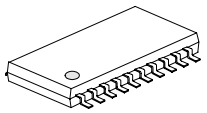
THREE OR FOUR-CELL LI+ BATTERY PROTECTION CIRCUIT

DESCRIPTION

The SA45141 is a three- or four-cell Lithium-Ion Batteries protection circuit. SA45141 protects for Lithium-Ion Batteries. It has functions below: Overcharge detection, Overdischarge detection, Overcurrent detection. When the Lithium-Ion Batteries is in state of overcharge, overdischarge and overcurrent. The IC turns off and on the external MOSFET to protect the batteries.



SSOP-20-225-0.65

FEATURES

* Low current consumption
  -- Overcharge: 55μA (V_{CELL}=4.4V CON=0V)
  -- Normal: 27μA (V_{CELL}=3.5V CON=0V)
  -- Overdischarge: 2μA (V_{CELL}=1.8V CON=0V)
  -- Overdischarge: 0.1μA Max(V_{CELL}=1.0V CON=0V)
* Overcharge detection voltage:
  two types (4.350±0.025V, 4.250±0.025V)
*Overcharge detection hysteresis voltage:
  two types (200±60mV, 8±8mV)
* Overdischarge detection voltage: three types(2.3±0.1V, 2.6±0.2V , 2.9±0.1V)
* Overdischarge release voltage: two types (3.0±0.15V, 3.0±0.20V)
* Overcurrent detection voltage: two types(150±15mV,200±15mV)

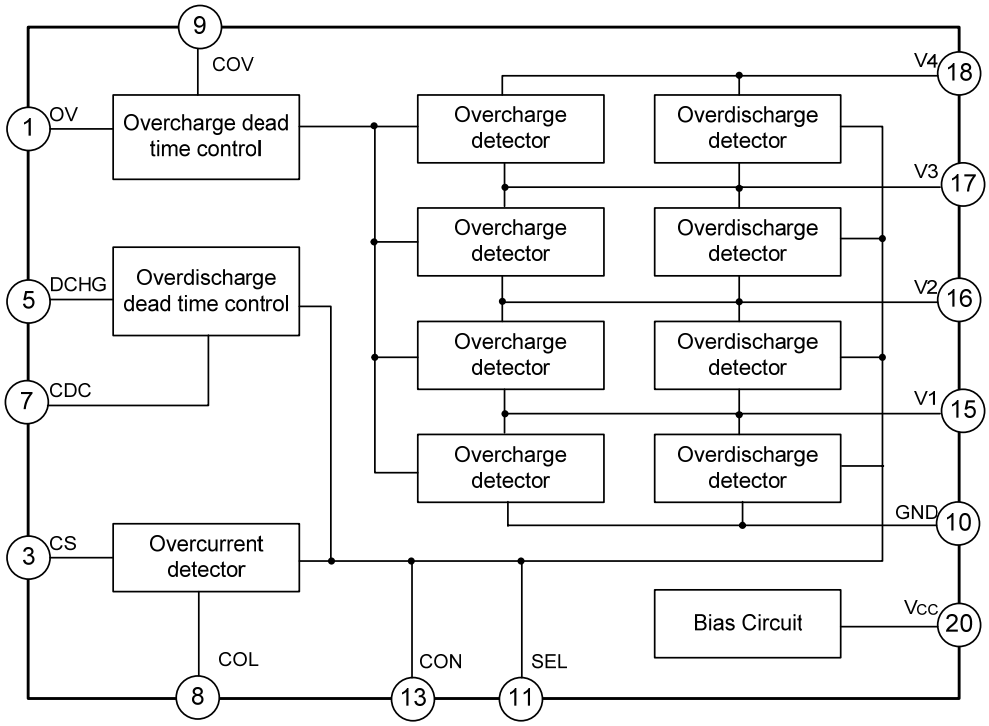
APPLICATIONS

* 3-cell or 4-cell lithium-ion batteries
* Notebook PC
* Electric bicycle
* Electric tools

