

Single-cell lithium battery synchronous switch step-down charging IC

1 characteristic

- Synchronous Switch Buck Charging
- charging efficiency 94%(3.7V/2A)
- Maximum charge current 3A
- The charging current can be adjusted by an external resistor
- Automatically adjust input current, compatible with small current adapters
- support 4.20V/4.30V/4.35V/4.4V Battery supports
- charging NTC temperature protection
- supported charging status indicator
- power MOS built-in
- 750KHz switching frequency, can support 1uH inductor input
- overvoltage and undervoltage protection
- I_C cover temperature protection
- Charging overtime protection
- **ESD 4KV**

2 application

- Single-cell Li-ion/Li-ion battery charging

3 Introduction

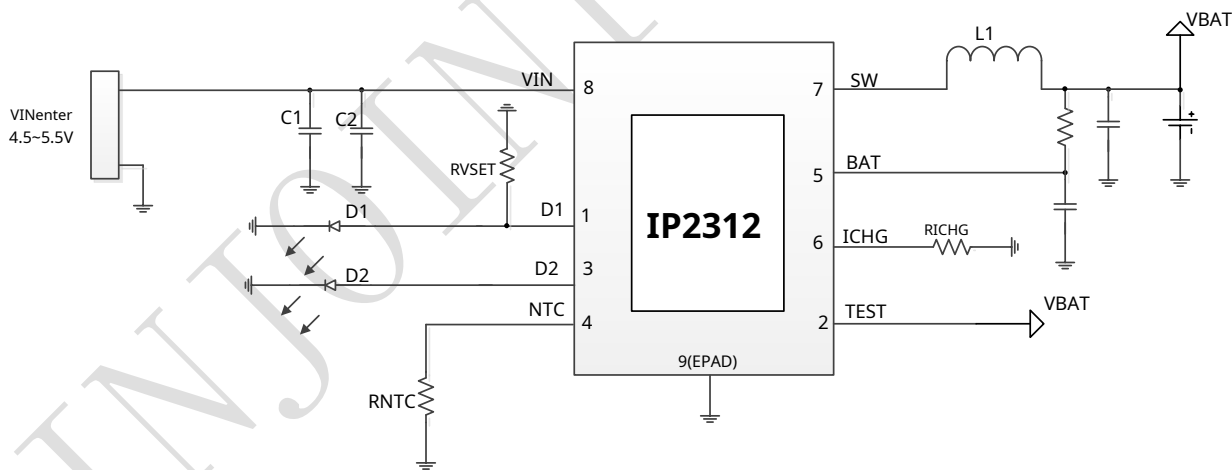
IP2312 is a 5V input, supports single-cell lithium battery synchronous switch buck charge management IC.

IP2312 integrated power MOS, using a synchronous switch architecture, which requires only a few peripheral devices in application, and effectively reduces the overall program size, reducing the BOM cost.

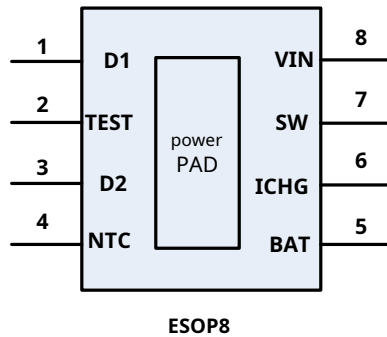
IP2312 The operating frequency of the boost switching charge converter 750KHz, the maximum charge current is 3A, 5V enter, 3.7V/2A conversion efficiency 94%; The charge current can be set by an external resistor.

IP2312 The input voltage is 5V, the input can intelligently adjust the charging current to prevent the adapter from being pulled.

IP2312 use ESOP8 encapsulation.



picture1 Simplified Application Schematic

4pin definition


picture2IP2312pin diagram

Pin Name	Pin Number	Pin Description
D1	1	ledDrive Pin/Battery Type Selection (IP2312_VSET)
TEST	2	test pin, connect 1K Resistor to battery positive
D2	3	leddrive pin
NTC	4	NTC temperature protection, then NTC resistance
BAT	5	Connect the positive pole of the lithium battery
ICHG	6	Charge current setting pin
SW	7	DC-DC switch pin
VIN	8	5V charging input pin
EPAD	--	GND

