# IP5306

# Fully-Integrated Power Bank System-On-Chip with 2.1A charger, 2.4A discharger

## Features

- **Switch buck charger and boost**
  - ✧ 2.1A Synchronous switching charger and 5V 2.4A boost converter
  - ✧ Boost converter efficiency up to 92%
  - ✧ Switching charger efficiency up to 91%
  - ✧ Integrated power-path management, charging batteries and charging cellphones at the same time
- **Charger**
  - ✧ Adaptive charging current control, excellent adapter compatibility
  - ✧ Support 4.20/4.30/4.35/4.40V batteries
- **State of charge (SOC) indicator**
  - ✧ Integrated LED controller supports 4/3/2/1 LEDs as the SOC indicator
- **Fully featured**
  - ✧ Key ON/OFF
  - ✧ Integrated flashlight controller
  - ✧ Integrated cellphone plug-in and plug-out detector
- **Low power**
  - ✧ Smart load detector, switching to standby mode automatically
  - ✧ <100 µA standby current
- **Ultra simplified BOM**
  - ✧ Integrated power FET, charging/boosting with a single inductor
- **Multiple protections, high reliability**
  - ✧ Output over-current, over-voltage, short-circuit protection
  - ✧ Input over-voltage, over-current, battery over-charge, over-drain, over-current protection
  - ✧ Thermal Shutdown
  - ✧ ESD 4KV

## Applications

- **Power bank, Portable Charger**
- **Mobile Phones, Smart Phones, Handheld Devices, Portable Media Player, Tablet**

## Description

IP5306 is a fully-integrated multi-function power management SoC. It integrates a boost converter, a Li battery charger management system and a battery state of charge indicate controller. It provides a turn-key solution for power bank and portable charger applications.

IP5306's high integration and rich features make the minimized component number in application. It can effectively downsize the application and lower the BOM cost.

IP5306 only needs a single inductor to realize step-down and step-up which provides 2.4A output current. It can switch to standby mode at light load automatically

IP5306's synchronous switching charger provides 2A charging current. Its efficiency is up to 91%. It regulates the charging current by IC temperature and input voltage.。

IP5306 integrates voltage based fuel gauge indication of 1/2/3/4 LEDs and flashlight function.
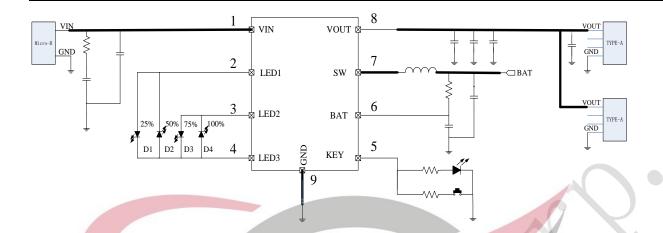
IP5306 is available in ESOP8

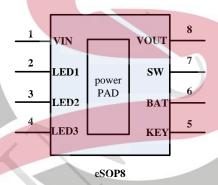图 1 Simplified application schematic (4 LEDs as the SOC indicator)

## Pin Definition



eSOP8

图 2    IP5306 Pin Diagram

| Pin Name | Pin Number | Pin Description |
|----------|-----------|----------------|
| VIN | 1 | Charger 5V input pin |
| LED1 | 2 | Battery indicator pin1 |
| LED2 | 3 | Battery indicator pin2 |
| LED3 | 4 | Battery indicator pin3 |
| KEY | 5 | ON/OFF key input，    multiplex torch lighting driver |
| BAT | 6 | Battery voltage sense pin |
| SW | 7 | DCDC switch node，connect inductor |
| VOUT | 8 | DCDC 5V output pin |
| PowerPAD | | Connect to GND |

