VIC6201DL

One Cell Lithium-ion/Polymer Battery Protection IC

Description

The VIC6201DL battery protection IC is designed to protect lithium-ion/polymer battery from damage or degrading the lifetime due to overcharge, overdischarge, 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 VIC6201DL 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.

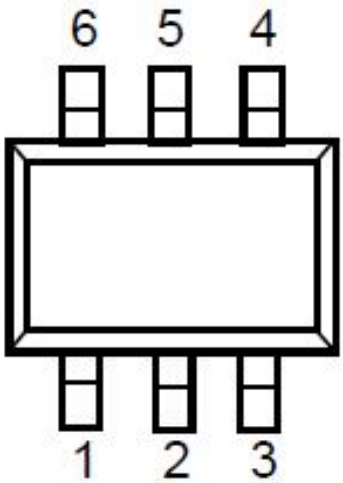
Features

- Ultra-Low Quiescent Current at 3uA (Vcc=3.9V).
- Ultra-Low Power-Down Current at 0.1uA (Vcc=2.0V)
- Precision Overcharge Protection Voltage 4.25V ±50mV
- Load Detection Function during Overcharge Mode
- Two Detection Levels for Overcurrent Protection
- Delay times are generated by internal circuits. No external capacitors required.

Applications

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

Pin Assignment



Ordering Information