ORDERING INFORMATION

Device	Package	Overcharge detect voltage（V）	Overcharge detect hysteresis voltage（mV）	Overdis-charge detect voltage（V）	Overdis-charge release voltage（V）	Overcurrent detect voltage（mV）
SA45141SC	SSOP-20-225-0.65	4.350±0.025	200±60	2.3±0.1	3.00±0.15	150±15
SA45141SD		4.350±0.025	200±60	2.6±0.2	3.00±0.20	150±15
SA45141SE		4.350±0.025	200±60	2.9±0.1	3.00±0.15	200±15
SA45141SH		4.250±0.025	8±8	2.9±0.1	3.00±0.15	200±15

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

Characteristics	Symbol	Ratings	Unit
Supply Voltage	V_{CC} max	-0.3~24	V
OV Pin Voltage	V_{OV} max	-0.3~24	V
SEL Pin Voltage	V_{SEL} max	-0.3~24	V
CON Pin Voltage	V_{CON} max	-0.3~24	V
Allowable Dissipation	Pd	300	mW
Storage Temperature Range	Tstg	-40~125	°C
Operating Temperature Range	Tamb	-20~70	°C

ELECTRICAL CHARACTERISTICS

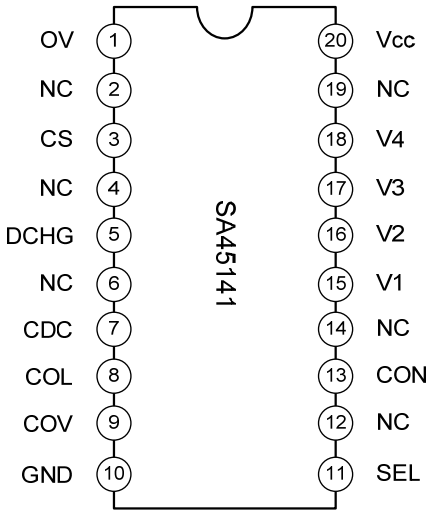
(Unless otherwise stated, T_{amb}=25°C, V_{CC}=V4+V3+V2+V1, V_{CELL}=3.5, CON=GND, SEL=V_{CC})

Characteristics	Symbol	Test conditions		Min.	Typ.	Max.	Unit
Overcharge Detection Voltage	V_U	T_{amb}= 0°C ~50°C	SA45141SC SA45141SD SA45141SE	4.325	4.350	4.375	V
			SA45141SH	4.225	4.250	4.275	

