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 modeat 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.

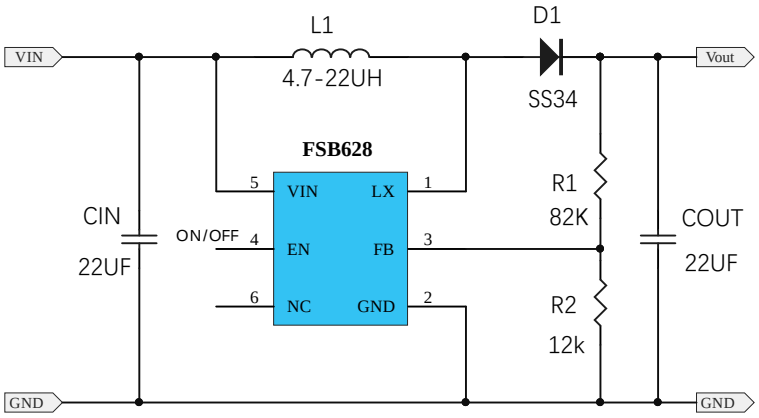
FEATURES

- 2.2V to 16V Input Voltage
- Up to 20V Output Voltage
- 1.2MHz Fixed Switching Frequency
- Adjustable Output Voltage
- Internal Compensation
- Over Voltage Protection
- Integrated 80mΩ Power MOSFET

APPLICATIONS

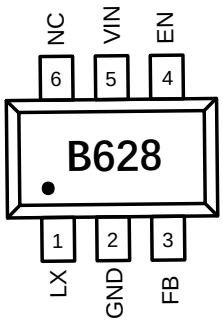
- Chargers
- LCD Displays
- Digital Cameras
- Handheld Devices
- Portable Products

TYPICAL APPLICATION CIRCUIT



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

PIN ASSIGNMENT/DESCRIPTION



(Device code Mark : B628)

Pin Number	Pin Name	Function
1	LX	Power Switch Output
2	GND	IC Ground
3	FB	Error Amplifier Inverting Input
4	EN	Enable Control (Active High)
5	VIN	IC Power Supply
6	NC	NC

Absolute Maximum Ratings (note)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
LX Voltage	V_{LX}		-0.3		22	V
EN Voltage	V_{EN}		-0.3		18	V
VIN Voltage	VIN		-0.3		18	V
Power Dissipation	PD	TA=25°C			600	mW
Thermal Resistance	θJA				+250	°C / W
Junction Temperature	TJ				+160	°C
Operating Temperature	TOP		-40		+85	°C
Storage Temperature	TST		-65		+150	°C
Lead Temperature		(soldering, 10 sec)			+300	°C

Note : TJ is calculated from the ambient temperature TA and power dissipation PD according to the following formula: TJ = TA + (PD) x (250°C/W).

Layout Considerations

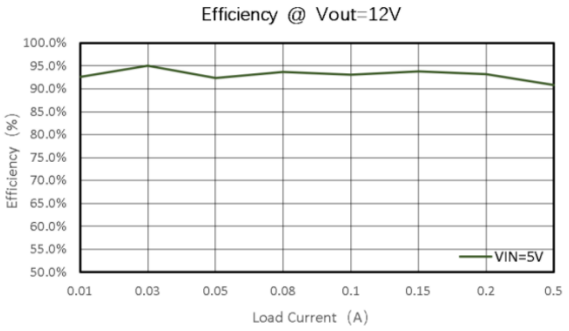
1. The power traces, consisting of the GND trace, the LX trace and the VIN trace should be kept short, direct and wide.
2. LX、L and D switching node, wide and short trace to reduce EMI.
3. Place CIN near VIN pin as closely as possible to maintain input voltage steady and filter out the pulsing input 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.

