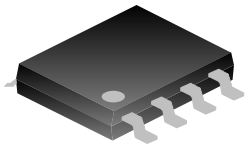
150V CURRENT MODE PWM CONTROLLER

DESCRIPTION

SD4938 is a current mode PWM controller with 150V MOSFET used for SMPS.

SD4938 integrates high-voltage start-up circuit. It enters burst mode at light load to reduce the system standby power dissipation; the frequency reduction function optimizes the conversion efficiency at light load; the soft startup function reduces the stress of device to avoid transformer saturation.

SD4938 features various protections, including VDD undervoltage protection, VDD overvoltage protection, lead edge blanking, over current protection, over temperature protection, etc. Meanwhile, if any protection occurs, the circuit will continue to restart automatically until the system recovers.



SOP-8-225-1.27

FEATURES

- Input voltage: 20V~150V
- Adjustable output voltage including: 12V, 15V and 18V
- Output current: 0.5A
- High-voltage self-startup
- Burst mode at light load
- Frequency reduction
- Soft startup
- VDD undervoltage protection
- VDD overvoltage protection
- Leading edge blanking
- Output overload protection
- Over current protection
- Over temperature protection

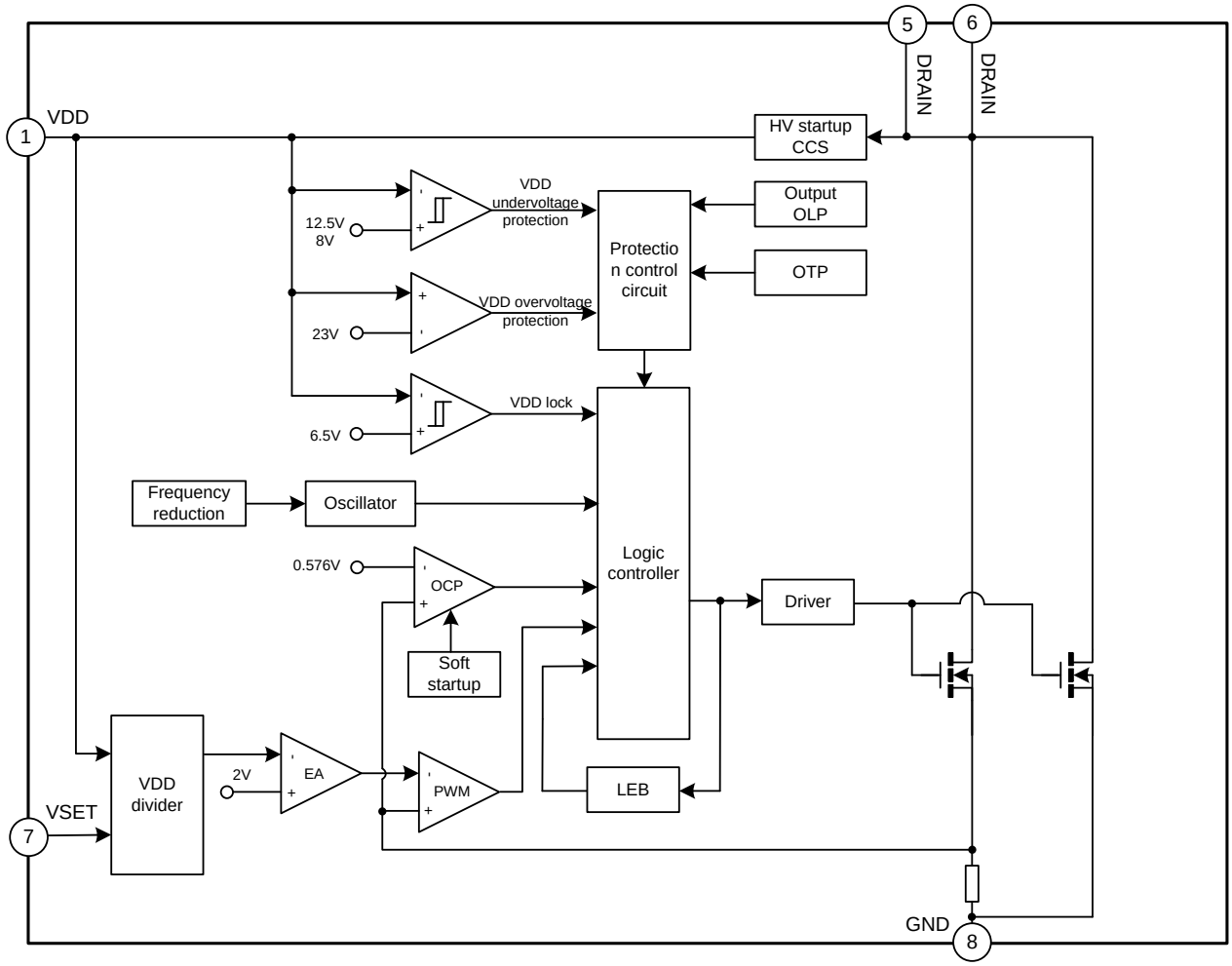
APPLICATIONS

- Balance wheel
- PoE
- E-bike
- Electric tool

ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SD4938	SOP-8-225-1.27	SD4938	Halogen free	Tube
SD4938TR	SOP-8-225-1.27	SD4938	Halogen free	Tape&reel

