General Description

The SM5308 is a multifunctional power management SOC that integrates a boost converter, lithium battery charging management, and battery power indication, providing a complete power solution for mobile power supplies.

The high integration and rich functionality of the SM5308 enable it to use only a few external devices, effectively reducing the size of the overall solution and BOM costs.

The SM5308 requires only one inductor to achieve buck and boost functions. It can support low-cost inductors and capacitors.

The synchronous boost system of the SM5308 provides a maximum output current of 2.4A, with a conversion efficiency of up to 92%. When no-load, it automatically enters the sleep state, and the static current drops to 25uA.

The SM5308 uses switching charging technology to provide a maximum current of 2.1A, with a charging efficiency of up to 91%. The built-in IC temperature and input voltage intelligently adjust the charging current.

The SM5308 supports 1, 2, 3, and 4 LED power displays.

The package of the SM5308 is ESOP8.

Applications

- **Mobile power supply**
- **Power Bank**
- **Mobile phones, laptops and other portable devices**

Features

- **Synchronously switch charge and discharge**

  2.4A synchronous boost conversion, 2.1A synchronous switch charging

  Boost efficiency up to 92%

  Charging efficiency up to 91%

  Built-in power path management, supporting charging while discharging

- **Charging**

  Adaptive charging current regulation

  Adapt to adapters

  Support 4.20/4.25V batteries

- **Battery power display**

  Support 4/3/2/1 LED power display

  Support low battery alarm indication

- **Multi-functions**

  Button press to startup

  Built-in lighting drive

  Auto-detect phone insertion and removal

- **Low power consumption**

  Intelligent identification of load, automatic standby

  Standby power consumption 25μA

- **Minimal BOM**

  Built-in Power MOSFET, charging and discharging with one single inductor

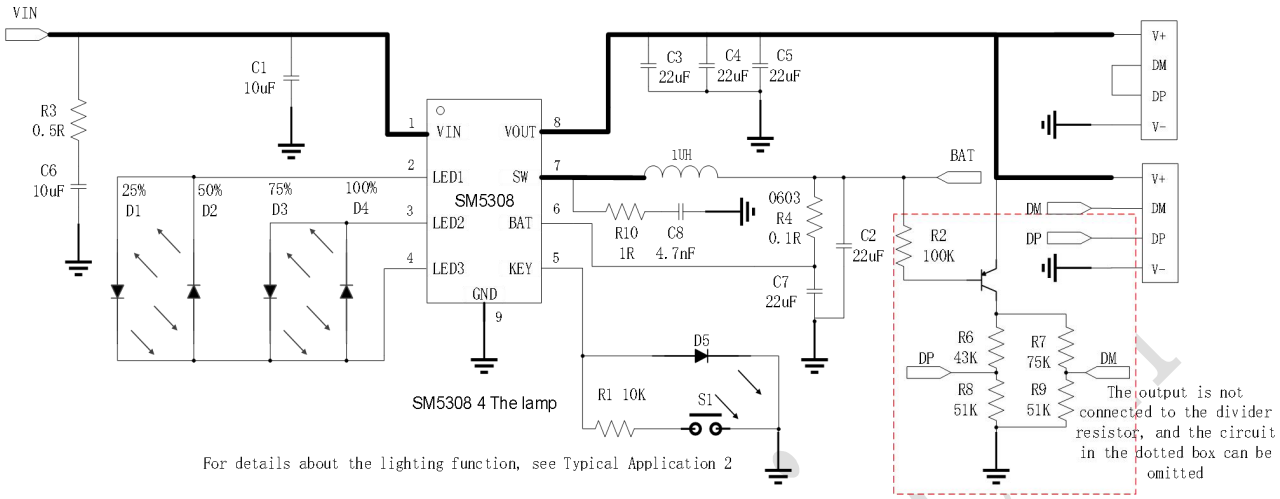
- **Multiple protection and high reliability**

