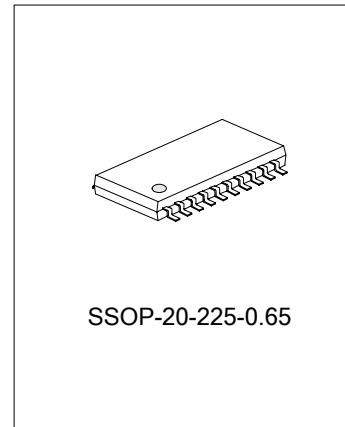


THREE OR FOUR-CELL LI⁺ BATTERY PROTECTION CIRCUIT

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.



FEATURES

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

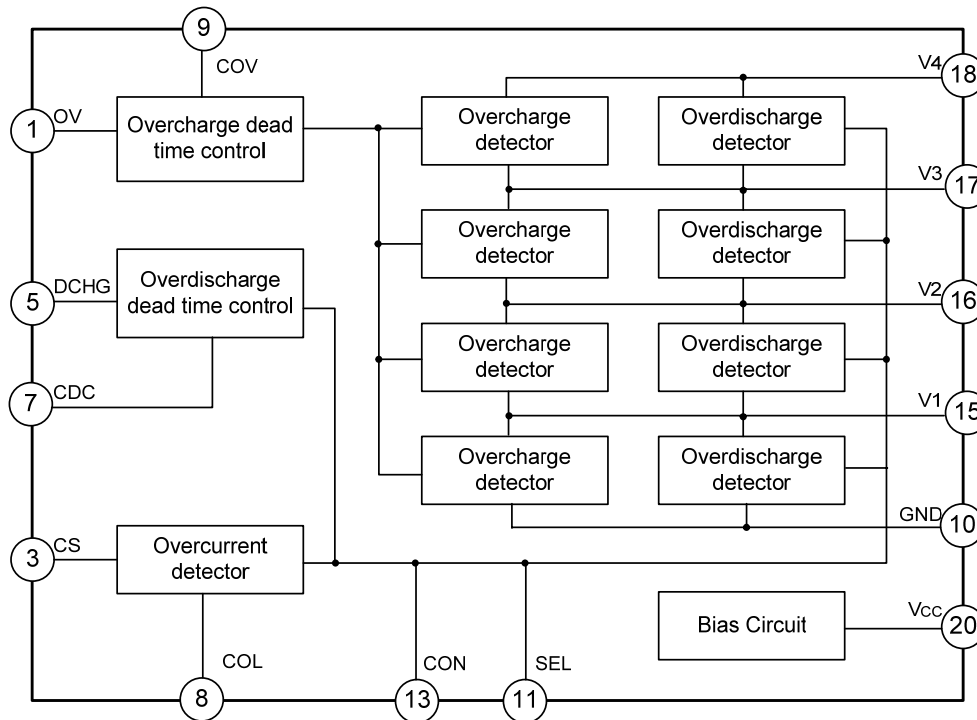
APPLICATIONS

- * 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)	Overdischarge detect voltage (V)	Overdischarge release voltage (V)	Overcurrent detect voltage (mV)
SA45141SC	SSOP-20-225-0.65	4.350 \pm 0.025	200 \pm 60	2.3 \pm 0.1	3.00 \pm 0.15	150 \pm 15
SA45141SE		4.350 \pm 0.025	200 \pm 60	2.9 \pm 0.1	3.00 \pm 0.15	200 \pm 15
SA45141SH		4.250 \pm 0.025	8 \pm 8	2.9 \pm 0.1	3.00 \pm 0.15	200 \pm 15

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

Characteristics	Symbol	Ratings	Unit
Supply Voltage	VCC max	-0.3~24	V
OV Pin Voltage	Vov max	-0.3~24	V
SEL Pin Voltage	VSEL max	-0.3~24	V
CON Pin Voltage	VCON 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, Tamb=25°C, VCC=V4+V3+V2+V1, VCELL=3.5, CON=GND, SEL=VCC)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit	
Overcharge Detection Voltage	VU	Tamb=0°C ~50°C	SA45141SC	4.325	4.350	4.375	V
			SA45141SE				
			SA45141SH	4.225	4.250	4.275	

