High-Voltage Low-Power Synchronous BOOST Controller

HM5183

Features

- High Efficiency >90%
- Synchronous N-type MOSFET Rectifier
- Wide Input Voltage Range:3V~20V
- 1.5% Output Voltage Accuracy
- High Side Current Sampling
- Integrated Soft Start
- 750KHz Switch Frequency
- Shut Down Current <8μA
- PWM Peak Current Mode Control
- Empty Load automatically turn into Burst Mode
- Logic Control Enable Pin
- Cycle-by-cycle Current Limit
- Temperature range: -40℃~125℃
- MSOP10 Package

Applications

- Mobile Phone
- Industrial Power Supply
- Communications Hardware

Description

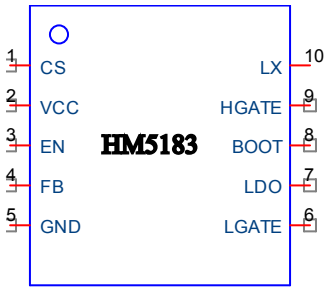
HM5183 is a constant frequency PWM current-mode control, high efficiency synchronous boost controller with N-type power MOSFET driver. Synchronous rectification can im prove efficiency, reduce power consumption and reduce cooling requirements, so HM5183 can be applied in high-power environments.

Input voltage 3V to 20V supports a wide range of the power supply system and battery applications. Automatically switch the operation mode in accordance with the change of the load.

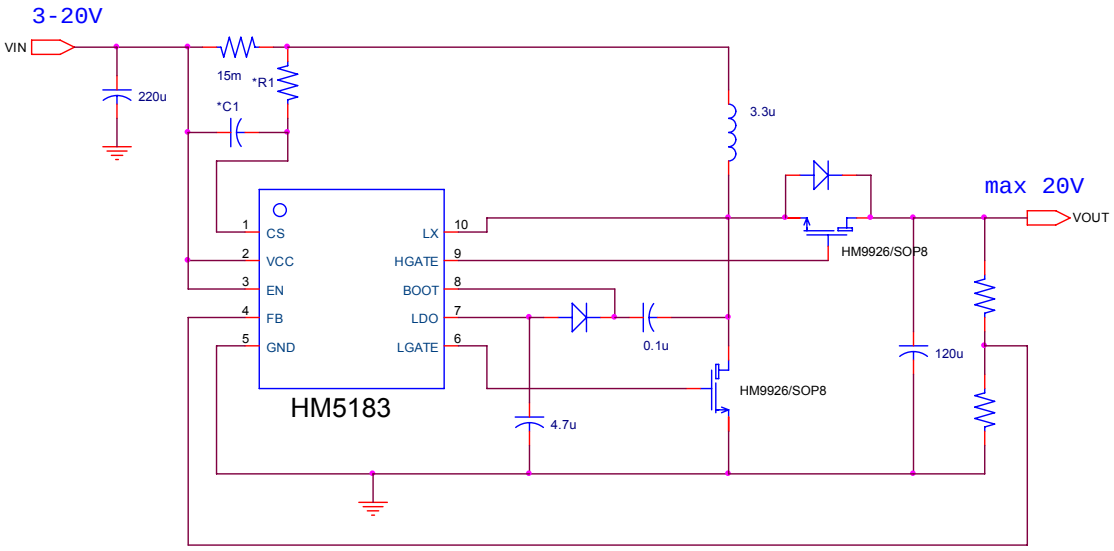
The HM5183 integrates peak current limit and o utput over voltage protection. The chip current falls below 8μA when EN logic control is low.