  Output over current, over voltage and short circuit protection

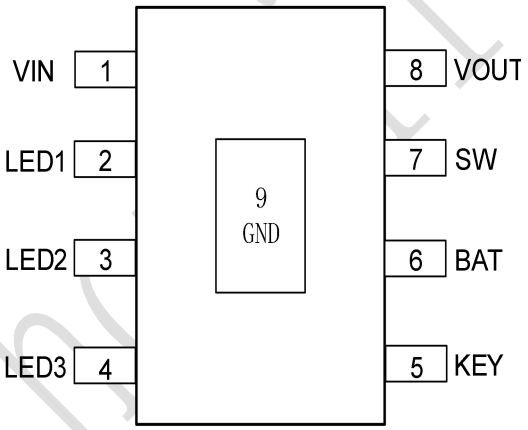
  Input over voltage, over charge, over discharge, and over current discharge protection

  Over temperature protection for the whole machine（Only internal temperature of chip）

Typical Application Circuit



Pin Assignment



ESOP8

Pin Description

Pin Name	Pin No.	Pin function
VIN	1	DC 5V charging input pin
LED1	2	LED driver pin
LED2	3	LED driver pin
LED3	4	LED driver pin
KEY	5	Press key input, lighting drive multiplexing
BAT	6	Boost input pin, connected to the positive electrode of lithium battery
SW	7	DC-DC switch pin
VOUT	8	5V boost output pin
Power PAD	9	Heat sink, connected to the ground

Maximum ratings(1)

VIN .....-0.3V~6V
All other pin.....-0.3V~5.5V
Junction temperature（TJ） .....-40℃~+150℃
Storage temperature(TSTG) .....-40℃~+150℃
Thermal resistance(junction temperature to environment)(θJA) .....50℃/W
HBM.....2KV

The scope of work

VCC .....2.5V~5.5V

(1) When the operating range of the IC exceeds the maximum rated value, the device may be damaged; The actual operation of the IC at the maximum rated value or any other operating conditions that exceed the recommended operating conditions is not recommended; Continuous operation of the IC under maximum rated conditions may affect the reliability of the device. The maximum rating is only the withstand voltage rating.

Ordering information

SM5308 ①②③④-⑤

Symbol	Label	Description
①	H	Click to turn on/off output, double-click to turn off output and lighting, and long press to turn on/off lighting.
	I	Click to turn on/off output, double-click to turn on/off lighting, long press to turn off output, and ultra-long press to turn off output and lighting.
	J	Click to turn on/off output, ultra-long press to turn off output and lighting, long press to turn on/off lighting.
	K	Shake Function
②	0	The LED indicator light only refreshes when powered on for the first time.Each time it is charged or discharged, it continues to be in the state before standby.
	1	In standby mode, the LED status is refreshed based on the current battery voltage each time charged or discharged.
	2	In standby mode, each discharge the LED status is refreshed based on the current battery voltage. While charging, it will continue the state before standby.
③	B20	Vfloat=4.20V
	B25	Vfloat=4.25V
④	R	Tape direction: positive
	L	Tape direction: reverse
⑤	G	Green Material

Electrical Characteristics

(TA=25℃， L=1.0uH, unless otherwise noted.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Charging system						
Input Voltage	VIN		4.65	5	5.5	V
Charge Target Voltage	VTRGT			4.2		V
Charge Current	ICHRG	VIN Input Current		1.8		A
Charge Switch Frequency	fs			1000		KHZ
Trickle Charge Current	ITRKL	VIN=5V,BAT=2.7V		200		mA
Trickle Cut-off Voltage	VTRKL			3.0		V
Trickle Charge Hysteresis Voltage	VTRHYS			200		mV
Recharging Threshold	VRCH			4.1		V
Input Under Voltage Protection	VUVLO	increase voltage		4.5		V
Under Voltage Protection Hysteresis	VUVLOH			200		mV
Booster system						
Battery Operating Voltage	VBAT		3.0		4.4	V
Input Current of Switching Operation Battery	IBAT	VBAT=3.7V,VOUT=5V ,fs=500KHZ		3		mA
		VIN=5V,Device not switching		100		uA
DC Output Voltage	VOUT	VBAT=3.7V		5.0		V
Boost Voltage to Turn on Battery				3.2		V
Boost Hysteresis Voltage				200		mV
Output voltage ripple	ΔVOUT	VBAT=3.7V,VOUT=5V ,fs=500KHZ		100		mV
Boost Switch Frequency	fs			500		KHZ
Supply Current of Booster System	IVOUT			2.4		A
Detection Time of Load	TUVD	The output current is		10		ms

