Data Sheet

DATASHEET

TP5000

(2A switching 4.2V lithium battery lithium iron /3.6V Battery charger)
TP5000 is a single step-down switching manganese lithium battery / charge management chip lithium iron phosphate. QFN16 ultra small package with its simple external circuit, so that the large current charging management application TP5000 ideal for portable devices. Meanwhile, the input TP5000 built overcurrent, undervoltage protection, over temperature protection, short circuit protection, battery temperature monitoring, reverse battery protection.

TP5000 a wide input voltage, trickle charge the battery into pre-charge, constant current, constant-voltage three phase, pre-charge current trickle charge current is adjusted through an external resistor, the maximum charging current of 2A. TP5000 using switching mode frequency to 800KHz so that it can use a smaller peripheral devices, and still maintain a smaller amount of heat in the large current charging. TP5000 built-in power of the PMOSFET, anti-intrusion circuit, there is no need peripheral anti-intrusion protection Schottky diode. TP5000 constant current function, can also be used in a string of 2 or 4 lithium battery string input, constant current drive 0.5-7W white LED.

characteristic
- Single 4.2V 3.6V lithium manganese iron phosphate or a lithium battery
- Built-in power MOSFET, a switching mode of operation, less heating device, a simple peripheral
- Programmable charge current, 0.1A - 2A
- Programmable precharge current, 10% - 100%
- No external Schottky diode anti-intrusion
- Wide operating voltage, maximum reach 9V
- Two charge status indicator LED
- Chip temperature protection, overcurrent, undervoltage protection
- Battery temperature protection, reverse battery shutdown, short circuit protection
- Switching frequency of 800KHz, the available inductance 2.2uH-10uH
- Automatic recharge function
- Charging voltage control accuracy of less than 1%
- Trickle, constant current, constant voltage charging three sections, a battery protection
- QFN16 4mm * 4mm using ultra small package

Absolute Maximum Ratings
- Input supply voltage (VIN): 10V
- BAT: -4.2V ~ 9V
- BAT Short circuit duration: Continuous
- Maximum junction temperature: 145 ℃
- Working temperature range: -40 ℃ ~ 85 ℃
- Storage Temperature Range: -65 ℃ ~ 125 ℃
- Lead Temperature (welding time of 10 seconds): 260 ℃

Application
- Portable equipment, various chargers
- Smart phone, PDA, mobile cellular phone
- MP4, MP5 players, tablet computers
- Miner
- electrical tools
- White LED driver

Typical application

![Application Diagram](attachment:image.png)
Package / Ordering Information

Orders models

TP5000-QFN16

Device Marking

TP5000

Physical picture

16 Pin 4mm * 4mm QFN16 A top view of the package

(Fin unacceptably other ground potential)
## Electrical characteristics

The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are $T_i = 25 \, ^\circ\text{C}$, VIN = 6V, unless otherwise noted.