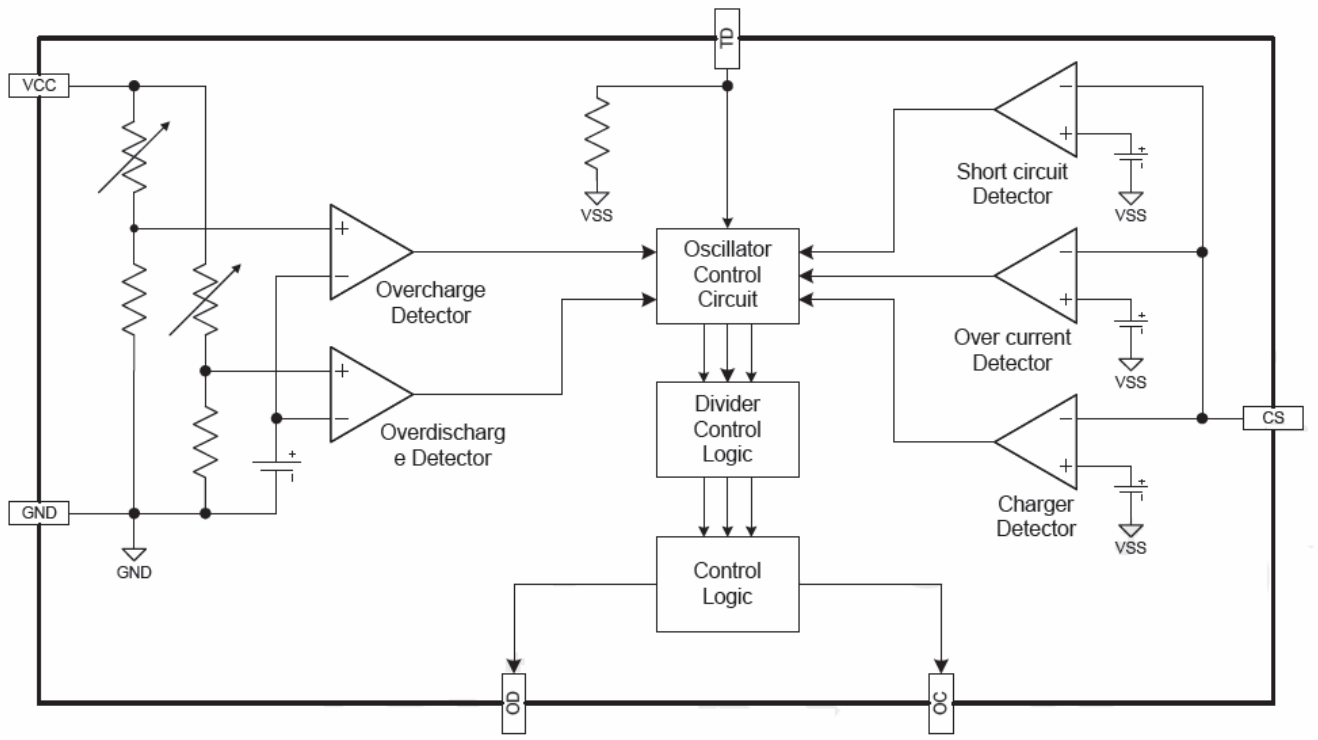
VIC6201 □□

Package Type
DL: SOT23-6

Function Pin Description

Pin No.	Pin Name	Pin Description
1	OD	MOSFET gate connection pin for discharge control
2	CS	Input pin for current sense, charger detect
3	OC	MOSFET gate connection pin for charge control
4	TD	Test pin for reduce delay time
5	VCC	Power supply, through a resistor (R1)
6	GND	Ground pin

Functional Block Diagram



Absolute Maximum Ratings

(GND=0V, Ta=25℃ unless otherwise specified)

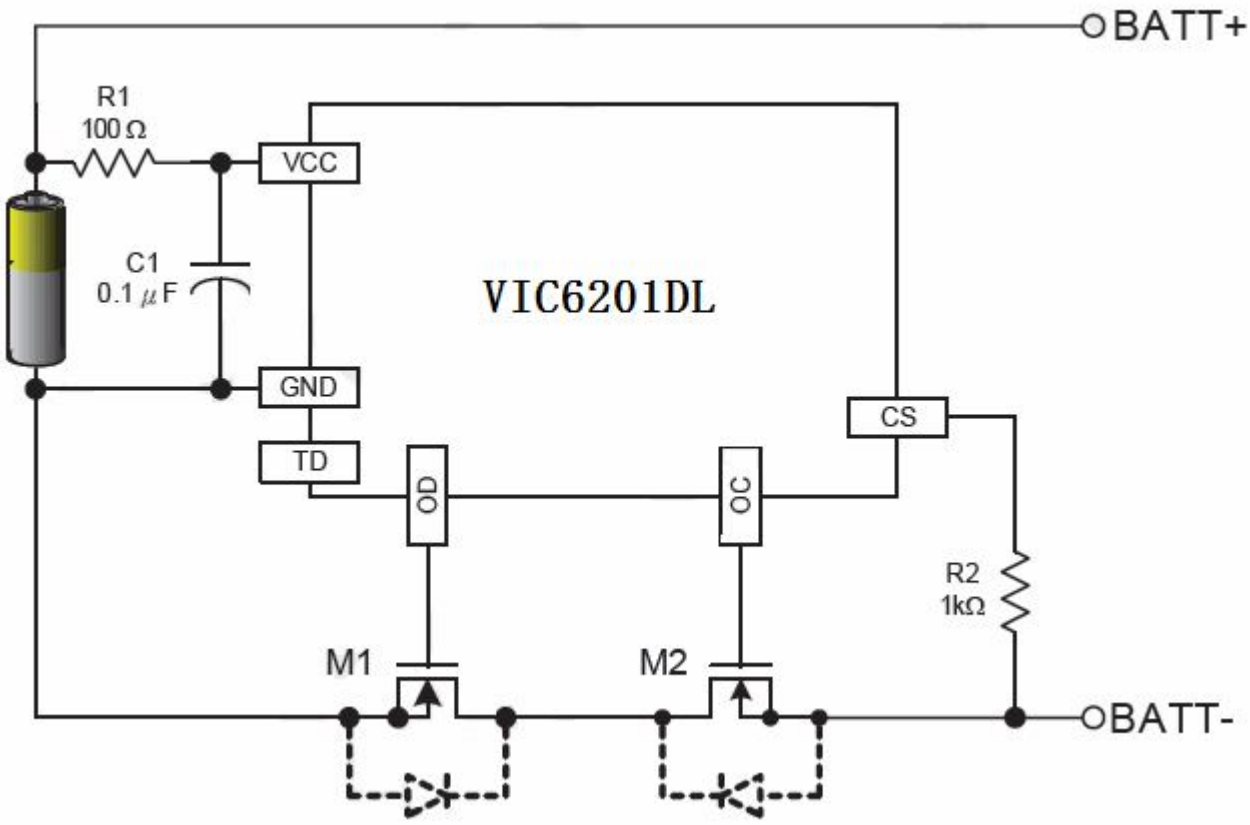
Item	Symbol	Rating	Unit
Input voltage between VCC and GND *	VCC	GND-0.3 to GND+10	V
output pin voltage	VOC	VCC -24 to VCC +0.3	V
output pin voltage	VOD	GND-0.3 to VCC +0.3	V
input pin voltage	VCS	VCC -24 to VCC +0.3	V
Operating Temperature Range	TOP	-40 to +85	℃
Storage Temperature Range	TST	-40 to +125	℃

