LP5311

30V Over-Voltage Protection Switch

Features

- Input voltage tolerance up to 30V
- Low on-state resistance to 30mΩ
- 90μA low current consumption
- Under-voltage lockout: 2.6V
- Over-voltage protection: 6V
- Output discharge integrated
- Thermal shutdown protection
- ESD Protection:
  - Human Body Model: 4kV
  - Charged Device Model: 0.5kV
- Package: SOT23-6

Applications

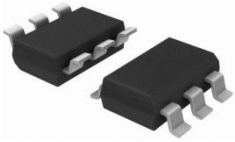
- Notebook and PC
- Cell phone and PDAs
- USB or other peripheral ports
- Camera

General Description

The LP5311 is a power switch device provides full protection to systems and loads which may encounter input over-voltage conditions.

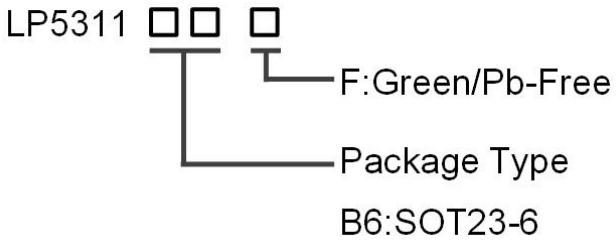
The device contains a 30mΩ MOSFET which can operate over an input voltage range from 3.0V to 30V. The OVP will disconnect VIN and VOUT when the voltage on VIN is higher than over voltage threshold. Switch is controlled by an active-low logic pin. Thermal shutdown protection is integrated which shuts off the switch to prevent damage to the part when the temperature is higher than threshold.

LP5311 is available in space-saving SOT23-6 packag



SOT23-6

Marking Information



Ordering and Package Information

Part Number	Top Mark	Package	Tape & Reel
LP5311B6F	LPS 8JYWX	SOT23-6	3K/REEL
Marking indication: Y: Production Year, W: Production week, X: Series Number			

Typical Application Circuitry

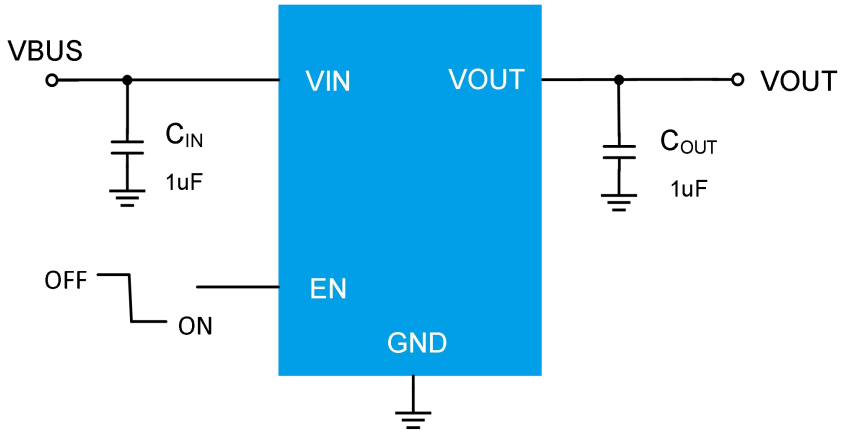
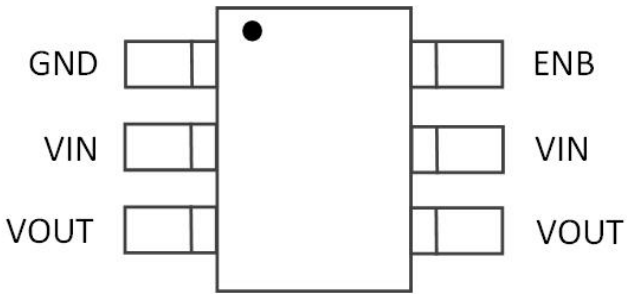


Figure 1. Typical Application Circuitry

Pin Configuration



SOT23-6 (Top View)

