# IP5528

## TWS Charging Box SOC

## integrated MCU with 1A charger and 400mA Boost

## 1 Features

- **MCU**
  - ✧ Integration of 32 bits CPU
  - ✧ 16K Bytes MTP ROM. Supports USB port upgrade
  - ✧ 2K Bytes RAM
  - ✧ Supports hardware Reset PIN
  - ✧ Double UART. support earphone independent communication function
- **Boost**
  - ✧ 400mA synchronous boost conversion
  - ✧ Boost converter efficiency up to 93%
- **Charger**
  - ✧ 1A synchronous switching charger
  - ✧ Switch charger efficiency up to 90%
  - ✧ Automatically adjusts charging current of different load capacity adapters
  - ✧ Supports 4.20V, 4.30V,4.35V, 4.40V batteries
- **Battery indicators**
  - ✧ Built-in 12bits ADC
  - ✧ Supports 1/2/3/4 LED battery indicator
  - ✧ Support a variety of 188 digital tube display
  - ✧ Support Coulometer
- **Fully featured**
  - ✧ Supports NTC function
  - ✧ Supports external pin selection of standby voltage
  - ✧ Supports hall selection for external PIN
  - ✧ Supports detection of earphone plug-in/plug-out independently
  - ✧ Supports independent current limiting with earphones
  - ✧ VPHL/VPHR supports adjustable output voltage from 3.2V to 5.2V@Step=50mV, and supports quick charging for earphones
- **Low power**
  - ✧ Automatically detect load plugged-out. Automatically enter standby mode
  - ✧ Standby power consumption up to 15 μA minimum
  - ✧ Standby power consumption in shipping mode is less than 3 μA
- **Simplified BOM**
  - ✧ Built-in power MOS, charging and boosting with a 1μH single inductor
  - ✧ Multiple protection, high reliability
  - ✧ Independent current limiting with earphones
  - ✧ Input: under voltage protection, over voltage protection and Battery over charged protection
  - ✧ Over temperature protection
  - ✧ VIN pin can withstand up to 15V
- **In-depth customization**
  - ✧ Flexible and low-cost customized program
- **Package:QFN28 4mm*4mm**

## 2 Applications

- TWS Bluetooth Earphone Charging Box
- Lithium Battery Portable Device

## 3 Description

IP5528 is a multi-functional power management SOC that integrates boost converter, lithium battery charge management, battery level indicator for total solution on TWS Bluetooth Earphone Charging BOX.

IP5528 is highly integrated with abundant functions, which makes the total solution with minimized-size and low-cost BOM.

The synchronous boost of IP5528 provides rated 400mA output current with conversion efficiency up to 93%. IP5528 can automatically enter sleep state, and the standby current can be reduced to 15μA.

IP5528 adopts switch charging technology to provide rated 1A charging current with switching efficiency up to 90%. Built-in IC temperature protection and input voltage intelligent adjustment of charging current.

IP5528 can support 1/2/3/4 LED battery indicator and the built-in 12bits ADC can accurately calculate the Charging Box's battery voltage and current.

 

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# 4 Reversion History

Note: Page numbers of previous editions may differ from those of the current edition.

| Version V1.00 changed in April 2022 | Page |
|---|---|
| ● First Release | 1 |

| Version V1.00 changed to version V1.01 in April 2022 | Page |
|---|---|
| ● Chapter 1:Increased ship mode power consumption | 1 |
| ● Chapter 11 increased standby power consumption in shipping mode | 10 |

| Version V1.01 changed to version V1.02 in April 2022 | Page |
|---|---|
| ● Chapter 11 Modifying the Current Limiting Range of earphones | 9 |
| ● Section 12.6 fixes the error | 15 |

| Version V1.02 changed to version V1.03 in May 2023 | Page |
|---|---|
| ● Chapter 11 adds the description of GPIO | 9 |

## 5 Simplified application schematic

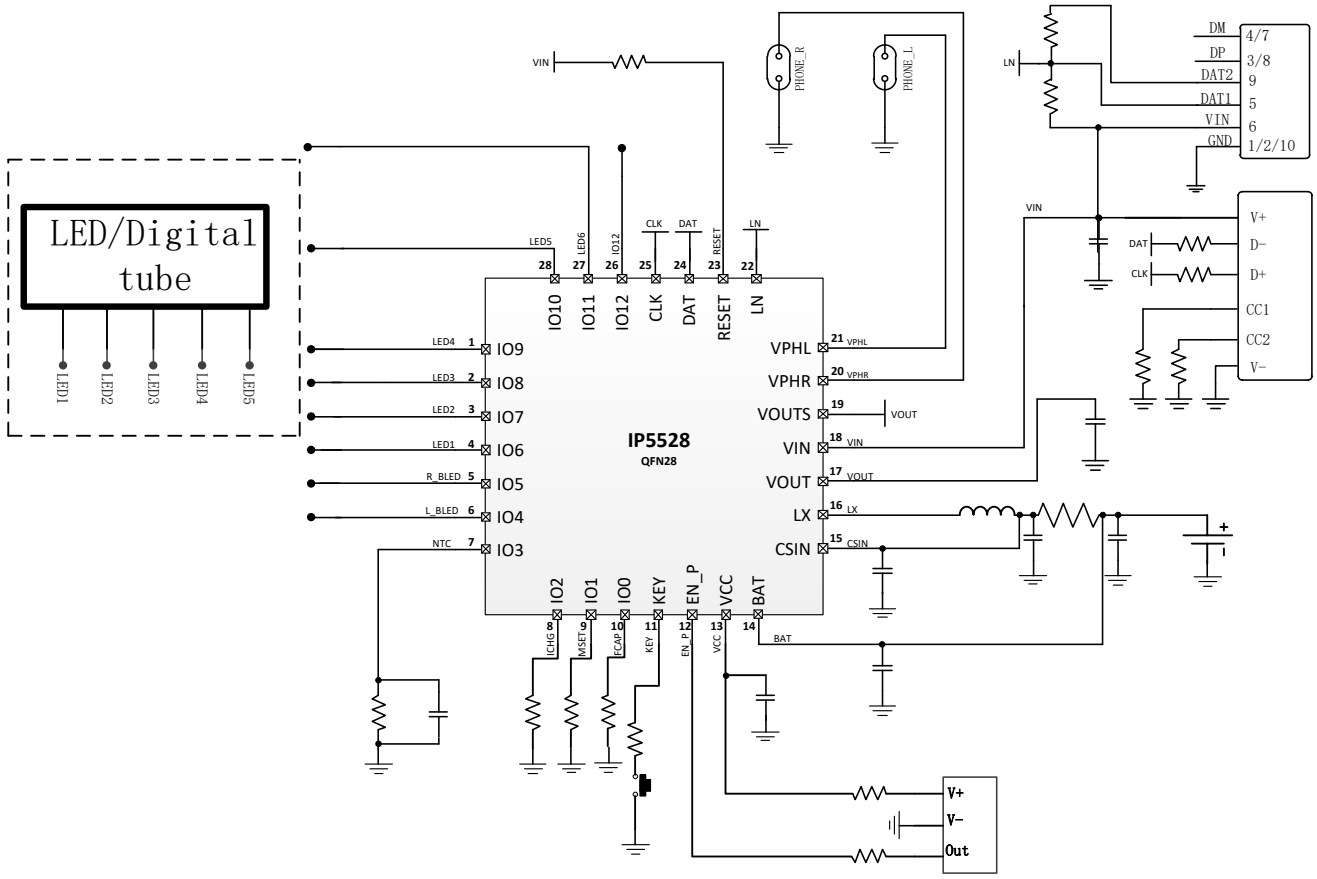



Figure 1 Simplified application schematic

## 6 IP Series TWS Charging IC Products List

| IC Part No. | Charge-discharge | | Main features | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | discharge | charge | Wireless charging | LED | KEY | HALL | VSET | NTC | USB C | Package |
| IP5513 | 300mA | IO option | - | 1/2/3/4/ Digital Tube | Support | | Customizable | Customizable | - | SOP16 |
| IP5516 | 300mA | IO option | - | 1/2/3/4/ Digital Tube | Support | Support | Customizable | Support | - | QFN16 |
| IP5518 | 300mA | IO option | - | 1/2/3/4/ Digital Tube | Support | Support | Customizable | Support | - | QFN24 |
| IP6816 | 300mA | Customizable | Support | 1/2/3/4/ Digital Tube | Support | Support | Customizable | Support | - | QFN16 |
| IP6818 | 300mA | Customizable | Support | 1/2/3/4/ Digital Tube | Support | Support | Customizable | Support | - | QFN24 |
| IP5333 | 1A | IO option | - | 1/2/3/4/ Digital Tube | Support | Support | IO option | Support | Support | QFN24 |
| IP5528 | 400mA | IO option | - | 1/2/3/4/ Digital Tube | Support | Support | Customizable | Support | - | QFN28 |
| IP5416 | 200mA | 500mA | - | 1/2 | Support | Support | Customizable | - | - | SOP8 |
| IP5413T | 200mA | 500mA | - | 1/2/4 | Support | - | Customizable | - | - | SOP8 |

