5.5V, 2A, Synchronous Buck Converter TD6820

General Description

The TD6820 is a compact 5V Buck Converter which can deliver 2A output current.

TD6820 employs a proprietary control loop to achieve a fast transient load response. It keeps high converting efficiency in both light load and heavy load. TD6820 is equipped with all kinds of protection, such as input over voltage protection, output short circuit protection, over current protection and over temperature protection.

TD6820 consists of internal power tree generator, bandgap voltage reference module, under-voltage-lockout (UVLO) module, error amplifier, protection circuitry, driver block, current sensing block and two power MOSFETs.

TD6820 is available in SOT23-5L packages.

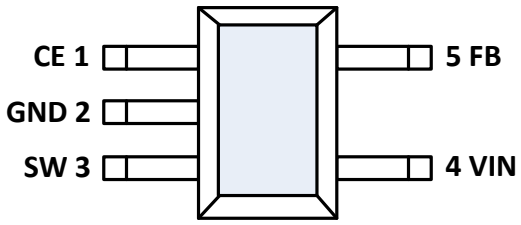
Features

- Input operation range: 2.7 – 5.5V
- Input over voltage protection at 6V
- 40uA quiescent current in operation
- Output current up to 2A
- Efficiency up to 97%
- OCP, SCP and OTP protection
- SOT23-5L package

Application

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

Pin Configurations



(Top view)

Pin Description

Pin Number	Pin Name	Description
1	CE	Chip enable pin, pull high to turn on the chip.
2	GND	Ground.
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

Ordering Information

TD6820 □ □

Circuit Type

Package
T：SOT23-5

Packing:
Blank：Tube
R: Tape and Reel

Function Block

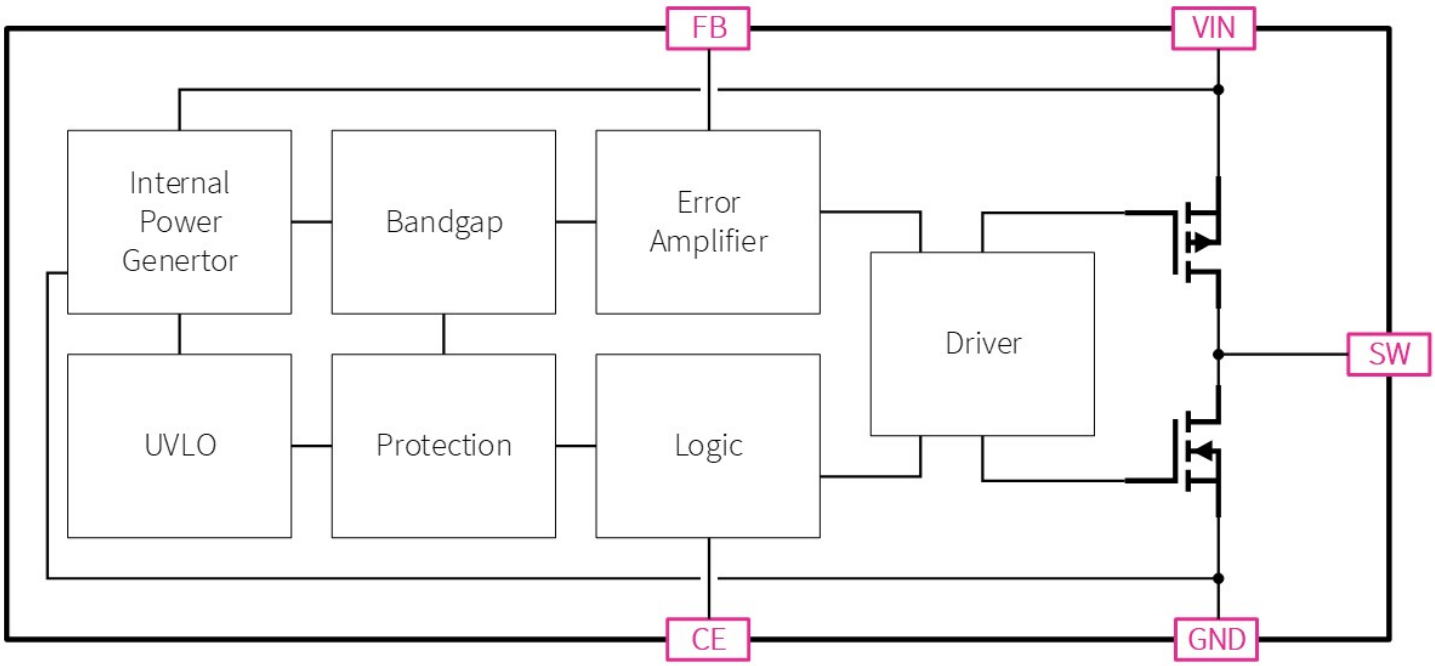


Figure1 Function Block Diagram of TD6820

Absolute Maximum Ratings (at T_A=25℃)

