FEATURES

- Operating voltage range：2.7V to 5.5V
- Low Operating Current: 32uA@5V
- Adjustable Output Voltage
- Output Voltage up to 18V Feedback
- Voltage Accuracy：±1% Output
- Power: up to 35W
- High Efficiency: up to 94%
- Available in SOT23-6
- Pb-free, rohs-Compliant and
- Halogen-free

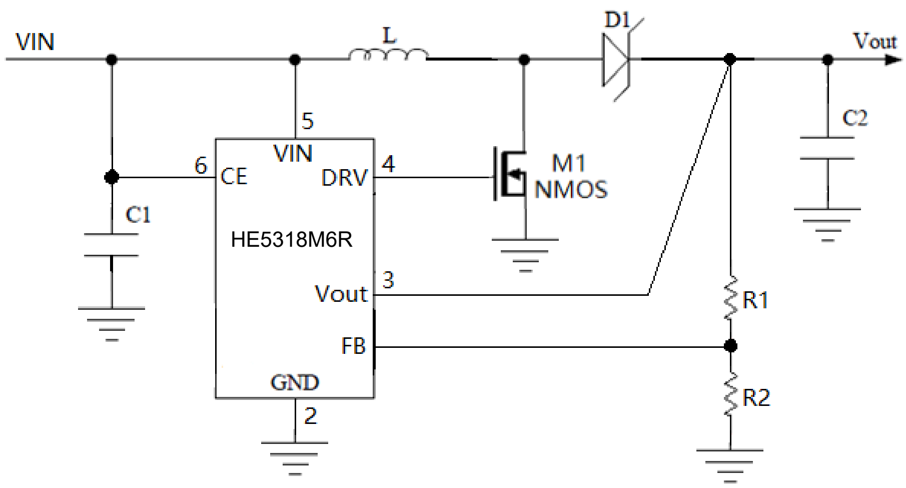
APPLICATIONS

- Hand-held Devices
- Power Bank
- Medical Equipment
- Charger

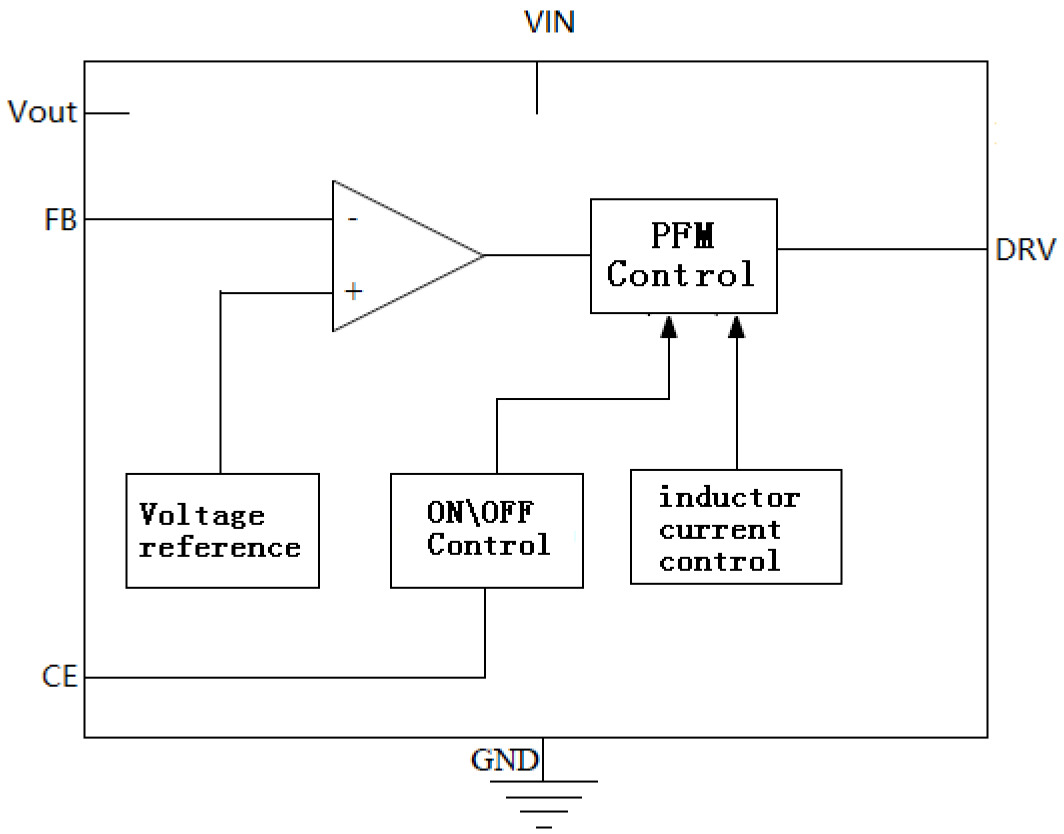
GENERAL DESCRIPTION

The HE5318 is a simple, compact PFM boost controller designed for applications where extremely low cost and small size are top priorities. The output voltage can be adjusted by the external resistor divider with 1% feedback voltage accuracy from an input voltage range of +2.7V to +6.5V. Low current consumption of 32uA typical makes HE5318 ideal for battery-powered applications. The HE5318 is designed specifically to provide a simple application circuit and minimize the size and number of external components, making them ideal for consumer electronics applications. The HE5318 adopts PFM operating mode, which provides excellent efficiency over a wide-range of input voltage and load currents. The on-time and off-time are tuned to permit optimization of external component size. Chip enable input can make HE5318 into ultra-low-current shutdown mode. The HE5318 is available in a space-saving 6-pin SOT23 package.

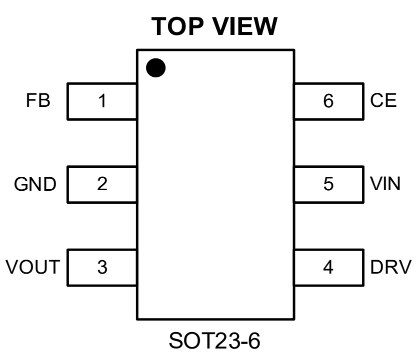
Typical Application Circuit



Block Diagram



