描述 / Descriptions

The BRCD3482SC is a fully integrated, high– efficiency 2A synchronous rectified step-down converter. The BRCD3482SC operates at high efficiency over a wide output current load range.
This device offers two operation modes, PWM control and PFM Mode switching control, which allows a high efficiency over the wider range of the load.
The BRCD3482SC requires a minimum number of readily available standard external components and is available in an 8-pin SOP ROHS compliant package.

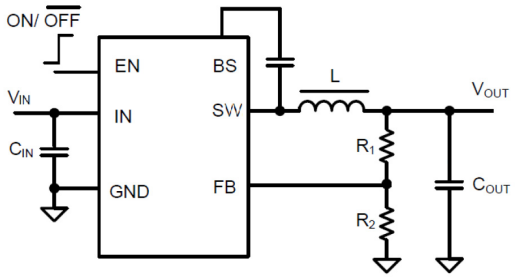
特征 / Features

- High Efficiency: Up to 94%
- 500KHz Frequency Operation
- 2A Output Current
- No Schottky Diode Required
- 4.5V to 18V Input Voltage Range
- Output Adjustable Down to 0.923V
- Slope Compensated Current Mode Control for Excellent Line and Load Transient Response
- Integrated internal compensation
- Stable with Low ESR Ceramic Output Capacitors
- Over Current Protection
- Thermal Shutdown
- Inrush Current Limit and Soft Start
- -40°C to +85°C Temperature Range

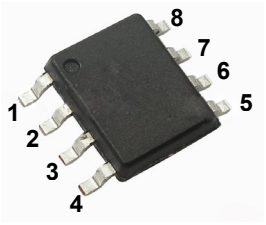
用途 / Applications

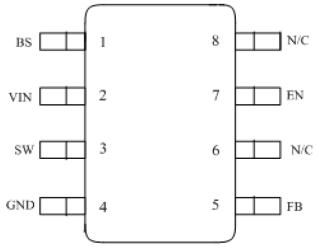
- Distributed Power Systems
- Digital Set Top Boxes
- Flat Panel Television and Monitors
- Wireless and DSL Modems

内部等效电路& 应用电路 / Equivalent Circuit or Application Circuit



引脚排列 / Pinning





PIN	NAME	FUNCTION
1	BS	Bootstrap. A capacitor connected between SW and BST pins is required to form a floating supply across the high-side switch driver
2	VIN	Power supply Pin
3	SW	Switching Pin
4	GND	Ground
5	FB	Adjustable version feedback input. Connect FB to the center point of the external resistor divider
6	NC	No Connect
7	EN	Enable Pin. EN is pulled up to 3V with a 1uA current, and contains a precise 1.4V logic threshold. Drive this pin to a logic-high or leave unconnected to enable the IC. Drive to a logic-low to disable the IC and enter micro-power shutdown mode
8	NC	No Connect

印章代码 / Marking

见印章说明。See Marking Instructions.

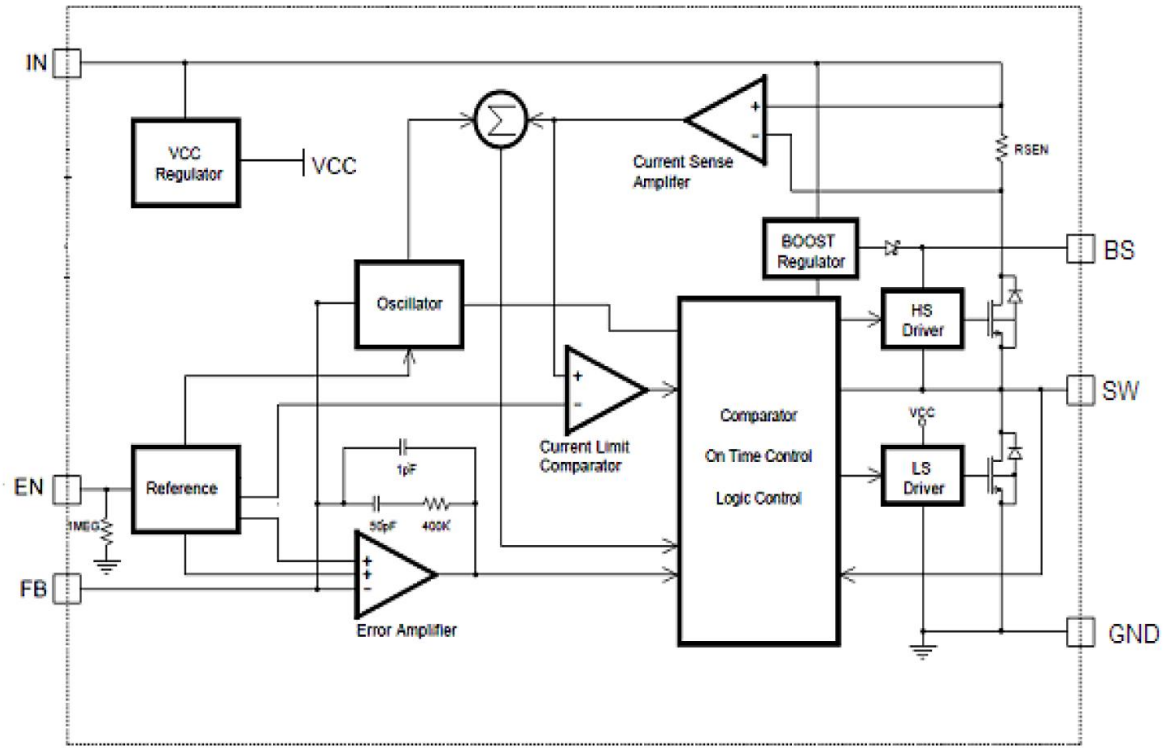
极限参数 / Absolute Maximum Ratings(Ta=25℃)