5 Limit parameter

parameter	symbol	value	unit
Port input voltage range	V_{IN}	- 0.3 ~ 6.5	V
Junction temperature range	T_J	- 40 ~ 150	°C
storage temperature range	T_{stg}	- 60 ~ 150	°C
Thermal Resistance (Junction Temperature to Ambient)	θ_{JA}	60	°C/W
Mannequin (HBM)	ESD	4	KV

*Stresses above those listed in the Absolute Maximum Ratings section may cause permanent damage to the device. Under any Absolute Maximum Ratings conditions

Excessive exposure time may affect the reliability and service life of the device

6 Recommended working conditions

parameter	symbol	minimum value	typical value	maximum value	unit
Input voltage	V_{IN}	4.5	5	5.5	V
recharging current	I_{CHRG}	0	2.1	3	A

*Device performance is not guaranteed beyond these operating conditions.

7 electrical characteristics

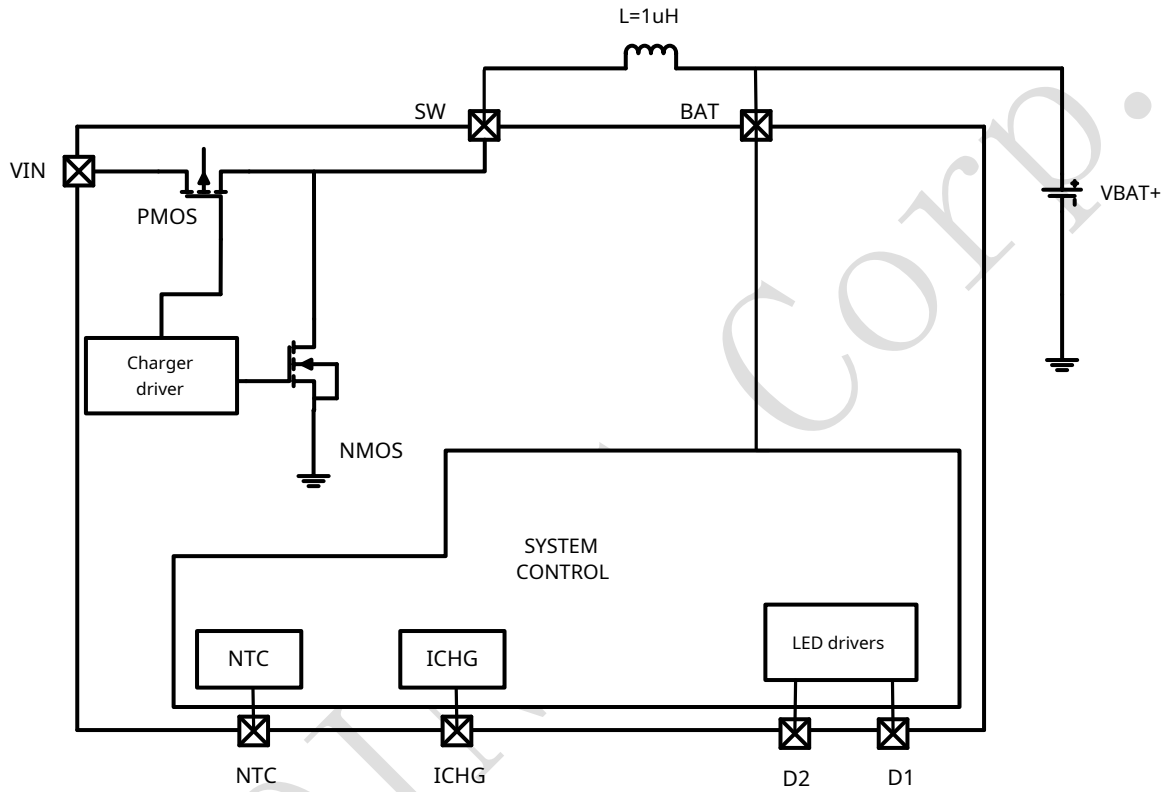
Unless otherwise specified, $T_A=25^{\circ}\text{C}$, $L=1\mu\text{H}$, $V_{IN}=5\text{V}$, $V_{BAT}=3.7\text{V}$

