TX3410K-06M5R

1.0A Synchronous Step-Down Converter

Features

- 2.7V to 5.5V Input Voltage Range
- Input over voltage protection at 6V
- 40uA quiescent current in operation
- Output current up to 1A
- Efficiency up to 95%
- OCP, SCP and OTP protection
- SOT23-5L package

Applications

- Set-top Box
- Solid State Drive
- WIFI and Network Devices
- Security surveillance system
- Toys
- TV
- All other electronic devices

General Description

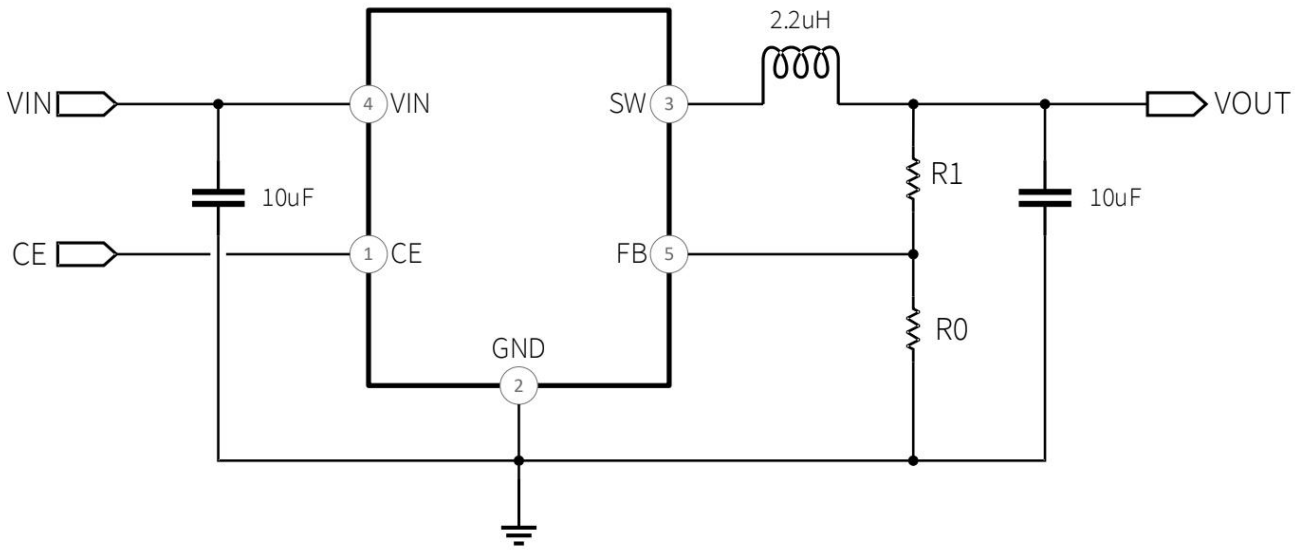
The TX3410K-06M5R is a compact 5V Buck Converter which can deliver 1A output current.

TX3410K-06M5R employs a proprietary control loop to achieve a fast transient load response. It keeps high converting efficiency in both light load and heavy load. TX3410K-06M5R is equipped with all kinds of protection, such as input over voltage protection, output short circuit protection, over current protection and over temperature protection.