参数 Parameter	数值 Rating	单位 Unit
Input Supply, EN Voltage	-0.3 to 21	V
FB Voltages	-0.3 to 6.0	V
SW Voltage	-0.3 to (Vin+0.5)	V
BS Voltage	(V_{sw}-0.3) to (V_{sw}+5)	V
Operating Temperature Range	-40 ~+85	℃
Lead Temperature(Soldering,10s)	300	℃
Storage Temperature Range	-65~+150	℃

电性能参数 / (V_{IN}=12V, V_{OUT}=3.3V, T_A = 25°C, unless otherwise noted.)

参数 Parameter	测试条件 Test Conditions	最小值 Min	典型值 Typ	最大值 Max	单位 Unit
Input Voltage Range		4.5		18	V
UVLO Threshold			3.5	4.5	V
Supply Current in Operation	V_{EN}=2.0V, V_{FB}=1.1V		0.4	0.6	mA
Supply Current in Shutdown	V_{EN} =0 or EN = GND		4.0	8.0	μA
Regulated Feedback Voltage	T_A = 25°C, 4.5V≤V_{IN} ≤18V	0.905	0.923	0.940	V
High-Side/Low-Side Switch On-Resistance			110		mΩ
High-Side Switch Leakage Current	V_{EN}=0V, V_{SW}=0V		0	10	μA
Upper Switch Current Limit			3.0		A
Oscillation Frequency			0.5		MHz
Maximum Duty Cycle	V_{FB}=0.923V		95		%
Minimum On-Time			60		nS
Thermal Shutdown			160		℃

原理框图 / Functional Block Diagram



功能描述 / Functional Description

Internal Regulator

The BRCD3482SC is a current mode step down DC/DC converter that provides excellent transient response with no extra external compensation components. This device contains an internal, low resistance, high voltage power MOSFET, and operates at a high 500 KHz operating frequency to ensure a compact, high efficiency design with excellent AC and DC performance.

Error Amplifier

The error amplifier compares the FB pin voltage with the internal FB reference (V_{FB}) and outputs a current proportional to the difference between the two. This output current is then used to charge or discharge the internal compensation network to form the COMP voltage, which is used to control the power MOSFET current. The optimized internal compensation network minimizes the external component counts and simplifies the control loop design.

Internal Soft-Start

The soft-start is implemented to prevent the converter output voltage from overshooting during startup. When the chip starts, the internal circuitry generates a soft-start voltage (SS) ramping up from 0V to 0.923V. When it is lower than the internal reference (REF), SS overrides REF so the error amplifier uses SS as the reference. When SS is higher than REF, REF regains control. The SS time is internally fixed to 1.5 ms.

Over-Current-Protection and Hiccup

The BRCD3482SC has cycle-by-cycle over current limit when the inductor current peak value exceeds the set current limit threshold. Meanwhile, output voltage starts to drop until FB is below the Under-Voltage (UV) threshold, typically 30% below the reference. Once a UV is triggered, the BRCD3482SC enters hiccup mode to periodically restart the part. This protection mode is especially useful when the output is dead-short to ground. The average short circuit current is greatly reduced to alleviate the thermal issue and to protect the regulator. The BRCD3482SC exits the hiccup mode once the over current condition is removed.

