working conditions

		MIN	MAX	Unit
V_{DD}	Supply voltage	4.5	20	V
$V_{IN+, IN-}$	signal input voltage	0	20	V
TA	environment temperature	-40	125	°C

5.4 Thermal resistance information

		Value	Unit
$R_{\theta JA}$	junction temperature – environment thermal resistance	165	°C/W
$R_{\theta JB}$	junction temperature – PCB thermal resistance	55	°C/W

5.5 Electrical specifications

Unless otherwise specified, V_{DD} = 12 V, T_A = –40°C to 125°C

In the environment of 25°C, in the designated pin, the positive-going current is input, and the inversed current is output.

Parameters	Testing conditions	MIN	Typical	MAX	Unit
Bias current					
I_{DDoff} Starting current	VDD=3V, IN=0V		62		μA
I_{DDq} Quiescent current	IN=0V		145		μA
Undervoltage protection					
V_{ON} under voltage locking threshold value V_{OFF}	Rise threshold value		3.8	4.2	V
	Drop threshold value	3.2	3.5		
input (IN+, IN-)					
V_{INH} input rise threshold value			2.0	2.4	V
V_{INL} input drop threshold value		0.8	1.2		V
V_{INHYS} input hysteresis			0.8		V
V_{INHYS} Negative voltage input		-5			V
output (OUTH, OUTL)					
I_{OH} Sourcing and sinking current peak value	C_{LOAD} =0.22uF, With external current limiting resistor, 1kHz switching frequency		4.0		A
I_{OL} Sourcing and sinking current peak	C_{LOAD} =0.22uF, With external current limiting resistor, 1kHz switching frequency		8.0		A
V_{OH} output high level	I_{OUTH} = -10mA		V_{DD}-0.055	V_{DD}-0.12	V
V_{OL} output low level	I_{OUTL} = 10mA		0.0035	0.007	V
R_{OH} output quiescent pull-up resistance			5.5	12	Ω
R_{OL} output pull-down resistance			0.35	0.7	Ω
Time series					
TD_{ff} rise delay TD_{rr} drop dela	Cload = 1.8nF		16 16	30 30	ns
T_f rise time T_r drop time	Cload = 1.8nF		6 4.5		ns