Over Current		continuously greater than 4A				
Detection Time of Load Short Circuit	T_{OCD}	The output voltage is consistently below 4.13V		10		us
Control system						
PMOS on resistance	r_{DSON}			35		mΩ
NMOS on resistance	r_{DSON}			30		mΩ
Battery Input Standby Current	I_{STB}	VIN=0V, V_{BAT}=3.7V		25		uA
LED Lighting Drive Current	Key	V_{KEY}=2.24V, V_{BAT}=4.2V		35		mA
LED Display Drive Current	$I_{L1}/I_{L2}/I_{L3}$			18		mA
Automatic Load Detection Time	T_{loadD}	The load current is continuously less than 45mA		32		s
Short Press Wakeup Time	$T_{OnDebounce}$			50		ms
Light On time	$T_{Keylight}$			2		s
Thermal Shutdown Temperature	T_{OTP}	raise temperature（Only internal temperature of chip）		125		℃
Thermal Shutdown Temperature Hysteresis	ΔT_{OTP}	（Only internal temperature of chip）		40		℃

Function Description

Boost

The SM5308 integrates a boost DC-DC converter with an output of 5V and a load capacity of 2.4A. The switching frequency is 500KHz. And when the BAT voltage is 3.8V input and the boost output is 5V/2.1A, the efficiency is 92%.

The built-in soft start function of the SM5308 can prevent faults caused by excessive impulse current during startup, and integrates protection functions such as output over current, short circuit, over voltage, and overheating. When an output over-current or short-circuit is detected, the output is restarted every 1s to ensure stable and reliable operation of the system.

If the output current of the SM5308 is less than 45mA, turn off the power display after 32 seconds and enter the low - power mode.

The SM5308 will shut down the output after detecting that the BAT voltage is lower than 3.0V. After the BAT voltage rises, it needs to be charged to activate to output normally.

When the BAT voltage is detected to be lower than 3.0V during discharging, the output will be turned off. Then the SM5308 will enter a 8-second low battery alarm flicker state (flicker frequency: 2Hz). After the flicker is completed, the chip will enter the standby state.

In standby mode, if the BAT voltage is between 2.8V and 3.0V, the boost will be continuously turned off every time the button is pressed or the load is automatically recognized and the indicator light will enter the low battery alarm state. After flickering, the chip enters the standby state again. Only when the BAT voltage rises to above 3.2V, the load automatically recognizes or presses the key to start the boost. Then the chip outputs 5V, and the indicator light displays the battery normally.

Charging

The SM5308 has a constant current and constant voltage lithium battery charger with a synchronous switching structure. When the battery voltage is less than 3V, it uses 200mA trickle charging. When the battery voltage is greater than 3V, it enters constant current charging, and the VIN input current limiting ring does not work at this time. Then when the battery voltage is greater than 4.2V, it enters constant voltage charging. When charging is finished, it will restart the battery charging if the battery voltage is lower than 4.1V.

The SM5308 uses switching charging technology with a switching frequency of 1MHz. When charging current of the VIN input is 1.8A, its charging efficiency can be up to 91%.

The SM5308 has adaptive power path management and supports charging while discharging.

The SM5308 charger automatically adjusts the charging current to accommodate adapters with different load capacities of adapters, without affecting the work of adapter.

Key Press Action

The SM5308 can recognize long and short key pressing operations. And the PIN5 can be floated when no keys are needed.

