2.1A Charge 2.4A Discharge Integrated TYPE_C Protocol Mobile Power SOC

1 characteristics

- Synchronous switch charging and discharging
  - ✧ 2.4A Synchronous Boost Conversion, 2.1A Synchronous Switching Charge
  - ✧ Boost efficiency of up to 93%
  - ✧ Charging efficiency of up to 92%
  - ✧ Built-in power path management, supports charging and discharging at the same time
- recharge batteries
  - ✧ Automatically adjusts input current to match adapter output capability
  - ✧ 2.1 A charge.
  - ✧ Supports 4.20V, 4.35V and 4.4V batteries
  - ✧ Supports battery temperature NTC comparison
- battery level indicator
  - ✧ Supports 4 / 3 / 2 / 1 LED power display
  - ✧ Battery power curve can be set for a more even display light
- Feature-rich
  - ✧ Automatic detection of phone insertion and removal
  - ✧ Integrated TYPE-C DRP protocol, supports single-port input and output
  - ✧ Support load high current line complement function
- low power
  - ✧ Intelligent load recognition, automatically into standby
  - ✧ Standby power consumption less than 100 μA
- BOM Minimalist
  - ✧ Power MOS built-in, single inductor for charging and discharging
- Multiple protection, high reliability
  - ✧ Output overcurrent, overvoltage and short-circuit protection
  - ✧ Input over-voltage, over-charge, over-discharge and over-current discharge protection
  - ✧ Whole machine over temperature protection, battery temperature NTC protection
  - ✧ ESD 4KV, Instantaneous withstand voltage 11V
- In-depth customization
  - ✧ I2C interface for flexible, low-cost custom solutions

2 application

- Mobile power/rechargeable battery
- Portable devices such as mobile phones and tablets

3 brief introduction

The IP5219 is a multi-functional power management **SOC that** integrates a boost converter, Li-ion battery charge management, battery level indication and **TYPE_C** protocol to provide a complete power solution for mobile power.

The IP5219's high level of integration and rich functionality allows it to be applied with very few peripheral devices and effectively reduces the overall solution size and **BOM** cost.

The IP5219 requires only one inductor for buck and boost functions and can support low-cost inductors and capacitors.

The IP5219's synchronous boost system provides a full **2.4A** output current with conversion efficiency as high as **93%**. At no load, it automatically enters a sleep state and reduces quiescent current to **100uA.**

The IP5219 uses switching charging technology to deliver up to **2.1A** with up to **92%** charging efficiency. The built-in **IC** temperature and input voltage intelligently regulates the charging current.

IP5219 supports custom **I2C** interface to read chip information (custom model **IP5219_I2C)** customizable battery power curve, and accurate battery power display. Support **1/2/3/4 LED** power display and lighting function.

