BCT1810
1A, 1.5MHz Synchronous Step-Down Converter

GENERAL DESCRIPTION

The BCT1810 is a high efficiency, high frequency synchronous DC-DC step-down converter. The 100% duty cycle feature provides low dropout operation, extending battery life in portable systems.

The internal synchronous switch increases efficiency and eliminates the need for external Schottky diode. At shutdown mode, the input supply current is less than 1μA.

The BCT1810 integrates current limit， output Short protection and thermal protection.

The BCT1810 is available in Green SOT23-5，DFN1.6×1.6-6L package, which provides a compact solution with minimal external components.

FEATURES

- 2.5V~5.5V Input Voltage Range
- 1A Output Current
- 1.5MHz Switching Frequency Minimizes the External Components
- Up to 95% efficiency
- 100% Duty Cycle in Dropout Operation
- Output Voltage as Low as 0.6V
- No Schottky Diode Required
- Internal soft-start
- Output short protection
- Output Auto-Discharge When EN Low
- Thermal protection
- SOT23-5，DFN1.6×1.6-6L Packages

APPLICATIONS

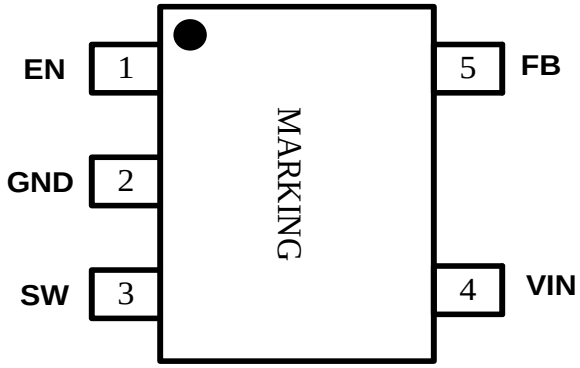
- Cellular and Smart Phones
- Portable Instruments
- Digital Cameras
- Set Top Box
- LCD TV

ORDERING INFORMATION

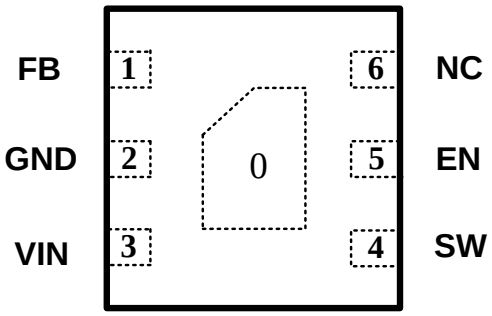
Order Number	Package Type	Temperature Range	Marking	QTY/Reel
BCT1810EUK-TR	SOT23-5	-40°C to +85°C	PGXX	3000
BCT1810ELT-TR	DFN1.6x1.6-6L	-40°C to +85°C	PGXX	3000

Note: "XX" in Marking will be appeared as the batch code.