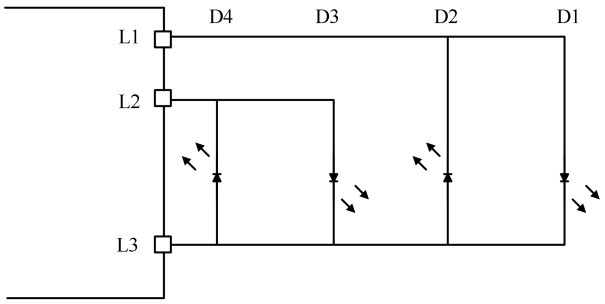
(1) The duration of pressing the button is longer than 50ms but less than 2s, which means a short press action. A short press will turn on the battery power display light and boost output.

(2) The button duration is longer than 2s, which is a long press action. Long press will turn on or off the lighting LED (version H).

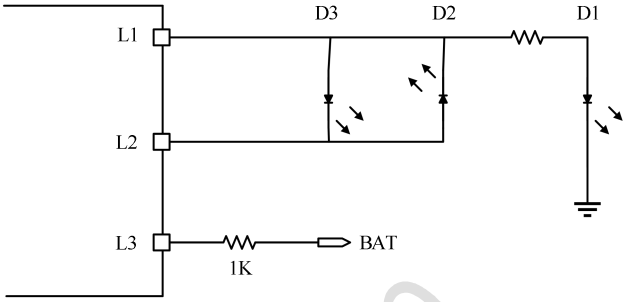
(3) Button pressing actions less than 50ms will not have any response.

(4) Press the button twice within 1s to turn off the boost output, battery power display, and lighting LEDs (version H).

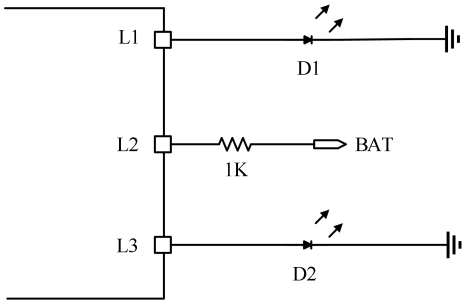
Light Display Mode



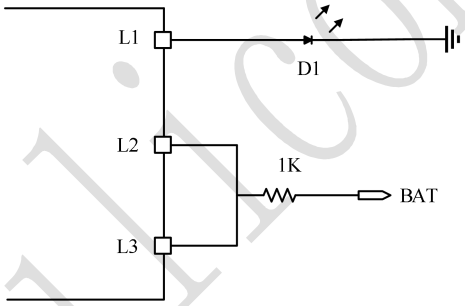
Four lights



Three lights



Two lights



One light

Four Lights Mode

Discharging

Battery Power C（%）	D1	D2	D3	D4
C≥75%	light	light	light	light
50%≤C＜75%	light	light	light	dark
25%≤C＜50%	light	light	dark	dark
3%≤C＜25%	light	dark	dark	dark
0%＜C＜3%	2HZ flicker	dark	dark	dark

Charging

Battery Power C（%）	D1	D2	D3	D4
Full	light	light	light	light
75%≤C	light	light	light	1HZ flicker
50%≤C＜75%	light	light	1HZ flicker	dark
25%≤C＜50%	light	1HZ flicker	dark	dark
C＜25%	1HZ flicker	dark	dark	dark

Three Lights Mode

The display mode of the three lights is similar to that of the four lights, and the corresponding battery power of each light mode is shown in the following table.

