DESCRIPTION

The A4001 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 A4001 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

The A4001 is available in SOT-26 package.

ORDERING INFORMATION

Package Type	Part Number	
SOT-26 SPQ: 3,000pcs/Reel	E6	A4001E6R
		A4001E6VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

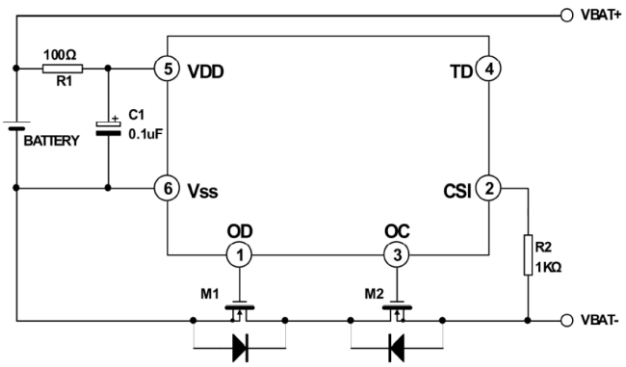
FEATURES

- Reduction in Board Size due to Miniature
- Ultra-Low Quiescent Current at 3uA
- Ultra-Low Power-down Current at 0.1uA
- Precision Overcharge Protection Voltage 4.3V+50mV for the A4001
- Load Detection Function during Overcharge Mode
- Two Detection Levels for Overcurrent Protection
- Delay times are generated by internal circuits. No external capacitors required
- Available in SOT-26 Package

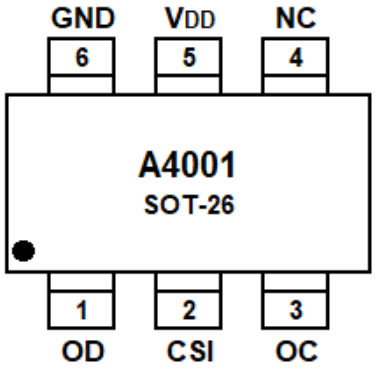
APPLICATION

- One-Cell Lithium-ion Battery Pack
- Lithium-Polymer Battery Pack

TYPICAL APPLICATION



PIN DESCRIPTION



Top View

Pin #	Symbol	Function
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	No connection
5	V_{DD}	Power supply, through a resistor (R1)
6	GND	Ground pin

ABSOLUTE MAXIMUM RATINGS

T_A= 25℃, unless otherwise noted

V_{DD}, Supply Voltage	-0.3V~10V
OC,CSI, Input Pin Voltage	V_{DD}-26V ~ V_{DD}+0.3V
OD, Input Pin Voltage	-0.3V ~ V_{DD}+0.3V
T_J, Operation Junction Temperature	150°C
T_{STG}, Storage Temperature Range	-40°C ~+125°C
T_{OPR}, Operation Temperature	0°C ~+80°C

Stress beyond above listed “Absolute Maximum Ratings” may lead permanent damage to the device. These are stress ratings only and operations of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

T_A = 25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Detection Voltage						
Overcharge Detection Voltage	V_{CU}		4.25	4.30	4.35	V
Overcharge Release Voltage	V_{CL}		4.05	4.10	4.15	V
Overdischarge Detection Voltage	V_{DL}		2.30	2.40	2.50	V
Overdischarge Release Voltage	V_{DR}		2.90	3.00	3.10	V
Charger Detection Threshold Voltage	V_{CH}		-1.2	-0.7	-0.2	V
OD pin Output “H” Voltage	V_{DH}		3.5	-	-	V
OD pin Output “L” Voltage	V_{DL}		-	-	0.5	V
OC pin Output “H” Voltage	V_{CH}		3.5	-	-	V
OC pin Output “L” Voltage	V_{CL}		-	-	0.5	V
Detection Current						
Overcurrent Protection Voltage	V_{OI1}		120	150	180	mV
Short Current Protection Voltage	V_{SHORT}	V_{DD}=3.6V	1.25	1.35	1.45	V
Current Consumption						
Current Consumption in Normal Operation	I_{OPE}	V_{DD}=3.9V	-	3	6	uA
Current Consumption in Power Down	I_{PDN}	V_{DD}=2.0V	-	-	0.1	uA
Detection Delay Time						
Overcharge Voltage Detection Delay Time	t_{CU}		-	80	200	ms
Overdischarge Voltage Detection Delay Time	t_{DL}		-	20	60	ms
Overdischarge Current Detection Delay Time	*t_{IOV}		-	10	20	ms
Load Short-Circuiting Detection Delay Time	*t_{SHORT}		-	5	50	us

