一、 概述

FM5324GA is an integrated power management IC used in mobile power, integrating lithium battery charging management, battery boost output, battery power judgment and LED power indication.

FM5324GA is charged in a switching mode, including trickle charging, constant current charging and constant voltage charging. The accuracy can reach ±1% in the whole temperature range, and it has the advantages of small charging current ripple and high charging efficiency.

The DC-DC boost of FM5324GA can achieve an accuracy of ±1%, and can provide a boost conversion efficiency of more than 94%, extending the battery life. between.

FM5324GA is equipped with 3 LED drive ports, which can drive 4 LEDs to display the battery power. The chip has a built-in logic lock function to prevent the power indication from being unstable.

FM5324GA has multiple protection designs, including load overcurrent protection, soft start protection, input overvoltage protection, output short circuit protection, chip temperature protection, At the same time, the chip port is designed with a high-performance ESD protection circuit, making the chip extremely reliable.

二、 产品特点

• Simple peripheral circuit, no external MOS required • Can achieve 2.0A@5V synchronous switch charging at the input end • Can achieve 2.4A@5V synchronous switch boost output • Low standby current, about 60uA • Optional full charge voltage • Soft start function • Trickle/constant current/constant voltage three-stage charging • Input power failure, battery automatic boost power supply • The overall solution boost maximum efficiency can reach 94%@2.4A • OUT output overcurrent, short circuit protection • Automatic load detection start function • No-load detection shutdown function • Output line compensation function • Fast full charge function • Multiple button modes are optional • Optional electrical expansion function • 1-4 light power display function, multiple power display methods • Multiple power curves are optional • Package form: eSOP8L

三、 应用领域

• Mobile power • Other portable devices

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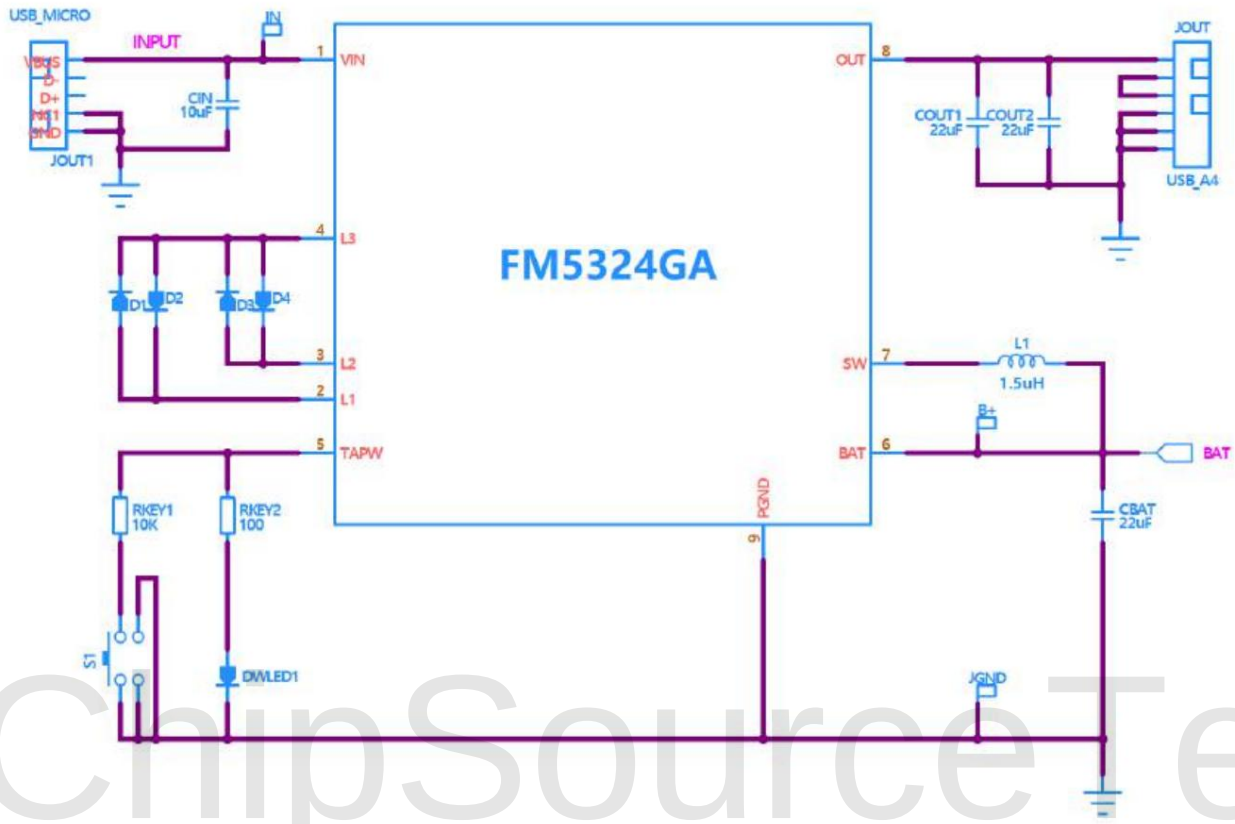
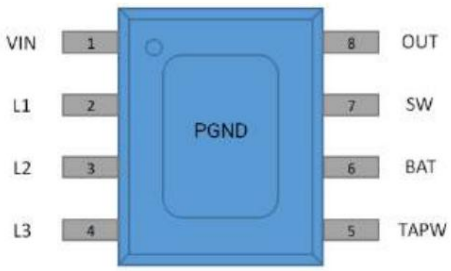
四、 典型应用电路