	D1	D2	D3	D4
three lights	33%	66%	100%	
four lights	25%	50%	75%	100%

Two Lights Mode

	state	D1	D2
charging	charging process	flicker	dark
	full	light	dark
discharging		dark	light
	low battery	dark	flicker

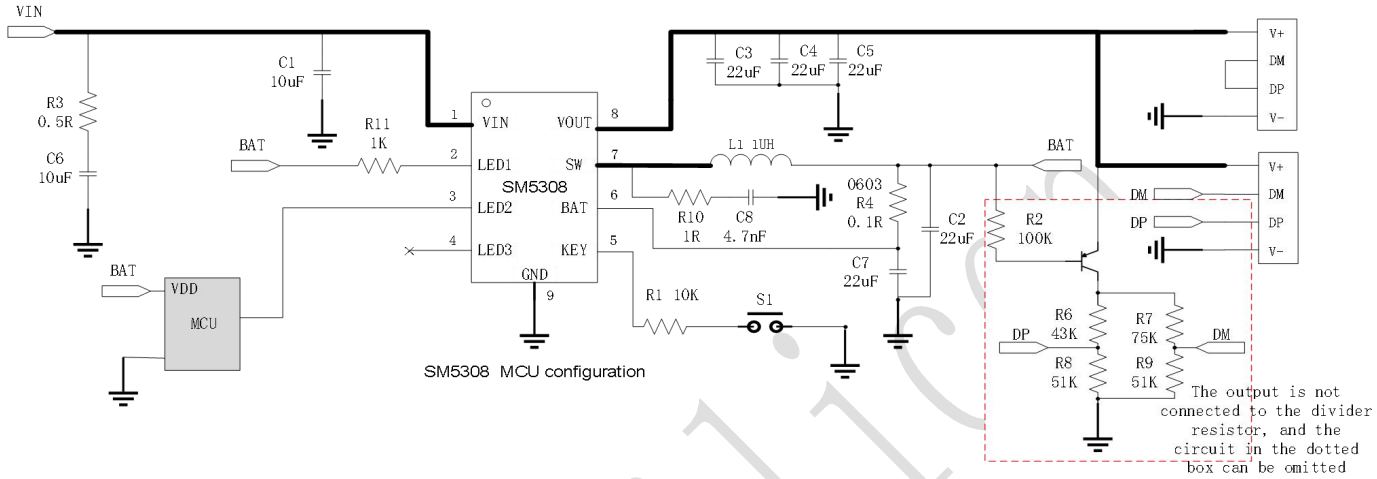
One Lights Mode

	state	D1
charging	charging process	flicker
	full	light
discharging	normally discharging	light
	low battery	flicker

Note: The BAT must be powered on at 2.9V for the first time to complete reading the LED status.

MCU reading status function

Removing all LEDs and connecting the LED1 to the BAT, the LED2 will output a square wave. The frequency of LED2 can be read through the MCU to get the current state of the IC.

