One Cell Lithium-ion/Polymer Battery Protection IC

General Description

The WPDW01A battery protection IC is designed to protect lithium-ion/polymer battery from damage or degrading the lifetime due to overcharge, over discharge, and/or overcurrent for one-cell lithium-ion/ polymer battery powered systems, such as cellular phones.

The ultra-small package and less required external components make it ideal to integrate the WPDW01A into the limited space of battery pack. The accurate ±50mV overcharging detection voltage ensures safe and full utilization charging. The very low standby current drains little current from the cell while in storage.

Applications

Protection IC for One-Cell Lithium-Ion /Lithium-Polymer Battery Pack

Features

Reduction in Board Size due to Miniature Package SOT-23-6.

Ultra-Low Quiescent Current at 3μA (Vcc=3.9V).

Ultra-Low Power-Down Current at 0.1μA (Vcc=2.0V).

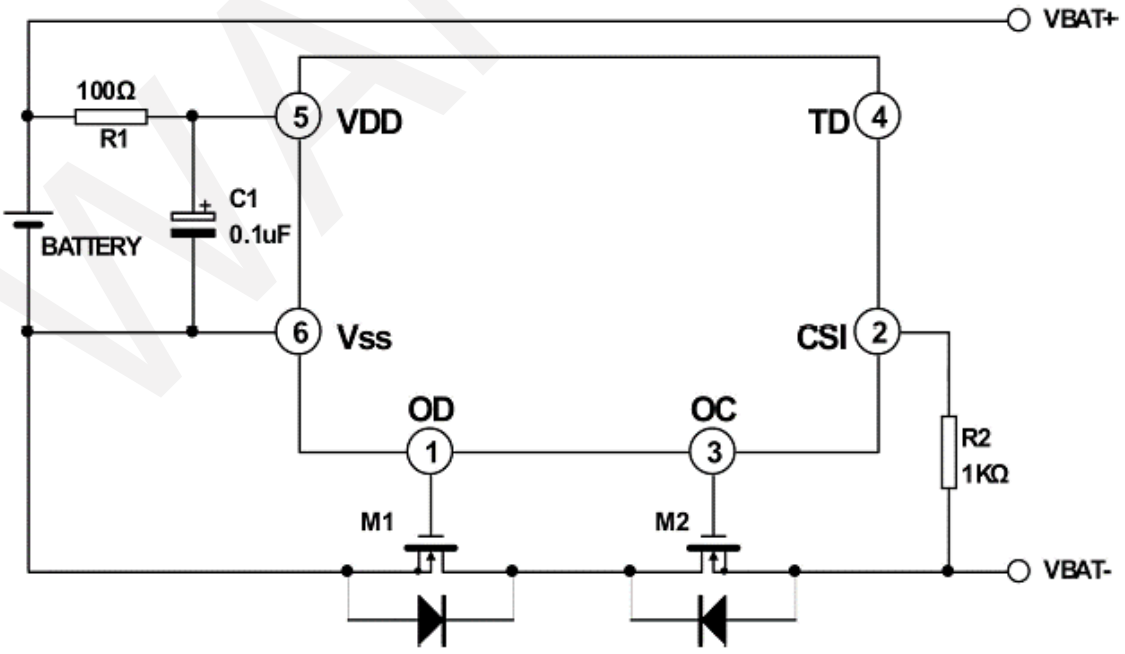
Precision Overcharge Protection Voltage 4.3V± 50mV for the WPDW01A

Load Detection Function during Overcharge Mode.

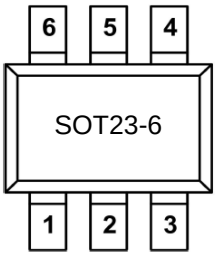
Two Detection Levels for Overcurrent Protection.

Delay times are generated by internal circuits. No external capacitors required.