Startup and Shutdown

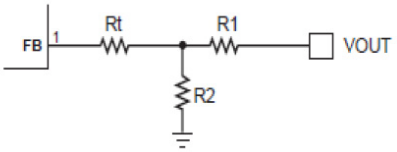
If both VIN and EN are higher than their appropriate thresholds, the chip starts. The reference block starts first, generating stable reference voltage and currents, and then the internal regulator is enabled. The regulator provides stable supply for the remaining circuitries. Three events can shut down the chip: EN low, VIN low and thermal shutdown. In the shutdown procedure, the signaling path is first blocked to avoid any fault triggering. The COMP voltage and the internal supply rail are then pulled down. The floating driver is not subject to this shutdown command.

应用信息 / Application Information

Setting the Output Voltage

The external resistor divider is used to set the output voltage (see Typical Application on page 1). The feedback resistor R1 also sets the feedback loop bandwidth with the internal compensation capacitor. Choose R1 to be around 100kΩ for optimal transient response. R2 is then given by:

$$R_2 = \frac{R_1}{V_{out} / V_{FB} - 1}$$



Selecting the Inductor

A 4.7μH to 10μH inductor with a DC current rating of at least 25% percent higher than the maximum load current is recommended for most applications. For highest efficiency, the inductor DC resistance should be less than 15mΩ. For most designs, the inductance value can be derived from the following equation.

$$L = \frac{V_{out} \times (V_{in} - V_{out})}{V_{in} \times \Delta I_L \times f_{OSC}}$$

Where ΔIL is the inductor ripple current. Choose inductor ripple current to be approximately 30% if the maximum load current, 2A. The maximum inductor peak current is:

$$I_{L(MAX)} = I_{LOAD} + \frac{\Delta I_L}{2}$$

Under light load conditions below 100mA, larger inductance is recommended for improved efficiency.

Selecting the Output Capacitor

The output capacitor (C2) is required to maintain the DC output voltage. Ceramic, tantalum, or low ESR electrolytic capacitors are recommended. Low ESR capacitors are preferred to keep the output voltage ripple low. The output voltage ripple can be estimated by:

$$\Delta V_{OUT} = \frac{V_{OUT}}{f_S \times L} \times \left[1 - \frac{V_{OUT}}{V_{IN}}\right] \times \left[R_{ESR} + \frac{1}{8 \times f_S \times C_2}\right]$$

应用信息 / Application Information

Where L is the inductor value and RESR is the equivalent series resistance (ESR) value of the output capacitor. In the case of ceramic capacitors, the impedance at the switching frequency is dominated by the capacitance. The output voltage ripple is mainly caused by the capacitance. For simplification, the output voltage ripple can be estimated by:

$$\Delta V_{OUT} = \frac{V_{OUT}}{8 \times f_S^{\,2} \times L \times C_2} \times \left[1 - \frac{V_{OUT}}{V_{IN}}\right]$$

In the case of tantalum or electrolytic capacitors, the ESR dominates the impedance at the switching frequency. For simplification, the output ripple can be approximated to:

$$\Delta V_{OUT} = \frac{V_{OUT}}{f_S \times L} \times \left[1 - \frac{V_{OUT}}{V_{IN}}\right] \times R_{ESR}$$

The characteristics of the output capacitor also affect the stability of the regulation system. The BRCD3482SC can be optimized for a wide range of capacitance and ESR values.

