5V input 2~3 series battery built-in power mos Asynchronous boost charging IC

1 Features

- ✧ Built-in power mos
- ✧ 5V input asynchronous boost charging
- ✧ 2 to 3 series lithium batteries or lithium iron phosphate batteries are supported
- ✧ Constant voltage charge voltage can be set by external resistor
- ✧ input constant current charging, external resistance can be set
- ✧ Maximum input charging current 2A.
- ✧ boost charging efficiency 84%
- ✧ Automatically adjusts input current and ADAPTS adaptor load
- ✧ Support LED charging status indicator, support single-pin electric dual lamp function
- ✧ Input undervoltage, overvoltage protection
- ✧ Supports 0V battery trickle charging
- ✧ Supports NTC protection
- ✧ IC overtemperature protection
- ✧ ESD 4KV

2 Application Products

- 2~3 series lithium battery/lithium iron phosphate battery charging

3 Overview

IP2342 is an asynchronous boost charge management IC that supports 2-3 series lithium batteries/lithium iron phosphate batteries.

IP2342 adopts asynchronous switching architecture, so that it needs few peripheral devices in application, and effectively reduces the size of the overall solution and reduces the BOM cost.

IP2342's boost switch charging converter operates at 500KHz; 5V/2A input, 8V output conversion efficiency 84%;

The IP2342 has the input undervoltage protection function, which can intelligently adjust the charging current and adapt the load capacity of the adapter to prevent the adapter from being pulled down.

The IP2342 supports the VSET pin external resistor to set the constant voltage charging voltage.

The IP2342 supports the ISET pin external resistor to set the constant charging current at the input end.

IP2342 supports NTC function, NTC low temperature or high temperature stop charging.

The IP2342 is packaged in ESOP8.

4 Simplified application

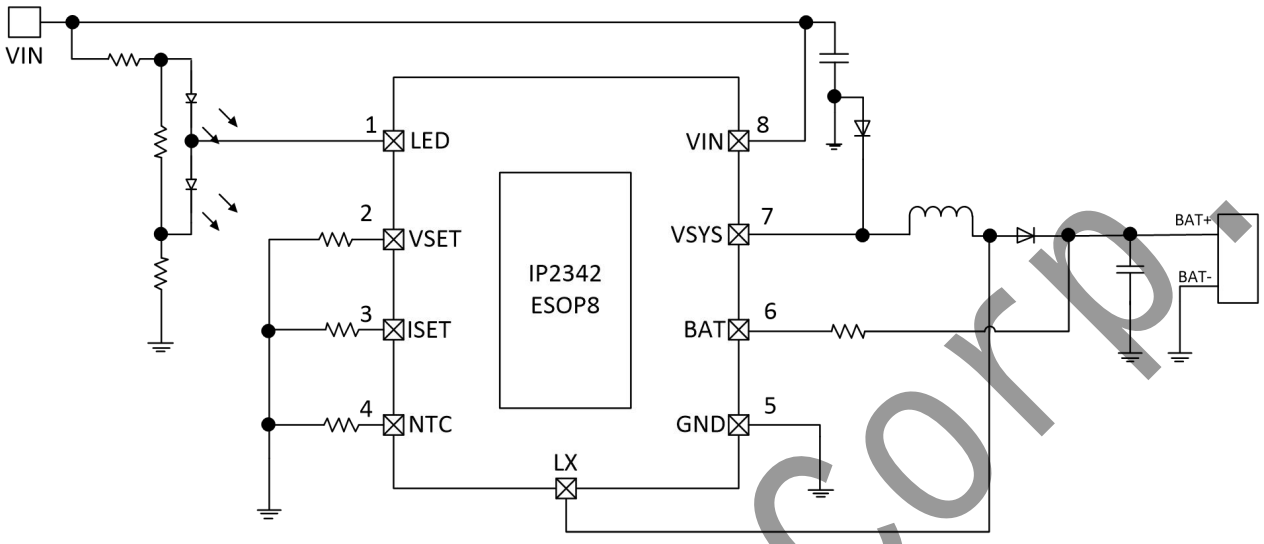

Figure 1 Schematic diagram of simplified application

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5 Record

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● Added the description of NTC protection temperature	12

