Description

DW03B has built-in high-precision voltage detection circuit and delay circuit, which can realize overcharge, overdischarge and overcurrent protection of the battery by detecting the voltage and current of the battery. The protection circuit is suitable for a single ithium ion/lithium polymer rechargeable battery.

Features

- High Precision Voltage Detection Function:

1.Overcharge Protection Voltage	4.300V	Accuracy: ±50mV
2.Overcharge Release Voltage	4.100V	Accuracy: ±50mV
3.Overdischarge Protection Voltage	2.800V	Accuracy: ±100mV
4.Overdischarge Release Voltage	3.000V	Accuracy: ±100mV
5.Discharge OverCurrent Detection	3.6A	
6.Short Circuit Current Detection	16.0A	
7.Charging OverCurrent Detection	3.4A	

- Internal Detection Delay Time:：

1.Overcharge Protection Delay	1.0S
2.Overdischarge Protection Delay	128mS
3.Delay of Discharge Overcurrent	10mS
4.Delay of Charge Overcurrent	10mS

- Charger Detection and Load Detection Function
- Function of Charging 0V Battery — Allow
- Dormancy Function — No
- Conditions for Relieving Discharge Overcurrent — Disconnect The Load
- The Release Voltage of Discharge Overcurrent State — V_{RIOV}
- Low Current Consumption

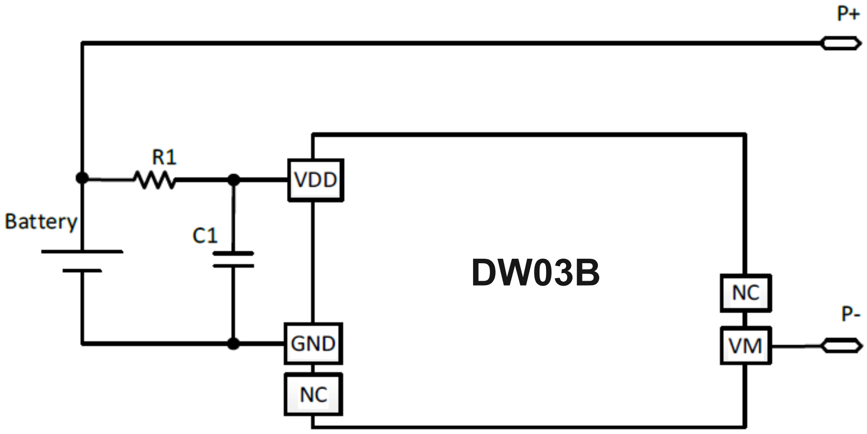
1. At Work	1.0μA(Typ.) (Ta=25°C)
2.Overdischarge	0.5μA(Typ.) (Ta=25°C)

- On-Resistance Ofinternal Power N-MOSFET: 50mΩ
- Lead-Free and Halogen-Free
- Operating Temperature Range: -40°C~+85°C
- Available Package: SOT-23-5

Applications

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

Typical Application Circuit

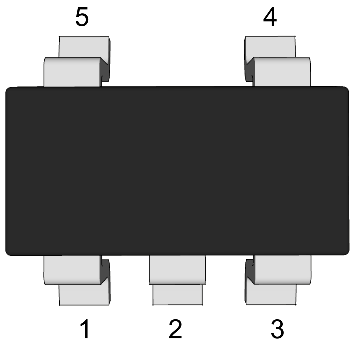


Device Identification	Min.	Typ.	Max.	Unit
R1	510	1000	1500	Ω
C1	0.047	0.1	0.22	μF

Note :
1. The above parameters may be changed without notice.
2. The schematic diagram and parameters of IC are notused asthe bass to ensure the circuit to work Please make fllmeasurement on the actual applcation crcuit before seting the parameters.

Pin Distribution

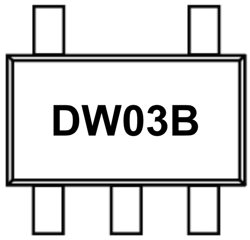
SOT-23-5



Functional Pin Description

Pin NO.	Symbol	Pin Description
1,5	NC	Not Connected
2	GND	Ground Pin
3	VDD	Power Supply
4	VM	The charging and discharging current detection terminal is linked with the charger load or the load

Ordering Information

Orderable Device	Package	Reel (inch)	Package Qty (PCS)	Eco Plan Note	MSL Level	Marking Code
DW03B	SOT-23-5	7	3000	RoHS & Green	MSL3	

Note:

RoHS: TN defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials.

