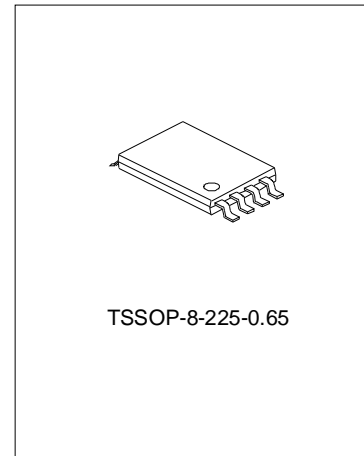**Silan**
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SA1412

TWO CELL LI$^+$ BATTERY PROTECTION CIRCUIT

DESCRIPTIONS

SA1412 protects for Lithium-Ion Batteries. When the Lithium-Ion Batteries is in state of overcharge, overdischarge and overcurrent. The IC turns off the external mosfet to protect the batteries.

FEATURES

* Overcharge consumption current(V_{CELL}=4.5V ROC=270KΩ): 150μA

* Normal consumption current(V_{CELL}=3.5V): 18μA

* Overcharge consumption current(V_{CELL}=1.9V): 0.5μA

  Overcharge consumption current(V_{CELL}=1.0V): 0.1μA

TSSOP-8-225-0.65

APPLICATIONS

* Digital camer
* Digital vidicon
* Special illumination
* Portable DVD
* PDA
* Interphone
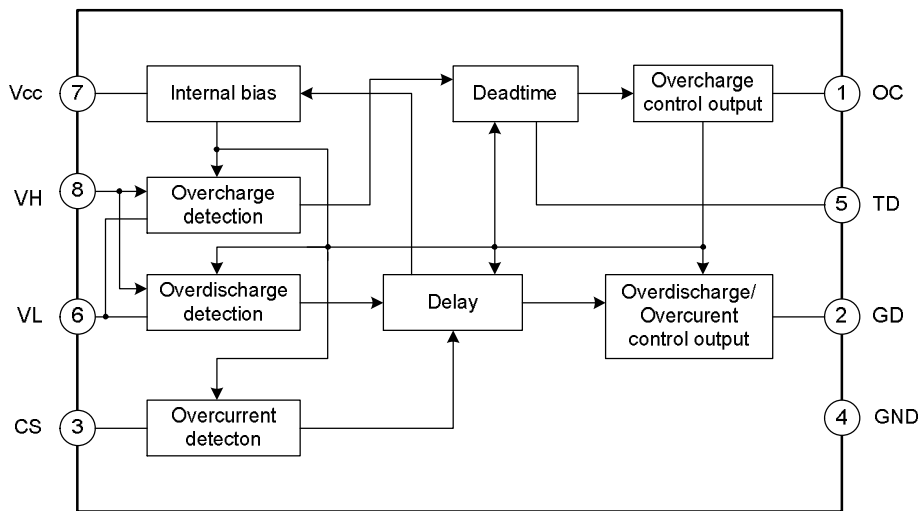* 7.2V large capacity battery.

ORDERING INFORMATION

Device	Package
SA1412	TSSOP-8-225-0.65

PRODUCTS CATALOG

Part No.	Overcharge Detection Voltage	Overcharge Detection Hysteresis Voltage	Overdischarge Detection Voltage	Overdischarge Release Voltage	Overcurrent Detection Voltage
SA1412A	4.350±0.025V	220±50mV	2.3±0.1V	3.5±0.2V	150±15mV
SA1412B	4.300±0.025V	220±50mV	2.3±0.1V	3.5±0.2V	150±15mV
SA1412C	4.250±0.025V	220±50mV	2.3±0.1V	3.5±0.2V	150±15mV
SA1412D	4.300±0.025V	200±50mV	2.5±0.1V	3.0±0.1V	75±15mV

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BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATING

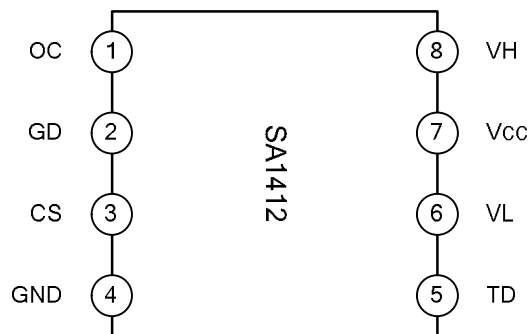| Characteristics	Symbol	Rating	Unit
Supply Voltage	$V_{CC\,max}$	-0.3~18	V
CS Pin Voltage	V_{CSmax}	-0.6~V_{CC}	V
OC Pin Voltage	V_{OCmax}	-0.6~V_{CC}	V
Allowable Dissipation	P_d	300	mV
Storage Temperature Range	T_{stg}	-40~125	°C
Operating Temperature Range	T_{amb}	-20~70	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, take SA1412B for instance, T_{amb}=25°C)