Typical Application



Pin Assignment



Pin Descriptions

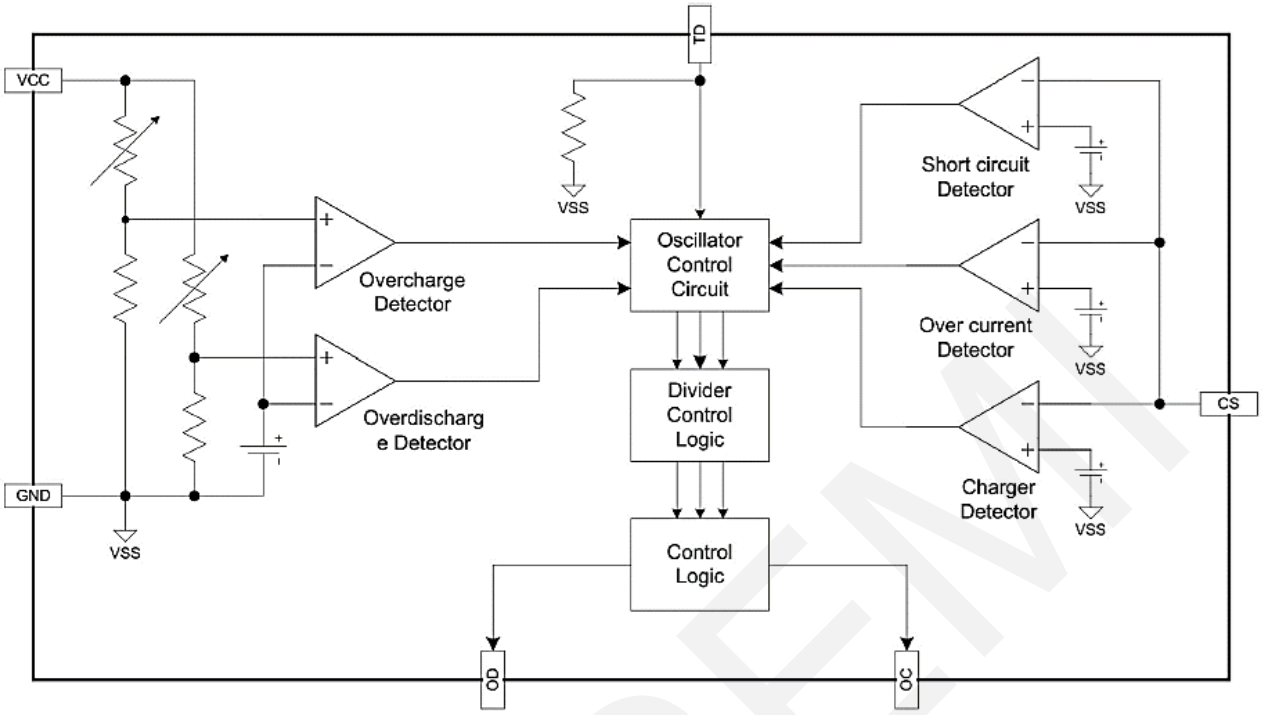
Pin Num	Pin Name	I/O Descriptions
1	OD	MOSFET gate connection pin for discharge control
2	CSI	Input pin for current sense, charger detect
3	OC	MOSFET gate connection pin for charge control
4	NC	Current sense input
5	VDD	Power supply, through a resistor (R1)
6	GND	Ground

Absolute Maximum Ratings

Symbol	Value			Unit
	Min.	Typ.	Max.	
V_{DD}			10	V
OC, CS	V_{DD} - 26		V_{DD} + 0.3	V
OD			V_{DD} + 0.3	V
Operating Temperature Range	-40		150	℃
Min/Max Storage Temperature Tstg	-40		125	℃
Lead Temperature （Soldering， 10secs）			260	℃

Note: WPDW01A contains a circuit that will protect it from static discharge; but please take special care that no excessive static electricity or voltage which exceeds the limit of the protection circuit will be applied to it.

Block Diagram



Electrical Characteristics

(Ta = 25°C, V_{DD}=16V, if not otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Supply Voltage (V_{DD}) Section						
I_{DD}	Supply Current	V_{DD}=3.9V		3	6	μA
I_{PD}	Power-Down Current	V_{DD}=2.0V			0.1	μA
V_{OCP}	Overcharge Protection Voltage		4.25	4.30	4.35	V
V_{OCR}	Overcharge Release Voltage		4.05	4.10	4.15	V
V_{ODP}	Overdischarge Protection Voltage		2.30	2.40	2.50	V
V_{ODR}	Overdischarge Release Voltage		2.90	3.00	3.10	V
V_{OI1}	Overcurrent Protection Voltage		120	150	180	MV
V_{OI2}	Short Current Protection Voltage	V_{DD}=3.6V	1.25	1.35	1.45	V
T_{OC}	Overcharge Delay Time			80	200	MS
T_{OD}	Overdischarge Delay Time	V_{DD}=3.6V to 2.0V		20	60	MS
T_{OI1}	Overcurrent Delay Time (1)			10	20	MS
T_{OI2}	Overcurrent Delay Time (2)			5	50	US
V_{CH}	Charger Detection Threshold Voltage		-1.2	-0.7	-0.2	V
V_{DH}	OD Pin Output “H” Voltage	V_{DD}=3.6V	3.5			V