五、 引脚示意图及说明

eSOP8L



Pin Name	Pin Number	Functional Description
COME	1	Power input pin
L1-L3	2-4	Battery indicator pin
TAPW	5	button pins
ONE	6	Battery positive terminal detection pin
SW	7	Inductor drive pin, power tube drain
OUT	8	Chip output pin, power P tube source end
PGND		EP chip power ground, power N tube source end

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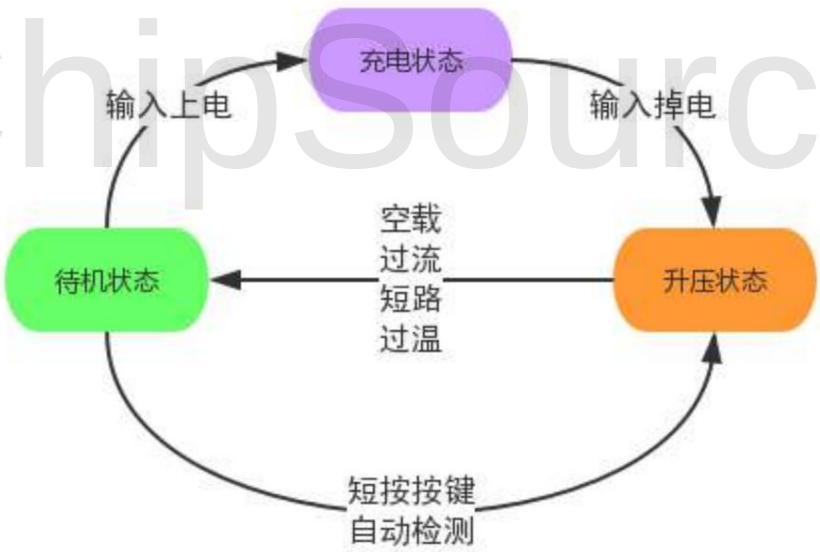
六、 极限参数和推荐工作状态

SYMBOL	ITEMSInput	VALUE	UNITS
COME	voltageInput	-0.3~6	In
VSYS	voltageInput	-0.3~6	In
VLED	voltageOperating	-0.3~6	In
TOP	temperature rangeOperating	-40~85	ÿ
TJ	junction temperature	-20~150	ÿ
TST	rangeStorage	-55~150	ÿ
MST	temperatureStorage	<30%	
TLEAD	humidityPin soldering temperature (10 sec)	300	ÿ
COME	Recommended input	4.5~5.5	In
TOP	voltageRecommended operating ambient temperature	0~50	ÿ