Pin Assignment



Pin Description

Pin No.	Symbol	Description
1	FB	**Output Voltage Feedback Input.** This pin should be connected to the external feedback resistors to sense the output voltage. In normal operation, FB pin is regulated to 1.205V typical with 1% accuracy.
2	GND	**GND.** Ground, namely the negative terminal of input supply and output voltage.
3	Vout	**Positive Terminal of Output Voltage.** Connect this pin to the positive terminal of the output voltage.
4	DRV	**Gate Drive for external N-Channel MOSFET.** Connect DRV pin to the gate of external N-Channel MOSFET.
5	VIN	**Positive Terminal of Power Supply.** The internal circuits of HE5318 are powered from this pin.
6	CE	**Chip Enable Input.** A high input will put the HE5318 in the normal operating mode. Pulling the CE pin to low level will put the HE5318 into disable mode. The CE pin can be driven by TTL or CMOS logic level.

ABSOLUTE MAXIMUM RATINGS

Terminal Voltage (With respect to GND)
VIN and FB voltage....….........-0.3V to +6.5V
Vout Voltage……………..……－0.3V to 20V
DRV and CE voltage……….......-0.3V to VIN
Lead Temperature (soldering, 10s) .....+260°C

Thermal Resistance…………………..300°C/W
Operating Temperature.…..……...-40 to +85°C
Maximum Junction Temperature............. 150°C
Storage Temperature.........….......-65 to +150°C

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical Characteristics

(VIN = 3.7V, TA = –40°C to +85°C,Typical values are at TA = +25°C, unless otherwise noted)