(To be continued)

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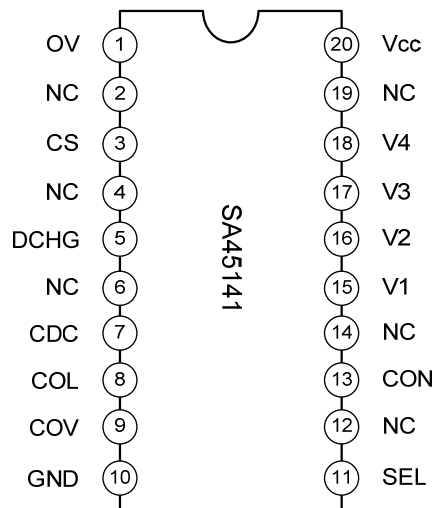
Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Overcharge Detection Hysteresis Voltage	ΔV_U	SA45141SC,SA45141SE	140	200	260	mV
		SA45141SH	--	8	16	
Overdischarge Detection Voltage	V_D	SA45141SC	2.20	2.30	2.40	V
		SA45141SE,SA45141SH	2.80	2.90	3.00	
Overdischarge Release Voltage	V_{DF}		2.85	3.00	3.15	V
Overdischarge Detection Hysteresis Voltage	ΔV_D	SA45141SC	0.45	0.70	0.95	V
		SA45141SE,SA45141SH	--	0.10	0.35	
Overcurrent Detection Voltage	V_{OC}	SA45141SC	135	150	165	mV
		SA45141SE,SA45141SH	185	200	215	
Overcurrent Detection Hysteresis Voltage	ΔV_{OC}		--	20	40	mV
Overcurrent Release			Load release: more than 5M Ω			
Consumption Current (VCC pin) 1	I_{CC1}	$V_{CELL}=4.4V$	--	55	110	μA
Consumption Current (VCC pin) 2	I_{CC2}	$V_{CELL}=3.5V$	--	27	50	μA
Consumption Current (VCC pin) 3	I_{CC3}	$V_{CELL}=1.8V$	--	2	4	μA
Consumption Current(VCC pin) 4	I_{CC4}	$V_{CELL}=3.5V$ CON= VCC	--	12	20	μA
Consumption Current (VCC pin) 5	I_{CC5}	$V_{CELL}=1.8V$ CON=VCC	--	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=0.1 μF	0.5	1.0	1.5	s
Overdischarge Detection dead time	t_{CDC}	CDC=0.1 μF	0.5	1.0	1.5	s
Overcurrent Detection dead time 1	t_{COL1}	COL=0.001 μF	5	10	15	ms
Overcurrent Detection dead time 2	t_{COL2}	COL=0.001 μF , VCC-CS>1.0V	--	1.5	3.0	ms
Overcurrent Detection dead time 3	t_{COL3}	COL=0.001 μF	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}	$V_{CC}-V_{DCHG}$, Iso=20 μA SW: B	--	--	0.8	V

(To be continued)

(Continued)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
DCHG Pin Output Voltage(Low)	V _{THDCL}	V _{DCHG} -GND, I _{SI} =-20μA SW: B	--	--	0.8	V
OV Pin Sink Current	I _{SI} OV	V _{OV} =0.4V	100	--	--	μA
OV Pin Leak Current	I _{LK} OV	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

(To be continued)

(Continued)

Pin no.	Pin name	I/O	Description
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
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.

