BATTERY PROTECTION IC FOR 1-CELL PACK

■ Features

(1) High-accuracy voltage detection circuit

・Overcharge detection voltage	3.6 to 4.4V	Accuracy	±50 mV
・Overcharge release voltage	3.6 to 4.4V	Accuracy	±50 mV
・Overdischarge detection voltage	2.0 to 3.0 V	Accuracy	±100 mV
・Overdischarge release voltage	2.0 to 3.4V	Accuracy	±100 mV
・Discharge overcurrent detection voltage	0.05 to 0.30 V	Accuracy	±30 mV
・Load short-circuiting detection voltage	0.6V	Accuracy	±200 mV

(2) Detection delay times are generated by an internal circuit (external capacitors are unnecessary).

・Overcharge detection delay time	Typical	100ms
・Overdischarge detection delay time	Typical	120ms
・Discharge overcurrent detection delay time	Typical	16ms
・Load short-circuiting detection delay time	Typical	750μs

(3) High voltage tolerance is used for charger connection pins, VM and CO pins are absolute maximum rating＝28V)

(4) 0V battery charge function available /unavailable are selectable.

(5) Wide operating temperature range   -40 to +85℃
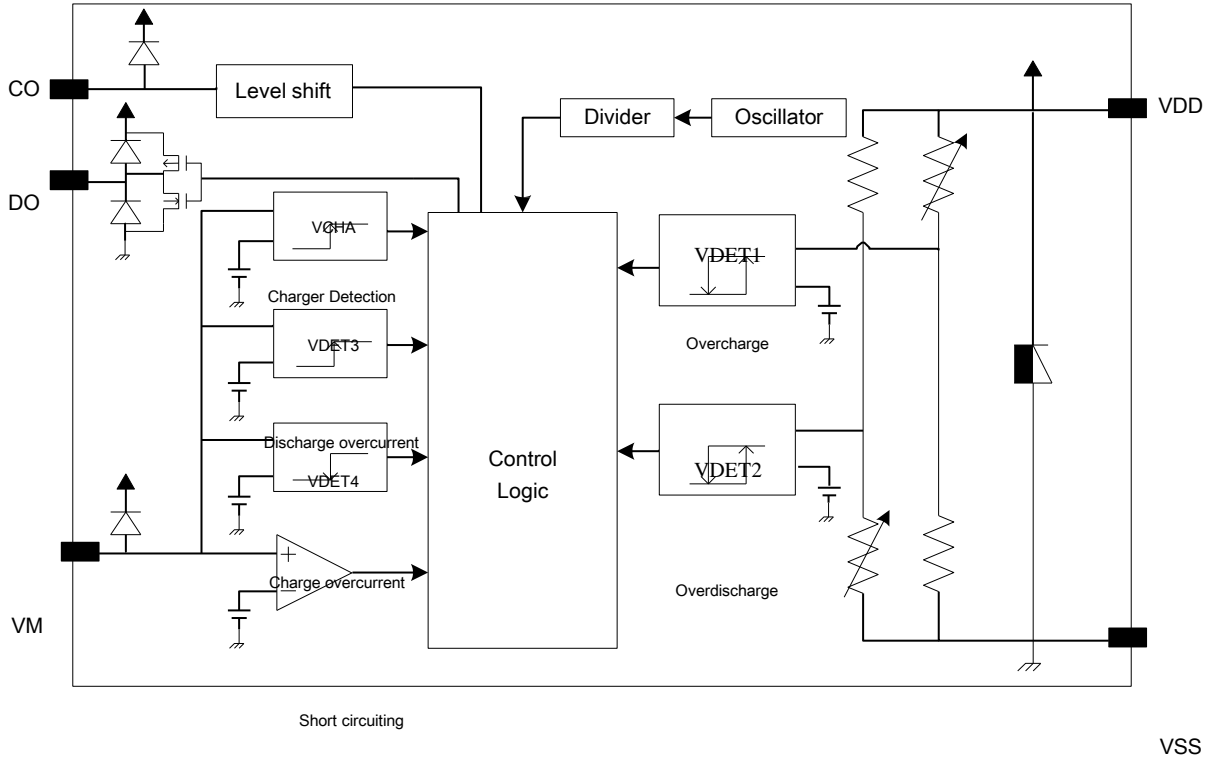
(6) Low current consumption

●Operation mode	Typ. 2.4 μA Max. 6.0 μA （25℃）	
●Standby mode	Green-mode	Max. 0.1 μA （25℃）
	Self-recovery function	Max. 3.0 μA （25℃）