Not supported:-

# 7 Pin Definition

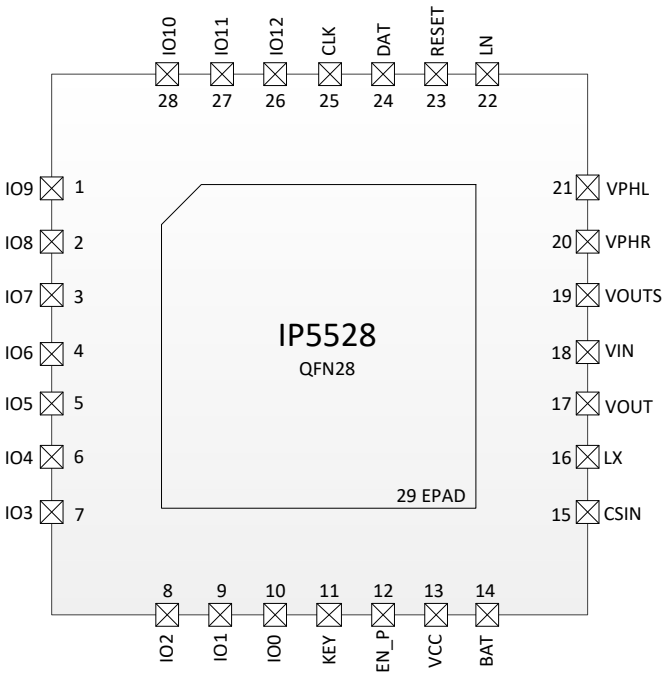



Figure 2 Pin Definition

## 7.1 Pin description

| Pin Num | Name | Description |
|---|---|---|
| 1 | IO9 | IO9 |
| 2 | IO8 | IO8 |
| 3 | IO7 | IO7.can be configured as breathing lamp drive pin |
| 4 | IO6 | IO6. can be configured as breathing lamp drive pin |
| 5 | IO5 | IO5. can be configured as breathing lamp drive pin |
| 6 | IO4 | IO4. can be configured as breathing lamp drive pin |
| 7 | IO3 | IO3.NTC function pin |
| 8 | IO2 | IO2.charging current setting pin |
| 9 | IO1 | IO1.standby voltage and Hall function setting pin |
| 10 | IO0 | IO0.Battery capacity setting pin |
| 11 | KEY | KEY driver pin |
| 12 | EN_P | Hall switch input signal |
| 13 | VCC | LDO 3.1V output pin |
| 14 | BAT | Battery voltage positive pin |
| 15 | CSIN | Bat voltage sampling pin |
| 16 | LX | DCDC switch node |
| 17 | VOUT | Boost 5V output |
| 18 | VIN | USB power pin |
| 19 | VOUTS | Need to short circuit with VOUT |
| 20 | VPHR | Right earphone positive pin |

| | | |
|---|---|---|
| 21 | VPHL | Left earphone positive pin |
| 22 | LN | Lightning input decoded pin |
| 23 | RESET | A reset pin that rises from low to high and continues for a period of time to trigger a reset |
| 24 | DAT | Upgrade data pin online |
| 25 | CLK | Upgrade clock pin online |
| 26 | IO12 | IO12，can be reused as UART TX/RX |
| 27 | IO11 | IO11，can be reused as UART TX/RX |
| 28 | IO10 | IO10，can be reused as UART TX/RX |
| Epad | GND | Ground |

## 8 System Diagram

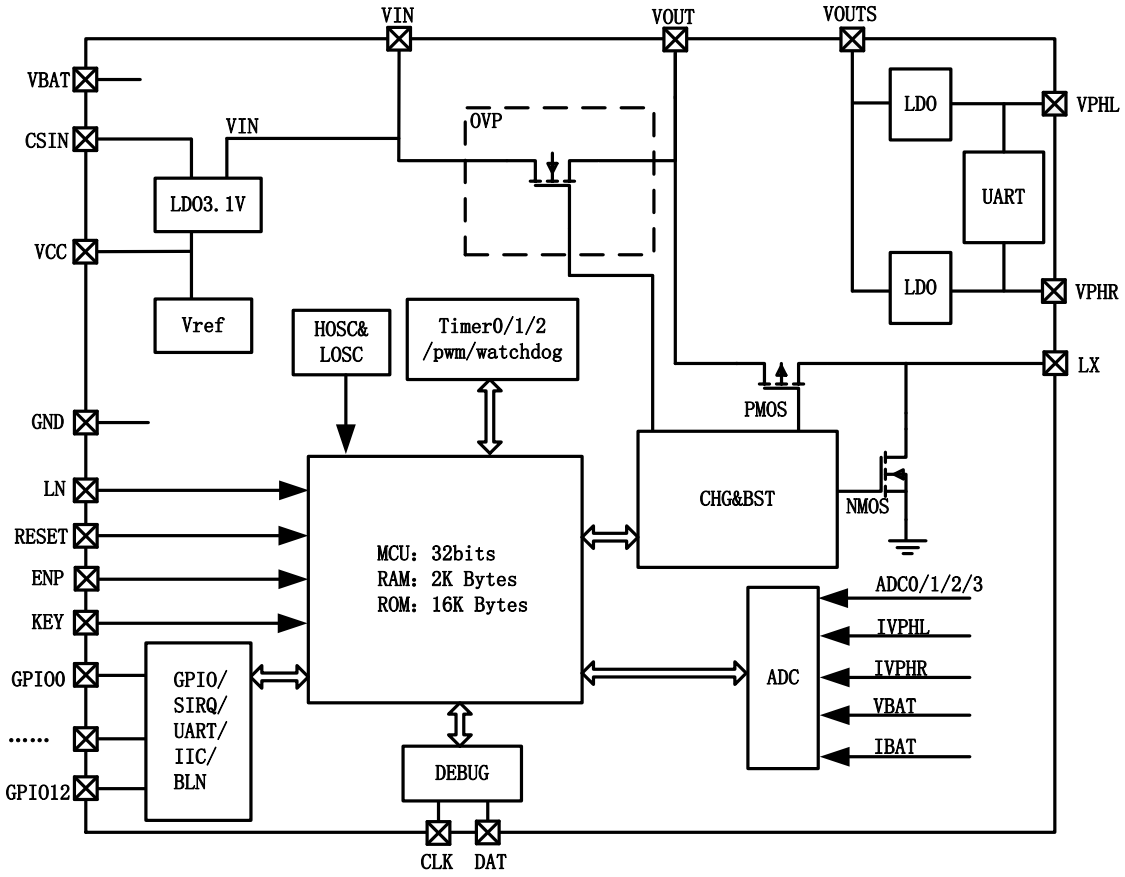



Figure 3 IP5528 Internal System Diagram

## 9 Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Input Voltage Range | Vin | -0.3 ~ 15 | V |
| | BAT\CSIN\LX\VOUT\VOUTS\VPHL\VPHR\RESET\DAT\CLK | -0.3~10 | V |
| Junction Temperature Range | $T_J$ | -40 ~ 150 | ℃ |
| Storage Temperature Range | Tstg | -60 ~ 150 | ℃ |
| Thermal Resistance (Junction to Ambient) | $\theta_{JA}$ | 40 | ℃/W |
| ESD (Human Body Model) | ESD | 4 | KV |

*Stresses beyond these listed parameter may cause permanent damage to the device.

Exposure to Absolute Maximum Rated conditions for extended periods may affect device reliability.

## 10 Recommended Operating Conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input voltage | Vin | 4.5 | 5 | 6.0 | V |
| Operating Temperature | TA | -20 | -- | 85 | ℃ |

*Device performance cannot be guaranteed when working beyond these Recommended Operating Conditions.