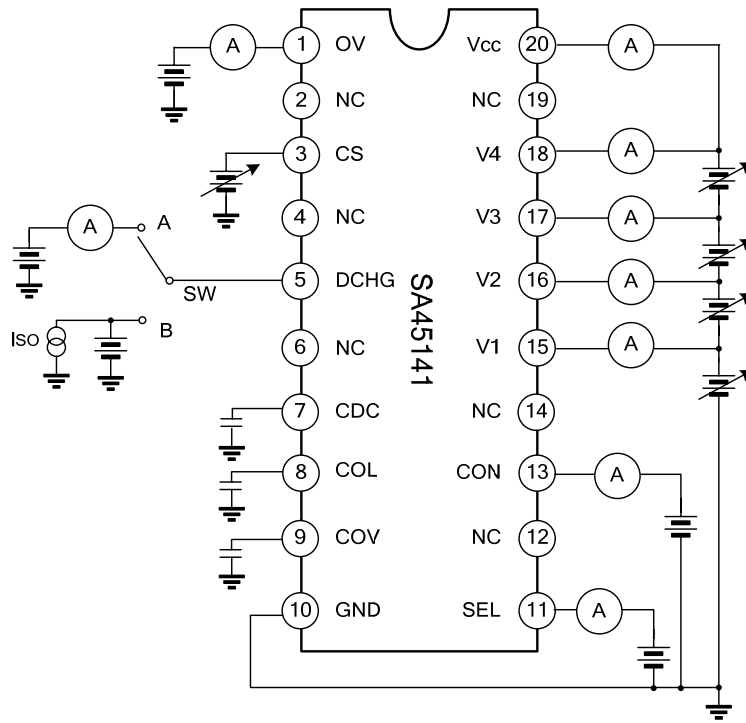
4. Overcurrent mode

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

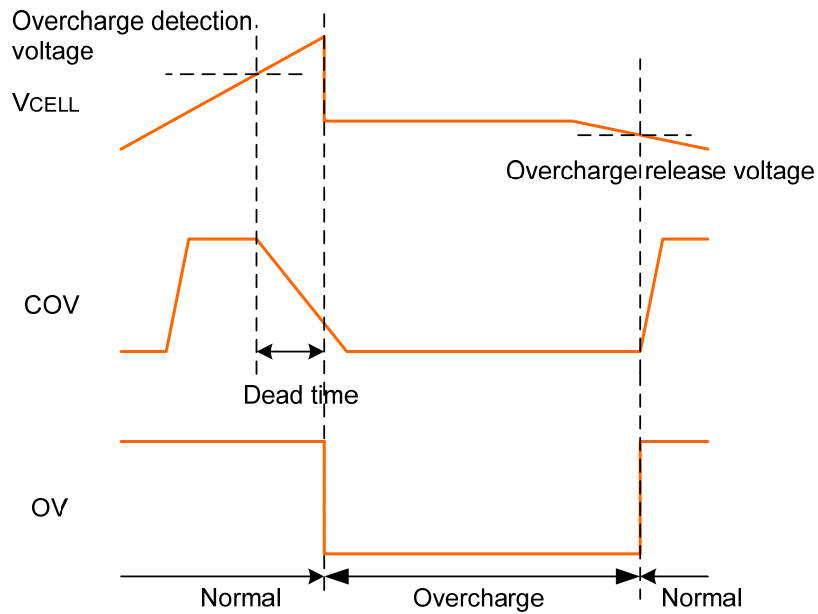
CON=low: DCHG=low, normal; CON=high: DCHG=high, discharge prohibited.