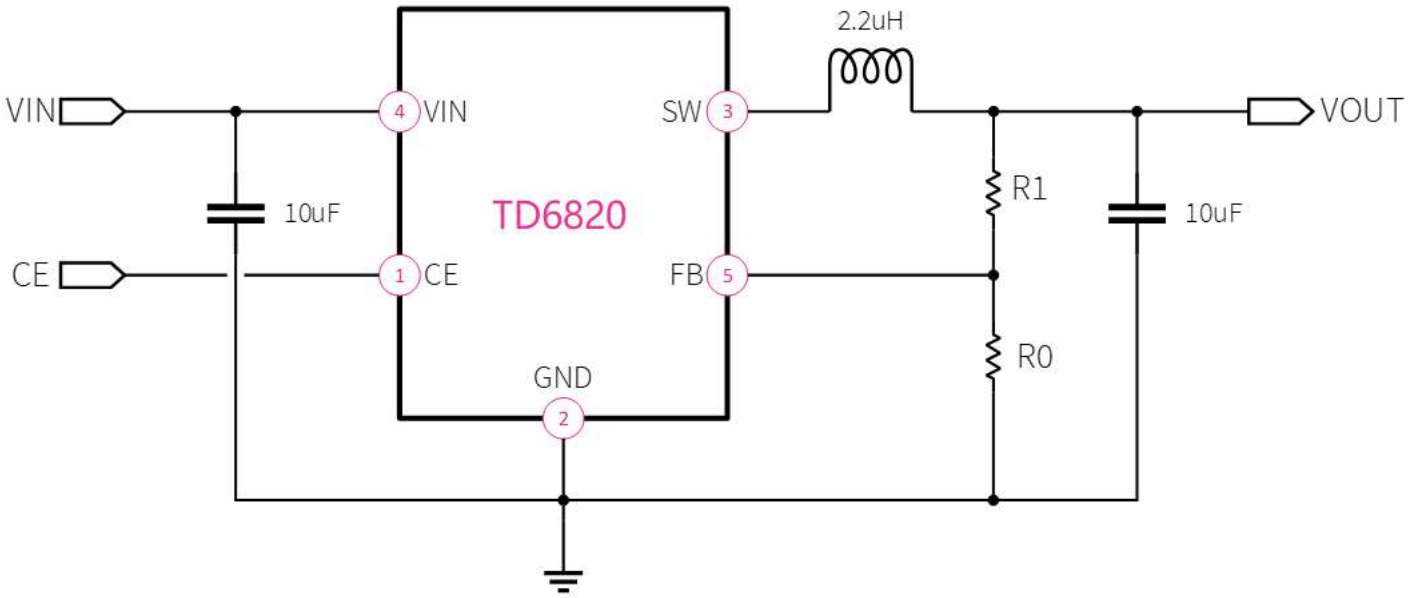
Symbol	Parameter	Rating	Unit
V_{IN}	VIN pin voltage	-0.3 to 6	V
V_{OUT}		-0.3 to +5.5	V
P_D	Continuous Power Dissipation (T_A = 25℃)	0.4	W
θ_{JA}	Junction-to-Ambient Resistance in free air	170	°C/W
θ_{JC}	Junction-to-Case Resistance in free air	75	°C/W
T_J	Operating Junction Temperature	-40 to 125	°C
T_{STG}	Storage Temperature	-65 ~ 150	°C
T_{SDR}	Maximum Lead Soldering Temperature (10 Seconds)	260	°C

Electrical Characteristics

Unless otherwise specified, these specifications apply over V_{IN}=5V, T_J = 25°C.