NOTE1: * The parameter is guaranteed by design

DETAILED INFORMATION

Functional 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 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

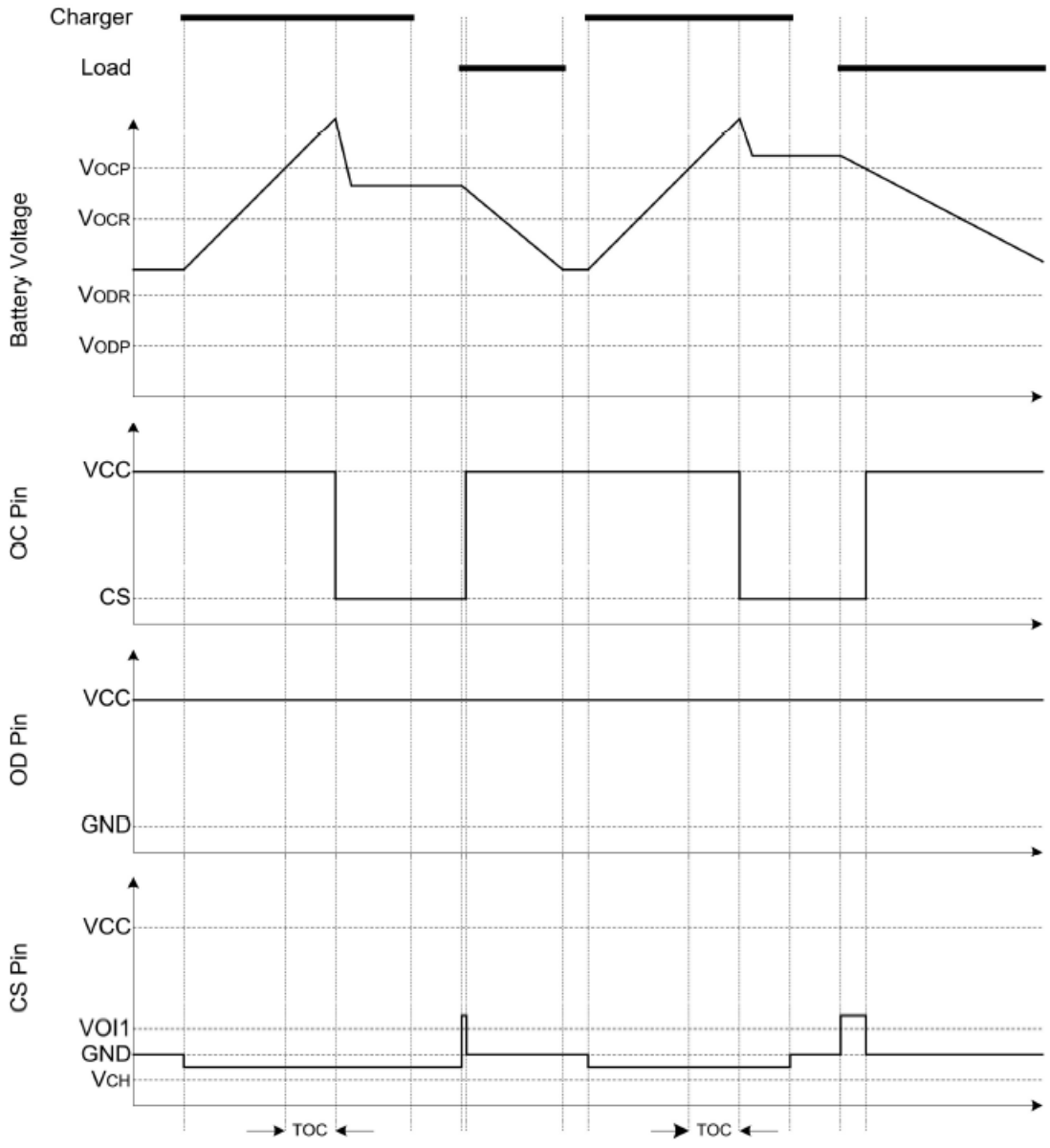
To suppress the ripple and disturbance from charger, connecting R1 and C1 to V_{CC} is recommended.