## 11 Electrical Characteristics

Unless otherwise specified. TA=25℃, L=1μH

| Parameter | Symbol | Test conditions | Min. | Tye. | Max. | Unit |
|---|---|---|---|---|---|---|
| Charging System | | | | | | |
| Input Voltage | VIN | VBAT=3.7V | 4.6 | 5.0 | 5.8 | V |
| Input Over Voltage | VIN-OV | | 5.8 | 6.0 | 6.2 | V |
| Input Under Voltage | VIN-UV | Vout voltage | 4.55 | 4.60 | 4.65 | V |
| Constant Charge Voltage | $CV_{4.2V}$ | Different CV voltages need to be customized, default CV=4.2V | 4.18 | 4.21 | 4.25 | V |
| | $CV_{4.30V}$ | | 4.28 | 4.31 | 4.34 | V |
| | $CV_{4.35V}$ | | 4.33 | 4.36 | 4.40 | V |
| | $CV_{4.4V}$ | | 4.38 | 4.41 | 4.44 | V |
| Charge Stop Current | $I_{vinstop}$ | VIN=5V | | 50 | 80 | mA |
| Charge Current | $I_{vin}$ | VIN=5V, VBAT=3.7V, Riset=NC | | 0.8 | 0.85 | A |
| Trickle Charge Current | $I_{TRKL}$ | VIN=5V, VBAT=2.7V | 30 | 50 | 70 | mA |
| Trickle Charge Stop Voltage | $V_{TRKL}$ | | 2.9 | 3.0 | 3.1 | V |
| Recharge Voltage Threshold | $V_{RCH}$ | | 4.04 | 4.08 | 4.10 | V |
| Boost System | | | | | | |
| Battery Operation Voltage | $V_{BAT}$ | | 3.2 | 3.7 | 4.4 | V |
| Low Power Shutdown Voltage | $V_{BATLOW}$ | IOUT=200mA | 3.15 | 3.20 | 3.25 | V |
| DC Output Voltage | $V_{OUT}$ | VBAT=3.7V @0A | 5.0 | 5.12 | 5.25 | V |
| | | VBAT=3.7V @100mA | 4.75 | 5.0 | 5.15 | V |
| Output Voltage Ripple | $\Delta V_{OUT}$ | VBAT=3.2V~4.4V @IOUT=100mA | 50 | 100 | 150 | mV |

| | | | | | | |
|---|---|---|---|---|---|---|
| Boost Output Current | $I_{vout}$ | VBAT=3.7V | 0 | | 400 | mA |
| Earphone Overcurrent Shut Down Threshold | $I_{shut-vph}$ | VBAT=3.7V | | 160 | 225 | mA |
| Control System | | | | | | |
| Switch Frequency | Fs | Discharge switch frequency | | 1000 | | kHz |
| | | Charge switch frequency | | 1000 | | kHz |
| PMOS On Resistance | $R_{DSON}$ | | | 170 | | mΩ |
| NMOS On Resistance | | | | 200 | | mΩ |
| VIN OVP On Resistance | Rovp | | | 150 | | mΩ |
| VCC Voltage | VCC | Vbat=3.7V | | 3.1 | | V |
| Battery Input Standby Current | $I_{STB}$ | Vin=0V，VBAT=3.7V | | 15 | 20 | μA |
| Standby current in shipping mode | $I_{STOP}$ | In shipping mode | 0 | 1.5 | 3 | μA |
| Light Load Shut Down Detect Time | $T_{loadD-ph}$ | Load current less than 4mA | | 8 | | s |
| Light Load Shut Down Current | $I_{plout-ph}$ | VBAT=3.7V，VPH pin | | 4 | | mA |
| Short Press On Key Wake Up Time | $T_{OnDebounce}$ | | 60 | | 200 | ms |
| Thermal Shut Down Temperature | $T_{OTP}$ | Rising temperature | 130 | 140 | 150 | ℃ |
| Thermal Shut Down Hysteresis | $\Delta T_{OTP}$ | | 30 | 40 | 50 | ℃ |
| **GPIO** | | | | | | |
| IO Driving Current | $I_{GPIO}$ | | | 5 | | mA |
| Minimum input high level | $V_{IH}$ | | 0.7VCC | | | V |
| Minimum input low level | $V_{IL}$ | | | | 0.3VCC | V |
| Output high level | $V_{OH}$ | | | VCC | | V |
| Output low level | $V_{OL}$ | | | GND | | V |
| Pull-up Resistor | $R_{pu}$ | | | 100 | | KΩ |
| Pull- down Resistor | $R_{pd}$ | | | 100 | | KΩ |

# 12 Function Description

## 12.1 BOOST

IP5528 integrates a boost dc-dc converter with 5V@400mA output，1MHz switching frequency. To avoid large rush current causing device failure , it is built in overcurrent, short circuit, overvoltage and over temperature protection function, ensuring the reliability and stability of system operation..

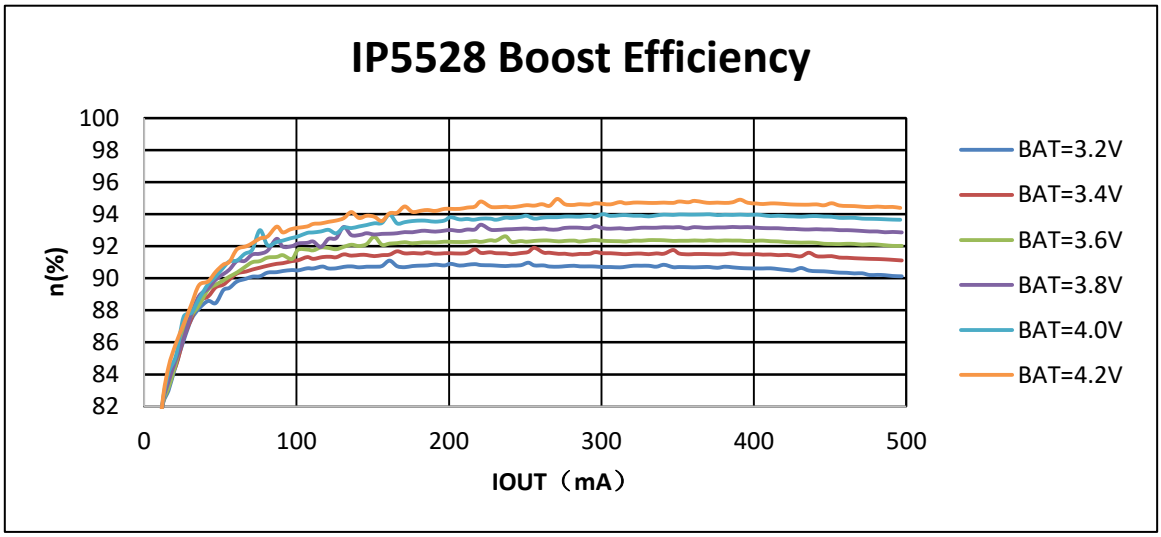



Figure 4　IP5528 Boost Efficiency Curve

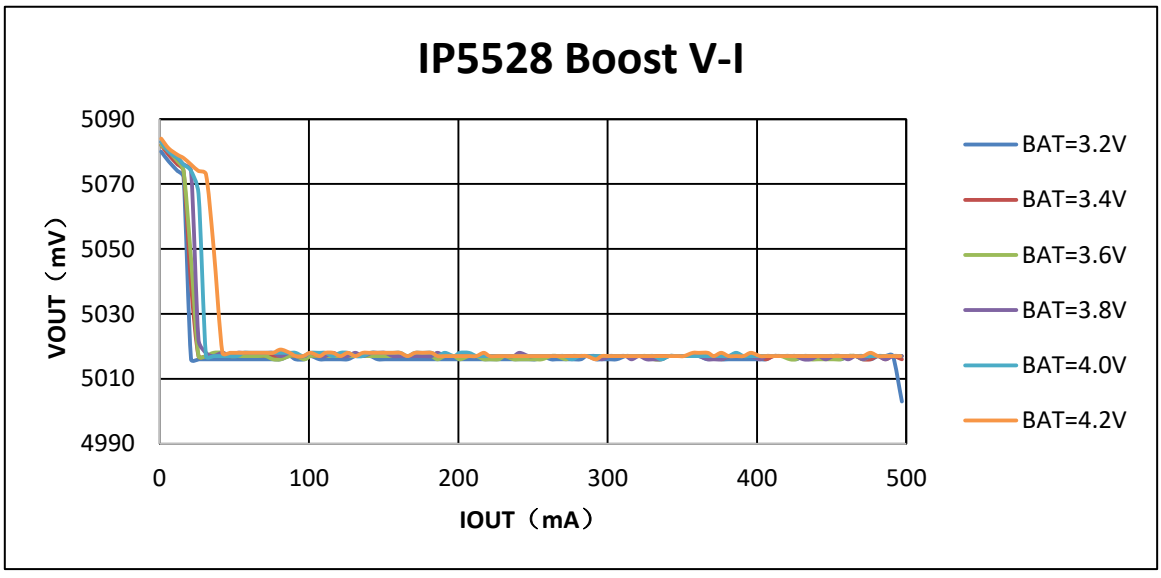



Figure 5　IP5528 Boost Output V/I Curve

## 12.2 Charge

IP5528 integrates a synchronous switch Li battery charging management system. When the battery voltage is less than 3V, precharge with 0.1 CC; when the battery voltage is higher than 3V, enter constant current(CC) charging; when the battery voltage is near to 4.2V/4.3V/4.35V/4.4V, enter constant voltage(CV) charging. After the charging is accomplished, once the battery voltage falls under 4.1V, battery charging stage will be restarted.