七、 状态转换图



八、 功能描述

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
IQ	standby power consumption	VBAT =4.2V		55	75	a
RON-IRB	Input reverse blocking switch Rdson			75		mÿ
RON-TS	Top switch Rdson			35		mÿ
RON-BS	Bottom switch Rdson			35		mÿ

• Charging management

1. Charging status

After the chip VIN voltage exceeds VUVLO-RS and VIN exceeds the VBAT voltage VREV, the chip enters the charging state.

2. Charging function

The chip uses synchronous rectification switching to charge the battery in three stages: trickle current, constant current, and constant voltage . When the battery voltage is higher than VTRKL, it is charged at a constant current ; when the battery voltage is close to VBAT-REG, it is charged at a constant voltage. The charging current starts to decrease gradually. When the current decreases to IFULL, the battery is judged to be fully charged, and the chip stops charging. After reaching VRECHG, it is recharged (Recharge).

3.Charge current setting (ICHG function)

The charging current is determined by the current limit value IVIN-CHG at the input VIN terminal . When the input power supply is insufficient or the chip temperature is too high, IVIN-CHG will drop. drop.

4. Full charge voltage setting (BDIV function)

The FM5324GA sub-model can set different full charge voltage values from 4.20V to 4.40V. See Optional Functions for details.

5. Charging soft start function

When the battery directly enters constant current charging, the chip will control the charging current to gradually increase to the set value, avoiding the instantaneous high current shock. various problems.

6. Accelerated charging function

When VBAT is close to VBAT-REG, the chip will slightly increase the voltage of VBAT-REG to reduce the constant voltage charging time.

7. Input overvoltage protection

When the input voltage is too high and exceeds VIN-OVP, the chip will control the USB output to prevent the portable device connected to the USB from being damaged due to overvoltage. Damaged, the status will be released after the input voltage returns to normal.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
ICC-CHG	chip operating current	VIN =5V Charging status		4.0		m.a.
VUVLO-RS	Power supply undervoltage threshold	VIN from low to high		4.2		In
VUVLO-DN		VIN from high to low		3.5		In
VREV	input anti-reverse threshold VIN-VBAT	VIN Rising		150		mV
		VIN Falling		50		mV
VTRKL	Trickle flow to constant flow	VBAT from low to high		3.00		In
	Hysteresis voltage	VBAT from high to low		0.30		In
VBAT-REG	floating charge threshold voltage		4.16	4.20	4.24	In
IFULL	charging judgment full current	VIN=5.0V		300		m.a.
VRECHG	recharge threshold voltage	VBAT rising		4.05		In
		VBAT falling		4.00		In

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SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
IVIN-CHG	input constant current charging current	VIN=5.0V		2.0		A
ITRKL	trickle charge current	VBAT=2.8V		270		m.a.
VIN-LIM	Input voltage current limit point	ICHG = IVIN-CHG·90%		4.69		In
		ICHG = IVIN-CHG·50%		4.65		In
		ICHG = IVIN-CHG·20%		4.64		In
VIN-OVP	Input overvoltage protection voltage	Input voltage increase		6.0		In
	Hysteresis voltage	Input voltage reduction		0.4		In

• Boost function

FM5324GA has a synchronous rectification boost function, which can boost the voltage of a single lithium battery to 5V output to power the load.

When it is lower than VUVLO-DN, the system will determine that the power adapter is powered off and start the boost circuit.

1. Boost start function

When the boost is turned on, if the battery voltage is lower than VBSTL When the chip is in low battery condition, it will not start the voltage boost.

Start-up function: when starting the boost, the peak current will gradually increase to ensure the stability of the system.

2. Boost discharge function

In standby mode, single-click the button (S1) to start the boost output.

3. Automatic load detection function

In standby mode, when the OUT terminal is detected to be connected to a load, the chip will automatically start the boost output.