Pin Description

Pin No.	Pin Name	Description
1	GND	Ground
2,5	VIN	Power supply and input of power switch
3,4	VOUT	Output of power switch
6	ENB	Active-low device enable pin

Functional Block Diagram

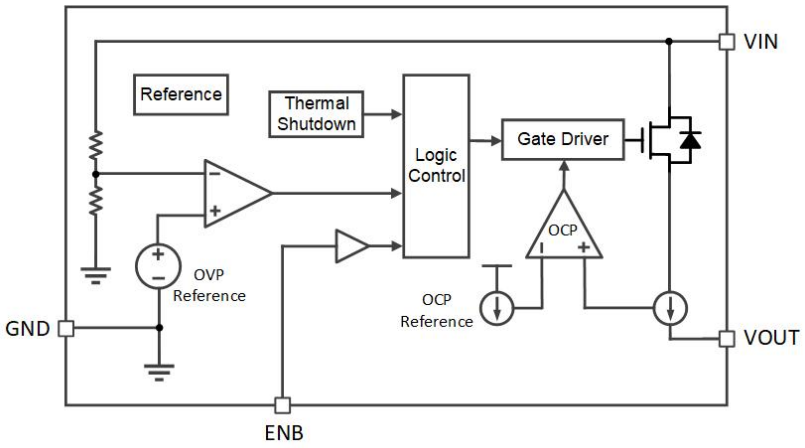


Figure 2. Internal Block Diagram (LP5311)

Absolute Maximum Ratings (Note 1)

- VIN to GND ---------- -0.3V to 30V
- VOUT to GND ---------- -0.3V to 7V
- ENB to GND ---------- -0.3V to 7V
- Maximum Junction Temperature (TA) ---------- 150°C
- Maximum Soldering Temperature (at leads, 10 seconds) ---------- 260°C

Note 1: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, instead of functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Thermal Information

- Maximum Power Dissipation (SOT23-6, PD, TA <= 25℃) ---------- 0.6W
- Thermal Resistance (SOT23-6, θJA) (Note 2)---------- 203°C/W

Note 2: It is based on 2S2P JEDEC standard PCB.

ESD Ratings

- HBM (Human Body Model, JEDEC JS-001) ---------- ±4000V
- CDM (Charged Device Model, JEDEC JS-002) ---------- ±500V

Recommended Operating Conditions

- Input Voltage ---------- 3.0V to 5.5V
- Enable Voltage ---------- 0V to 6V
- Output current ---------- 0A to 5A
- Ambient Temperature ---------- -40°C to 85°C

Electrical Characteristics

The following parameters are guaranteed under condition V_{IN} =5V, T_A = -40°C to 85°C unless otherwise noted, T_A = 25°C for typical value.

Parameters	Symbol	Test conditions	Min	Typ	Max	Unit
On-resistance	$R_{DS(ON)}$	V_{IN} = 5V, I_{OUT}=500mA, T_A=25°C		30		mΩ
Input quiescent current	I_Q	V_{IN} = 5V, OUT floating, V_{ENB} = 0V		90	150	μA
Input shutdown current	I_{SD}	V_{IN} = 5V, OUT grounded, V_{ENB} = 5V		1	3	μA
Under-Voltage Lockout level	V_{UVLO_F}	VIN voltage falling		2.6		V
	V_{UVLO_R}	VIN voltage rising		2.8		V
Over-Voltage Protection level	V_{OVP_F}	VIN voltage falling		5.9		V
	V_{OVP_R}	VIN voltage rising	5.8	6.0	6.2	V
Soft-Start limit current	I_{SS}	V_{IN} = 5V, T_A=25°		3		A
Short circuit protection level	I_{SHORT}	V_{IN} = 5V, T_A=25°C		18		A
Output auto discharge	R_{DIS}	V_{IN} = 5V, V_{ENB} = 0V		3		kΩ
Enable logic high voltage level	V_{IH}	V_{IN} = 3V to 5.5V	1.4			V
Enable logic high voltage level	V_{IL}	V_{IN} = 3V to 5.5V			0.4	V
Load switch turned on delay	t_{DON}	V_{IN} = 5V, R_{OUT} = 100Ω, C_{OUT} = 22μF, time from enabled to V_{OUT} = 0.5		10		ms
Output rising time	t_R	V_{IN} = 5V, R_{OUT} = 100Ω, C_{OUT} = 22μF, time from V_{OUT} = 0.1×V_{IN} to 0.9×V_{IN}		450		μs
Over-Voltage Protection response time	t_{OVP}	V_{IN} rising from 5V with 30V/μs, R_{OUT} = 100Ω, C_{OUT} = 0, time from V_{IN} > V_{OVP_R} to OUT voltage stop rising		100		ns
Load switch turned off delay	t_{OFF}	V_{IN} = 5V, R_{OUT} = 500Ω, C_{OUT} = 0.1μF, time from disabled to V_{OUT} = 0.9×V_{IN}		10		μs
Thermal shutdown trigger	T_{SD}	Temperature rising		150		°C
Thermal shutdown release	T_{SD_REL}	Temperature falling		130		°C