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Overcharge Detection Hysteresis Voltage	ΔV_U	SA45141SC,SA45141SD ,SA45141SE	140	200	260	mV
		SA45141SH	--	8	16	
Overdischarge Detection Voltage	V_D	SA45141SC	2.20	2.30	2.40	V
		SA45141SD	2.40	2.60	2.80	
		SA45141SE ,SA45141SH	2.80	2.90	3.00	
Overdischarge Release Voltage	V_{DF}	SA45141SC ,SA45141SE , SA45141SH	2.85	3.00	3.15	V
		SA45141SD	2.80	3.00	3.20	
Overdischarge Detection Hysteresis Voltage	ΔV_D	SA45141SC	0.45	0.70	0.95	V
		SA45141SD	0.00	0.40	0.8	
		SA45141SE,SA45141SH	--	0.10	0.35	
Overcurrent Detection Voltage	V_{OC}	SA45141SC,SA45141SD	135	150	165	mV
		SA45141SE,SA45141SH	185	200	215	
Overcurrent Detection Hysteresis Voltage	ΔV_{OC}		--	20	40	mV
Overcurrent Release			Load release: more than 5MΩ			
Consumption Current (V_{CC} pin) 1	I_{CC1}	V_{CELL}=4.4V	--	55	110	μA
Consumption Current (V_{CC} pin) 2	I_{CC2}	V_{CELL}=3.5V	--	27	50	μA
Consumption Current (V_{CC} pin) 3	I_{CC3}	V_{CELL}=1.8V	--	2	4	μA
Consumption Current(V_{CC} pin) 4	I_{CC4}	V_{CELL}=3.5V CON= V_{CC}	--	12	20	μA
Consumption Current (V_{CC} pin) 5	I_{CC5}	V_{CELL}=1.8V CON=V_{CC}	--	1	2	μA
Consumption Current (V4 pin) 1	I_{V41}	V_{CELL}=4.4V	--	10	20	μA
Consumption Current (V4 pin) 2	I_{V42}	V_{CELL}=3.5V	--	8	15	μA
Consumption Current (V4 pin) 3	I_{V43}	V_{CELL}=1.8V	--	2.5	5.0	μA
V1 Pin Input Current	I_{V1}	V_{CELL}=3.5V	-0.3	0	0.3	μA
V2 Pin Input Current	I_{V2}	V_{CELL}=3.5V	-0.3	0	0.3	μA
V3 Pin Input Current	I_{V3}	V_{CELL}=3.5V	-0.3	0	0.3	μA
Overcharge Detection dead time	t_{OV}	COV=0.1μF	0.5	1.0	1.5	s
Overdischarge Detection dead time	t_{CDC}	CDC=0.1μF	0.5	1.0	1.5	s
Overcurrent Detection dead time 1	t_{COL1}	COL=0.001μF	5	10	15	ms
Overcurrent Detection dead time 2	t_{COL2}	COL=0.001μF, V_{CC}-CS>1.0V	--	1.5	3.0	ms
Overcurrent Detection dead time 3	t_{COL3}	COL=0.001μF	5	10	15	ms
DCHG Pin Source Current	I_{SODCH}	V_{CELL}=1.8V, SW:A V_{DCHG}=V_{CC}-0.8V	20	--	--	μA
DCHG Pin Sink Current DCHG	I_{SIDCH}	V_{CELL}=3.5V, SW:A V_{DCHG}= 0.8V	20	--	--	μA
DCHG Pin Output Voltage(High)	V_{THDCH}	V_{CC}-VDCHG,I_{SO}=20μA SW: B	--	--	0.8	V
DCHG Pin Output Voltage(Low)	V_{THDCL}	V_{DCHG}-GND, ISI=-20μA SW: B	--	--	0.8	V

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
OV Pin Sink Current	I_{SIOV}	V_{OV}=0.4V	100	--	--	μA
OV Pin Leak Current	I_{LKOV}	V_{OV}=24V	--	--	0.1	μA
CON Pin Low Voltage	V_{CONL}	DCHG="HIGH"	--	--	0.4	V
CON Pin High Voltage	V_{CONH}	DCHG= "LOW"	V_{CC}-0.4	--	--	V
CON Pin Current	I_{CON}	V_{CELL}=3.5V, CON=0.4V	--	1	2	μA
SEL Pin Low Voltage	V_{SELL}	3 cells	--	--	0.4	V
SEL Pin High Voltage	V_{SELH}	4 cells	V_{CC}-0.4	--	--	V
SEL Pin Current	I_{SEL}	V_{CELL}=3.5V, SEL=0.4V	--	1	2	μA

PIN CONFIGURATIONS



PIN DESCRIPTION

Pin no.	Pin name	I/O	Description
1	OV	O	Overcharge detection output pin
2	NC	--	Not connected
3	CS	I	Overcurrent detection input pin
4	NC	--	Not connected
5	DCHG	O	Discharge control FET drive output pin Normal state: DCHG=Low; Overdischarge state: DCHG=High
6	NC	--	Not connected
7	CDC	--	Overdischarge detection dead time setting pin
8	COL	--	Overcurrent detection dead time setting pin
9	COV	--	Overcharge detection dead time setting pin
10	GND	--	Ground
11	SEL	I	3 or 4 cell select switch pin SEL=V1 or GND:3 cell ; SEL=Vcc:4 cell
12	NC	--	Not connected

Pin no.	Pin name	I/O	Description
13	CON	I	Discharge FET ON/OFF pin CON=low: DCHG=low, normal ; CON=high: DCHG=high, discharge prohibited
14	NC	--	Not connected
15	V1	I	V1 cell positive electrode side ,V2 cell negative electrode side
16	V2	I	V2 cell positive electrode side ,V3 cell negative electrode side
17	V3	I	V3 cell positive electrode side ,V4 cell negative electrode side
18	V4	I	V4cell positive electrode side
19	NC	--	Not connected
20	VCC	--	Power supply input pin

FUNCTION DESCRIPTION

This IC is a lithium-ion batteries (3-cell or 4-cell) protection IC. It has functions below: Overcharge detection, Overdischarge detection, Overcurrent detection. It controls the batteries charging or discharging by control the external MOSFET off and on.

