Product Specification

产品规格手册

QNW01

lithium-ion/polymer battery protection circuit

锂离子/聚合物电池保护电路

General Description

QNW01 is a lithium-ion/polymer battery protection circuit, designed to avoid the lithium-ion/polymer battery due to overcharge, overdischarge, excessive current resulting in shortened battery life or battery damage .

QNW01 has high precision voltage detection and time delay circuit. With 0V charging function, charging abnormal detection, overcharge lock and overdischarge self-recovery function. It is not suitable for products with poor wireless and RF signal arrangement and shielding. Please make sure to verify the finished product before using this product.

The ultra-small package and less required external components make it ideal to integrate the QNW01 into the limited space of battery pack. The accurate ±50mV overcharging detection voltage ensures safe and full utilization charging. The very low standby current drains little current from the cell while in storage.

Product feature

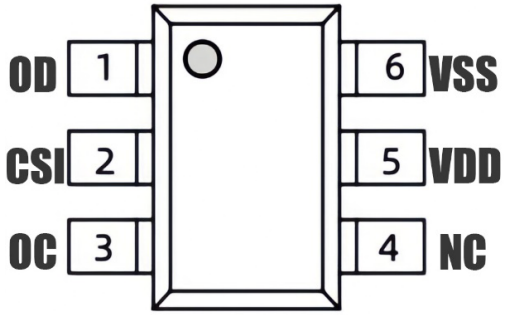
- Low working current
- Overcharge detection 4.280V, overcharge release 4.08V
- Overrelease detection 2.4V, overrelease 3.0V
- Overcurrent detection 0.16V, short circuit current detection 1.3V
- Overcurrent protection reset resistor
- Charger detection
- 0V charging enabled
- Charging anomaly detection
- Wide operating voltage range
- With self-recovery function
- Small package:SOT23-6

Product	Package	Overcharge detection voltage[V_{OCP}](V)	Overcharge release voltage[V_{OCR}](V)	Overdischarge detection voltage[V_{ODL}](V)	Overdischarge release voltage[V_{ODR}](V)	Overcurrent detection voltage[V_{OIL}](mV)
QNW01	SOT23-6	4.280±0.050	4.080±0.050	2.40±0.1	3.00±0.1	160±0.03

Applications

Protection IC for One-Cell Lithium-Ion/Lithium-Polymer Battery Pack.