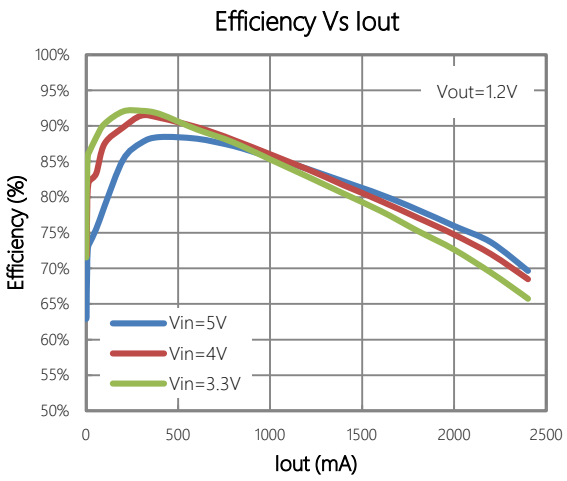
Symbol	Characteristics	Conditions	Min	Typ	Max	Units
V_{IN}	Input Voltage Range		2.7	-	5.5	V
V_{OVP}	VIN Over Voltage Protection	Input overvoltage threshold	5.8	6.0	6.5	V
UVLO		Rising	-	2.55	2.65	V
		Falling	2.25	2.37	-	V
I_Q	Quiescent Current	V_{IN}=5V	20	40	60	μA
I_{SD}	Shutdown Current	V_{IN}=5V, V_{CE}=0V	-	0.1	2	μA
V_{FB}	FB Pin Voltage	V_{IN}=5V	588	600	612	mV
I_{LIM}	Current Limit	V_{IN} = 5V, V_{OUT} = 3.3V	2.5	3	-	A
	Line regulation	V_{IN} = 3 to 5V	-	0.2	-	%/V
	Load regulation	I_{LOAD}=0.1-1A	-	0.1	2	%/A
f_{SW}	Switching Frequency	V_{IN}=5V	1	1.3	1.8	MHz
R_{ONP}	PMOSFET $RDS_{(ON)}$	V_{IN}=5V	-	140	-	mΩ
R_{ONN}	NMOSFET $RDS_{(ON)}$	V_{IN}=5V	-	80	-	mΩ
V_{ENH}	EN input threshold ON	V_{IN}=5V	-	0.9	1.1	V
V_{ENL}	EN input threshold OFF	V_{IN}=5V	0.4	0.7	-	V
	EN input pull down resistor		-	750	-	KΩ
R_{pd}	Output discharge resistor	V_{IN}=5V	-	50	-	Ω
T_{SD}	Thermal Shutdown		-	150	-	°C
T_{SD_HYS}	Thermal Shutdown Protection hysteresis		-	40	-	°C

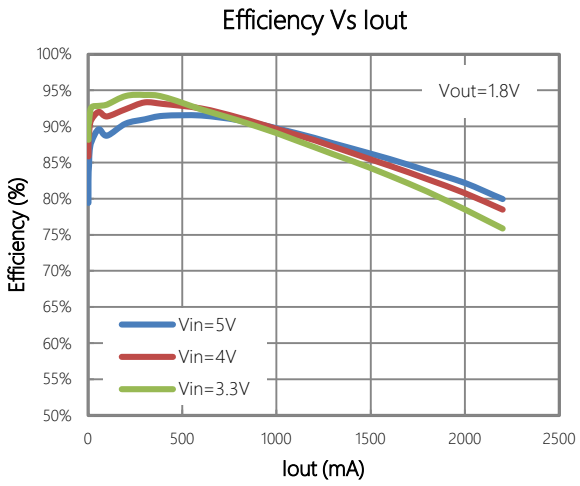
Typical Application Circuit



Typical Operating Characteristics

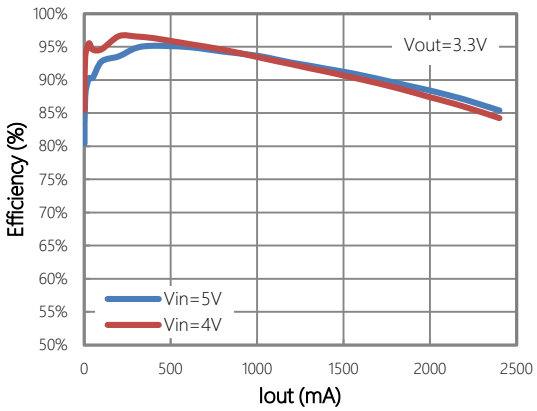
C_{IN}=C_{OUT}=10uF, T_A=25℃, unless otherwise noted.



