BL8042C

High Efficiency 1.2MHz 28V Step-up DC/DC Converter

DESCRIPTION

The BL8042C is a constant frequency, current mode step-up converter intended for small, low power applications. The BL8042C 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 BL8042C includes under-voltage lockout, current limiting, thermal shutdown protection and output over voltage protection.

BL8042C is available in SOT23-5 package that is Pb-free.

FEATURES

- 2.5V to 24V input voltage
- Up to 28V output voltage
- Accurate reference: 0.6V
- Integrated 150mΩ power MOSFET
- 1.2MHz switching frequency
- Internal 3A switch current limit
- Internal compensation
- Thermal shutdown
- Available in SOT23-5 package

APPLICATIONS

- ABS set-top boxes
- DVB-S/S2

TYPICAL APPLICATION

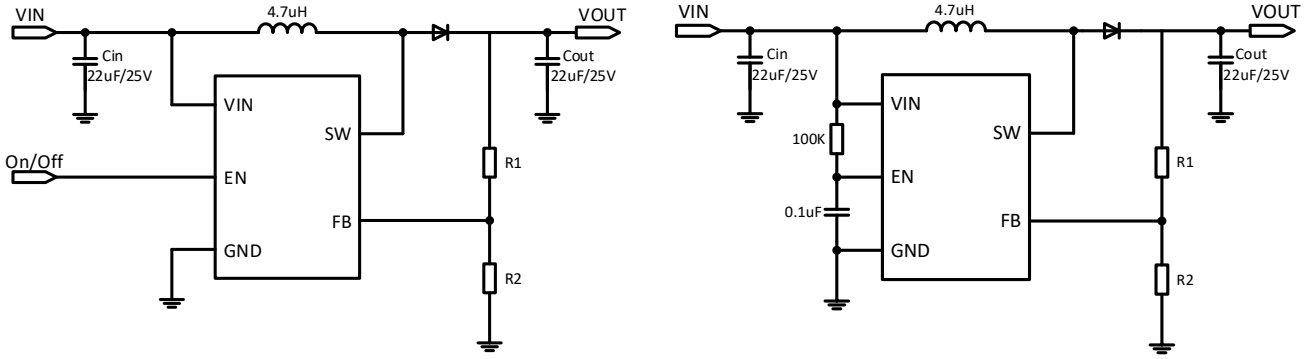


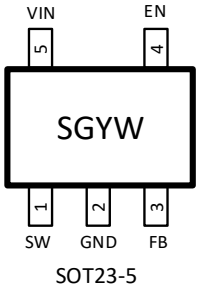
Figure 1. BL8042C typical application circuit

ORDERING INFORMATION

BL8042C [1] [2] [3]

Code	Description
[1]	Temperature & Rohs: C: -40~85°C, Pb free Rohs std.
[2]	Package type: B5: SOT23-5
[3]	Packing type: TR: tape & reel (standard)

MARKING INFORMATION

Product classification		BL8042CCB5TR
Marking		
SGYW	SG: product code	
	YW: date code	

SOT23-5

PIN DESCRIPTION

Pin No.	Symbol	Description
1	SW	Power switch output. SW is the drain of the internal MOSFET switch. Connect the power inductor and output rectifier to SW. SW can swing between GND and 28V.
2	GND	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	Power supply. Must be locally bypassed.

ABSOLUTE MAXIMUM RATING

Parameter		Value
VIN, EN pin voltage		-0.3V to 26V
SW pin voltage		-0.3V to 30V
All other pin voltage		-0.3V to 6V
Junction temperature (T_J)		150°C
Power dissipation	SOT23-5	600mW
Thermal resistance (θ_{JA})		250°C/W
Thermal resistance (θ_{JC})		130°C/W
Storage temperature (T_S)		-65°C to 150°C
Lead temperature & time		260°C, 10s

RECOMMENDED WORK CONDITIONS

Parameter	Value
Input voltage range	2.5V to 24V
Output voltage range	VIN to 28V
Operating ambient temperature (T_A)	-40°C to 85°C