<table>
<thead>
<tr>
<th>symbol</th>
<th>parameter</th>
<th>condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN</td>
<td>Input supply voltage</td>
<td>•</td>
<td>4.0</td>
<td>5</td>
<td>9.0</td>
<td>V</td>
</tr>
<tr>
<td>ICC</td>
<td>Input supply current</td>
<td>Charging mode, $R_s = 0.1 \Omega$</td>
<td>•</td>
<td>250160</td>
<td>300180</td>
<td>250</td>
</tr>
<tr>
<td>V FLOAL</td>
<td>Charge-cutoff voltage</td>
<td>4.2V Lithium-ion battery</td>
<td>4.158</td>
<td>4.2</td>
<td>4.242</td>
<td>V</td>
</tr>
<tr>
<td>I BAT</td>
<td>BAT Pin Current (current mode test conditions) CS = VIN Battery = 3.8V</td>
<td>•</td>
<td>950145000</td>
<td>1000</td>
<td>11001600</td>
<td>mA</td>
</tr>
<tr>
<td>I TRAX</td>
<td>Trickle pre-charge current</td>
<td>RTRICK Pin to ground</td>
<td>1.2V &lt;V&lt; Vmax₂, R = 0.067</td>
<td>•</td>
<td>150</td>
<td>170</td>
</tr>
<tr>
<td>P</td>
<td>The oscillation frequency</td>
<td>•</td>
<td>650</td>
<td>800</td>
<td>950</td>
<td>KHz</td>
</tr>
<tr>
<td>D MAX</td>
<td>The maximum duty cycle</td>
<td>•</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D MIN</td>
<td>The minimum duty cycle</td>
<td>•</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V TRAX</td>
<td>Trickle charge threshold voltage (4.2V) (3.6V) $R_s = 0.067 \Omega$, Vact rise</td>
<td>•</td>
<td>2.8</td>
<td>2.9</td>
<td>3.0</td>
<td>V</td>
</tr>
<tr>
<td>V TRAYS</td>
<td>Trickle charge voltage hysteresis</td>
<td>$R_s = 0.067 \Omega$</td>
<td>•</td>
<td>2.4</td>
<td>2.5</td>
<td>2.6</td>
</tr>
<tr>
<td>V UV</td>
<td>V vs Undervoltage lockout threshold</td>
<td>From V&lt; V&lt; Vmax</td>
<td>•</td>
<td>3.5</td>
<td>3.7</td>
<td>3.9</td>
</tr>
<tr>
<td>V UVHYS</td>
<td>V vs Undervoltage lockout hysteresis</td>
<td>•</td>
<td>150</td>
<td>200</td>
<td>300</td>
<td>mA</td>
</tr>
<tr>
<td>V ASD</td>
<td>V vs Lockout threshold voltage</td>
<td>V&lt; From low to high</td>
<td>•</td>
<td>605</td>
<td>10030</td>
<td>14050</td>
</tr>
<tr>
<td>I TRSM</td>
<td>C/10 Termination current threshold</td>
<td>R&lt; 0.067 \Omega</td>
<td>•</td>
<td>130</td>
<td>150</td>
<td>170</td>
</tr>
<tr>
<td>V CHRG</td>
<td>Low voltage output pin</td>
<td>$I_{CHRG} = 5mA$</td>
<td>•</td>
<td>0.3</td>
<td>0.6</td>
<td>V</td>
</tr>
<tr>
<td>V STBY</td>
<td>PIN output low</td>
<td>$I_{STBY} = 5mA$</td>
<td>•</td>
<td>0.3</td>
<td>0.6</td>
<td>V</td>
</tr>
<tr>
<td>V TEMP-H</td>
<td>TEMP Pin high voltage shutdown</td>
<td>•</td>
<td>&gt; 80</td>
<td>82</td>
<td>% * VIN</td>
<td></td>
</tr>
<tr>
<td>V TEMP-L</td>
<td>TEMP Pin low-end voltage shutdown</td>
<td>•</td>
<td>43</td>
<td>&lt;45</td>
<td>% * VIN</td>
<td></td>
</tr>
<tr>
<td>Δ V RECHRG</td>
<td>Threshold voltage of the rechargeable battery</td>
<td>V FLOAT - V RECHRG</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>mA</td>
</tr>
<tr>
<td>T UM</td>
<td>Chip temperature protection</td>
<td>•</td>
<td>145</td>
<td>145</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>R ON</td>
<td>Power FET &quot;On&quot; resistance</td>
<td>•</td>
<td>200</td>
<td>200</td>
<td>mΩ</td>
<td></td>
</tr>
<tr>
<td>t ON</td>
<td>Soft start time</td>
<td>$I_{BAT} = 0 \text{ to } I_{BAT} = 0.1V / R_s$</td>
<td>•</td>
<td>20</td>
<td>20</td>
<td>μS</td>
</tr>
<tr>
<td>t DISCHARGE</td>
<td>Filter Time recharge</td>
<td>V&lt; From high to low</td>
<td>•</td>
<td>0.8</td>
<td>1.8</td>
<td>4</td>
</tr>
<tr>
<td>t TERM</td>
<td>Termination Comparator Timer Time</td>
<td>•</td>
<td>0.8</td>
<td>1.8</td>
<td>4</td>
<td>mS</td>
</tr>
</tbody>
</table>
Typical performance indicators (CS Set as 4.2V Lithium battery charging mode)

Cutoff voltage and off-voltage relationship between the ambient temperature and power source voltage relationship of the battery charging current and voltage relationship

Pin Function

VIN (Pins 1, 2, 18): Input voltage at the positive input terminal. This voltage is the power supply pin of the internal circuit, VIN.

