Step-Up Current Mode PWM Converter

GENERAL DESCRIPTION

The FSB628 is a constant frequency, 6-pin SOT23 current mode step-up converter intended for small, low power applications. The FSB628 switches at 1.2MHz and allows the use of tiny, low cost capacitors and inductors 2mm or less in height. Internal soft-start results in small inrush current and extends battery life.

The FSB628 features automatic shifting to pulse frequency modulation mode at light loads. The FSB628 includes under-voltage lockout, current limiting, and thermal overload protection to prevent damage in the event of an output overload. The FSB628 is available in a small 6-pin SOT-23 package.

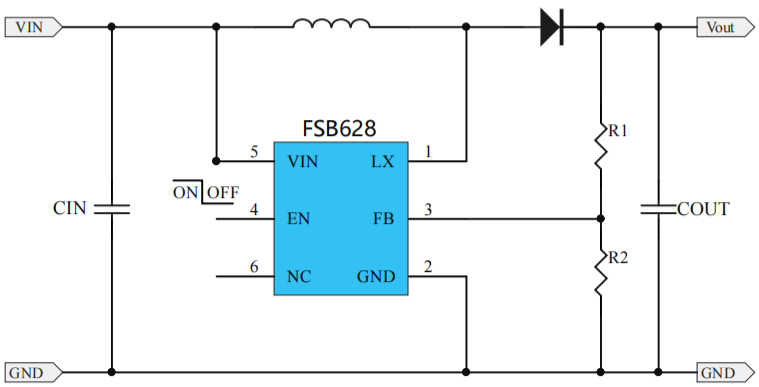
FEATURES

- up to 97% Efficiency
- 2V to 24V Input Voltage
- 1.2MHz Fixed Switching Frequency
- Internal 4A Switch Current Limit
- Adjustable Output Voltage
- Internal Compensation
- Up to 28V Output Voltage
- Automatic Pulse Frequency Modulation Mode at Light Loads
- Available in SOT23-6 Package
- Typical application:
  VIN=3V ~4.2V, Vout=5V,Iout=1A;
  VIN=3V ~4.2V, Vout=9V,Iout=0.6A.

APPLICATIONS

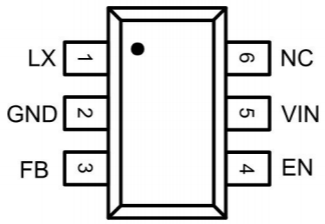
- Wearable Devices
- Sensor Power Supply
- Battery-Powered Equipment
- LCD Bais Supply

TYPICAL APPLICATION CIRCUIT



PIN ASSIGNMENT/DESCRIPTION

FSB628



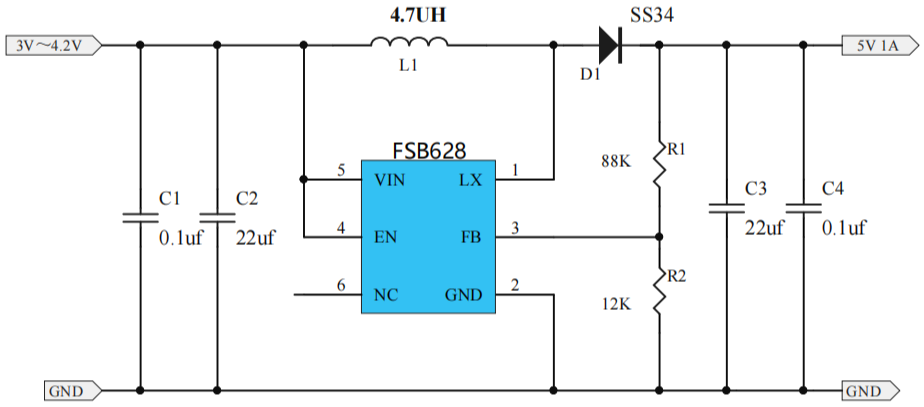
Pin Number	Pin Name	Function
1	LX	Power Switch Output. LX is the drain of the internal MOSFET switch. Connect the power inductor and output rectifier to LX. LX can swing between GND and 28V.
2	GND	IC Ground
3	FB	Feedback Input. The FB voltage is 0.6V. Connect a resistor divider to FB
4	EN	Regulator On/Off Control Input. A high input at EN turns on the converter, and a low input turns it off. When not used, connect EN to the input supply for automatic startup
5	VIN	Input Supply Pin
6	NC	Not Connection

Absolute Maximum Ratings (note1,2)

