

## *One Cell Lithium-ion/Polymer Battery Protection IC*

### General Description

The SL326 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 SL326 into the limited space of battery pack. The accurate  $\pm 25\text{mV}$  overcharging detection voltage ensures safe and full utilization charging. The very low standby current drains little current from the cell while in storage.

### Features

- **Reduction in Board Size due to Miniature Package SOT-23-6.**
- **Ultra-Low Quiescent Current at  $3\mu\text{A}$  ( $V_{\text{CC}}=3.9\text{V}$ ).**
- **Auto recovery**
- **0V charging**
- **Precision Overcharge Protection Voltage  $4.375\text{V} \pm 25\text{mV}$  for the SL326**
- **Load Detection Function during Overcharge Mode.**
- **Two Detection Levels for Overcurrent Protection.**
- **Delay times are generated by internal circuits. No external capacitors required.**

### Ordering Information

PACKAGE TYPE  
SOT-23-6

TEMPERATURE RANGE  
 $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$

OVERCHARGE PROTECTION  
 $4.375\text{V} \pm 25\text{mV}$

### Applications

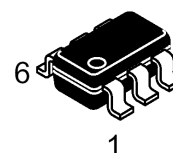
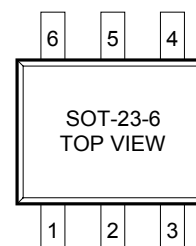
- **Protection IC for One-Cell Lithium-Ion / Lithium-Polymer Battery Pack :**  
built-in cell of mobile phone  
digital product cell  
camera cell  
portable power
- Reflow soldering internal actual temperature  $< 250$  degrees,  
time in high temperature  $< 7\text{ s}$ .

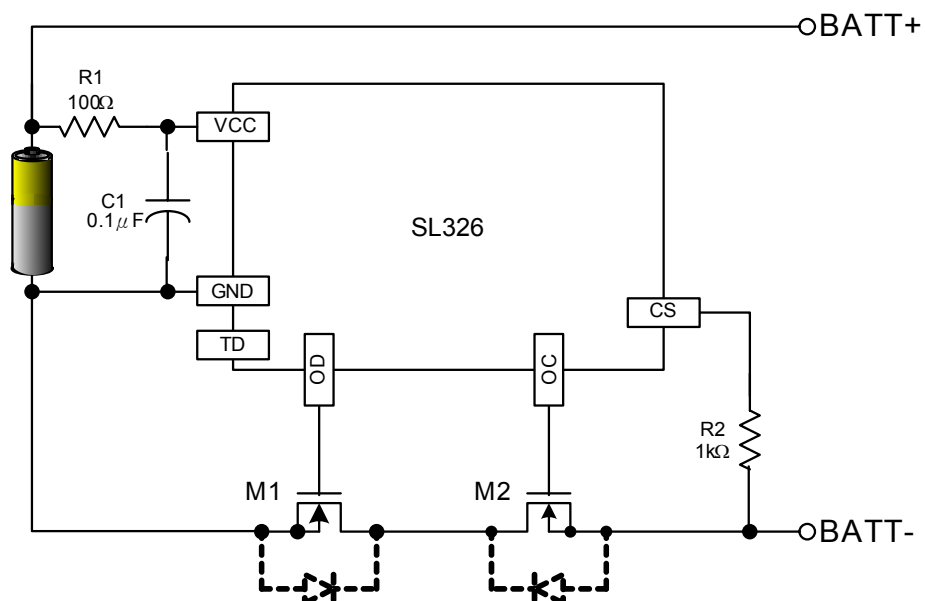
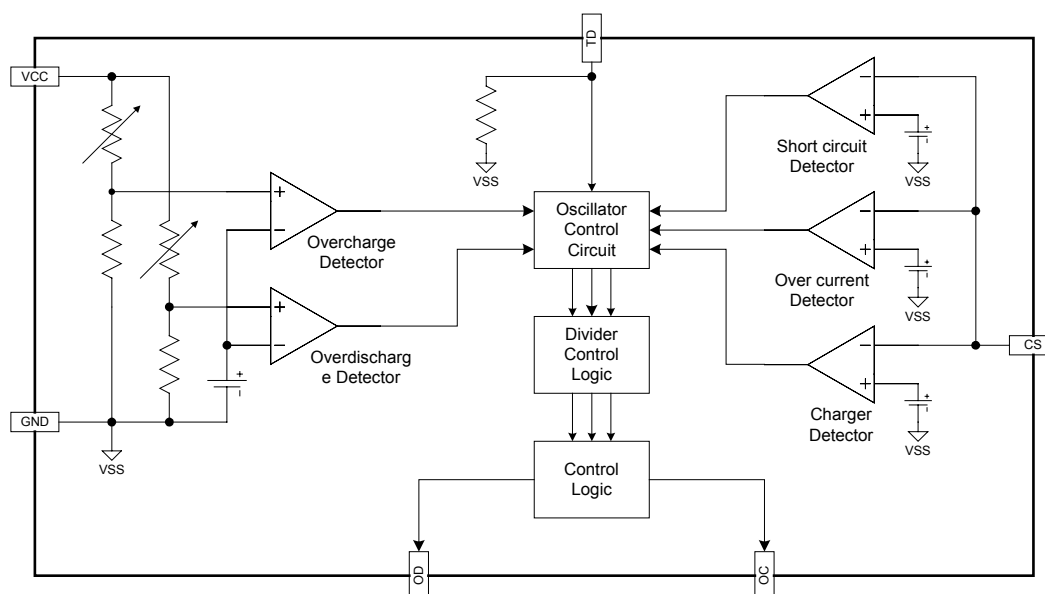
## Product Name List