Package and pin arrangement

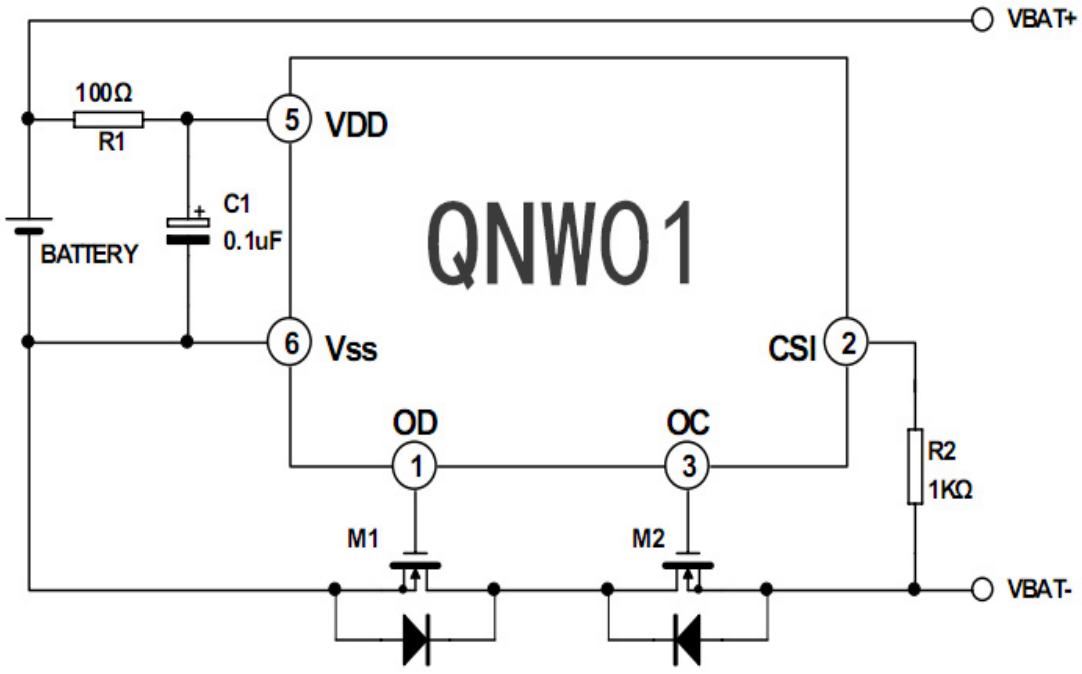


SOT23-6

Pin function description

Pin	Pin name	I/O	Functional descriptiom
1	OD	O	Discharge control FET threshold connection pin
2	CSI	I/O	Current sensing input pin, charger detection
3	OC	O	Charge control FET threshold connection pin.
4	NC	--	Connectionless
5	VDD	I	Positive power input pin
6	VSS	I	Negative power input pin

Typical Application Circuit



Absolute Maximum Ratings

Arguments	Symbol	Parameter range value	Unit
Supply voltage	VDD	VSS-0.3~VSS+8	V
OC Output pin voltage	VOC	VDD-15~VDD+0.3	V
OD Output pin voltage	VOD	VSS-0.3~VDD+0.3	V
CSI input pin voltage	VCSI	VDD-15~VDD+0.3	V
Operating temperature	Topr	-40~+85	℃
Storage temperature	Tstg	-40~+125	℃

"Limit parameter" means that if the operating point exceeds this parameter, the chip may be permanently damaged . If the operating point is close to the limit parameter for a long time, the chip reliability may be reduced.

Electrical characteristic parameter（Ta=25 ℃）

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
Working voltage	VDD		1.5		8	V
Working current	IDD	VDD=3.9V		4.0	6.0	uA
Overcharge detection voltage	VOCU		4.23	4.28	4.33	V
Overcharge releases voltage	VOCR		4.03	4.08	4.13	V
Overdischarge detection voltage	VODL		2.30	2.40	2.50	V
Overdischarge releases voltage	VODR		2.90	3.00	3.10	V
Overcurrent 1 Detects voltage	VOI1		0.13	0.16	0.19	V
(short-circuit current) Detects voltage	VOI2	VDD=3.6V	0.80	1.30	1.75	V
Overcurrent reset resistor	Rshort	VDD=3.6V	5	10	200	KΩ
Charger test voltage	VCH		-1.2	-0.7	-0.2	V
Charging abnormal detection voltage	VCIP	VDD=3.6V	-1.2	-0.7	-0.2	V
Overcharge detection delay time	TOC	VDD=3.6V~4.4V		80	200	ms

Overdischarge detection delay time	TOD	VDD=3.6V~2.0V		40	120	ms
Overcurrent 1 Detection delay time	TOI1	VDD=3.6V		10	20	ms
(short-circuit current) detection delay time	TOI2	VDD=3.6V		50	120	us
Charging anomaly detection delay time	TCIP	VDD=3.6V, CS=-1.1V		10	20	ms
OC pin output high level voltage	Voh1		VDD-0.1	VDD-0.02		V
OC pin output low level voltage	Voh1			0.1	0.5	V
OD pin output high level voltage	Voh2		VDD-0.1	VDD-0.02		V
OD pin output low level voltage	Voh2			0.1	0.5	V

Functional description

- Normal conditions

If VODL<VDD<VOCU, and VCH<CSI<VOI1, both M1 and M2 are turned on (see typical application circuit diagram). At this time, charging and discharging can be carried out normally.

- Overcharge condition

When entering the charging state from the normal state, the battery voltage can be detected by VDD. When the battery voltage enters this charging state, the VDD voltage is greater than the VOCU, the delay time exceeds the TOC, and M2 is turned off.

- Release the overcharged state

After entering the state of over-recording, there are two ways to release the state of over-recording and enter the normal state.

1) Disconnect the charger, if the battery self-discharge, and VDD<VOCR, M2 on, return to the normal state.