Electrical Characteristics

(The specifications which apply over the full operating temperature range, otherwise specifications are at TA = 25°C. unless otherwise noted.)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Supply Current	ICC	VCC=3.9V		3.0	6.0	uA
Power-Down Current	IPD	VCC=2.0V			0.1	uA
Overcharge Protection Voltage	VOCP	VIC6201DL	4.20	4.25	4.30	V
Overcharge Release Voltage	VOCR		4.00	4.05	4.10	V
Overdischarge Protection Voltage	VODP		2.30	2.40	2.50	V
Overdischarge Release Voltage	VODR		2.90	3.00	3.10	V
Overcurrent Protection Voltage	VOIP		120	150	180	mV
Short Current Protection Voltage	VSIP	VCC=3.6V	1.00	1.35	1.70	V
Overcharge Delay Time	TOC			80	200	ms
Overdischarge Delay Time	TOD	VCC=3.6V to 2.0V		40	100	ms
Overcurrent Delay Time (1)	TOI1	VCC=3.6V		10	20	ms
Overcurrent Delay Time (2)	TOI2	VCC=3.6V		5	50	us
Charger Detection Threshold Voltage	VCHA		-1.2	-0.7	-0.2	V
OD Pin Output “H”Voltage	VDH		VCC-0.1	VCC-0.02		V
OD Pin Output “L”Voltage	VDL			0.1	0.5	V
OC Pin Output “H”Voltage	VCH		VCC-0.1	VCC-0.02		V
OC Pin Output “L”Voltage	VCL			0.1	0.5	V

Typical Application



Description of Operation

Normal Condition

If VODP\<VCC\<VOCP and VCH\<VCS\<VOI1, M1 and M2 are both turned on. The charging and discharging processes can be operated normally.

Overcharge Protection

When the voltage of the battery cell exceeds the overcharge protection voltage (VOCP) beyond the overcharge delay time (TOC) period, charging is inhibited by turning off of the charge control MOSFET. The overcharge condition is released in two cases:

The voltage of the battery cell becomes lower than the overcharge release voltage (VOCR) through self-discharge.

The voltage of the battery cell falls below the overcharge protection voltage (VOCP) and a load is connected. When the battery voltage is above VOCP, the overcharge condition will not release even a load is connected to the pack.

Overdischarge Protection

When the voltage of the battery cell goes below the overdischarge protection voltage(VODP)

beyond the overdischarge delay time (TOD) period, discharging is inhibited by turning off the discharge control MOSFET.

The default of overdischarge delay time is 10ms. Inhibition of discharging is immediately released when the voltage of the battery cell becomes higher than overdischarge release voltage (VODR) through charging.

Overcurrent Protection

In normal mode, the VIC2601DL continuously monitors the discharge current by sensing the voltage of CS pin. If the voltage of CS pin exceeds the overcurrent protection voltage (VOIP) beyond the overcurrent delay time (TOI1) period, the overcurrent protection circuit operates and discharging is inhibited by turning off the discharge control MOSFET. The overcurrent condition returns to the normal mode when the load is released or the impedance between BATT+ and BATT- is larger than 500kΩ. The VIC6201DL provides two overcurrent detection levels (0.15V and 1.35V) with two overcurrent delay time (TOI1 and TOI2) corresponding to each overcurrent detection level.

Charge Detection after Overdischarge

When overdischarge occurs, the discharge control MOSFET turns off and discharging is inhibited. However, charging is still permitted through the parasitic diode of MOSFET. Once the charger is connected to the battery pack, the VIC6201DL immediately turns on all the timing generation and detection circuitry. Charging progress is sensed if the voltage between CS and GND is below charge detection threshold voltage (VCH).

Power-Down after Overdischarge

When overdischarge occurs, the VIC6201DL will enter into power-down mode, turning off all the timing generation and detection circuitry to reduce the quiescent current to 0.1uA (VCC=2.0V). At the same time, the CS pin is pull-up to VCC through an internal resistor.