| Model | Package  | Overcharge<br>detection<br>voltage<br>[V <sub>OCF</sub> ] (V) | Overcharge<br>release<br>voltage<br>[V <sub>OCR</sub> ] (V) | Overdischarge<br>detection<br>voltage<br>[V <sub>ODP</sub> ] (V) | Overdischarge<br>release<br>voltage<br>[V <sub>ODR</sub> ] (V) | Overcurrent<br>detection<br>voltage<br>[V <sub>OI1</sub> ] (mV) |
|-------|----------|---------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------------------|
|       | SOT-23-6 |                                                               |                                                             |                                                                  |                                                                |                                                                 |
| SL326 | SL326    | 4.375±0.025                                                   | 4.100±0.050                                                 | 2.40±0.100                                                       | 3.0±0.100                                                      | 180±30                                                          |

## Pin Configuration

| Pin No. | Symbol | 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                                       |





## Absolute Maximum Ratings

(VSS=0V, Ta=25°C unless otherwise specified)

| Item                                | Symbol | Rating             | Unit |
|-------------------------------------|--------|--------------------|------|
| Input voltage between VDD and VSS * | VDD    | VSS-0.3 to VSS+10  | V    |
| OC output pin voltage               | VOC    | VDD-26 to VDD+0.3  | V    |
| OD output pin voltage               | VOD    | VSS-0.3 to VDD+0.3 | V    |
| CS input pin voltage                | VCS    | VDD-26 to VDD+0.3  | V    |
| Operating Temperature Range         | TOP    | -40 to +85         | °C   |
| Storage Temperature Range           | TST    | -40 to +125        | °C   |

Note: SL326 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.