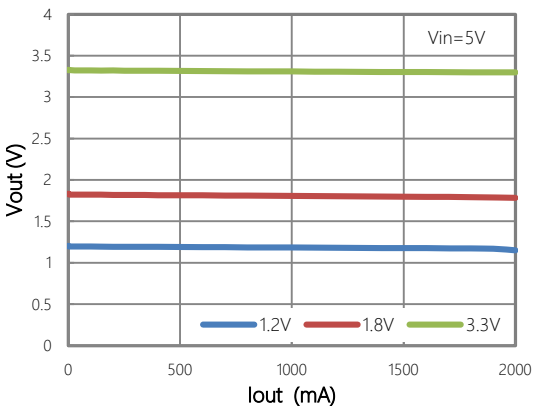


Typical Operating Characteristics(cont.)

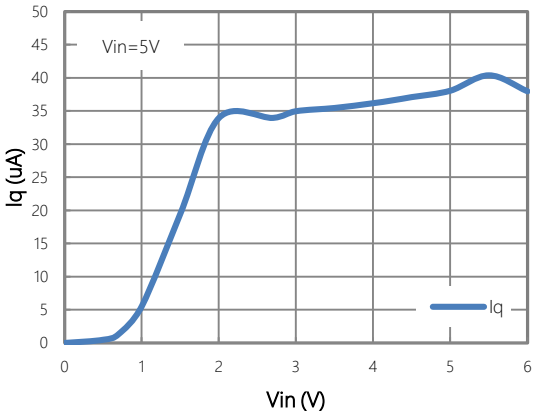
Efficiency Vs Iout



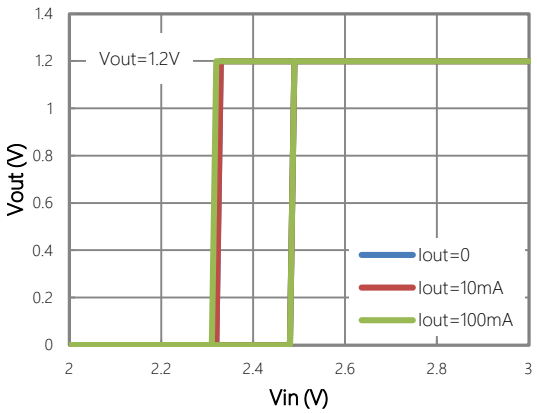
Vout Vs. Iout



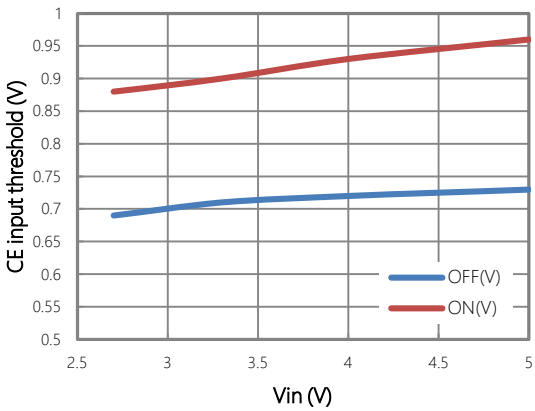
Iq Vs. Vin



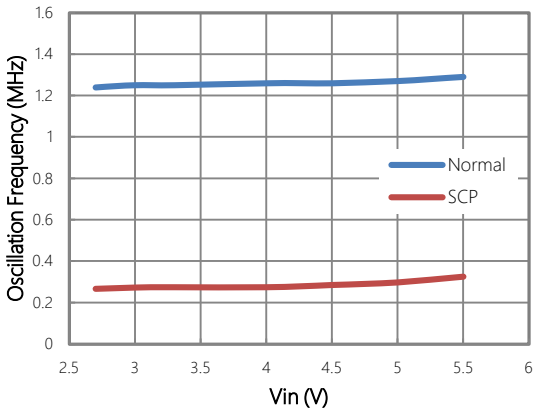
UVLO Vs Vin



Threshold Vs. Vin

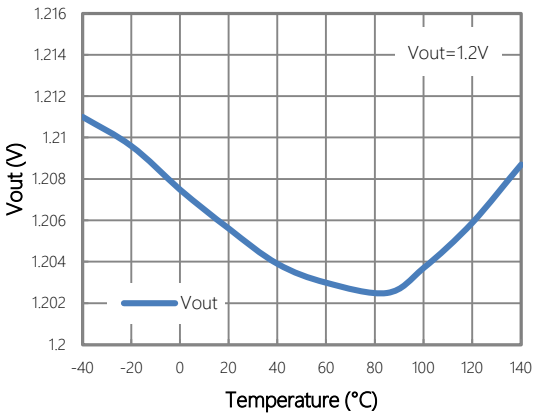


Frequency Vs. Vin

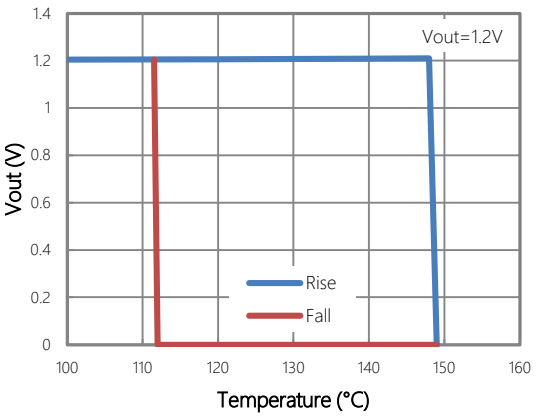


Typical Operating Characteristics(cont.)

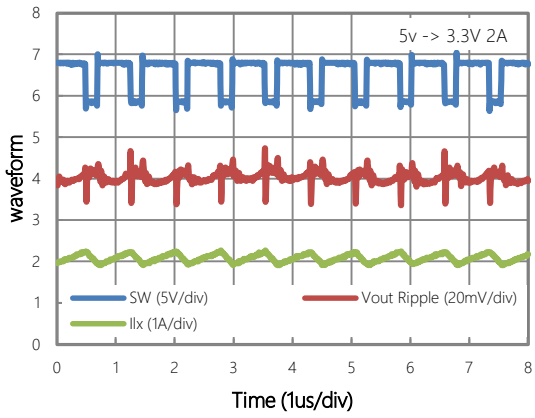