6. Typical Characteristics

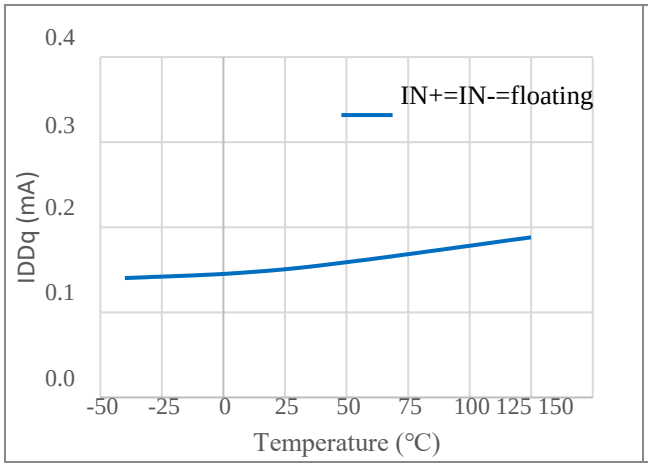


Figure 1. Quiescent current IDDq vs temperature

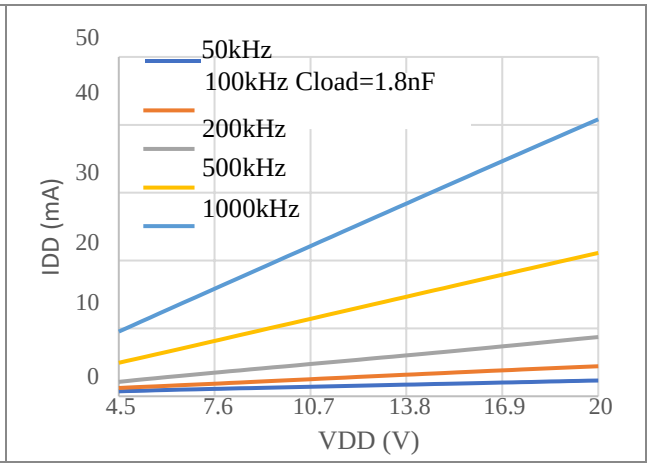


Figure 2. Working current IDD vs VDD

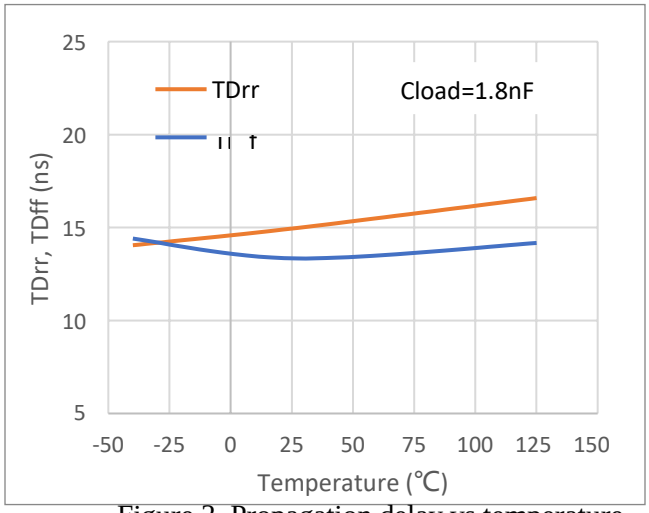


Figure 3. Propagation delay vs temperature

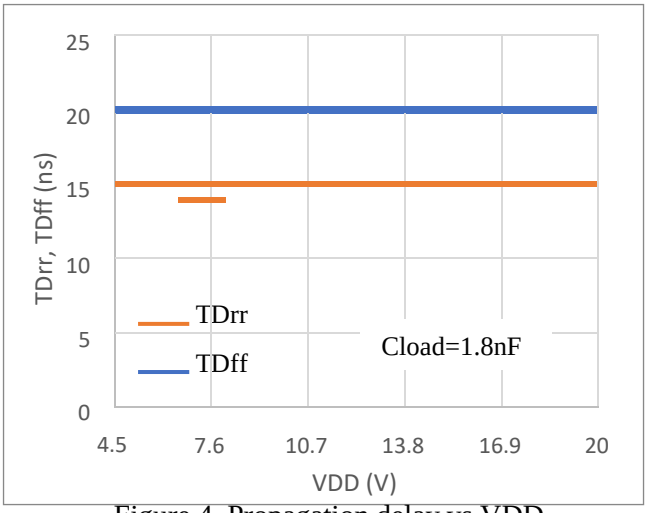


Figure 4. Propagation delay vs VDD

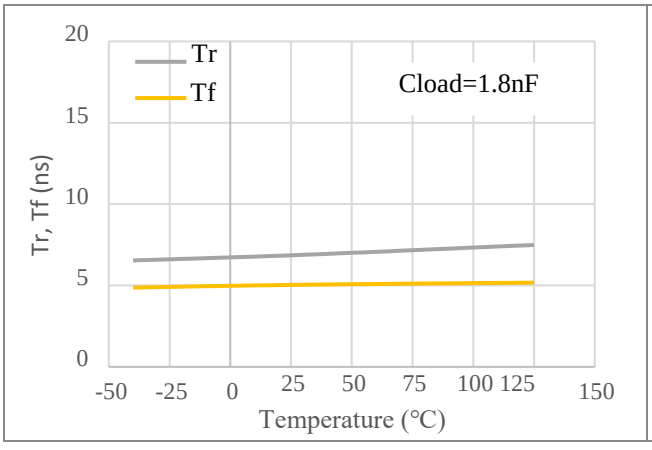


Figure 5. Rise time and drop time vs temperature

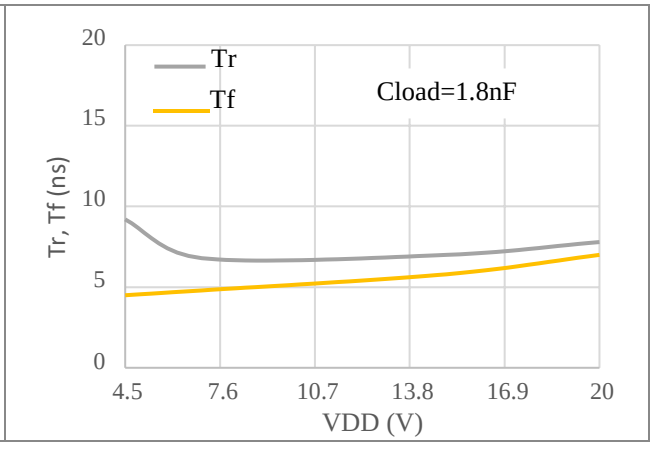


Figure 6. Rise time and drop time vs VDD

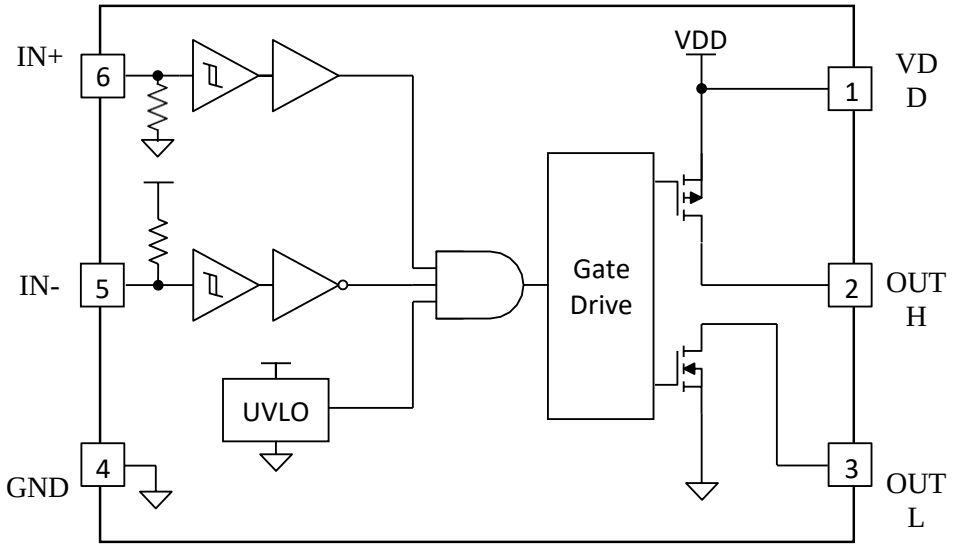
7. Detailed Description

SL27511 driver can provide single-channel high-speed low-side grid driving, and the separating output can be used to regulate the connecting speed and the disconnecting speed independently.

7.1 Signal Input

IN+ is the positive logic gird driving input, and IN- is the reverse logic grid driving input. The two pins are the weak pull-down input and the week pull-up input, respectively, If the input is kept floating, the output will be pulled to the ground. The input is the TTL and CMOS compatible logic level, with the maximum input tolerance of 20V.