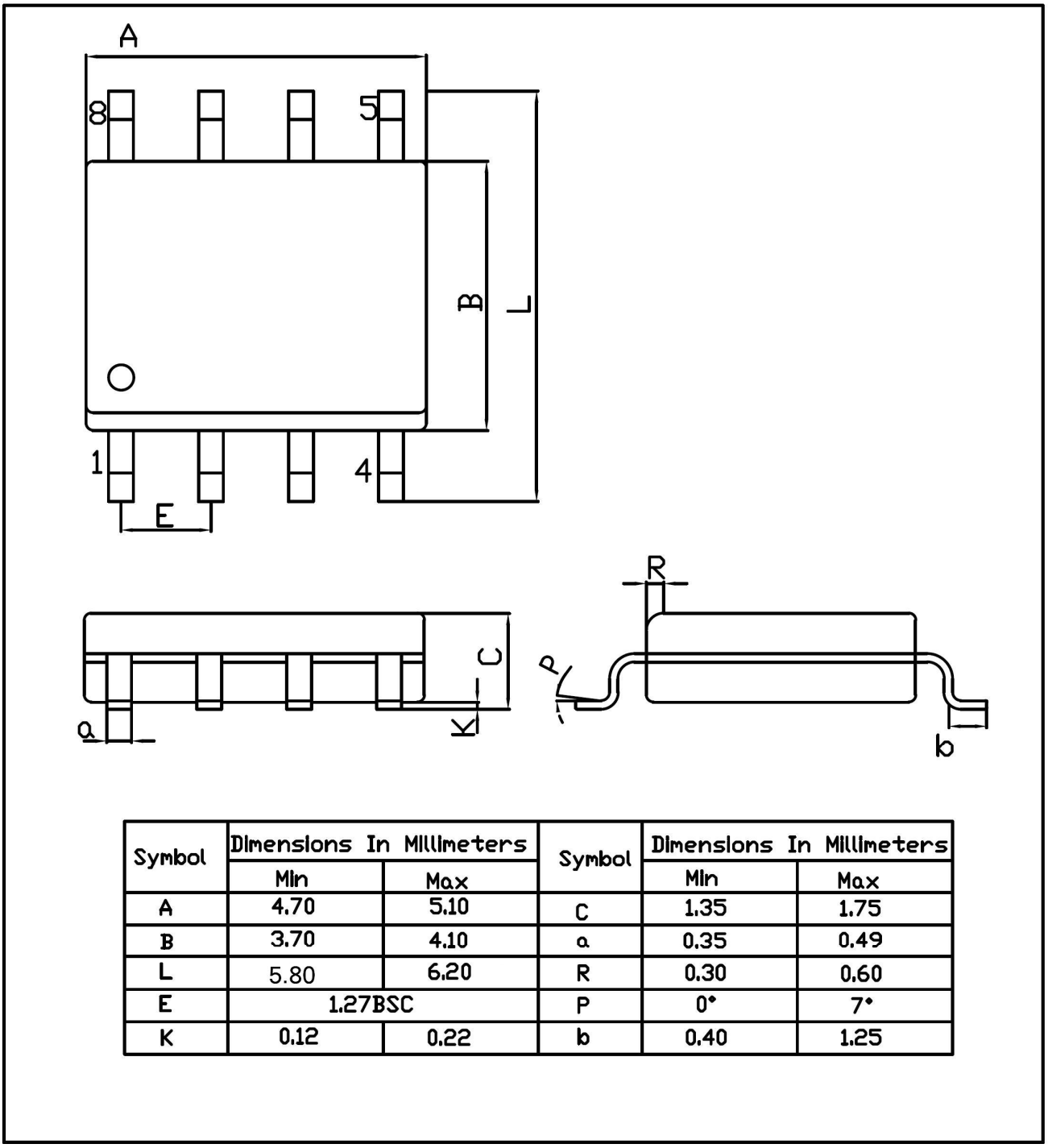
PCB Layout Guide

PCB layout is very important to achieve stable operation. It is highly recommended to duplicate EVB layout for optimum performance. If change is necessary, please follow these guidelines and take Figure 4 for reference.

1) Keep the path of switching current short and minimize the loop area formed by Input capacitor, high-side MOSFET and low-side MOSFET.
2) Bypass ceramic capacitors are suggested to be put close to the Vin Pin.
3) Ensure all feedback connections are short and direct. Place the feedback resistors and compensation components as close to the chip as possible.
4) VOUT, SW away from sensitive analog areas such as FB.
5) Connect IN, SW, and especially GND respectively to a large copper area to cool the chip to improve thermal performance and long-term reliability.
6) An example of 2-layer PCB layout is shown in Figure 4 for reference.