IP5528 supports VIN port 1A charging, and at the same time detects the input voltage and IC

temperature to automatically adjust the charging current.

When IP5528 is in charging state, it will detect whether the VOUT (output voltage) is higher than 4.6V. If it is higher than 4.6V, it will charge the battery with the maximum current; if it is lower than 4.6V, it will reduce the charging current and automatically adapt to the load output capacity of the adapter.

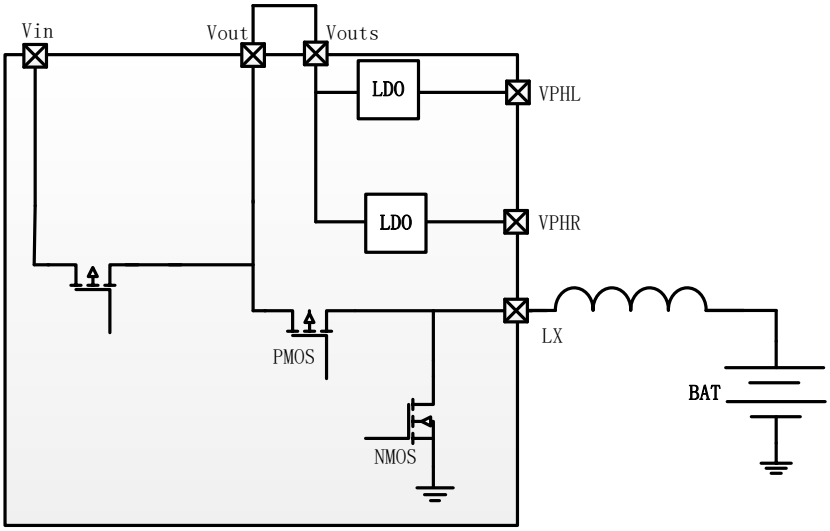
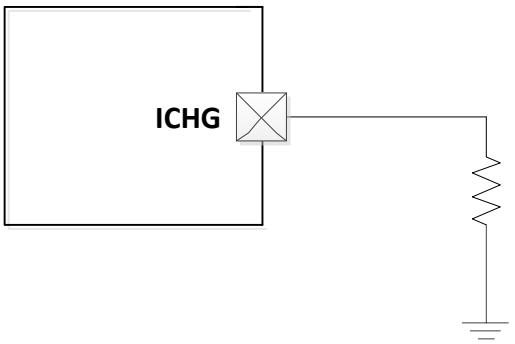



Figure 6 Schematic Diagram of Power Path Management

## 12.3 Charge current regulation

IP5528 adjusts the charging current of the input terminal by setting ICHG function on the GPIO2 pin and pulling different resistors underground.




| Richg | Charge current |
|---|---|
| NC | 800mA |
| 10kΩ | 300mA |
| 20kΩ | 400mA |
| 33kΩ | 500mA |
| 43kΩ | 600mA |
| 56kΩ | 700mA |
| 68kΩ | 900mA |
| 82kΩ | 1A |

Figure 7 Charge current regulation

## 12.4 KEY

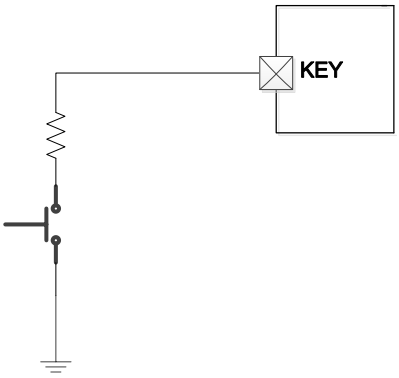



Figure 8 KEY Circuit

IP5528 key connection mode is shown in Figure 8.

- Pressed time in range of 100ms ~ 2s, turn on the battery indicator and boost output.

## 12.5 Coulombmeter and battery level display

IP5528 has a built-in coulombmeter algorithm, which can accurately display the remaining battery power according to the cell capacity.

IP5528 can support 1/2/3/4 LED battery indicator, and the system can automatically identify which LED modes is.

IP5528 can also support other power displays such as breathing lights and 188 digital tubes. Such special lights need to be customized separately. Please contact INJOINIC technical support department.

### 12.5.1 LED display mode

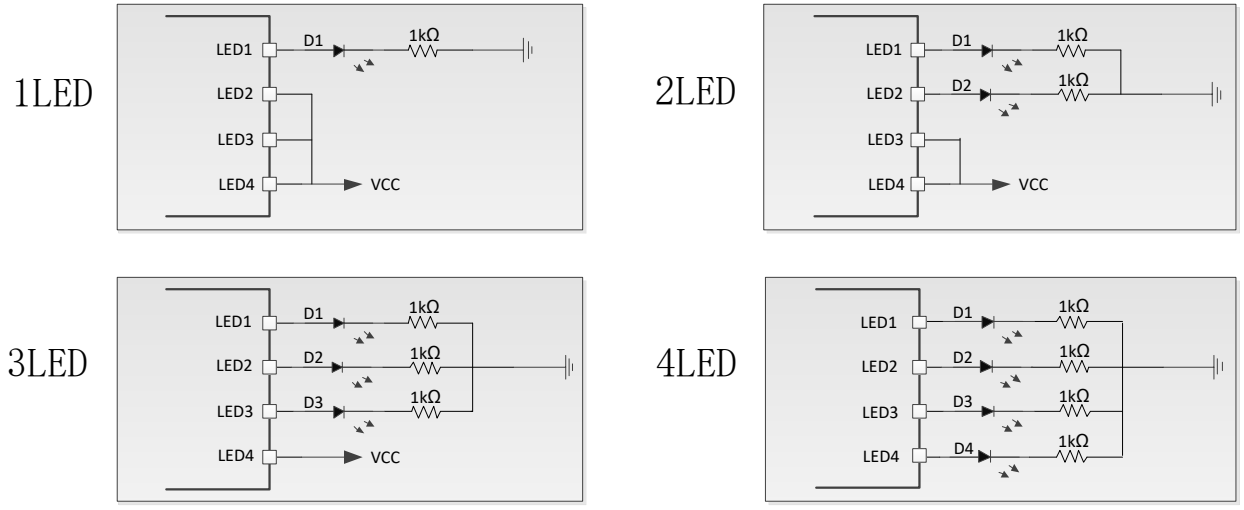



Figure 9 LED Display Mode Configuration Circuit

■ 4 LED Mode

Discharge

Table 1 Discharge Quantity Display of Lamp

| Battery capacity(C)(%) | D1 | D2 | D3 | D4 |
|---|---|---|---|---|
| C≥75% | on | on | on | on |
| 50%≤C＜75% | on | on | on | off |
| 25%≤C＜50% | on | on | off | off |
| 3%≤C＜25% | on | off | off | off |
| 0%＜C＜3% | 1Hz blink | off | off | off |

Charge

Table 2 4 Lamp Charging Quantity Display

| Battery capacity(C)(%) | D1 | D2 | D3 | D4 |
|---|---|---|---|---|
| C=100% | on | on | on | on |
| 75%≤C | on | on | on | 0.5Hz blink |
| 50%≤C＜75% | on | on | 0.5Hz blink | off |
| 25%≤C＜50% | on | 0.5Hz blink | off | off |
| C＜25% | 0.5Hz blink | off | off | off |

■ 3 LED Mode

Discharge

Table 3 Discharge Quantity Display of Lamp

| Battery capacity(C)(%) | D1 | D2 | D3 |
|---|---|---|---|
| C≥66% | on | on | on |
| 33%≤C＜66% | on | on | off |
| 3%≤C＜33% | on | off | off |
| 0%＜C＜3% | 1Hz blink | off | off |