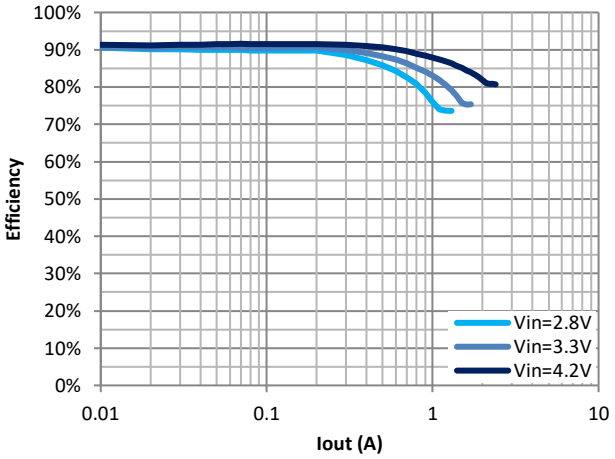
ELECTRICAL CHARACTERISTICS

Test conditions: V_{IN}=5V, V_{OUT}=12V and L=4.7uH. Typical values are at T_A=25°C, unless otherwise specified.

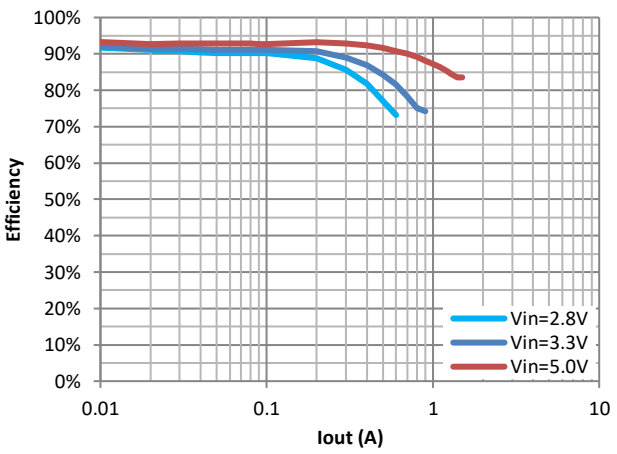
Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IN}	Operating input voltage		2.5		24	V
V_{IN_UVLO}	Under voltage lockout threshold	VIN rising		2.4		V
		V_{IN_UVLO} hysteresis		50		mV
V_{FB}	Feedback voltage		588	600	612	mV
I_{FB}	FB input bias current	V_{FB}=0.6V	-50	-10		nA
I_{SW_LKG}	SW leakage	V_{SW}=20V			1	uA
I_Q	Quiescent current	V_{FB}=0.8V, No switch		0.25	0.5	mA
		V_{EN}=0V		0.1	1	uA
F_{SW}	Oscillator frequency			1.2		MHz
T_{SS}	Soft-start time			1.5		ms
D_{MAX}	Maximum duty cycle			85		%
$T_{ON(MIN)}$	Minimum ON time			120		ns
V_{EN_H}	EN pin logic high threshold		1.0			V
V_{EN_L}	EN pin logic low threshold				0.5	
R_{DS_ON}	SW on-resistance			150		mΩ
I_{LIMIT}	Current limit	V_{IN}=5V, Duty cycle=50%		3		A
T_{SD}	Thermal shutdown			160		°C

TYPICAL PERFORMANCE CHARACTERISTICS

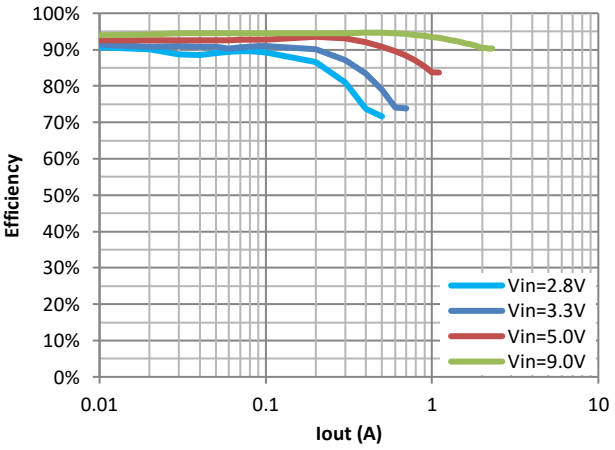
Efficiency vs. Iout
(Vout=5V)