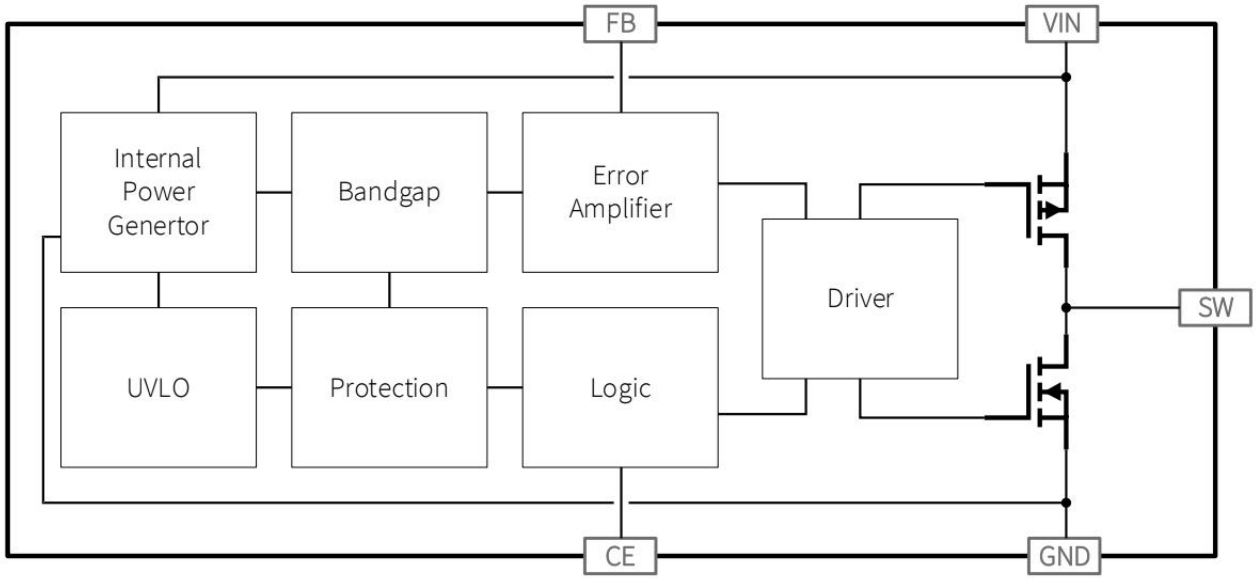
TX3410K-06M5R is consists of internal power tree generator, bandgap voltage reference module, under-Voltagelockout (UVLO) module, error amplifier, protection circuitry, driver block, current sensing block and two power MOSFETs.

TX3410K-06M5R is housed in a SOT23-5L package.

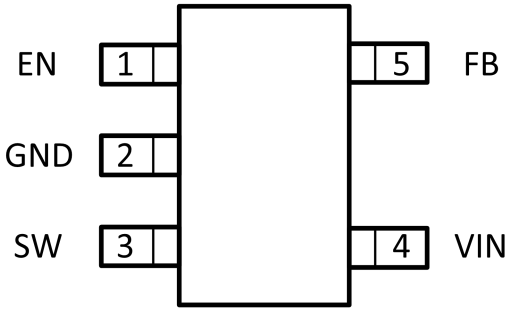
Typical Application



Block Diagram



Package/order Information



(SOT23-5)

The package of TX3410K-06M5R is SOT23-5L, with pin assignment shown in following table:

Pin Description

PIN	NAME	FUNCTION
1	EN	Chip enable pin, pull high to turn on the chip.
2	GND	Ground Pin
3	SW	The switching node, connecting a 2.2uH inductor to this node
4	VIN	The input power node, connecting a 10uF capacitor to ground.
5	FB	Feedback node, with Vfb at 0.6V

Absolute Maximum Ratings

Item	Min	Max	Unit
V_{IN} voltage(1)	-0.3	6.0	V
V_{OUT} voltage (1)	-0.3	5.5	V
Continuous Power Dissipation (TA = 25°C) (2)			
Power dissipation	Internally Limited		
Operating junction temperature, T_J	-40	125	°C
Storage temperature, T_{stg}	–65	150	°C
Lead Temperature (Soldering, 10sec.)		260	°C

Symbol	Parameter	Max.	Unit
θ_{JA}	Thermal Resistance(3)	170	℃/W
θ_{JC}		75	℃/W

Note (1): Exceeding these ratings may damage the device.