PIN CONFIGURATION（TOP VIEW）



SOT23-5

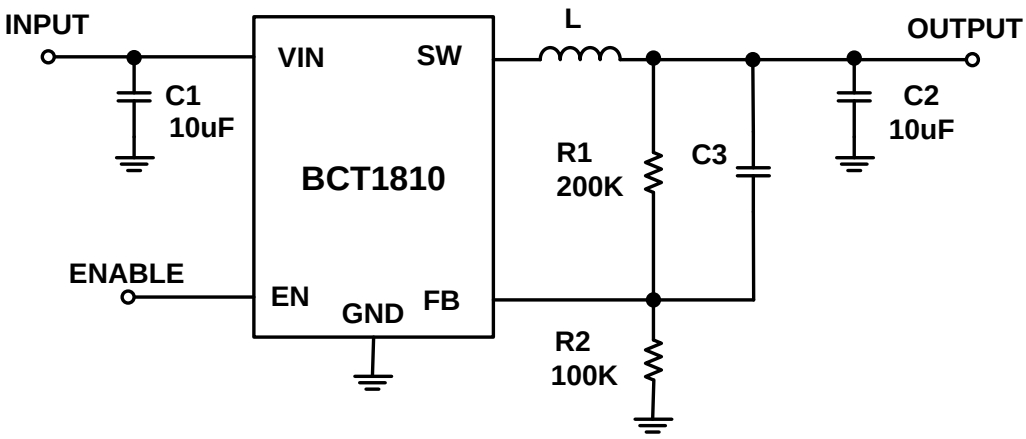


DFN1.6x1.6-6L

PIN DESCRIPTION

PIN		NAME	FUNCTION
SOT23-5	DFN1.6x1.6-6L		
1	5	EN	Drive EN pin high to turn on the regulator and low to turn off the regulator.
2	0, 2	GND	Power ground pin.
3	4	SW	Power Switching Output. Connect an inductor to the drains of internal high side PMOS and low side NMOS.
4	3	VIN	Power Supply Input. Must be closely decoupled to GND with a 4.7µF or greater ceramic capacitor.
5	1	FB	Output feedback pin. FB senses the output voltage and is regulated by the control loop to 0.6V. Connect a resistive divider at FB.
-	6	NC	No Connect

Typical Operating Circuit（VOUT=1.8V）



ABSOLUTE MAXIMUM RATINGS

Input Supply Voltage.....-0.3V to 6.5V
EN, FB ,SW PIN .....-0.3V to VIN+0.3V
SW Voltage (AC, Less than 10ns) while Switching…….
GND-3V，Vcc+3V
Storage Temperature Range.....-65℃ to +150℃
Junction Temperature.....150℃
Operating Temperature Range.....-40℃ to +85℃
Lead Temperature (Soldering, 10 sec).....260℃
Package Thermal Resistance(θ_{JA})
SOT23-5.....260℃/W
DFN1.6×1.6-6L.....179℃/W
Package Thermal Resistance(θ_{JC})
SOT23-5.....110℃/W
DFN1.6×1.6-6L.....80℃/W

NOTE:

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

CAUTION

This integrated circuit can be damaged by ESD if you don’t pay attention to ESD protection. Broadchip recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Broadchip reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact Broadchip sales office to get the latest datasheet.

ELECTRICAL CHARACTERISTICS

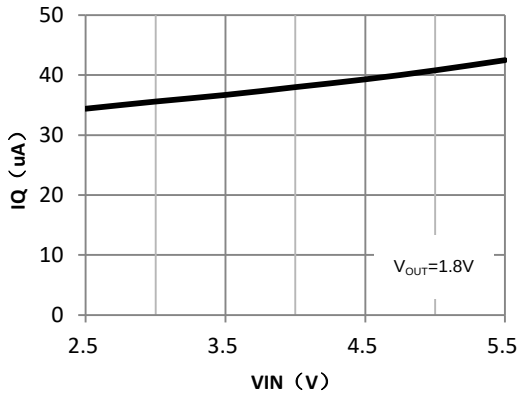
(VIN= 5V, T_A = 25℃, unless otherwise specified.)

PARAMETER	SYM	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN} Input Supply Voltage	VIN		2.5		5.5	V
V_{IN} UVLO Threshold	V_{IN_MIN}	V_{IN} Rising		2.4		V
V_{IN} Under Voltage Lockout Threshold Hysteresis	$V_{IN\_MIN\_HYST}$	V_{IN} Falling		200		mV
Shutdown Supply Current	I_{SD}	V_{EN}=0V			1	uA
Supply Current	I_Q	V_{EN}=5V, V_{FB}=0.63V		40		uA
Feedback Voltage	V_{FB}		0.585	0.600	0.615	V
Top Switch On-Resistance	$R_{DS(ON)T}$			200		mΩ
Bottom Switch On-Resistance	$R_{DS(ON)B}$			150		mΩ
Switch Frequency	F_{SW}			1.5		MHz
Top Switch Current Limit	I_{LIM_TOP}			1.5		A
Max Duty Cycle			100			%
Minimum On Time	T_{ON_MIN}			100		ns
EN Rising threshold voltage	V_{EN_H}	V_{EN} rising	1.5			V
EN Falling threshold	V_{EN_L}	V_{EN} falling			0.4	V
EN Input current	I_{IN}	V_{EN} = 0V to VIN			1	uA
Soft-Start Time	t_{SS}			1		ms
Thermal Shutdown Temperature	T_{SD}			160		℃
Thermal Shutdown Hysteresis	T_{HYS}			15		℃