Changed versions V1.01 to V1.02 (June 2024)	Page
● The VIN pin description is added separately for limit parameters	6

Changed versions V1.00 to V1.01 (May 2024)	Page
● Add charge input current and single section CV voltage description	10

First release V1.00 (April 2024)

6 Model selection

Model name	Description
IP2342_BZ	Standard model, support 5 series of lithium batteries, a single battery full voltage 4.2V
IP2342_3S	Support 3 series of lithium batteries, a single battery full voltage 4.2V

7 Pin definition

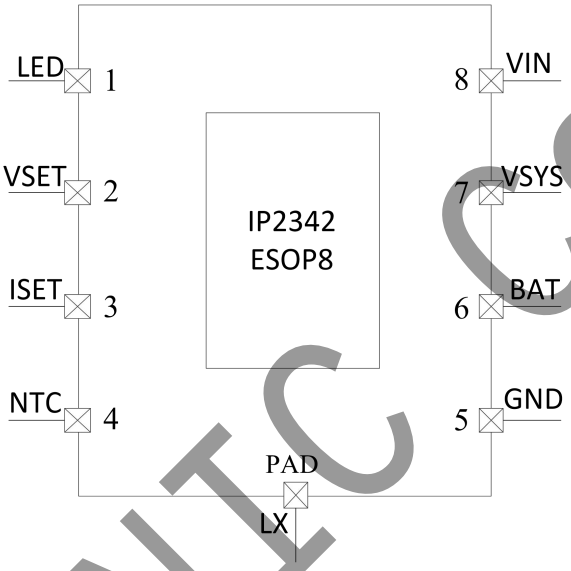


Figure 2 Pin diagram of IP2342

7.1 Pin description

Pin Name	Pin Num	Pin Description
LED	1	LED output pin (supports single-pin dual light function)
VSET	2	Constant voltage charge voltage setting pin
ISET	3	Input constant current charge current setting pin
NTC	4	The battery temperature detector foot is connected with a negative temperature coefficient resistor (NTC) to detect the battery temperature
GND	5	GND, ground
BAT	6	BAT pin, connect to the positive battery terminal
VSYS	7	VSYS pin, connected to the inductor
VIN	8	5V charging input pin
LX	9	DCDC switch node, connected to the inductor

8 Limit parameters

Parameter	Symbol	Value	Unit
BAT/LX voltage range	$V_{BAT/LX}$	-0.3 ~ 33	V
VIN voltage range	V_{IN}	-0.3 ~ 7.5	V
Other pins voltage range	V_{MAX}	-0.3 ~ 7.5	V
Junction temperature range	T_J	-40 ~ 150	℃
Storage temperature range	T_{stg}	-60 ~ 150	℃
Thermal resistance (junction temperature to environment)	θ_{JA}	60	℃/W
Human Body Model (HBM)	ESD	4	KV

*Stresses higher than the values listed in the Absolute Maximum Ratings section may cause permanent damage to the device. Excessive exposure under any absolute maximum rating conditions may affect the reliability and service life of the device.

9 Recommended working conditions

Parameter	Symbol	Min	Typical	Max	Unit
Input voltage	V_{IN}	4.5	5	5.5	V
Charging current	I_{VIN}			2	A

*Beyond these operating conditions, device operating characteristics cannot be guaranteed.