IP5219 in QFN24 package

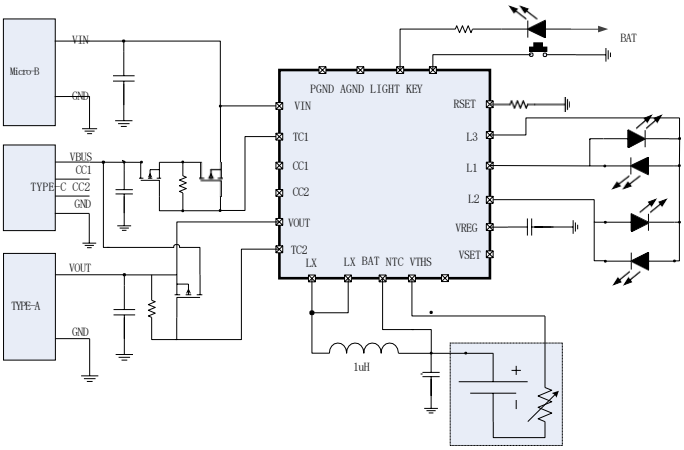


Figure **1** Simplified application schematic **(4 LEDs** indicate power**)**

4 Pin Definitions

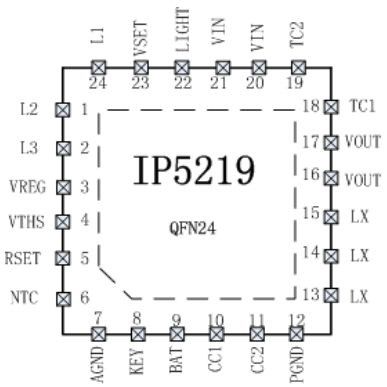


Figure 2IP5219 Pinout Diagram

pins		description
Serial number	name (of a thing)	
1	L2/SDA	Power lamp driver pin L2, SDA for I2C function
2	L3	Power light driver pin L3
3	VREG	Chip 3.1V Voltage Output
4	VTHS	Battery Platform Selection
5	RSET	Battery internal resistance compensation for fine-tuning the power curve
6	NTC	Thermistor detection pins
7	AGND	simulated land
8	KEY	Key Input Pins
9	BAT	IC BAT Power Supply and Cell Voltage Detection Pin
10	CC1	TYPE-C detection pin CC1
11	CC2	TYPE-C detection pin CC2
12	PGND	powerland
13, 14, 15	LX	DCDC Switch node, connection inductor
16, 17	VOUT	5V boost output pin
18	TC1	VBUS charge input PMOS control pin
19	TC2	VBUS Discharge Output PMOS Control Pin
20, 21	VIN	DC5V charge input pin
22	LIGHT	Lighting Driver Pin, Open Drain Output
23	VSET	Battery Type Setting
24	L1/SCK	Power lamp driver pin L1, SCK for I2C function
25 (EPAD)	GND	Power ground and thermal ground, need to keep good connection to GND
		good touch

5 IP Series Mobile Power IC Model Selection Table

IC Model	charge and discharge		Key Features							package	
	discharger	recharge batteries	LEDs lamp count	a light	button or key (on a device)	I2C	DCP	Type-C	QC Certification	specifications	compatible
IP5101	1.0A	1.2A	1,2	-	-	-	-	-	-	eSOP8	
IP5303	1.0A	1.2A	1,2	√	√	-	-	-	-	eSOP8	PIN2PIN
IP5305	1.0A	1.2A	1,2,3,4	√	√	-	-	-	-	eSOP8	
IP5306	2.4A	2.1A	1,2,3,4	√	√	-	-	-	-	eSOP8	
IP5206	2A (Max)	1.5A	3,4,5	√	√	-	-	-	-	eSOP16	PIN2PIN
IP5108E	2.0A	1.0A	3,4,5	√	√	-	-	-	-	eSOP16	
IP5108	2.0A	2.0A	3,4,5	√	√	√	-	-	-	eSOP16	
IP5207	1.2A	1.2A	3,4,5	√	√	-	-	-	-	QFN24	PIN2PIN
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	
IP5318Q	18W	4.8A	2,3,4,5	√	√	√	√		√	QFN40	PIN2PIN
IP5318	18W	4.8A	2,3,4,5	√	√	√	√	√	√	QFN40	

6 Limit parameters

parameters	symbolic	happen to	unit
Port Input Voltage Range	VIN	-0.3 ~ 6	V
Knot temperature range	T_J	-40 ~ 150	℃
Storage temperature range	Tstg	-60 ~ 150	℃
Thermal resistance (junction temperature to ambient)	θJA	40	℃/W
Human Body Model (HBM)	ESD	4	KV

*Stresses above the values listed in the absolute maximum rating section have the potential to cause permanent damage to the device at any absolute maximum rating condition

Any prolonged exposure may affect the reliability and lifetime of the device

7 Recommended working conditions

parameters	symbolic	minimum value	typical value	maximum value	unit
Input Voltage	VIN	4.75	5	5.5	V
Load current	I	0	2.4		A

* Outside these operating conditions, the device operating characteristics are not guaranteed.

