



Shenzhen Fuman Electronics Group Co., Ltd.

SHEN ZHEN FINE MAD ELECTRONICS GROUP CO., LTD.

DW06D(File No:S&CIC1057)

2-in-1 lithium battery protection IC

I. Overview

DW06D The product is a highly integrated solution for the protection of single-cell Li-ion/Li-polymer rechargeable battery packs. DW06D Includes advanced power MOSFETs, High-precision voltage detection circuit and delay circuit.

DW06D has a very small SOT23-6 package, which makes the device ideal for rechargeable battery pack applications where space constraints are very small. DW06D It has overcharge, overdischarge, overcurrent, short circuit and other protection functions required by the battery, and the power consumption is very low during operation. The chip is not only designed for mobile phones, but also suitable for all applications of various information products that require lithium-ion or lithium-polymer rechargeable batteries to supply power for a long time.

2. Features

- Internally integrated equivalent 50mΩ advanced power left and right MOSFETs;
- 3Segment overcurrent protection: Overdischarge current1, overdischarge current2 (optional), load short-circuit current;
- Charger detection function;
- Delay time internal setting;
- High-precision voltage detection;
- Low static current consumption: normal working current 3.8uA
- compatible ROHS and lead-free standards.
- use SOT23-6 Package form plastic seal.

3. Application

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

4. Order information

model	encapsulation	Overcharge detection voltage [V _{CU}](V)	Overcharge release voltage [V _{CL}](V)	Over-discharge detection voltage [V _{DL}](V)	Over discharge release voltage [V _{DR}](V)	Overcurrent detection voltage [V _{O11}](mV)	print mark
DW06D	SOT23-6	4.3	4.1	2.4	3.0	150	DW06D

5. Pin Diagram and Description

Package form	pin number	Pin name	Pin Description
<p>SOT23-6</p>	1	V-	Current sense input pin, charger detection
	2	S1	Charge MOS Tube Spole, charging negative pole
	3	S2	discharge MOS Tube Spole, connect VSS, external connection
	4	D.	MOS Tube D. pole
	5	VDD	Positive power input pin
	6	VSS	Connect to the negative pole of the battery cell



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6. Limit parameters

parameter	symbol	parameter range	unit
voltage	VDD	VSS-0.3~VSS+12	V
CSIInput pin voltage	VCSI	VDD+15~VDD+0.3	V
Operating temperature	Topr	- 40~+85	°C
storage temperature	Tstg	- 40~+125	°C

7. Electrical characteristic parameters

parameter	symbol	Test Conditions	minimum value	typical value	maximum value	unit
Operating Voltage						
Operating Voltage	VDD	- -	1.5	- -	10	V
current consumption						
Working current	IDD	VDD=3.9V	- -	3.0	6.0	uA
Detection voltage						
Overcharge detection voltage	VOCP	- -	4.25	4.30	4.35	V
Overcharge release voltage	VOCR	- -	4.05	4.10	4.15	V
Overdischarge detection voltage	VODP	- -	2.30	2.40	2.50	V
Over-discharge release voltage	VODR	- -	2.90	3.00	3.10	V
Overcurrent1Detection voltage	VOI1	- -	0.12	0.15	0.18	V
Overcurrent2(Short Circuit Current) Detection Voltage	VOI2	VDD=3.6V	0.80	1.00	1.20	V
Overcurrent reset resistor	Rshort	VDD=3.6V	50	100	150	KΩ
Passer detection voltage	VCHA	- -	- 0.8	- 0.5	- 0.2	V
Lag time						
Overcharge detection delay time	TOC	VDD=3.6V~4.4V	- -	110	200	ms
Overdischarge detection delay time	TOD	VDD=3.6V~2.0V	- -	80	140	ms
Overcurrent1Detection delay time	TOI1	VDD=3.6V	5	13	20	ms
Overcurrent2(Short Circuit Current) Detection Delay time	TOI2	VDD=3.6V	- -	5	50	us
MOSparameter						
singleMOSTransistor drain to source conduction impedance	Rds(on)	VGS= 2.5V, ID.= 3.3A	- -	22.0	30.0	mΩ
	Rds(on)	VGS= 4.5V, ID.= 8.2A	- -	16.0	20.0	
overcurrent	Iodc	VDD=3.6V	2.4	3.0	3.6	A
Drain-source breakdown voltage	V(BR)DSS	VGS= 0V, ID.= 250μA	19	20	- -	V
continuous drain current	ID(DeviceRef.)	TJ= 25°C			5A	A
Gate Threshold Voltage	VGS(th)	VDS=VGS, ID.=250μA	0.55	0.65	0.95	V
Drain-Source Current	IDSS	VDS=20V, VGS= 0V, TJ= 25°C			1	uA
Gate-Source Current	IGSS	VGS= ±10V			100	n



8. Function description

DW06D Monitor the voltage and current of the battery, and by disconnecting the charger or load, protect the single-cell rechargeable lithium battery from damage due to over-charge voltage, over-discharge voltage, over-discharge current, and short circuit. These functions make the rechargeable battery work within the specified range.