Item	VALUE	Unit
VIN EN voltages	-0.3 to 26	V
LX voltage	-0.3 to 30	V
FB Voltages	-0.3 to 6	V
Operating Temperature	-40 to 85	°C
Storage temperature Range	-65 to 150	°C
Lead Temperature (Soldering, 10sec.)	+300	°C
Junction Temperature	160	°C

Layout Considerations

1. The power traces, consisting of the GND trace, the LX trace and the Vin trace should be kept short, direct and wide.
2. LX、L and D switching node, wide and short trace to reduce EMI.
3. Place CIN near Vin pin as closely as possible to maintain input voltage steady and filter out the pulsing input current.
4. The resistive divider R1and R2 must be connected to FB pin directly as closely as possible.
5. FB is a sensitive node. Please keep it away from switching node, LX.
6. The GND of the IC, CIN and COUT should be connected close together directly to a ground plane.



Typical Application

(1) $I_{VIN}=\frac{V_{OUT}*I_{OUT}}{V_{VIN_{MIN}}*eff}=\frac{5*1}{3*0.85}$

(2) $I_{VIN}=\frac{V_{OUT}*I_{OUT}}{V_{VIN_{MIN}}*eff}=\frac{9*0.55}{3*0.85}$

(3) $I_{VIN}=\frac{V_{OUT}*I_{OUT}}{V_{VIN_{MIN}}*eff}=\frac{12*0.4}{3*0.85}$

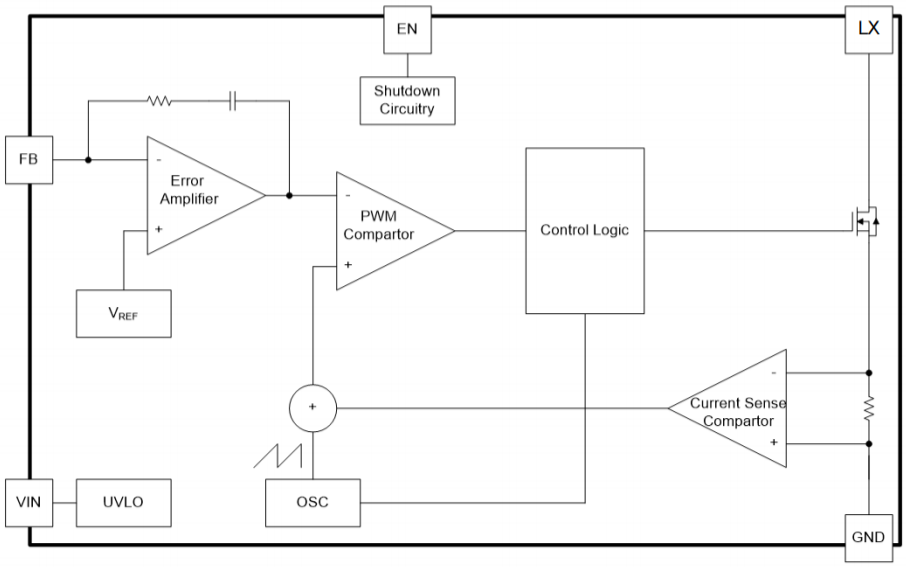
ELECTRICAL CHARACTERISTICS

VIN,V_{EN}=5V, TA=25°C, unless otherwise specified.

Parameter	Conditions	MIN	TYP	MAX	unit
Operating Input Voltage		2		24	V
Under Voltage Lockout				1.98	V
Under Voltage Lockout Hysteresis			100		mV
Current (Shutdown)	V_{EN}= 0V		0.1	1	μA
Quiescent Current (PFM)	V_{FB}=0.7V， No switch		100	200	μA
Quiescent Current (PWM)	V_{FB}=0.5V， switch		1.6	2.2	mA
Switching Frequency			1.2		MHz
Maximum Duty Cycle	V_{FB} = 0V	90			%
EN Input High Voltage		1.5			V
EN Input Low Voltage				0.4	V
FB Voltage		0.588	0.6	0.612	V
FB Input Bias Current	V_{FB} = 0.6V	-50	-10		nA
LX On Resistance (1)			80	150	mΩ
LX Current Limit (1)	V_{IN}= 5V, Duty cycle=50%		4		A
LX Leakage	V_{SW} = 20V			1	μA
Thermal Shutdown			155		℃

