BST3115

1. Product Overview

The BST3115 is a high voltage synchronous Buck -Boost DC/DC converter with a wide input and output voltage range of 2.7V to 40V, making it ideal for use in a variety of automotive and industrial power supplies. A proprietary low noise switching algorithm optimizes the conversion efficiency when the input voltage is higher, lower or even eqμAl to the output voltage, and ensures seamless transitions between operating modes.

Programmable frequency PWM mode operation provides low noise, high efficiency operation and the ability to switch synchronously to an external clock. Operating frequencies up to 2 MHz are supported to allow the use of small inductors for circuit miniaturization. Burst mode can be selected by pin to reduce standby current and improve light load efficiency, and the shutdown current of 3μA makes the BST3115 very suitable for battery-powered applications. Other features include output disconnection during shutdown, short-circuit protection, and internal soft start.

2. Product Features

- Wide input voltage range: 2.7V to 40V.
- Wide output voltage range: 2.7V to 40V.
- 0.8A output current; Vin ≥ 3.6V, Vout=5V.
- 2A output current; buck working mode, Vin ≥ 6V.
- Programmable frequency: 100kHz ~ 2 MHz.
- Synchronizable with external clock up to 2 MHz.
- Efficiency up to 95%.
- No-load quiescent current in Burst mode is as low as 30μA.
- Ultra-low noise Buck -Boost PWM mode.
- Built-in soft start.
- 3μA shutdown current.
- Programmable Input Undervoltage Lockout Threshold.
- 4mm × 5mm × 0.75mm DFN package.
- 2 0-pin T SSOP package.
- A EC-Q100 is suitable for automotive applications.