■ Applications

・ Lithium-ion rechargeable battery packs
・ Lithium polymer rechargeable battery packs

■ Block Diagram

CO

DO

VM

Level shift

VCHA

Charger Detection

VDET3

Discharge overcurrent

VDET4

Charge overcurrent

Control
Logic

Divider

Oscillator

VDD

VDET1

Overcharge

VDET2

Overdischarge

VSS

Short circuiting

■ Absolute Maximum Rating

Item	Symbol	Rating	Unit
Supply voltage	VDD	-0.3~10	V
VM termial input voltage	VM	VDD-28~VDD+0.3	V
CO terminal Output voltage	VCO	VDD-28~VDD+0.3	V
DO terminal Output voltage	VDO	VDD-0.3~VDD+0.3	V
Operation temperature	Topr	-40~+85	℃
Storage temperature	Tstg	-55~+125	℃

■ Electrical Characteristics

Operation Temperature=25℃

| Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating voltage between VDD & VSS	VDD		1.5	—	9.0	V
Operating voltage between CO & VM			1.5	—	25.0	V
Minimum operating voltage for 0V charging	Vst	VDD-VM, VDD-VSS=0V	—	—	1.2	V
Discharging overcurrent release resistance	Rshort	VDD=3.6,VM=1.0V	30	50	100	KΩ
CO pin Nch ON voltage	VCOL		—	0.4	0.5	V
CO pin Pch ON voltage	VCOH		VDD-0.1	VDD-0.02	—	V
DO pin Nch ON voltage	VDOL		—	0.2	0.5	V
DO pin Pch ON voltage	VDOH		VDD-0.1	VDD-0.02	—	V
Current consumption	IDD	VDD=3.5V,VM=0V	1.2	2.4	6.0	uA
Current consumption at stand-by(Green)	Ist	VDD=VM=2.0V	—	—	0.1	uA
Overdischarge current consumption (Self-recovery)	IDOX	VDD=VM=2.0V	—	1.8	3.0	uA

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Overcharge detection voltage	Vdet1	R1=100Ω	4.240	4.2800	4.330	V
Overcharge release voltage	Vrel1	R1=100Ω	4.030	4.080	4.130	V
Overcharge hysteresis voltage	Vhys1	R1=100Ω Vhys1=Vdet1-Vrel1	—	0.200	—	V
Overdischarge detection voltage	Vdet2	VM=0V,R1=100Ω	2.300	2.400	2.500	V
Overdischarge release voltage	Vrel2	R1=100Ω	2.900	3.000	3.100	V
Overdischarge release voltage2	Vrel2'	R1=100Ω, R2=1.0kΩ, VM=Vchg	2.300	2.400	2.500	V
Discharging overcurrent detection voltage	Vdet3	VDD=3.0V, R2=1.0kΩ	0.110	0.140	0.170	V
Short detection voltage	Vshort	VDD=3.0V	0.40	0.60	0.80	V
Overcharge detection delay time	T_{Vdet1}	VDD=3.8V→4.5V	50	100	150	ms
Overdischarge detection delay time	T_{Vdet2}	VDD=3.2V→2.2V	60	120	180	ms
Discharging overcurrent detection delay time	T_{Vdet3}	VDD=3.0V, VM=0V→0.2V	8	16	24	ms
Short detection delay time	T_{short}	VDD=3.5V, VM=0V→1.0V	350	750	1100	us
Charger detection voltage	Vchg	VDD=3.6V, R2=1.0kΩ	0.3	0.7	1.1	V

■ Application Circuits
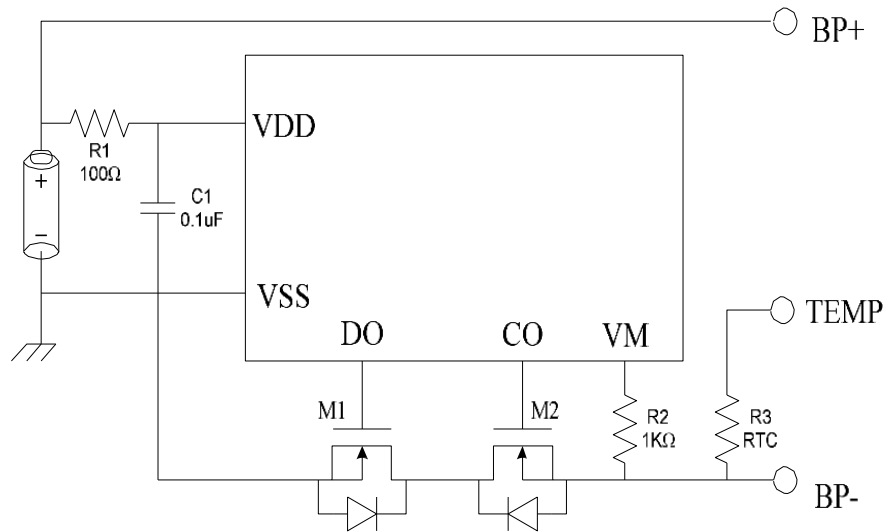
Discrete	Components	Function	Min.	Typ.	Max.	Unit	Remarks
R1	Resistor	Current limit Noise filtering	–	100	1K	Ω	*1
R2	Resistor	Current limit ESD protection	300	1K	2K	Ω	*4
R3	Thermistor	Temp. protection	–	–	–	kΩ	
C1	Capacitor	Noise filtering	0.022	0.1	1.0	μF	*3
M1	N-MOSFET	Discharge switch					*2
M2	N-MOSFET	Charge switch					*2