Typical Timing Diagram

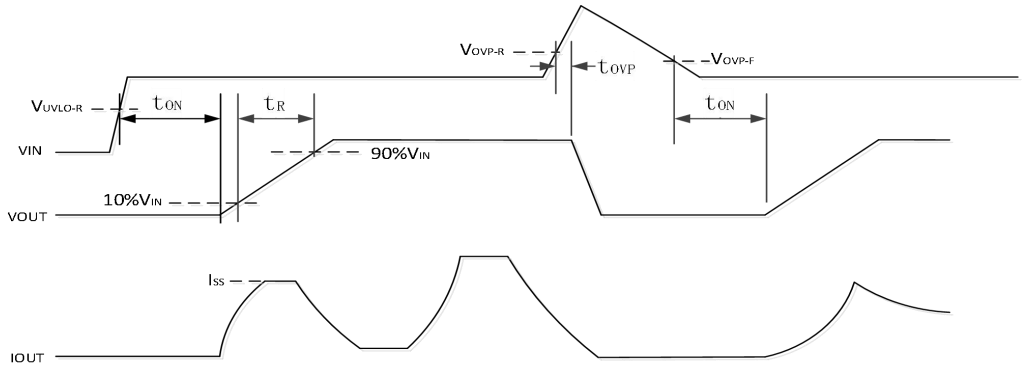


Figure 3. Start-up and over voltage protection

Typical Performance Characteristics

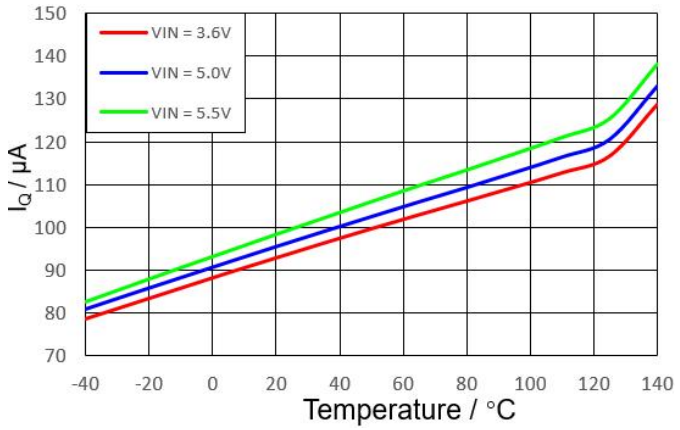


Figure 4. Quiescent Current vs Temperature and V_{IN} (C_{IN}=C_{OUT}=1µF, V_{ENB} = 0V, no load)