Changes in scope 4.5V to 9V between, and through a 10 μF Tantalum capacitor bypass. When VIN with Vout Pressure lower than 30mΩ internal resistor. In case RTRICK Floating the precharge current equals the constant current.

LX (Pins 3, 4, 5): Built-in power drain of PMOSFET connection point. LX is TP5000 current output terminal of the external inductor is connected to a battery charging current input terminal.

GND (Pins 6, 7): Power ground.

VS (Pins 8): Positive input of the output current detection.

BAT (Pins 9): Battery voltage detection terminal. The positive terminal of the battery is connected to this pin.

VREG (Pins 19): An internal power supply. VREG is an internal power supply, it is an external bypass capacitor 0.1uF to ground.

TS (Pins 11): Battery temperature detection input terminal. will TS Pin to battery NTC (Negative temperature coefficient thermistor) sensor output. in case TS Pin voltage less than the input voltage 45% Or greater than the input voltage 80% It means that the battery temperature is too low or too high, the charging is suspended. In case TS Direct access GND Battery temperature detection function is canceled, another charging function properly.

RTRICK (Pins 12): Trickle precharge current set terminal. will RTRICK Pin to ground to the pre-charge current 10%

Setting a constant current, the precharge current may be provided by an external resistor. in case RTRICK Floating the precharge current equals the constant current.

CS (Pins 13): Lithium iron phosphate or a lithium-ion state of the chip select input. CS High-end input level will TP5000 in the lithium-ion battery 4.2V Off-state voltage. CS The vacant end TP5000 in lithium iron phosphate 3.6V Off-state voltage. Low input level so TP5000 It is shutdown.

CS End can be TTL or CMOS Level driver.

STDBY (Pins 14): Indicating completion of charging the battery terminal.

When the battery is fully charged STDBY Internal switch is pulled low to indicate the completion of charging. In addition,

STDBY The pin is in high impedance state.

CHRG (Pins 15): Charging indicator status. When the battery is being charged, CHRG Internal switch pin is pulled low, indicating the charging progress; otherwise

CHRG Pin is high impedance.
working principle

TP5000 is designed for single 4.2V lithium ion/3.6V
Switching high current charger IC, a chip inside a power transistor using lithium iron phosphate for the design of the battery and trickle, constant current and constant voltage charging. The charging current can be programmed with an external resistor, the charging current up to the maximum continuous 2A, No additional anti-intrusion diode. TP5000 comprising two open-drain output state indication output terminal, the charging indicator status CHRG And FULL status outputs STDBY. Power management circuitry inside the chip junction temperature of the chip exceeds 14 Automatically reduces the charge current 5 ℃, this feature allows the user to use the maximum power handling capability of the chip, do not worry about damaging the chip or the chip overheating external components.

When the input voltage is greater than the threshold voltage of the chip enable and chip enable input terminal HIGH or floating time, TP5000 start charging the battery, CHRG Output pin low to indicate that charging is in progress. If the lithium ion battery voltage is below 2.9V (Lithium iron phosphate is lower than the voltage 2.5V). The battery trickle charger for pre-charging (pre-charge current through the external adjustable resistance) with a small current. The constant current VS Pin and VBAT Determining the resistance between the pin. When the voltage is close to the lithium ion battery 4.2V (Proximity lithium iron phosphate 3.6V), The charge cut-off voltage of about from 60mV (Comparable resistance to the internal resistance of the battery voltage differs depending on the circuit), the charging current is gradually reduced, TP5000 constant voltage charging mode. When the charging current is reduced to the off current, the charging period ends, CHRG End a high impedance state, STDBY
The low potential side.

