BL9382B

20V 2A Synchronous Buck Converter

DESCRIPTION

The BL9382B is a high efficiency current-mode synchronous, 20V/2A buck converter. Its input voltage ranges from 4.5V to 20V and it provides an adjustable regulated output voltage from 0.923V to 17V while delivering up to 2A of output current.

The internal synchronous switches increase efficiency and eliminate the need for an external Schottky diode. The switching frequency is set to 350KHz.

BL9382B consists of many protection block such as UVLO, thermal protection and output short circuit protection.

The BL9382B is available in the SOP8 and ESOP8 (with exposed pad for heat dissipation) package

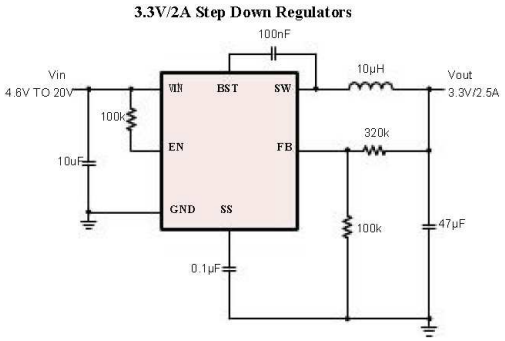
FEATURES

- Adjustable Output Voltage, Vfb=0.923V
- Maximum output current is 2A
- Range of operation input voltage: Max 20V
- Standby current: 60uA (typ.)
- Operating current at zero load: 0.1mA (typ.)
- Line regulation: 0.1%/V (typ.)
- Load regulation: 10mV (typ.)
- High efficiency, up to 94%
- Environment Temperature: -20°C~85°C

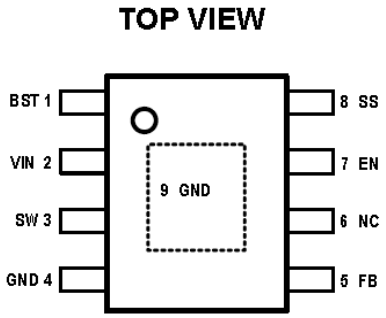
APPLICATIONS

- Set-top-box
- Consumer Electronic Device for automobile
- LCD Monitor and LCD TV
- Portable DVD
- ADSL Modem, WLAN router
- Other 12V or double cell Li-ion battery powered device

