Shenzhen Fuman Electronics Group Co., Ltd.
SHEN ZHEN FINE MADE ELECTRONICS GROUP CO., LTD.

5088A(Document No.:S&CIC1609) **Two-in-one lithium battery protectionIC**

Overview

5088AThe product is a highly integrated solution for protecting single-cell lithium-ion/lithium-polymer rechargeable battery packs.5088AIncludes advanced power MOSFET, high-precision voltage detection circuit and delay circuit.

5088AIt has all the necessary battery protection functions such as overcharge, over-discharge, overcurrent, short circuit, etc., and has very low power consumption during operation. This chip is suitable for all applications of various information products that require long-term power supply from lithium-ion or lithium polymer rechargeable batteries.

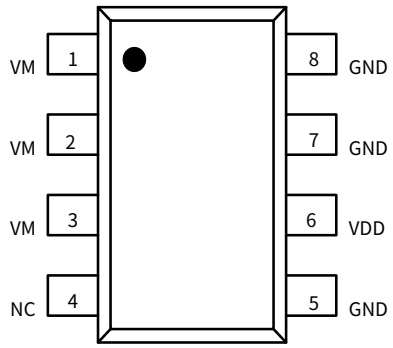
Features

- Internally integrated equivalent16mΩAdvanced power left and right MOSFET;
- 2Segment discharge overcurrent protection: over discharge current1, load short-circuit current;
- Charging overcurrent protection
- have0VCharging function
- Delay time is set internally;
- High-precision voltage detection;
- Low quiescent current consumption: normal operating current3.0uA
- compatibleROHSand lead-free standards.
- useSOP-8Packaging type: plastic packaging.

application

- Single-cell lithium-ion battery pack;
- Lithium polymer battery pack.

Pin diagram and description

Package	Pin Number	Pin Name	Pin Description
 SOP-8	1、2、3	VM	Overcurrent and short circuit detection pin (load ground terminal)
	4	NC	Dangling
	5、7、8	GND	ICNegative power supply terminal (battery cell negative input pin)
	6	VDD	ICPositive power supply terminal (positive input pin of battery cell)

Limit parameters

parameter	symbol	Parameter range	unit
VDDPower supply	VDD	-0.3~+10	V
VMAllowable input voltage.	VM	VDD-6~VDD+0.3	V
Operating temperature	T_A	-40~+85	℃
Storage temperature		- 55~125	℃

Electrical characteristic parameters

parameter	symbol	Test conditions	Minimum	Typical Value	Maximum	unit
Operating voltage						
Operating voltage	V_{DD}	- -	1.5	- -	10	V
Current consumption						
Working current	I_{DD}	VDD=3.7V	- -	3.0	6.0	uA
Detection voltage						
Overcharge detection voltage	V_{OCP}	- -	4.25	4.275	4.3	V
Overcharge release voltage	V_{OCR}	- -	4.025	4.075	4.125	V
Overdischarge detection voltage	V_{ODP}	- -	2.35	2.425	2.50	V
Overdischarge release voltage	V_{ODR}	- -	2.775	2.825	2.875	V
Overdischarge current detection voltage	V_{OI}	- -	0.12	0.15	0.18	V
Overcharge current detection voltage	V_{CI}	- -	- 0.12	- 0.15	- 0.18	V
Short-circuit current detection voltage	V_{SHORT}	VDD=3.6V	0.82	1.36	1.75	V
Delay time						
Overcharge detection delay time	T_{OC}	VDD=3.6V~4.4V	60	110	160	ms
Over-discharge detection delay time	T_{OD}	VDD=3.6V~2.0V	30	55	85	ms
Overcurrent detection delay time	T_{OI}	VDD=3.6V	4	7	11	ms
Short-circuit current detection delay time	T_{SHORT}	VDD=3.6V	200	400	600	us
other						
MOSTransistor on-resistance	R_{DS}(on)	V_{GS}= 3.7V, I_D= 1.0A	- -	16	20	mΩ
Continuous load current				7		A
Over temperature protection				140		℃
Over temperature protection recovery				110		℃
Charger voltage (0VCharge)	- -	- -	1.2	- -	- -	V

Functional Description

5088AIt is a high-precision lithium battery protection circuit. Under normal conditions, if the battery is charged,5088AIt may enter the overvoltage charging protection state; at the same time, it will return to the normal state after meeting certain conditions. If the battery is discharged, it may enter the overvoltage discharge protection state or the overcurrent discharge protection state; at the same time, it will return to the normal state after meeting certain conditions.

