# 36V 600mA Linear Li-Ion Battery Charger IC

## General Description

ET95164 is a linear charging management chip, Integrated trickle current, constant current and constant voltage three-stage linear charging management, comply with the charging standards for Li-Ion battery. The charging input can directly draw power from the USB port, maximum rating input voltage 36V. The maximum charging current can reach up to 600mA, it can be programmed via an external resistor.

The trickle current of ET95164 is 15% of the programmed constant current, At the same time, charging will be terminated when the charging current drops below 12%, and the device will enter the fully charged state. ET95164 also supports charging short-circuited battery.

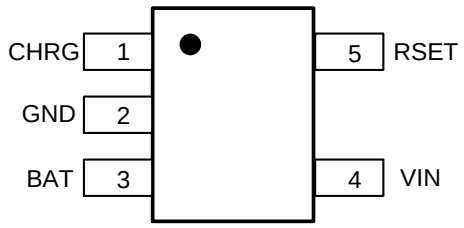
ET95164 integrates an anti-backflow circuit, The return current path of the battery is automatically cut off after the input voltage is pulled out or even short-circuited. At this point, only 0.6uA is consumed from the battery. ET95164 integrates a battery-free mode similar to LDO, that is when the battery is not connected, the average output voltage at the battery is 4.2V.

## Features

- Programmable Up to 600mA Fast Charge Current
- 36V Maximum Rating for Input Voltage
- Over Voltage Protection Threshold: 6.1V
- Float voltage: 4.2V±50mV
- Built-in anti-backflow function. When no input is provided, it consumes only 0.6uA from the battery
- Compliant with the three-stage charging standard of trickle charge, constant current charge and constant voltage charge
- Integrated chip over temperature protection
- Integrated chip over voltage protection
- Charging status LED indicator
- Device and package Information：

| Part No. | $V_{FLOAT}$ | Package | Reel | MSL |
|---|---|---|---|---|
| ET95164 | 4.2V | SOT23-5 | 3k/Reel | 3 |

## Pin Configuration(Top View)

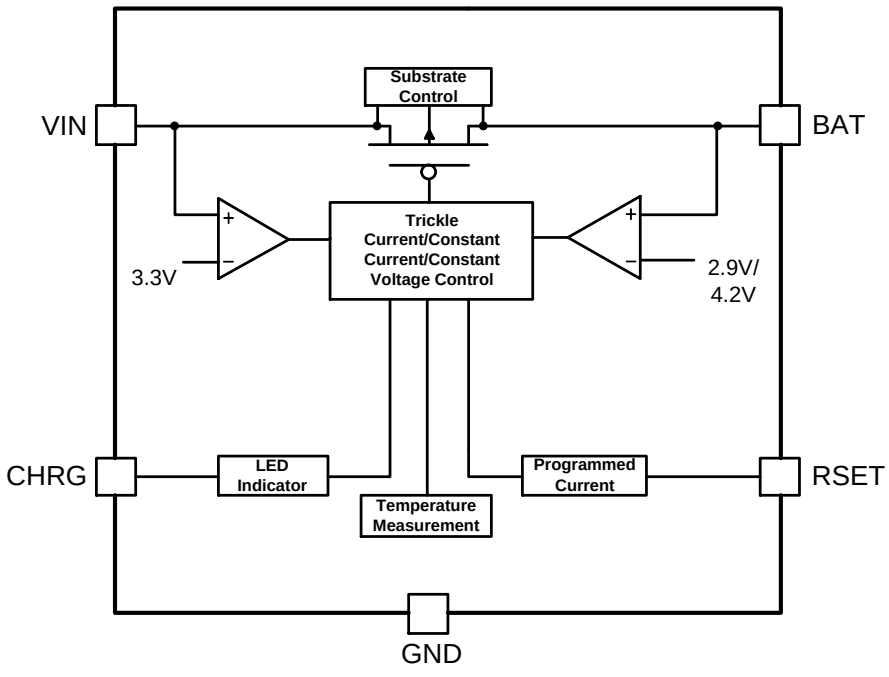



TOP VIEW

## Pin Function

| Pin No. | Pin Name | Description |
|---|---|---|
| 1 | CHRG | Constant current pull-down during charging. |
| 2 | GND | GND. Connect to the system ground. |
| 3 | BAT | Charging output, the battery terminal. |
| 4 | VIN | Charging input. |
| 5 | RSET | Fast Charge Current Program Pin. Shut down charge when the pin is pulled up. |