Parameters	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Voltage Range	VIN		2.7		6.5	V
Operating current	IVIN1	No switching	27	32	37	uA
Quiescent current	IVIN2	No loading		50		uA
Vout pin input current	IVout	VOUT=6V	1.7	2.2	2.7	uA
		VOUT=12V	3.5	4.4	5.5	
		VOUT=18V	5.1	6.8	8.5	
FB Pin						
FB Feedback Voltage	VFB	Normal operation	1.193	1.205	1.217	V
FB Bias Current	IFB	VIN=6V, VFB=6V	－50		+50	nA
DRV Pin						
DRV Source Current				0.65		A
DRV Sink Current		VOUT＝VIN－0.2V，VDRV＝0.5×VIN		0.65		A
DRV Output High	VOH	IDRV＝5mA	VIN－0.3			V
DRV Output Low	VOL	IDRV＝－5mA			0.3	V
CE Pin						
Input Low Voltage	VCEL	CE voltage falls			0.7	V
Input High Voltage	VCEH	CE voltage rises	2.2			V
Input Current	ICEL	CE=GND，VIN=6V	－100			nA
	ICEH	CE=VIN=6V			100	

Detailed Description

The HE5318 is a simple, compact PFM boost controller designed for DC-DC conversion topologies including step-up, SEPIC, and flyback applications. The device is designed specifically to provide a simple application circuit with a minimum of external components and is ideal for portable devices and other low-cost consumer electronics applications.

The output voltage of HE5318 is set by external feedback resistors. The low operating current of 32uA makes the HE5318 ideal for battery-powered applications.

The HE5318 uses a unique variable on-time and off-time architecture, which provides excellent efficiency over a wide range of input voltage and load currents.

The chip enable input can bring the chip into ultra-low current shutdown mode, in which current consumption is only 1uA maximum.

Applications Information

Input Voltage Range

The HE5318 functions well when the input voltage is between 2.7V to 6.5V. On-chip UVLO circuit will shut down the HE5318 if input voltage falls below UVLO threshold (2.65V Max.).

Chip Enable/Disable

There is a chip enable input CE pin. When the voltage at CE pin is above 2.2V, HE5318 functions normally; When the voltage at CE pin is below 0.7V, HE5318 is disabled. In disable mode, the operating current is quite small (1uA Max.).

Do not apply a voltage between 0.7V and 2.2V on CE pin, otherwise HE5318 may be in uncertain state and draw more current.

Set Output Voltage with External Resistor

The output voltage of HE5318 is set with external feedback resistor at FB pin as shown in Figure 1, in which resistors R1 and R2 serve the purpose. The output voltage is calculated with the following equation: Vout = Vref x (1+R1/R2)

Where,

- Vref is internal reference voltage of 1.205V (Typical)
- R1 and R2 are the feedback resistors as shown in Figure 1

The internal reference voltage's accuracy is ±1%. The metal resistor with 1% accuracy is better choice for R1 and R2.

The Selection of Input Bypass Capacitor

In most applications, a bypass capacitor at VIN is needed. An ceramic capacitor, placed in close proximity to VIN and GND pins, works well. The capacitance is chosen based on the input current, the power supply characteristics and cable length. The capacitor's breakdown voltage should be higher than the maximum input voltage.

Generally a capacitor between 4.7uF and 47uF works well, ceramic capacitor of X5R or X7R is highly recommended.

The Selection of Output Capacitor

In a boost DC-DC converter, the output capacitor requirements are demanding due to the fact that the current waveform is pulsed. The choice of component is driven by the acceptable ripple voltage which is affected by the ESR, ESL and bulk capacitance.

The capacitance of the output capacitor should meet the requirement of the following formula and be rounded up to the nearest standard value.

$$C_{OUT} \geqslant 43 \times 10^{-6} \times I_{OMAX}$$

For many designs it is possible to choose a single capacitor type that satisfies both the ESR and bulk C requirements. In certain demanding applications, however, the ripple voltage can be improved significantly by connecting two or more types of capacitors in parallel. For example, using a low ESR ceramic capacitor can minimize the ESR step, while an electrolytic capacitor can be used to supply the required bulk C.

The selection of Inductor

An inductor should be chosen that can carry the maximum input DC current which occurs at the minimum input voltage. The peak-to-peak ripple current is set by the inductance and a good starting point is to choose a ripple current of 30% of its maximum value:

$$\triangle I_L = 30\% \times \frac{Vout \ X \ Iomax}{0.9 \ X \ VIN}$$

Where, Iomax is the maximum output current of the DC-DC converter.