1. Overcharge mode

The battery voltage of either 3 cell batteries or 4 cell batteries goes above overcharge detection voltage. The IC shuts down the charging loop. Dead time can be set by connecting a capacitor.

2. Normal mode

When the battery voltage of both 3 cell batteries and 4 cell batteries are above overdischarge detection voltage and below overcharge detection voltage, it can realize the normal charging and discharging function.

3. Overdischarge mode

The battery voltage of either 3 cell batteries or 4 cell batteries drops below overdischarge detection voltage. The IC shuts down the discharging loop. Dead time of overdischarge detection can be set by connecting a capacitor.

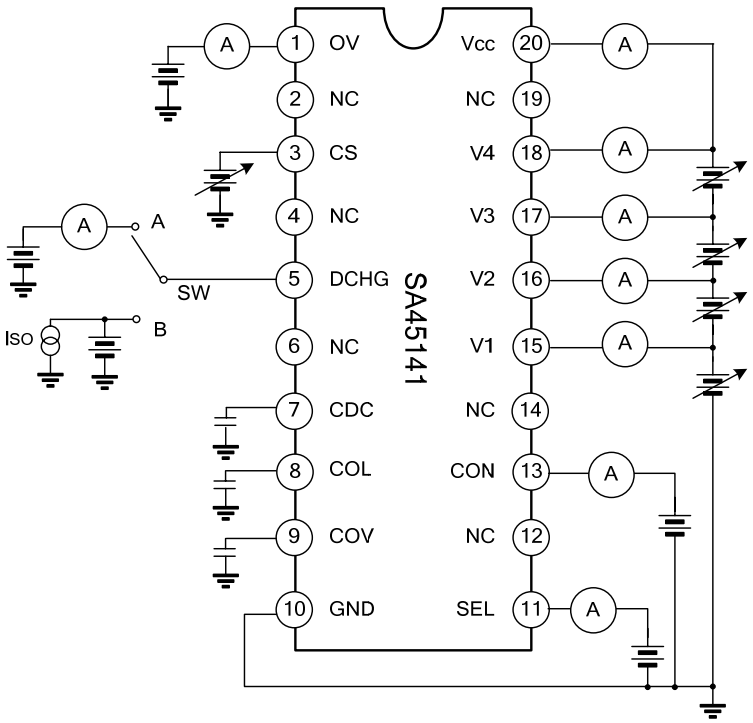
4. Overcurrent mode

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

5. Discharge FET ON/OFF pin CON

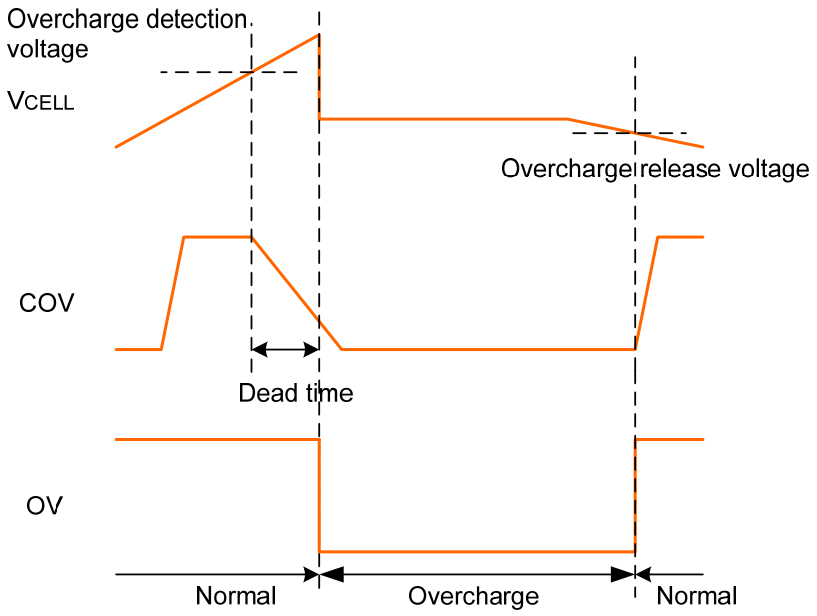
CON=low: DCHG=low, normal; CON=high: DCHG=high, discharge prohibited.

