One lithium-ion/lithium polymer battery protection IC

FEATURES

- High accuracy voltage detection circuit
  - ✓ Overcharge detection voltage: 4.28V±0.025V;
  - ✓ Overcharge release voltage: 4.08V±0.05V;
  - ✓ Over-discharge detection voltage:2.0V±0.05V;
  - ✓ Over-discharge release voltage: 3.0V±0.5V;
  - ✓ Discharge over current detection voltage: 0.25V±0.03V;
  - ✓ Charging over current detection voltage: -0.15V±0.03V
  - ✓ Load short circuit detection voltage: 0.6-1.2V;
- The terminal connected to the charger adopts high voltage withstand devices
- The various delay times only need to be achieved by built-in circuits (without external capacitors)
- Equipped with charging over current protection function
- Equipped with charging 0V batteries
- Equipped with sleeping function
- Low current consumption
  - ✓ Under normal working conditions: Typical value=1.0μA; Maximum value =3.0μA
  - ✓ In low-power state: Maximum value =1μA
- The range of operating temperature is −40℃ to +85℃

OVERVIEWS

DP8261-SAB has a built-in high-precision voltage detection circuit and delay circuit, suitable for the protection IC of lithium-ion/lithium-polymer rechargeable batteries.

DP8261-SAB is most suitable for overcharging, discharging, and over current protection of one lithium-ion/lithium-polymer rechargeable battery pack.

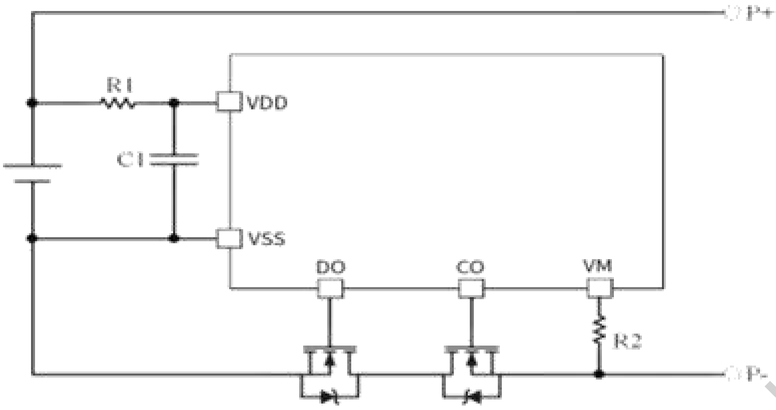
APPLICATIONS

- Lithium-ion rechargeable battery pack
- Lithium polymer rechargeable battery pack

PACKAGE INFORMATION

The form of Packaging	The form of Eco-friendly	The method of Packaging	Quantity/Plate	The level of Humidity sensitivity
SOT23-6	ROHS+HF	Braid	3000	MSL=3

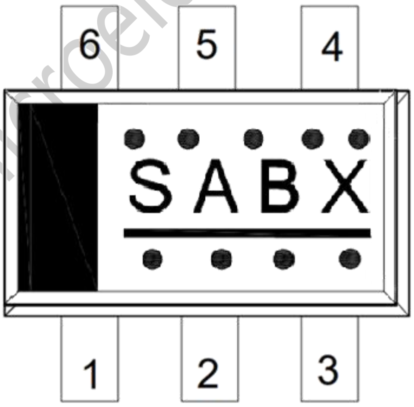
APPLICATION SCHEMATIC DIAGRAM



Device identification	Typical values	Parameter range	Units
R1	100	100 ~ 470	Ω
R2	1	1 ~ 2	kΩ
C1	0.1	0.1 ~ 1	μF

PRODUCT DESCRIPTION

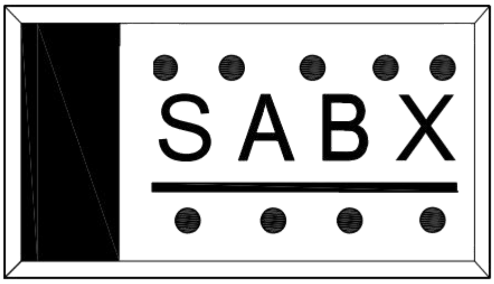
➢ Pin Arrangement



➢ Pin Function

Pin symbol	Pin name	Description
1	OD	Discharge control FET threshold connection pins.
2	VM	Current detection input pin, and charger detection.
3	OC	Charge control FET threshold connection pin.
4	NC	Not connected.
5	VDD	Positive power input.
6	VSS	Negative power input.