Charge

Table 4 3 Lamp Charging Quantity Display

| Battery capacity(C)(%) | D1 | D2 | D3 |
|---|---|---|---|
| C=100% | on | on | on |
| 66%≤C＜100% | on | on | 0.5Hz blink |
| 33%≤C＜66% | on | 0.5Hz blink | off |

| | | | |
|---|---|---|---|
| C＜33% | 0.5Hz blink | off | off |

■ 2 LED Mode

Table 5 Charging and Discharging Quantity Display of Lamp

| | state | D1 | D2 |
|---|---|---|---|
| charge | charging | 0.5Hz blink | off |
| | full | on | off |
| discharge | discharging | off | on |
| | low | off | 1Hz blink |

■ 1 LED Mode

Table 6 1 Lamp Charging And Discharging Quantity Display

| | state | D1 |
|---|---|---|
| charge | charging | 0.5Hz blink |
| | full | on |
| discharge | discharging | on |
| | low | 1HZ blink |

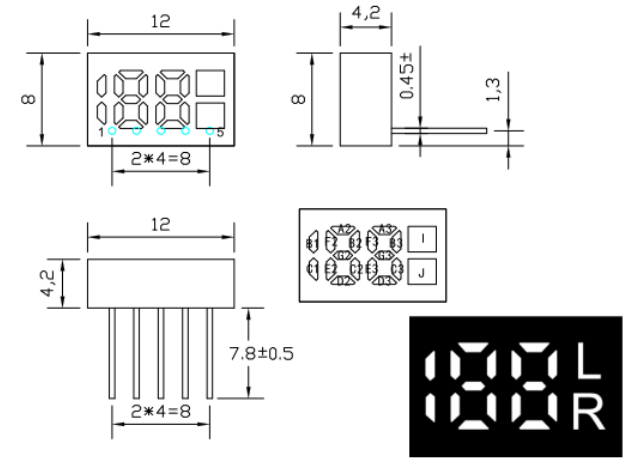
### 12.5.2 Digital Tube Display Mode

Table 7 Charging and Discharging Quantity Display of Digital Tube

| Digital Tube | Charge | | Boost | |
|---|---|---|---|---|
| | In Charging | Full | C<5% | C>5% |
| 5pin 188 mode （YFTD2259SW-5） | 188:0-99% 0.5HZ blink L/R:Earphone discharge is steady on | 188:100% L/R:Earphone discharge is steady on | 188:0-5% 1HZ blink L/R:Earphone discharge is steady on | 188:5%-100% Always bright L/R:Earphone discharge is steady on |

IP5528 supports 5PIN 188 by default. The schematic diagram is as follows:




4. 电路图（Circuit Diagram）：

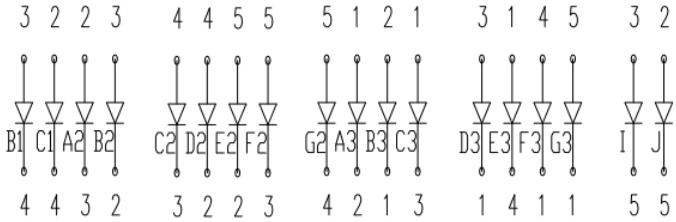



Figure 10　5pin 188 Digital Tube Circuit Diagram

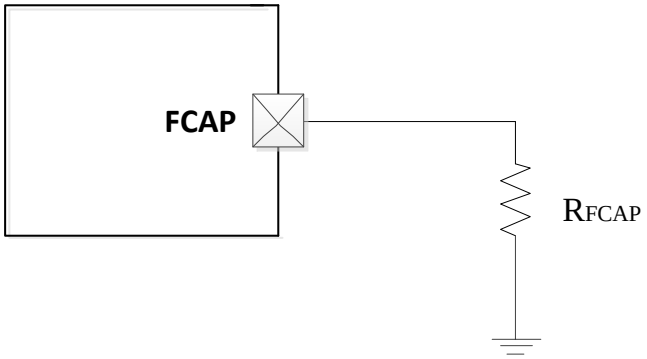
Table 8　Mapping Relationship of Digital Tube

| | IP5528 LED Driver Pin | Digital Tube Pin | Note |
|---|---|---|---|
| Mapping relationship between IP5528 LED driver pin and digital tube pin | LED1(4 PIN) | 1 PIN | |
| | LED2(3 PIN) | 2 PIN | |
| | LED3(2 PIN) | 3 PIN | |
| | LED4(1 PIN) | 4 PIN | |
| | LED5(28 PIN) | 5 PIN | |
| | LED6(27 PIN) | 6 PIN | |

### 12.5.3 Coulombmeter

IP5528 can select the battery capacity by configuring the FCAP function on the GPIO0 pin by connecting different pull-down resistors.

The residual capacity of the battery can be managed by integrating the current and time of the battery, which can accurately display the current battery capacity.




| Batteries capacity | RFCAP |
|---|---|
| 600mAH | NC |
| 500mAH | 10kΩ |
| 400mAH | 33kΩ |
| 300mAH | 82kΩ |

Figure 11 Battery Capacity Setting Circuit

### 12.6 Plug-in automatic detection with light load automatic standby

Once detecting the insertion of the earphone, the IP5528 is waked up from the standby mode and turns on the boost 5V to charge the earphone, eliminating the button operation and supporting the buttonless mold solution. In the standby mode, the VPHL/VPHR output voltage has two configurations: 5V or battery volage.

When VPHL/VPHR Standby voltage is setting to battery volage: When VPHL/VPHR detects a pull-down of more than 2.5μA, it is considered that there is load insertion.When VPHL/VPHR detects a pull-down below 1μA, it is considered that there is load pull-out.

When each of the earphone's loading current on VPHL and VPHR is less than 4mA and lasts for 8s, IP5528 will automatically enter the standby mode.

IP5528 supports independent current limiting 160mA protection in VPHL/VPHR: the current is limited by the LDO on the output path, when it is detected that the current of the LDO reaches above 160mA, the output path is closed.

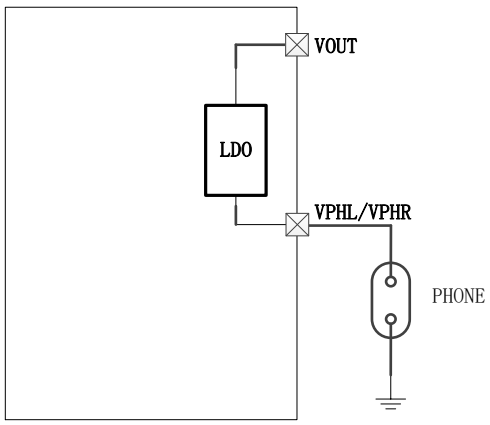



Figure 12 IP5528 Earphone Connection Schematic

## 12.7 Standby voltage and Hall function

IP5528 can select the battery capacity by configuring the MSET function on the GPIO1 pin by connecting different pull-down resistors.

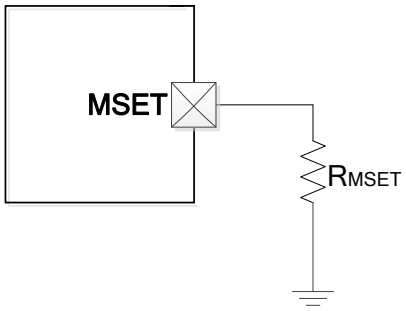



Figure 13 Standby voltage and Hall function Setting Circuit

Table 9 MSET Resistance Function

| $R_{MSET}$ | Hall function | Standby voltage |
|---|---|---|
| NC | not support | battery voltage |
| 10kΩ | not support | 5V |
| 33kΩ | Turn off cover low<br>Open cover high level | Turn off the standby battery voltage<br>Open cover standby 0V |
| 82kΩ | Turn off cover low<br>Open cover high level | Close cover standby 5V<br>Open cover standby 0V |

## 12.8 NTC Function

IP5528 integrates NTC function, which can detect battery temperature. When the IP5528 is working, NTC pin generates a constant current to the NTC resistor. IP5528 detects the voltage of the NTC pin to determine the current battery temperature.

* The 100nF capacitance of NTC must be close to IC PIN.