V_{DL}	OD Pin Output “L” Voltage				0.5	V
V_{CH}	OC Pin Output “H” Voltage	V_{DD}=3.6V	3.5			V
V_{CL}	OC Pin Output “L” Voltage				0.5	V

Operation Description

◆ Selection of External Control MOSFET

Because the overcurrent protection voltage is preset, the threshold current for overcurrent detection is determined by the turn-on resistance of the charge and discharge control MOSFETs. The turn-on resistance of the external control MOSFETs can be determined by the equation: $R_{ON}=V_{OIP}/ (2 \times I_T)$ (I_T is the overcurrent threshold current). For example, if the overcurrent threshold current I_T is designed to be 3A, the turn-on resistance of the external control MOSFET must be 25mΩ. Be aware that turn-on resistance of the MOSFET changes with temperature variation due to heat dissipation. It changes with the voltage between gate and source as well. (Turn-on resistance of MOSFET increases as the voltage between gate and source decreases). As the turn-on resistance of the external MOSFET changes, the design of the overcurrent threshold current changes accordingly.

◆ Suppressing the Ripple and Disturbance from Charger

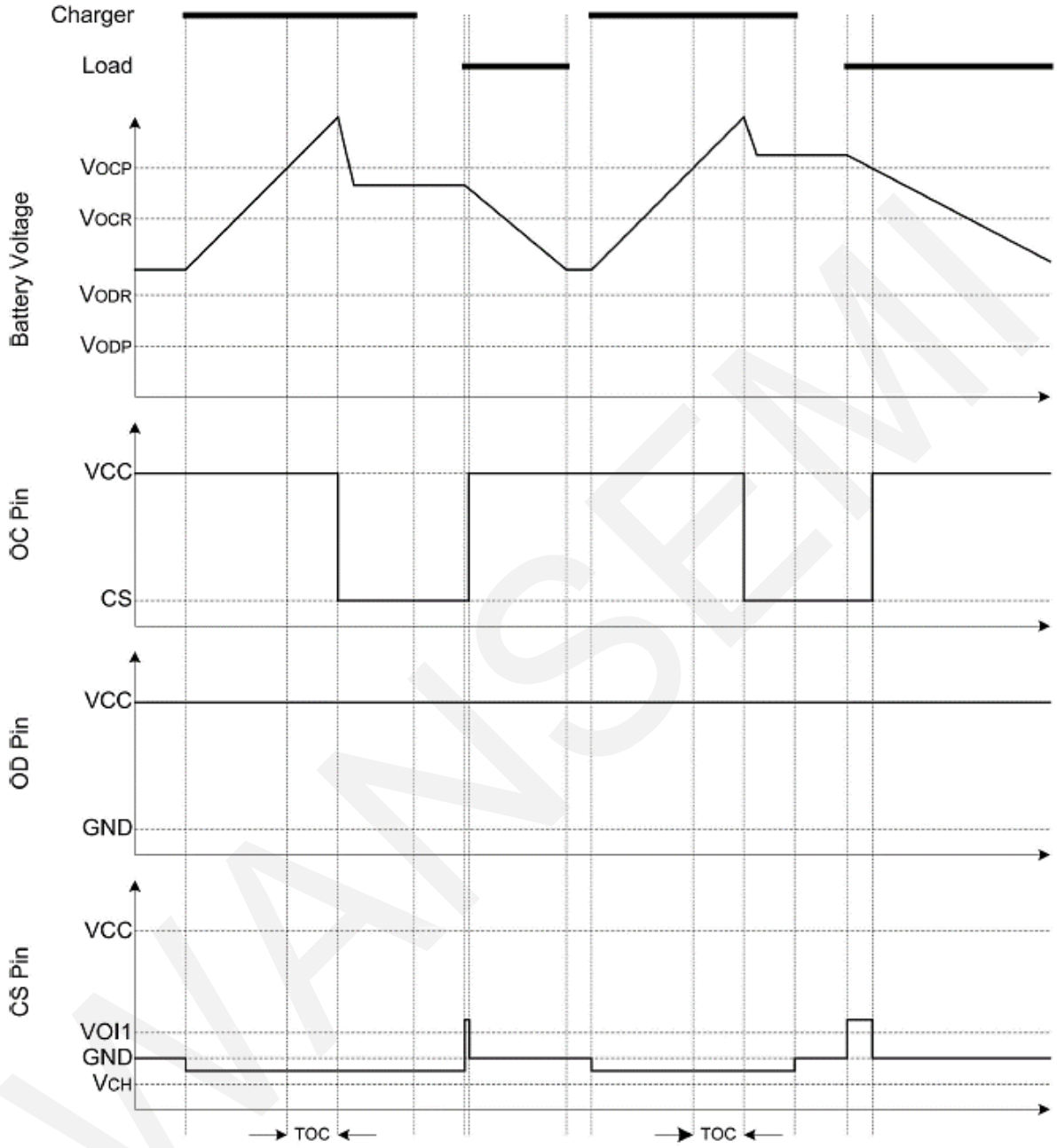
To suppress the ripple and disturbance from charger, connecting R1 and C1 to V_{CC} is recommended.