## Block Diagram



## Function Description

### Overview

ET95164 is a linear charging management chip, Integrated trickle current, constant current and constant voltage three-stage linear charging management. The charging input can directly draw power from the USB port. Maximum input voltage: 36V. The maximum charging current can reach up to 600mA, it can be programmed via an external resistor.

### Programming Fast Charge Current

The charge current of ET95164 can be programmed via an external resistor, like Figure 1, charge current can be estimated by following formula:

$$I_{BAT} = \frac{1000}{R_{SET}}$$

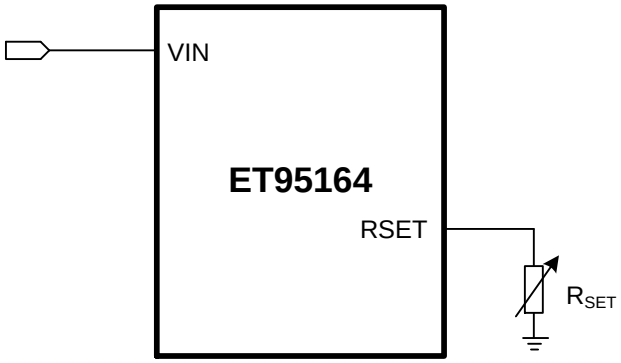



Figure 1. Programmed Charge Current

### Charging Status Indicator

ET95164 supports LED to indicate the charging status. The CHRG pin integrates constant current control technology, eliminating the need for external current limiting, ensuring stable brightness of the indicator light.

| Function | CHRG LED |
|---|---|
| Charging | Bright |
| Charge Terminated | Destroy |
| Input Over Voltage/Under Voltage | Destroy |

### Enable Function

ET95164 can shut off charging by leaving the RSET pin externally floating. For example, the negative end of the RSET resistor is connected to the IO port of the MCU. During charging, the IO output is at a low level; when shutting off, the IO is set to high resistance or input.

### Charge Current and Thermal Regulation

The ET95164 is equipped with a thermal limit function, which is designed to protect the chip from being damaged due to overheating. This also means that the charging current may not be the value set by the

formula $I_{BAT}$ = 1000 / $R_{SET}$, When the chip temperature reaches 140℃, the charge current will be restricted by the temperature instead of following the aforementioned formula.

At this point, the heat can be shared by connecting a small resistor in series on the input path, thereby increasing the charging current. In other words, when there is a thermal limit, connecting a resistor in series on the input path can actually increase the charging current. It should be noted that the power rating of the connected resistor must meet the requirements.

The value of this resistor needs to be determined based on actual measurements, as it is related to the actual heat dissipation capacity of the PCB.

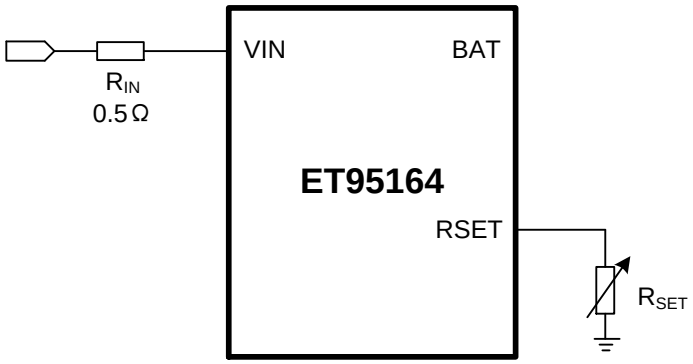



Figure 2. Input Thermal Sharing Resistance Setting

**USB Hot Plug**

Although the input voltage withstand capability of ET95164 reaches 36V, when it is connected to a voltage of 20V or higher, such as when the USB-C port of a computer is hot-swapped, the VIN pin will observe ringing voltage. This voltage may be much higher than the chip's tolerance range and cause the chip to be damaged. In order to suppress such ringing voltages, like Figure 3, The input capacitor should be an electrolytic capacitor, or a surface mount capacitor connected in series with a small resistor.