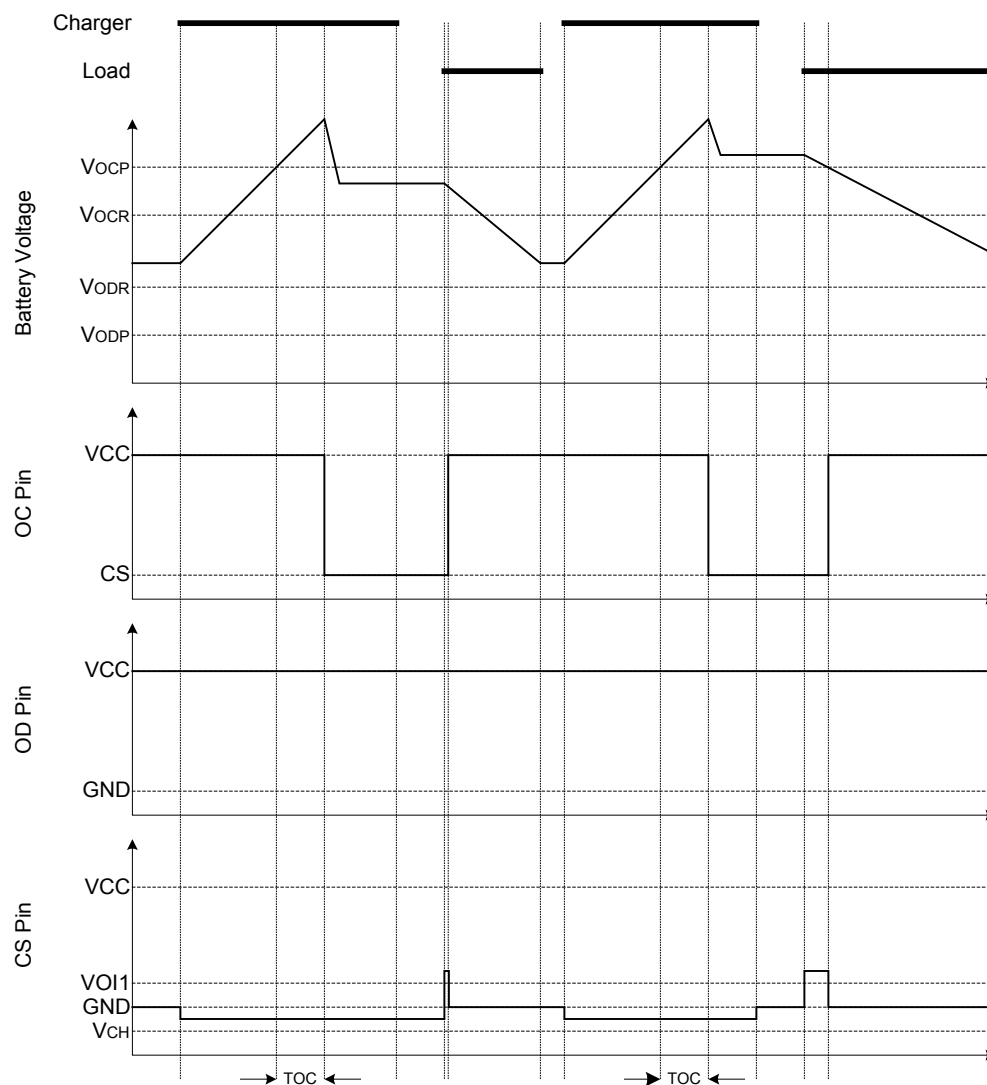
## Electrical Characteristics

(Ta=25°C unless otherwise specified)