BLOCK DIAGRAM



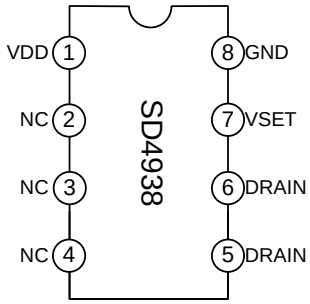
ABSOLUTE MAXIMUM RATING

Characteristics	Symbol	Ratings	Unit
HV Input (DRAIN to SOURCE)	$V_{HV,MAX}$	155	V
Power Supply (VDD to SOURCE)	$V_{DD,MAX}$	30	V
Power Dissipation	P_D	0.8	W
Thermal Resistance, Junction-to-Ambient	θ_{ja}	140	°C/W
Thermal Resistance, Junction-to-Case	θ_{jc}	28	°C/W
Operating junction temperature	T_J	150	°C
Operating temperature range	T_{amb}	-40~+125	°C
Storage temperature range	T_{STG}	-55~+150	°C

ELECTRICAL CHARACTERISTICS(UNLESS OTHERWISE SPECIFIED, V_{DD}=12V, T_{amb}=25°C)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
HV Startup						
Charging Current	I_{HVC}	V_{DD}=0V, V_{DRAIN}=150V	--	1.5	--	mA
Shutdown Drain Current	I_{HVS}	V_{DD}=18V, V_{DRAIN}=150V	--	3	--	uA
Operating Voltage						
Operating Voltage Range	VDD	After startup	10	--	21	V
Current in Protection State	IDD0		--	0.3	--	mA
Operating Current	IDD1		--	0.9	--	mA
Current Below VDD Off Voltage	IDD_{OFF}		--	0.15	--	mA
VDD On Voltage	VDD_{ON}		12.1	13	13.9	V
VDD Off Voltage	VDD_{OFF}		7.9	8.7	9.5	V
VDD Restart Threshold	$VDD_{RESTART}$		6	6.5	7	V
Overvoltage Protection Threshold	VDD_{OVP}		21.5	23	24.5	V
VDD Clamp Voltage	VDD_{CLAMP}		28	31	35	V
Operating Frequency						
Normal Switching Frequency	f_{SW1}		54	60	66	KHz
Frequency Jitter Range	FD			±5		%
Max. Duty Ratio	D_{MAX}		74	80	86	%
Minimum Switching Frequency	f_{SW2}		--	20	--	KHz
Overload Protection						
Overload Protection Delay	T_{d_olp}		--	68	--	mS
Peak Current Limit						
Peak Limiting Threshold	I_{PKLIM}		1.4	1.6	1.8	A
Current Sensing Turn-off Delay	t_d	ID = 0.2A	--	200	--	ns
LEB Time	t_{LEB}		--	300	--	ns
Min. Turn-on Time	t_{ONMIN}		--	500	--	ns
Soft Startup Time	t_{SS}		--	8.5	--	ms
MOSFET						
On Resistance	R_{dson}		--	1.3	--	Ω
Over Temperature Protection						
Over Temperature Detection	T_{SD}		--	180	--	°C
Over Temperature Hysteresis	T_{HYS}		--	20	--	°C

PIN CONFIGURATION



PIN DESCRIPTION

Pin No.	Pin Name	I/O	Function description
1	VDD	I/O	Power supply for control circuit
2,3,4	NC	NC	No connection
5,6	DRAIN	O	Drain of power MOSFET
7	VSET	I	SET different output voltage. If floating, output 12V. If short to GND, output 15V. If connect a 51K resistor to GND, output 18V
8	GND	G	Source of power MOSFET and reference ground of control circuit

FUNCTION DESCRIPTION

SD4938 is a current mode PWM controller with built-in high voltage MOSFET used for SMPS. It enters burst mode at light load to reduce the system standby power dissipation. S D4938 features frequency reduction and soft startup function, various protections, including VDD undervoltage protection, VDD overvoltage protection, lead edge blanking, output overload protection, over current protection, over temperature protection, etc.