2) Disconnect the charger, connect the load, if VOCR<VDD<VOCU, CSI>VOI1, M2 turn on, return to normal mode.

Note: After overcharge is detected, if the charger is connected all the time, the overcharge state cannot be released even if the cell voltage is reduced to below VOCR. By disconnecting the charger connection, and CSI>VCH can release the overcharge state, which is the overcharge lock function.

- Overdischarge detection

When the normal state enters the discharge state, the battery voltage can be detected through VDD. When the battery voltage enters the overdischarge state, the VDD voltage is less than VODL and the delay time is more than TOD, then M1 is turned off.

- Release the power off mode

When the battery is in power off mode, if connected to a charger, and at this time VCH<VCSI<VOI2, VDD<VODR, M1 is still off, but release power off mode. If VDD>VODR, M1 turns on and returns to normal mode. Or when the load is suspended, the VDD voltage returns to VDD>VODR, M1 turns on and returns to normal mode (self-recovery function).

- Charge detection

If there is a charger connected to the battery in power off mode, the voltage will change to VCSI<VCH and VDD>VODL. M1 Turns on and returns to normal mode.

- Abnormal state of charge

In the normal working state of the battery, during the charging process, if the CSI terminal voltage is lower than the charge anomaly detection voltage (VCIP), and the duration of this state exceeds the charge anomaly detection delay time (TCIP), the MOSFET (OC terminal) used for charge control is turned off and the charging is stopped, this state is called "charge anomaly state".

After entering the charging abnormal detection state, if the CSI terminal voltage is higher than the charging abnormal detection voltage (VCIP) by disconnecting the charger, the charging abnormal state will be removed and the normal working state will be restored.

- Overcurrent/short-circuit current detection

In normal mode, when the discharge current is too large, the voltage detected by the CSI pin is greater than VOIX (VIO1 or VIO2), and the delay is greater than TOIX (TIO1 or TIO2), then the overcurrent (short circuit) state is represented. M1 shuts down and CSI pulls to VSS via internal resistor RCSIS.

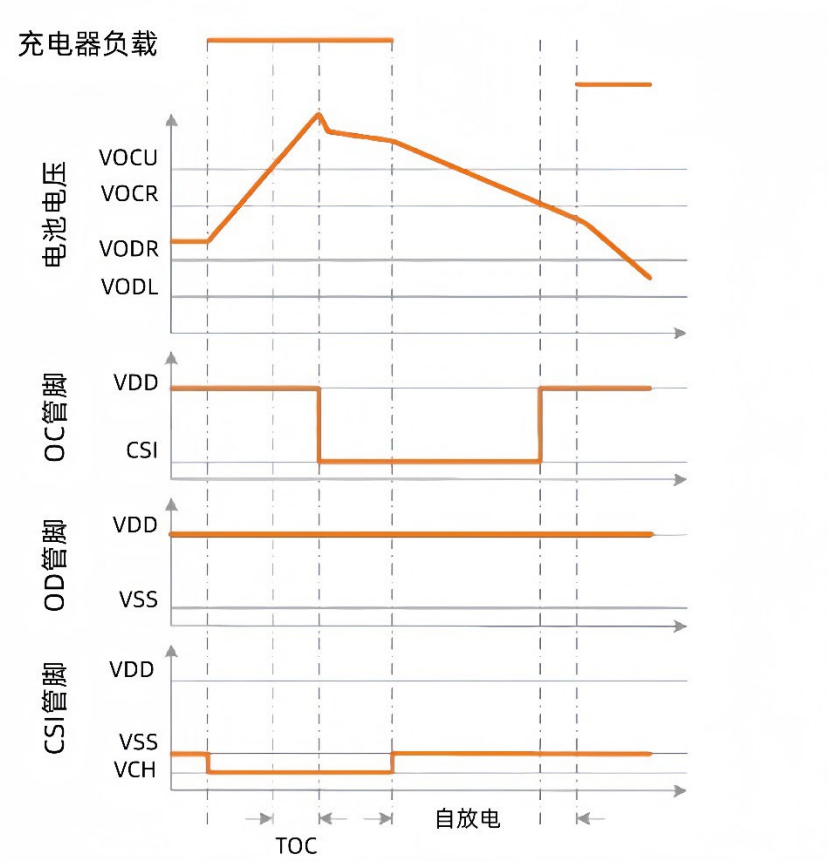
- Release overcurrent or short-circuit current

When the protection circuit remains in the overcurrent/short-circuit current state, the load is removed or the impedance between VBAT+ and VBAT- is greater than 500 kù, and VCSI<VOI1, then M1 turns on and returns to normal conditions.