Protection the CSI pin

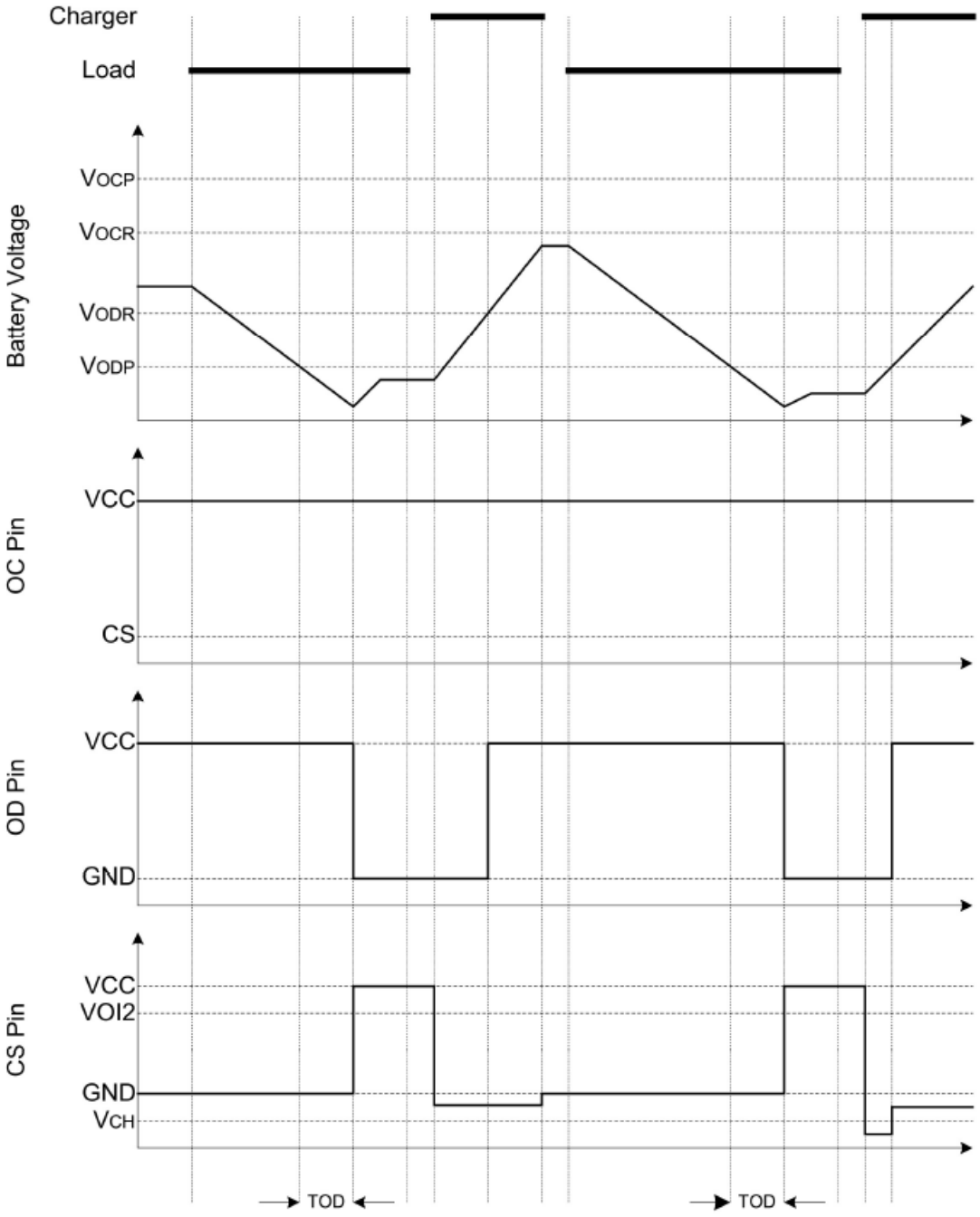
R2 is used for latch-up protection when charger is connected under overdischarge condition and overstress protection at reverse connecting of a charger