Note (2): The maximum allowable power dissipation is a function of the maximum junction temperature TJ(MAX), the junction-toambient thermal resistance θJA, and the ambient temperature TA. The maximum allowable continuous power dissipation at any ambient temperature is calculated by PD(MAX)=(TJ(MAX)-TA)/θJA. Exceeding the maximum allowable power dissipation will cause excessive die temperature, and the regulator will go into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage.

Note (3): Measured on JESD51-7, 4-layer PCB.

Electrical Charcteristics

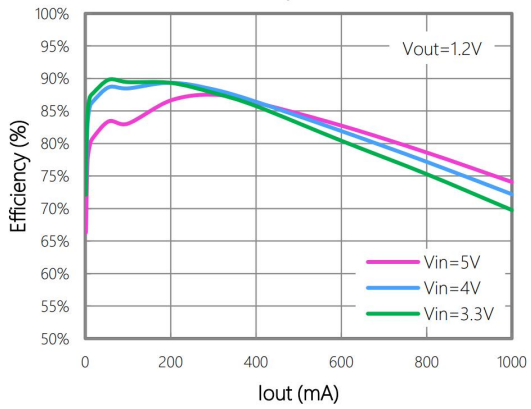
V_{IN}=5V, T_A=25°C, unless otherwise specified.

Parameter	Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range		2.7		5.5	V
Input over voltage protection		5.8	6	6.5	V
Quiescent current, I_Q	V_{IN} =5.0V	20	40	60	μA
Shutdown current, I_{OFF}	V_{IN} =5.0V , V_{CE} =0		0.	2.0	μA
Input voltage UVLO	Rising		2.55	2.65	V
	Falling	2.25	2.37		V
Feedback Voltage	V_{IN} =5.0V	0.588	0.6	0.612	V
Output current Limit	V_{IN} = 5.0V, V_{OUT} = 3.3V	1	1.2		A
Line regulation	V_{IN} = 3 to 5.0V		0.2		%/V
Load regulation	I_{OUT}= 0.1 – 1A		0.1	2	%/A
Switching frequency	V_{IN} =5.0V	1	1.5	2	MHz
ON resistance PMOS	V_{IN} =5.0V		0.38		Ω
ON resistance NMOS	V_{IN} =5.0V		0.25		Ω
CE input threshold ON	V_{IN} =5.0V		0.9	1.1	V
CE input threshold OFF	V_{IN} =5.0V	0.4	0.7		V
CE input pull down resistor			750		kΩ
Output discharge resistor, R_{pd}	V_{IN} =5.0V		600		Ω
Over temperature protection			150		℃
OTP hysteresis			40		℃

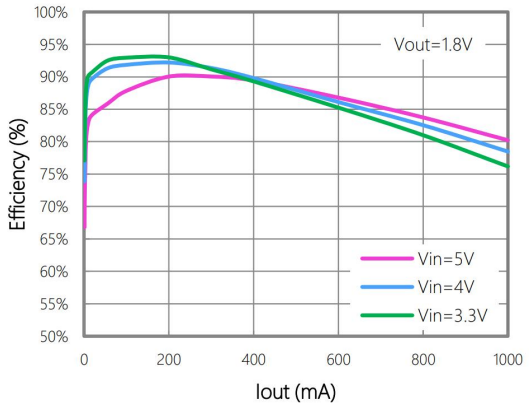
Typical Performance Characteristics

CIN=COUT=10uF, TA = 25°C, unless otherwise specified.