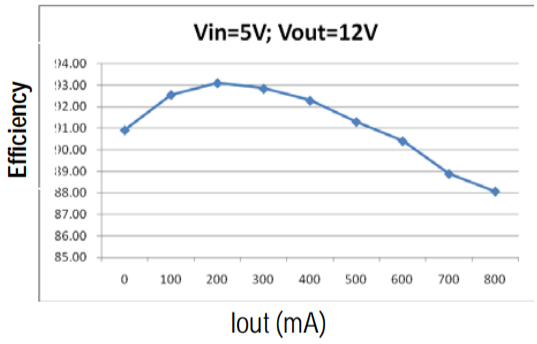
Note1: Guaranteed by design, not tested

Function Block Diagram

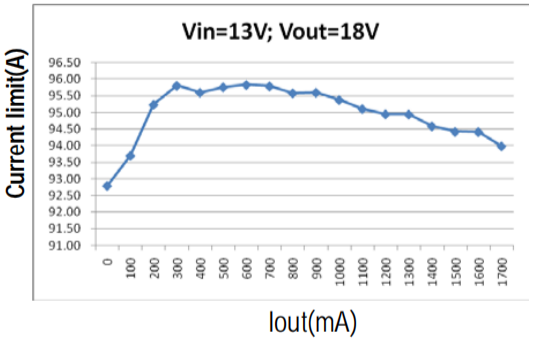


TYPICAL OPERATING CHARACTERISTICS

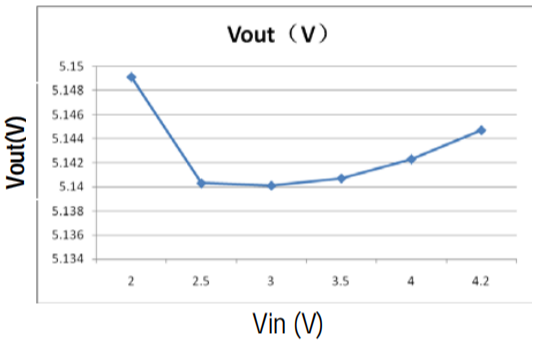
(VIN =5V, VOUT=12V, TA = +25ºC, unless otherwise noted.)



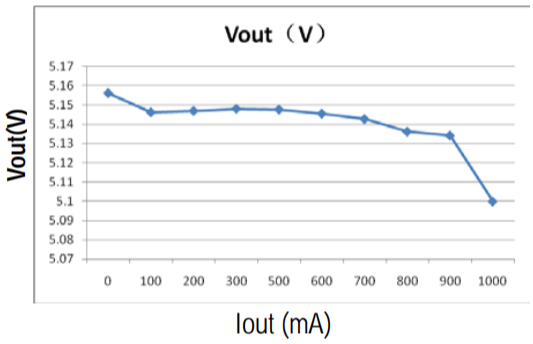
Efficiency Curve



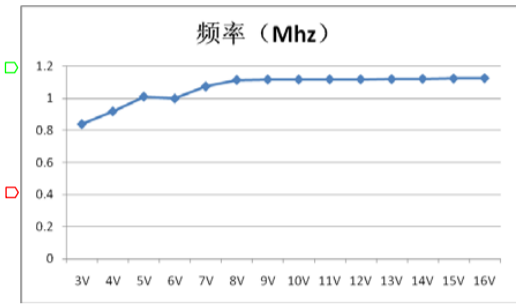
Efficiency Curve



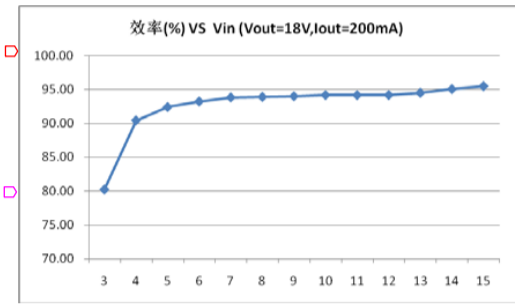
line Regulation



Load regualation



Freq VS Vin



Efficiency VS Vin

Function Description

The FSB628 uses a fixed frequency, peak current mode boost regulator architecture to regulate voltage at the feedback pin. The operation of the FSB628 can be understood by referring to the block diagram of (Functional Block Diagram). At the start of each oscillator cycle the MOSFET is turned on through the control circuitry. To prevent sub-harmonic oscillations at duty cycles greater than 50 percent, a stabilizing ramp is added to the output of the current sense amplifier and the result is fed into the negative input of the PWM comparator. When this voltage equals The output voltage of the error amplifier the power MOSFET is turned off. The voltage at the output of the error amplifier is an amplified version of the difference between the 0.6V bandgap reference voltage and the feedback voltage. In this way the peak current level keeps the output in regulation. If the feedback voltage starts to drop, the output of the error amplifier increases. These results in more current to flow through the power MOSFET, thus increasing the power delivered to the output. The FSB628 has internal soft start to limit the amount of input current at startup and to also limit the amount of overshoot on the output.