TIMING CHART

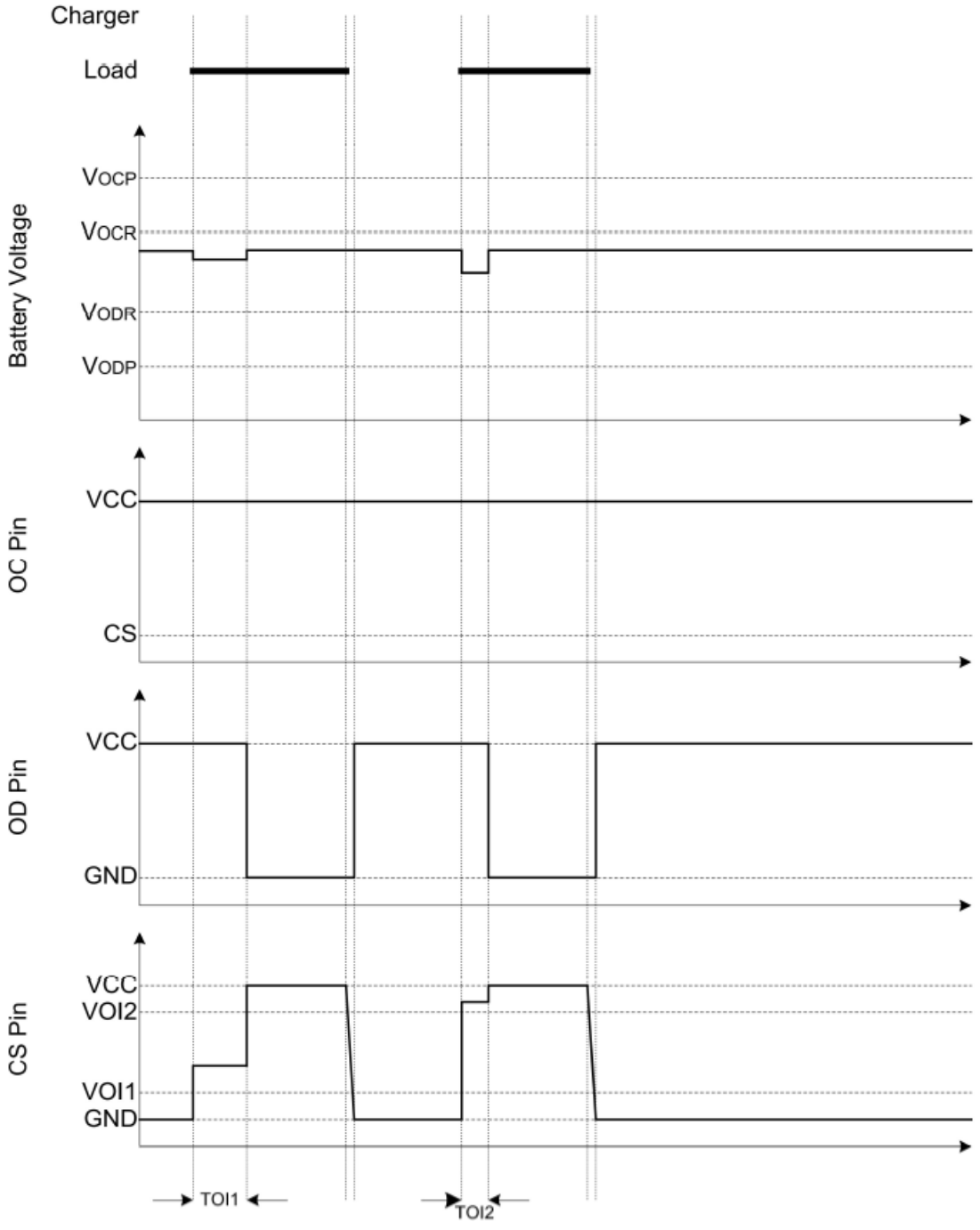
Overcharge Condition-> Load Discharging-> Normal Condition