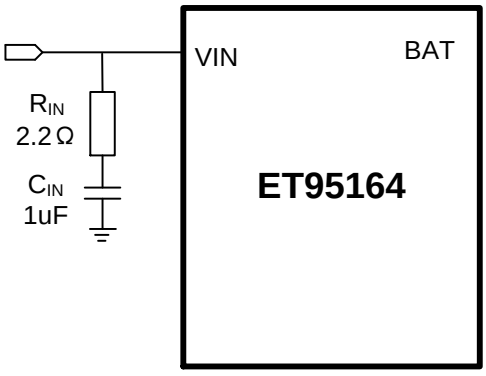



Figure 3. Improve The Reliability Of Hot Plug

## Absolute Maximum Ratings

Exceeding the following limits will cause permanent damage to the chip.

| Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|
| $V_{PIN}$ | VIN/CHRG to GND | GND-0.3 | GND+36 | V |
| | BAT to GND | GND-5 | GND+10 | V |
| | RSET to GND | GND-0.3 | GND+6.5 | V |
| $T_J$ | Maximum Junction Temperature | -40 | +150 | °C |
| $T_{STG}$ | Storage Temperature Range | -65 | +150 | °C |
| $\theta_{JA}$ | Thermal Resistance from Junction-to-Ambient | | 160 | °C/W |
| $V_{ESD}$ | Human Body Model | | ±2000 | V |

## Recommended Operating Conditions

Beyond the scope of the above-mentioned work, the performance of the chip will deteriorate.

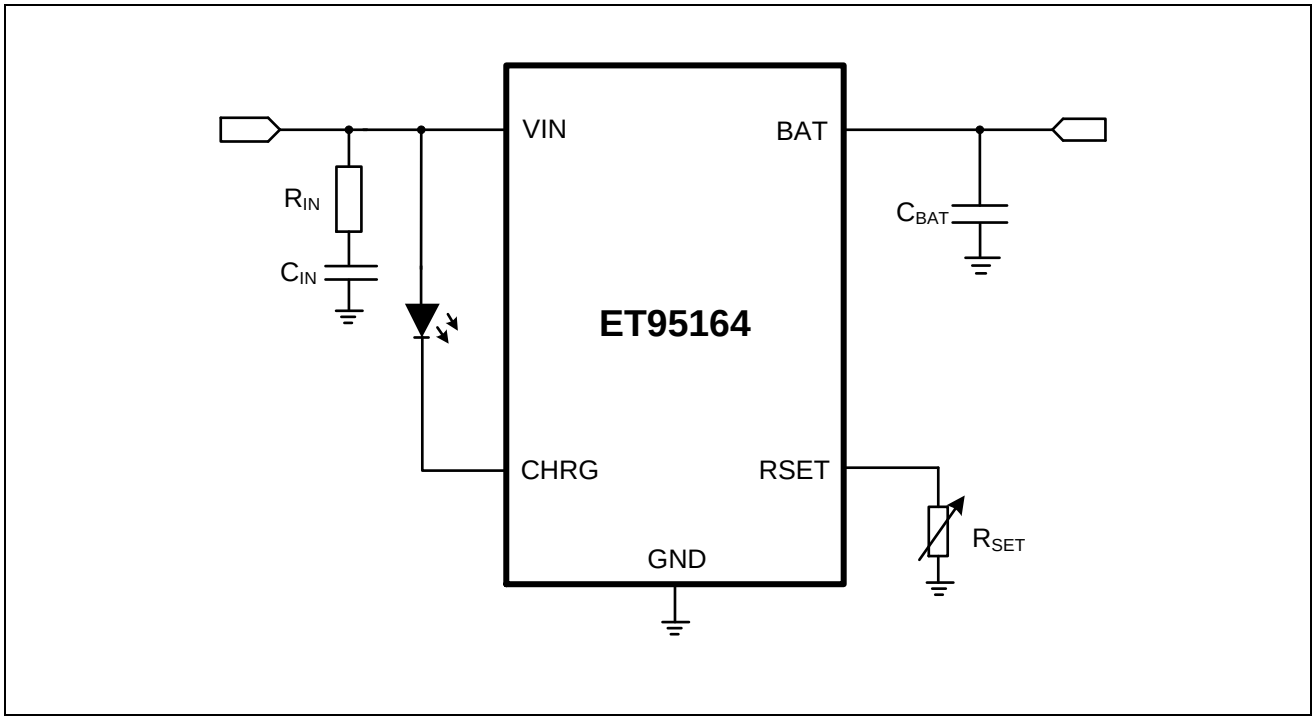
| Symbol | Characteristic | Min | Max | Unit |
|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | 4.5 | 5.5 | V |
| $I_{BAT}$ | Maximum Charge Current | | 600 | mA |
| $T_A$ | Operating Ambient Temperature Range | -40 | +85 | °C |