Connection Diagrams

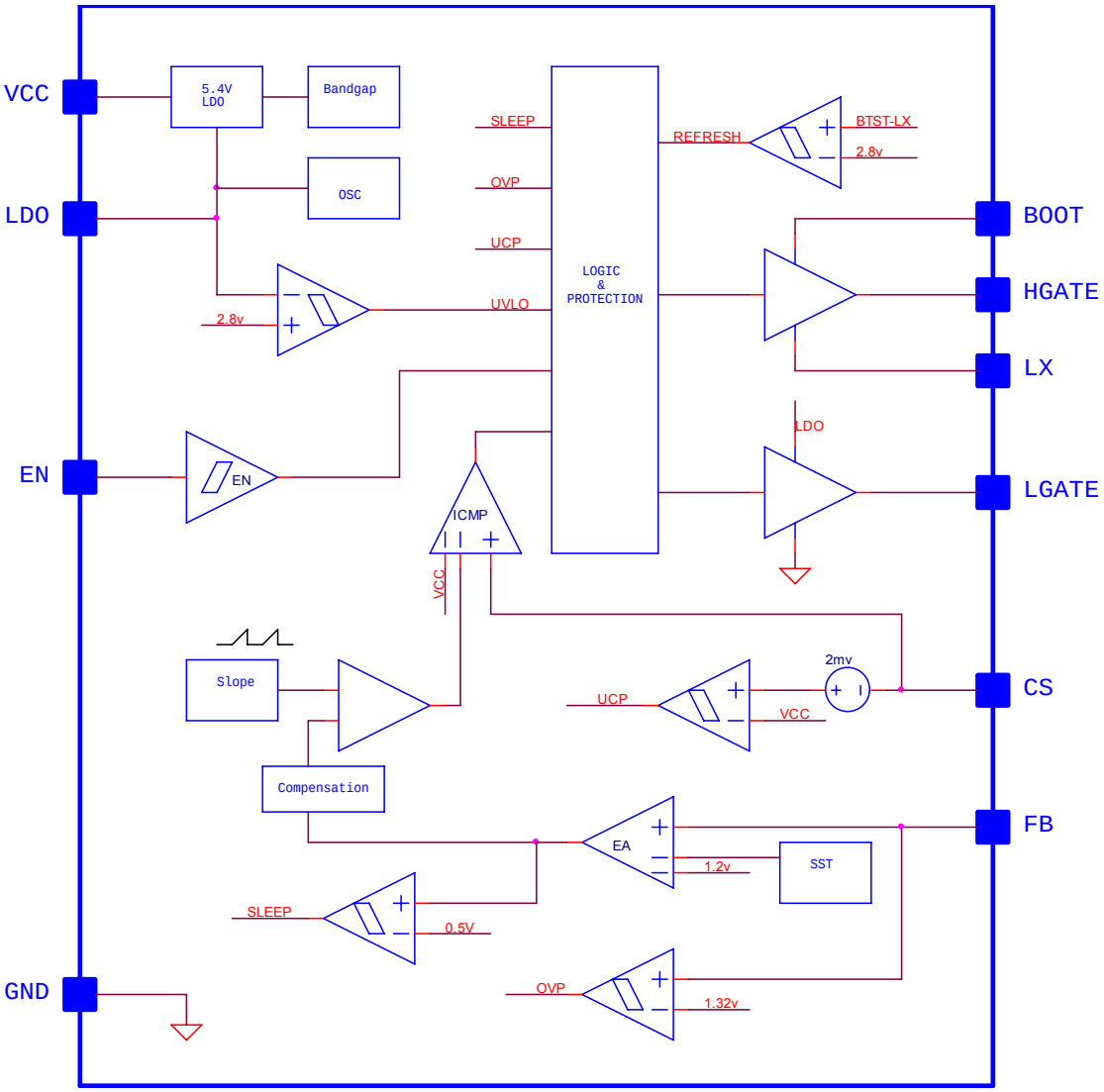
HM5183 MSOP-10 Package



Pin	Name	I/O	Description
1	CS	I	High side input current sense resistor negative input
2	VCC	-	Power input& High side input current sense resistor positive input
3	EN	I	Enable input
4	FB	I	Output voltage feedback input
5	GND	-	Analog ground
6	LGATE	O	Low side synchronous power MOSFET driver output
7	LDO	O	5.4V linear regulator output
8	BOOT	-	High side power MOSFET driver power supply positive input
9	HGATE	O	High side power MOSFET driver output
10	LX	-	High side power MOSFET driver power supply negative input


3-20V
VIN
220u
15m
*R1
*C1
3.3u
max 20V
VOUT
1
CS
2
VCC
3
EN
4
FB
5
GND
10
LX
9
HGATE
8
BOOT
7
LDO
6
LGATE
HM5183
HM9926/SOP8
0.1u
120u
HM9926/SOP8
4.7u

Block Diagram



Absolute Maximum Ratings

		MIN	MAX	UNIT
Voltage range	VCC, EN	-0.3	22	V
	BOOT-LX, LDO	-0.3	6	
	FB	-0.3	6	
	HGATE-LX, LGATE	-0.3	LDO	
	VCC-CS	-0.3	0.3	
	LX	-2	22	
Operating junction temperature range		-40	155	℃

Recommended Operating Conditions

		MIN	MAX	UNIT
Voltage range	VCC, EN	0	20	V
	BOOT-LX, LDO	0	5	
	FB	0	5	
	HGATE-LX, LGATE	0	LDO	
	VCC-CS	-0.2	0.2	
	LX	-2	20	
Operating junction temperature range		0	125	℃