parameter	symbol	Test Conditions	the smallest value	typical value	maximum value	unit
charging system						
Input voltage	V_{IN}		4.5	5	5.5	V
Charging target voltage	V_{TRGT}		4.15	4.2	4.23	V
Default charging current	I_{CHRG-}	$V_{IN}=5\text{V}, V_{BAT}=3.7\text{V}, R_{ICHG}=NC$	1.8	2.1	2.4	A
Charging switching frequency	f_{s}		650	750	850	KHz
Trickle charge current	I_{TRKL}	$V_{IN}=5\text{V}, V_{BAT}=2.7\text{V}$	50	100	300	mA
Trickle cut-off voltage	V_{TRKL}		2.9	3.0	3.1	V
recharge threshold	V_{RCH}		4.08	4.1	4.13	V
Charging deadline	T_{END}		20	twenty four	28	hours
Input under-voltage protection voltage	$V_{IN-UVLO}$		4.4	4.5	4.6	V
Input Overvoltage Protection Voltage	V_{IN-OVP}		5.5	5.6	5.7	V

PMOSON resistance	r _{DS(on)}		30	35	40	mΩ
NMOSON resistance			25	30	35	mΩ
Battery Input Standby Current	I _{STB}	V _{IN} =0V, V _{BAT} =3.7V	30	40	50	uA
ledDisplay drive current	I _{L1} I _{L2} I _{L3}		3	5	10	mA
thermal shutdown temperature	T _{OTP}	rise in temperature	110	135	150	°C
Thermal shutdown recovery temperature	T _{OTP}	drop temperature	70	85	100	°C

8Functional description

Block diagram structure

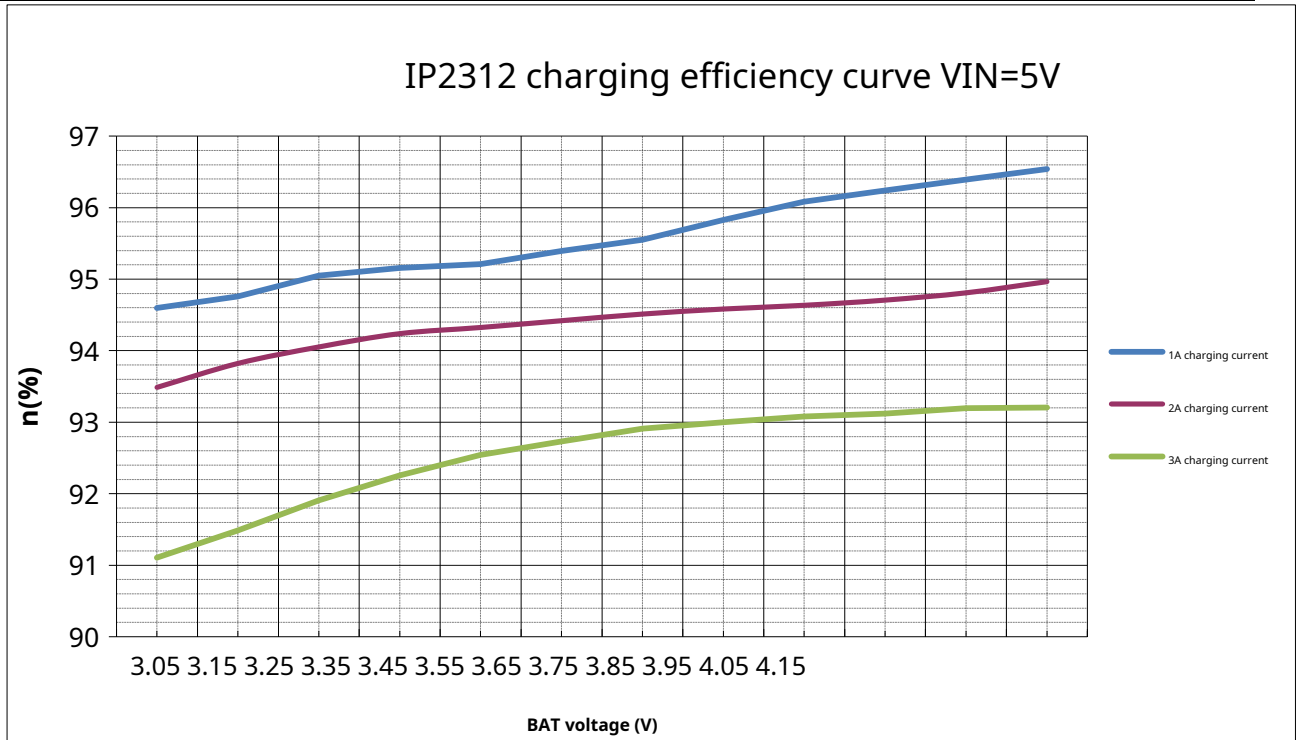


picture3 IP2312Internal block diagram

Synchronous Switching Buck Converter

IP2312 integrate a Buck Synchronous Switching Buck Charge Controller, Switching Frequency 750KHz,

5V enter, 3.7V/2A The output efficiency is 94%.



charging process

IP2312 use the complete CC/CV charging mode.