Characteristics	Symbol	Test condition	Min.	Typ.	Max.	Unit
Overcharge Detection Voltage	V_{OC}	T_{amb}=-20°C ~70°C;	4.275	4.300	4.325	V
Overcharge Detection Hysteresis Voltage	ΔV_{OC}		170	220	270	mV
Overdischarge Detection Voltage	V_{OD}		2.20	2.30	2.40	V
Consumption Current 1	I_{VH1}	V_H=V_L=1.0V, V_{CS}=1.4V	--	--	0.1	μA
Consumption Current 2	I_{VH2}	V_H=V_L =1.9V, V_{CS}=3.2V	--	0.5	0.8	μA
Consumption Current 3	I_{VH3}	V_H=V_L=3.5V	--	18.0	23.0	μA
Consumption Current 4	I_{VH4}	V_H=V_L =4.5V,R_{OC}=270 KΩ	--	150	--	μA
VL pin input Current	I_{VL}	V_H=V_L =3.5V	-0.3	0	0.3	μA
Overdischarge Release Voltage	V_{DF}	Discharge resume by voltage rise	3.3	3.5	3.7	V
GD Pin H Output Voltage	V_{GDH}	V_H=V_L =3.5V, I_L=-10μA	V_H-0.3	V_H-0.2	--	V
GD Pin L Output Voltage	V_{GDL}	V_H=V_L =3.5V, I_L=10μA	--	0.2	0.3	V

(To be continued)

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(Continued)

Characteristics	Symbol	Test condition	Min.	Typ.	Max.	Unit
OC Pin Output Current	I_{OCH}	$V_H=V_L=4.5V$	30	150	--	µA
Overcurrent Detection Threshold Value	V_{CS1}		135	150	165	mV
Overcurrent Short Threshold Value	V_{CS2}		0.35	0.45	0.55	V
Overcurrent Release		Load release: Load of 5MΩ or more between both battery pack pins				
Overcurrent Detection Delay Time 1	T_{OC1}		7	12	18	ms
Overcurrent Detection Delay Time 2	T_{OC2}		--	30	100	µs
Overdischarge Detection Delay Time	T_{od}		8	13	20	ms
Overcharge Detection Dead Time	T_{och}	$C_{TC}=0.18Uf$	0.5	1.0	1.5	s
Start-Up Voltage	V_{ST}	$V_H=V_L=2.5V$	-0.24	-0.12	-0.04	V

PIN DESCRIPTIONS

```
OC   1        8   VH
GD   2   SA1412  7   Vcc
CS   3        6   VL
GND  4        5   TD
```

PIN DESCRIPTION

Pin no.	Pin name	I/O	Description
1	OC	O	Overcharge detection output pin
2	GD	O	Discharge control FET (N-ch) control output pin
3	CS	I	Overcurrent detection input pin
4	GND	--	Ground pin, or lower cell load negative pole input pin.
5	TD	--	Overcharge detection dead time setting pin
6	VL	--	Connection pin for lower cell positive electrode side and upper cell negative electrode side.
7	Vcc	--	Power supply input pin
8	VH	--	Upper cell positive electrode input pin

FUNCTION DESCRIPTION

This IC is a lithium ion battery (2-cell in-series type) protection IC. It has functions below: Overcharge detection, Overdischarge detection, Overcurrent detection. It controls the batteries charging or discharging by control the

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external mosfet off and on. There are four opration modes as follows:

1. Overcharge mode:

The battery voltage of either the H or L cell goes above overcharge detection voltage. The IC shuts down the charging loop.Detection operation delay for overcharge detection can be set with the dead time setting pin.