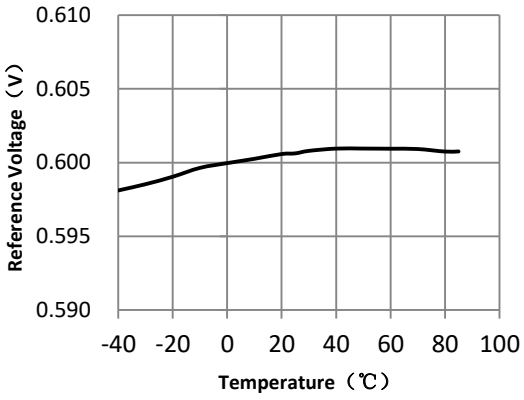
TYPICAL PERFORMANCE CHARACTERISTICS

V_{IN} = 5V ,C_{IN} = 10μF, C_{OUT} = 10μF ,L=2.2uH， T_A = +25℃, unless otherwise noted.

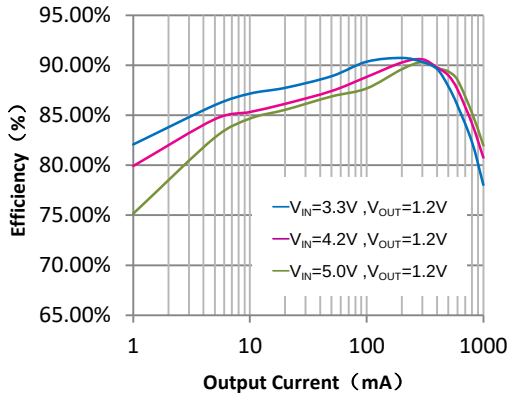
Quiescent current Vs. Input Voltage



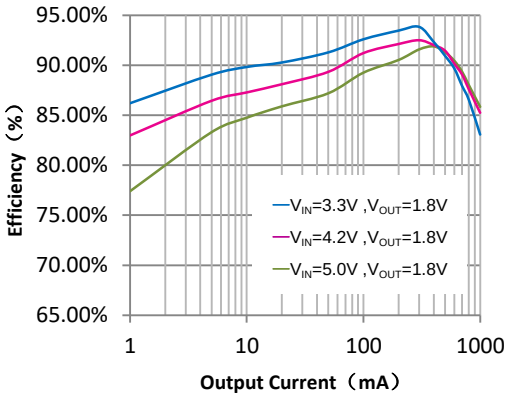
Reference Voltage Vs. Temperature



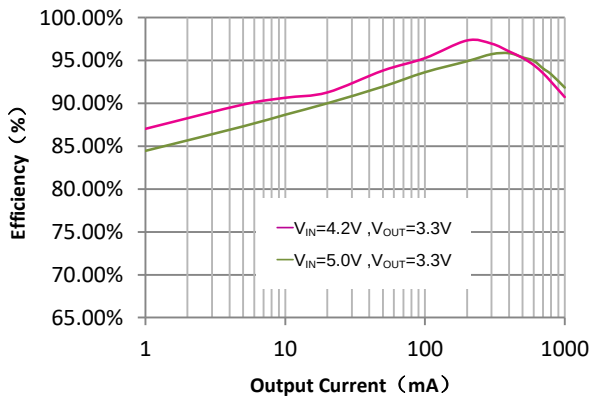
Efficiency Vs. Load Current



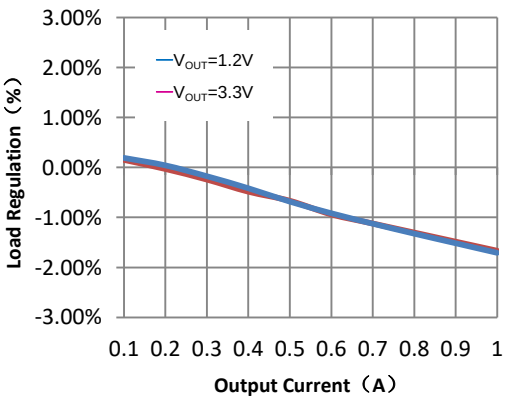
Efficiency Vs. Load Current



Efficiency Vs. Load Current



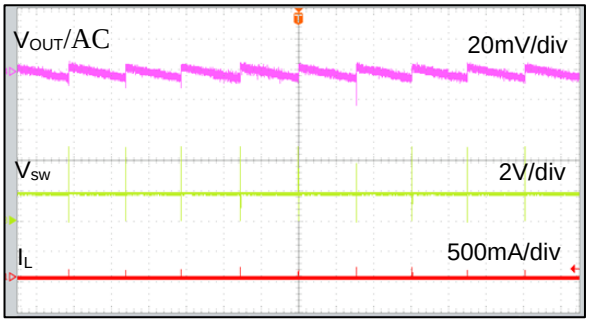
Load Regulation Vs. Output Current



TYPICAL PERFORMANCE CHARACTERISTICS

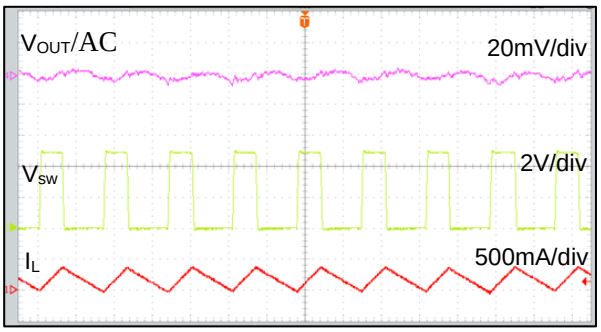
V_{IN} = 5V ,C_{IN} = 10μF, C_{OUT} = 10μF ,L=2.2uH， T_A = +25℃, unless otherwise noted.