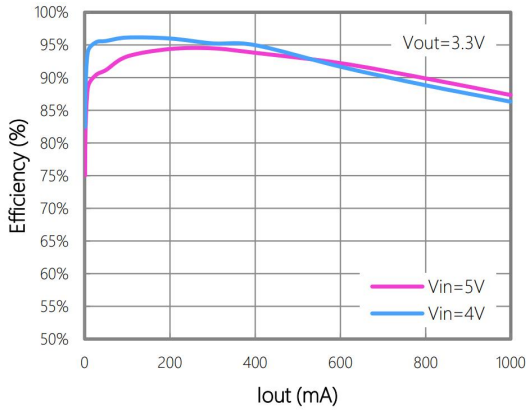
Efficiency vs. Iout



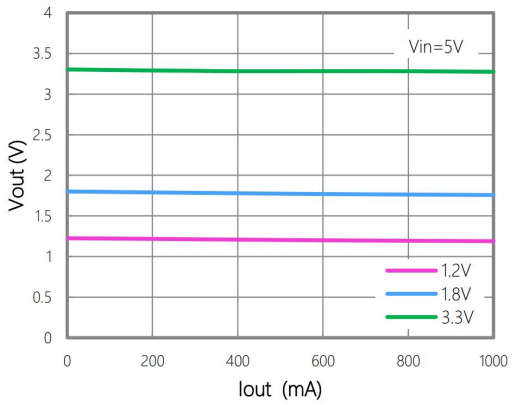
Efficiency vs. Iout



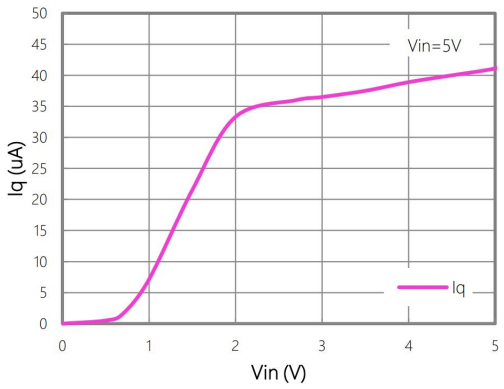
Efficiency vs. Iout



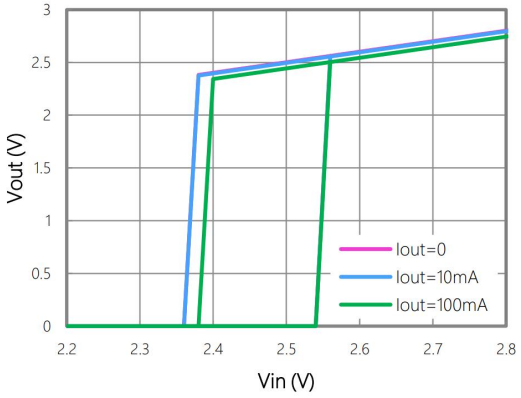
Vout vs. Iout



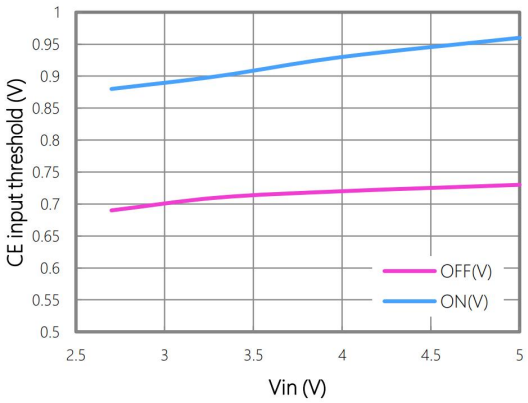
Iq vs. Vin



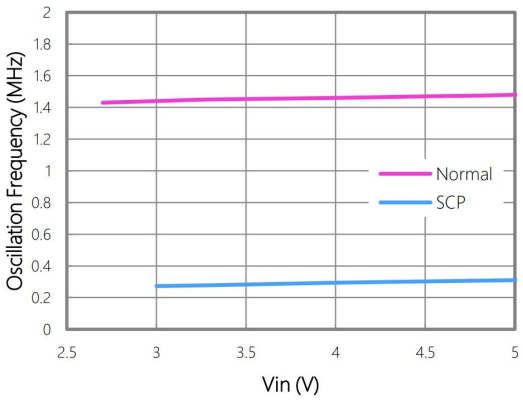
UVLO vs. Vin



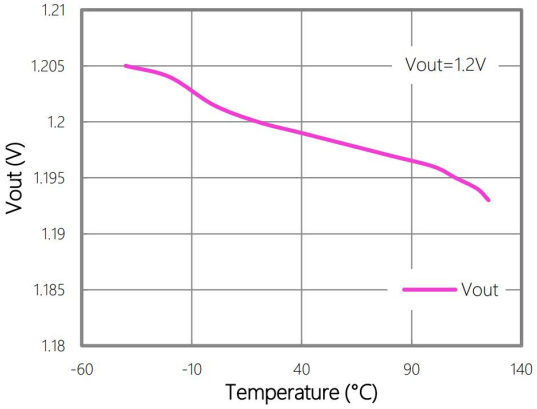
Threshold vs. Vin



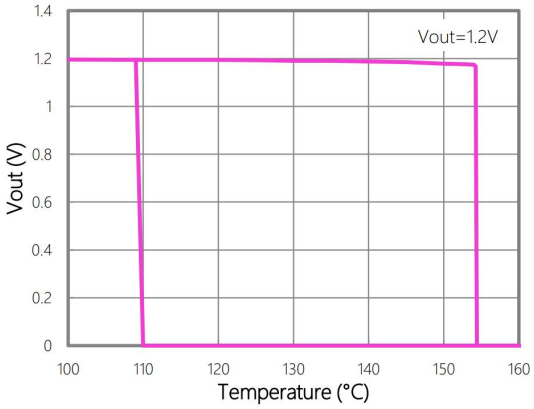
Frequency vs. Vin



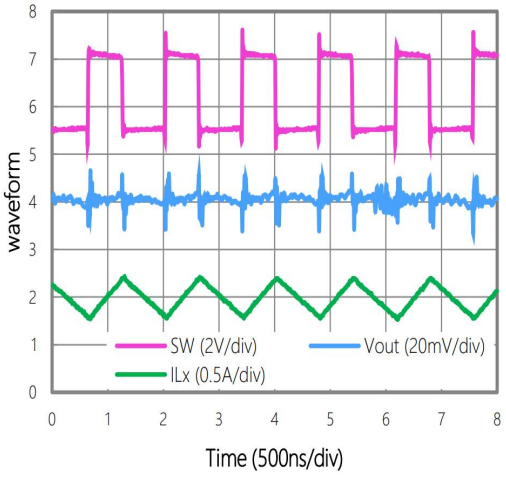
Vout vs. Temp



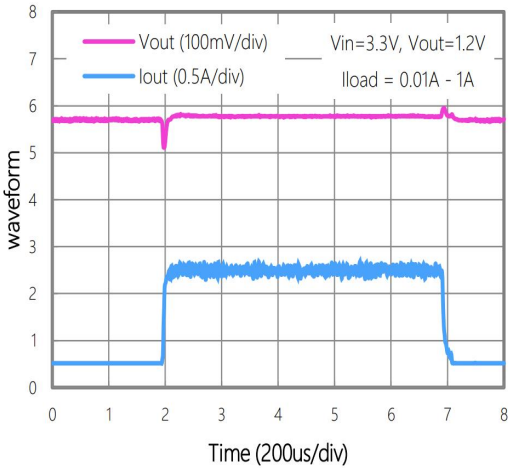
OTP Hystersis



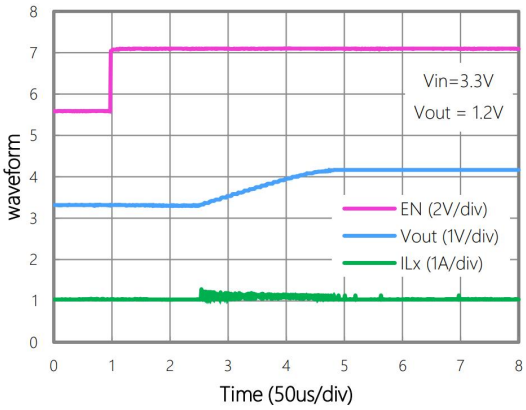
Switching Waveform