MOSFETs Built-in, the typical value of the equivalent resistance is 50mΩ

normal working mode

If no abnormal condition is detected, both charging and discharging process will switch freely. This situation is called normal working mode.

Overcharge voltage condition

During charging under normal conditions, when the battery voltage is higher than the overcharge detection voltage (VOCP), and the duration reaches the overcharge voltage detection delay time (TOC) or longer, DW06D will control MOSFETs to stop charging. This condition is called an overcharge voltage condition. The overcharge voltage condition will be released under the following two conditions:

- 1, When the battery voltage is lower than the overcharge release voltage (VOCR), DW06D Control charging FETs Turn on and return to normal working mode.
- 2, When a load is connected and discharge starts, DW06D Control charging FETs conduction returns to normal operating mode. The release mechanism is as follows: After the load is connected, the discharge current flows through the charging immediately FETs. The internal parasitic diode starts to discharge, BATT-voltage rises to 0.7V, DW06D After detecting this voltage, when the battery voltage is equal to or lower than the overcharge detection voltage (VOCP), DW06D Immediately return to the normal working mode. In addition, when the load is connected and discharged, if BATT-voltage equal to or lower than the overcurrent1 detection voltage, the chip will not return to normal state.

Note: When the battery is charged to exceed the overcharge detection voltage (VOCP) and the battery voltage does not drop below the overcharge detection voltage (VOCP) Below, even with an overload that can cause overcurrent, overcurrent1 and overcurrent2 will not work unless the battery voltage drops below the overcharge detection voltage (VOCP) the following. But in fact, the battery has internal resistance. When the battery is connected to a heavy load, the voltage of the battery will drop immediately. 1 and overcurrent2 will act. Short circuit protection is independent of battery voltage.

Over-discharge voltage

During normal discharge, when the battery voltage drops to the over-discharge detection voltage (VODP) below, and the duration reaches the over-discharge voltage detection delay time (TOD) or longer, DW06D The connection between the battery and the load will be cut off, and the discharge will stop. This condition is called an over-discharge voltage condition. When controlling discharge FETs is turned off, BATT-through internal BATT-and VDD between RBATT-D resistor is pulled high. when BATT-If the voltage is higher than the load short-circuit detection voltage, the current consumption of the chip will drop to the sleep current (IPDN). This condition is known as a dormant condition. In overdischarge and sleep conditions BATT-and VDD Between by RBATT-D Resistor connection. When a charger is connected and BATT-and VDD The potential difference between 1.3 V (Typical value) or higher (load short-circuit detection voltage) to release the sleep state. Discharge at this time FETs Still disconnected. When the battery voltage becomes the over-discharge detection voltage (VODP) or higher (see note), DW06D make FETs turn on to return to normal operating mode. .

Remarks: When the battery in the case of over-discharge is connected to the charger, if BATT-The terminal voltage is not lower than the charger detection voltage (VCHA), And the battery voltage reaches the over-discharge release voltage or higher (VODR) The over-discharge condition is released (the control discharge FETs conduction).

Over-discharge current condition

In normal working mode, when the discharge current is equal to or higher than the set value (BATT-voltage is equal to or higher than the overcurrent detection voltage) and the time continues to exceed the overcurrent detection delay time, DW06D Shutdown discharge FETs Stop discharging. This is called over-discharge current condition (including over-discharge current1, overdischarge current2 and load short-circuit current). In case of overcurrent BATT-and GND internally connected RBATT-S resistance. When a load is connected, BATT-voltage equal to VDD The voltage across the load resistor.

According to behavior such as cutting off the load, B+and B-The impedance between them increases to be greater than or equal to the impedance that can automatically return to the normal state, and the over-discharge current state will be released and return to the normal state. because BATT-and GND connection between RBATT-S resistance, when the load is disconnected, BATT-voltage is pulled to ground potential. when detected BATT-Potential below the overcurrent1 detection voltage (VOI1), the chip returns to normal state.



Abnormal charging current situation

During normal charging, if BATT-The voltage drops below the charging detection voltage (VCHA), the duration exceeds the overcharge voltage detection delay time (TOC), DW06DShutdown charging FETsStop charging. This is called abnormal charging current detection. when dischargingFETsturn on andBATT-voltage will reach the charging detection voltage (VCHA)The charging current detection does not work normally in the following cases. In the case of over-discharge voltage, when the abnormal charging current flows into the battery, after the battery voltage becomes the over-discharge detection voltage and the duration reaches the over-charge detection voltage delay time (TOC),DW06DShutdown chargingFETsStop charging.

disconnect the charger,BATT-andGNDThe voltage between is lower than the charger detection voltage (VCHA), the abnormal charging current mode is released.