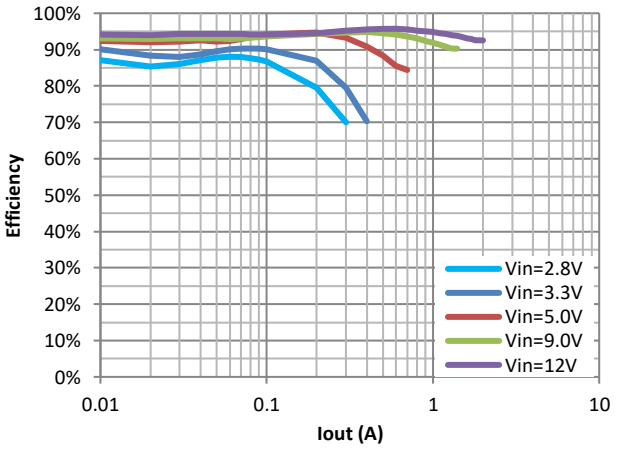
Efficiency vs. Iout
(Vout=9V)



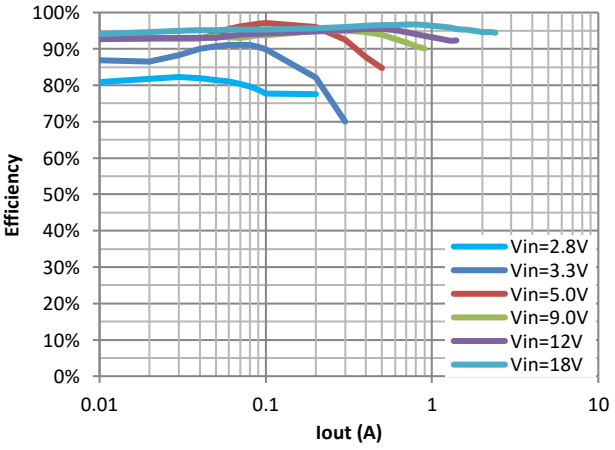
Efficiency vs. Iout
(Vout=12V)



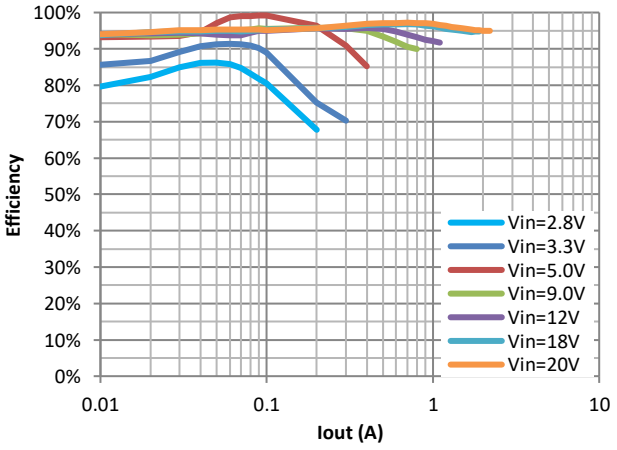
Efficiency vs. Iout
(Vout=18V)



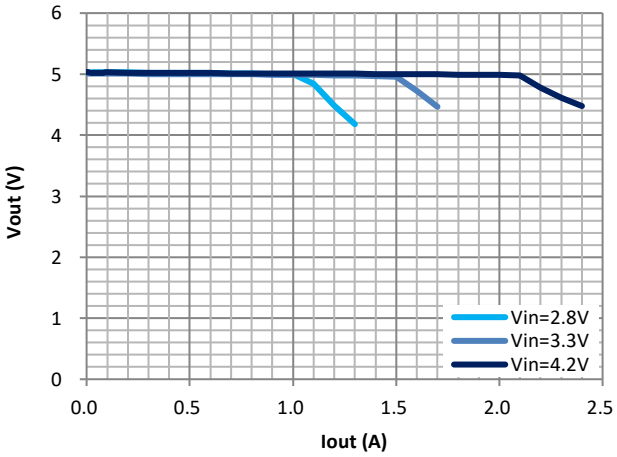
Efficiency vs. Iout
(Vout=24V)