10 Electrical characteristics

Unless otherwise specified,TA=25℃,L=2.2uH,VIN=5V,VOUT=8V,R_{ISET}=NC,R_{VSET}=NC

Parameter	Symbol	Test Conditions	Min	Typical	Max	Unit
Charging system						
Input voltage	V_{IN}		4.5	5	5.5	V
Input undervoltage	Drop voltage		4.4	4.5	4.6	V
Input over-voltage	Rising voltage		5.6	5.8	6.0	V
Input overvoltage protection hysteresis				400		mV
Input working current	I_{VIN}	V_{IN} =5V，V_{BAT}=NC，NO LED		5	10	mA
Standby current	$I_{standby-BAT}$	V_{IN} =0，V_{BAT} =18.5V		5	10	uA

Constant current charging current	I_{CC}	R_{ISET}=180K		0.8		A
		R_{ISET}=150K		1.0		A
		R_{ISET}=120K		1.2		A
		R_{ISET}=90K		1.5		A
		R_{ISET}>1.5M,NC	1.8	2.0	2.2	A
Charge voltage	V_{CV}	R_{VSET}=2K		8.6		V
		R_{VSET}=10K		8.7		V
		R_{VSET}=15K		8.8		V
		R_{VSET}>150K,NC	8.2	8.4	8.6	V
Full stop test voltage	V_{SV}	N indicates the number of battery strings		V_{CV}-0.05*N		V
Charge back pressure after full	V_{RC}	N indicates the number of battery strings		4.1*N		V
Trickle constant current voltage	V_{TK}		2.9*N	3*N	3.1*N	V
Trickle charging current 1	I_{TK1}	VBAT<1.05*V_{IN}	100	200	300	mA
Trickle charging current 2	I_{TK2}	1.05*V_{IN}<V_{BAT}<V_{TK}		0.5*I_{CC}		mA
Full stop charge detection current	$I_{STOP-IN}$	Input current		600		mA
mos internal resistance of VIN to VSYS path tube				80	100	mΩ
Boost tube mos internal resistance				40	50	mΩ
Control system						
LED display drive current	I_{Led}				5	mA
LED high level voltage	V_{Led}			5		V
Thermal turn-off temperature	T_{OTP}	Rising temperature	125	135	145	℃
Thermal shutdown recovery temperature	T_{OTP-H}	Drop temperature	100	110	120	℃