Note: When a battery is connected to VIC6201DL for the first time, it may not enter the normal condition (dischargeable may not be enabled). In this case, short the CS and VSS pins or connect to a charger to restore to the normal condition.

Design Guide

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: RON=VOIP/(2 x IT) (IT is the overcurrent threshold current). For example, if the overcurrent threshold current IT 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

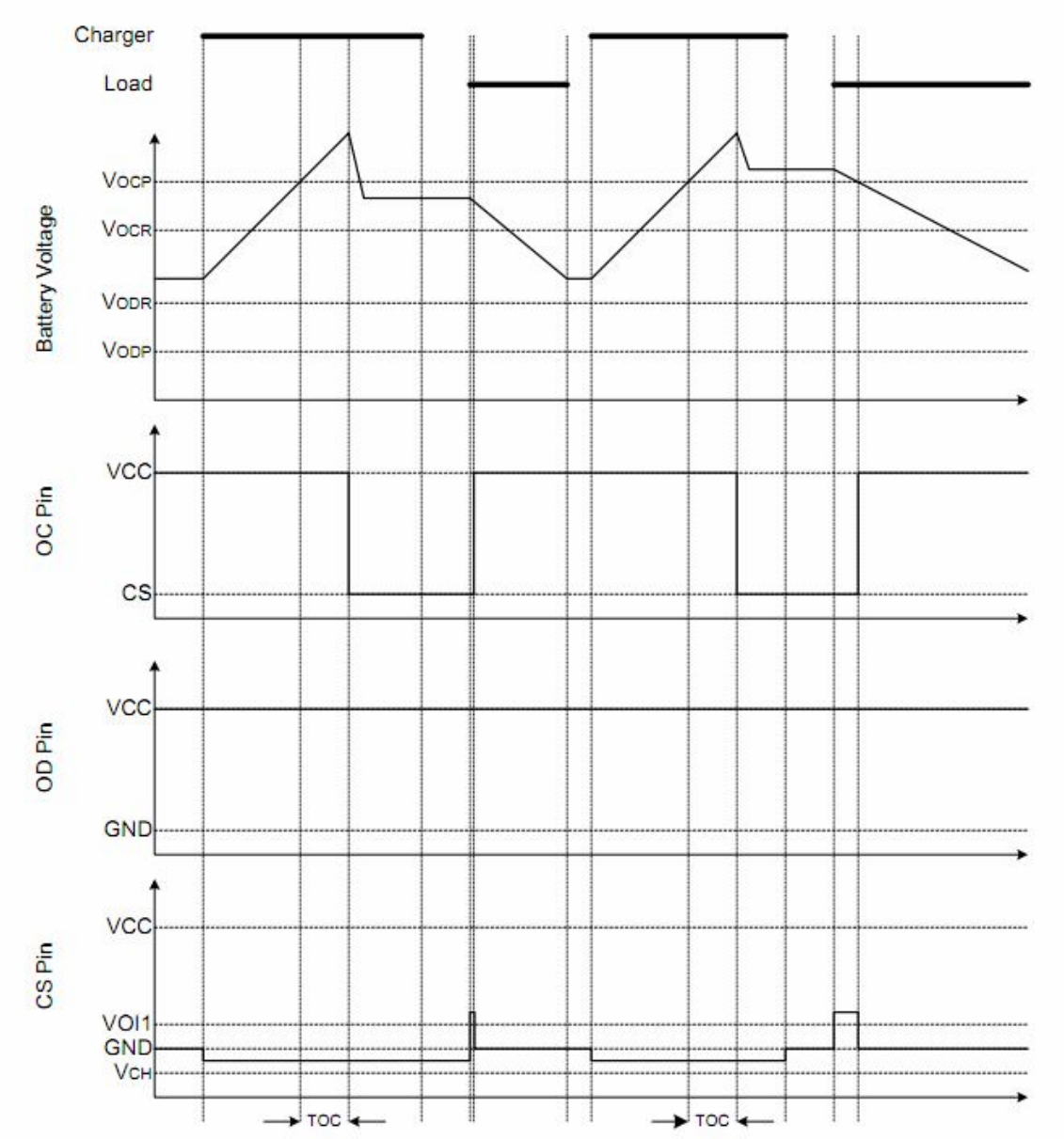
To suppress the ripple and disturbance from charger, connecting R1 and C1 to VCC is recommended.