4. Automatically switch to boost voltage during charging

In the charging state, the VIN terminal is powered off, COMELower than VUVLO-DN When the chip is judged as input power failure, it will automatically and the boost output is started.

5. No-load detection function

When the output current is less than INOLOAD and lasts for **6.** Low TNOLOADOFF After that, the chip determines that the external load disappears and enters the standby state.

battery reminder and low battery shutdown function

When the battery voltage is lower than , the lamp D1 needs to be charged. The VBST-D1F FLED-LQWB The frequency starts to flash, indicating that the battery power inside the system is low. battery continues to discharge. When the voltage is lower than **7.** Output line VBST-UVLO The boost system is shut down.

compensation function

When boosting, the chip has an output line compensation function, that is, as the output current increases, before the output current increases to the current limit point, the output voltage will It is slightly improved.

8. Output current limiting function

When the load current continues to increase and reaches about 90% of ILOAD-OCP , the output voltage begins to drop rapidly, limiting the output current.

9. Output overcurrent protection

When the load current continues to increase and the output voltage is lower VLOAD-OCP , and the duration exceeds TOCP-OFF , then the system starts the load overcurrent than the protection function, the chip turns off the boost output and enters the standby state.

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10. Output short circuit protection

When the output is short-circuited, the chip will enter the short-circuit judgment state. If the short circuit is removed, the chip will restart the boost. TSTP-DLY

If the short circuit state is not released after a certain time, the chip turns off the output and enters the standby state.

SYMBOL PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
ICC-BST chip working current	Discharge state: VBAT=4.2V, ILOAD=0, indicator light off		3.8		m.a.
VOUT-NL no-load output voltage	IOUT=0		5.10		In
VLOAD-OCP over-current protection voltage			4.62		In
ILOAD-OCP output overcurrent protection current			3.0		A
TOCP-OFF output overload protection time		12	14	16	mS
TSTP-DLY short circuit recovery delay			1.0		S
TLOAD-STP output short circuit current detection time		56	60	64	uS
INOLOAD no-load shutdown current			80		m.a.
TNOLOADOFF No-load shutdown boost system waiting time ILOAD < INOLOAD			30		S
VBSTL boost no-load startup minimum voltage fOSC			3.21		In
oscillator frequency fSW switching			1000		KHz
operating frequency			500		KHz
VBAT-UVLO shutdown voltage during discharge			2.90		In

• Protection function

1. Output short circuit protection during charging

When charging, if the output is short-circuited, the chip will turn off the output and turn off the power indicator. When the short circuit is removed, the output will turn on and the power indicator will turn on.

The indicator light comes on and charging resumes automatically.

2. Chip temperature limit protection

When the internal temperature of the chip exceeds TEMPOTL, the chip enters the temperature limit protection state: if it is charging, the charging current is reduced; if it is

Boosting reduces the output voltage.

3. Chip over-temperature protection

If the chip temperature exceeds TEMPOTP during operation, the internal switch MOS is turned off and the operation is resumed after the temperature drops.

SYMBOL PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
TLED-HOLD boost power display holding time			8		S
TEMPOTL chip temperature limit protection temperature			95		ÿ
TEMPOTP chip over temperature protection temperature			135		ÿ