➢ Product Marking

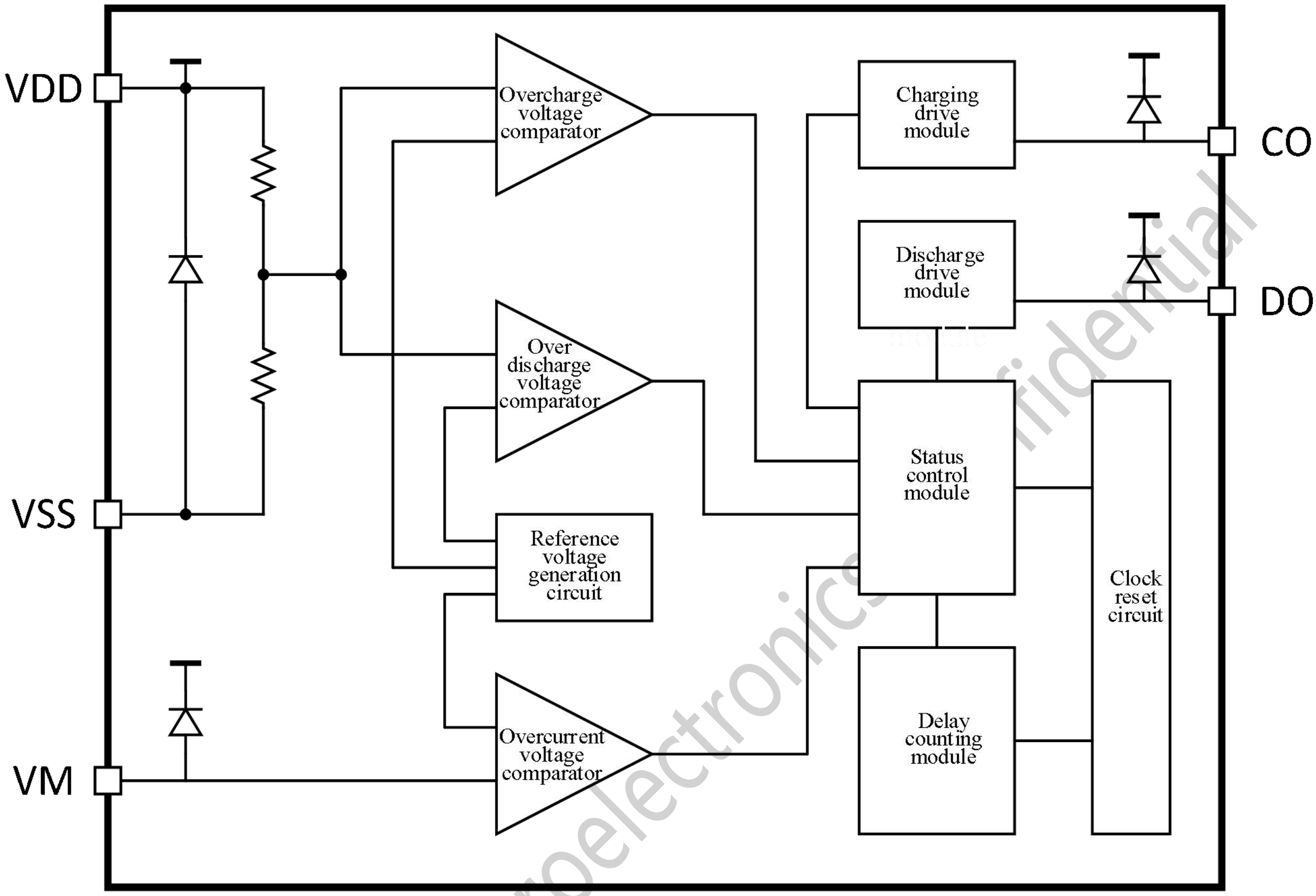


- The top five dots represent the production date; For example, 11001 represents the 25th day;
- SAB represents the product model;
- "X" represents the production month; A-L represents January to December in sequence;
- The bottom four dots represent the last digit of the production year; For example, in 2017, 0111 was printed;
- Note: 0 indicates that the dots are not printed, and 1 indicates that the dots are printed.