Application Information

Setting the Output Voltage

The internal reference VREF is 0.6V (Typical). The output voltage is divided by a resistor divider,R1 and R2 to the FB pin. The output voltage is given by

$$\left(1+\frac{R1}{R2}\right)*0.6V = Vout$$

Inductor Selection

The recommended values of inductor are 4.7 to 22μH. Small size and better efficiency are the major concerns for portable device, such as FSB628 used for mobile phone. The inductor should have low core loss at 1.2MHz and low DCR for better efficiency. To avoid inductor saturation current rating should be considered.

Capacitor Selection

Input and output ceramic capacitors of 22μF are recommended for FSB628 applications. For better voltage filtering, ceramic capacitors with low ESR are recommended. X5R and X7R types are suitable because of their wider voltage and temperature ranges.

Diode Selection

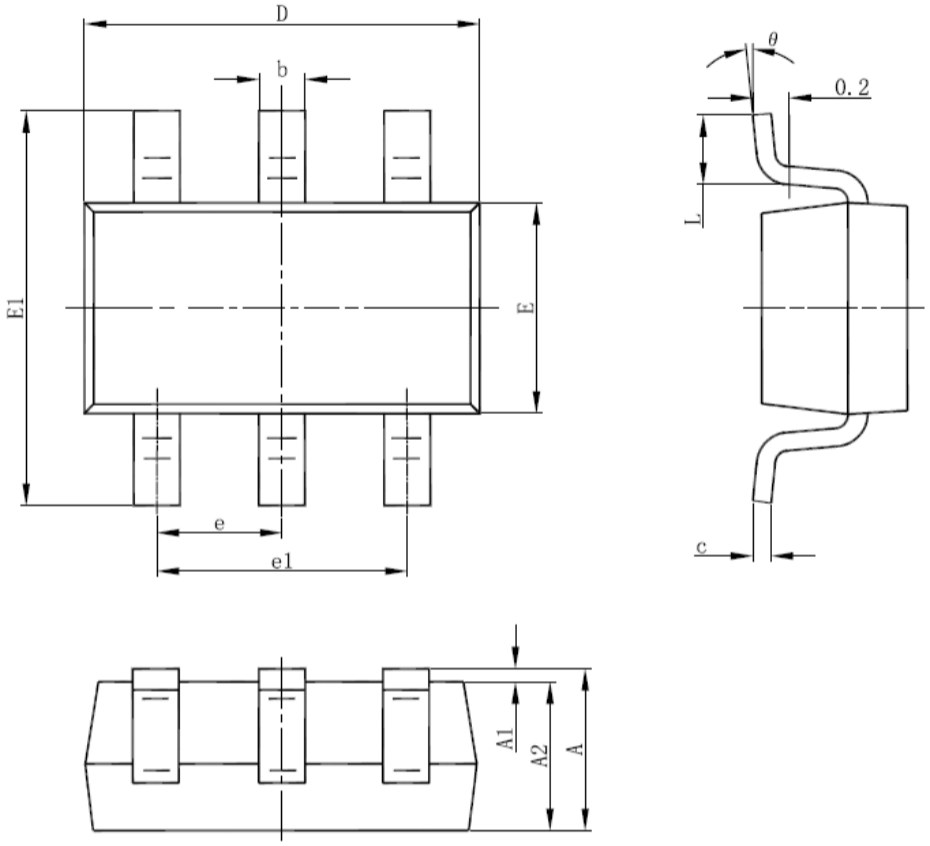
Schottky diode is a good choice for FSB628 because of its low forward voltage drop and fast reverses recovery. Using Schottky diode can get better efficiency. The high speed rectification is also a good characteristic of Schottky diode for high switching frequency. Current rating of the diode must meet the root mean square of the peak current and output average current multiplication as following :

$$I_D(RMS) \approx \sqrt{I_{OUT} \times I_{PEAK}}$$

The diode' s reverse breakdown voltage should be larger than the output voltage.

PACKAGE DESCRIPTION

FSB628 SOT23-6L



Symbol	Dimensions In Millimeters	
	Min	Max
A	0.900	1.450
A1	0.000	0.150
A2	0.900	1.300
b	0.300	0.500
c	0.100	0.200
D	2.800	3.000
E	1.500	1.700
E1	2.650	2.950
e	0.950(BSC)	
e1	1.800	2.000
L	0.300	0.600
θ	0°	8°