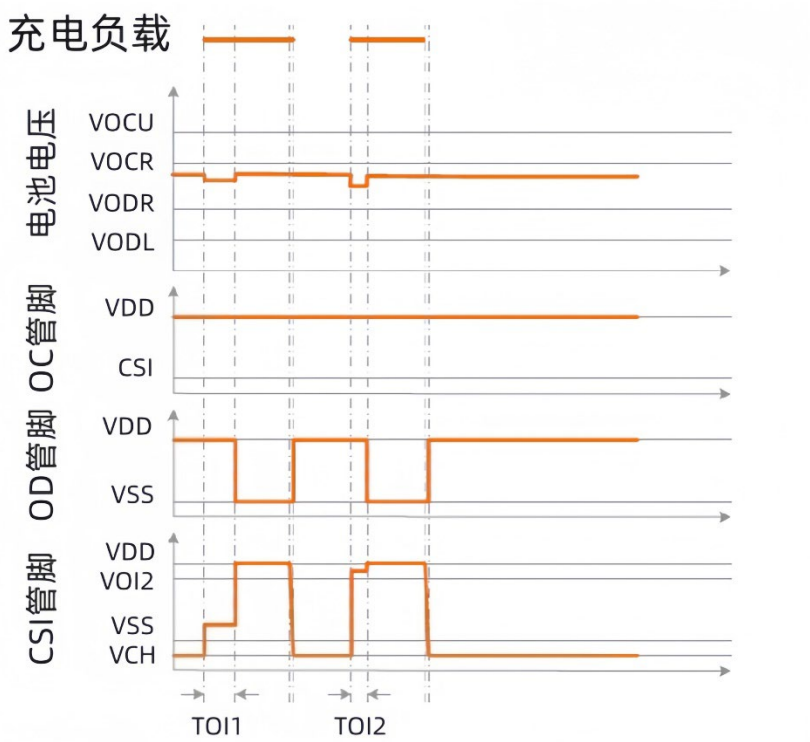
Note: When the battery is first connected to the protection circuit, this circuit may not enter normal mode and cannot discharge at this time. If this phenomenon occurs, the CSI pin voltage is equal to the VSS voltage (short circuit the CSI and VSS or connect the charger), you can enter the normal mode.

Sequence chart

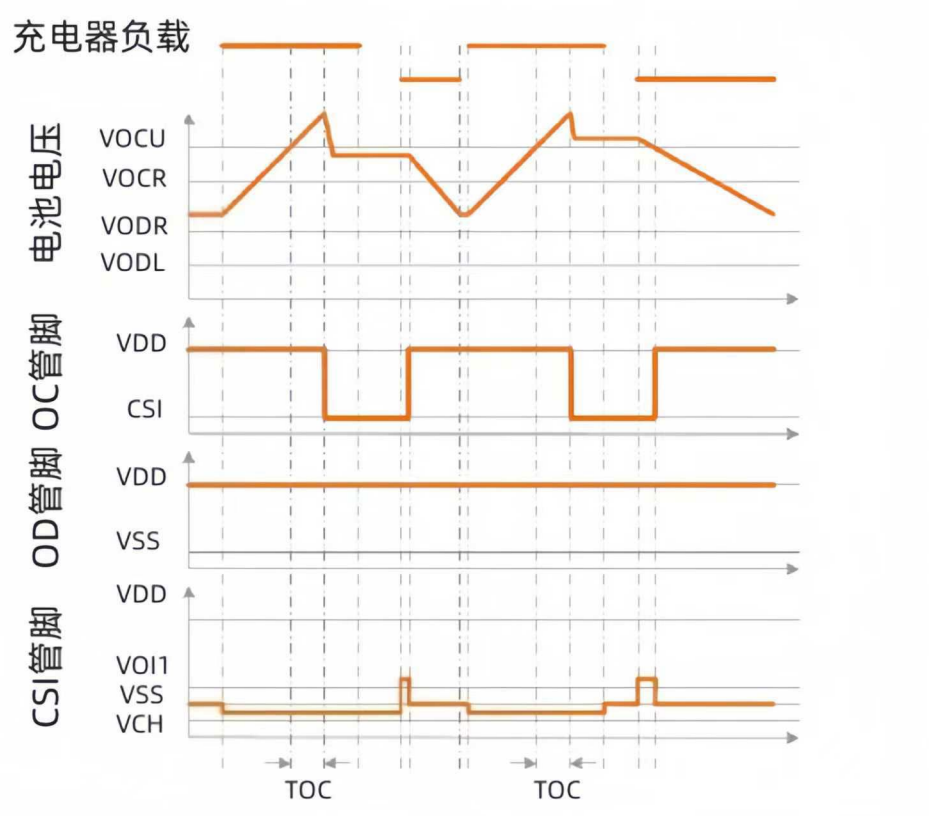
- Overcharge state → self-discharge state → Normal state