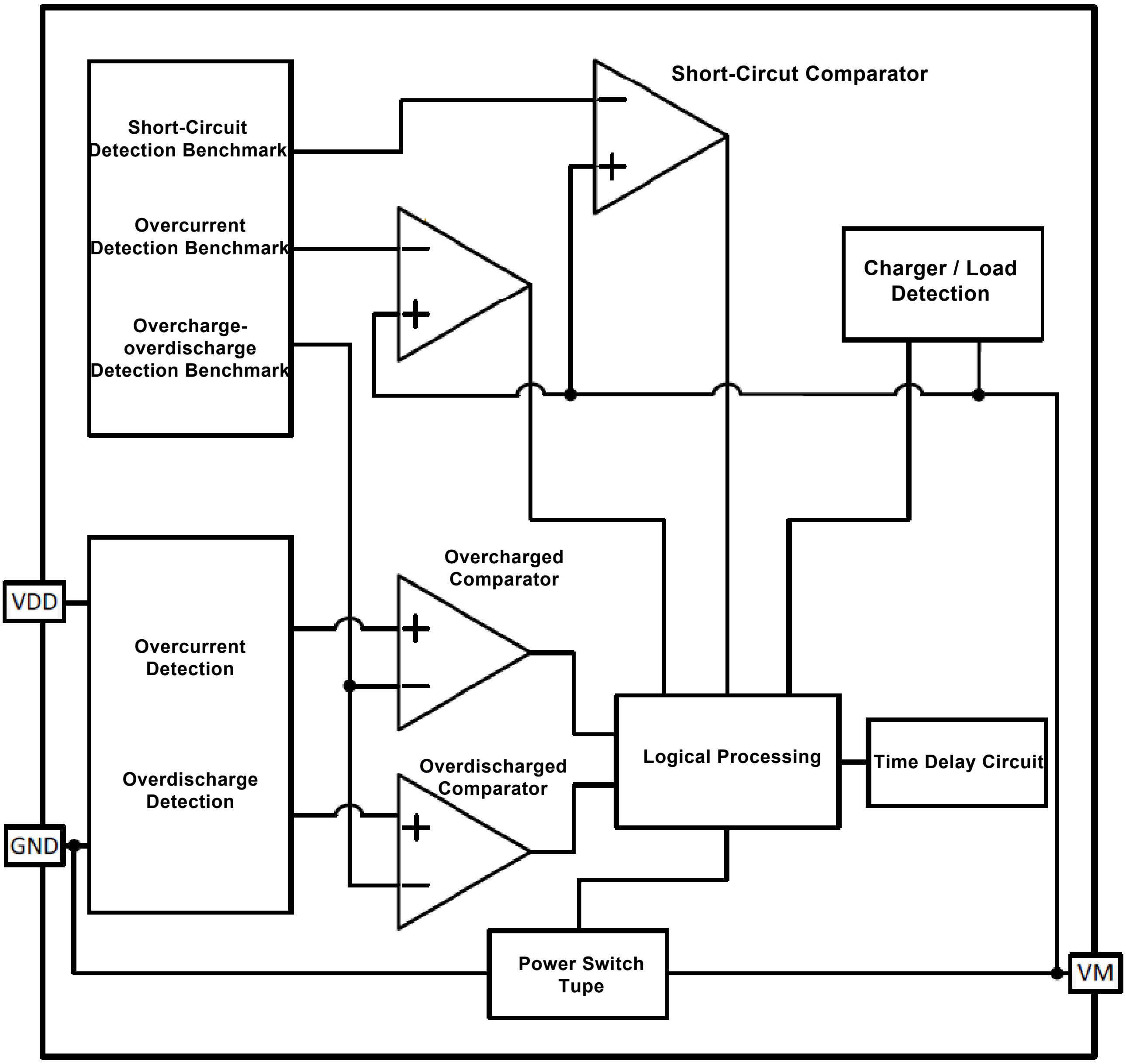
Green: TN defines "Green" to mean Halogen-Free and Antimony-Free.

Product List

1.Detection Voltage Sheet

Device Name	$R_{DS(on)}$	Overcharge Protection Voltage V_{OC}	Overcharge Release Voltage V_{OCR}	Overdischarge Protection Voltage V_{OD}	Overdischarge Release Voltage V_{ODR}	Discharge OverCurrent Detection I_{DI}	Short Circuit Current Detection I_{SHORT}	Charging OverCurrent Detection I_{CI}
DW03B	50mΩ	4.300V	4.100V	2.800V	3.000V	3.6A	16A	3.4A

Block Diagram



Absolute Maximum Ratings Note

(T_A=25℃ , unless otherwise noted.)

Parameter	Symbol	Rating	Unit
Input Voltage Between VDD and GND	VDD	-0.3 ~6	V
VM Pin Outtput Voltage	V_{VM}	-6 ~10	V
Operating Ambient Temperature Range	T_{OPR}	-40 ~ 85	°C
Storage Temperature Range	T_{STG}	-55 ~ 125	°C
ESD(HBM State)	$V_{ESD(HBM)}$	4000	V

Note :
The applied voltage exceeds the absolute maximum rating, which may cause irreversible damage to the chip.