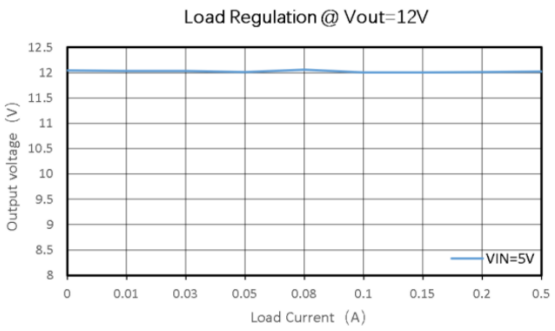
ELECTRICAL CHARACTERISTICS

(VIN=VEN=5V, TA=25°C,unless otherwise specified)

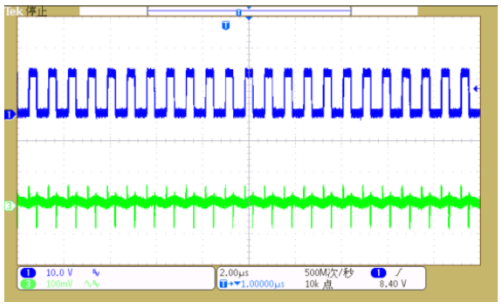
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Input Voltage		2.2		16	V
Under Voltage Lockout				2.2	V
FB Voltage		0.588	0.6	0.612	V
FB Input Bias Current	VFB = 0.6V	-50	-10		nA
Quiescent Current (PFM)	VFB=0.7V, No switch		100	200	μA
Quiescent Current (PWM)	VFB=0.5V, switch		1.6	2.2	mA
Switching Frequency			1.2		MHz
Maximum Duty Cycle	VFB = 0V	90			%
EN Input High Voltage		1.5			V
EN Input Low Voltage				0.6	V
OVP with Output			20		V
Current (Shutdown)	VEN= 0V		0.1	1	μA
Under Voltage Lockout Hysteresis			100		mV
LX On Resistance			80	150	mΩ
LX Current Limit	VIN= 5V, Duty cycle=50%,		2.5		A
Leakage	VLX= 20V			1	μA
Thermal Shutdown			160		℃
Thermal Shutdown Hysteresis			25		℃