When the battery voltage falls below the recharge threshold (lithium ion battery 4.06V, Lithium iron phosphate battery 3.48V), The charge cycle starts automatically. Inside the chip precision voltage reference source, an error amplifier and the resistor divider network to ensure that the battery terminal voltage cutoff accuracy + - 1% Or less, a lithium ion battery satisfying the lithium iron phosphate and charging requirements. When the input voltage or input voltage down below the battery voltage, the charger enters a low power shutdown mode, no external anti-intrusion diode chip drain from the battery approaches 4uA. Charge cutoff voltage selection TP5000 having a single lithium-ion / iron phosphate lithium two charging cut-off voltage selected, when CS High-end connected

Electric potential VIN, The lithium-ion battery is 4.2V standard cut-off voltage 4.2V. When the vacant terminal CS, the charging standard lithium iron phosphate, the cutoff voltage 3.6V. When CS Termination low GND, The charger stops charging.

TP5000 composite design of the CS terminal can be determined by an external control TP5000 is in charging mode is switched to the stop mode.

4.2V lithium-ion battery and a state of the stop mode
Switch, 4, the output port of the CS terminal via an open-drain, the gate of NMOS transistor if the input low, Ni off, then terminating CS high, the charge-cutoff voltage of 4.2V, TP5000 lithium ion batteries. When the NMOS transistor gate input high, Ni turned on, when CS is pulled down to GND, TP5000 is a stop mode.

Map 5 By lithium iron phosphate in the state of charge of the external control
And stopping the switching state
Charging current setting

Battery charging current \(I_{BAT}\) is determined by the external current sense resistor \(R_s\). \(R_s\) ratio adjust the threshold voltage \(V_s\) and the constant charge current across the resistor is determined by the voltage across the constant current condition \(R_s\) is 100mV.

![Circuit Diagram](image)

FIG 6 is provided a battery charging current and the charging current setting resistor is calculated using the following equation:

\[
R_s = \frac{0.1 \ V \ (Current \ units \ A \ Resistance \ per \ unit)}{I_{BAT}}
\]

For example:

To set the charging current 1A, Calculated into the formula

\[
R_s = \frac{0.1 \ V}{1A} = 0.1 \Omega
\]

Setting resistor and a pre-charge current is calculated using the following equation:

\[
R_{TRICK} = \frac{400 \ k\Omega + 400 \ mA}{I_{TRICK}}
\]

In order to facilitate customers to quickly design, Table 3 gives \(R_{TRICK}\)

And the pre-charge current and constant trickle current setting of \(I_{BAT}\)

Relationship: Table 3: \(R_{TRICK}\) and setting the constant current trickle current

<table>
<thead>
<tr>
<th>(R_{TRICK} (k))</th>
<th>(I_{TRICK} (mA))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10% (I_{BAT})</td>
</tr>
<tr>
<td>50k</td>
<td>20% (I_{BAT})</td>
</tr>
<tr>
<td>114k</td>
<td>30% (I_{BAT})</td>
</tr>
<tr>
<td>320k</td>
<td>50% (I_{BAT})</td>
</tr>
<tr>
<td>Pin floating</td>
<td>100% (I_{BAT})</td>
</tr>
</tbody>
</table>

Charge termination

CV phase, when the charging current drops below the maximum value constant 1/10 When the charge cycle is terminated. This condition is achieved by using an internal filtered comparator \(R_s\). The pressure drop is monitored to detect, when \(R_s\) To a voltage difference across the 10mV For longer than \(I_{BAT}\) (typically 1.8ms), charging is terminated. Charging current is turned off, TP5000 enters standby mode, where the input supply current to 170µA, about the battery drain current flows 4µA.
In standby mode, TP5000 of BAT Pin voltage is continuously monitored. If the lithium ion battery 4.05V this voltage drops (voltage drops lithium iron phosphate 3.45V) recharging limit switches  V_{low} Or less, and a new charging cycle begins again, a current supplied to the battery. Charging status indicator

<table>
<thead>
<tr>
<th>Green</th>
<th>red light</th>
<th>CHRG</th>
<th>charging</th>
</tr>
</thead>
<tbody>
<tr>
<td>STDBY</td>
<td>Destroy</td>
<td>bright</td>
<td>Charging status</td>
</tr>
<tr>
<td></td>
<td>Destroy</td>
<td>Destroy</td>
<td>Battery is fully charged state</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Voltage, battery temperature is too high, too low or non-fault state battery Access (TS end use)</td>
</tr>
</tbody>
</table>