- When the battery voltage is lower than 3V, enter trickle charge mode to 100mA charging current to charge the battery.
- When the battery voltage is greater than 3V after that, enter the constant current charging mode, and charge the battery with the set constant current charging current.
- When the battery voltage approaches 4.2V, and the charging current is less than 300mA, enter the constant voltage charging mode. After entering constant voltage mode, every 4 seconds stop charging after 10 minutes, and check whether the battery voltage is higher than 4.15V: if higher than 4.15V, stop charging; otherwise, continue charging, and then 4 seconds check in minutes.
- When the battery is fully charged, if it is detected that the battery voltage is lower than 4.1V, will turn on charging the battery again.

charging protection

IP2312 It has perfect protection function. The built-in soft start function prevents failure caused by excessive inrush current at startup, and integrates input overvoltage, undervoltage, overtemperature and other protection functions to ensure stable and reliable operation of the system.

- IP2312 integrated VIN input undervoltage protection, VIN The input loop will automatically adjust the charge current when the IP2312 The input voltage is detected (p.8 pin voltage) is lower than the 4.5V After that, the charging current will be reduced so that the input voltage (p.8 pin voltage) is stabilized at 4.5V, make sure not to pull the adapter dead.
- IP2312 integrated VIN input overvoltage protection when IP2312 The input voltage is detected (p.8 pin voltage) higher than the 5.6V After that, charging will stop.

- IP2312 Integrated NTC temperature protection function, with NTC thermistor, when the temperature is detected at 0~43°C Normal charging when the temperature is within the range; when the temperature is higher than 43°C When the temperature is higher, the charging current is reduced by half; when the temperature is higher than 45°C When the temperature is low, stop charging.
- IP2312 Integrated charging overtime protection: when the charging time exceeds twenty four hours later, charging will be forcibly stopped.
- IP2312 Integrated over-temperature protection function: when IP2312 is detected that the die temperature reaches 135°C, it will stop charging; when the temperature drops to 85°C, IP2312 Only when the temperature returns to normal, start charging again;

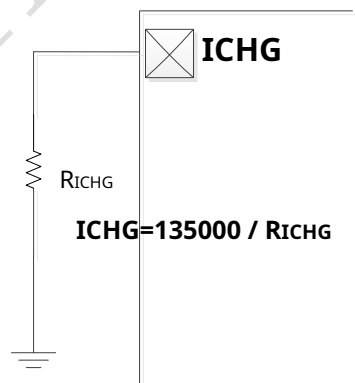
Battery Type Selection (Only IP2312_VSET models supported)

IP2312 default support 4.2V lithium battery, IP2312_VSET support through the D1 (No.1 Pin) is connected with pull-down resistors of different resistances to select the corresponding battery type, which is the same as shown in the typical application schematic:

D1 (No.1 Pin) on RVSET	Battery type selection (battery full voltage)
NC	4.2V
43K 1%	4.3V
75K 1%	4.35V
100K 1%	4.4V

Constant current charging current setting

Constant charging current I_{CC} can be passed through external resistor R_{ICHG} to set, the set current is the battery terminal constant current charging current: $I_{CC} = 135000 / R_{ICHG}$.

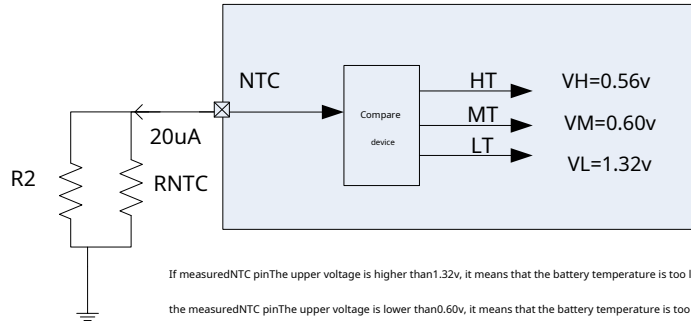


Typical current recommended resistance:

R_{ICHG} Terminal resistance	Battery terminal constant current charging current I_{CC}
135Kohm	1A
91 Kohm	1.5A
45Kohm	3A
NC	Defaults 2.1A

ChargeNTC

IP2312 support NTC protection function, through NTC the pin detects the temperature of the battery, and when the detected temperature exceeds the set temperature, it turns off charger.



picture4 NTCs block diagram

- when NTC detected temperature at 0~43 Normal charging within the temperature range. When the temperature is higher than 43 When the temperature is higher, the charging current is reduced by half; when the temperature is higher than 45 When the temperature is low, stop charging.
- if not required NTC function, you can NTC use 51K resistance to ground, NTC the pin cannot be left floating, otherwise it may cause abnormal charging.
- from NTC release 20uA current, NTC connect an external resistor to the GND, The temperature range is judged by the voltage drop produced by this current across the resistor.

Example: RNTC=100K @25°C thermistor (B=4100), R2=82K, the corresponding temperature and NTC Voltage:

temperature (degrees)	Internal Judgment Voltage (V)
- 20	1.52
- 15	1.49
- 10	1.44
0	1.32
43	0.60
45	0.56
50	0.49
55	0.43
60	0.38
65	0.33

Charge led instruct

IP2312 support 1 pieces or 2 grain led Indicator lights: 2

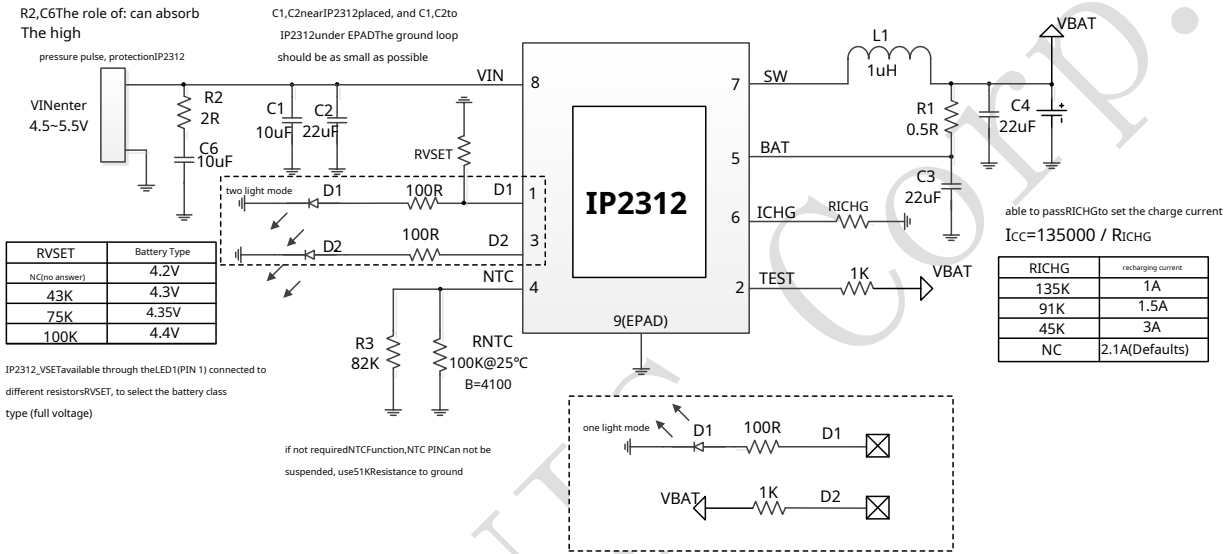
- lamp

	state	D1	D2
Charge	charging process	Bright	off
	full	off	Bright

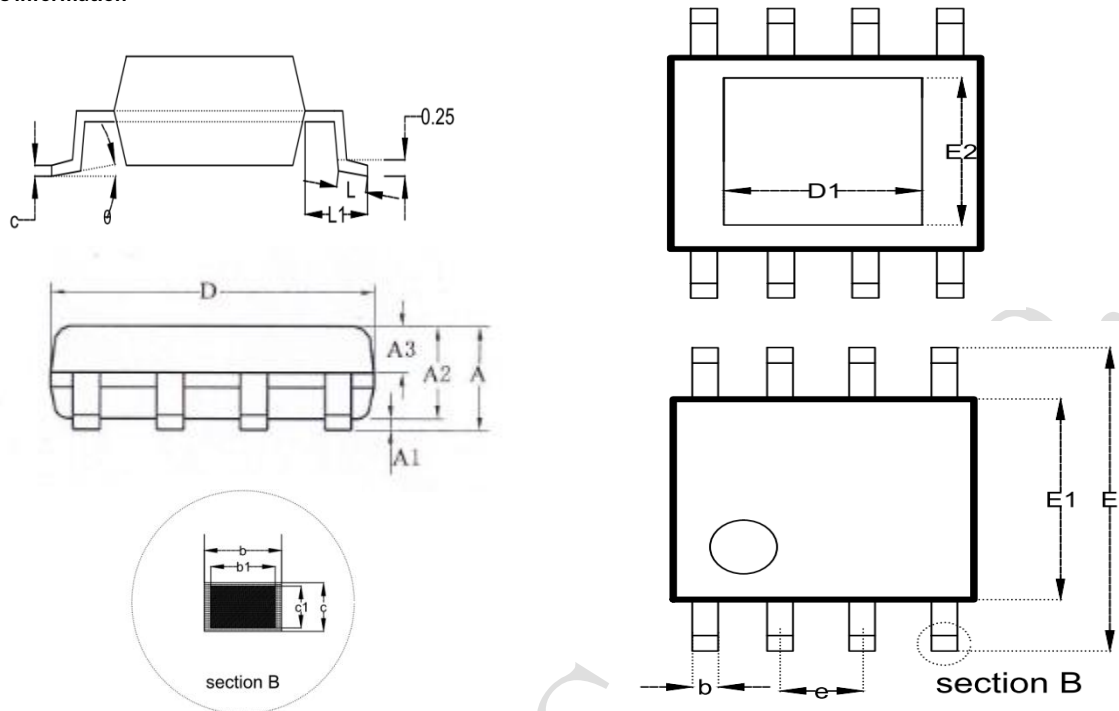
-1 lamp

	state	D1
Charge	charging process	0.5Hzflashing
	full	Bright

9Typical Application Schematic



picture5Typical Application Schematic

10Package information


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	--	--	1.65
A1	0.05	--	0.15
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	--	0.48
b1	0.38	0.41	0.43
c	0.21	--	0.25
c1	0.19	0.20	0.21
D.	4.70	4.90	5.10
E.	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
L	0.50	0.60	0.80
L1	1.05BSC		
θ	0	--	8°
D1	--	2.09	--
E2	--	2.09	--

Responsibility and Copyright Statement

Yingjixin Technology Co., Ltd. has the right to correct, modify, enhance, improve or make other changes to the products and services provided, and customers

You should obtain the latest relevant information before placing an order and verify that such information is complete and up to date. All product sales are subject to order confirmation