◆ Protection the CS pin

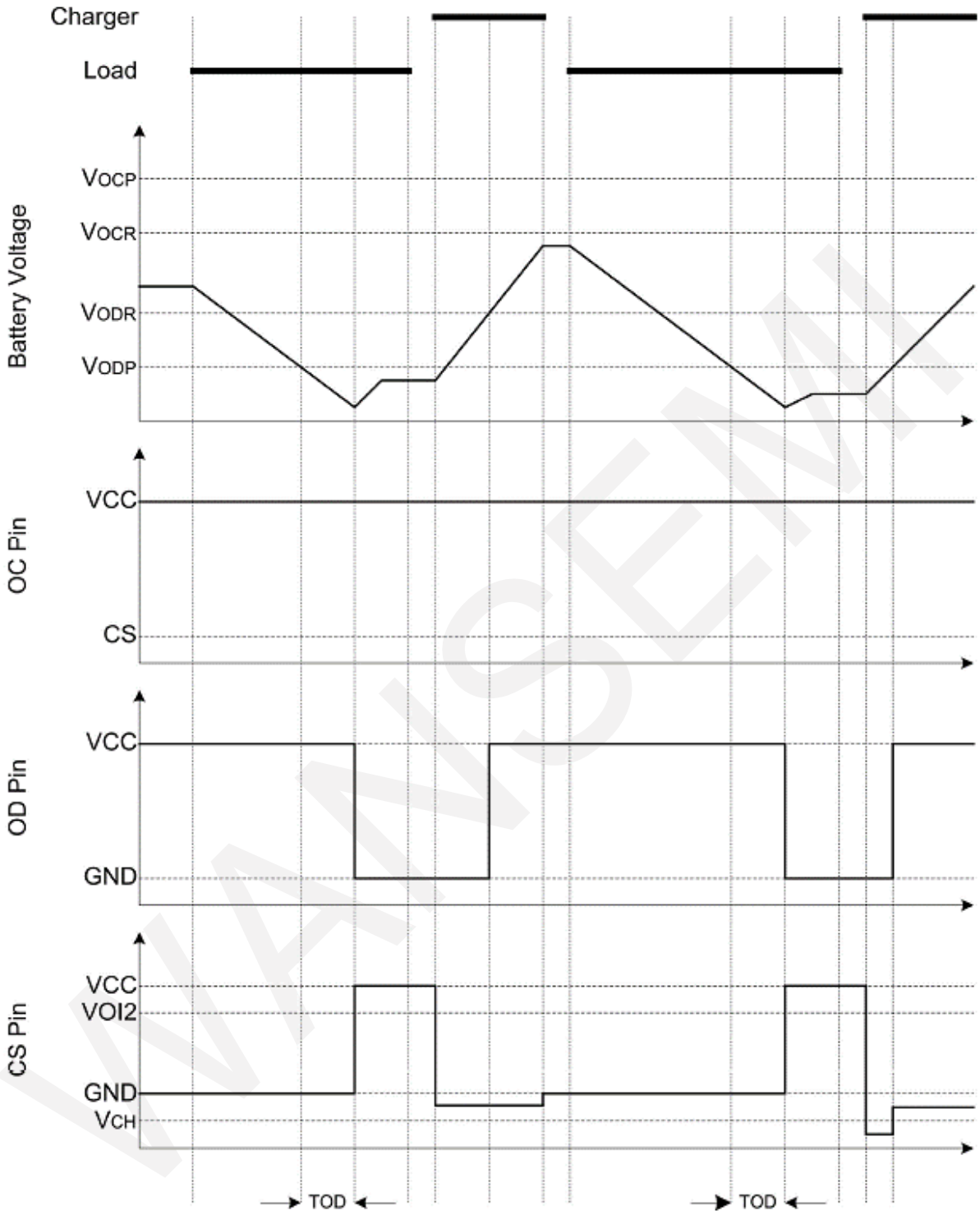
R2 is used for latch-up protection when charger is connected under overdischarge condition and overstress protection at reverse connecting of a charger.