High-voltage startup and under-voltage protection

SD4938 features a high-voltage startup circuit. When the IC is powered, AC input voltage activates the built-in constant current source from pin DRAIN, and charges the VDD capacitor with charging current of 1.5mA. When the VDD voltage reaches12.5V, the high-voltage start-up constant current source is off and VDD is no longer charged but is powered by inductor voltage through diode; if VDD voltage drops below 8V, the MOSFET is turned off, VDD drops to 6.5V and high-voltage start-up constant current source is on again. Then VDD is charged through pin DRAIN and it reaches to 12.5V.

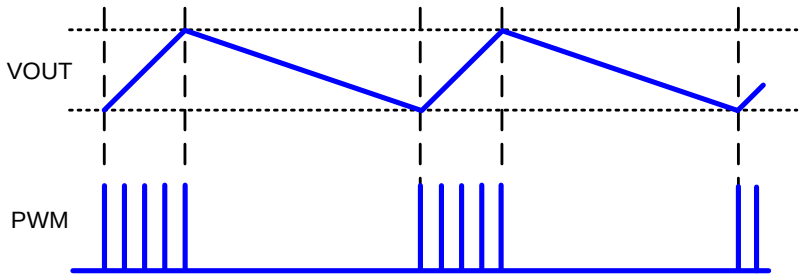
Constant voltage control

SD4938 detects the change of output voltage by VDD pin and internal error amplifier, when Vout drops, the output of error amplifier is raised to increase the width of PWM，finally makes Vout rise to balance itself. Vout is approximately equal to VDD voltage. The VSET pin is used to set different output voltage. If it is floating, Vout is equal to12V. If it is short to GND, Vout is equal to 15V .If it is connected a 51K resistor to GND, Vout is equal to 18V.

Burst mode at light load

When VDD rises to a value that is more than the reference voltage at light load, the MOSFET will be turned off that

makes the VDD drops, and the MOSFET will be turned on when VDD drops to a value. If the above process occurs constantly, SD4938 enters burst mode that can decrease the number of switches and reduce the system standby power dissipation effectively.



Waveforms at burst mode

Soft startup

SD4938 enables the maximum peak current of DRAIN to increase restrictedly step by step within8.5ms soft startup time, hence, it can reduce the stress of devices and prevent the transformer from turning into saturation.

VDD overvoltage protection

SD4938 turns off the MOSFET once the VDD voltage reaches OVP voltage (23V), and is locked out till the VDD voltage decreases to VDD restart voltage (6.5V), and then the circuit restarts.

Leading edge blanking

As soon as internal MOSFET is turned on, a high current spike will appear due to the parasitic capacitor at DRAIN. If this spike is sensed, the over current protection will be activated. To avoid this false trigger, SD4938 senses the current of DRAIN pin after the LEB time of 300ns since MOSFET is turned on.

Output Over-load Protection

When VDD is much less than the setting voltage and output of EA is high, the over-load protection is activated. VDD decreases and IC restarts when VDD drops to 6.5V.

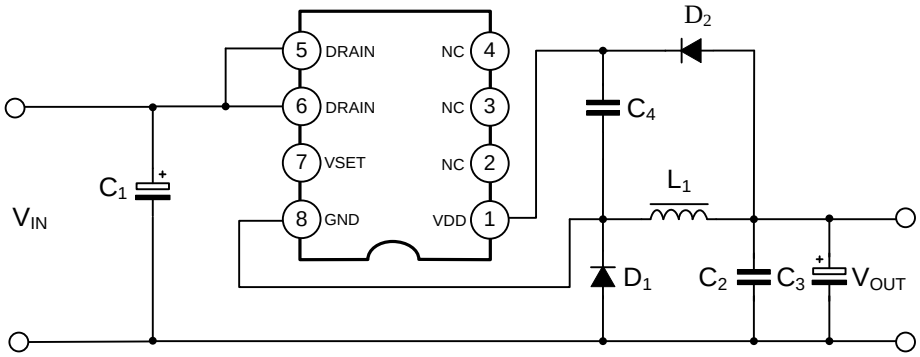
Cycle by cycle over current protection

SD4938 senses the current of MOSFET cycle by cycle, if the current of MOSFET is higher than 1.6A, the cycle by cycle over current protection will be activated.