➢ Absolute Maximum Ratings

Parameter	Symbol	Parameter range	Unit
Supply voltage	VDD	VSS-0.3~VSS+10	V
OC output pin voltage	V_{OC}	VDD-25~VDD+0.3	V
OD output pin voltage	V_{OD}	VSS-0.3~VDD+0.3	V
VM input pin voltage	V_{VM}	VDD-25~VDD+0.3	V
Operation temperature	Topr	-40~+85	℃
Storage temperature	Tstg	-40~+125	℃
Permissible power consumption	P_D	250	mW

FUNCTION BLOCK DIAGRAM



ELECTRICAL PARAMETERS (Unless we otherwise specified，Tamp=25℃)

Symbol	Parameter	Test conditions	Minimum	Typical	Maximum	Unit
Working voltage						
VDD-VSS working voltage	V_{DD}-V_{SS}	--	1.5	--	6	V
Consumption current						
Working current	I_{DD}	V_{DD}=3.7V，Vm=0V	--	1.0	3.0	uA
Over-discharge Working current	I_{OD}	V_{DD} =2.0V	--	0.5	1	uA
Detection voltage						
Overcharge detection voltage	V_{CU}	--	4.255	4.28	4.305	V
Overcharge release voltage	V_{CR}	--	4.03	4.08	4.13	V
Over-discharge detection voltage	V_{DL}	--	1.95	2.00	2.05	V
Over-discharge release voltage	V_{DR}	--	2.95	3.00	3.05	V
Discharge overcurrent detection voltage	V_{DIOV}	V_{DD} =3.6V	235	250	265	mV
Charging overcurrent detection voltage	V_{CIOV}	V_{DD} =3.6V	-165	-150	-135	mV
Load short circuit detection voltage	V_{SHORT}	V_{DD} =3.6V	0.6	0.9	1.2	V
0V charging allowable voltage threshold	V_{0V_CH}	Charger voltage	1.2	--	--	V
Delay time						
Overcharge detection delay time	T_{cu}	V_{DD} =3.6V~4.4V	800	1000	1200	ms
Delay time for over discharge detection	T_{DL}	V_{DD} =2.0V~3.6V	50	100	200	ms
Delay time for discharge overcurrent detection	T_{DIOV}	V_{DD} =3.6V	15	20	25	ms
Charging overcurrent detection delay time	T_{CIOV}	V_{DD} =3.6V	15	20	25	ms
Load short circuit detection delay time	T_{SHORT}	V_{DD} =3.6V	280	400	520	us

PRODUCT APPLICATION INFORMATION

- **Normal working state**

The function of this IC is to control the charging and discharging by monitoring the battery voltage between VDD-VSS, as well as the voltage between VM-VSS. When the battery voltage is above the over-discharge detection voltage (V_{DL}) and below the overcharge detection voltage (V_{CU}), and the voltage of the VM terminal is above the charging over current detection voltage (V_{CIOV}) and below the discharging over current detection voltage (V_{DIOV}), both the charging control FET and the discharging control FET are turned on. At this point, free charging and discharging can be carried out. This state is called a normal state.

Note: When connecting the battery cell for the first time, there may be a possibility that it cannot discharge. At this time, short circuiting the VM terminal and VSS terminal, or connecting the charger, and you can restore normal working state。

- **Overcharge state**

When the battery voltage in a normal state exceeds the overcharging detection voltage (V_{CU}) during charging and remains above the overcharging detection delay time (T_{CU}), turn off the charging control FET and stop charging. This state is called overcharge state.

The discharge of the overcharge state is divided into the following two methods:

1. If the voltage of the VM terminal is lower than the discharge overcurrent detection voltage (V_{DIOV}), and the battery voltage drops below the overcharging release voltage (V_{CR}), the overcharging state can be relieved.
2. If the voltage of the VM terminal is higher than the discharge overcurrent detection voltage (V_{DIOV}), and the battery voltage drops below the overcharging detection voltage (V_{CU}), the overcharging state can be relieved。

Note:

1. Batteries that are above the overcharge detection voltage (V_{CU}), even if a larger load is connected, cannot cause the battery voltage to drop below the overcharge detection voltage (V_{CU}). Discharge overcurrent detection and load short circuit detection are not effective. But in fact, due to the internal impedance of the battery, when a large load is connected and generates a large current, the battery voltage will quickly decrease below the overcharging detection voltage (V_{CU}). Discharge overcurrent detection and load short circuit detection will return to normal working conditions.