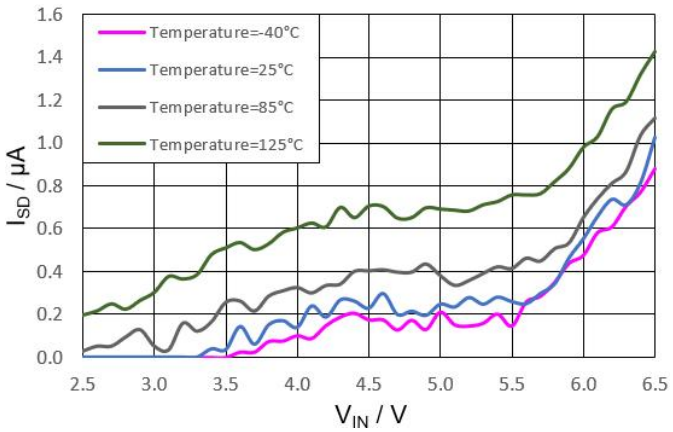


Figure 5. Shutdown Current vs V_{IN} and Temperature (C_{IN}=C_{OUT}=1µF, V_{ENB} = 5V, no load)

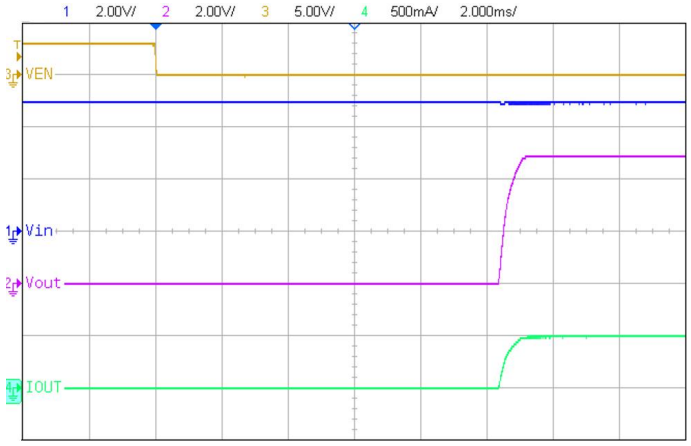


Figure 6. Start-up with enabled by ENB (V_{IN} = 5V, C_{IN} = C_{OUT} = 1µF, R_{LOAD} = 10Ω)

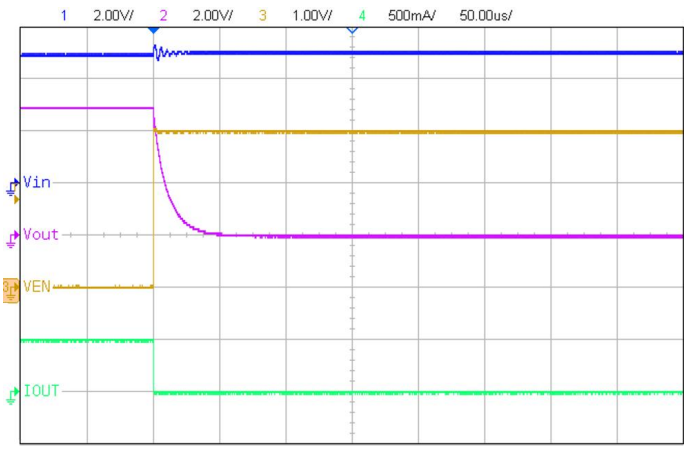


Figure 7. Disabled by ENB (V_{IN} = 5V, C_{IN} = C_{OUT} = 1µF, R_{LOAD} = 10Ω)

Function Description

General Description

LP5311 is an OVP power switch integrated multiple protection to protect systems and loads which can be damaged or disrupted by the application of high currents or high temperature.The devices all contain a 30m Ω N-channel MOSFET and a controller capable of working over a wide input operating range of 3V to 30V. The controller protects against system malfunctions through output short protection, under-voltage lockout and thermal shutdown.

Enable Control

The ENB pin controls the state of the switch. When ENB is pulled low or floating more than 10ms de-bounce time, the load switch is turned on. Activating ENB continuously holds the switch in the on state so long as there is no fault. An under-voltage, over-voltage condition on VIN or a junction temperature in excess of 150°C overrides the ENB control to turn off the switch. The LP5311 does not turn off in response to an long as ENB is active and the thermal shutdown or VIN voltage not in proper range.