Timing Diagram

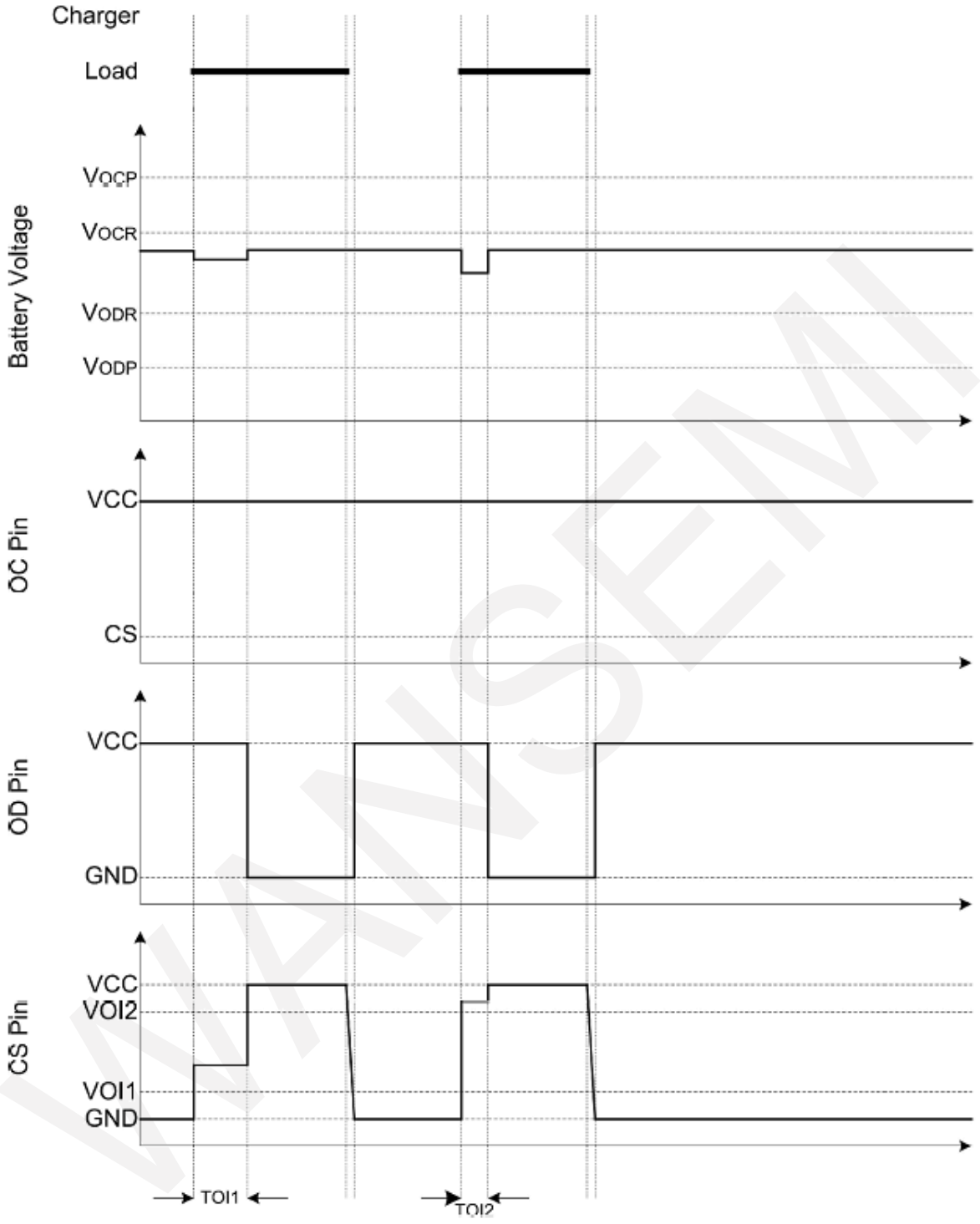
Overcharge Condition -> Load Discharging -> Normal Condition