Electrical Characteristics

3V<VCC<20V, 0℃<T_j<125℃, Typical values are Temp=25℃, VCC=5V

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage and Current						
VCC supply voltage	VCC		3		40	V
VCC supply current	I_{VCC}	Switch Mode		6		mA
		EN=0V		8		μA
VFB Voltage Regulation						
Feedback voltage regulation	V_{FB}			1.2		V
Output constant voltage accuracy			-1.5%		+1.5%	
Load regulation		VCC-CS=0~75mV		0.013		%/mV
Voltage regulation		VCC=3~40V		0.002		%/V
LDO Output						
LDO output voltage	V_{REGN}	5V<VCC<40V, LDO outputs 0~50mA		5		V
LDO under voltage lock out	V_{UVLO}	LDO rising		3		V
		LDO falling		2.8		V

EN enable	V_{EN}	EN rising	2			V
		EN falling			0.5	V
OSC and Drivers Outputs						
Switch frequency	F_{OSC}			750		kHz
Maximum duty	D_{MAX}			96		%
Minimum turn-on time	T_{MIN}			60		ns
Driver output rising time	T_R	C_{LOAD}=3.3nF, 10% to 90%		20		ns
Driver output falling time	T_F	C_{LOAD}=3.3nF, 10% to 90%		20		
Dead time	T_{DEAD}	C_{LOAD}=3.3nF		40		ns
Protections						
FB Over voltage protection threshold	V_{OVP}			1.32		V
Zero Current Protection Threshold	V_{ZCD}	VCC-CS, voltage across sense resistor		2		mV
Maximum Peak Current Protection Threshold	V_{LIM}	VCC-CS, voltage across sense resistor		100		mV
Thermal shutdown trip	T_{TEMP}			160		℃
Thermal hysteresis	T_{HYS}			20		

Typical Operating Performance

Fig. 1 Soft Start

Fig. 2 Load Transition

Detail Description

Main Control Loop

The HM5183 use a constant frequency, current mode boost control structure. In the normal mode, the bottom main power MOSFET is open when the clock is set up, closed at the reset of the ICMP peak current control comparator. Output trigger and reset signal is generated by peak current comparator inductor current and error amplifier EA. Error amplifier output feedback voltage FB and internal 1.2V reference.

When the bottom main power MOSFET is turned off, the top rectifier MOSFET is turned on; When the inductor current is closed to the threshold, the reverse is about to begin, the top rectifier MOSFET turn off.

LDO Output

Supply power for the top and bottom MOSFET drivers and most of the internal circuits. The maximum current is limited to 50mA.

Shut Down and Start Up

The HM5183 shut down when EN is low; the power consumption of the chip drops below 8μA. EN is logic high, the chip enable.

Maximum Peak Current Limit

When the HM5183 is in normal mode, if the voltage across the external sense resistor exceeds 100mV, PWM controller immediately shuts down to prevent inductor current is too high.