Vout Vs. Temp



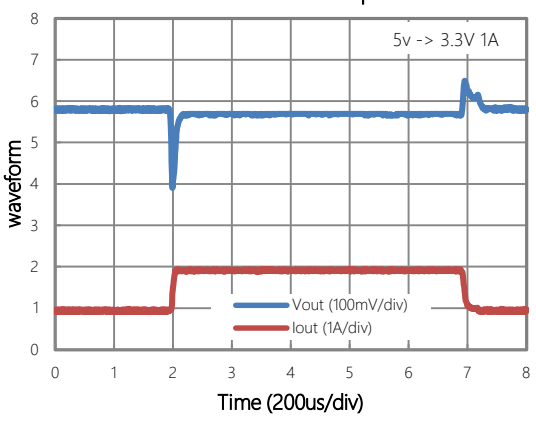
OTP Hystersis



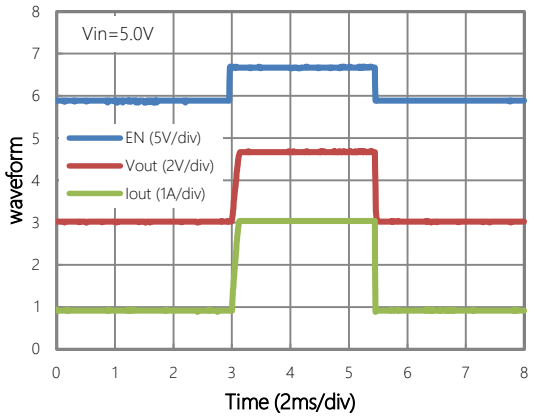
Switching Waveform



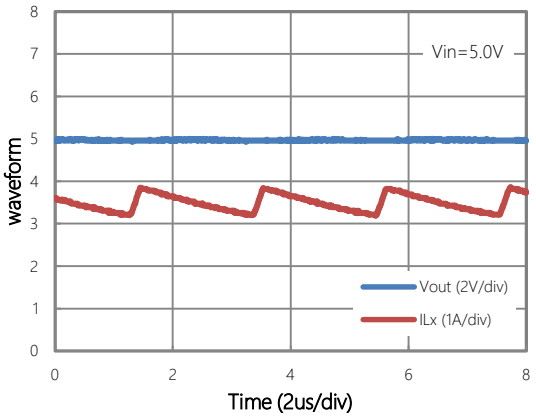
Load Transient Response



EN Startup



Short Circuit Response



APPLICATION INFORMATION

Output Voltage Setting

TD6820'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

TD6820 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 TD6820's VIN pin and VOUT pin as possible. An PCB layout example is shown at PCB layout recommendation section.