Output Ripple（V_{OUT}=1.8V,I_O=0mA）



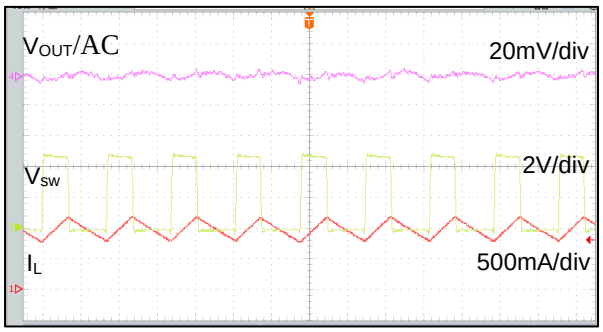
Time 2ms/div

Output Ripple（V_{OUT}=1.8V,I_O=200mA）



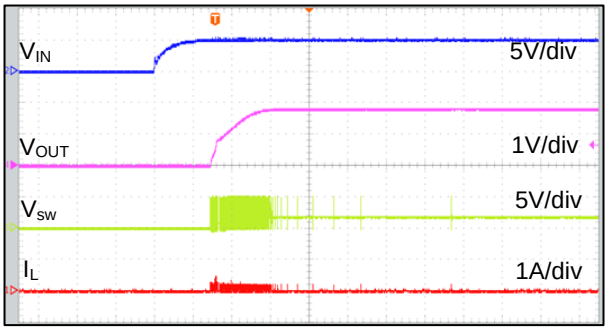
Time 400ns/div

Output Ripple（V_{OUT}=1.8V,I_O=1A）



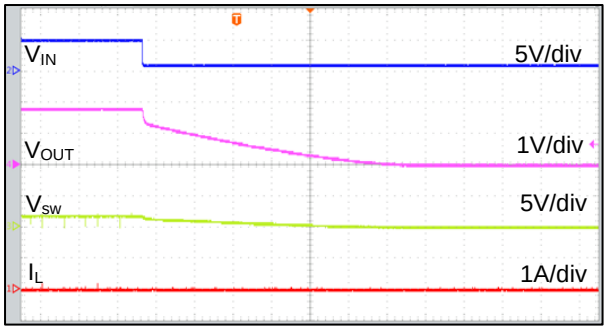
Time 400ns/div

V_{IN} Power Up（V_{OUT}=1.8V,I_O=0A）



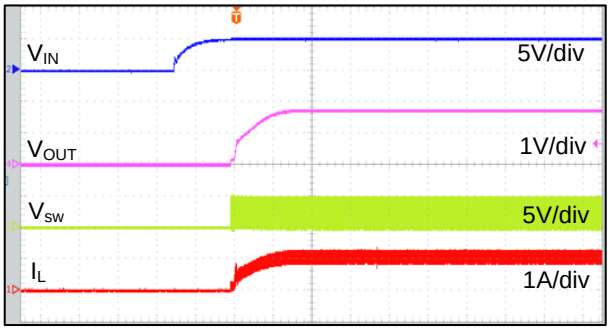
Time 400us/div

V_{IN} Power Off（V_{OUT}=1.8V,I_O=0A）



Time 10ms/div

V_{IN} Power Up（V_{OUT}=1.8V,I_O=1A）

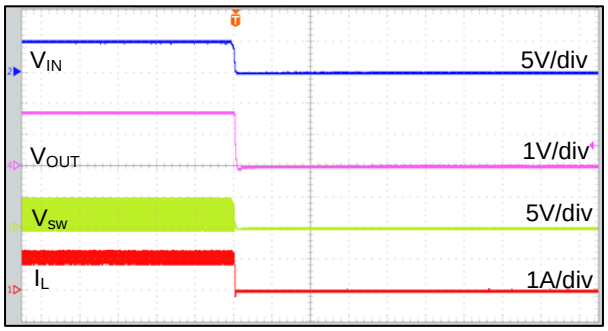


Time 400us/div

TYPICAL PERFORMANCE CHARACTERISTICS

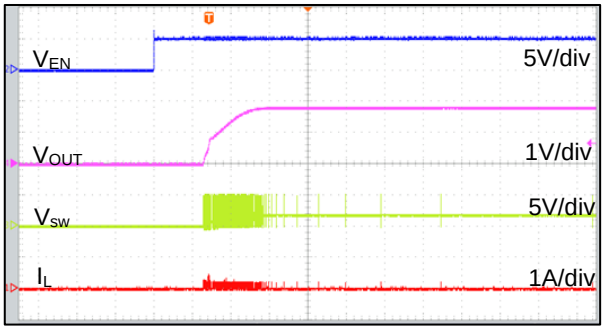
V_{IN} = 5V ,C_{IN} = 10μF, C_{OUT} = 10μF ,L=2.2uH， T_A = +25℃, unless otherwise noted.

