



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		

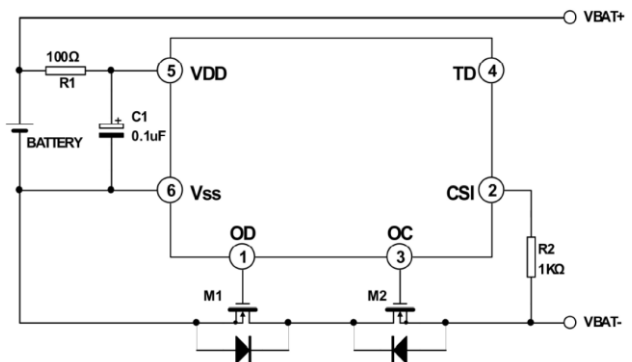
FEATURES

- 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

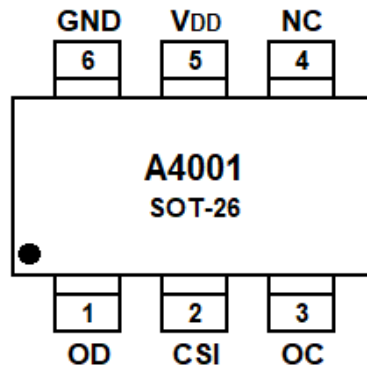
- One-Cell Lithium-ion Battery Pack
- Lithium-Polymer Battery Pack

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°C, 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°C, 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.