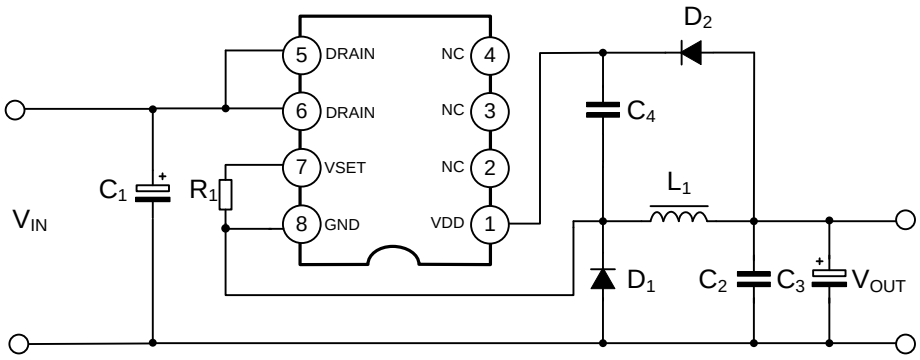
Over temperature protection

SD4938 turns off the switch once the temperature reaches to OTP threshold 180°C, and turns on the switch if the temperature decreases by 20°C.

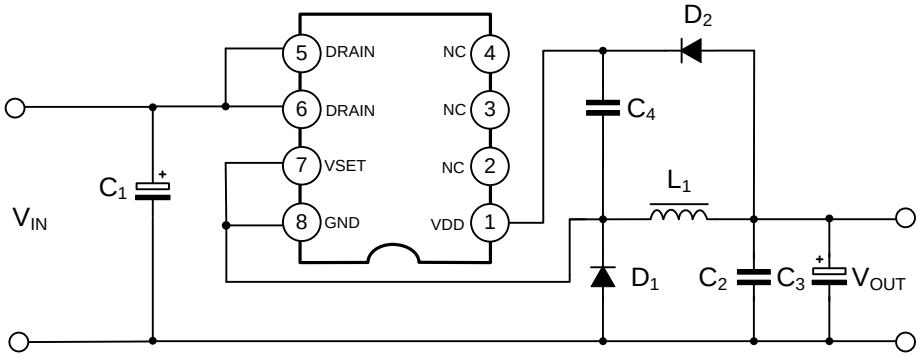
TYPICAL APPLICATION CIRCUIT



12V/0.3A output



18V/0.3A output

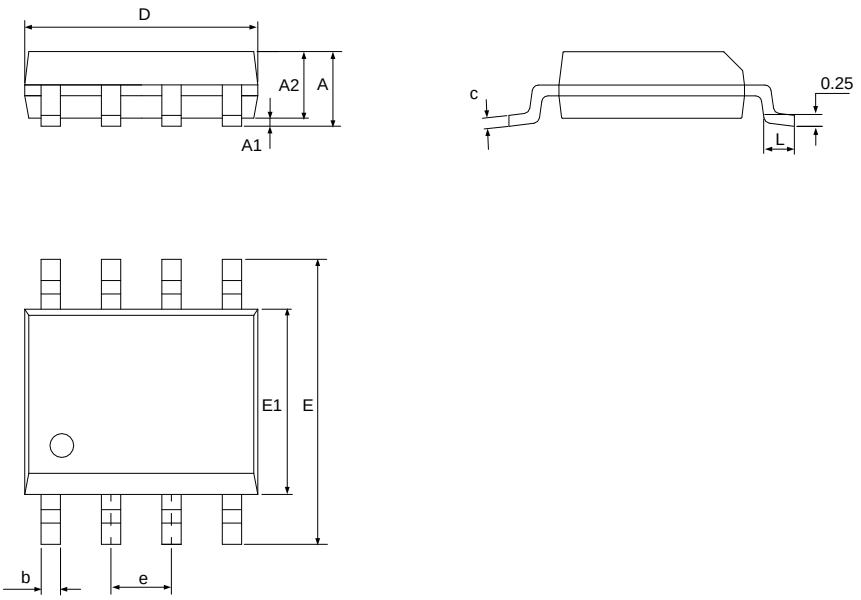


15V/0.3A output

Note: The circuit and parameters are for reference only, please set the parameters of application circuits based on real tests.

PACKAGE OUTLINE

SOP-8-225-1.27 **Unit: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.05	0.15	0.25
A2	1.25	—	1.65
b	0.32	0.42	0.52
c	0.15	0.2	0.26
D	4.70	4.90	5.30
E	5.60	6.00	6.40
E1	3.60	3.90	4.20
e	1.27BSC		
L	0.30	—	1.27

MOS DEVICES OPERATE NOTES:

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

- The operator must put on wrist strap which should be earthed to against electrostatic.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed in antistatic/conductive containers for transportation.

Important notice :

- **The instructions are subject to change without notice！ Customers should obtain the latest relevant information before placing orders and should verify that such information is complete and current.**
- **Our products are consumer electronic products, and / or civil electronic products.**
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Rev.: 1.0

Revision History:

1. First release