The enable pin ENB control voltage and VIN pin have independent recommended operating ranges. The ENB pin voltage can be driven by a voltage level higher than the input voltage. There is internal pull-down resistor on ENB pin. Leave the pin floating will active the device as well.

Over-Voltage Protection

The LP5311 has Over-Voltage protection to prevent high voltage on VIN passing through to VOUT. Once the voltage on input exceeds the OVP threshold, the power FET will be turned off immediately. When VIN drop back below OVP release level, the switch will be turned on again after a 10ms de-bounce time.

Start-Up

The LP5311 has a current limit function during start-up, If after the soft-start time are complete and the current limit is exceeded, the device initiates a over-current check (100uS), During this check. the current is clamped to Iss, If the timer expires and the current remains clamped by the current limit, the internal power power FET is turned off, Once the switch is turned off. unless by disabled through ENB pin, it will not conduct again until 1.3s later. The hiccup behavior will continue as long as the heavy loading condition exist, until the overload condition is removed.

Additionally, if the current is not limited after the completion of the soft-start sequence, the device enters normal operation.

Under-Voltage Lockout

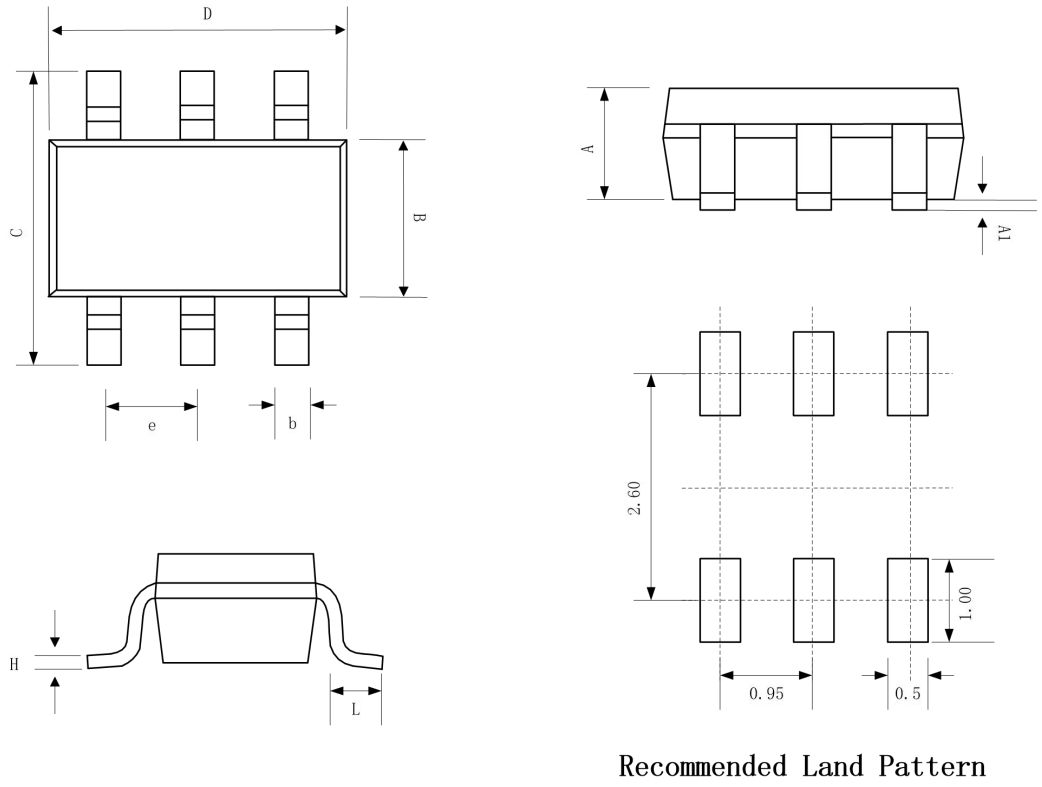
The under-voltage lockout turns-off the switch if the input voltage drops below the under-voltage lockout threshold. With the ENB pin active, the input voltage rising above the under-voltage lockout threshold more than 10ms will cause a controlled turn-on of the switch which limits current over-shoots.