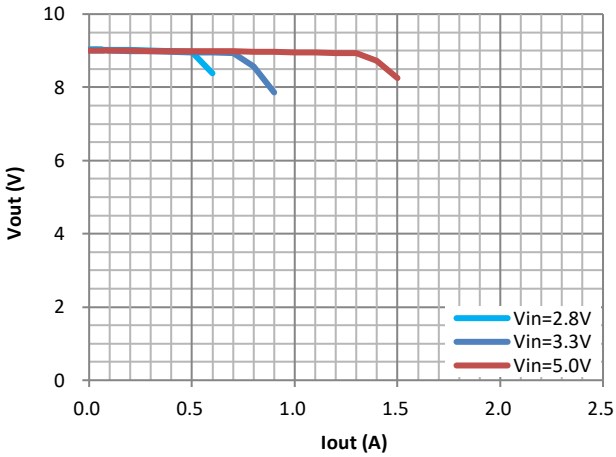
Efficiency vs. Iout
(Vout=28V)



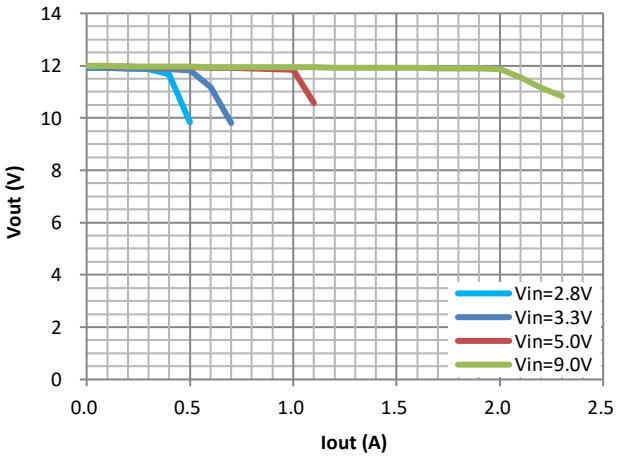
Load Regulation
(Vout=5V)



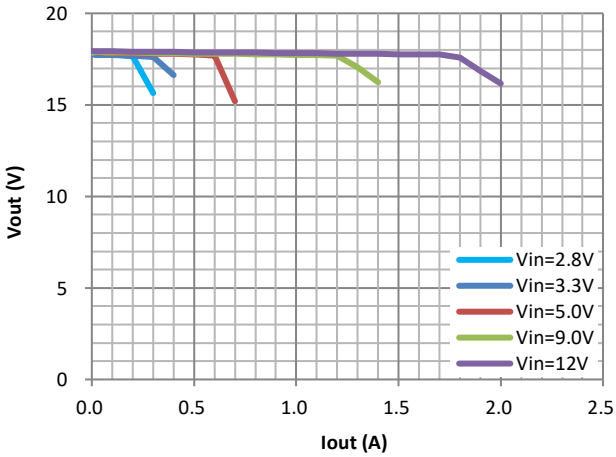
Load Regulation
(Vout=9V)



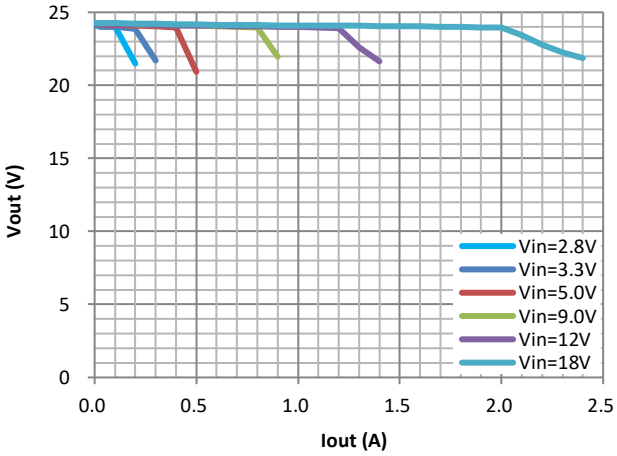
Load Regulation
(Vout=12V)