Normal state

Under normal conditions,5088APowered by batteries,VDDThe terminal voltage is above the overvoltage charge protection threshold$V_{OC}$and overvoltage discharge protection thresholdV_{OD} between,VMThe terminal voltage is at the charger detection voltage (V_{CHG}) and the overcurrent discharge protection threshold (V_{EDI}), built-inN-MOSAt this point, you can use a charger to charge the battery, or you can use a load to discharge the battery.

Overvoltage charging protection status

- **Protection conditions**

Under normal conditions, charge the battery.VDDThe terminal voltage rises above the overvoltage charging protection thresholdV_{OC}, and the duration exceeds the overvoltage charging protection delay timet_{OC},but5088AWill make the built-inN-MOSThe tube is turned off and the charging circuit is "cut off", i.e.5088AEnter the overvoltage charging protection state.

- **Recovery conditions**

There are two conditions that can make5088ARecovering from overvoltage charge protection state to normal state:

1) The battery is discharged due to "self-discharge"VDDThe terminal voltage is lower than the overvoltage charge recovery thresholdV_{OCR};

2) discharges the battery through the load (note that although the built-inN-MOSThe tube is turned off, but due to the existence of the internal diode, the discharge circuit still exists).VDDThe terminal voltage is lower than the overvoltage charging protection thresholdV_{OC},andVMThe terminal voltage is higher than the overcurrent discharge protection thresholdV_{EB}(In builtN-MOS Before the tube is turned on,VMThe terminal voltage will beGNDThe voltage drop of a diode is higher than the conduction voltage of the other end).

5088AAfter returning to normal state, the built-inN-MOSThe tube returns to the on state.

Overvoltage discharge protection/low power consumption state

- **Protection conditions**

Under normal conditions, if the battery is dischargedVDDThe terminal voltage drops to the overvoltage discharge protection thresholdV_{OD}, and the duration exceeds the overvoltage discharge protection delay timet_{OD},but5088Abuilt-inN-MOSThe tube is closed and the discharge circuit is "cut off", that is,5088AEnter the overvoltage discharge protection state. At the same time,VMThe terminal voltage will pass through the internal resistorRVMDPulled upVDD.

- **Recovery conditions**

When the charger is connected andVMVoltage**Lower than**Charger detection voltageV_{CHG}When the battery voltage rises to the overvoltage discharge protection thresholdV_{OD}When above, 5088Abuilt-inN-MOSThe chip enters normal mode.VMThe voltage is not lower than the charger detection voltageV_{CHG}, then the battery voltage rises to the overvoltage discharge recovery thresholdV_{ODR}When above,5088Abuilt-inN-MOSThe tube is turned on and the chip enters normal mode.

Overcurrent discharge/load short circuit protection status

- **Protection conditions**

Under normal conditions, the battery is discharged through the load.5088ACircuitVMThe terminal voltage will increase with the increase of discharge current.VMThe terminal voltage exceeds the overcurrent discharge protection thresholdV_{EDI}, and the duration exceeds the over-current discharge protection delay timet_{EDI},but5088AEnter

Overcurrent discharge protection state; if the discharge current increases further,VMThe terminal voltage exceeds the battery short circuit protection thresholdV_{SHORT}, and the duration exceeds the short-circuit delay timet_{short},but5088AEnter the battery short circuit protection state.

5088AIn over-current discharge/load battery short-circuit protection state, built-inN-MOSThe tube is closed and the discharge circuit is "cut off"; at the same time,VM The internal resistorRVMSConnect toGND, after the discharge load is removed,VMThe terminal level becomesGNDTerminal level.