## Electrical Characteristics

$V_{IN}$=5V, $T_A$=25°C for typical values (unless otherwise noted).

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IN}$ | Input Voltage Range | | 4.5 | 5.0 | 5.5 | V |
| $I_{IN}$ | Chip Power Consumption | Full Charge | | 80 | | uA |
| $V_{FLOAT}$ | Floating Charge Voltage | $V_{IN}$=5V,$I_{CHG}$ become 0mA | -50mV | 4.20 | +50mV | V |
| $I_{BAT}$ | Current of BAT Pin | Charging, $R_{SET}$=10kΩ | 90 | 100 | 110 | mA |
| | | Charging, $R_{SET}$=2kΩ | 450 | 500 | 550 | mA |
| | | Full Charge | | -5 | | uA |
| | | $V_{IN}$=0V | | -0.6 | -0.9 | uA |
| $V_{TRKL}$ | Trickle Current Threshold | $R_{SET}$=10kΩ, Measure when $V_{BAT}$ rises | 2.8 | 2.9 | 3.0 | V |
| $I_{TRKL}$ | Trickle Current | $R_{SET}$=10kΩ, $V_{BAT}$=2.6V | 10 | 15 | 20 | mA |
| | | $R_{SET}$=2kΩ, $V_{BAT}$=2.6V | 70 | 80 | 95 | mA |
| $V_{UV}$ | Input Under Voltage Threshold | Measure when $V_{IN}$ rises | 3.0 | 3.3 | 3.6 | V |
| | $V_{UV}$ Hysteresis | Measure when $V_{IN}$ decreases, Record the difference | | 0.2 | | V |
| $V_{OV}$ | Input Over Voltage Threshold | Measure when $V_{IN}$ rises | 5.8 | 6.1 | 6.4 | V |
| | $V_{OV}$ Hysteresis | Measure when $V_{IN}$ decreases, Record the difference | | 0.2 | | V |
| $V_{ASD}$ | $V_{IN}$-$V_{BAT}$ Startup Threshold | $V_{BAT}$=3.7V, Measure when $V_{IN}$ rises | | 150 | | mV |
| | $V_{IN}$-$V_{BAT}$ Shutdown Threshold | $V_{BAT}$=3.7V, Measure when $V_{IN}$ decreases | | 100 | | mV |
| $I_{TERM}$ | Termination Current Threshold | $R_{SET}$=10kΩ | | 12 | | mA |
| | | $R_{SET}$=2kΩ | | 60 | | mA |
| $V_{RECHG}$ | Battery Recharging Threshold | $V_{FLOAT}$-$V_{RECHG}$ | | 150 | | mV |
| $T_{CC}$ | Over Temperature Protection Threshold | | | 140 | | °C |
| $I_{LED}$ | LED Lighting Current | $V_{CHRG}$=0.5V | 3.0 | 5.0 | 7.0 | mA |