11 Function description

11.1 Block diagram structure

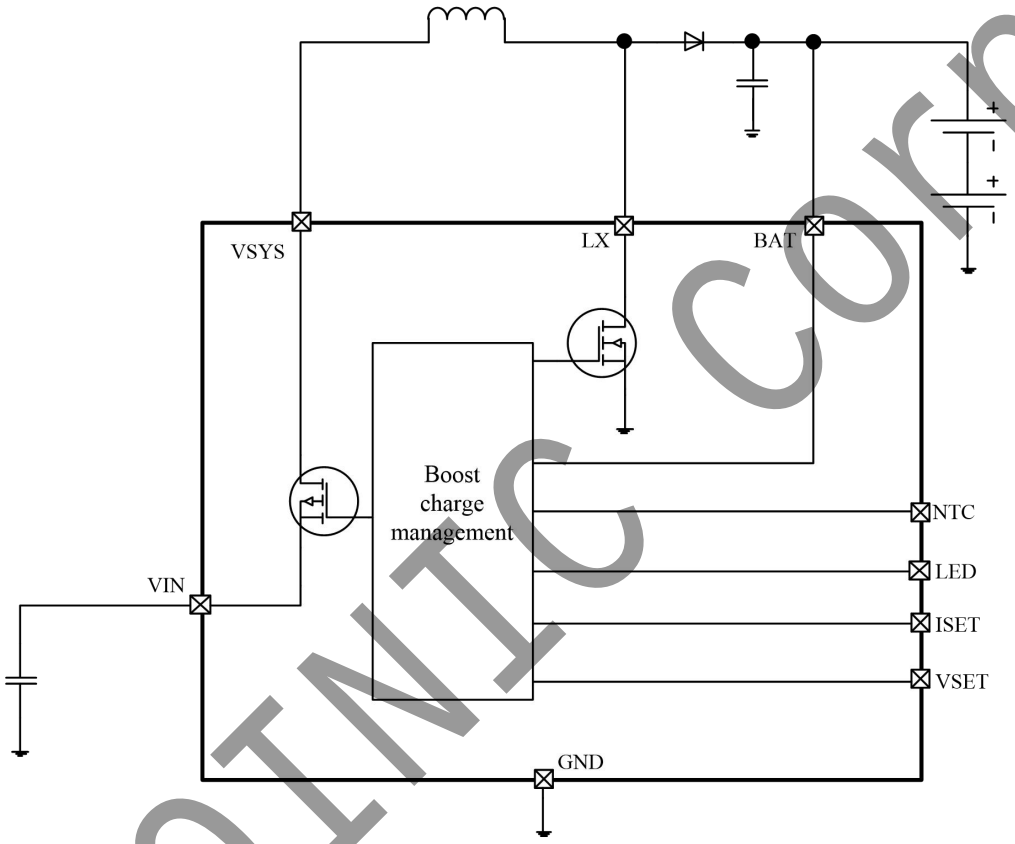


Figure 3 Internal block diagram of IP2342

11.2 Boost charge

The IP2342 integrates an asynchronous boost charging controller with a switching frequency of 500KHz to charge 2-3 lithium batteries/lithium iron phosphate batteries. With 5V/2A input and 8V output, the efficiency is 84%.

11.3 Charging process

The IP2342 uses a complete trickle/constant current/constant voltage charging mode.

The constant current charging current of IP2342 is a constant input current;

When the battery voltage VBAT<1.05*VIN, charge at 200mA trickle.

When the battery voltage is 1.05*VIN<VBAT<VTK, charge at half of the constant current input charging current.

When battery voltage VBAT >VTK, charge with constant current input charging current ICC;

When the battery voltage is close to the set constant voltage charging voltage VCV, the charging voltage VCV remains unchanged, the charging current slowly decreases, and the battery enters the constant voltage charging mode.

After entering the constant voltage charging mode, if the charging current is less than the full stop charge detection current ISTOP, the charging will be stopped first, and then the battery voltage will be detected whether it is higher than the stop charge voltage VSV; If it is higher than the stop charging voltage VSV, stop charging; If it is below the stop charge voltage, continue charging.

After the battery is full and stops charging, and the input VIN remains valid, if the battery voltage is less than VRC, it will enter the full and recharge stage, and the charging process will be started again.