2. For batteries above the overcharge detection voltage (V_{CU}), disconnect the charger, and the battery is in an unloaded or loaded state. The VM can rise above the discharge overcurrent detection voltage (V_{DIOV}) through internal circuits or external loads, and the battery voltage can be reduced below the overcharge detection voltage (V_{CU}) to release the overcharge state。

- **Over discharge state**

When the battery voltage in a normal state is below the over discharge detection voltage (VDL) during discharge and remains in this state above the over discharge detection delay time (TDL), the discharge control FET will be turned off to stop discharge. This state is called an over discharge state.

This chip has a sleep function. When the battery is in an over discharge state, the sleep function will start working and the chip's current consumption will be reduced to sleep current.

There are two methods for releasing the sleep function (over discharge state):

1. Connect the charger, and if the voltage of the VM terminal is lower than the charging overcurrent detection voltage (VCIOV), the over discharge state will be released when the battery voltage is higher than the over discharge detection voltage (VDL), and the normal working state will be restored.
2. Connect the charger, and if the voltage of the VM terminal is higher than the charging overcurrent detection voltage (V_{CIOV}), when the battery voltage is higher than the over discharge release voltage (V_{DR}), the over discharge state will be released and the normal working state will be restored.

Note:

1. This chip has a sleep function. After the chip is assembled with the battery cell, it may be mistakenly triggered to enter the sleep state due to external environmental influences. Once the chip enters the sleep state, it can be restored to the normal state by connecting a charger; If you mind this impact, we suggest that the customer change to a product with over discharge and self-recovery to avoid such issues.

2. For batteries in a dormant (over discharge) state, if the charger is not connected, the battery will remain in an over discharge (dormant) state, even if the VDD voltage is above the overcharge detection voltage (V_{CU}).

- **Discharge over current status and load short circuit status**

In a normal discharge state of a battery, the voltage of the VM terminal increases as the discharge current increases. When the detection voltage of the VM terminal rises above the discharge overcurrent detection voltage (V_{DIOV}) and the duration of this state exceeds the discharge overcurrent detection delay time (T_{DIOV}), the discharge control FET will be turned off, and this state is called the discharge overcurrent state.。

Under normal discharge conditions, the voltage of the VM terminal increases as the discharge current increases. When the VM terminal detection voltage rises above the load short circuit detection voltage (V_{SHORT}) and the duration of this state exceeds the short circuit detection delay time (T_{SHORT}), the discharge control FET will be turned off, and this state is called the load short circuit state.

Release conditions for discharge overcurrent state and load short-circuit state:

When the protection circuit triggers a discharge overcurrent/load short-circuit state, reducing the voltage of the VM terminal to the voltage of the VSS terminal can relieve the discharge overcurrent state or load short-circuit state. Connect the charger so that the voltage of the VM terminal is below the voltage of the VSS terminal, and it can also relieve the discharge overcurrent state or load short circuit state.

- **Charging overcurrent status**

In the normal charging state of the battery, the voltage at the VM terminal decreases as the charging current increases. The VM pin detects that the voltage decreases below the charging overcurrent detection voltage (V_{CIOV}), and the delay is greater than the charging overcurrent detection delay time (T_{CIOV}). The charging control

FET will be turned off, and this state is called the charging overcurrent state.

Charging overcurrent release conditions:

When the protection circuit remains in the charging overcurrent state, disconnecting the connection to the charger will restore the VM terminal to the VSS terminal voltage and also release the charging overcurrent state.