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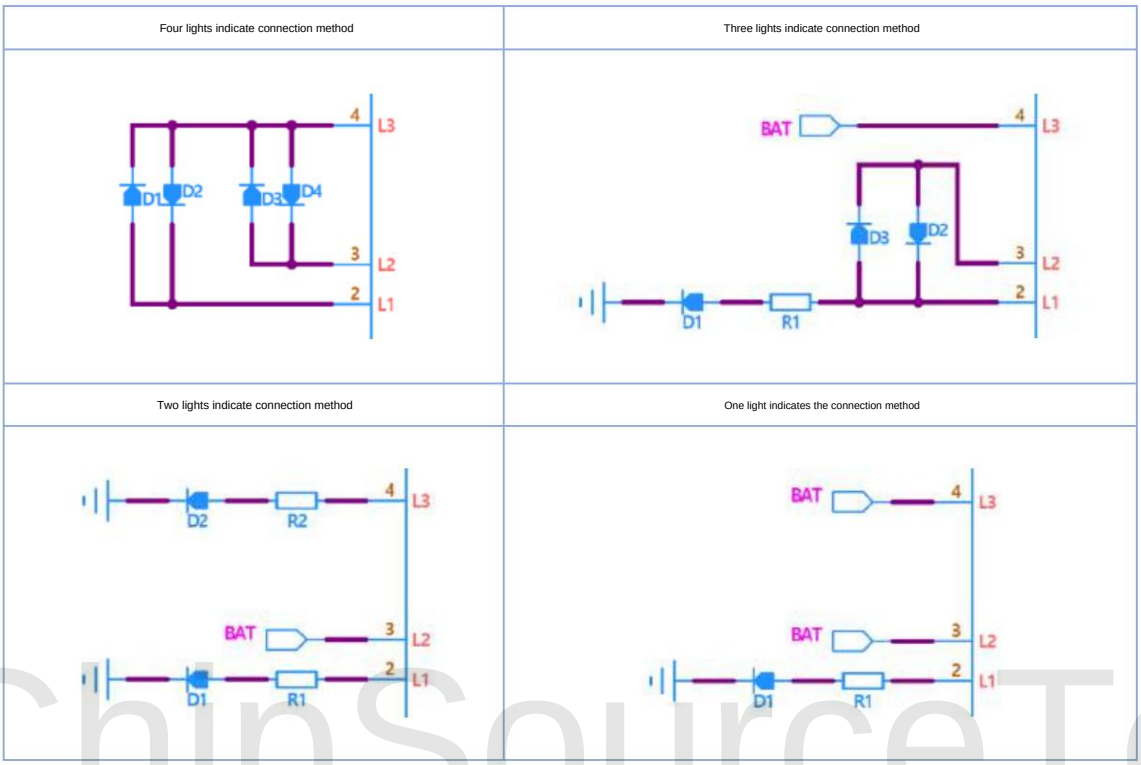
• Indicator light display mode

1. Lamp socket connection



2. Four-light display mode

After the input is powered on, the indicator light will run once and then indicate normally.

state	Power	D1	D2	D3	D4	frequency
Charging status	0%~25%	Flashing	Off	Off	Off	1Hz
	25%~50% Always on 50%~75% Always		Flashing	Off	Off	1Hz
	on 75%~100% Always on Always on		On On	Flashing	Off	1Hz
	75%~100% Always on 50%~75% Always		On On	On On	Flashing	1Hz
	100%	on	On On	On On	Steady on	
Discharge status	25%~50% Always on Always on Flashing		On On	On Off	Always on	
			Off Off	Off Off	Destroy	
					Destroy	
	3%~25%				Destroy	
	<3%				Destroy	2Hz

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3. Three-light display mode

Status Power		D1	D2	D3	frequency
Charging status	0%~33%		Off	Off	1Hz
	Flashing 33%~66% Constant			Off	1Hz
	on 66%~99% Constant on		Flashing	Flashing	1Hz
	100%		On On	Steady on	
Discharge status	Constant on 66%~100%		On On	Always on	
	Constant on 33%~66%		On Off	Destroy	
	3%~33%		Off	Destroy	
	<3%	Constant on Constant on Flashing		Destroy	2Hz

4. Two-light display mode

Status Process Charging process Fully		D1	D2	frequency
Charging status	charged Discharging			1Hz
	process	Flashing	Destroy	
Discharge status	Low charge	On	Always on	
		Off	Flash	2Hz

5. One light display mode

Status Process Charging process Fully		D1	frequency
Charging status	charged Discharging	Flashing	1Hz
	process		
Discharge status	Low power	Always on	
		Flash	2Hz