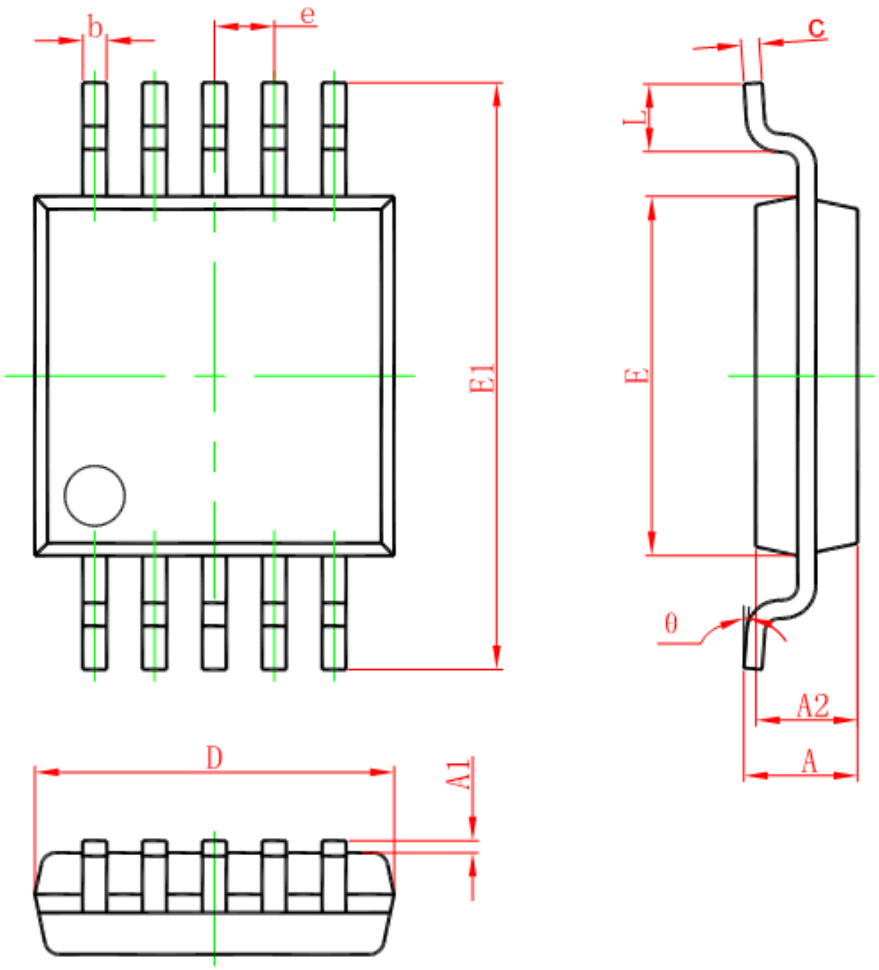
Light Load Burst Mode

The HM5183 automatically switch into Burst mode with light loads, to improve the work efficiency.

If the average inductor current is higher than that required by the load, the output of the error amplifier EA decreases. When the EA output gets down to the threshold value, the HM5183 turns into Burst mode, the external main MOSFET and the rectifying MOSFET are turned off. When the output feedback voltage FB reduce the error amplifier output starts to rise, the Burst sleep mode is terminated, circuit loop continues to work properly, the inductor peak current is limited to 10% of the maximum value.

Over Voltage Protection

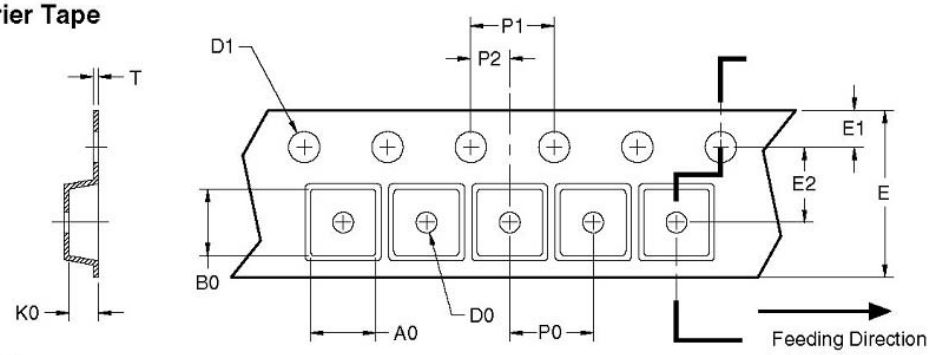
The HM5183 integrates over voltage protection function. When the output voltage is too high, for example, the overvoltage generated when the load is suddenly removed, this function can protect the chip itself and other components. FB greater than 1.32V, the function immediately turns off the PWM controller, the bottom and rectifier MOSFETs drives.



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.50(BSC)		0.020(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

SOP-10 Tape and Reel Dimensions

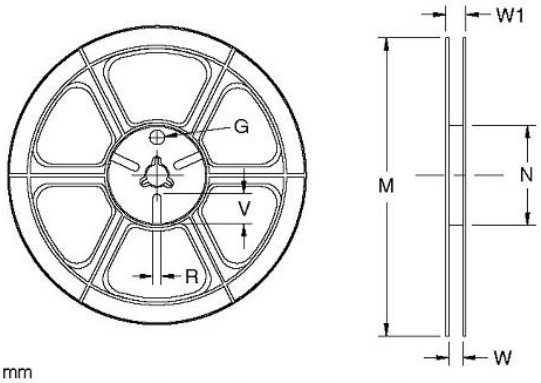
Carrier Tape



UNIT: mm

Package	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
SO-10 (12mm)	5.00 ±0.10	5.00 ±0.10	1.50 ±0.10	1.60 ±0.10	1.50 ±0.10	12.00 ±0.10	1.75 ±0.10	5.50 ±0.10	7.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.25 ±0.10

Reel



UNIT: mm

Tape Size	Reel Size	M	N	W	W1	H	K	S	G	R	V
12mm	ø330	ø330.00 ±0.50	ø97.00 ±0.10	13.00 ±0.30	17.40 ±1.00	ø13.00 +0.50/-0.20	10.60	2.00 ±0.50	—	—	—

Leader/Trailer and Orientation