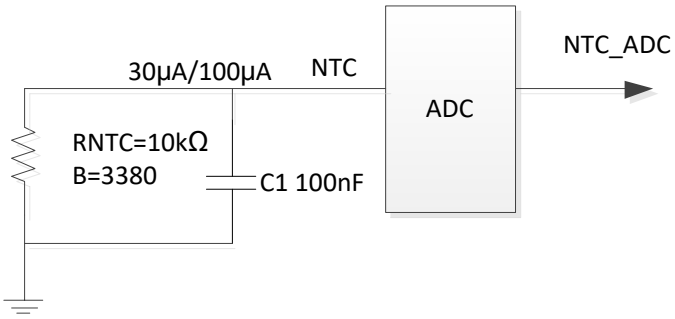



Figure 14 NTC Circuit

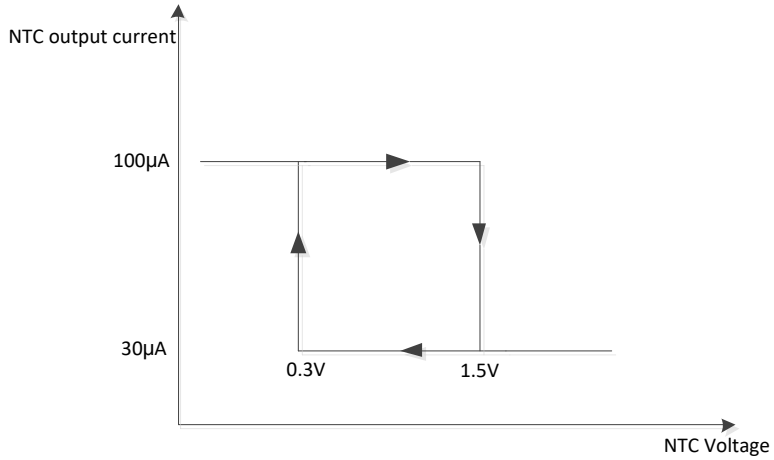



Figure 15 Relationship Between NTC Voltage and Output Current

In order to distinguish between high temperature and low temperature, NTC pin outputs 100μA current at high temperature and 30μA current at low temperature. When the NTC discharge current is 100μA, and the NTC voltage is higher than 1500mV, the current becomes 30μA. When the NTC discharge current is 30μA, and the NTC voltage is lower than 300mV, the current changes to 100μA.

For the state of charge:

When the NTC voltage is lower than 0.49V, it means the battery temperature is higher than 45 ℃; the charging is stopped.

When the NTC voltage is higher than 0.82V, it means the battery temperature is lower than 0 ℃; the charging is stopped.

For the state of discharge:

When the NTC voltage is lower than 0.30V, it means the battery temperature is higher than 60 ℃; the discharging is stopped.

When the NTC voltage is higher than 2.09V, it means the battery temperature is lower than -20 ℃; the discharging is stopped.

If NTC is not required in the scheme, the NTC pin shall be connected 10kΩ to GND. Floating or direct grounding is not allowed.

## 12.9 Reset function

IP5528 integrates an independent hardware Reset circuit. When a externally Reset sequence is added to the Reset PIN, the whole IP5528 chip will be reset.

Reset timing sequence: a rising edge from low to high, and the high level lasts for more than 32ms.

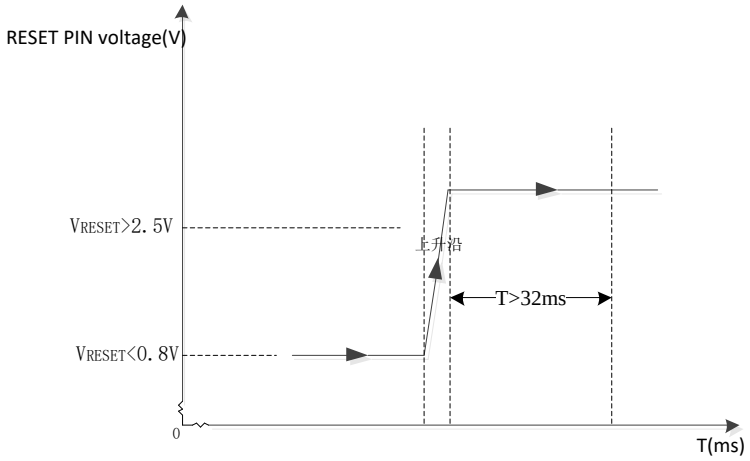



Figure 16 Reset Sequence

## 12.10 VCC

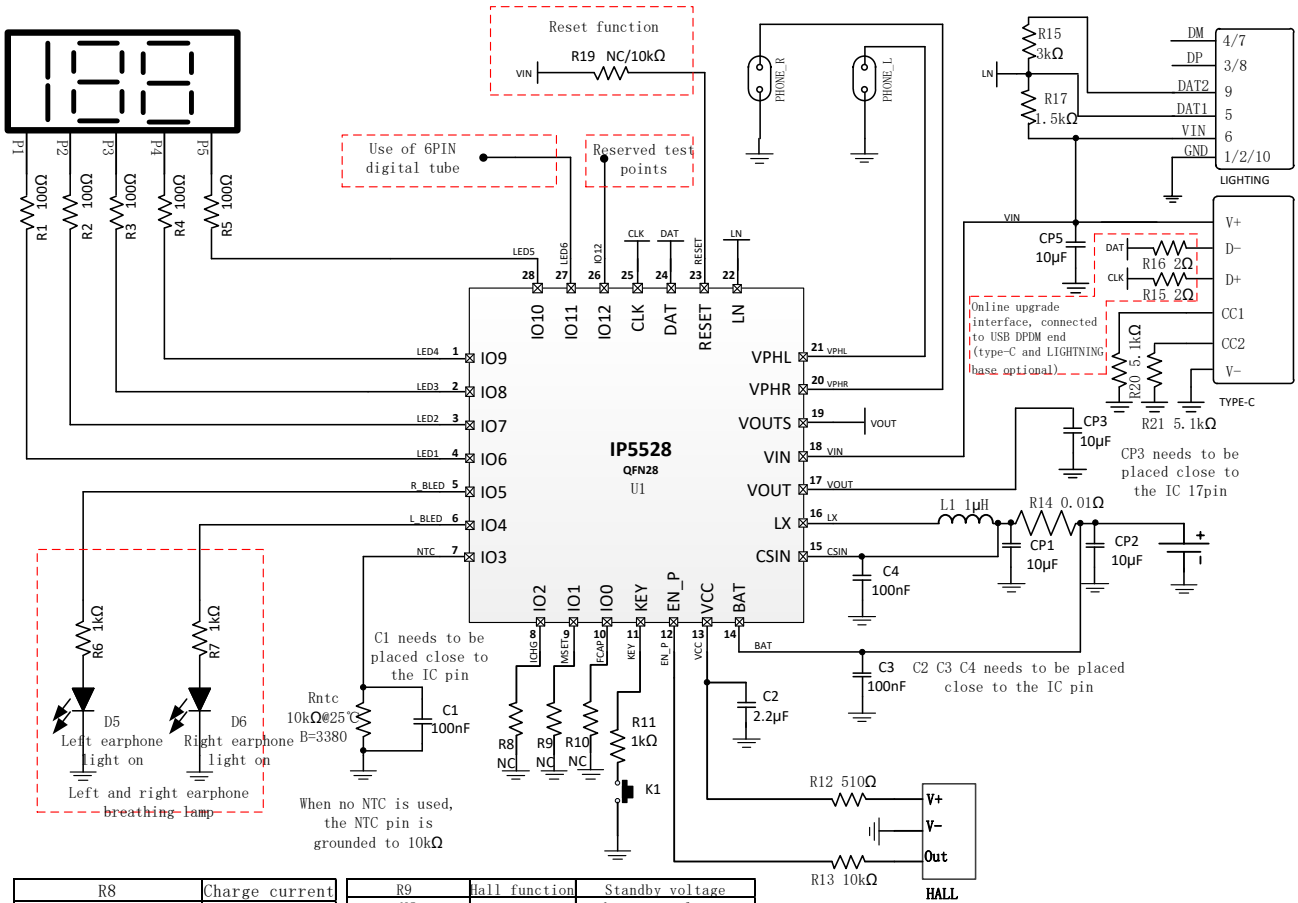
The VCC is an internally integrated 3.1V LDO. Its load capacity is 30mA. A 2.2uf capacitor needs to be connected in parallel between VCC and GND.

# 13 Typical Application Diagram

IP5528 only needs inductors, capacitors and resistors to realize the complete scheme of mobile power supply.