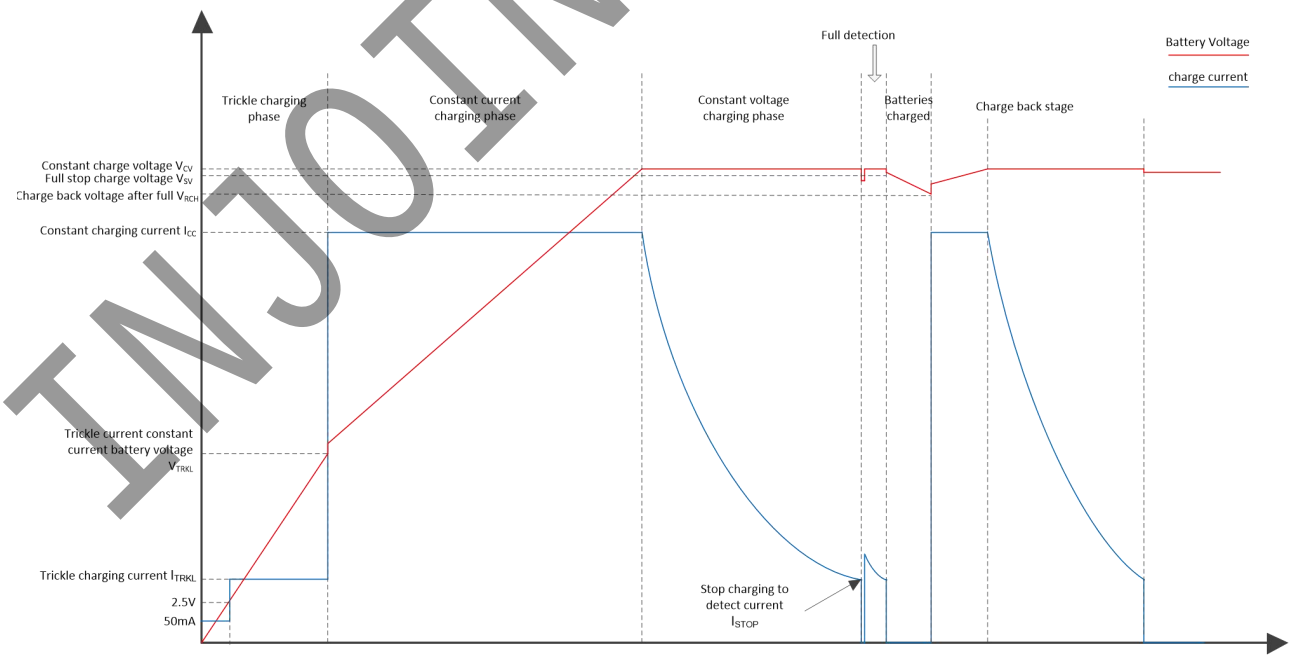


Figure 4 Battery charging process diagram

11.4 Charge protection

IP2342 has perfect protection function, integrated input undervoltage, overvoltage protection, IC overtemperature protection and other functions to ensure the stable and reliable work of the system.

The IP2342 has an input VIN input voltage regulator loop. When the input voltage is detected to be close to the 4.5V undervoltage threshold, it will automatically adjust and reduce the charging current to ensure that the input voltage is stable near the input undervoltage threshold and ensure that the adapter will not be suspended.

IP2342 integrated input overvoltage protection function, when the input voltage is detected to be greater than 5.6V overvoltage threshold, will stop charging;

IP2342 integrated overtemperature protection function, when the internal temperature of the chip is detected to exceed 135 degrees, it will forcibly stop charging;

11.5 Input charging current setting

IP2342 supports the ISET pin external resistor RISET to set the constant current charging current IIN at the input end. The relationship between charging current IIN and RISET is as follows:

I_{IN}（A）=2.13-R_{ISET}(KΩ)/143。

R_{ISET}（Ω）	Charging current
200K	0.8A
160K	1.0A
120K	1.2A
100K	1.5A
NC（≥1.5M）	2.0A

11.6 Constant voltage charging voltage setting

IP2342 supports VSET pin external resistor RVSET to set constant voltage charging voltage. The relationship between constant voltage charging voltage VCV and RVSET is as follows:

V_{CV}（V）=（0.05+0.025*R_{VSET}(KΩ)+4.2）*N　(N is the number of battery strings)

R_{VSET}（Ω）	Charge voltage
2K	4.3V
4K	4.35V
6K	4.4V
NC（≥150K）	4.2V

IP2342 standard is 2 series ternary lithium battery charging, require 3 series or lithium iron phosphate needs to be customized;

11.7 Lamp display function

IP2342 supports single-pin dual light function, LED1 is on during charging, LED2 is off (LED pin output low level), LED1 is off after full charging, LED2 is on (LED pin output high level). During the charging process, the LED flashes alternately after the NTC protection.

The IP2342 has the battery detection function. When the VIN is connected but the battery is not connected, the LED1 and LED2 blink alternately, indicating an exception. When the unconnected battery LED blinks abnormally, it will enter the normal charging process after connecting the battery.