6. Indicator light displays parameters

SYMBOL PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
ILED	L1-L3 port output current		4	5	6	m.a.
FLED-CHG	LED flashing frequency when charging	Single light flashing	0.9	1	1.1	Hz
TLED-ATOFF	The time when the battery indicator automatically turns off	mode no load, button boost		8		S
FLED-LOWB	Low battery LED flashing frequency		1.8	2	2.2	Hz
VBST-D43	D4 OFF VBAT voltage	Discharge state, no-load		3.91		In
VBST-D32	D3 OFF VBAT voltage	discharge state, no-load		3.65		In
VBST-D21	D2 OFF VBAT voltage	discharge state, no-load		3.57		In
VBST-D1F	D1 Blinking VBAT voltage	discharge state, no-load		3.36		In

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• Other functions

1. Button and flashlight control function (TAP&WLED)

1) When RKEY1=10Kÿ, short press button S1 to start boost from standby mode.

2) When RKEY1=10Kÿ, long press button S1 to activate the flashlight function

3) When RKEY1=10Kÿ, double-click button S1 to turn off the boost output

4) When RKEY1=2Kÿ, the flashlight function is blocked, and long pressing has no function.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
VTAP	TAP port floating voltage	VIN =5V		4.9		In
		VIN =0VÿVBAT =4.2V		4.15		In
TTAPSHORT	Manual key short press time		24	28	32	mS
TTAPLONG	manual button long press time		1.50	1.75	2.00	S
IWLED	flashlight port current driving capability	VBAT=4.0V		22		m.a.

2. Other optional features

FM5324GA has some optional functions built in for different user conditions. Please consult us for specific functions and sample requirements.

Business and engineering staff.

Function	Optional function A	Optional function B	Optional function C	Optional function D
Key Mode RKEY1=10Kÿ	Double-click to shut down, long-press to switch on Flashlight	Double-click no function, long press to open Turn off the flashlight	Double-click to turn on the flashlight, long press Shutdown	Double-click to enter the small current negative Load detection mode, long press to open Turn off the flashlight
Key Mode RKEY1=2Kÿ	Double-click to shut down, long press to disable able	Double-click no function, long press off machine	Double-click to turn on the flashlight, long press Shutdown	Double-click to enter the small current negative Load detection mode, long press to turn off machine
Select 4.20V for full charge voltage, select mode		4.25V	4.35V	4.40V
1 for battery curve, select 3.0A for output		Mode 2	Mode 3	Mode 4
overcurrent protection, adjust input current		1.5A		
limit to 4.6V, and set no-load current to about		4.8V		
80mA. Set charging input current to 2.0A. Select none		About 200mA		
for flashlight current expansion mode		1.0A		
		have		
Indicator light display mode	Boost load indicator light Lights up, turns off when no load	The indicator light keeps on Bright		
Switching frequency 500KHz		1MegHz		

九、 应用说明

1. Capacitor selection: CVIN,

CBAT, COUT capacitors are filter capacitors. Ceramic capacitors can be used. The withstand voltage is 10V (recommended) or 6.3V. Under the condition that the cost allows, increasing COUT and CBAT will make the system more stable; if the boost output ripple requirement is not high, COUT can be slightly reduced while ensuring the stable operation of the system and having a certain margin; if the solution is for a larger output current, the capacitance value should be increased accordingly. In any case, choosing a capacitor of poor quality may cause the performance of the entire system to decline, shorten the service life, or even fail to work properly, so please choose the capacitor carefully. **2.** Inductor **L1** selection: It is recommended to use a 1.5uH shielded inductor, and an

unshielded inductor can also be used

to reduce costs. **3.** Boost load test: Because the chip has added two levels of short-circuit protection, there are

certain requirements for the boost

load test: If the output is connected to a large capacitive load (some models of load meters have very large capacitance), it

may be misjudged as short-circuit protection. When using a voltage source or simulated battery instead of a battery for testing, the transient response of various power sources is different, and the impedance of the power line may be relatively large. When boosting with CC or CR load or starting with load, short circuit protection may also occur. In actual application, since the battery is connected, the CC or CR situation will be improved. Generally, the input capacitance of portable devices is relatively small, and they will detect the input voltage. If the input voltage is not enough, they will not charge. Therefore, when the actual mobile power supply product charges the portable device, there will be no false short circuit.