- **0V battery charging**

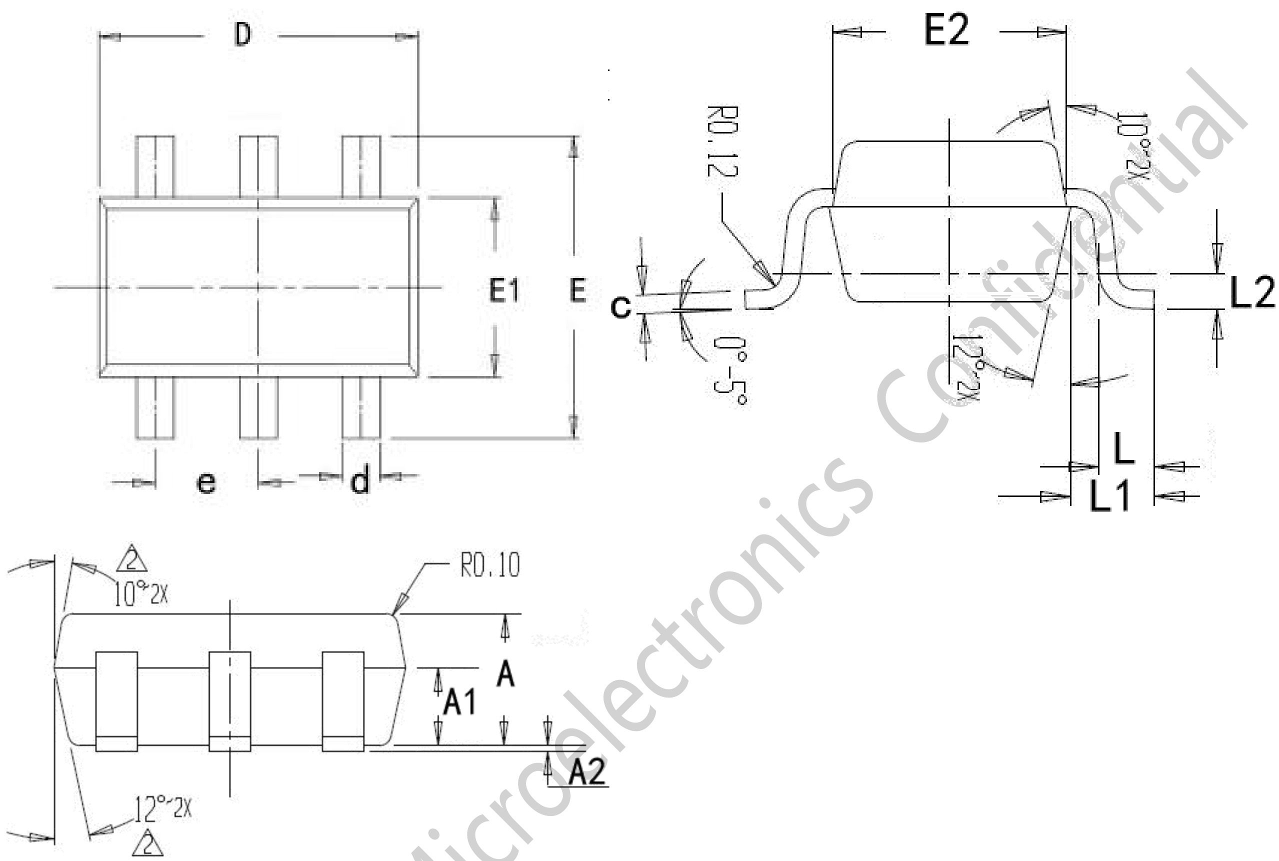
The function of charging when the battery voltage drops to 0 V due to self-discharge. If a charger is used to charge the battery in the "0V" state, and the voltage between the VDD end and the VM end of this IC circuit is greater than the 0V charging allowable threshold (V_{0V_CH}), the charging control end OC will be connected to the VDD end. If the voltage can make the external charging control FET conductive, the internal diode of the discharge control FET can form a charging circuit, causing the battery voltage to increase; When the battery voltage rises to a level that causes the VDD terminal voltage to exceed the over discharge detection voltage (V_{DL}), it will return to the normal state. At the same time, the discharge control terminal OD outputs a high level, making the external discharge control FET in a conductive state。

Note:

For the charging overcurrent detection function, the function of charging 0 V batteries has priority. Therefore, products that are "allowed" to charge 0 V batteries will be forcibly charged when the battery voltage is lower than the over discharge detection voltage (V_{DL}), and cannot perform charging overcurrent detection work.

PACKAGE (unit: mm)

SOT23-6



Symbol	Min	Nom	Max
A	1.050	1.100	1.150
A1	0.625	0.650	0.675
A2	0.010	0.050	0.090
c	0.047	0.127	0.207
D	2.900	2.950	3.000
d	0.325	0.350	0.375
E	2.720	2.800	2.880
E1	1.600	1.650	1.700
E2	1.550	1.600	1.650
e	0.925	0.95	0.975
L	0.300	0.380	0.460
L1		0.599REF	
L2		0.250BSC	

OFFICIAL ANNOUNCEMENT

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