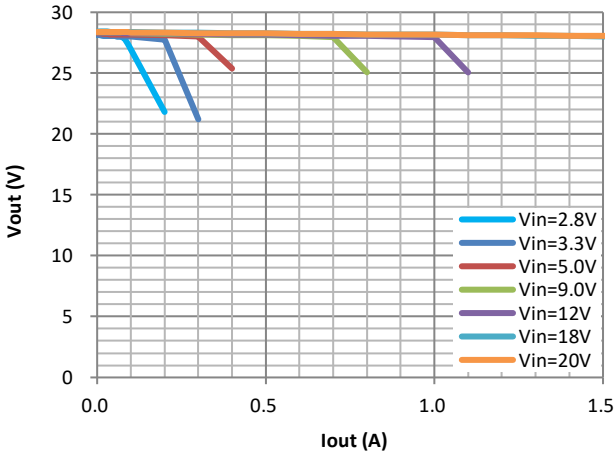
Load Regulation
(Vout=18V)



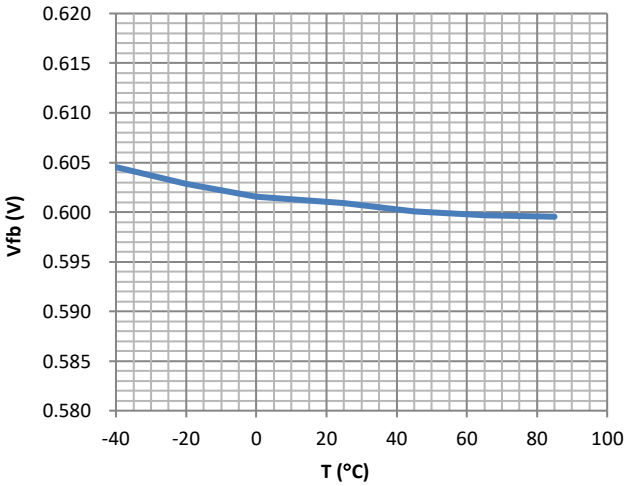
Load Regulation
(Vout=24V)



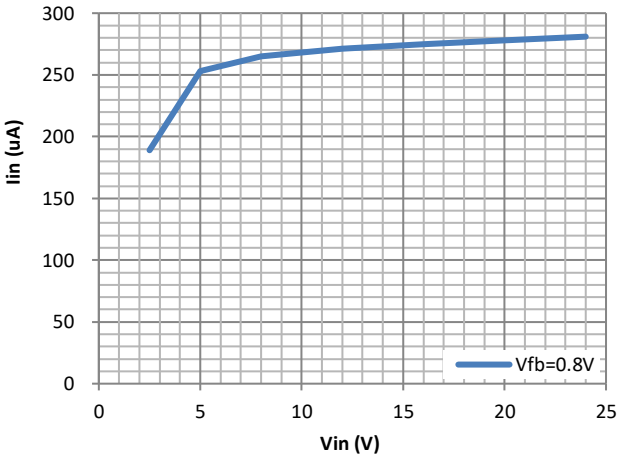
Load Regulation
(Vout=28V)



V_{FB} vs. Temperature

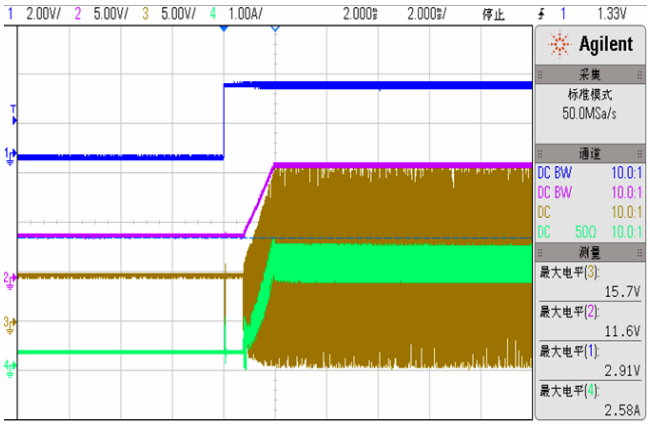


I_Q
(No switching)