- Recovery conditions

In the over-current discharge/battery short-circuit protection state, whenVMThe terminal voltage drops from high to below the overcurrent discharge protection thresholdV_{EDI}, and the duration exceeds the overcurrent discharge recovery delay timet_{EDIR},but5088ATherefore, in the over-current discharge/battery short-circuit protection state, when all discharge loads are removed,5088AIt can "self-recover".

5088AAfter returning to normal state, the built-inN-MOSReturn to the on state.

Over current charging protection status

- **Protection conditions**

Under normal conditions, the battery is charged through the power supply.5088ACircuitVMThe terminal voltage will decrease as the charging current increases.VMThe terminal voltage exceeds the overcurrent charging protection thresholdV_{ECI}, and the duration exceeds the over-current charging protection delay timet_{ECI},but5088AEntering the overcurrent charging protection state.

- **Recovery conditions**

In the over-current charging protection state, whenVMThe terminal voltage rises from low to above the overcurrent charging protection thresholdV_{ECI}, and the duration exceeds the overcurrent charge recovery delay timet_{ECIR},but5088ACan be restored to normal state.

5088AAfter returning to normal state, the built-inN-MOSReturn to the on state.

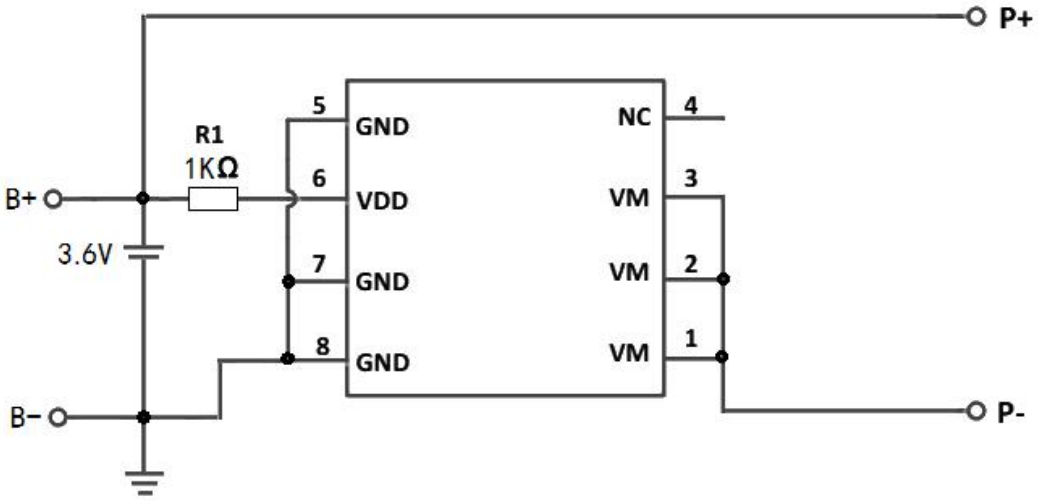
0VBattery Charging

- **0V battery charging allowed**

for0VThe battery charging circuit allows the battery to be charged if a charger is used.5088ACircuitVDDEnd relativeVMThe voltage at the end is greater than0V Charging permission thresholdV_{0V_CHG}WhenN-MOSThe diode inside the tube can form a charging circuit to increase the battery voltage; when the battery voltage increases toVDDThe terminal voltage exceeds the overvoltage discharge protection thresholdVODhour,5088AWill return to normal state, while the built-in N-MOSReturn to the on state.

Note: When the battery is first connected to the protection circuit, it may not enter normal mode and cannot be discharged.VMPin voltage equalGNDVoltage (VMandGNDShort circuit) or connect a charger to enter normal mode.

Typical application circuit diagram



Notice:1, pay attention to the input and output voltages and load currents to ensure that the chip power consumption does not exceed the maximum power consumption that the package can withstand.

21. This product has anti-static protection function, but do not exceed the product's maximum static resistance. 3、R1Range470Ωarrive1KΩ.

Packaging information