Functional block diagram



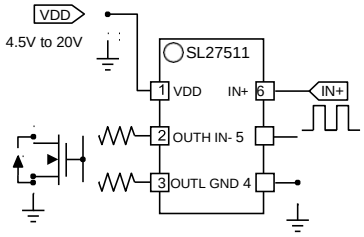
7.2 OUTH and OUTL

OUTH and OUTL are separating output, in which OUTH is composed by a composite pair of pull-up P-model MOSFET and N-model MOSFET, and OUTL is composed by a pull-down N-model MOSFET. The output of SL27511 can provide the 4A peak value sourcing current and 8A peak value sinking current pulse. The output voltage swings from rail to rail between VDD and GND. The diode of MOSFET will also provide voltage clamping access to restrain the output voltage to exceed or lower than the ranges. In many conditions, the external Schottky diode clamping is not necessary.

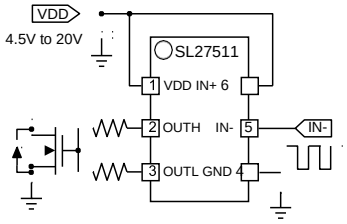
7.3 VDD and undervoltage protection

The maximum rated input voltage of SL27511 is 24V. SL27511 can meet the grid driving requirements of Si MOSFET、IGBT, and SiC MOSFET. SL27511 can meet the grid driving requirements of Si MOSFET、IGBT, and SiC MOSFET. SL27511 can meet the grid driving requirements of Si MOSFET, IGBT, and SiC MOSFET.