## 13.1 188 digital tube typical application diagram



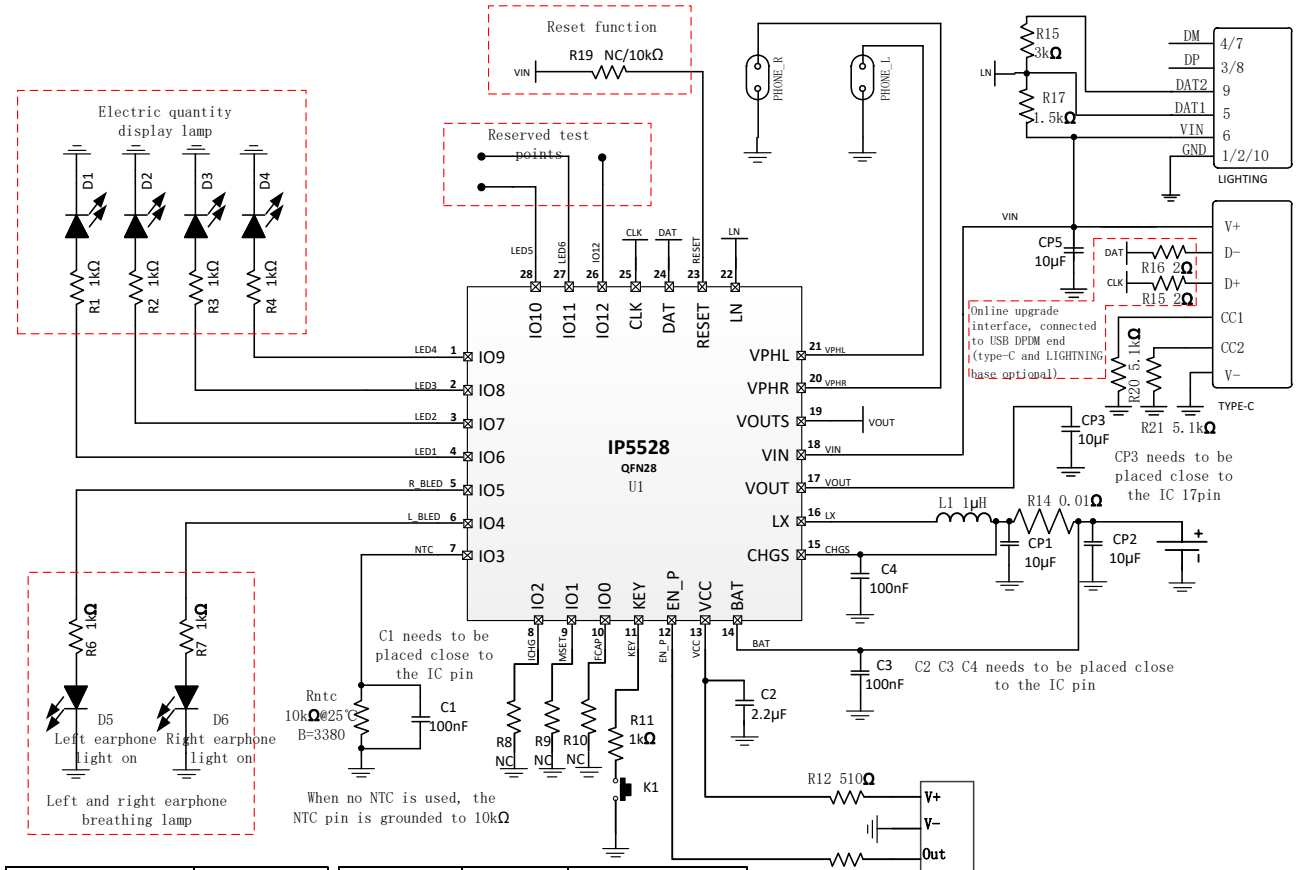

| R8 | Charge current |
|---|---|
| NC | 800mA |
| 10kΩ | 300mA |
| 20kΩ | 400mA |
| 33kΩ | 500mA |
| 43kΩ | 600mA |
| 56kΩ | 700mA |
| 68kΩ | 900mA |
| 82kΩ | 1A |

| R9 | Hall function | Standby voltage |
|---|---|---|
| NC | not support | battery voltage |
| 10kΩ | not support | 5V |
| 33kΩ | Turn off cover low | Turn off the standby battery voltage Open cover standby 0V |
| 82kΩ | Open cover high level | Close cover standby 5V Open cover standby 0V |

| R10 | battery capacity |
|---|---|
| NC | 600mAH |
| 10kΩ | 500mAH |
| 33kΩ | 400mAH |
| 82kΩ | 300mAH |

Figure 17 IP5528 188 Typical Application Diagram Circuit

## 13.2 4LED mode typical application diagram




| R8 | Charge current |
|---|---|
| NC | 800mA |
| 10kΩ | 300mA |
| 20kΩ | 400mA |
| 33kΩ | 500mA |
| 43kΩ | 600mA |
| 56kΩ | 700mA |
| 68kΩ | 900mA |
| 82kΩ | 1A |

| R9 | Hall function | Standby voltage |
|---|---|---|
| NC | not support | battery voltage |
| 10kΩ | not support | 5V |
| 33kΩ | Turn off cover low | Turn off the standby battery voltage<br>Open cover standby 0V |
| 82kΩ | Open cover high level | Close cover standby 5V<br>Open cover standby 0V |

| R10 | battery capacity |
|---|---|
| NC | 600mAH |
| 10kΩ | 500mAH |
| 33kΩ | 400mAH |
| 82kΩ | 300mAH |

Figure 18 IP5528 LED Typical Application Diagram Circuit

Table 10 Device Parameter Requirements

| Device | Location | Parameter |
|---|---|---|
| CP5 | VIN capacitance | 10uF/±10%, withstanding voltage >15V |
| Other capacitance | Other capacitance | precision±10%, withstanding voltage≥10V |
| L1 | Inductance | 1uH/±20%<br>DCR<50mΩ@ICHG=1A<br>DCR<100mΩ@ICHG=0.5A<br>Saturation current >5A@ICHG=1A<br>Saturation current >2.5A@ICHG=0.5A |

## 14 PCB LAYOUT

1.VIN capacitor should be placed close to VIN PIN, VOUT capacitor needs to be placed nearby VOUT PIN 17.

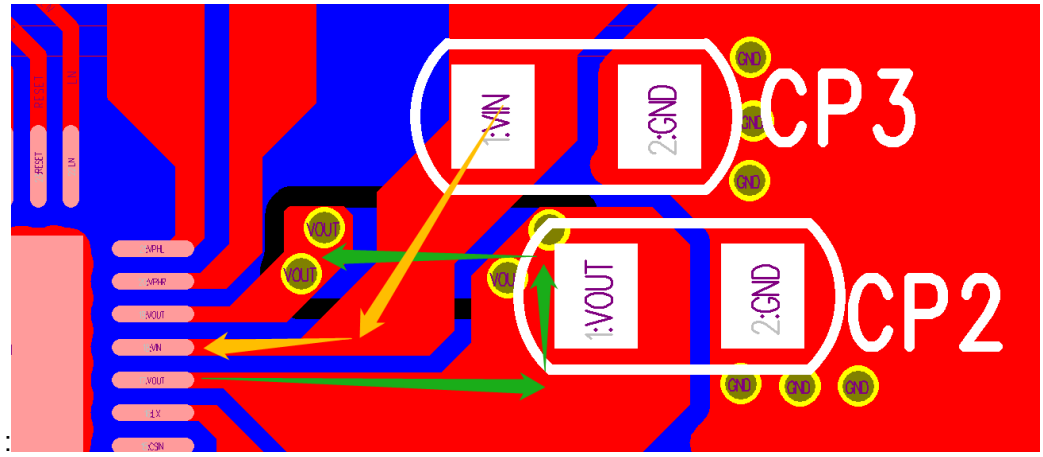



Figure 19 VIN and VOUT Capacitor

2.VCC capacitor placed close to the VCC pin.