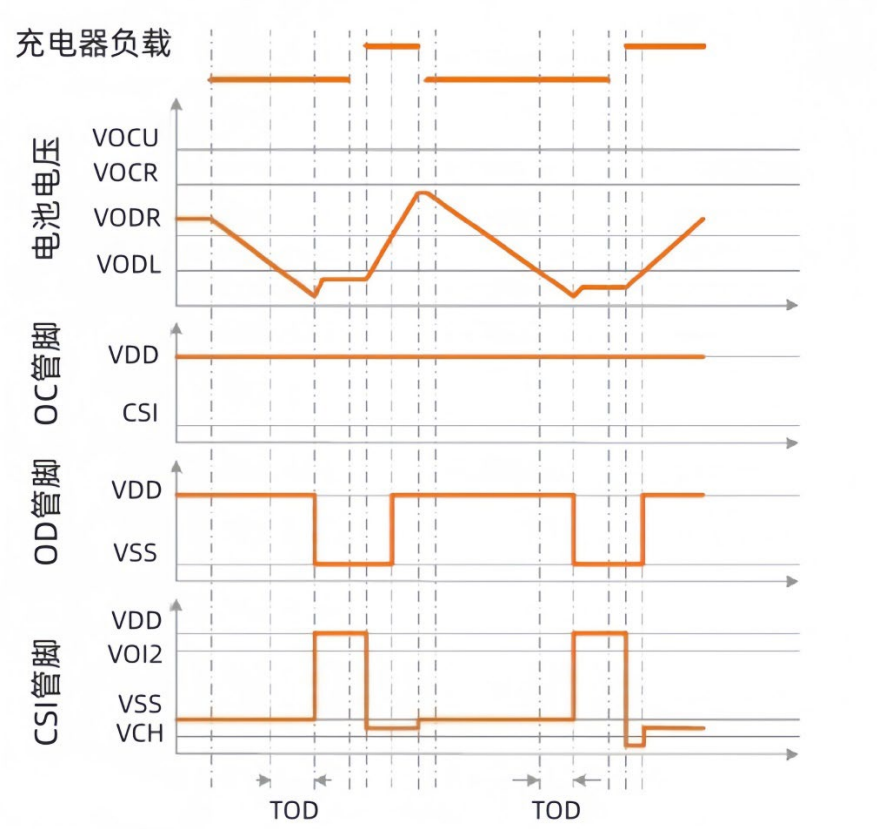
- Overcharge state → Load discharge state → Normal state