Overdischarge Condition -> Charging by a Charger -> Normal Condition

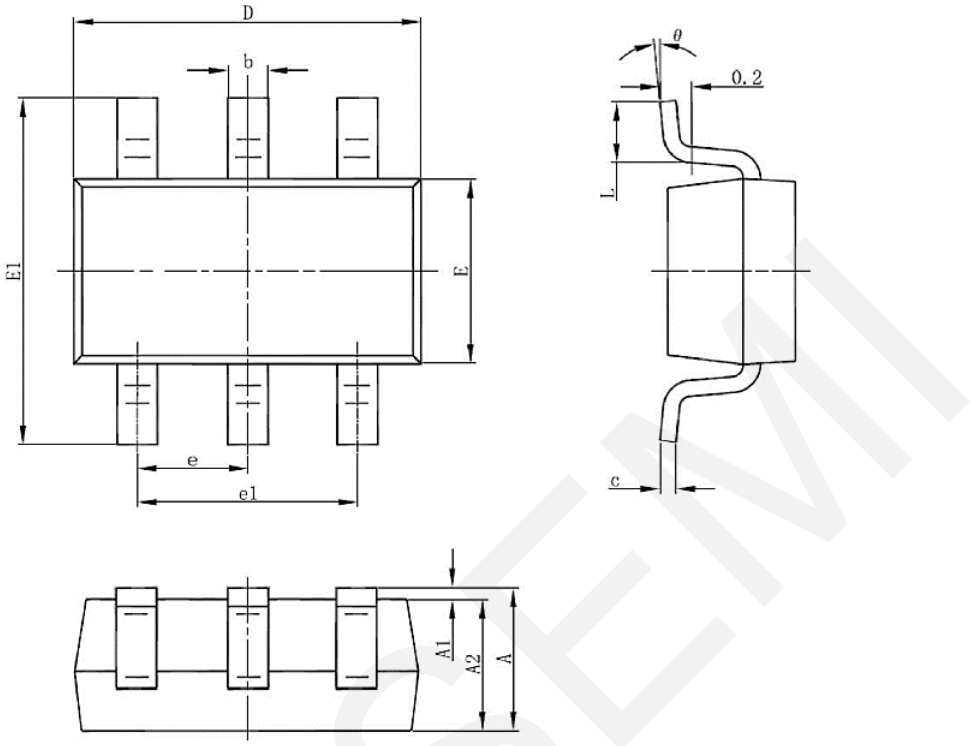


Over Current Condition -> Normal Condition



Package Information

SOT23-6 (unit: mm)



Symbol	Millimeters		
	Min	Nor	Max
A	-	-	1.35
A1	0.04	-	0.15
A2	1.00	1.10	1.20
b	0.30	0.40	0.50
c	0.10	0.15	0.20
D	2.72	2.92	3.12
E	1.40	1.60	1.80
E1	2.60	2.80	3.00
e	0.95BSC		
e1	1.98BSC		
L	0.30	-	0.60
θ	0°	-	8°

Important Notice

WAN SEMICONDUCTOR (NINGBO) CO.,LTD reserves the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services and to discontinue any product or service. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to WANSEMI’s terms and conditions of sale supplied at the time of order acknowledgment.

WANSEMI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in WANSEMI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent WANSEMI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

WANSEMI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using WANSEMI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

No WANSEMI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those WANSEMI components which WANSEMI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of WANSEMI components which have not been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

Unless WANSEMI has specifically designated certain components which meet ISO/TS16949 requirements, mainly for automotive use, WANSEMI will not be responsible for any failure of such components to meet such requirements.