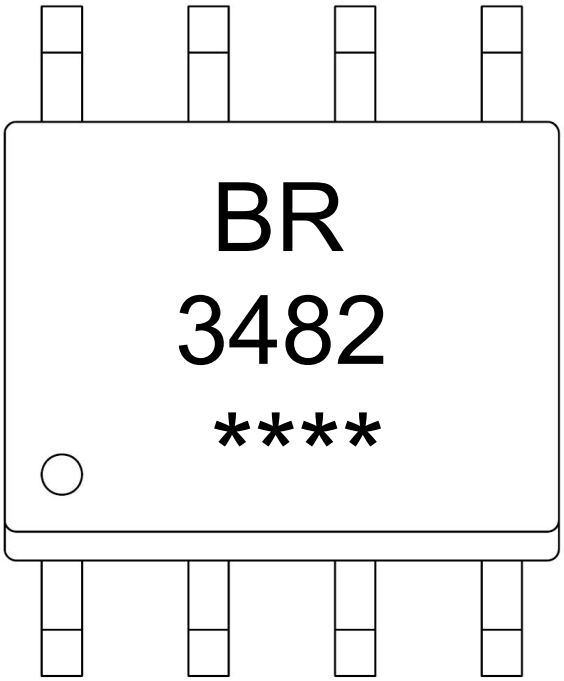
外形尺寸图 / Package Dimensions

SOP-8 Unit:mm



Symbol	Dimensions In Millimeters		Symbol	Dimensions In Millimeters	
	Min	Max		Min	Max
A	4.70	5.10	C	1.35	1.75
B	3.70	4.10	α	0.35	0.49
L	5.80	6.20	R	0.30	0.60
E	1.27BSC		P	0°	7°
K	0.12	0.22	b	0.40	1.25

印章说明 / Marking Instructions



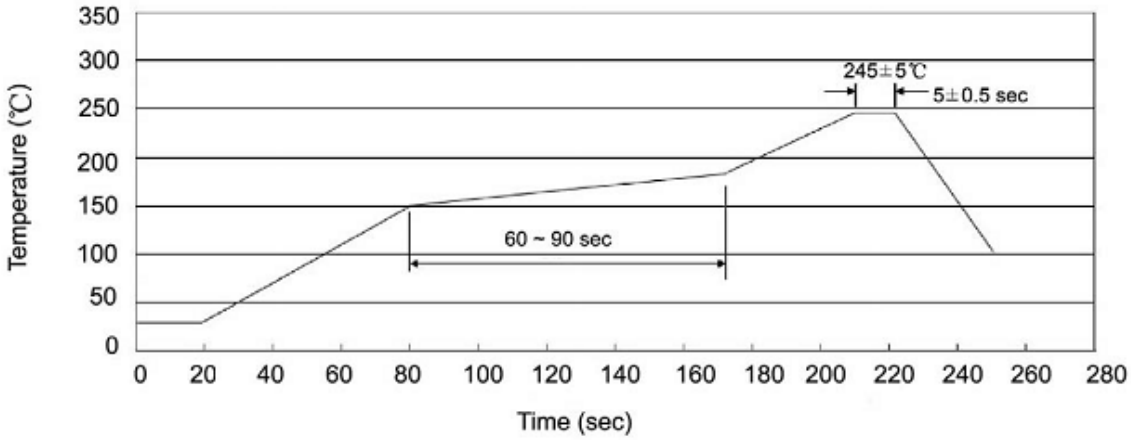
说明：

BR：	为公司代码
3482：	为产品型号
****：	为生产批号代码，随生产批号变化。

Note:

BR:	Company Code.
3482:	Product Type.
****:	Lot No. Code, code change with Lot No.

回流焊温度曲线图(无铅) / Temperature Profile for IR Reflow Soldering(Pb-Free)



说明：

1、预热温度 150～180℃，时间 60～90sec;

2、峰值温度 245±5℃，时间持续为 5±0.5sec;

3、焊接制程冷却速度为 2～10℃/sec.

Note:

1.Preheating:150~180℃, Time:60~90sec.

2.Peak Temp.:245±5℃, Duration:5±0.5sec.

3. Cooling Speed: 2~10℃/sec.

耐焊接热试验条件 / Resistance to Soldering Heat Test Conditions

温度：260±5℃ 时间：10±1 sec. Temp.:260±5℃ Time:10±1 sec

包装规格 / Packaging SPEC.

卷盘包装 / REEL

Package Type 封装形式	Units 包装数量					Dimension 包装尺寸 (unit: mm^3)		
	Units/Reel 只/卷盘	Reels/Inner Box 卷盘/盒	Units/Inner Box 只/盒	Inner Boxes/Outer Box 盒/箱	Units/Outer Box 只/箱	Reel	Inner Box 盒	Outer Box 箱
SOP/ESOP-8	4,000	2	8,000	6	48,000	13″ ×12	360×360×50	380×335×366

使用说明 / Notices