## The PartList of PowerBank SoC

| PartNum | charger | Boost | LEDs | Torch | KEY | I2C | DCP | Type-C | Quick Charge | Package |
|---------|---------|-------|------|-------|-----|-----|-----|--------|-------------|---------|
| IP5303 | 1.0A | 1.2A | 1,2 | √ | √ | – | – | – | – | eSOP8 |
| IP5305 | 1.0A | 1.2A | 1,2,3,4 | √ | √ | – | – | – | – | eSOP8 |
| IP5306 | 2.4A | 2.1A | 1,2,3,4 | √ | √ | √ | – | – | – | eSOP8 |
| IP5108 | 2.0A | 2.0A | 3,4,5 | √ | √ | √ | – | – | – | eSOP16 |
| IP5308 | 2.4A | 2.1A | 1,2,3,4 | √ | √ | √ | √ | | | eSOP16 |
| IP5207T | 1.2A | 1.2A | 1,2,3,4 | √ | √ | – | √ | – | – | QFN24 |
| IP5109 | 2.1A | 2.1A | 3,4,5 | √ | √ | √ | – | – | – | QFN24 |
| IP5209 | 2.4A | 2.1A | 3,4,5 | √ | √ | √ | √ | – | – | QFN24 |
| IP5219 | 2.4A | 2.1A | 1,2,3,4 | √ | √ | √ | √ | √ | – | QFN24 |
| IP5312 | 15W | 3.5A | 2,3,4,5 | √ | √ | √ | √ | | √ | QFN32 |
| IP5318Q | 18W | 4.8A | 2,3,4,5 | √ | √ | √ | √ | | √ | QFN40 |
| IP5318 | 18W | 4.8A | 2,3,4,5 | √ | √ | √ | √ | √ | √ | QFN40 |

## Absolute maximum ratings

| Parameter | symbol | value | Unit |
|---|---|---|---|
| Port input voltage range | $V_{IN}$ | -0.3 ~ 6 | **V** |
| Operating free-air temperature range | $T_A$ | 0 ~ 70 | ℃ |
| Junction temperature | $T_J$ | -40 ~ 150 | ℃ |
| Storage temperature | Tstg | -60 ~ 150 | ℃ |
| Thermal resistance (from junction to ambient air) | $\theta_{JA}$ | 40 | ℃/**W** |
| Human-body model (HBM) | ESD | 4 | **KV** |

**\*** Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device.

These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## Recommended operation conditions

| Parameter | symbol | MIN | Typical | MAX | Unit |
|---|---|---|---|---|---|
| Input voltage | $V_{IN}$ | 4.65 | 5 | 5.5 | V |
| Load current | I | 0 | 2.1 | 0 | A |
| Operating ambient temperature | $T_A$ | 0 | -- | 70 | ℃ |

*Beyond these operation conditions, the device's performance will not be guaranteed