## Application Circuit

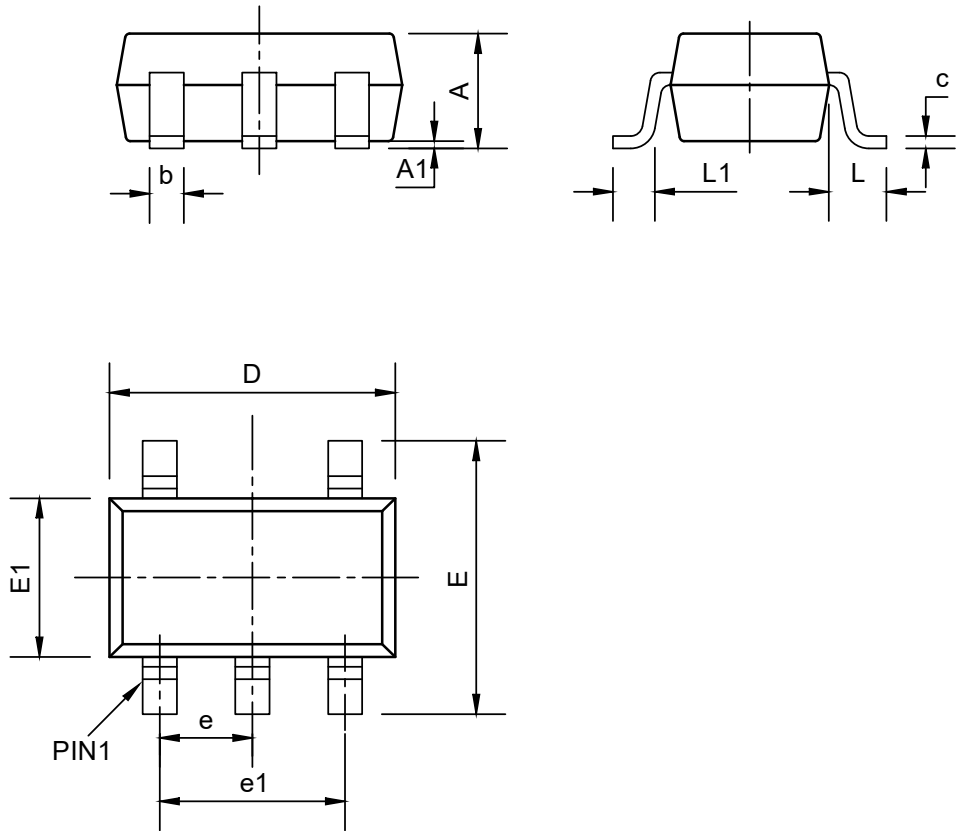



**BOM list**

| Symbol | Characteristic | Requirement | Quantity |
|---|---|---|---|
| $C_{IN}$ | Input voltage stabilizing capacitor | 105 or larger in capacitance surface-mount capacitors, with a voltage rating of 25V or higher | 1 |
| $C_{BAT}$ | Output voltage stabilizing capacitor | 105 or larger in capacitance surface mount capacitors | 1 |
| $R_{IN}$ | Anti-surge resistor | 2.2Ω | 1 |
| $R_{SET}$ | Current setting resistor | 1% Precision SMD Resistor | 1 |

## Package Dimension

**SOT23-5**




**Dimensions Table (Units:mm)**

| Symbol | Min | Max |
|---|---|---|
| A | 1.050 | 1.250 |
| A1 | 0.000 | 0.100 |
| b | 0.300 | 0.400 |
| c | 0.100 | 0.200 |
| D | 2.820 | 3.020 |
| E | 2.650 | 2.950 |
| E1 | 1.500 | 1.700 |
| e | 0.950 BSC | |
| e1 | 1.800 | 2.000 |
| L | 0.300 | 0.600 |
| L1 | 0.700 BSC | |

## Revision History and Checking Table

| Version | Date | Revision Item | Modifier | Function & Spec Checking | Package & Tape Checking |
|---|---|---|---|---|---|
| 1.0 | 2025-6-16 | Official Version | Licx | Xiayj | Liujy |
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