V_{IN} Power Off（V_{OUT}=1.8V,I_O=1A）



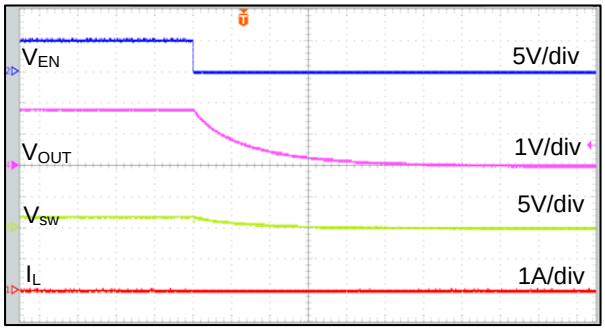
Time 400us/div

EN Start Up（V_{OUT}=1.8V,I_O=0A）



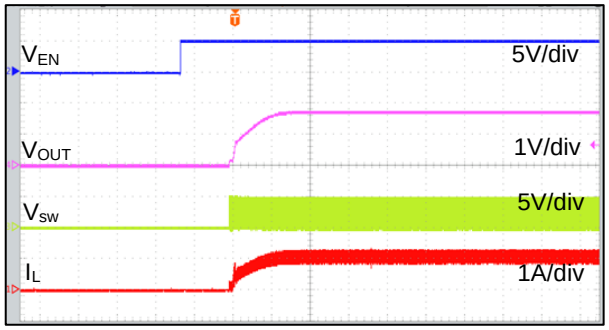
Time 400us/div

EN Shut Down（V_{OUT}=1.8V,I_O=0A）



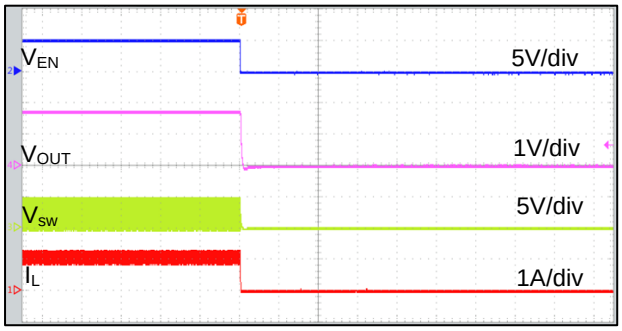
Time 400us/div

EN Start Up（V_{OUT}=1.8V,I_O=1A）



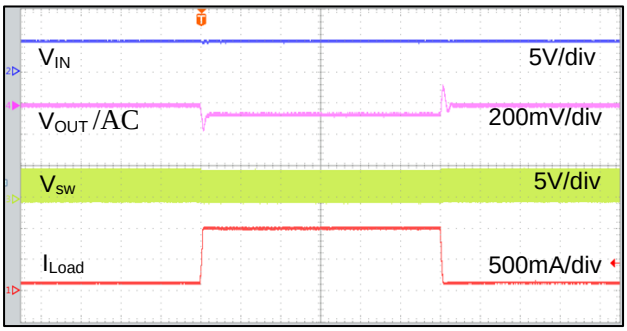
Time 400us/div

EN Shut Down（V_{OUT}=1.8V,I_O=1A）



Time 400us/div

Load Transient（V_{OUT}=1.8V,I_O=0.1A to 1A）

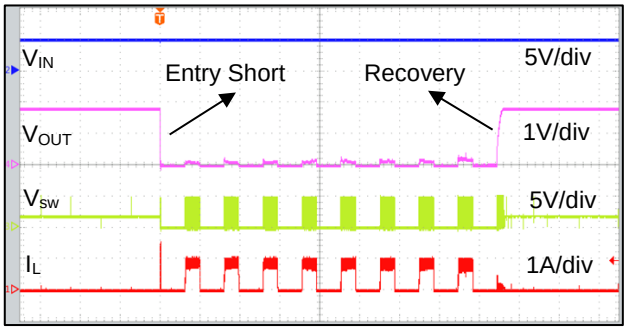


Time 100us/div

TYPICAL PERFORMANCE CHARACTERISTICS

V_{IN} = 5V ,C_{IN} = 10μF, C_{OUT} = 10μF ,L=2.2uH， T_A = +25℃, unless otherwise noted.

Short Circuit（V_{OUT}=1.8V）



Time 4ms/div

FUNCTIONAL DESCRIPTION

The BCT1810 is a high performance, 1A, 1.5MHz monolithic step-down converter. The BCT1810 requires only three external power components (CIN, COUT and L). The adjustable version can be programmed with external feedback to any voltage, ranging from 0.6V to the input voltage.

At dropout operation, the converter duty cycle increases to 100% and the output voltage tracks the input voltage minus the RDS(ON) drop of the high-side MOSFET.

The internal error amplifier and compensation provides excellent transient response, load, and line regulation. Soft start function prevents input inrush current and output overshoot during start up.

APPLICATION INFORMATION

Setting the Output Voltage

The internal reference VREF is 0.6V (Typical).The output voltage is divided by a resistor, R1 and R2 to the FB pin. The output voltage is given by:

$$V_{OUT} = 0.6 \times (1 + \frac{R1}{R2})$$

Inductor Selection

For most designs, the BCT1810 operates with inductors of 1µH to 4.7µH. Low inductance values are physically smaller but require faster switching, which results in some efficiency loss. The inductor value can be derived from the following equation:

$$L = \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times \Delta I_L \times f_S}$$

Where ΔIL is inductor Ripple Current. Large value inductors result in lower ripple current and small value inductors result in high ripple current. For optimum voltage-positioning load transients, choose an inductor with DC series resistance in the 50mΩ to 150mΩ range.

Input Capacitor Selection

The input capacitor reduces the surge current drawn from the input and switching noise from the device. The input capacitor impedance at the switching frequency should be less than input source impedance to prevent high frequency switching current passing to the input. A low ESR input capacitor sized for maximum RMS current must be used. Ceramic capacitors with X5R or X7R dielectrics are highly recommended because of their low ESR and small temperature coefficients. A 4.7µF ceramic capacitor for most applications is sufficient. A large value may be used for improved input voltage filtering.

Output Capacitor Selection

The output capacitor is required to keep the output voltage ripple small and to ensure regulation loop stability. The output capacitor must have low impedance at the switching frequency. Ceramic capacitors with X5R or X7R dielectrics are recommended due to their low ESR and high ripple current ratings.The output voltage ripple can be estimated by:

$$\Delta V_{OUT} = \frac{V_{OUT}}{f_S \times L} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right) \times \left(R_{ESR} + \frac{1}{8 \times f_S \times C2}\right)$$

PCB Layout Recommendations

When laying out the printed circuit board, the following checking should be used to ensure proper operation of the BCT1810 Check the following in your layout:

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

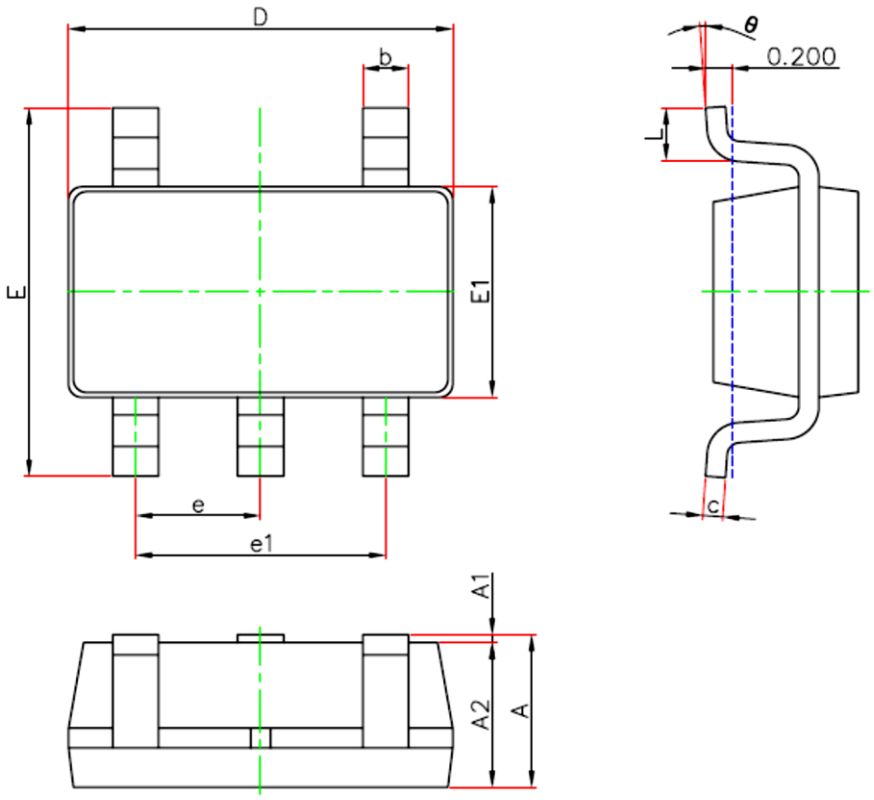
Does the (+) plates of CIN connect to VIN as closely as possible. This capacitor provides the AC current to the internal power MOSFETs.

Keep the switching node, SW, away from the sensitive VOUT node.

Keep the (-) plates of CIN and COUT as close as possible

PACKAGE OUTLINE DIMENSIONS

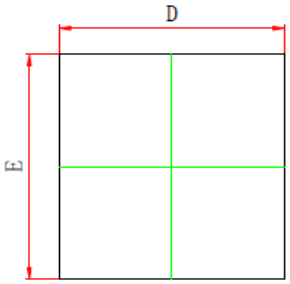
SOT23-5



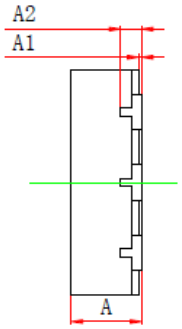
Symbol	Dimensions In Millimeters	
	Min	Max
A	1.05	1.3
A1	0	0.15
A2	1.05	1.15
b	0.28	0.5
c	0.1	0.23
D	2.82	3.02
E1	1.5	1.7
E	2.65	3.05
e	0.95(BSC)	
e1	1.8	2
L	0.3	0.6
θ	0	8°