Recognize the terms and conditions of sale offered at the time.

Yingjixin Technology Co., Ltd. assumes no obligation for application assistance or customer product design. Customers should use Injoinic's products and applications

Use your own responsibility. To minimize risks associated with customer products and applications, customers should provide adequate design and operational safety verification.

Customers acknowledge and agree that while any application-related information or support may still be provided by Injoinic, they are solely responsible for satisfying their product

products and all legal, regulatory and safety-related requirements related to the use of Injoinic products in their applications. Customer represents and agrees that they have the

All the expertise and knowledge required to implement safety measures, foresee the dangerous consequences of failures, monitor failures and their consequences, and reduce possible

Occurrence of a malfunction that could cause personal injury and take appropriate remedial action. Customer will be fully indemnified for the use of any Yingji in such critical applications

Any losses caused to Yingjixin and its agents due to the core products.

For Injoinic's product manuals or data sheets, only if there is no tampering with the content and with relevant authorizations, conditions, restrictions and statements

Copying is only allowed under the circumstances. Injoinic assumes no responsibility or liability for such falsified documents. Copying information from third parties may require

subject to additional restrictions.

Yingjixin will update the content of this document from time to time. The actual parameters of the product may vary due to different models or other matters. This document does not

express or implied warranties or warranties

When reselling Yingjixin products, if there are differences or false elements in the statement of the product parameters compared with the parameters indicated by Yingjixin, it will be

Lose all express or implied authorizations for related Injichip products, and this is an improper and fraudulent business practice. Injoinic is liable for any such false

None of the representations assumes any responsibility or liability.