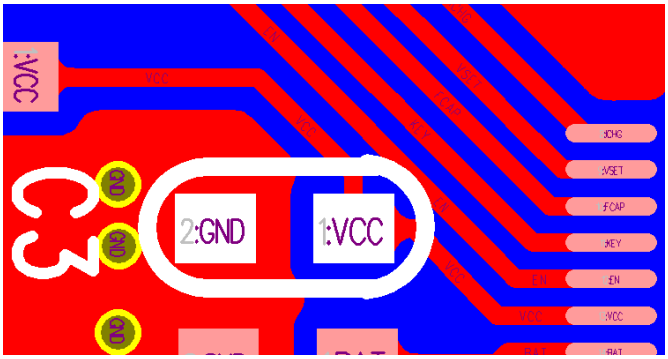



Figure 20 VCC Capacitor

3. It is forbidden to layout any other networks wire under the 5528 chip. Only GND vias need to be drilled under the EPAD。

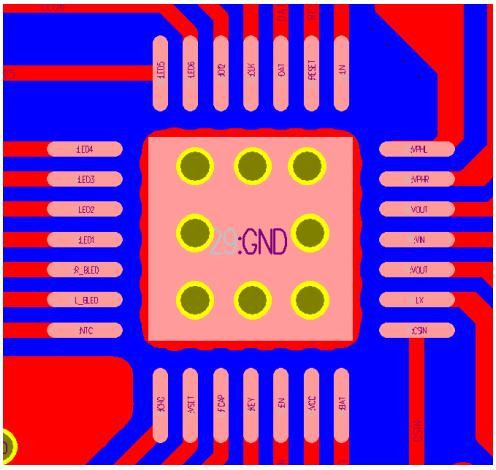



Figure 21 EPAD Holes

4.CSIN and BAT pins are the signals for differential current sampling, so they need to be separately

routed to the inner ends of the 10mΩ resistance. These wires should be as short as possible and in the differential form to reduce the introduction of PCB impedance. Two 100nF capacitors are placed nearby the CSIN/BAT pins.

The lead to the CSIN PIN shall be specially at least 30mil width and shall not overlap with the power path to one end of the inductor.

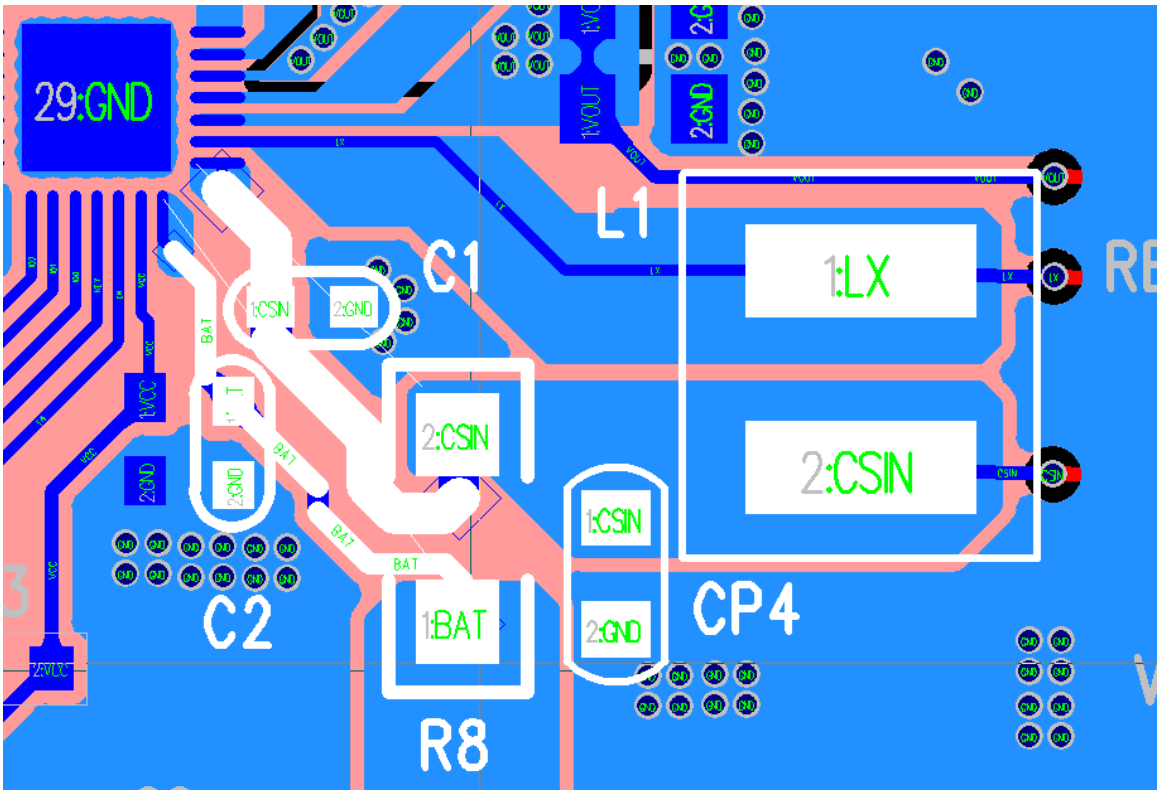



Figure 22 CSIN and BAT lines

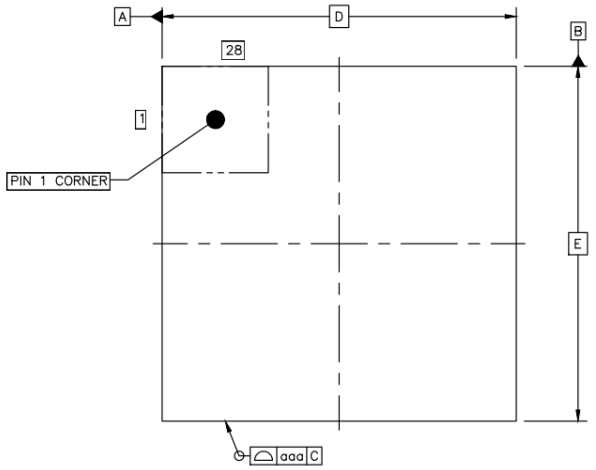
## 15 IC Mark Description


NOTE:

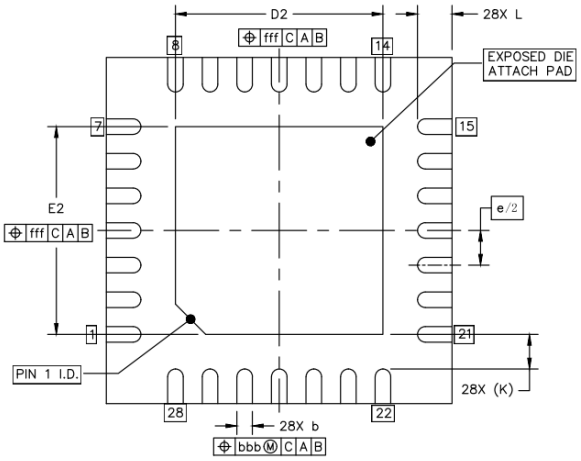
| | | |
|---|---|---|
| 1、 | | --Injoinic Logo |
| 2、 | IP5528 | --Part Number |
| 3、 | XXXXXXXX | --Manufacture Number |
| 4、 | ○ | --PIN1 location |

Figure 23 IP5528 Mark Description

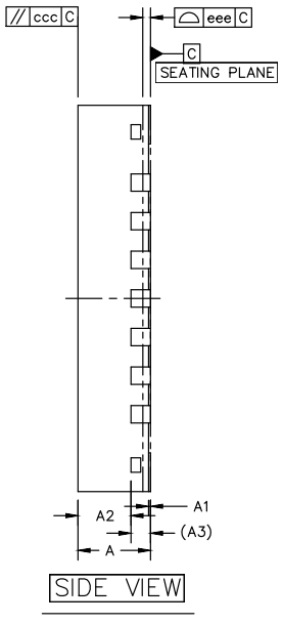
## 16 Package




TOP VIEW




BOTTOM VIEW




SIDE VIEW

| | | SYMBOL | MIN | NOM | MAX |
|---|---|---|---|---|---|
| TOTAL THICKNESS | | A | 0.7 | 0.75 | 0.8 |
| STAND OFF | | A1 | 0 | 0.02 | 0.05 |
| MOLD THICKNESS | | A2 | --- | 0.55 | --- |
| L/F THICKNESS | | A3 | | 0.203 REF | |
| LEAD WIDTH | | b | 0.15 | 0.20 | 0.25 |
| BODY SIZE | X | D | | 4 BSC | |
| | Y | E | | 4 BSC | |
| LEAD PITCH | | e | | 0.4 BSC | |
| EP SIZE | X | D2 | 2.3 | 2.4 | 2.5 |
| | Y | E2 | 2.3 | 2.4 | 2.5 |
| LEAD LENGTH | | L | 0.3 | 0.4 | 0.5 |
| LEAD TIP TO EXPOSED PAD EDGE | | K | | 0.4 REF | |
| PACKAGE EDGE TOLERANCE | | aaa | | 0.1 | |
| MOLD FLATNESS | | ccc | | 0.1 | |
| COPLANARITY | | eee | | 0.08 | |
| LEAD OFFSET | | bbb | | 0.07 | |
| EXPOSED PAD OFFSET | | fff | | 0.1 | |

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