Thermal Shutdown

The thermal shutdown protects the device from internally or externally generated excessive temperatures. During an over temperature condition, the switch is turned off. The switch automatically turns on again if the temperature drops below the threshold temperature more than 1.3s.

Package Information

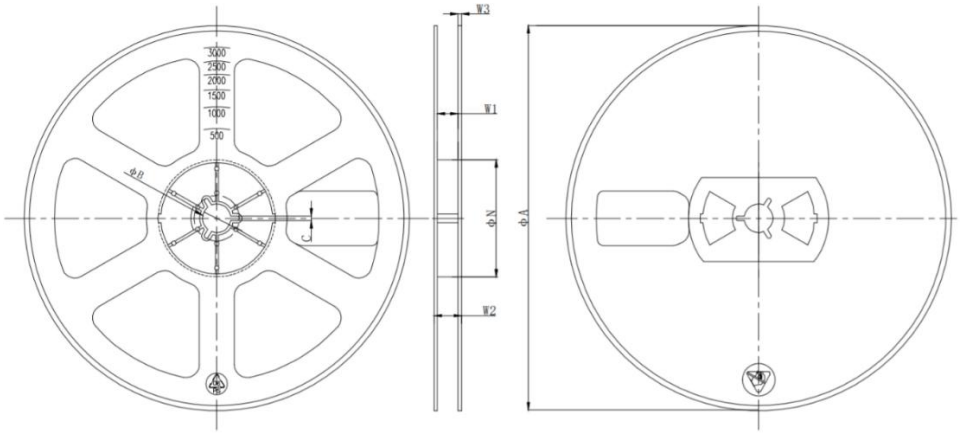
SOT23-6



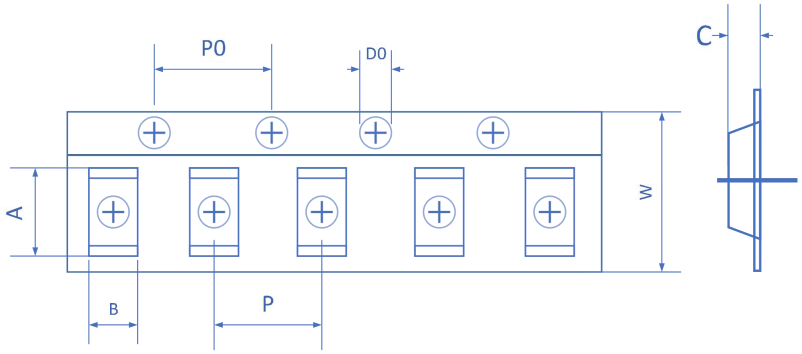
Recommended Land Pattern

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.889	1.100	1.295
A1	0.000	0.050	0.152
B	1.397	1.600	1.803
b	0.28	0.35	0.559
C	2.591	2.800	3.000
D	2.692	2.920	3.120
e		0.95BSC	
H	0.080	0.152	0.254
L	0.300	0.450	0.610

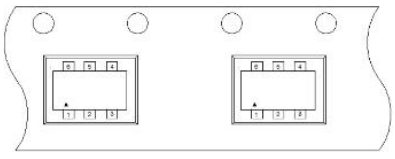
Tape and Reel Information



Device	Package Type	Pins	SPQ	ϕA (mm)	ϕN (mm)	ϕB (mm)	C (mm)	W1 (mm)	W2 (mm)	W3 (mm)
LP5311B6F	SOT23-6	6	3000	178	54	13.2	2.2	9.5	≤13	1.4



Device	Package Type	A (mm)	B (mm)	P0 (mm)	P (mm)	D0 (mm)	W (mm)	C (mm)
LP5311B6F	SOT23-6	3.2±0.2	3.26±0.2	4.0±0.1	4.0±0.1	1.5±0.15	8.0±0.3	1.40±0.2



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