## Electrical Characteristics

TA=25℃, L=1uH unless otherwise noted

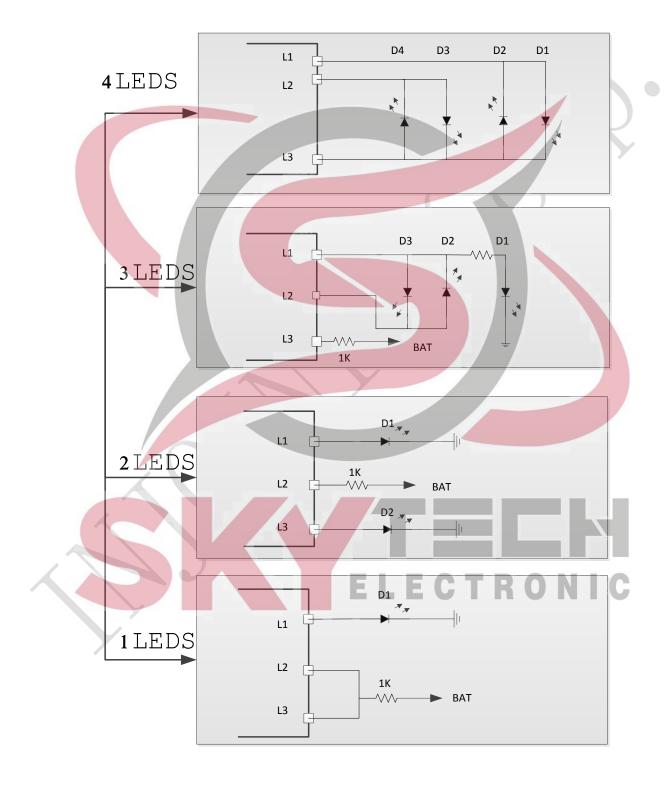| Parameter | symbol | Test condition | MIN | TYP | MAX | Unit |
|---|---|---|---|---|---|---|
| **Charger system** | | | | | | |
| Input voltage | $V_{IN}$ | | 4.65 | 5 | 5.5 | V |
| Target charge voltage | $V_{TRGT}$ | | | 4.2 | | V |
| Charge current | $I_{CHRG}$ | VIN current | | 1.8 | | A |
| charge Switching frequency | $f_s$ | | | 750 | | KHZ |
| Trickle charge current | $I_{TRKL}$ | VIN=5v，BAT=2.7v | | 100 | | mA |
| Trickle charge stop voltage | $V_{TRKL}$ | | | 2.9 | | V |
| Recharge threshold | $V_{RCH}$ | | | 4.1 | | V |
| Charger safety timer | $T_{END}$ | | | 24 | | Hour |
| Input under-voltage protection | $V_{UVLO}$ | Rising voltage | | 4.5 | | V |
| Input under-voltage protection hysteresis | $V_{UVLO}$ | | | 200 | | mV |
| **Boost system** | | | | | | |
| Battery operation voltage | $V_{BAT}$ | | 3.0 | | 4.4 | V |
| Battery operation current | $I_{BAT}$ | VBAT=3.7V，VOUT=5.1V，fs=500KHz | | 3 | | mA |
| | | VIN=5V，Device not switching | | 100 | | uA |
| DC-DC output voltage | $V_{OUT}$ | VBAT=3.7V | | 5.0 | | V |
| Output voltage ripple | $\Delta V_{OUT}$ | VBAT=3.7V，VOUT=5.0V，fs=500KHz | | 50 | | mV |
| Boost output current | $I_{vout}$ | | | 2.4 | | A |
| Load over-current detect timer | $T_{UVD}$ | Output voltage continuously lower than 4.4V | | 30 | | ms |
| Load short-circuit detect timer | $T_{OCD}$ | Output current continuously larger than 4A | 150 | | 200 | us |
| **Control system** | | | | | | |
| Switching frequency | | Switching frequency | | 500 | | KHz |
| PMOS on resistance | $r_{DSON}$ | | | 35 | | mΩ |
| NMOS on resistance | | | | 30 | | mΩ |
| Battery standby current | $I_{STB}$ | VIN=0V，VBAT=3.7V | | 50 | | uA |

| LED lighting current | Ilight | | | 25 | | mA |
|---|---|---|---|---|---|---|
| LED indicator current | $I_{L1}$ $I_{L2}$ $I_{L3}$ | | | 4 | | mA |
| Load removal detect timer | $T_{loadD}$ | Load current continuously lower than 45mA | | 32 | | s |
| Push-button wake-up timer | $T_{OnDebounce}$ | | | 50 | | ms |
| Push-button light-on timer | $T_{Keylight}$ | | | 2 | | s |
| Thermal shutdown | $T_{OTP}$ | Rising temperature | | 125 | | ℃ |
| Thermal shutdown hysteresis | $\Delta T_{OTP}$ | | | 40 | | ℃ |

## State Of Charge (SOC) indication

■ **4 LEDs mode**

Discharging mode, 4 LEDs as the indicator

| SOC（%） | L1 | L2 | L3 | L4 |
|---|---|---|---|---|
| SOC≥75% | ON | ON | ON | ON |
| 50%≤SOC＜75% | ON | ON | ON | OFF |
| 25%≤SOC＜50% | ON | ON | OFF | OFF |
| 3%≤SOC＜25% | ON | OFF | OFF | OFF |
| 0%＜SOC＜3% | 1.5Hz blink | OFF | OFF | OFF |
| SOC=0% | OFF | OFF | OFF | OFF |

Charging mode 4 LEDs as the indicator

| SOC（%） | L1 | L2 | L3 | L4 |
|---|---|---|---|---|
| Full | ON | ON | ON | ON |
| 75%≤SOC | ON | ON | ON | 0.5Hz blink |
| 50%≤SOC＜75% | ON | ON | 0.5Hz blink | OFF |
| 25%≤SOC＜50% | ON | 0.5Hz blink | OFF | OFF |
| SOC＜25% | 0.5Hz blink | OFF | OFF | OFF |