Protection the CS pin

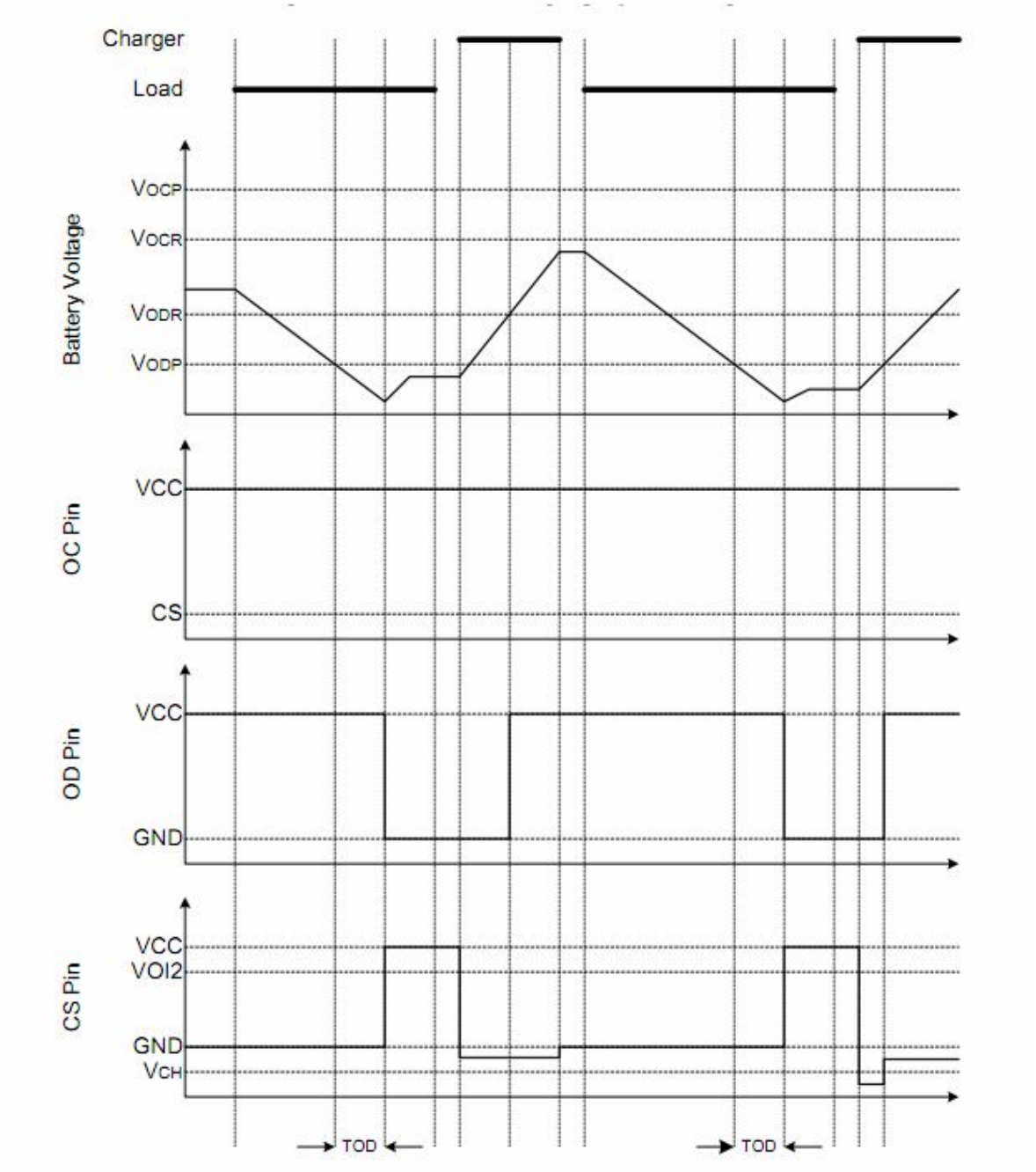
R2 is used for latch-up protection when charger is connected under overdischarge condition and overstress protection at reverse connecting of a charger.