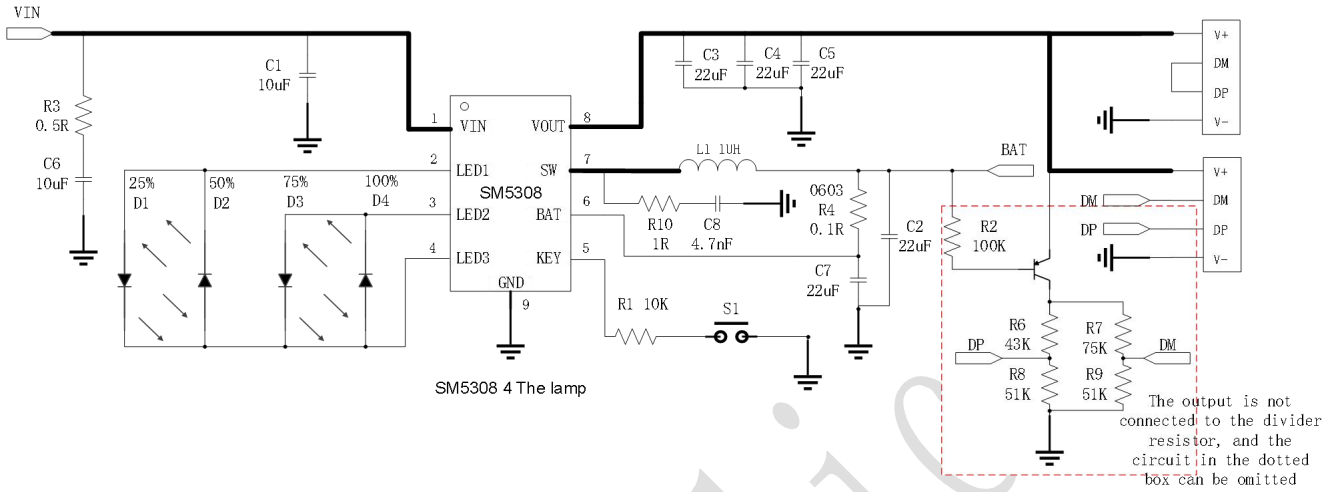


SM5308 MCU configuration

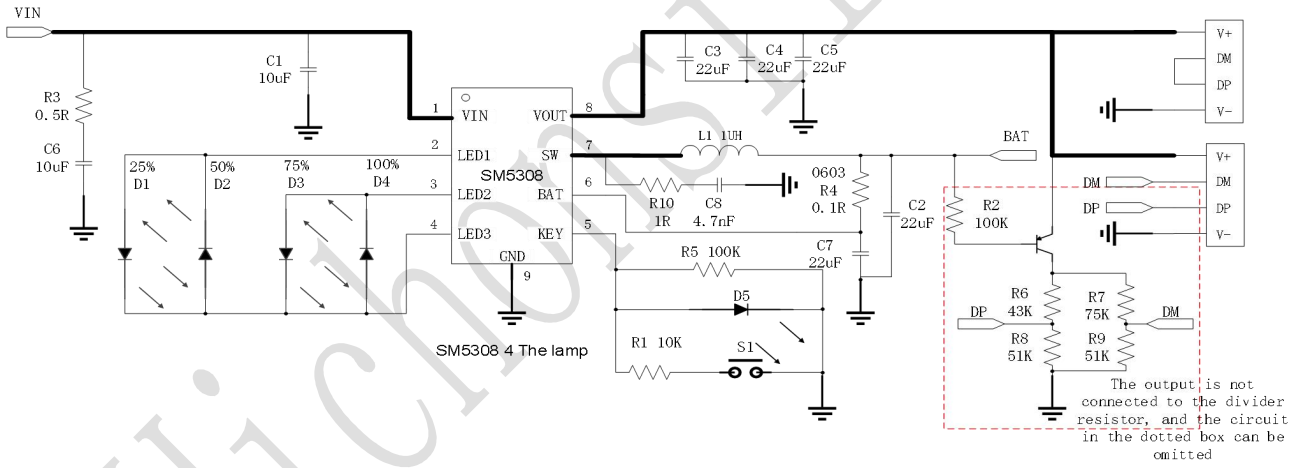
LED2 Output frequency	State
0Hz	Standby
128Hz	Charging process
64HZ	Full-charged
256Hz	The output current of the discharge boost is lower than the light load shutdown current
512Hz	The output current of the discharge boost is higher than the light load shutdown current
1KHz	Low battery alarm (discharging boost)
2KHz	Abnormal state (over current charging/ output short circuit/ abnormal temperature)

Typical Application

1.No flashlight function



2.With flashlight function



PCB LAYOUT Notices：

1. The GND of chip is EPAD. Ensure that the EPAD is in good contact with the ground of the PCB during welding.

2. R10 and C8 should be as close as possible to the SW pin. And SW pin must pass through R10 and C8 before connecting the inductor.

3. C7 should be as close as possible to the BAT pin. When routing, the BAT pin needs to be connected to R4 through a capacitor firstly.

4. C1 should be as close as possible to the VIN. C3, C4, and C5 should be as close as possible to the VOUT.

And when routing, they all should be connected to capacitors and then to the pin.