SOT23-5 Surface Mount Package

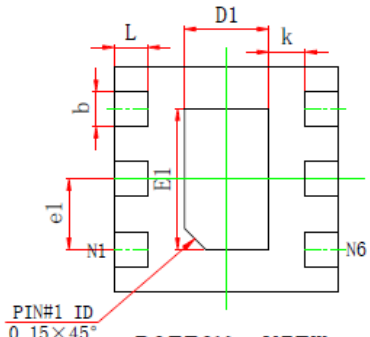
DFN1.6×1.6-6L



TOP VIEW
顶视图



SIDE VIEW
侧视图



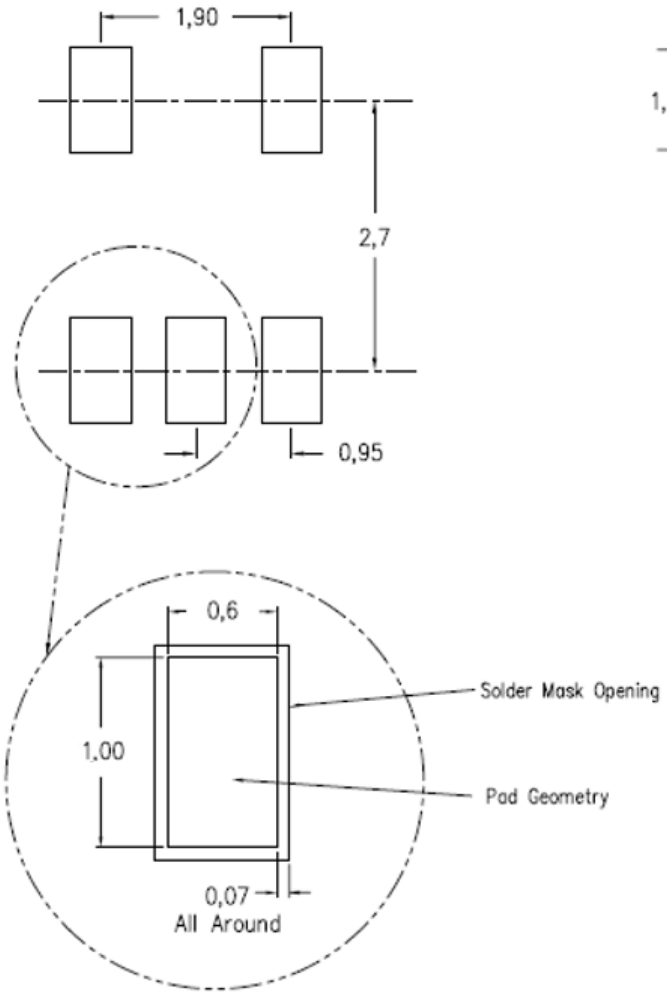
BOTTOM VIEW
背视图

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.450	0.550	0.018	0.022
A1	0.000	0.050	0.000	0.002
A2	0.150REF.		0.006REF.	
D	1.550	1.650	0.061	0.065
E	1.550	1.650	0.061	0.065
D1	0.500	0.700	0.020	0.028
E1	0.900	1.100	0.035	0.043
b	0.200	0.300	0.008	0.012
e1	0.500BSC.		0.020BSC.	
k	0.260REF.		0.010REF.	
L	0.190	0.290	0.007	0.011

DFN1.6×1.6-6L Surface Mount Package

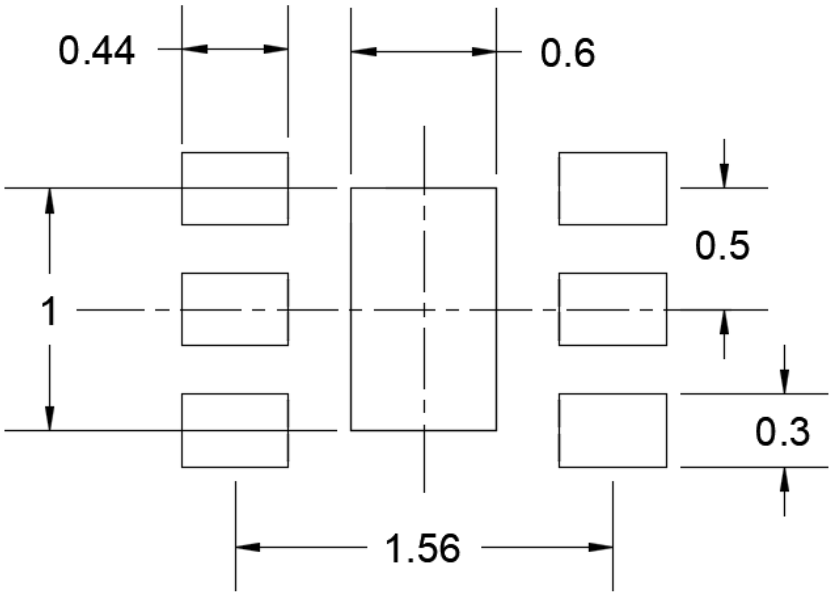
PCB Layout Pattern:

SOT23-5



RECOMMENDED PCB LAYOUT PATTERN (Unit: mm)

DFN1.6×1.6-6L



RECOMMENDED PCB LAYOUT PATTERN (Unit: mm)