3. Functional Block Diagram

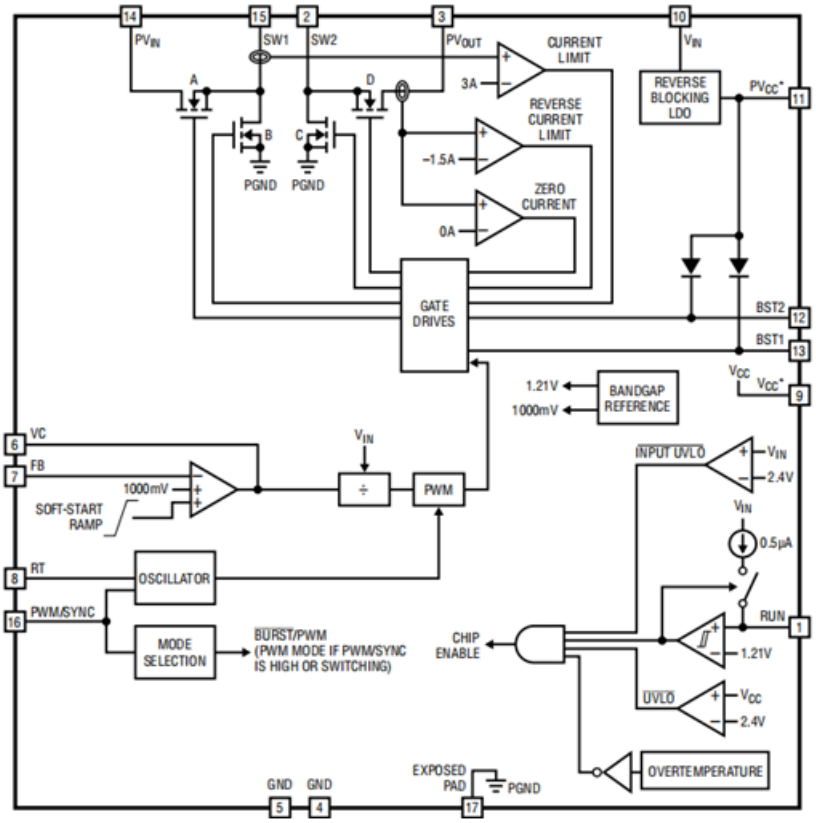


Figure 1. Functional Block Diagram

4. Pin Information

Pin Assignment Diagram

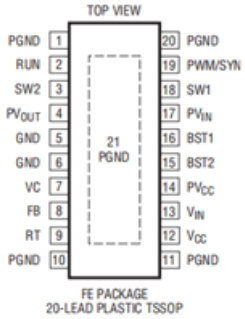


Figure 2. BST 3115 terminal arrangement diagram

Pin Description

Table 1. Terminal Function Description

Pin number	Pinout Symbol	Functional Description
1	PGND	Power Ground. This pin is connected to ground in the application, with the shortest and lowest impedance possible.
2	RUN	The input enable disables the chip as well as customizes the input UVLO threshold. This pin can be driven by an external logic signal to enable and disable the chip. The voltage on this pin can be set to an accurate undervoltage by connecting a resistor divider to the input voltage. The RUN pin voltage exceeding 1.21V enables the IC. Once enabled, 0.5μA current flows to RUN to provide hysteresis. This pin can be connected directly to the input voltage for continuous enable. The RUN pin voltage cannot be forced to exceed VIN + 0.3V under any circumstances.
3	SW2	Buck-Boost converter power switch pin, which is connected to the inductor side
4	PVOUT	Buck-Boost converter power output pin, this pin should be connected to a low ESR capacitor, at least 10μF, in applications where VOUT>20V is prone to output overload or short circuit, it is recommended to install a Schottky diode between SW2 (anode) and PVOUT (cathode). In applications where the output is short-circuited through an inductive load, it is recommended to install a Schottky diode between GND (anode) and PVOUT (cathode) to limit the transient response from PVOUT to GND.
5/6	GND	Signal Ground. These pins are the ground connections in the IC and must be grounded in the application.
7	VC	Error amplifier output. To stabilize the voltage control loop, a frequency compensation network must be connected between this pin and FB.
8	FB	Feedback Voltage Input. The resistor divider connected to this pin sets the output voltage of the Buck-Boost converter. The nominal FB voltage is 1000mV. Care should be taken when wiring connections to this pin to minimize stray coupling to the switch pin trace.
9	RT	Oscillator Frequency Programming Pin. Place a resistor between this pin and ground to set the switching frequency of the Buck-Boost converter.
10	PGND	Power Ground. This pin is connected to ground in the application, with the shortest and lowest impedance possible.
11	PGND	Power Ground. This pin is connected to ground in the application, with the shortest and lowest impedance possible.
12	VCC	Low voltage power input for control circuit. This pin supplies power to the internal IC control circuit and must be connected to the PVCC pin in the application. A 4.7μF or larger bypass capacitor should be connected between this pin and ground.
13	VIN	Power connection for internal circuits and VCC regulator. This pin provides power to the internal VCC regulator and is the input voltage sense connection for the VIN voltage divider. A 0.1μF bypass capacitor should be connected between this pin and ground, as close to the IC as possible and with a path to ground.

Pin number	Pinout Symbol	Functional Description
14	PVCC	Internal VCC regulator output. This pin is the output pin of the internal VIN to VCC regulator. PVCC is also the power supply for the power switch driver. If the wire length from PVCC to VCC cannot be shortened, an additional bypass capacitor should be connected from this pin to ground. The VCC and PVCC pins must be connected together in the application.
15	BST2	SW2 bootstrap capacitor pin. This pin must be connected to SW2 through a 0.1μF capacitor. This pin is used to generate the gate drive power supply of the power switch D
16	BST1	SW1 bootstrap capacitor pin. This pin must be connected to SW1 through a 0.1μF capacitor. This pin is used to generate the gate drive power supply of power switch A.
17	PVIN	Buck-Boost converter power input. A 4.7μF or larger bypass capacitor should be connected between this pin and ground, as close to the IC as possible, and connected to the VIN pin in the application.
18	SW1	Buck-Boost converter power switch pin, which is connected to the inductor side
19	PWM/SYNC	Burst mode/PWM mode control pin and synchronization input pin. This pin is forced high to make the IC work in PWM mode under all loads, and the internal oscillator works at the frequency set by RT. This pin is low to make the IC work in Burst mode to improve the conversion efficiency and low standby current under light load. If the external clock signal is connected to this pin, the Buck-Boost converter will synchronize its switching frequency to the same as the external clock and work in PWM mode. The pulse width of the clock should be greater than 100ns. When using the synchronization function, the internal frequency set by RT must be lower than the synchronization frequency. The maximum operating voltage of PWM/SYNC is 5.5V. The PWM/SYNC pin can be connected to VCC to force it to remain high all the time
20	PGND	Power Ground. This pin is connected to ground in the application, with the shortest and lowest impedance possible.
twenty one	PGND	Power Ground. This pin is connected to ground in the application, with the shortest and lowest impedance possible.