■ **3 LEDs mode**

The displays of 3 LEDs is similar to that of 4 LEDs. The corresponding SOC of each LED is presented in the following table.

| | D1 | D2 | D3 | D4 | D5 |
|---|---|---|---|---|---|
| 3 LEDs | 33% | 66% | 100% | NA | NA |
| 4 LEDs | 25% | 50% | 75% | 100% | NA |

■ **2 LEDs Mode**

| | state | LED1 | LED2 |
|---|---|---|---|
| Charging | In charging | Blink | OFF |
| | End of Charge | ON | OFF |
| Boost | In discharging | OFF | ON |
| | Low Battery | OFF | Blink |

■ **1 LED Mode**

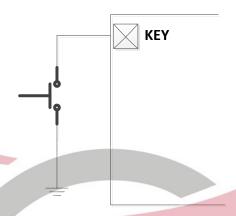| | 状态 | LED1 |
|---|---|---|
| Charging | In charging | Blink |
| | End of Charge | ON |
| Boost | In discharging | ON |
| | Low Battery | Blink |

Push Button



Figure 1 KEY button

Push button's connecting is shown in Fig 5. IP5306 can identify long push and short push.

- If button is pushed longer than 30ms but shorter than 2s, IP5306 will identify the action as short push. Short push will open SOC indicator LEDs and step-up converter
- If button is pushed longer than 2s, IP5306 will identify the action as long push. Long push will close step-up convertor, SOC indicator LED and flashlight LED.
- If button is pushed shorter than 30ms, IP5306 will ignore the action.
- If two short push is detected within 1s, IP5306 will open or close flashlight LED

## Typical Application Schematic

IP5306 only needs capacitors, resistors, and inductors to realize a full featured power bank solution.
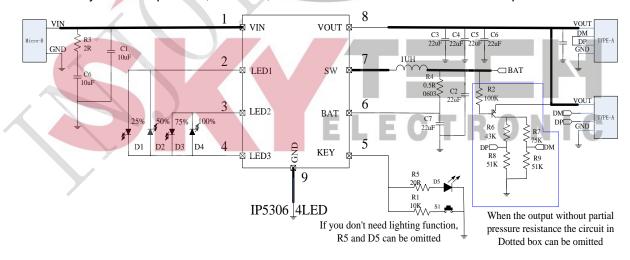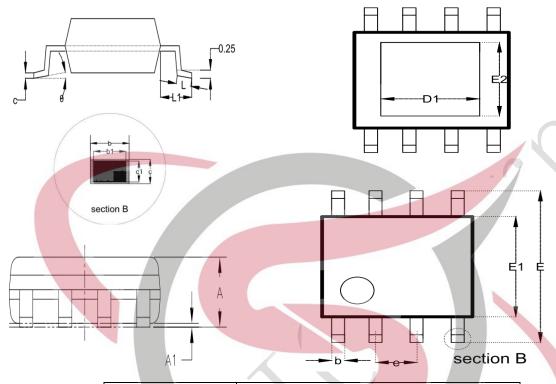


图 7    4 LEDs SOC indicator typical application schematic

## Package information

| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | **MIN** | **NOM** | **MAX** |
| A | -- | -- | 1.65 |
| A1 | 0.05 | -- | 0.15 |
| A | 1.30 | 1.40 | 1.50 |
| A3 | 0.60 | 0.65 | 0.70 |
| b | 0.39 | -- | 0.48 |
| b1 | 0.38 | 0.41 | 0.43 |
| c | 0.21 | -- | 0.25 |
| c1 | 0.19 | 0.20 | 0.21 |
| D | 4.70 | 4.90 | 5.10 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.70 | 3.90 | 4.10 |
| e | 1.27BSC | | |
| h | 0.25 | -- | 0.50 |
| L | 0.50 | 0.60 | 0.80 |
| L1 | 1.05BSC | | |
| θ | 0 | -- | 8º |
| D1 | -- | 3.10 | -- |
| E2 | -- | 2.21 | -- |

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