8 Electrical Characteristics

TA=25° C, L=1uH unless otherwise stated

parameters	symbolic	Test conditions	minimum happen to	typical happen to	largest happen to	unit
Charging system						
Input Voltage	VIN		4.65	5	5.5	V
Charging target voltage	VTRGT		4.16	4.2	4.24	V

Charging current	ICHRG	BAT end current		2.1	2.4	A
Trickle charge current	ITRKL	VIN=5v, BAT=2.7v		250		mA
Trickle Cutoff Voltage	VTRKL		2.9	3	3.1	V
Recharging Threshold	VRCH		4.08	4.1	4.13	V
Charging Deadline	TEND		20	24	27	Hour
Input undervoltage protection	VUVLO	Rising Voltage	4.4	4.5	4.6	V
Undervoltage protection hysteresis	VUVLO			200		mV
Boosting system						

Battery operating voltage	VBAT		3.0		4.4	V
Switching operating battery input current	IBAT	VBAT=3.7V, VOUT=5.1V, fs=500KHz	2	3	10	mA
		VIN=5V, Device not switching	45	75	100	uA
DC Output Voltage	VOUT	VBAT=3.7V @0A	5.0	5.12	5.25	V
		VBAT=3.7V @2.1A	4.75	5	5.15	V
Output voltage ripple	ΔVOUT	VBAT=3.7V, VOUT=5.0V, fs=500KHz	50	100	150	mV
Boost system supply current	Ivout			2.4		A
Boost system overcurrent shutdown current			2.65	3.05	3.4	A
Load overcurrent detection time	TUVD	Output voltage consistently below 4.4V		30		ms
Load short circuit detection time	TOCD	Output current greater than 3.5 A continuous	150		200	us
control system						
Switching frequency	fs	Discharge switching frequency	450	500	550	KHz
		Charging switching frequency	650	700	750	KHz
PMOS On-resistance	rDSON		30	35	40	mΩ
NMOS On-resistance			25	30	35	mΩ
VREG Output Voltage	VREG	VBAT = 3.5 V		3.1		V
Battery input standby current	ISTB	VIN=0V, VBAT=3.7V	45	75	100	uA
LDO Output Current	ILDO		5	5	10	mA
LED lighting drive current	Ilight		20	30	40	mA
LED display drive current	IL1 IL2 IL3		1	10	20	mA
Automatic load detection time	TloadD	Load current less than 45mA continuous	25	32	44	s
Short key wake-up time	TOnDebounce		30	50	500	ms

Turn on light Time	TKeylight		1.2	2	3	s
Thermal shutdown temperature	TOTP	temperature rise	110	125	140	℃
Thermal shutdown temperature hysteresis	ΔTOTP			40		℃

9 Function Description

boost

The IP5219 integrates a boost DCDC converter with 5V output and 2.4A load capability. Switching frequency 500KHz, 3.7V input, 5V/2A efficiency of 92 %. The built-in soft-start function prevents faults caused by excessive inrush current at start-up, and the integrated output over-current, short-circuit, over-voltage and over-temperature protection functions ensure stable and reliable system operation.

The output current of the boost system is automatically adjusted with temperature to ensure that the IC temperature is below the set temperature.

recharge batteries

IP5219 has a synchronous switch structure constant current, constant voltage lithium battery charger. When the battery voltage is less than 3V, it uses 100mA trickle charging; when the battery voltage is greater than 3V, it enters into constant current charging; when the battery voltage is greater than 4.2V, it enters into constant voltage charging. After charging is completed, if the battery voltage is lower than 4.1V, turn on the battery charging again.

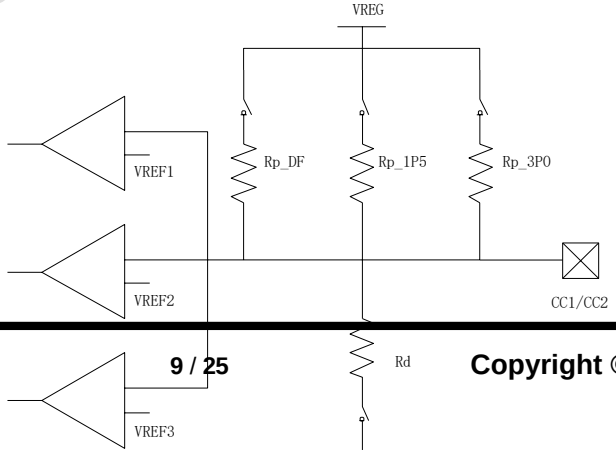
Adaptive power path management to prioritize power to external loads and support charging and discharging at the same time.