Enable Response

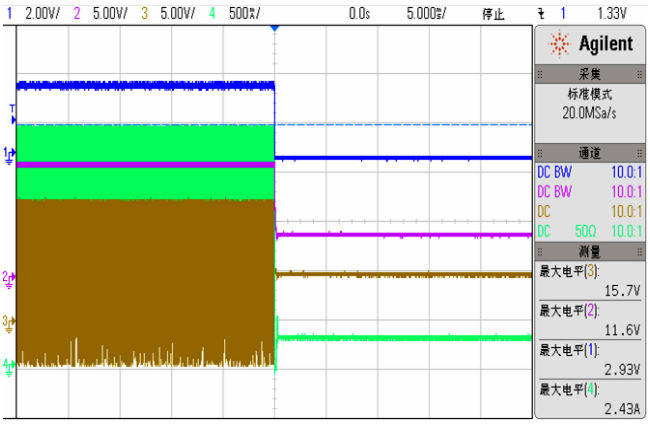
V_{IN}=5V, V_{OUT}=12V, I_{OUT}=800mA, EN=0V to 3V



CH1: EN, CH2: V_{OUT}, CH3: Vsw, CH4: Isw

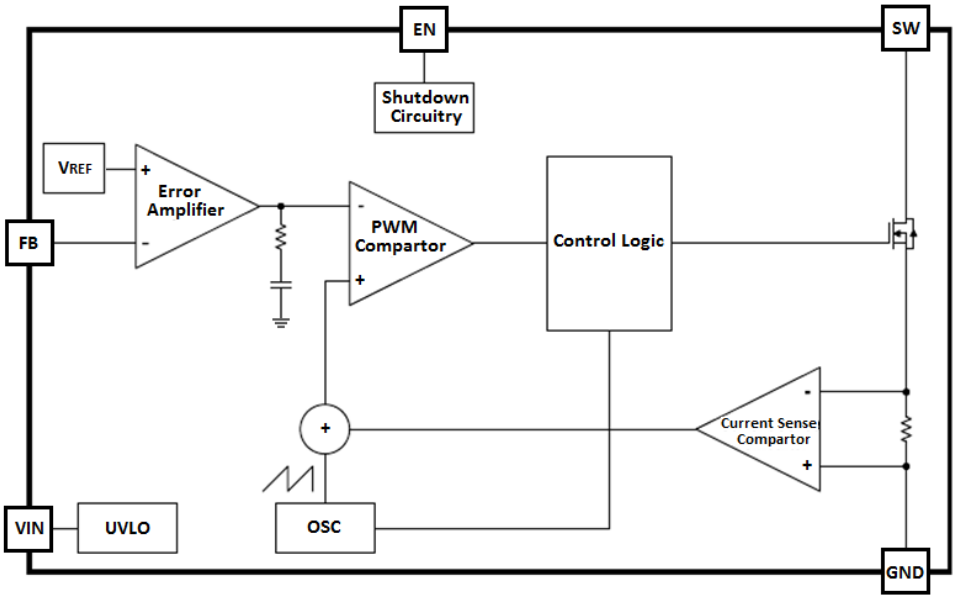
Enable Response

V_{IN}=5V, V_{OUT}=12V, I_{OUT}=800mA, EN=3V to 0V



CH1: EN, CH2: V_{OUT}, CH3: Vsw, CH4: Isw

BLOCK DIAGRAM



DETAILED DESCRIPTION

The BL8042C uses a fixed frequency, peak current mode boost regulator architecture to regulate voltage at the feedback pin. The operation of the BL8042C can be understood by referring to the 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 BL8042C has internal soft start to limit the amount of input current at startup and to also limit the amount of overshoot on the output.

The BL8042C includes a number of protection features including under-voltage lockout, current limiting, thermal shutdown protection and output over voltage protection. Output voltage protection works when FB is shorted to GND.

APPLICATION INFORMATION

Setting the output voltage

The internal reference V_{REF} 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

$$V_{OUT} = V_{REF} \times \left(1 + \frac{R_1}{R_2}\right)$$

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 BL8042C 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 BL8042C 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 BL8042C 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.