TEST CIRCUIT

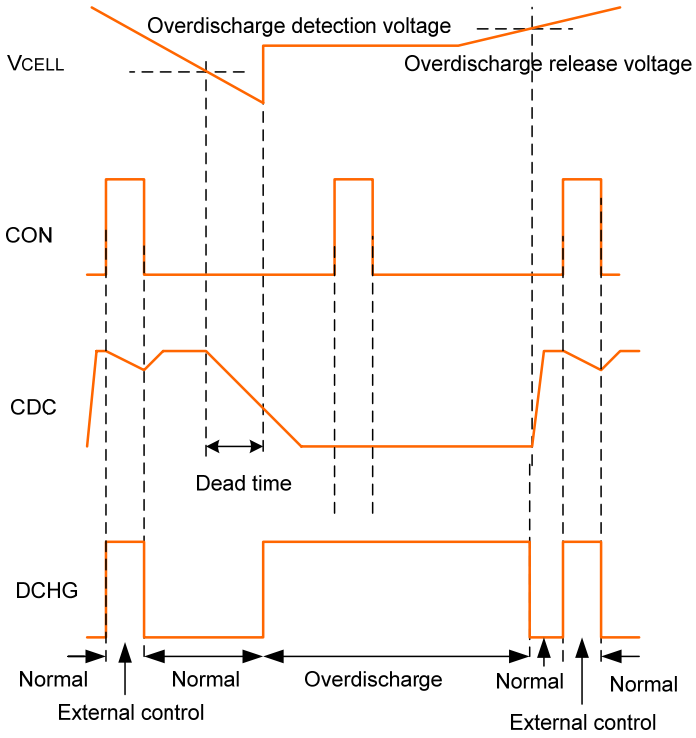


TIMING CHART

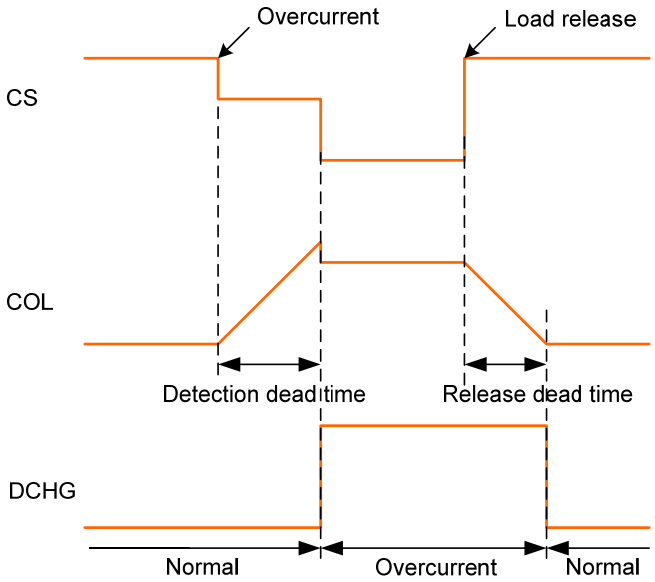
Overcharge mode



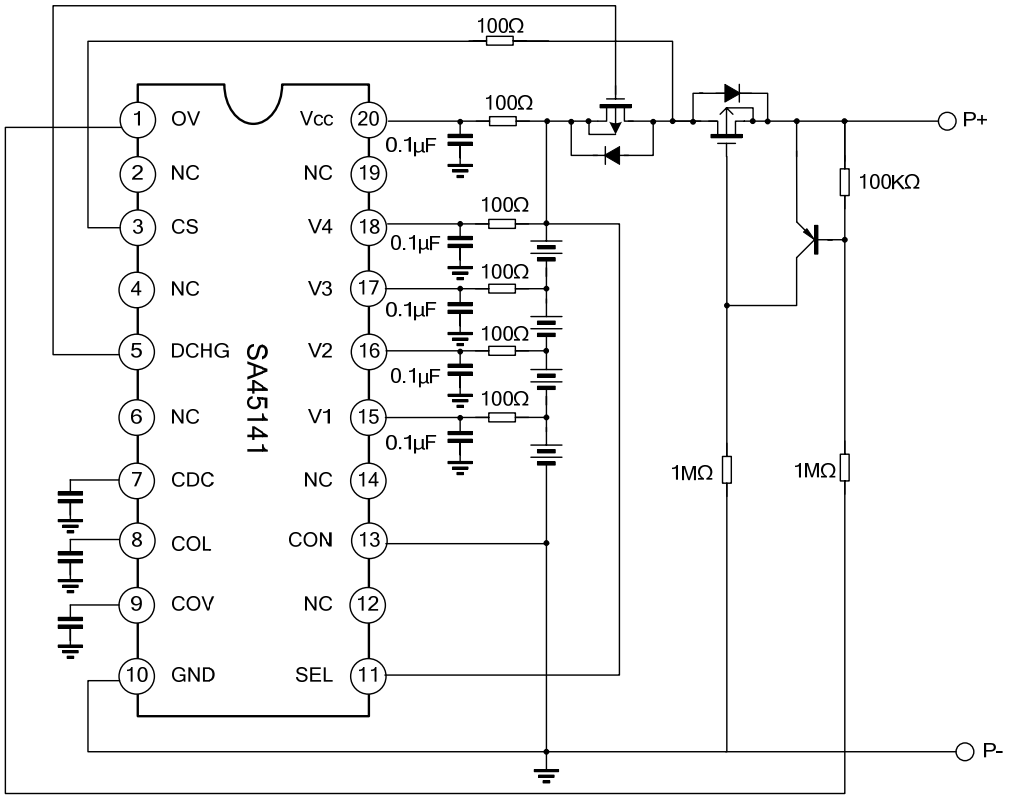
Overdischarge mode



Overcurrent mode