Battery over-temperature protection

In order to prevent the temperature is too high or too low battery damage caused, TP5000 integrated internal battery temperature detecting circuit. Battery temperature is detected by measuring the voltage pin TS implemented, the voltage pin TS is an NTC thermistor in a battery and a resistor divider network, as shown in FIG. TP5000 inside the TS pin chip with two voltage thresholds V_{low} and V_{high}. Compared to confirm that the temperature of the battery exceeds a normal range. Inside the TP5000, V_{low} is fixed 45% of V_{cc}, V_{new} is fixed 80% V_{cc}. If the TS pin

Voltage V_{ts} is lower than V_{low} or higher than V_{high}, Then

Temperature of the battery is too high or too low, the charging process is suspended, if voltage pin TS and/or V_{ts} above V_{low}, Among the charge cycle continues. If the TS pin to ground, battery temperature detection function can be disabled.

Example: room temperature 25 ℃ RNTC = 10k, set protection temperature 60 ℃, at 60 ℃ RNTC = 3k, R = 3.6k the calculated time, the NTC resistor-divider ratio is 45% of the supply voltage, i.e. 60 ℃ TP5000 stop charge.

An internal undervoltage lockout circuit monitors the input voltage, and if Vin rises above the undervoltage lockout threshold before the charger in shutdown mode, UVLO Charger will not remain in shutdown mode, no discharge current of the battery. In case UVLO The comparator transition occurs at VIN Raised higher than the battery voltage 50mV. Before charger will not retire

Battery power is insufficient relief situations.

Automatic restart

Once the charge cycle is terminated, TP5000 taken immediately
White LED driver

TP5000 may be designed to operate at 4.2V lithium battery charge mode, using 2 input string lithium (8.4V) or 4 as an input string of batteries (6V), the output of the direct drive WLED, the white LED is turned on since the operating voltage is about 3.6V, this when in the constant current phase. TP5000 may be provided as single or multiple pieces of parallel white LED white LED efficient, stable driving current, 4.2V and the output voltage limiting protection. Rs adjusts the driving current according to the setting, can be driven

0.5W-7W white LED. Input, output, terminal of the capacitor VS

You can use many types of capacitors, but requires high-quality power capacitors. When the multilayer ceramic capacitor with particular care must be taken, some types of ceramic capacitors having high EMI characteristic values, therefore, under certain conditions (such as the battery charger is connected to the power supply input and a work) may produce a high voltage transient damaging the chip-state signal, tantalum 10uF recommended, to use electrolytic capacitors, electrolytic capacitors need to add a 0.1uF be bypassed and the link pin chip must be mounted close position. Thermal Considerations

although QFN16 The small form factor package, but its good heat dissipation properties, but need PCB Version of the design with the best use of a sophisticated thermal design PCB Plate layout to most significantly increase the charging current may be used. For dissipate IC Cooling path of the generated heat from the chip to the lead frame, by die and reaches the bottom of the fin

PCB Board copper. The footprint copper pads should be as wide, and extends outwardly to a large copper area to spread the heat to the surroundings. It recommended to pay more through holes inside or backside copper layer, to improve the overall thermal performance of the charger.

When performing PCB Board layout design, other heat sources related to the charger board also must be considered, because they will affect overall temperature rise and the maximum charge current has been affected.

Inductor Selection

To ensure system stability, and constant current charging the pre-charge phase, the system needs to ensure that operate in continuous mode (CCM). The inductor current equation:

\[ i = \frac{1}{LFS} \left( \frac{V_{in} \cdot V_{bat}}{V_{in}} \right) \]

among them /s the inductor ripple, FS is the switching frequency, \( V_{in} \) /s the input voltage, \( V_{bat} \) /s the battery voltage.

\( i \) Take pre-charge current value, that is 1/5 of the constant current charging, the inductance value can be calculated according to the input voltage requirements.

Inductance values 2.2uH-10uH, recommended recommended 4.7uH. Inductor rated current greater than a charge current is chosen, the smaller the internal resistance of power inductors.