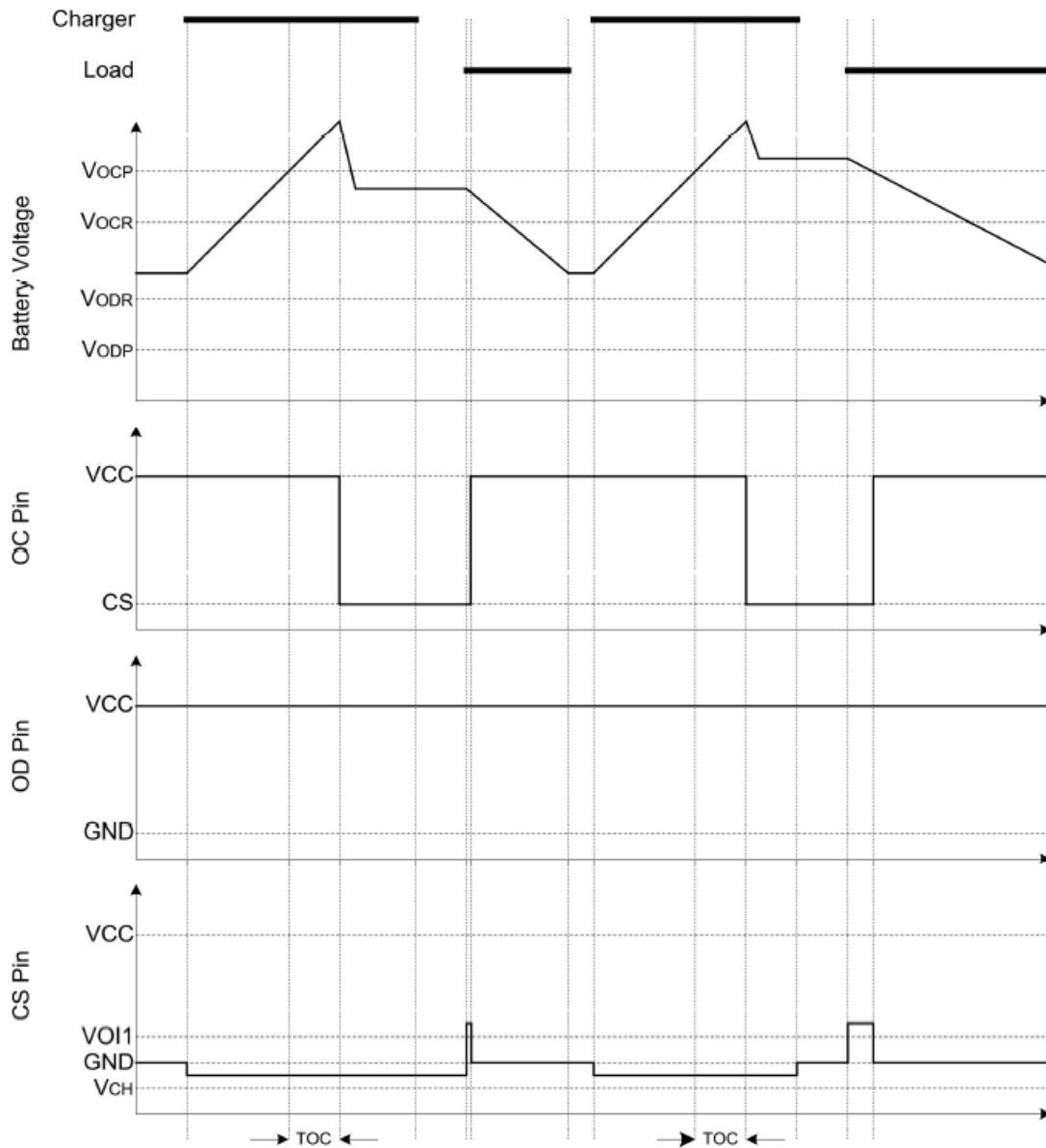
Protection the CSI pin

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



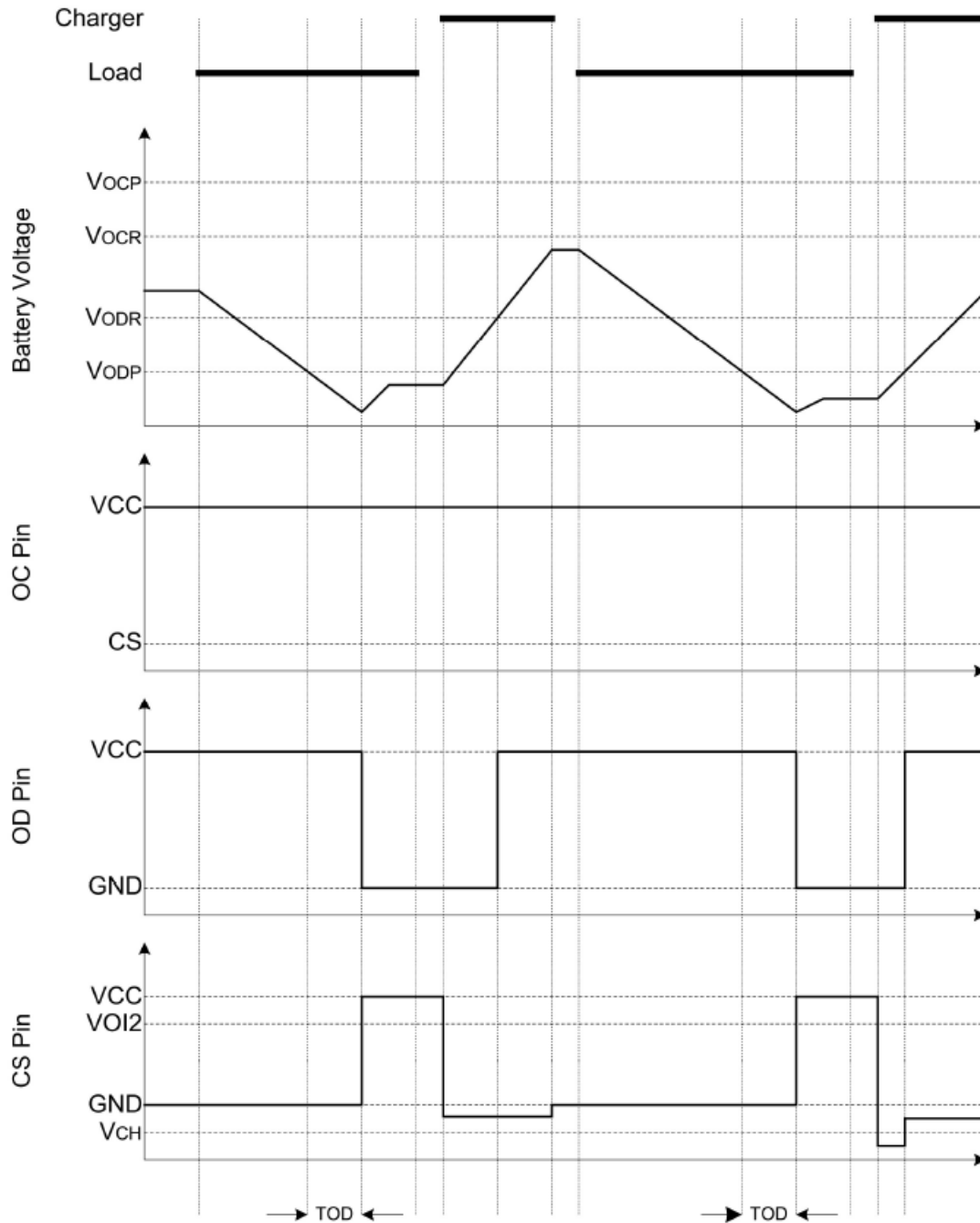
TIMING CHART