Timing Diagram

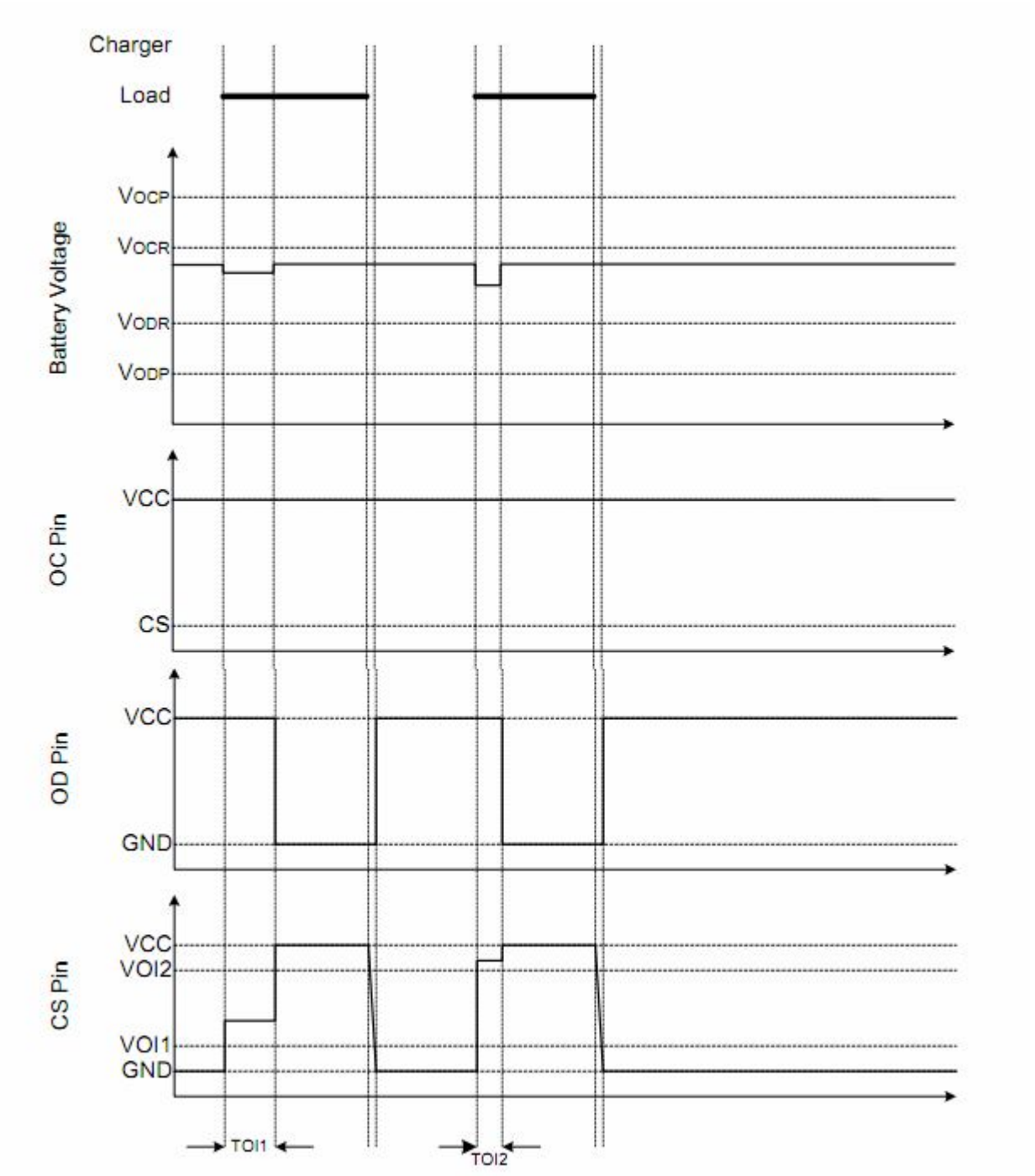
Overcharge Condition → Load Discharging → Normal Condition



Overdischarge Condition → Charging by a Charger → Normal Condition



Over Current Condition → Normal Condition



ORDERING INFORMATION

Part Number	Package code	Shipping
VIC6201DL	DL: SOT23-6	3000/Tape & Reel

● PACKAGE DIMENSIONS