Electrical Characteristics

(T_A=25℃ , unless otherwise noted.)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	VDD		1	-	5.5	V
Normal working current	I_{VCC}	VDD=3.5V	0.42	1.0	2.0	μA
Consume current during overdischarge	I_{OPED}	VDD=1.5V	--	0.5	1.0	μA
Overcharge Protection Voltage	V_{OC}	VDD=3.5→4.5V	4.250	4.300	4.350	V
Overcharge Release Voltage	V_{OCR}	VDD=4.5→3.5V	4.050	4.100	4.150	V
Overdischarge Protection Voltage	V_{OD}	VDD=3.5→2.0V	2.700	2.800	2.900	V
Overdischarge Release Voltage	V_{ODR}	VDD=2.0→3.5V	2.900	3.000	3.100	V
Discharge OverCurrent Detection	I_{DI}	VM-GND=0→0.2V	2.7	3.6	4.5	A
Charging OverCurrent Detection	I_{CI}	GND-VM=0→0.3V	2.5	3.4	4.3	A
Overcharge Protection Delay	T_{OC}	VDD=3.5→4.5V	500	1000	1500	ms
Overdischarge Protection Delay	T_{OD}	VDD=3.5→2.0V	64	128	192	ms
Delay of Discharge Overcurrent	T_{DI}	VM-GND=0→0.2V	5	10	20	ms
Delay of Charge Overcurrent	T_{CI}	GND-VM=0→0.3V	5	10	20	ms
Short Circuit Current Detection	I_{SHORT}	VM-GND=0→1.5V	8	16	24	A
Short Circuit Delay	T_{SHORT}	VM-GND=0→1.5V	100	250	400	μs
0V Charging, Charger Starting Voltage	V_{0CH}	Allow charging to 0V battery	0.0	1.5	2.0	V

Function Description

1. Normal Operating State

This IC continuously detects the battery voltage connected between the VDD and GND terminals, as well as the current flowing between the VM and GND terminals, to control charge and discharge. When the battery voltage is above the overdischarge protection voltage (V_{OD}) and below the overcharge protection voltage (V_{OC}), and the current flowing through the VM terminal to GND is between the charge overcurrent protection threshold (I_{CI}) and discharge overcurrent protection threshold (I_{DI}), the internal MOSFET of the IC is switched on. This state is called "normal working state". In this state, the MOSFET can be charged and discharged normally.

2. Overcharge State

When during the charging process under normal conditions, when the battery voltage is higher than the overcharge detection voltage (V_{OC}), and the duration reaches the overcharge voltage detection delay time (T_{OC}) or longer, the internal MOSFETof IC will turn off and stop charging, this situation is called overcharge voltage protection. The overcharge state can be lifted under the following two conditions:

(1). VM<V_{LD}, when the battery voltage is lowered below the overcharge release voltage (V_{OCR}), the overcharge state will be released.

(2). VM>V_{LD}， when the battery voltage is reduced to the overcharge protection voltage (V_{OC}) below, the overcharge state is lifted and returned to the normal working state, this function is called the load detection function.

Here (V_{LD}) =I_{DI}*$R_{SS(ON)}$, is the load detection voltage set inside the IC.

3. Overdischarge State

After the battery voltage drops below V_{OD} and the well continues T_{OD} for a period of time, the internal MOSFETof IC will turn off and stop discharging, which is called the overdischarge state. When the MOSFET inside the IC is turned off, the VM will be pulled up to VDD by the internal pull-up resistor R_{VMD}, and the IC power consumption will be reduced to I_{OPED}.

After entering the overdischarge state, to remove the overdischarge state and return to the normal state, there are several situations:

(1) Connect the charger, if VM<0V(typical value), when the battery voltage is higher than the overdischarge protection voltage (VOD), the overdischarge state is lifted and restored to the normal working state, this function is called the charger detection function.

(2) Connect the charger, if VM>0V(typical value), when the battery voltage is higher than the overdischarge release voltage (V_{ODR}), the overdischarge state is lifted and restored to the normal working state.

(3) When the charger is not connected, when the battery voltage is higher than the overdischarge release voltage (V_{ODR}), the overdischarge state is released and returned to the normal working state, that is, "no sleep function".

4. Discharge Overcurrent State

In the normal working state of the battery, the IC continuously detects the discharge current through the VM terminal voltage. If the discharge current exceeds the discharge current Limiting value (I_{DI}), and this state lasts longer than the discharge overcurrent Protection Delay time (T_{DI}), the internal MOSFETof IC will turn off and stop discharging. This state is called the discharge overcurrent state. If the discharge current exceeds the short-circuit protection current value, and this state lasts longer than the load short-circuit protection delay time (T_{SHORT}), the MOSFET inside the IC will turn off and stop discharging. This state is called the "load short-circuit state.