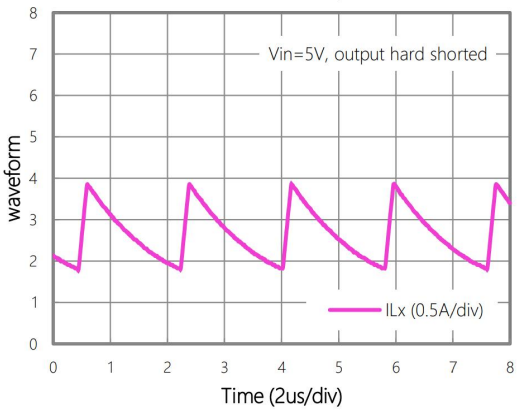
Load Transient Response



EN Startup



Short Circuit Response



Applications Information

Output Voltage Setting

TX3410K-06M5R's feedback voltage is set at 0.6V, and it requires a resistor from FB node to ground, named R0, which is suggested to be less than 120K. Assuming the resistor between output node and FVB node is R1, the output voltage of DC-DC converting system is given by:

$$Vout = \frac{0.6V}{R0} \times (R1+R0)$$

Capacitor Selection

TX3410K-06M5R requires one minimal 10uF MLCC capacitor at VIN node and one 10uF MLCC capacitor at VOUT node, however, it is always recommended to have