5. Absolute Maximum Ratings and Recommended Operating Ranges

Absolute Maximum Ratings

Input and output voltage (VIN, *PVIN, PVOUT*)…….... -0.3 ～45V
Switch terminal voltage ($V_{SW1,}$ V_{SW2})…… -0.3 V ～ (PVIN+0.3)V
Enable voltage (V_{RUN})....-0.3V ~ V_{IN} +0.3V
BST1 voltage to ground (V_{BST1})…….... (V_{SW1} -0.3V)～ (V_{SW1} + 6) V
BST2 voltage to ground (V_{BST2})…….... (V_{SW2} -0.3V)～ (V_{SW2} + 6) V
Other P IN voltages....-0.3V ~ 6V
Operating temperature range (T_{stg}) …….... -55°C ～150°C
Storage temperature range (T_{stg}) …….... -65°C ～150°C

Recommended working range

Recommended operating conditions are as follows:
Input voltage (V_{IN})....2. 7V～ 40V
Output voltage range.... 2.7V～ 40V
Working environment temperature (T_A)....- 55°C ～ 150°C
Operating Junction Temperature (T_J).... 175°C
Note: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device.

6. Electrical characteristics parameters

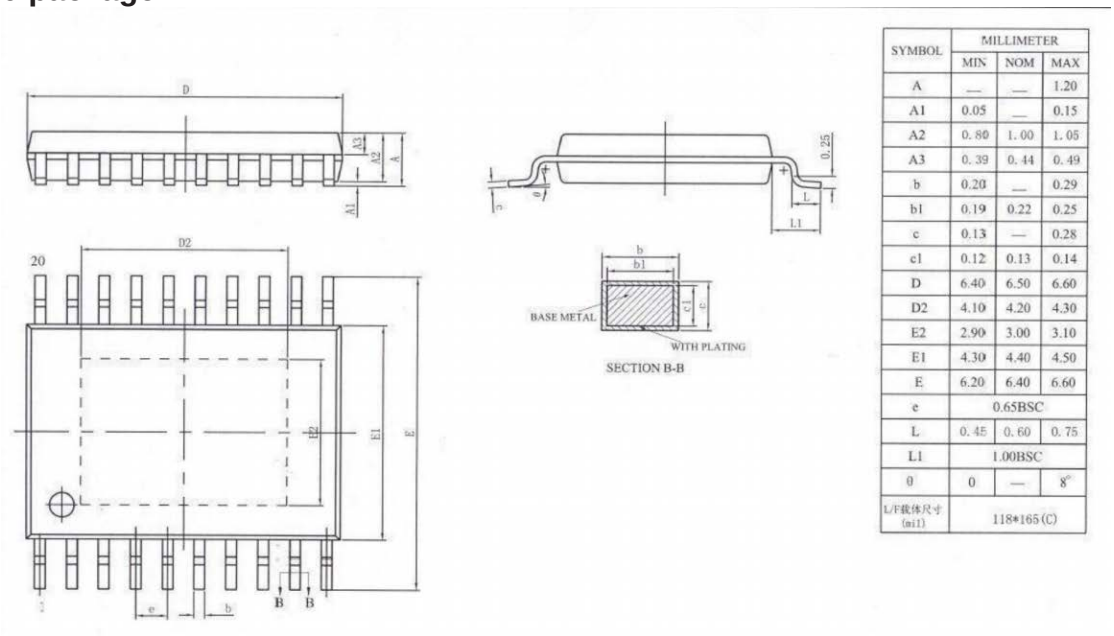
Unless otherwise specified, the electrical characteristics shall be as specified in Table 3 and shall apply to the full operating temperature range of -55°C ≤ T_A ≤ *125*°C and shall be tested in accordance with GB/T 17940-2000.