*1：R1 is a single-stage RC filter， the higher resistance of R1， the better the filtering effect。 If the R1 resistance higher than the recommended value， it will affect the internal detection circuit and the voltage detection accuracy will out of specification. We suggest using the recommended resistance in application.

*2：The absolute maximum rating of CO and VM is 28V, customer could choose 20V or 30V dual N-MOSFET switches for different application.

*3：Add a C1 capacitor between VDD and VSS could filter conduction and radiation noise.

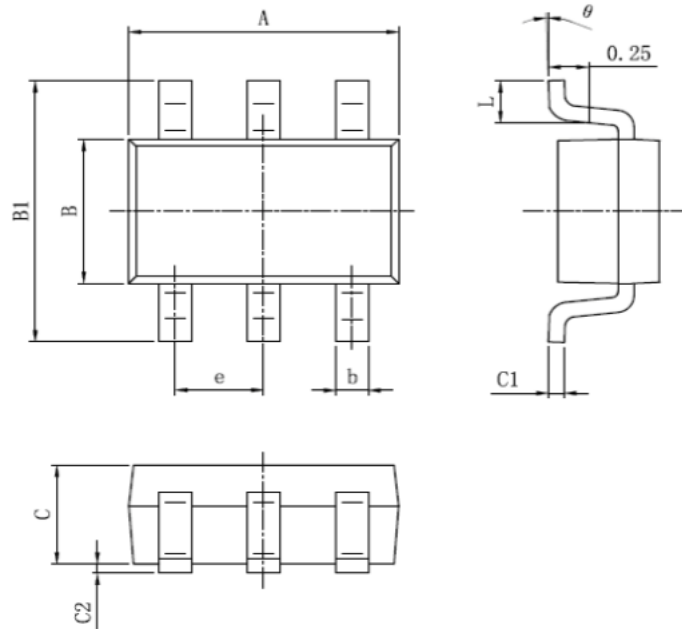*4：R2 resistor could have a current limit function and limit charger current surge.

封装及引脚排布

内部管控代码
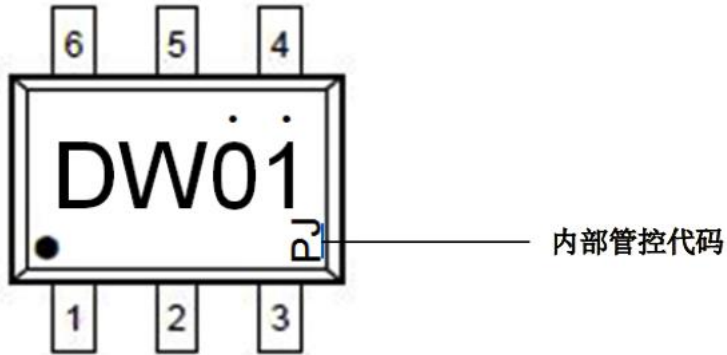
引脚功能说明

引脚号	管脚名称	I/O	功能描述
1	OD	O	放电控制 FET 门限连接管脚
2	CSI	I/O	电流感应输入管脚，充电器检测。
3	OC	O	充电控制 FET 门限连接管脚。
4	TD	I	延迟时间测试管脚。
5	VDD	I	正电源输入管脚。
6	VSS	I	负电源输入管脚。

Package Outline(Unit:mm)

标注 尺寸	最小（mm）	最大（mm）	标注 尺寸	最小（mm）	最大（mm）
A	2.82	3.03	C	1.00	1.20
e	0.95(BSC)		C1	0.10	0.23
b	0.28	0.50	C2	0.00	0.15
B	1.50	1.73	L	0.35	0.60
B1	2.60	3.05	θ	0º	8º