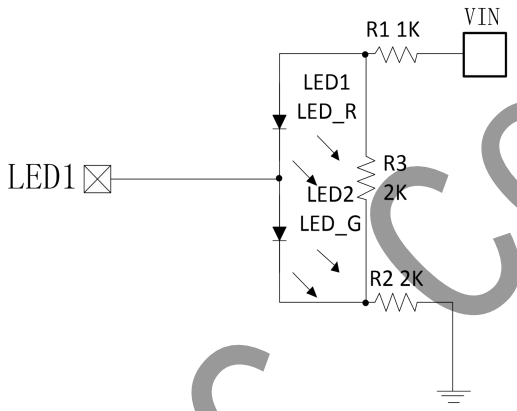


Figure 5 Schematic diagram of LED indicator.

11.7 NTC function

IP2342 integrates NTC function to detect battery temperature. When the IP2342 works, it generates a constant current source on the NTC pin and generates voltage with the external pull-down NTC thermistor. The chip determines the current battery temperature by detecting the voltage of the NTC pin internally.

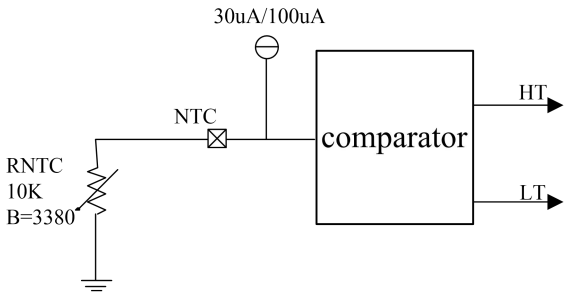


Figure 6 NTC comparator

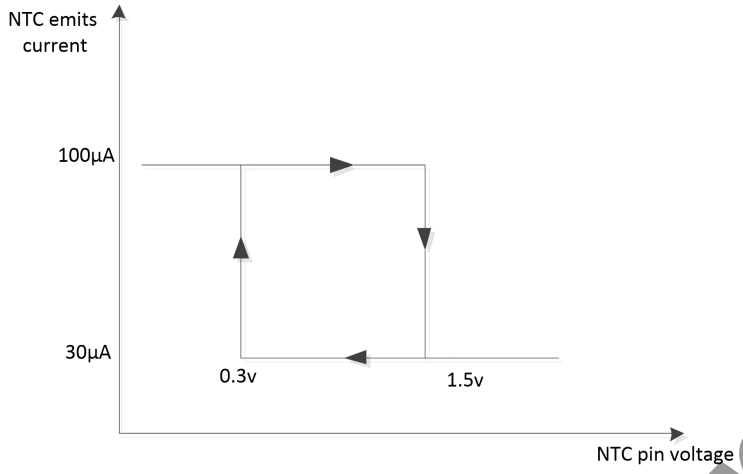


Figure 7 Relationship between NTC voltage and outgoing current

IP2342 releases 30/100uA current through the NTC pin, and then detects the voltage generated by the current on the NTC resistor to determine the temperature. When the detected temperature exceeds the set temperature, the charging is turned off.

The default output current is 100uA, when the pin voltage is detected to be greater than 1.5V (NTC resistance value is greater than 15K), the output current is reduced to 30uA;

At 30uA output, it is detected that the pin voltage is less than 0.3V (NTC resistance is less than 10K) and the output current becomes 100uA.

When charging:

When the NTC output current is 100μA and the voltage of the detected NTC pin is lower than 0.49V, the battery temperature is higher than 45 ° C and the charging function is stopped.

When the NTC output current is 30μA and the voltage of the detected NTC pin is higher than 0.82V, the battery temperature is lower than 0 ° C and the charging function is stopped.