TEST CIRCUIT

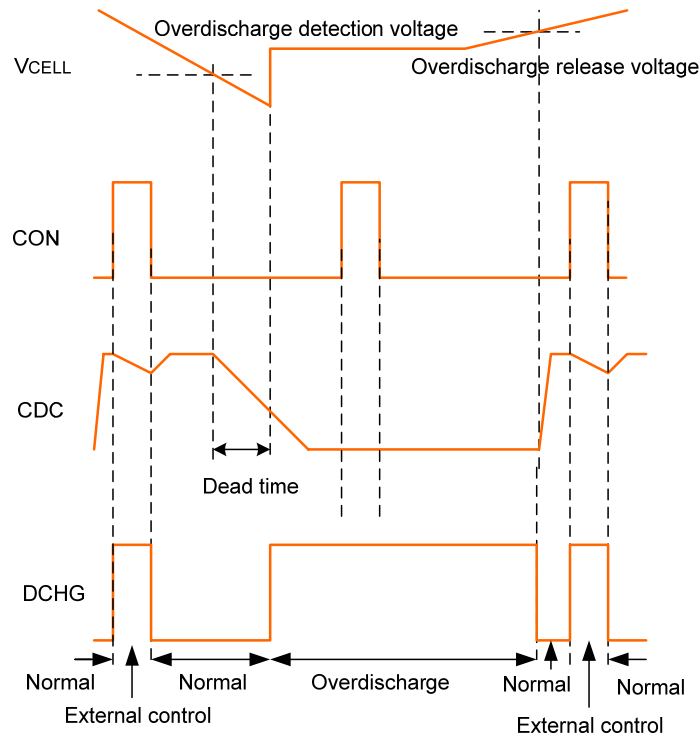


TIMING CHART

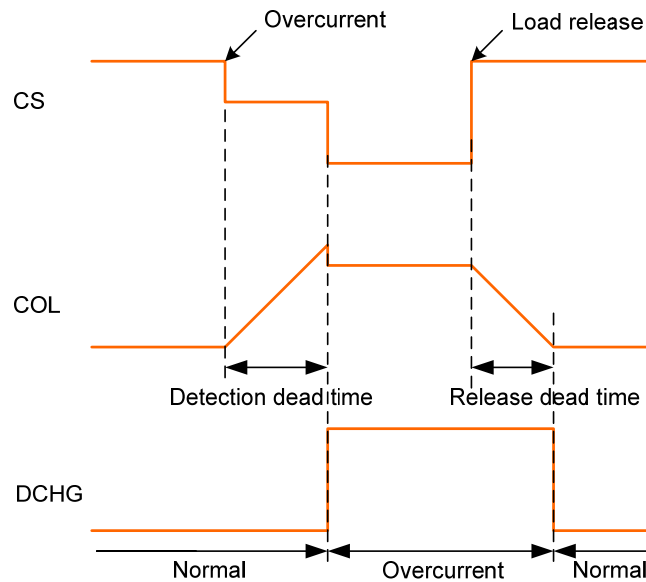
Overcharge mode



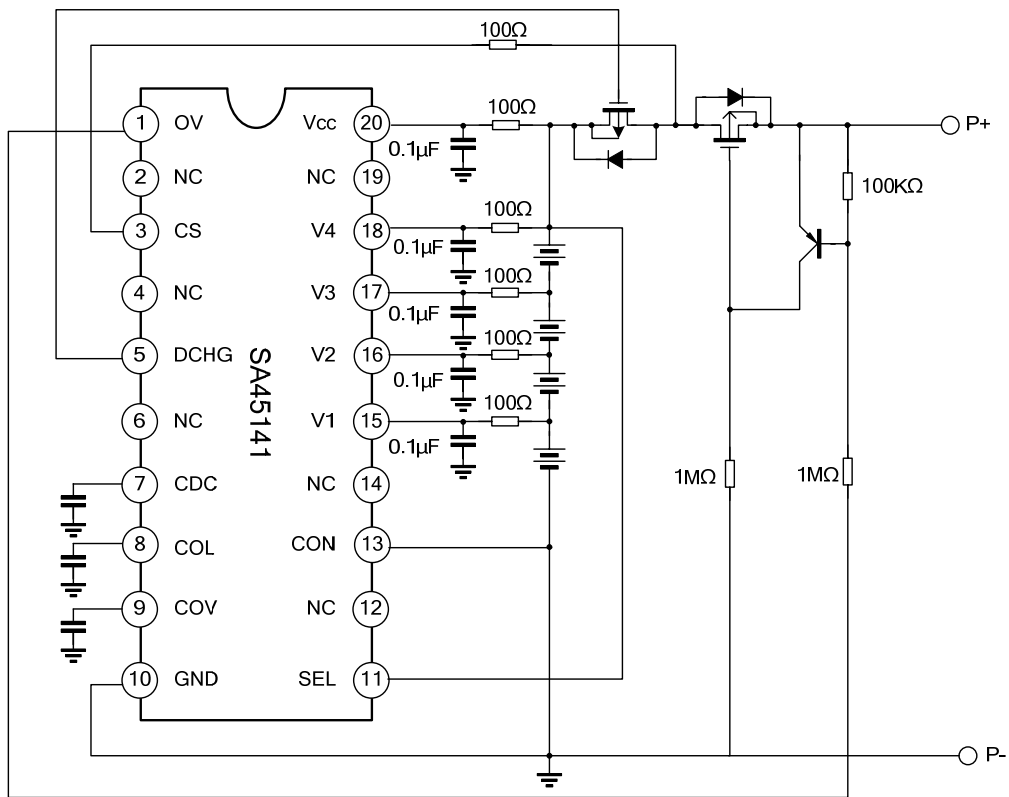
Overdischarge mode



Overcurrent mode



TYPICAL APPLICATION CIRCUIT

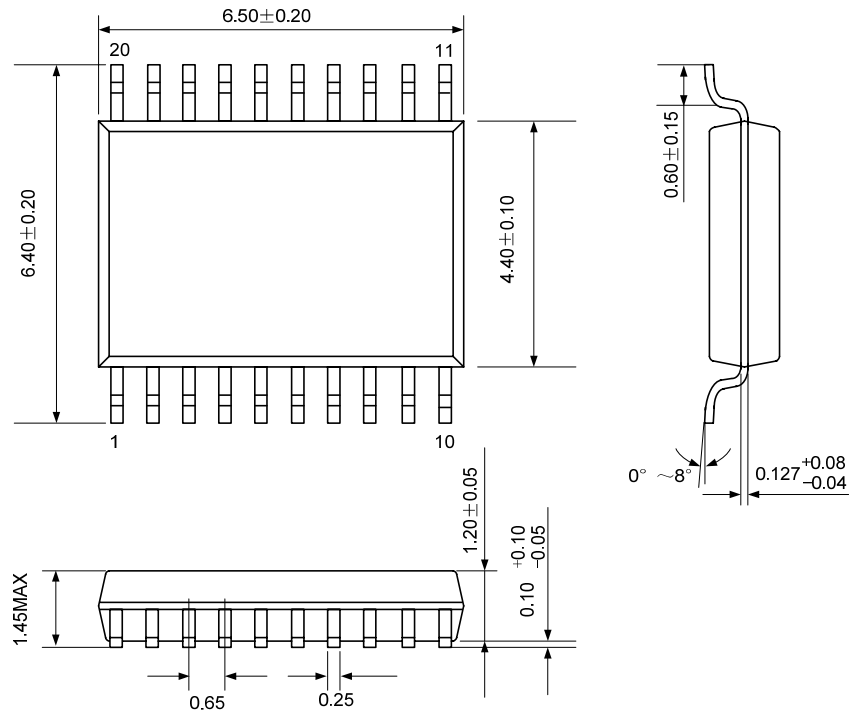


Note: The circuit and parameters are reference only, please set the parameters of the real application circuit based on the real test .

PACKAGE OUTLINE

SSOP-20-225-0.65

Unit: mm



Note: Silan reserves the right to make changes without notice in this specification for the improvement of the design and performance.
Silan will supply the best possible product for customers.



ATTACH

Revision History

Data	REV	Description	Page
2006.12.29	1.0	Original	
2007.08.03	1.1	Modify the "ORDERING INFORMATION"	
2007.10.16	1.2	Modify the "FEATURES"	
2007.12.10	1.3	Modify the "FEATURES" and "ORDERING INFORMATION"	
2008.03.12	1.4	Modify Overcharge detection voltage	