The IP5219 charger automatically adjusts the charge current level to accommodate adapters with different load capacities, ensuring no pulling on the adapter.

TYPE-C

IP5219 integrated TYPE-C DRP input and output identification interface, automatic switching of built-in pull-up and pull-down resistors, automatic identification of the charging and discharging properties of the plugged-in device. SRC function, when connected to each other as DRP devices, can give priority to each other for charging.

When operating as a DFP, the external output can be set with three current capability information of Default, 1.5A, and 3A (triple choice 1, default Default); when operating as a UFP, the output current capability of the other party can be recognized.



Pull-up and pull-down resistor values

Resistor Name	resistance value
Rp_DF	33k
Rp_1P5	11k

Rp_3P0	4.2k
Rd	5.1K

Comparator threshold when pull-up resistor Rp is enabled

Table 4-21 CC Voltages on Source Side – Default USB

	Minimum Voltage	Maximum Voltage	Threshold
Powered cable/adapter (vRa)	0.00 V	0.15 V	0.20 V
Sink (vRd)	0.25 V	1.50 V	1.60 V
No connect (vOPEN)	1.65 V		

Table 4-22 CC Voltages on Source Side – 1.5 A @ 5 V

	Minimum Voltage	Maximum Voltage	Threshold
Powered cable/adapter (vRa)	0.00 V	0.35 V	0.40 V
Sink (vRd)	0.45 V	1.50 V	1.60 V
No connect (vOPEN)	1.65 V		

Table 4-23 CC Voltages on Source Side – 3.0 A @ 5 V

	Minimum Voltage	Maximum Voltage	Threshold
Powered cable/adapter (vRa)	0.00 V	0.75 V	0.80 V
Sink (vRd)	0.85 V	2.45 V	2.60 V
No connect (vOPEN)	2.75 V		

Comparator threshold when pull-down resistor Rd is enabled

Table 4-25 Voltage on Sink CC pins (Multiple Source Current Advertisements)

Detection	Min voltage	Max voltage	Threshold
vRa	−0.25 V	0.15 V	0.2 V
vRd-Connect	0.25 V	2.04 V	
vRd-USB	0.25 V	0.61 V	0.66 V
vRd-1.5	0.70 V	1.16 V	1.23 V
vRd-3.0	1.31 V	2.04 V	