2. Normal mode

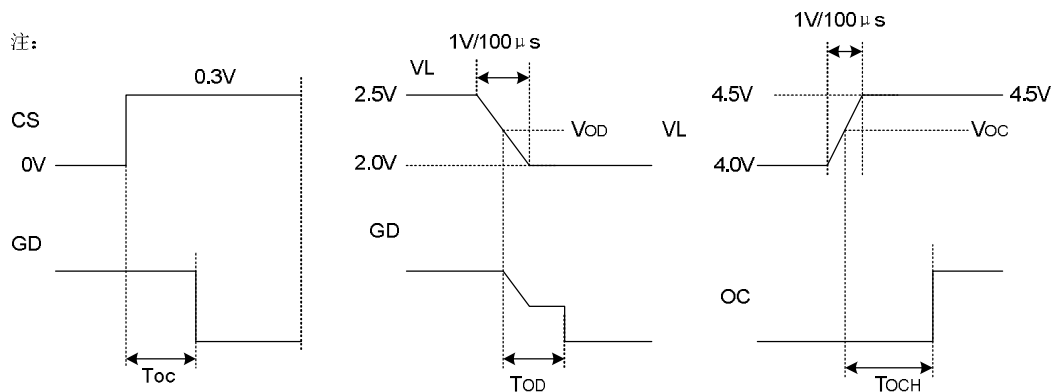The battery voltage of both H and L cells is above overdischarge detection voltage and below overcharge detection voltage.
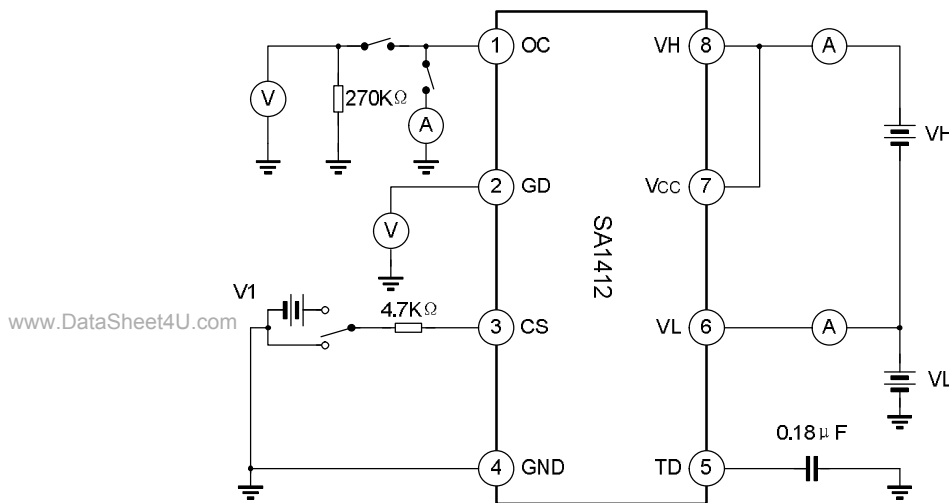
3. Overdischarge mode

The battery voltage of either the H or L cell drops below overdischarge detection voltage. The IC shuts down the discharging loop.Dead time for overdischarge detection is set internally.
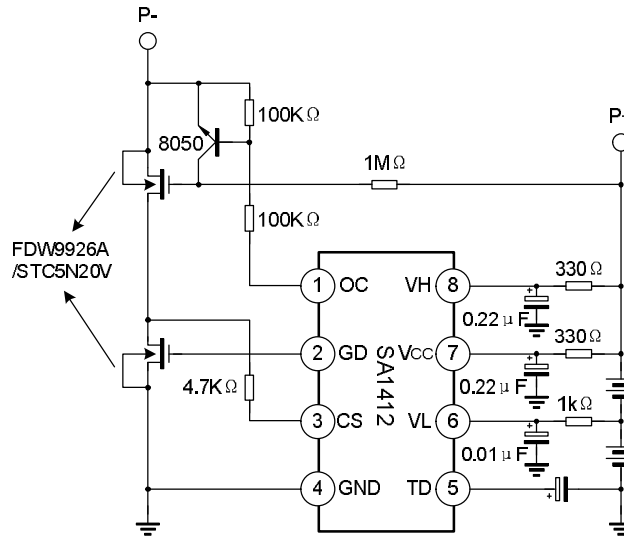
4. Overcurrent mode

The voltage between CS-GND goes above overcurrent detection voltage during discharge. The IC shuts down the discharging loop.

TEST CIRCUIT

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TYPICAL APPLICATION CIRCUIT

Note:The circuit and parameters are reference only, please set the parameters of the real application circuit based on the real test .

PACKAGE OUTLINE

TSSOP-8-225-0.65	UNIT: mm