The inductor value should meet the requirement of the following equation and be rounded down to the nearest standard value.

$$L \leqslant \frac{VIN \times 1.5 \ X \ 10^{-6}}{\triangle I_L}$$

The Selection of N-channel MOSFET

The HE5318's gate driver is capable of sourcing 0.65A and sinking 0.65A of current. The N-channel MOSFET selection is based on the output voltage, inductor current and operating switching frequency. Choose an N-channel MOSFET that has a higher breakdown voltage than the output voltage, low Rds(ON), and low total gate charge(Qg) for better efficiency. MOSFET threshold voltage must be adequate if operated at the low end(2.7V) of the input-voltage operating range.

The Selection of Free-Wheeling Diode

The forward voltage of the freewheeling diode (D1 in Fig.1) should be as low as possible for better efficiency. A Schottky diode is a good choice as long as the breakdown voltage is high enough to withstand the output voltage. The forward current rating of the diode must be at least equal to the maximum output current.

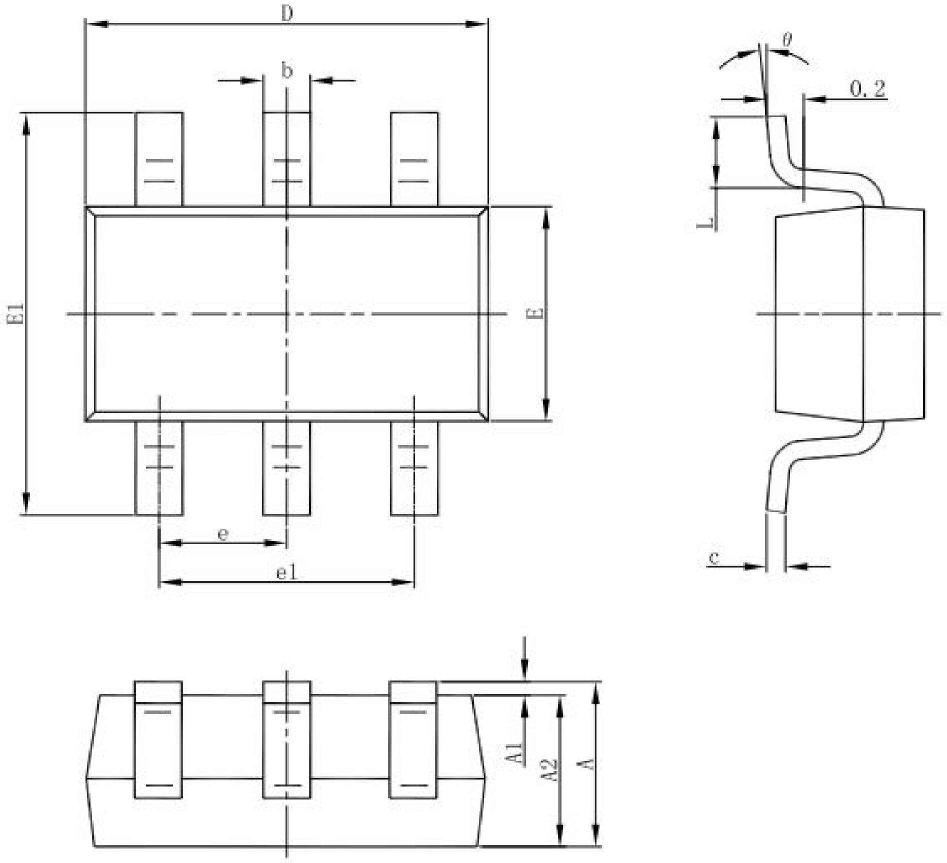
PCB Considerations

A good PCB design is very important to efficiency and performance. When laying out the printed circuit board, the following considerations should be taken to ensure proper operation of the IC.

- Use double-layer PCB for better performance.
- The ground connections of output capacitor and the source of N-channel MOSFET need to feed into same copper that connects to the input capacitor ground before tying back into system ground. This copper should be as wide as possible, and back to system ground separately.
- To minimize radiation, the diode, inductor, N-channel MOSFET, the input bypass capacitor and the output bypass capacitor traces should be kept as short as possible and wide enough.

Package Description

6-pin SOT23-6 Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°