Inductor Selection

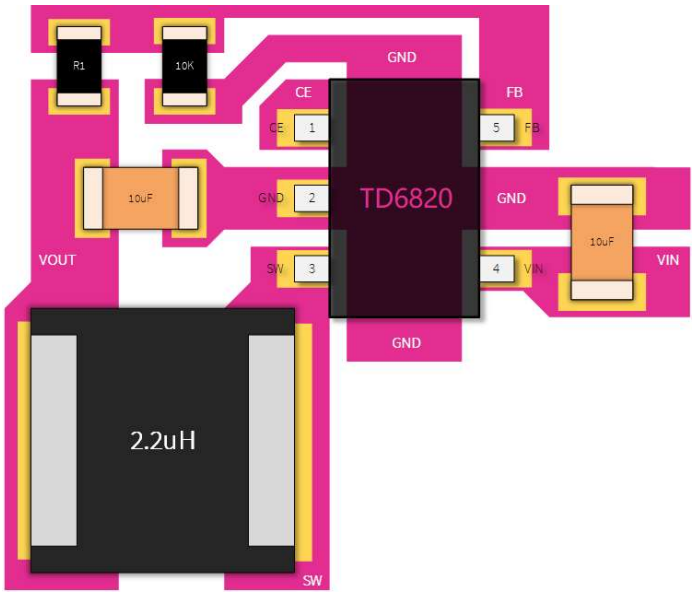
TD6820 works at a 1.3MHz oscillating frequency which helps to have a small voltage ripple at output. And 2.2uH inductor is found the most suitable value while meeting requirements on small output voltage ripple as well as a high-power conversion efficiency.

Thermal Considerations

Though TD6820 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 TD6820, please make sure the ground plate of PCB is big enough to carry away the heat generated in the chip.

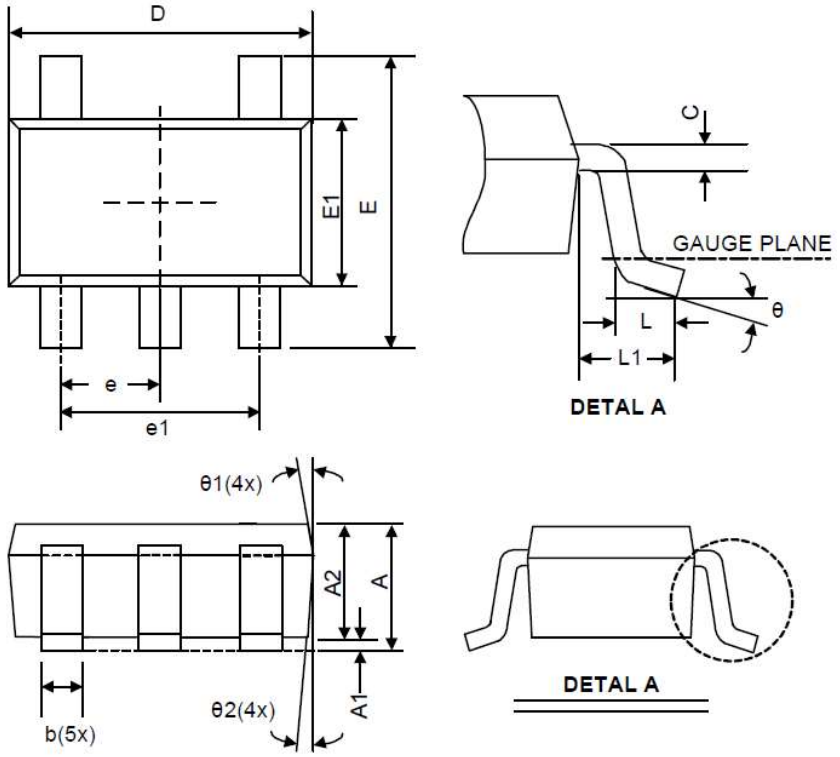
PCB Layout

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 Information

SOT23-5 Package Outline Dimensions



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.05	-	1.35	0.041	-	0.053
A1	0.05	-	0.15	0.002	-	0.006
A2	1.00	1.10	1.20	0.039	0.043	0.047
b	0.30	-	0.50	0.012	-	0.020
C	0.08	-	0.22	0.003	-	0.009
D	2.80	2.90	3.00	0.110	0.114	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
E	2.60	2.80	3.00	0.102	0.110	0.118
L	0.30	-	0.60	0.012	-	0.024
L1	0.50	0.60	0.70	0.020	0.024	0.028
e1	1.80	1.90	2.00	0.071	0.075	0.079
e	0.85	0.95	1.05	0.033	0.037	0.041
θ	0°	4°	8°	0°	4°	8°
θ1	5°	10°	15°	5°	10°	15°
θ2	5°	10°	15°	5°	10°	15°

Design Notes