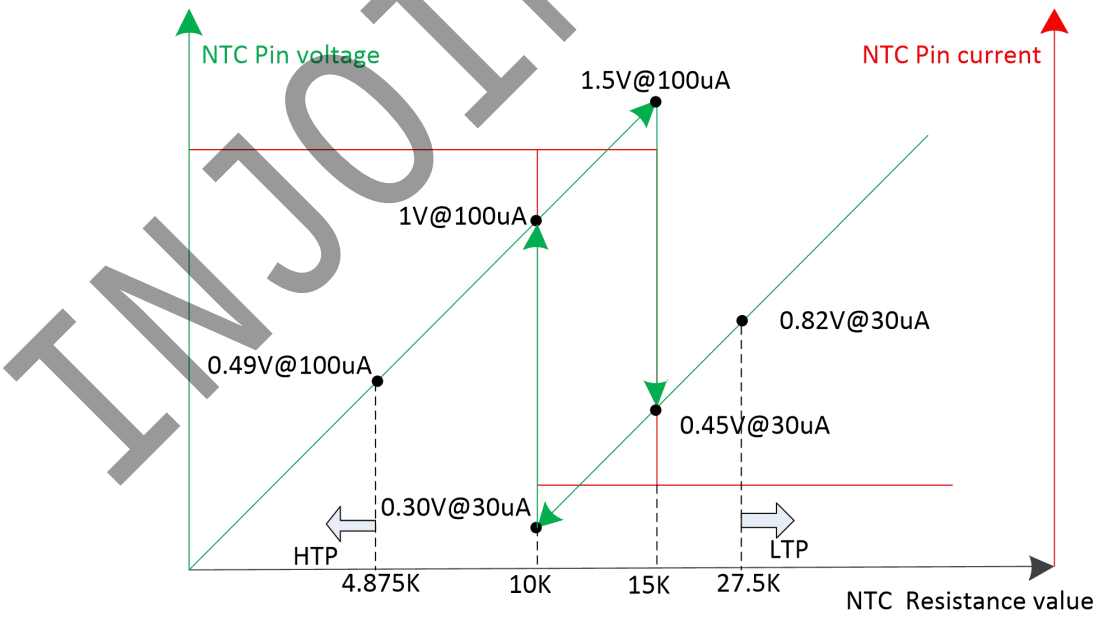


Figure 7 Relation between NTC voltage and NTC resistance value

If the NTC function is not required in the solution, connect the NTC pin to the ground with a 10 kω resistor. Do not float the NTC pin or ground it directly.