Overcharge Condition-> Load Discharging-> Normal Condition



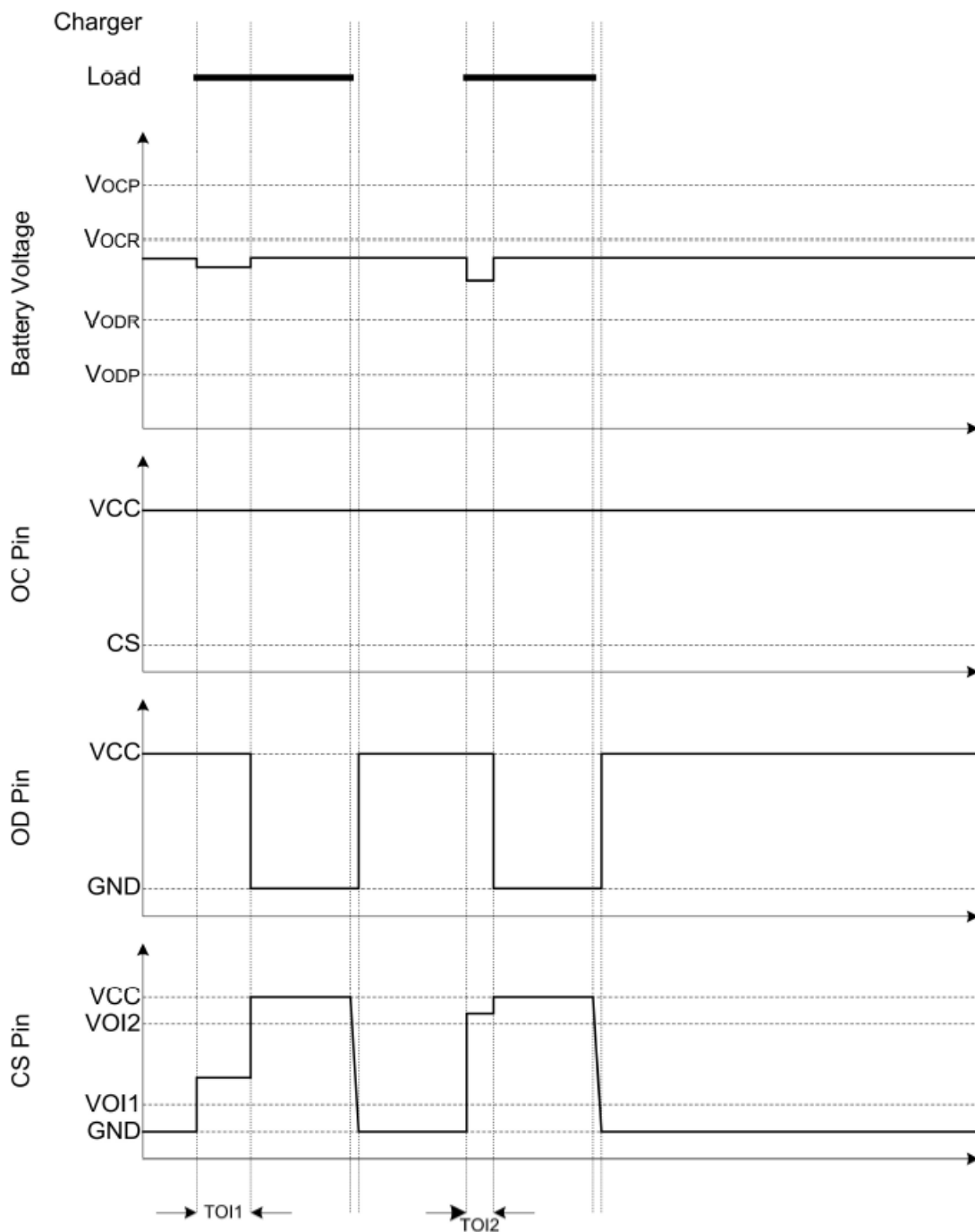


Overdischarge Condition->Charging by a Charger->Normal Condition