十、 PCB 布局注意事项

1. High-current loop The high-

current loop refers to the devices and wiring that carry high current during switching. In this system, it is composed of L1, CBAT, COUT and the connections between them. Their wiring should be as wide and short as possible. The high-frequency switching (discontinuous current) path should not pass through the through hole, that is, L1, CBAT, and COUT must be placed on the same side of the PCB.

2. OUT and **PGND** The OUT and

GND pins of the chip are the power supply and ground of the chip driving part respectively. When the switch is working, there will be instantaneous large current flowing in and out. Therefore, when drawing the PCB, COUT should be as close to the OUT and GND pins of the chip as possible. OUT and GND should be separately connected to the positive and negative ends of COUT. The high current loop cannot pass through the middle. The wiring should be as wide and short as possible, and try not to pass through the through hole. The negative end of COUT, the negative end of CBAT, and GND should be as close as possible, and no through holes

should be used. **3.** Placement of capacitors

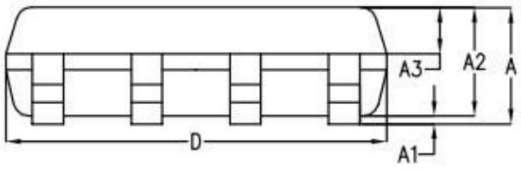
The negative end of COUT, the negative end of CBAT and the chip PGND pin should be as close together as possible without vias. The priority is COUT> CBAT> CIN.

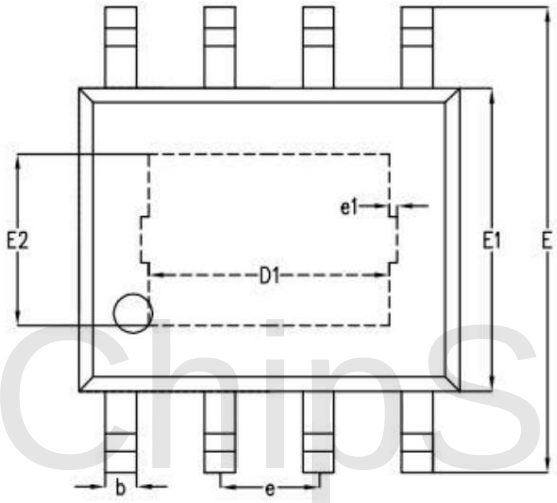
COUT, CBAT, CIN should be placed as close to the chip as possible, otherwise it may cause some abnormal conditions.

4. BAT pin

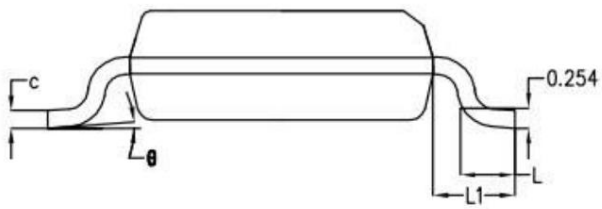
In the case of trickle charging, BAT will provide about 100mA current to the battery, so the lead from BAT to the battery should not be too thin.

十一、 封装信息：eSOP8L





SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	–	1.50	1.55
A1	–	0.10	0.15
A2	1.35	1.40	1.45
A3	0.55	0.60	0.65
b	0.35	0.40	0.45
c	0.17	0.22	0.25
D	4.85	4.90	4.95
E	5.90	6.00	6.10
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.60	0.65	0.70
L1	1.05BSC		
θ	0°	4°	6°



尺寸（mm） / L/F载体尺寸（mil）	D1	E2	e1
95*130	3.10REF	2.20REF	0.10REF
N/A	N/A	N/A	N/A

十二、 说明书版本信息

Version Update Date Description 2019/01/19	
1.0	Initial version
1.1	2019/02/25 Fixed some description errors
1.2	2019/09/03 Deleted the HOST function and the fixed time off mode