TYPICAL APPLICATION



PIN OUT



SOP8 and ESOP8

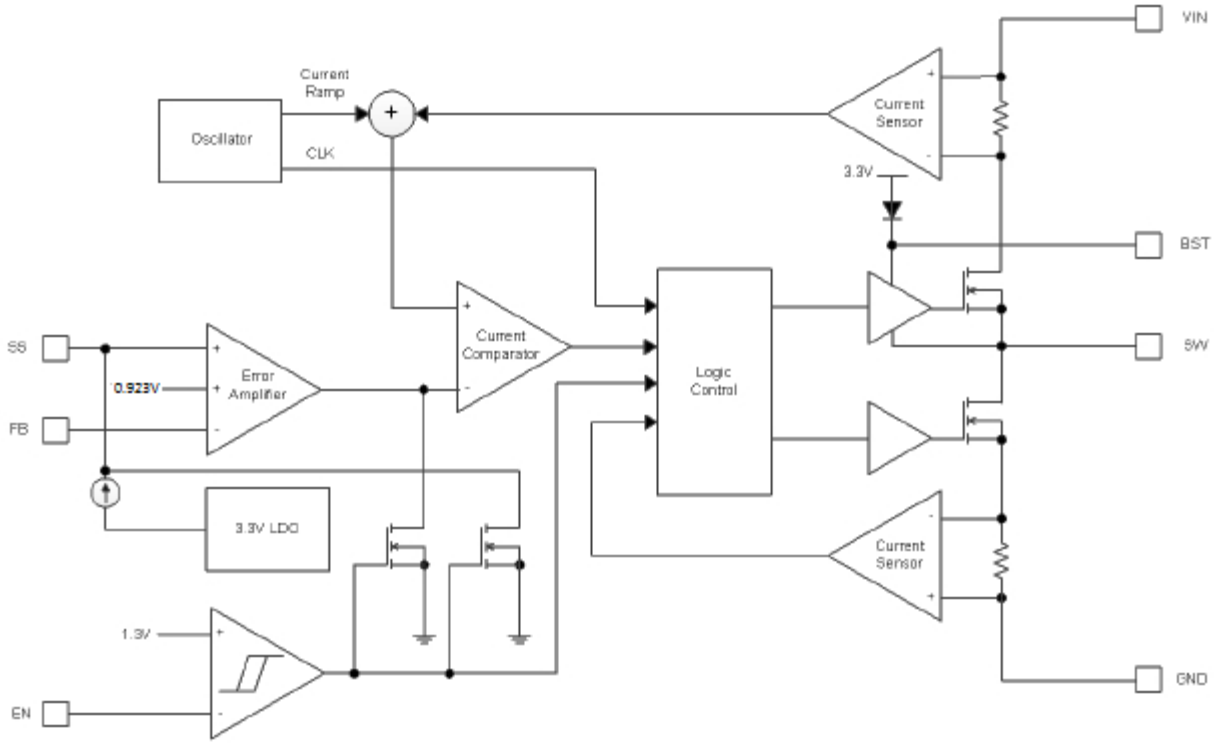
MARK and ORDERING INFORMATION

Mark Explanation		Ordering Information	
XX: Year YY: Week ZZ: Internal code	BL9382B XXYY ZZ	SOP8 2500pcs/reel	BL9382BCD8TR
		ESOP8 2500pcs/reel	BL9382BCS8TR

PINOUT DESCRIPTION

PIN #	NAME	DESCRIPTION
1	BST	High side power transistor gate drive boost input
2	VIN	Power input, the input capacitor should be placed as close to VIN and GND pin as possible
3	SW	Power switching node to connect inductor
4	GND	Ground.
5	FB	Feedback input with reference voltage set to 0.923
6	NC	No Connection.
7	EN	Enable input. Setting it to high level or connecting to Vin via a resistor may turn on the chip, while setting it to ground level will turn off the chip.
8	SS	Soft-start node. Connecting a 0.1uF capacitor to ground make the Buck converter output rise smoothly.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

Parameter		Value
Max Input Voltage		22V
Junction Temperature(Tj)		125°C
Ambient Temperature(Ta)		-20°C to + 85°C
Package Thermal Resistance (θjc)	SOP-8L	45°C / W
	ESOP-8L	10°C / W
Storage Temperature(Ts)		-40°C to +150°C
Lead Temperature & Time		260°C, 10S

Note: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.

RECOMMENDED WORK CONDITIONS

Parameter	Value
Input Voltage Range	4.5~20V
Operating Junction Temperature(Tj)	-20°C to +125°C

ELECTRICAL CHARACTERISTICS

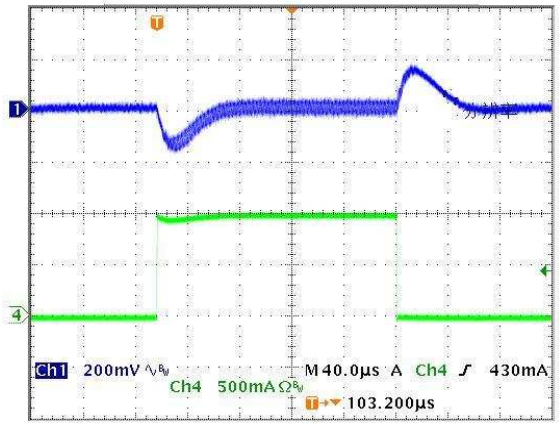
(VIN=12V, T_A=25°C)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VDD	Input Voltage Range		4.5		20	V
UVLO_UP	UVLO,IN UVLO Rising		4.0	4.2	4.4	V
UVLO Threshold Hysterisis				310		mV
Vref	Feedback Voltage	Vin=12V, Ven=5V	0.900	0.923	0.946	V
Ifb	Feedback Leakage current			0.1	0.4	uA
Iq	Quiescent Current	Active, Vfb=1V, No Switching		60		uA
		Shutdown, Vin=8V		0.1	3	uA
LnReg	Line Regulation	Vin=5V to 12V		0.1		%/V
LdReg	Load Regulation	Iout=0.1 to 2A		0.02		%/A
Fsoc	Switching Frequency	Ven=2V, Vin=12V		350		KHz
RdsonP	PMOS Rdson			100		mohm
RdsonN	NMOS Rdson			100		mohm
Ilimit	Peak Current Limit			2.7		A
Venh	EN High Threshold		1.3			V
Venl	EN Low Threshold				0.5	V
TSD	Over Temperature Proection			150		°C