two 10uF MLCC capacitors placed in parallel both at VIN and VOUT node to minimize the noise and withstand the current surge. It is also essential to place both input capacitors and output capacitors as close to TX3410K-06M5R's VIN pin and VOUT pin as possible. An PCB layout example is shown at PCB layout recommendation section.

Inductor Selection

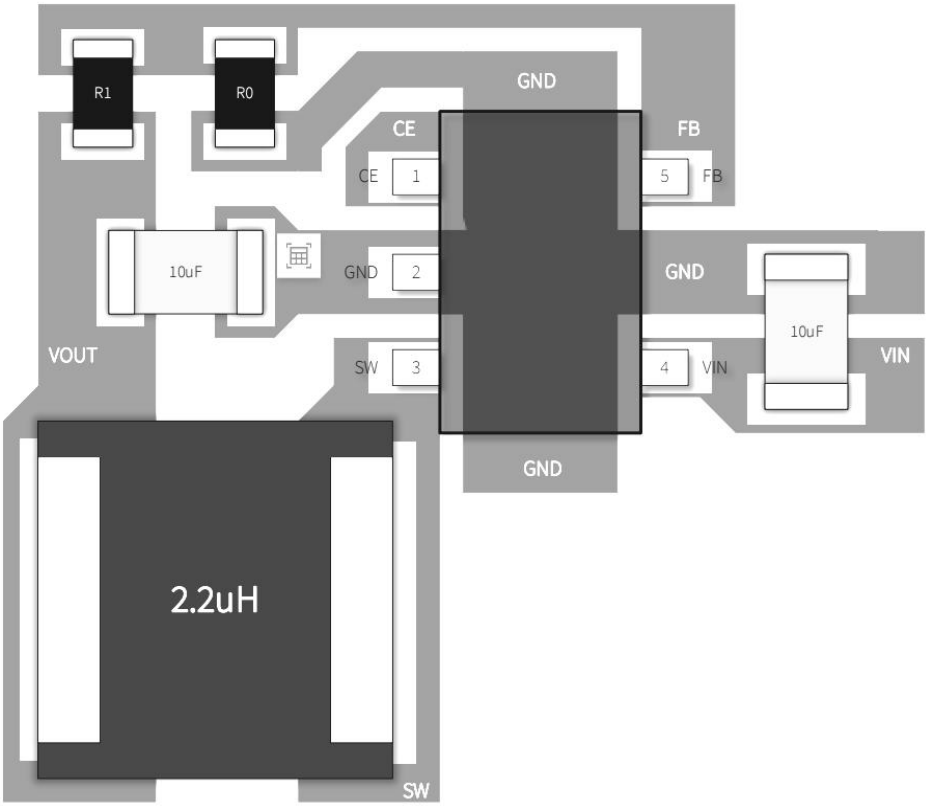
TX3410K-06M5R works at a 1.5MHz oscillating frequency which helps to have a small voltage ripple at output. And 2.2uH inductor is found the most suitable value while meeting requirements on small output voltage ripple as well as a high-power conversion efficiency.