- Overcharge state → Charger charging state → Normal state

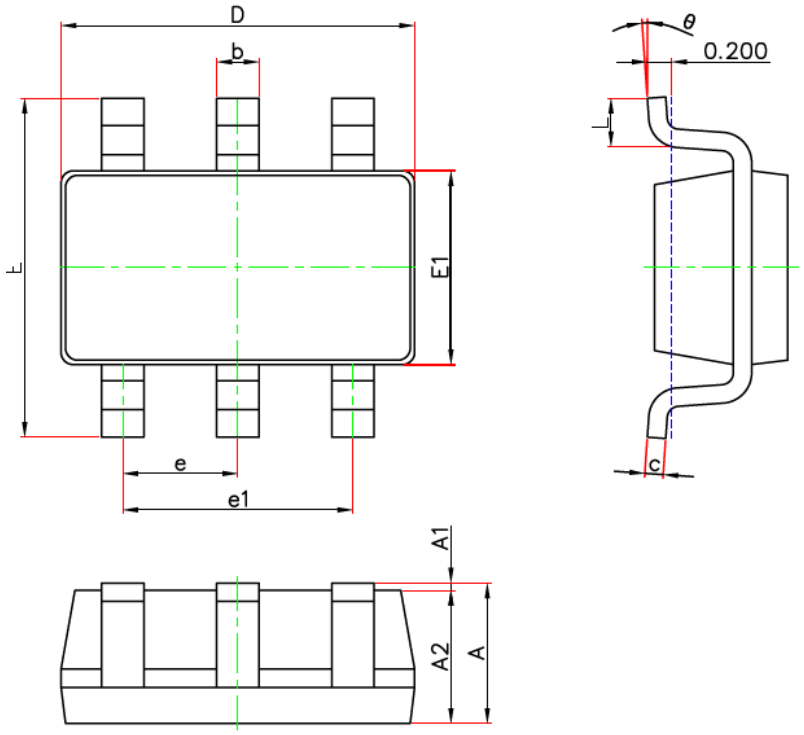


- Overcharge state →Normal state



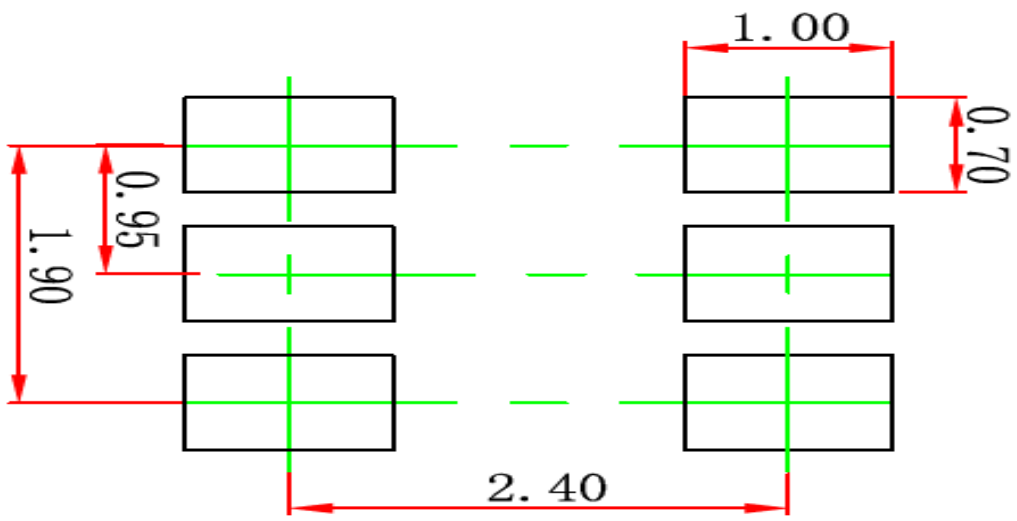
Package Outline Dimensions

(SOT23-6)



Symbol	Min.	Max.
A	1.050	1.250
A1	0	0.100
A2	1.050	1.150
b	0.300	0.500
c	0.100	0.200
D	2.820	3.020
E1	1.500	1.700
E	2.650	2.950
e	0.950	
e1	1.800	2.000
L	0.300	0.600
θ	0°	8°

Suggested Pad Layout



Note:

1.Controlling dimension: in millimeters

2.General tolerance: ±0.05mm

3.The pad layout is for reference purposes only

Packaging and ordering information

Name	Symbol	Package	QTY
QNW01	QNW01	SOT23-6	Braid reel 3000 pieces/reel