Discharge overcurrent state release condition "disconnect load" and discharge overcurrent state release voltage "V_{RIOV}"

In the discharge overcurrent state, the VM terminal inside the chip and the GND terminal can be connected through the R_{VMS} resistor. However, during the connection to the load, the VM terminal voltage changes to the VDD terminal voltage due to the connection to the load. If the connection to the load is disconnected, the VM terminal reverts to the GND terminal voltage. When the VM terminal voltage drops below V_{RIOV}, the discharge overcurrent state can be lifted.

5. Charge Overcurrent Protection

For a battery in normal working condition, if the current value flowing through GND to VM exceeds the charge overcurrent protection value (I_{CI}) during charging, and the state lasts longer than the charge overcurrent protection Delay time (T_{CI}), the internal MOSFETof IC will turn off and stop charging. This state is called charging overcurrent state. After entering the state of charge overcurrent detection, if disconnect the charger to make the flow through GND to When the current of the VM terminal is lower than the overcurrent protection value (I_{CI}), the charging overcurrent state is removed and returned to the normal working state.

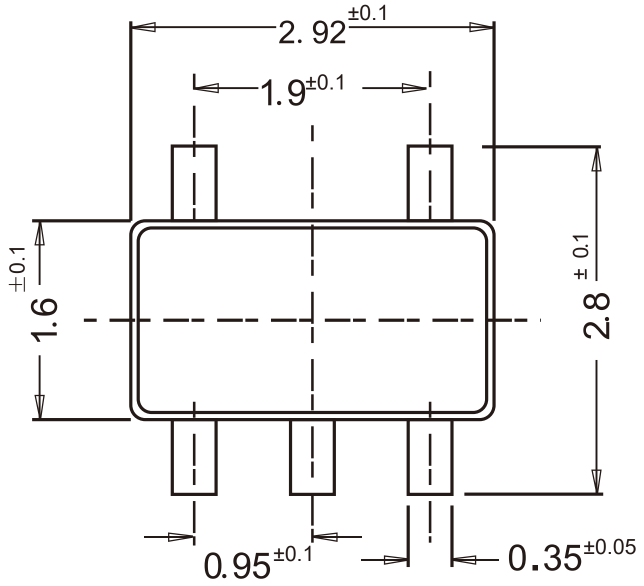
6. Charging Function to 0V Battery(Allowed)

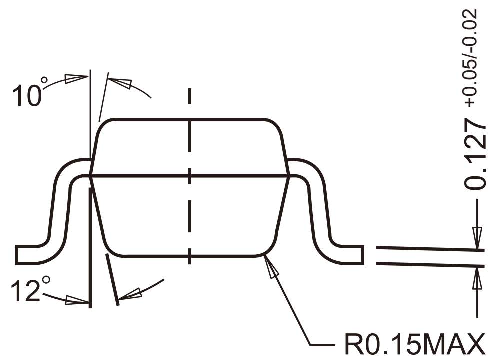
This function is used to recharge the battery that has self-discharged to 0V. When the charger voltage connected between the positive battery (P+) and the negative battery (P-) is higher than the charger starting voltage (V_{0CH}) to charge the 0V battery, the IC internal charge control MOSFET will switch on and start charging. When the battery voltage is higher than the overdischarge protection voltage (V_{OD}), the IC enters the normal working state.

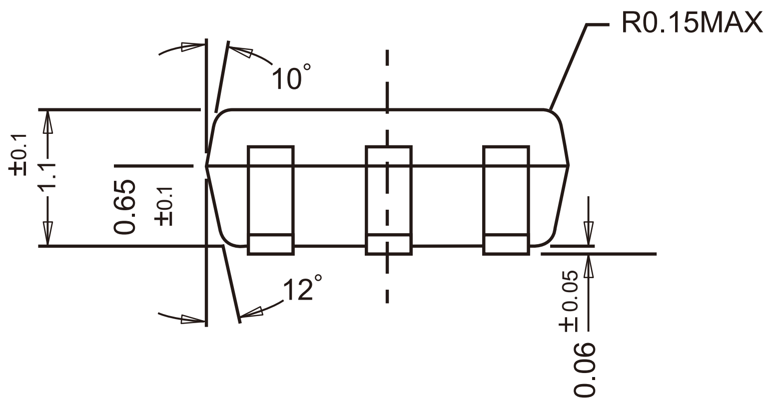
Note: Please ask the battery supplier to confirm whether the purchased battery has the "allow charging to the 0V battery" function or the "do not charge to the 0V battery" function".

Package Outline SOT-23-5

Dimensions in mm







Contact Information

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