12 Application schematic diagram

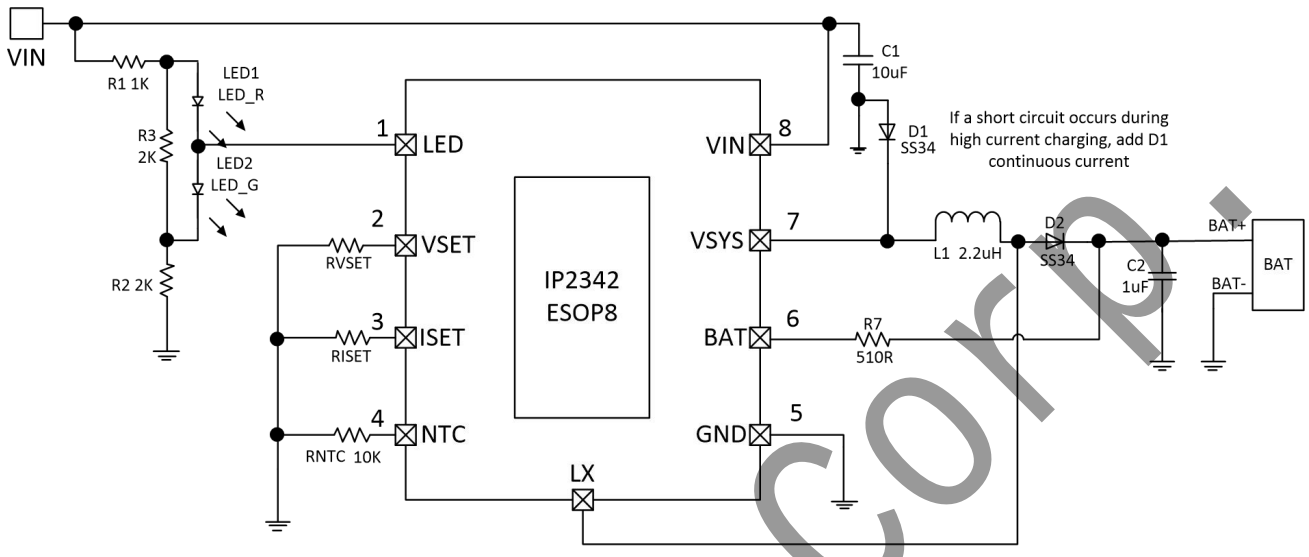


Figure 7 Schematic diagram of typical application

13 BOM

Num	Component name	Model & Specification	Location	Dosage	Remark
1	IC	IP2342	1	U1	
2	inductance	CD43	1	L1	Saturation Isat, temperature rise current Idc is greater than 3.5A, DCR is less than 35 milliohm, and the sensing value is 2.2uH @500KHz
3	Chip capacitance	0603 1uF 50V 10%	1	C2	The voltage value is greater than 50V, and the chip ceramic capacitor is required
4	Chip capacitance	0805 10uF 25V 10 %	1	C1	The voltage value is greater than 16V, and the chip ceramic capacitor is required
5	Patch resistance	0603 510R 5%	1	R7	
6	Patch resistance	0603 1K 5%	1	R1	
7	Patch	0603 2K 5%	2	R2,R3	

	resistance				
8	Patch resistance	0603	1	RVSET	Set constant voltage charging voltage; Select as needed
9	Patch resistance	0603	1	RISET	Set constant charging current; Select as needed
10	NTC resistance		1	RNTC	When not in use, connect 10K resistance to the ground;
11	Patch LED	0603	2	LED1,LED2	LED indicator
11	Schottky diode	SMA SS34	2	D1,D2	

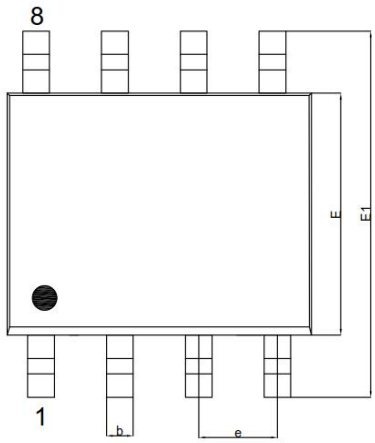
14 Silkscreen

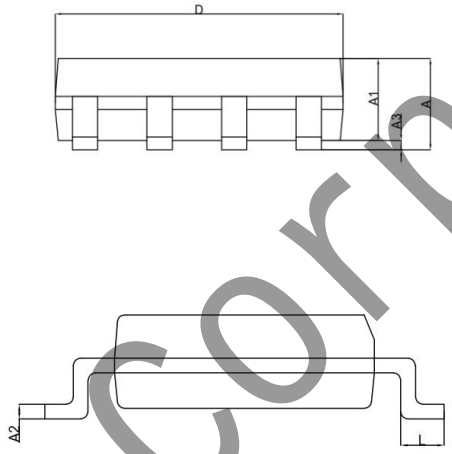
Instructions：

1、 ——Injoinic logo
2、IP2342 ——Product name
3、XXXXXXX ——Product number
4、 ○ ——Pin1 position

Figure 8 Silkscreen

15 Package





	POD	SOP8L		
		Size unit: mm		
	Symbol	Minimum	Normal	Maximum
Total Thickness	A	-	-	1.75
Molding Thickness	A1	1.30	1.40	1.50
LF Thickness	A2	0.20	-	0.24
Stand Off	A3	0.05	-	0.225
Body Size	D	4.80	4.90	5.00
	E	3.80	3.90	4.00
	E1	5.80	6.00	6.20
Lead Width	b	0.39	-	0.47
Lead Length	L	0.50	-	0.80
Lead Pitch	e	1.27 BSC		

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