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

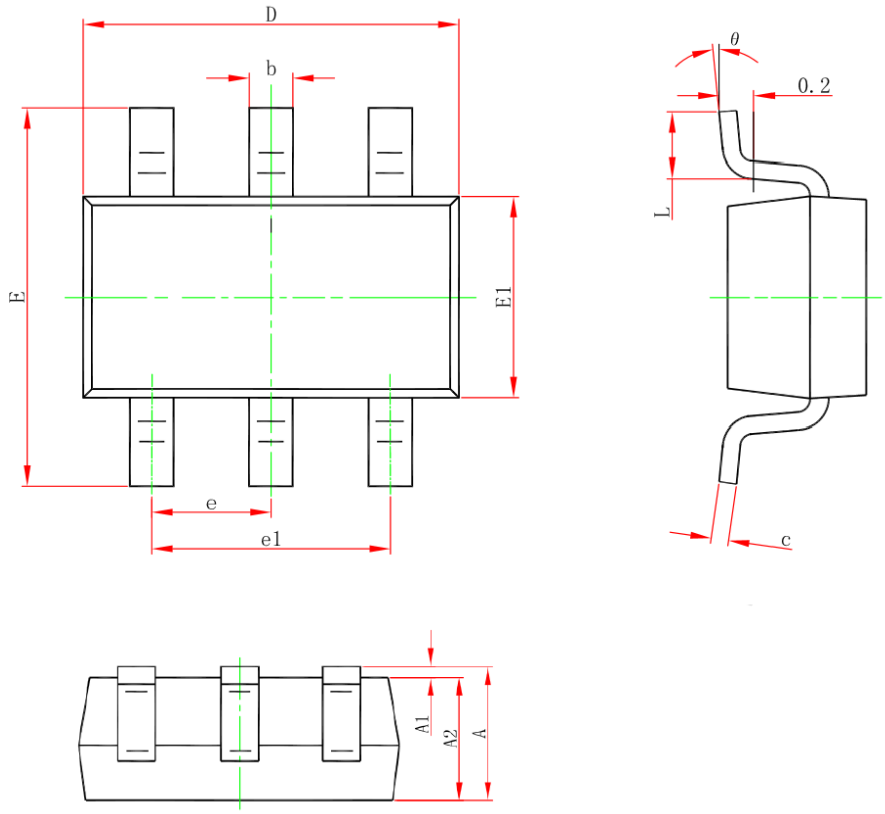


Over Current Condition->Normal Condition



PACKAGE INFORMATION

Dimension in SOT-26 (Unit: mm)



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E1	1.500	1.700	0.059	0.067
E	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

IMPORTANT NOTICE

AiT Semiconductor Inc. (AiT) reserves the right to make changes to any its product, specifications, to discontinue any integrated circuit product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

AiT Semiconductor Inc.'s integrated circuit products are not designed, intended, authorized, or warranted to be suitable for use in life support applications, devices or systems or other critical applications. Use of AiT products in such applications is understood to be fully at the risk of the customer. As used herein may involve potential risks of death, personal injury, or server property, or environmental damage. In order to minimize risks associated with the customer's applications, the customer should provide adequate design and operating safeguards.

AiT Semiconductor Inc. assumes to no liability to customer product design or application support. AiT warrants the performance of its products of the specifications applicable at the time of sale.