Layout consideration

When laying out the printed circuit board, the following checking should be used to ensure proper operation of the BL8042C.

Check the following in your layout:

1) The power traces, consisting of the GND trace, the SW trace and the VIN, trace should be kept short, direct and wide.

2) Keep the (+) plates of Cin connect to Vin as closely as possible. This capacitor provides the AC current to the internal power MOSFETs.

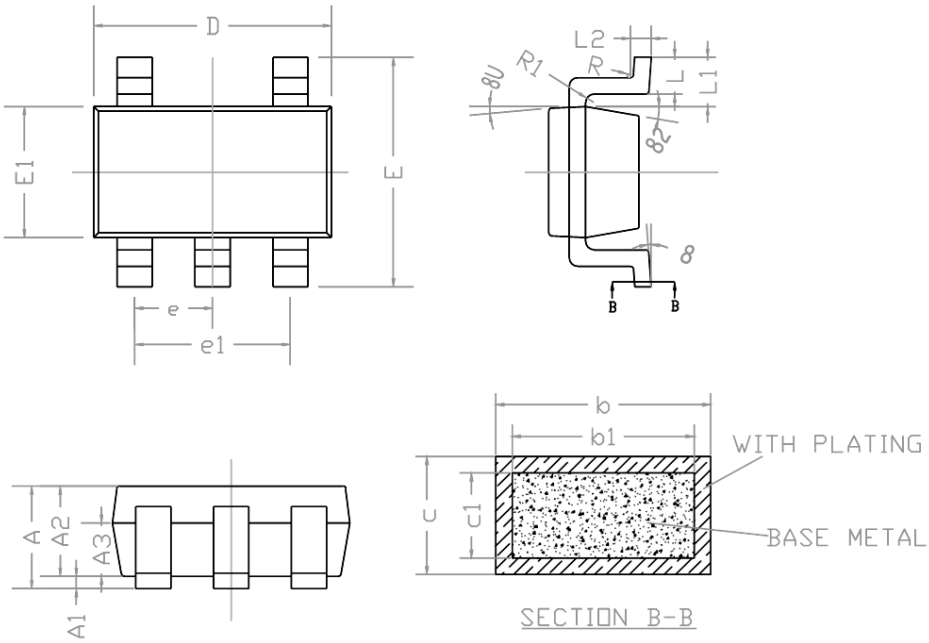
3) Keep the switching node SW away from the sensitive VOUT node.

4) Keep the (-) plates of Cin and Cout as close as possible.

PACKAGE OUTLINE

Package	SOT23-5	Devices per reel	3000pcs

Package dimension:



COMMON DIMENSION (MM)				DIMENSION In Inches		
PKG	SOT23-5L			SOT23-5L		
REF.	MIN.	NOM.	MAX	MIN.	NOM.	MAX
A	-	-	1.250	-	-	0.049
A1	0.000	-	0.150	0.00	-	0.006
A2	1.000	1.100	1.200	0.039	0.043	0.047
A3	0.600	0.650	0.700	0.024	0.026	0.028
b	0.360	-	0.500	0.014	-	0.020
b1	0.360	0.380	0.450	0.014	0.015	0.018
c	0.140	-	0.200	0.006	-	0.008
c1	0.140	0.150	0.160	0.006	0.006	0.006
D	2.826	2.926	3.026	0.111	0.115	0.119
E	2.600	2.800	3.000	0.102	0.110	0.118
E1	1.526	1.626	1.726	0.060	0.064	0.068
e	0.900	0.950	1.000	0.035	0.037	0.039
e1	1.800	1.900	2.000	0.071	0.074	0.079
L	0.350	0.450	0.600	0.014	0.018	0.024
L1	0.590REF			0.023REF		
L2	0.250BSC			0.010BSC		
R	0.050	-	-	0.002	-	-
R1	0.050	-	0.200	0.002	-	0.008
θ	0°	-	8°	0°	-	8°
θ1	3°	5°	7°	3°	5°	7°
θ2	6°	-	14°	6°	-	14°