Thermal Considerations

Though TX3410K-06M5R is a high efficiency DC/DC converter, there will always be some power lost during conversion, most of which becomes heat to make junction temperature higher. PCB design to ensure a good heat dissipation is important. Because the heat dissipation of the SOT23-5L package is conducted through the pin No. 2, which is GND node of TX3410K-06M5R, please make sure the ground plate of PCB is big enough to carry away the heat generated in the chip.

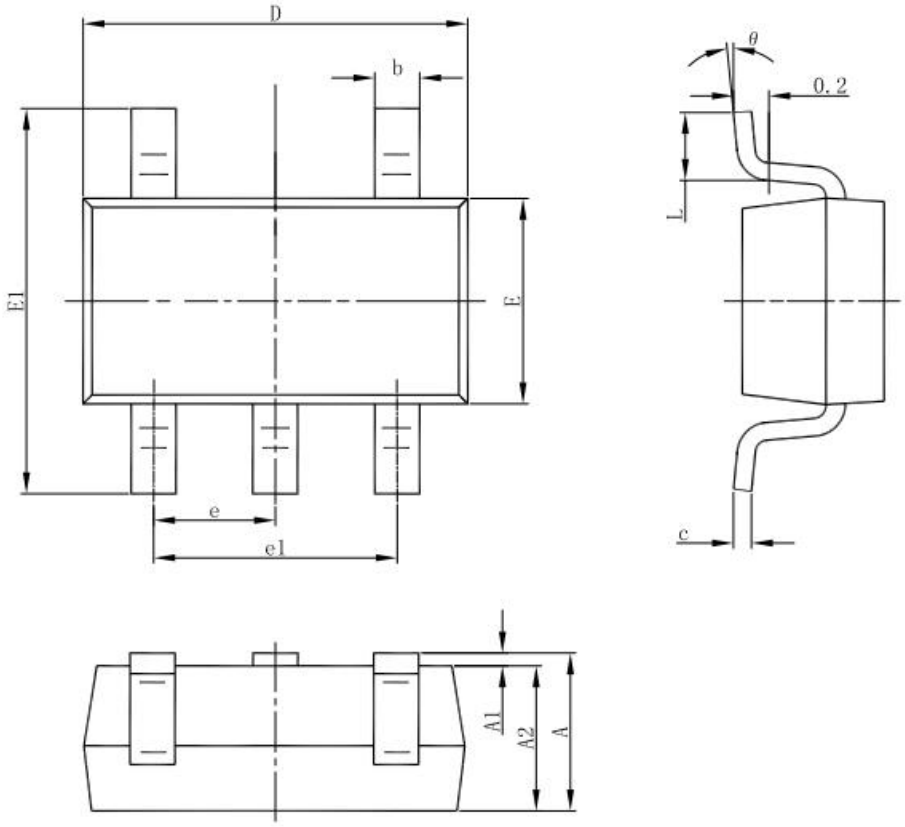
PCB Layout

An illustration of PCB layout recommendation with key elements is laid out as following. Please follow this PCB instruction to place the key peripheral devices such as input capacitors, output capacitors and inductor. And star-like connection for ground node is essential. And keeping power loop area as small as possible will improve the EMI performance.



Package Description

SOT23-5 Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°