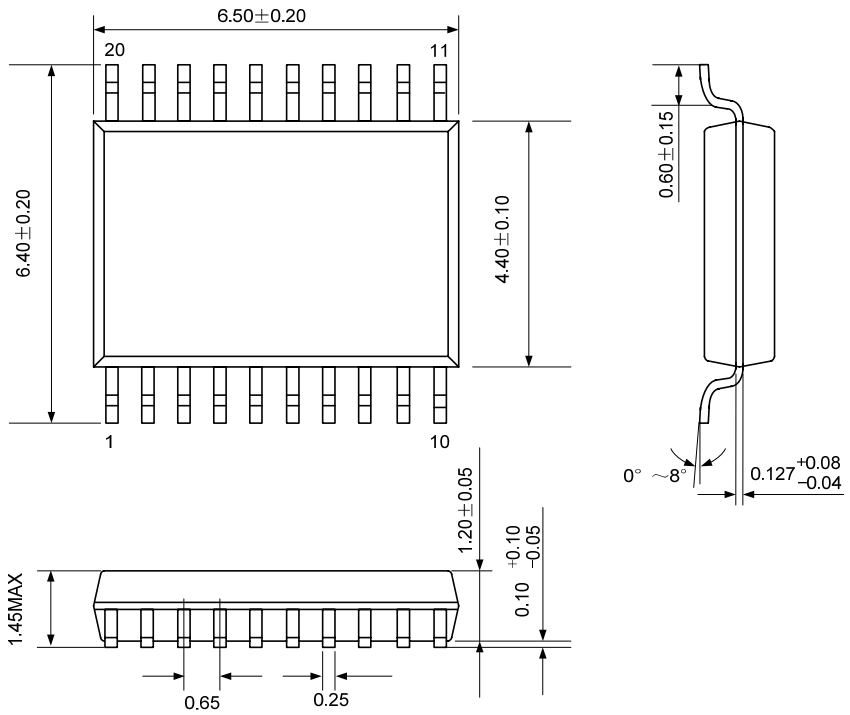
TYPICAL APPLICATION CIRCUIT



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

PACKAGE OUTLINE

SSOP-20-225-0.65 Unit: mm



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