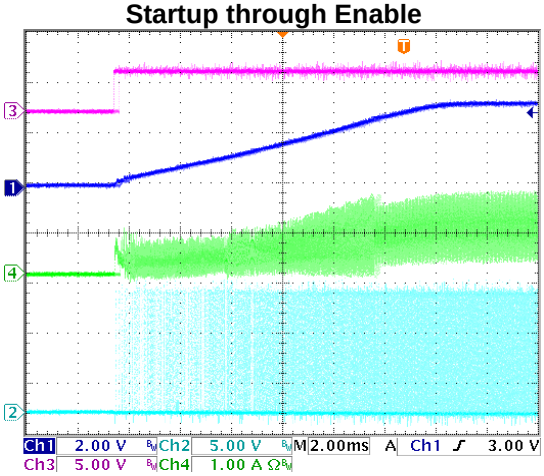
TYPICAL PERFORMANCE CHARACTERISTICS

(Vin=12V, Vout=3.3V, L=10uH, Cin=10uF, Cout=22uF, T_A=25°C, unless otherwise stated)

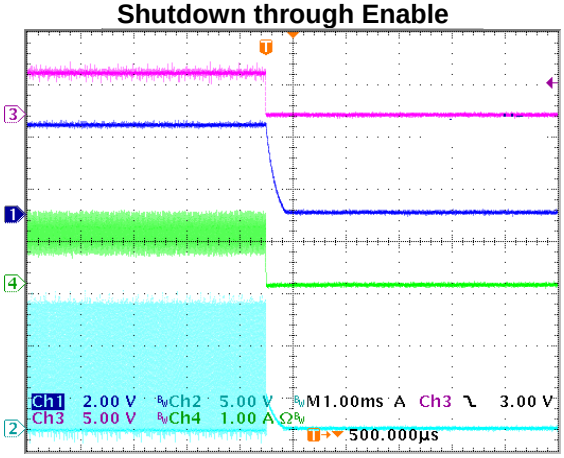
Fast Transient Response



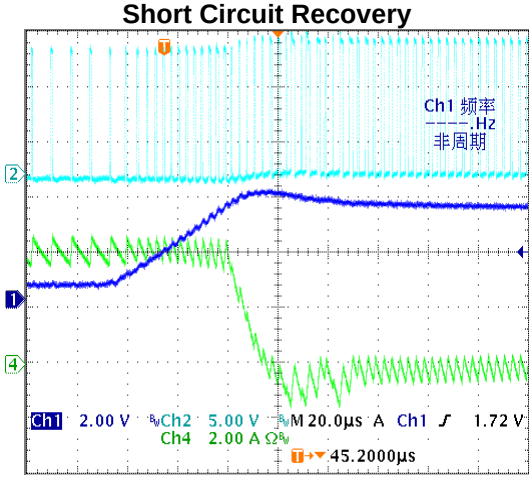
Startup through Enable



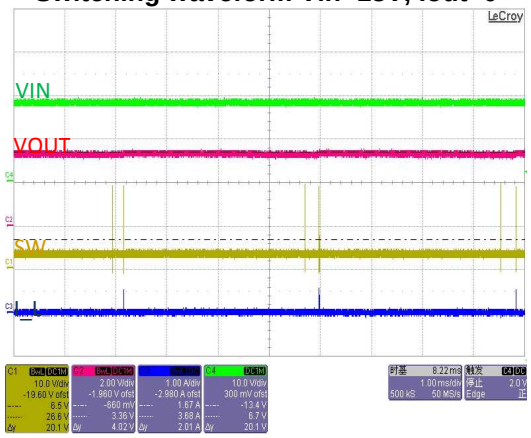
Shutdown through Enable



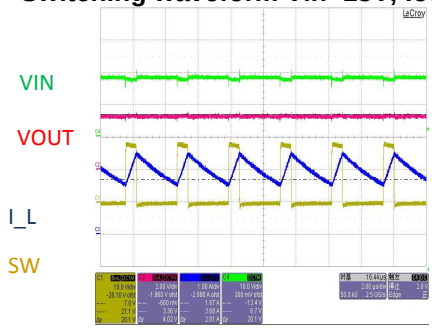
Short Circuit Recovery



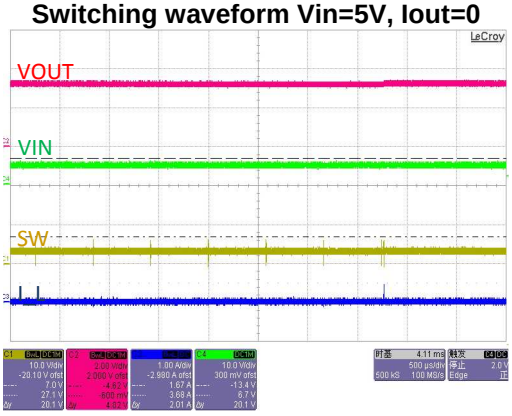
Switching waveform Vin=18V, Iout=0



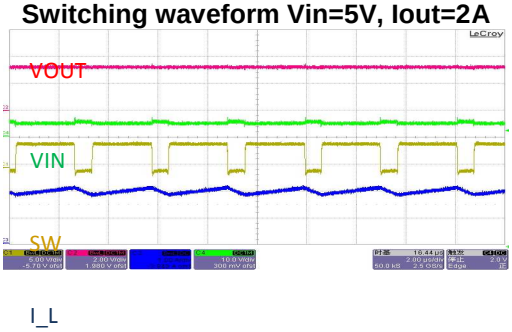
Switching waveform Vin=18V, Iout=2A



Switching waveform Vin=5V, Iout=0



Switching waveform Vin=5V, Iout=2A



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FUNCTIONAL DECRIPTIONS

The BL9382B is a synchronous, current-mode, step-down regulator. It regulates input voltages from 4.5V to 20V down to an output voltage as low as 0.923V, and is capable of supplying up to 2A of load current.

Current-Mode Control

The BL9382B utilizes current-mode control to regulate the output voltage. The output voltage is measured at the FB pin through a resistive voltage divider and the error is amplified by the internal transconductance error amplifier. Output of the internal error amplifier is compared with the switch current measured internally to control the output current limit.

PFM Mode

The BL9382B operates in PFM mode at light load. In PFM mode, switch frequency is continuously controlled in proportion to the load current, i.e. switch frequency is decreased when load current drops to boost power efficiency at light load by reducing switch-loss, while switch frequency is increased when load current rises, minimizing both load current and output voltage ripples.

Shut-Down Mode

The BL9382B operates in shut-down mode when voltage at EN pin is driven below 0.5V. In shut-down mode, the entire regulator is off and the supply current consumed by the BL9382B drops below 0.1uA.

Power Switch

N-Channel MOSFET switches are integrated on the BL9382B to down convert the input voltage to the regulated output voltage. Since the top MOSFET needs a gate voltage great than the input voltage, a boost capacitor connected between BST and SW pins is required to drive the gate of the top switch. The boost capacitor is charged by the internal 3.3V rail when SW is low.