Table 2. Electrical characteristics

parameter	Conditions: PVIN=VIN=24V,PVOUT=5V, Unless otherwise stated, typical values are measured at T_A = +25°C	Standard parameters			unit
		Minimum	typical	maximum	
Input voltage range		2.7		40	V
Output voltage range		2.7		40	V
Input Undervoltage Lockout Threshold	VIN decrease		2.4	2.7	V
	VIN rises		2.6	2.8	V
	VIN rise (0℃ ~ 125℃)			2.725	V
VIN UVLO Hysteresis			100		mV
VCC Undervoltage Lockout Threshold	VCC drops		2.4	2.6	V
VCC UVLO Hysteresis			200		mV
Input shutdown current	VRUN=0V		3	10	μA
Input Quiescent Current in Burst Mode	VFB=1.1V, no switch, VPWM/SYNC=LOW		50		μA
Oscillation frequency	RT=35.7K, VPWM/SYNC=HIGH	900	1000	1100	KHz
Oscillator operating frequency	VPWM/SYNC=HIGH	0.1		2	MHz
PWM/SYNC input frequency		0.1		2	MHz
PWM/SYNC logic threshold		0.5	1	1.5	V
Soft start time			9		ms
Feedback voltage		977	1000	1017	mV
Feedback voltage linear regulation rate	VIN=2.7V ~ 40V		0.1		%
Feedback pin input current			1	50	nA
RUN Pin Logic Threshold		0.3	0.8	1.1	V
RUN Pin Comparator Threshold	VRUN Rising	1.16	1.21	1.26	V
RUN pin hysteresis current			500		nA
RUN pin hysteresis voltage			100		mV
Inductor Current Limit		2.4	3.0	3.7	A
Reverse Inductor Current Limit	Current flows into PVOUT		1.5		A
Burst Mode Inductor Current Limit		0.65	1	1.35	A
Maximum duty cycle	In Boost mode, SW2 is a low percentage, RT=35.7K	90	95		%
Minimum duty cycle	In Buck mode, SW1 is high percentage, RT=35.7K			0	%
SW1, SW2 minimum low level time	RT=35.7K		100		ns
NMOS switch internal resistance	Switch A (PVIN to SW1)		150		mΩ
	Switch B (SW1 to PGND)		150		mΩ
	Switch C (SW2 to PGND)		150		mΩ
	Switch D (PVOUT to SW2)		150		mΩ
PVCC/VCC external voltage		4.58		5.5	V
VCC Adjust Voltage	Ivcc =1mA	4.33	4.45	4.58	V
VCC load regulation	Ivcc = 1mA to 20mA		1.2		%
VCC Line Regulation	Ivcc = 1mA, VIN = 5V to 40V		0.5		%
VCC Current Limit	VCC=2.5V	50	110		mA
VCC voltage drop	Ivcc = 5mA, VIN = 2.7V		50		mV
VCC reverse current	VCC=5V,VIN=3.6V		10		μA

7. Dimensions

TSSOP20 package



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	—	0.15
A2	0.80	1.00	1.05
A3	0.39	0.44	0.49
b	0.20	—	0.29
b1	0.19	0.22	0.25
c	0.13	—	0.28
c1	0.12	0.13	0.14
D	6.40	6.50	6.60
D2	4.10	4.20	4.30
E2	2.90	3.00	3.10
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65BSC		
L	0.45	0.60	0.75
L1	1.00BSC		
θ	0	—	8°
L/F载体尺寸 (mil)	118*165(C)		

Package Dimensions

8. Ordering Information

Table 3. Product ordering information

Product Model	Package	Packaging materials	QµAlity Grade	Detailed specifications	Product Status
BST3115	TSSOP2 0	Plastic packaging	Military temperature level		In research