load short circuit

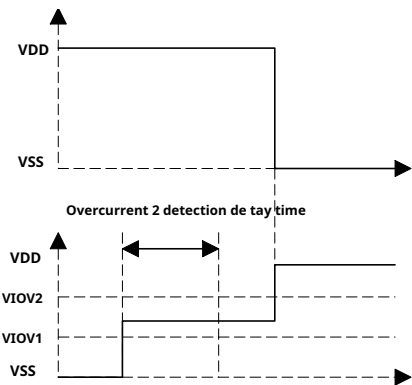
if BATT-The voltage is higher than the short-circuit protection voltage (VOI2), DW06DDisconnect from the load to stop discharging. Delay no longer thanTOI2. whenBATT- The voltage is higher than the short-circuit protection voltage (VOI2)When, for example, the load is removed, the load short condition will be released.

delay circuit

when overdischarge current1is detected, the overdischarge current2and load short-circuit detection delay time begins to count. Once the over-discharge current is detected2Or the load short-circuit time exceeds the over-discharge current2or load short-circuit delay time,DW06DDischarging will stop.

When the over-discharge current is detected and the over-discharge detection delay time is exceeded, if the battery voltage is lower than the over-discharge detection voltage, the system will enter the sleep state. like

Due to the over-discharge current, the over-discharge voltage drops to the over-discharge detection voltage,DW06DDischarge will be stopped by over-discharge current detection.



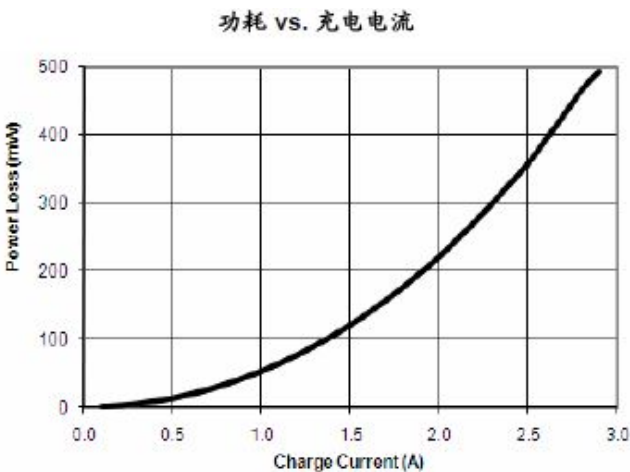
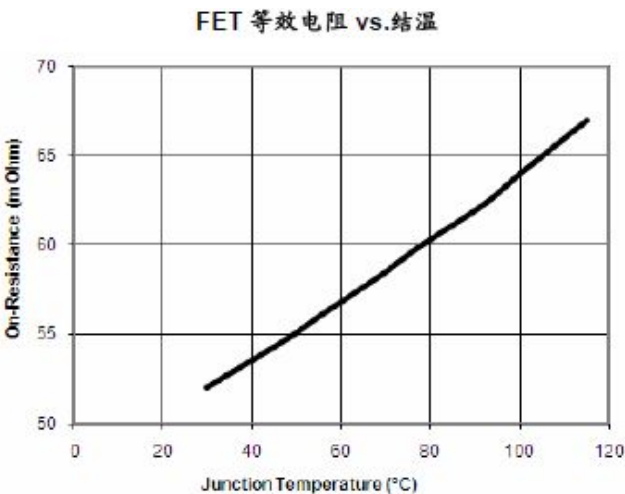
picture2.Overcurrent delay time

Note: When the battery is connected to the protection circuit for the first time, this circuit may not enter the normal mode and cannot be discharged at this time. If this phenomenon occurs, theS1 andS2Short circuit or connect the charger, you can enter the normal mode.



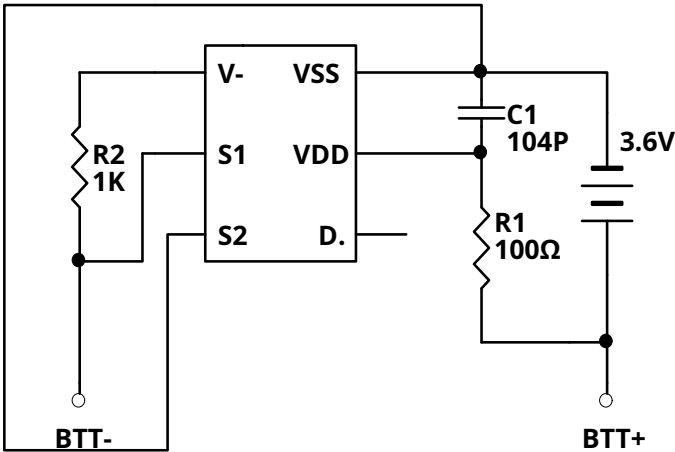
Nine, typical characteristics

(unless specifically noted $V_{BAT}=3.6V, T_A=25^{\circ}C$)



10. Typical applications

As shown in the figure: the thick line part is an over-current line, which must be as short as possible. Decoupling capacitor C1 to leave DW06D as close as possible.



Notice:1, Pay attention to the input and output voltage and load current, and ensure that the power consumption of the chip does not exceed the maximum power consumption of the package.

2, This product has anti-static protection function, but do not exceed the maximum electrostatic capacity of the product.



eleven, Package appearance