Map 9 A typical lithium-ion battery circulation state in FIG.
Package Description

4mm * 4mm 16 Pin QFN Package

Top View

Bottom View

Side View

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Dimensions in Millimeters</th>
<th>Dimensions in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>A</td>
<td>0.700/0.800</td>
<td>0.800/0.900</td>
</tr>
<tr>
<td>A1</td>
<td>0.000</td>
<td>0.050</td>
</tr>
<tr>
<td>A3</td>
<td>0.203REF.</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>3.900</td>
<td>4.100</td>
</tr>
<tr>
<td>E</td>
<td>3.900</td>
<td>4.100</td>
</tr>
<tr>
<td>D1</td>
<td>2.000</td>
<td>2.200</td>
</tr>
<tr>
<td>E1</td>
<td>2.000</td>
<td>2.200</td>
</tr>
<tr>
<td>k</td>
<td>0.200MIN.</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>0.250</td>
<td>0.350</td>
</tr>
<tr>
<td>e</td>
<td>0.650TYP.</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>0.450</td>
<td>0.650</td>
</tr>
</tbody>
</table>
TP5000 Other application circuit

Map 10 TP5000 is 4.2V A lithium ion battery without the battery temperature trickle protection 0.75A Constant current 1.5A Application schematic charging

(CS Pin is connected to high)

Map 11 TP5000 lithium iron phosphate without battery temperature protection 1.5A Schematic charging applications (CS Pin floating)
**TP5000 Precautions**

1. The circuit chip capacitors should be as close as possible.
2. VS BAT terminal end and electrolytic capacitors using tantalum or ceramic capacitors added.
3. Please choose the inductor current capability enough power inductors.
4. Selection Schottky diode voltage drop greater than or equal 2A small current capability of the Schottky diode.
5. For VIN and LX to be wider than the signal line common trace current loop.
6. Note that the capacitance of each node location of the grounding line, that the grounding point should be focused, well grounded.
7. chip large current should be considered a good heat sink and the bottom of the chip to the PCB, to ensure good heat dissipation.
TP5000 demo board circuit and use instructions

A circuit diagram: FIG typical application 12.

<table>
<thead>
<tr>
<th>Components</th>
<th>model</th>
<th>Package Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>chip</td>
<td>TP5000</td>
<td>QFN16</td>
</tr>
<tr>
<td>inductance</td>
<td>4.7uH</td>
<td>1</td>
</tr>
<tr>
<td>Tantalum capacitors</td>
<td>10uF</td>
<td>1206</td>
</tr>
<tr>
<td>Ceramic capacitors</td>
<td>0.1uF</td>
<td>0603</td>
</tr>
<tr>
<td>Schottky diodes S495</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>RS resistance</td>
<td>0.067 Ohms or 0.1 and 0.2Ω</td>
<td>1206</td>
</tr>
<tr>
<td>led Limiting resistor 1k</td>
<td></td>
<td>0805</td>
</tr>
<tr>
<td>Red and green common anode led</td>
<td></td>
<td>3mm</td>
</tr>
</tbody>
</table>

TP5000 Demo version of the pin and Port Description:

**Input:** Vin + Vin+ (Numbering 1) **Output:** Bat + Bat- (Numbering 2)

- **CS:** Default 4.2V Manganese lithium battery charging mode, CS meet Vin+. Use (No. 3) Solder acthesion;
- **RS:** Charge current default 1.5A Figure on RS resistance 1206 resistance. Customers can change the design according to their own needs.
- **TRICK:** Ground, the default precharge current is 10% Constant current. Use test

**Description:**

- Properly connected and the battery power supply, to charge the battery, charging the red light, green light charging end. In the constant current charging phase, the positive terminal may be an ammeter connected in series in the battery, the charging current is detected, ammeter large range gear. Considering the resistance meter, the final test is not recommended in the fully charged battery voltage mode ammeter connected in series. Resistance will cause shutdown battery voltage is lower than the actual turn-off voltage of the chip itself.
- **To drive white led** After simply adjust suitable current output (No. 2) Bat + Bat- Respectively, then white led
- Positive and negative.
- **Note that selection of the Schottky diode reverse leakage current is less than 1uA** At the end of charging or standby battery drain through the Schottky diode may be reversed. Reverse battery does not damage the chip, but the battery will be through the Schottky diode, an inductor.
- **RS** Short circuit loop itself. To replace the chip, it is recommended to use a heat gun such as welding equipment.