TYPICAL OPERATING CHARACTERISTICS

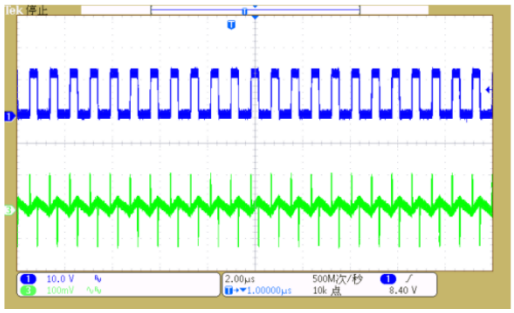


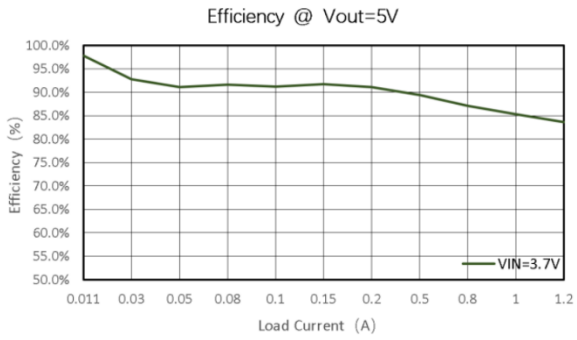


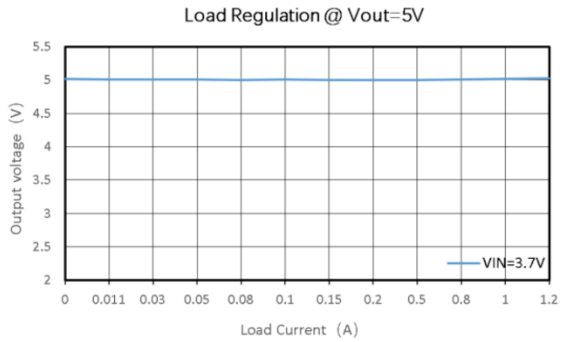
V_{IN}=5V,V_{OUT}=12V,I_{LOAD}=0.2A

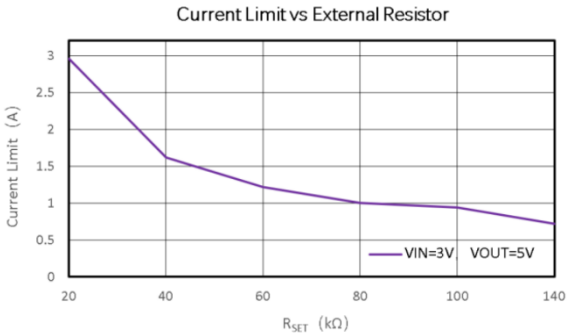


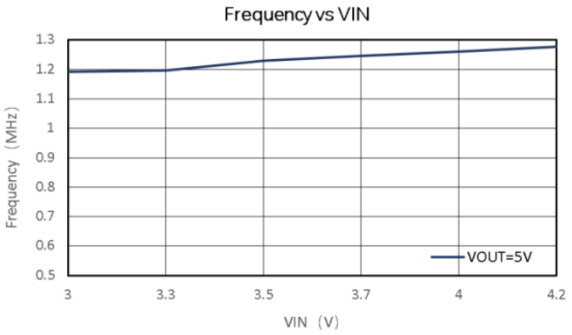
V_{IN}=5V,V_{OUT}=12V,I_{LOAD}=0.5A











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 Figure 2. At the start of each oscillator cycle the MOSFET is turned on through the control circuitry. To prevent subharmonic 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.

Over Voltage Protection (OVP)

In some condition, the resistive divider may be unconnected, which will cause PWM signal to operate with maximum duty cycle and output voltage is boosted higher and higher. The power MOSFET will be turned off immediately, when the output voltage exceeds the OVP threshold level. The FSB628's OVP threshold is 20V.

Application Information

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

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

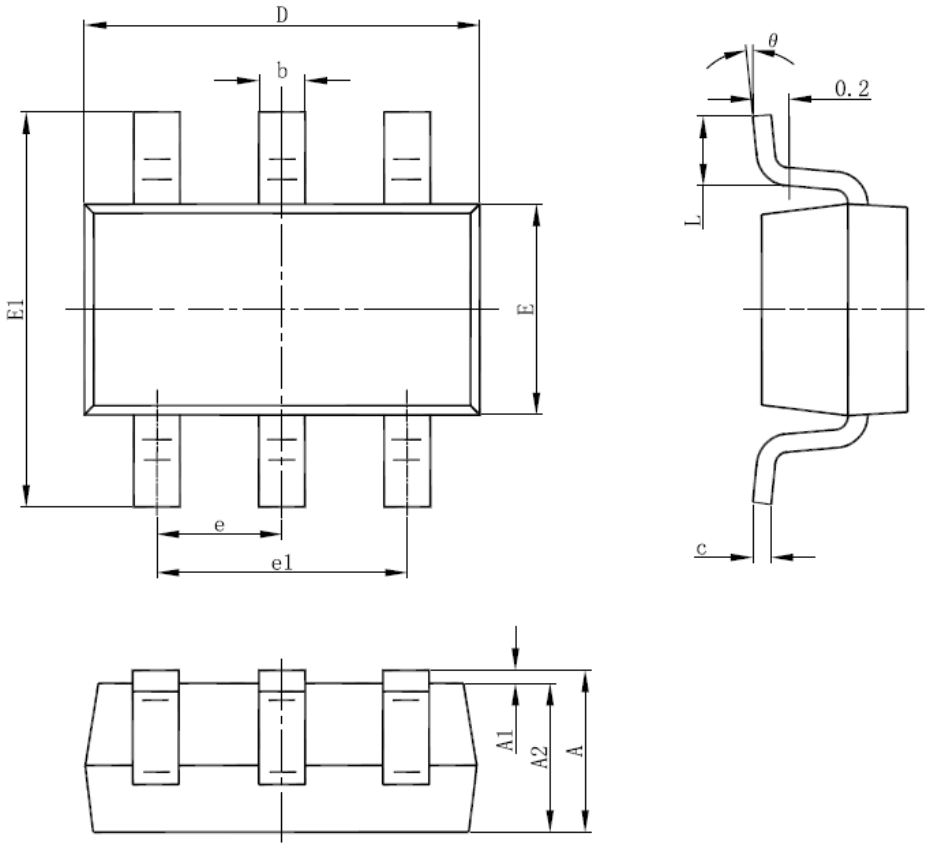
Output Voltage Programming

The output voltage is set by a resistive voltage divider from the output voltage to FB. The output voltage is:

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

PACKAGE DESCRIPTION

SOT23-6L



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°