Vin Under-Voltage Protection

A resistive divider can be connected between Vin and ground, with the central tap connected to EN, so that when Vin drops to the pre-set value, EN drops below 1.1V to trigger input under voltage lockout protection.

Vout Over-Voltage Protection

When output voltage rises above its regulated value, both the top and bottom power switches are turned off. Switching of the internal clock is also disabled. Only when output voltage falls to its regulated value can the internal clock, top power switch, and bottom power switch become active again.

Output Current Run-Away Protection

At start-up, due to the high voltage at input and low voltage at output, current inertia of the output inductance can be easily built up, resulting in a large start-up output current. A valley current limit is designed in the BL9382B so that only when output current drops below the valley current limit can the bottom power switch be turned off. By such control mechanism, the output current at start-up is well controlled.

Output Short Protection

When output is shorted to ground, output current rapidly reaches its peak current limit and the top power switch is turned off. Right after the top power switch is turned off, the bottom power switch is turned on and stay on until the output current falls below the valley current limit. When output current is below the valley current limit, the top power switch will be turned on again and if the output short is still present, the top power switch is turned off when the peak current limit is reached and the bottom power switch is turned on. This cycle goes on until the output short is removed and the regulator comes into normal operation again.

Thermal Protection

When the temperature of the BL9382B rises above 150°C, it is forced into thermal shut-down. Only when core temperature drops below 125°C can the regulator becomes active again.

COMPONENT SELECTRION

When setting up the BL9382B for different output voltage, please use following recommended component value for the best performance.