8. Application and realization

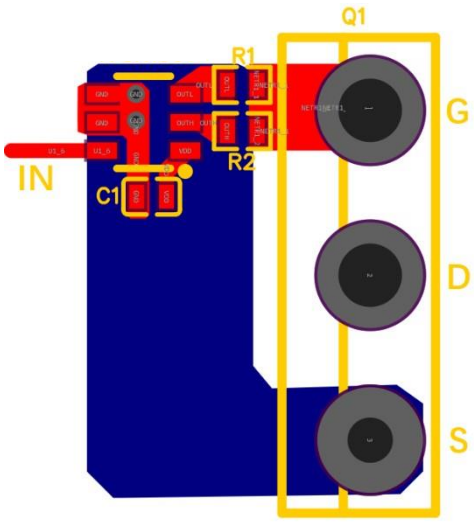


Positive-going input



Reverse input

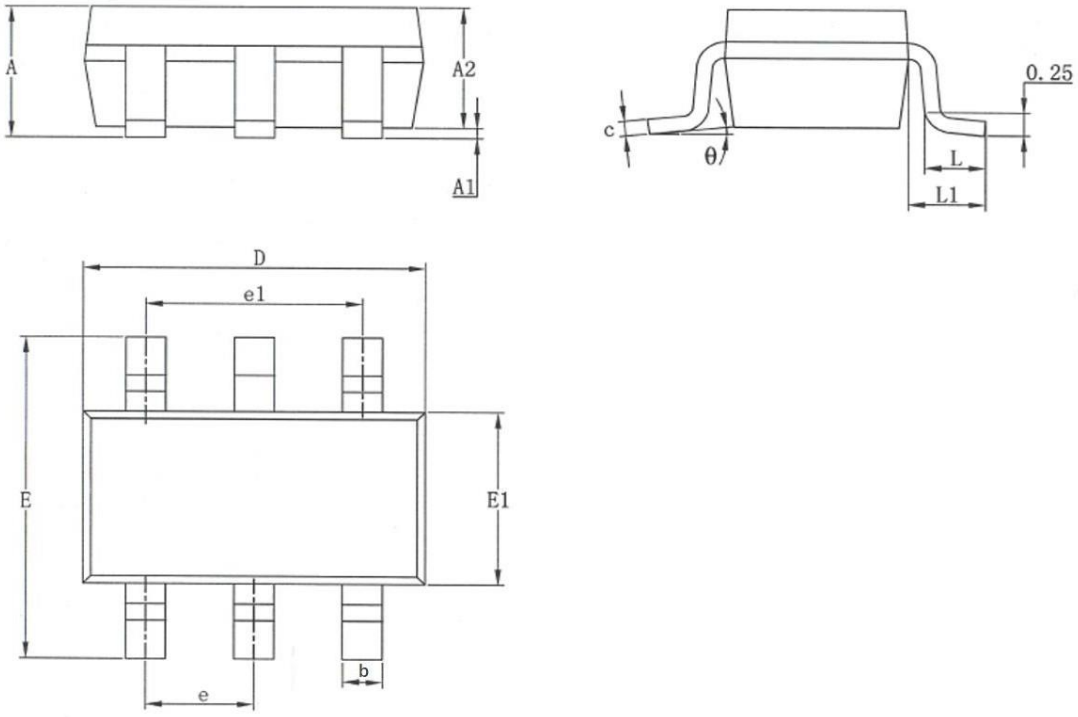
9. PCB arrangement



Arrangement example

10. Packaging information

SOT-23-6 Package Dimensions



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.450	0.035	0.057
A1	0.000	0.150	0.000	0.006
A2	1.100		0.043	
b	0.300	0.500	0.012	0.020
c	0.080	0.220	0.003	0.009
D	2.750	3.050	0.108	0.120
E1	1.450	1.750	0.057	0.069
E	2.600	3.000	0.102	0.118
e	0.950		0.037	
e1	1.900		0.075	
L	0.300	0.600	0.012	0.024
L1	0.600		0.024	
θ	0.000	8.000	0.000	0.315