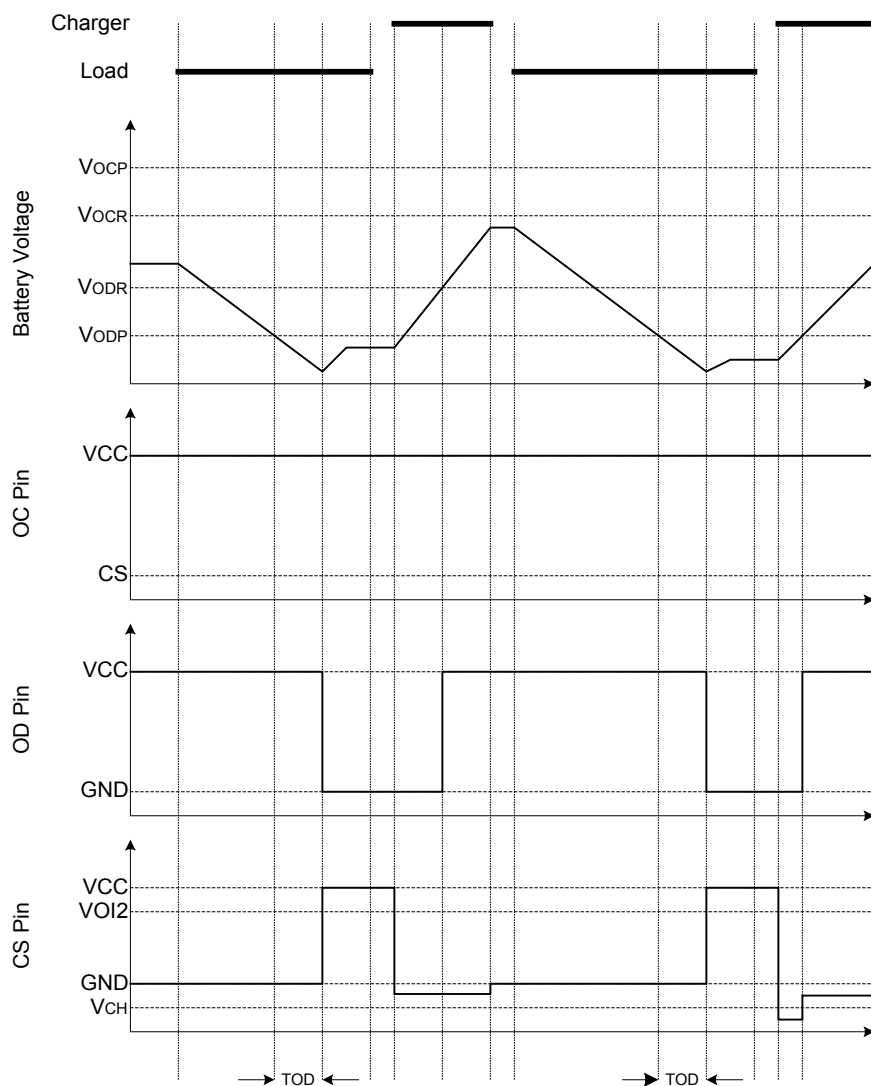
| PARAMETER                           | TEST CONDITIONS  | SYMBOL      | Min     | Typ      | Max  | UNIT |
|-------------------------------------|------------------|-------------|---------|----------|------|------|
| Supply Current                      | VCC=3.9V         | ICC         |         | 3.0      | 6.0  | μA   |
| Power-Down Current                  | VCC=2.0V         | IPD         |         |          | 0.1  | μA   |
| Overcharge Protection Voltage       | CS326            | VOCP        | 4.35    | 4.375    | 4.4  | V    |
| Overcharge Release Voltage          |                  | VOCR        | 4.05    | 4.10     | 4.15 | 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 (VOI1) | 150     | 180      | 210  | mV   |
| Short Current Protection Voltage    | VCC=3.6V         | VSIP (VOI2) | 1.25    | 1.35     | 1.45 | V    |
| Overcharge Delay Time               |                  | TOC         |         | 80       | 200  | ms   |
| Overdischarge Delay Time            | VCC=3.6V to 2.0V | TOD         |         | 40       | 100  | ms   |
| Overcurrent Delay Time (1)          | VCC=3.6V         | TOI1        |         | 10       | 20   | ms   |
| Overcurrent Delay Time (2)          | VCC=3.6V         | TOI2        |         | 5        | 50   | μs   |
| Charger Detection Threshold Voltage |                  | VCH         | -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    |

## Timing Diagram

### 1. Overcharge Condition → Load Discharging → Normal Condition



## 2. Overdischarge Condition → Charging by a Charger → Normal Condition



### 3. Over Current Condition → Normal Condition