V_{OUT} (V)	C_{OUT} (µF)	L (µH)
8	22x2	22
5	22x2	15
3.3	22x2	10
2.5	22x2	6.8
1.8	22x2	4.7
1.2	22x2	3.3

THERMAL CONSIDERATION

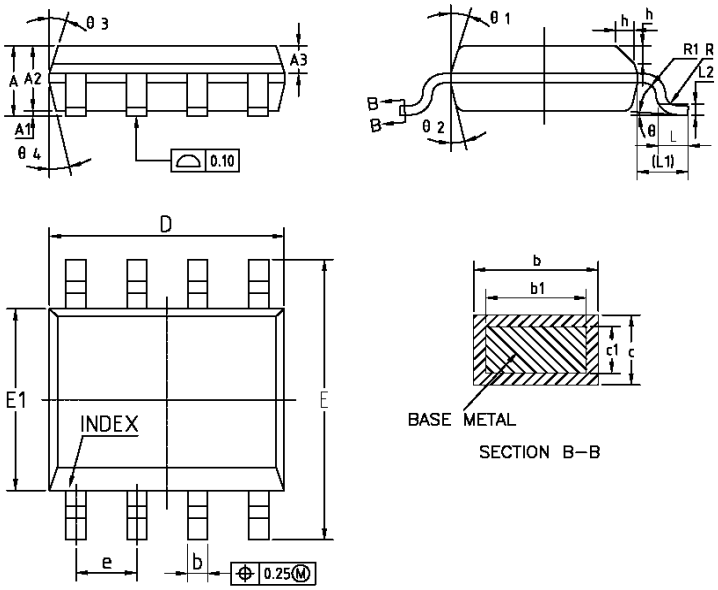
BL9382B is high efficiency Buck converter, which means it consumes very few power when converting the high voltage to low voltage. However, when output power is very large, like 5V/2A, the output power is as high as 10W, a heat dissipation path is strongly recommended to be routed on PCB. BL9382B has two different SOP8 package. For the normal SOP8, the heat is conducted out via Pin 4 (GND), so the heat dissipation route on PCB should be connected to the Pin 4 of the chip. If ESOP8 is selected, the heat dissipation copper area should be exposed and connected to the exposed pad underneath the chip body.

When output power is larger than 10W, the ESOP8 package is recommended.

PACKAGE OUTLINE

Package	SOP8			Unit	mm

Package specification：

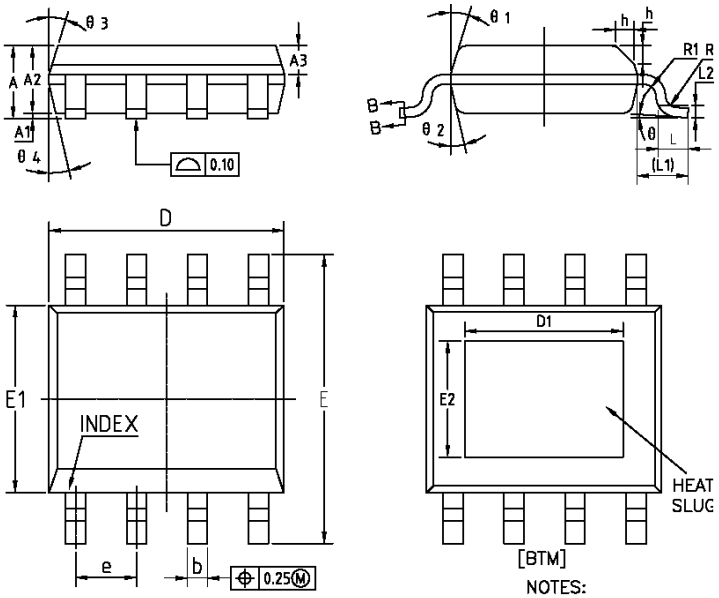


COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	–	0.51
b1	0.37	0.42	0.47
c	0.17	–	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27BSC	
L	0.45	0.60	0.80
L1		1.04REF	
L2		0.25BSC	
R	0.07	–	–
R1	0.07	–	–
h	0.30	0.40	0.50
θ	0°	–	8°
θ1	15°	17°	19°
θ2	11°	13°	15°
θ3	15°	17°	19°
θ4	11°	13°	15°

Package	ESOP8			Unit	mm

Package specification：



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0	0.10	0.15
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	–	0.51
b1	0.37	0.42	0.47
c	0.17	–	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
D1	3.10	3.30	3.50
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
E2	2.20	2.40	2.60
e		1.27BSC	
L	0.45	0.60	0.80
L1		1.04REF	
L2		0.25BSC	
R	0.07	–	–
R1	0.07	–	–
h	0.30	0.40	0.50
θ	0°	–	8°
θ1	15°	17°	19°
θ2	11°	13°	15°
θ3	15°	17°	19°
θ4	11°	13°	15°

NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARD MS–012 AA
DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.