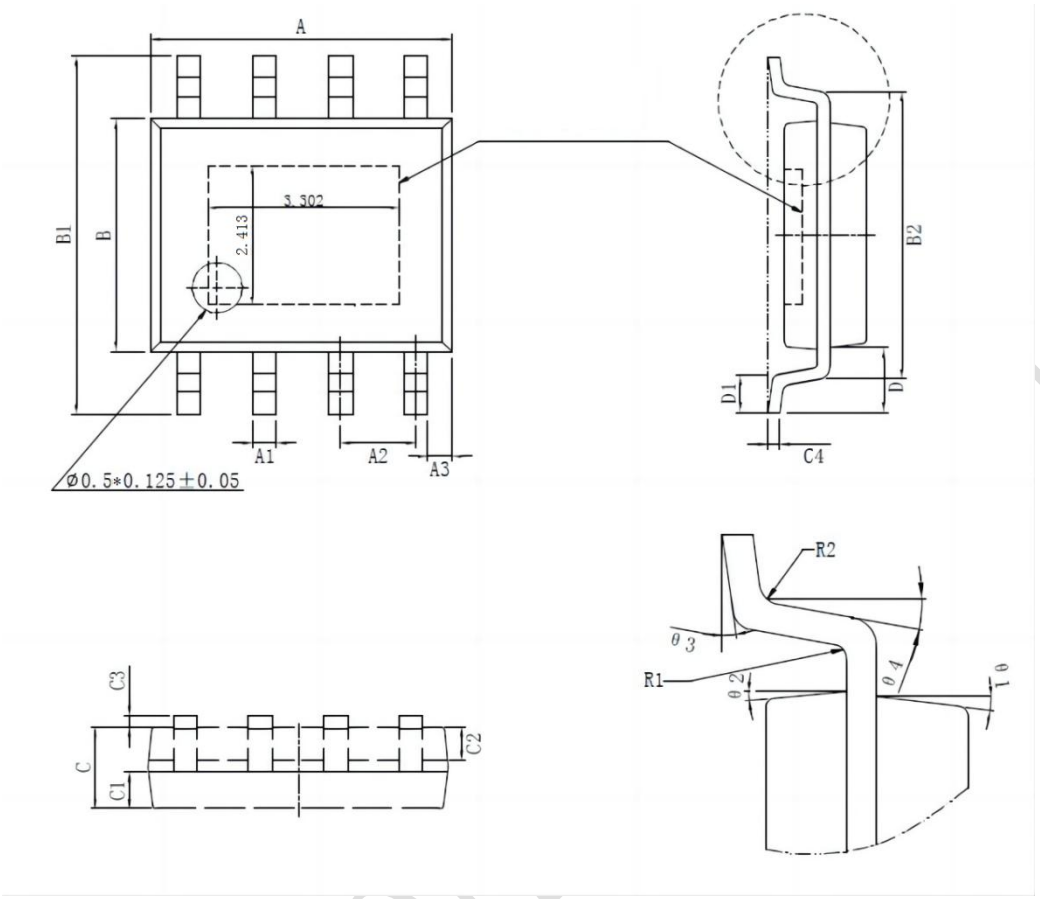
5. The capacitor in the application circuit must be made of X5R or X7R material.

6. There is high-frequency oscillation between the inductance L1 and SW pins, which must be close to each other and minimize the routing area; Other sensitive devices must be kept away from inductance to reduce coupling effects.

7. Large current circuits, such as BAT, VOUT, and GND, should be routed as wide as possible. If large current needs to pass through vias in the design, it is recommended to use multiple vias to reduce impedance.

8. Inductors must be packaged above CD75, and the saturation current must be greater than 6.5A.

Package Description ESOP8



Symbol	Dimensions In Millimeters		Symbol	Dimensions In Millimeters	
	Min	Max		Min	Max
A	4.80	5.00	C3	0.00	0.09
A1	0.356	0.456	C4	0.203	0.233
A2	1.27TYP		D	1.05TYP	
A3	0.345TYP		D1	0.40	0.80
B	3.80	4.00	R1	0.20TPY	
B1	5.80	6.20	R2	0.20TPY	
B2	5.00TPY		θ 1	17° TYP4	
C	1.30	1.60	θ 2	13° TYP4	
C1	0.55	0.65	θ 3	0°~8°	
C2	0.55	0.65	θ 4	4°~12°	

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