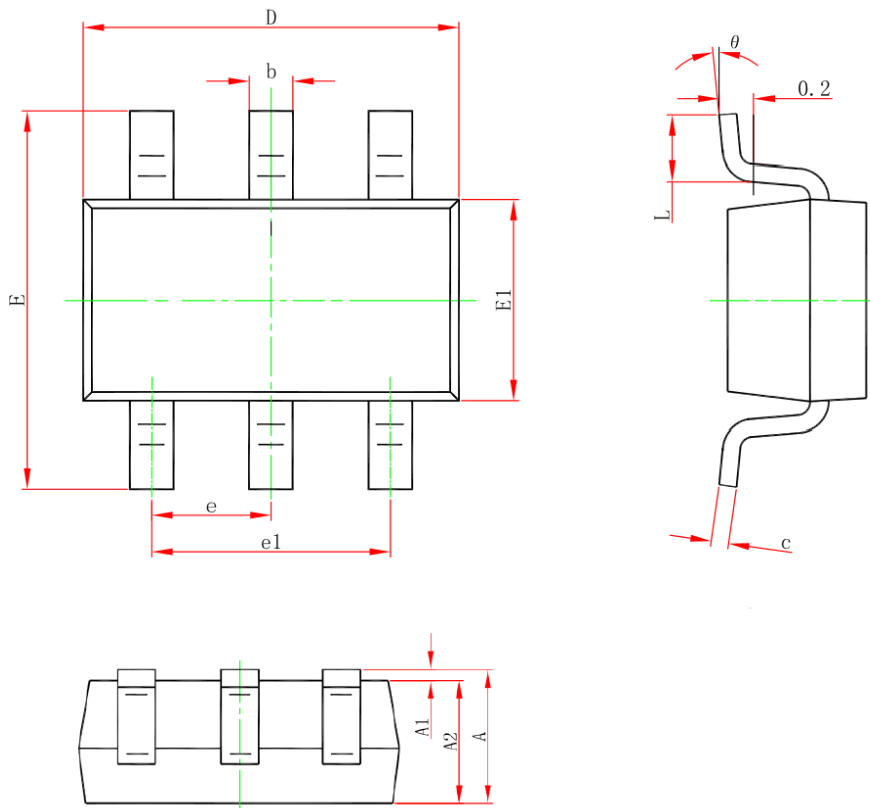
Over Current Condition->Normal Condition





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°



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