TYPE-C Testing Cycle

Figure 4-36 DRP Timing

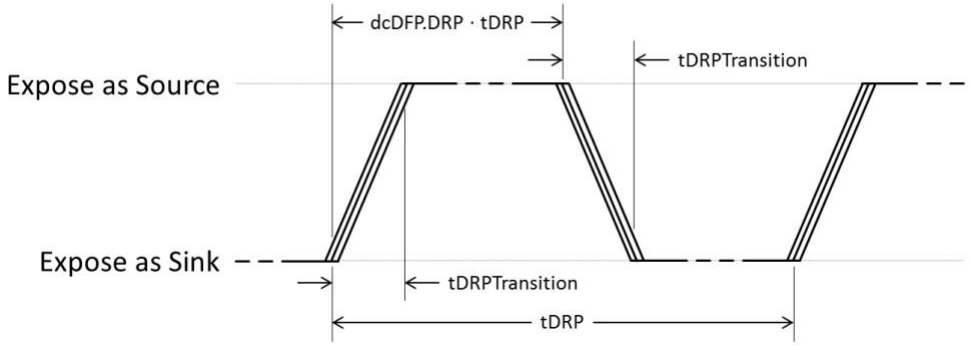
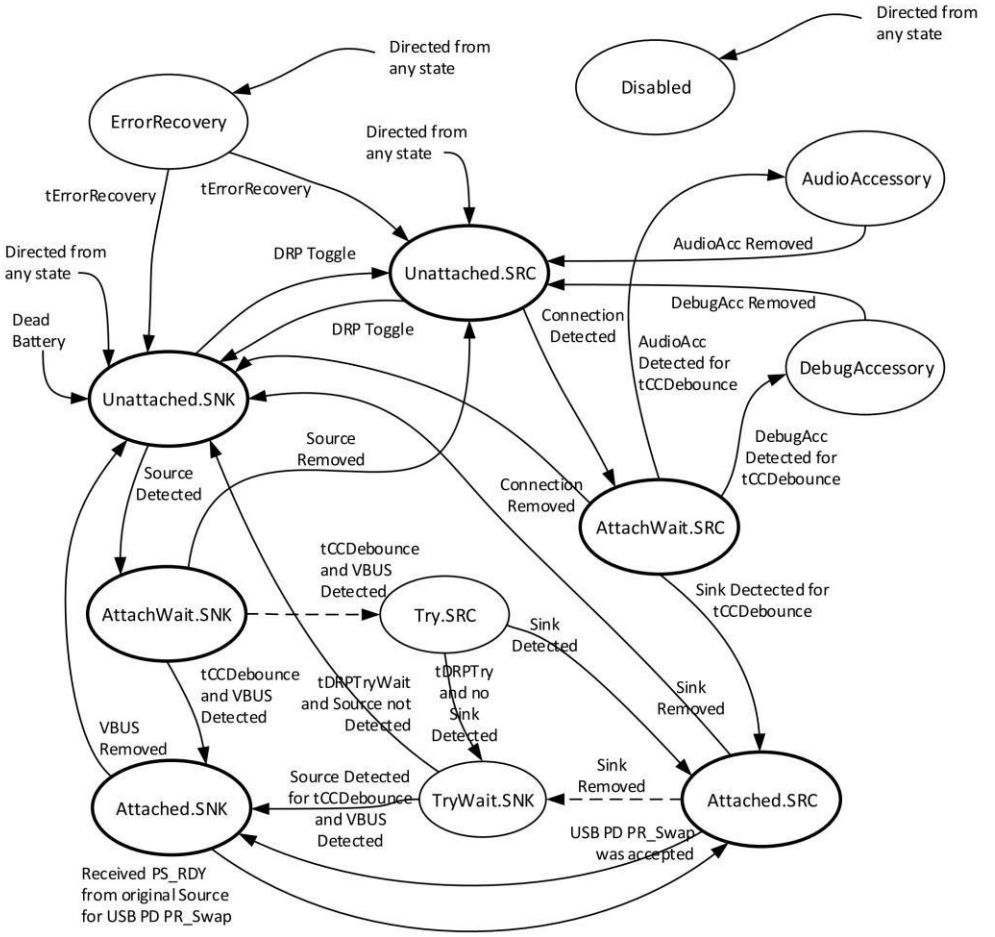


Table 4-19 DRP Timing Parameters

	Minimum	Maximum	Description
tDRP	50 ms	100 ms	The period a DRP shall complete a Source to Sink and back advertisement
dcSRC.DRP	30%	70%	The percent of time that a DRP shall advertise Source during tDRP
tDRPTransition	0 ms	1 ms	The time a DRP shall complete transitions between Source and Sink roles during role resolution
tDRPTry	75 ms	150 ms	Wait time associated with the Try.SRC state.
tDRPTryWait	400 ms	800 ms	Wait time associated with the TryWait.SNK state

TYPE-C Detection Status Conversion

Figure 4-16 Connection State Diagram: DRP with Accessory and Try.SRC Support



button or key (on a device)

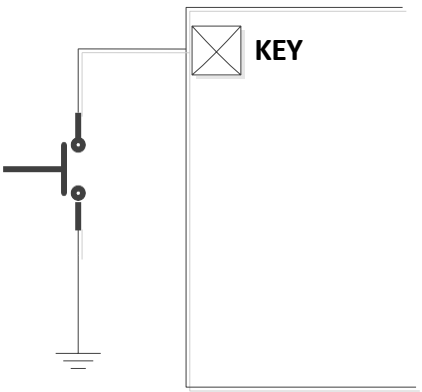
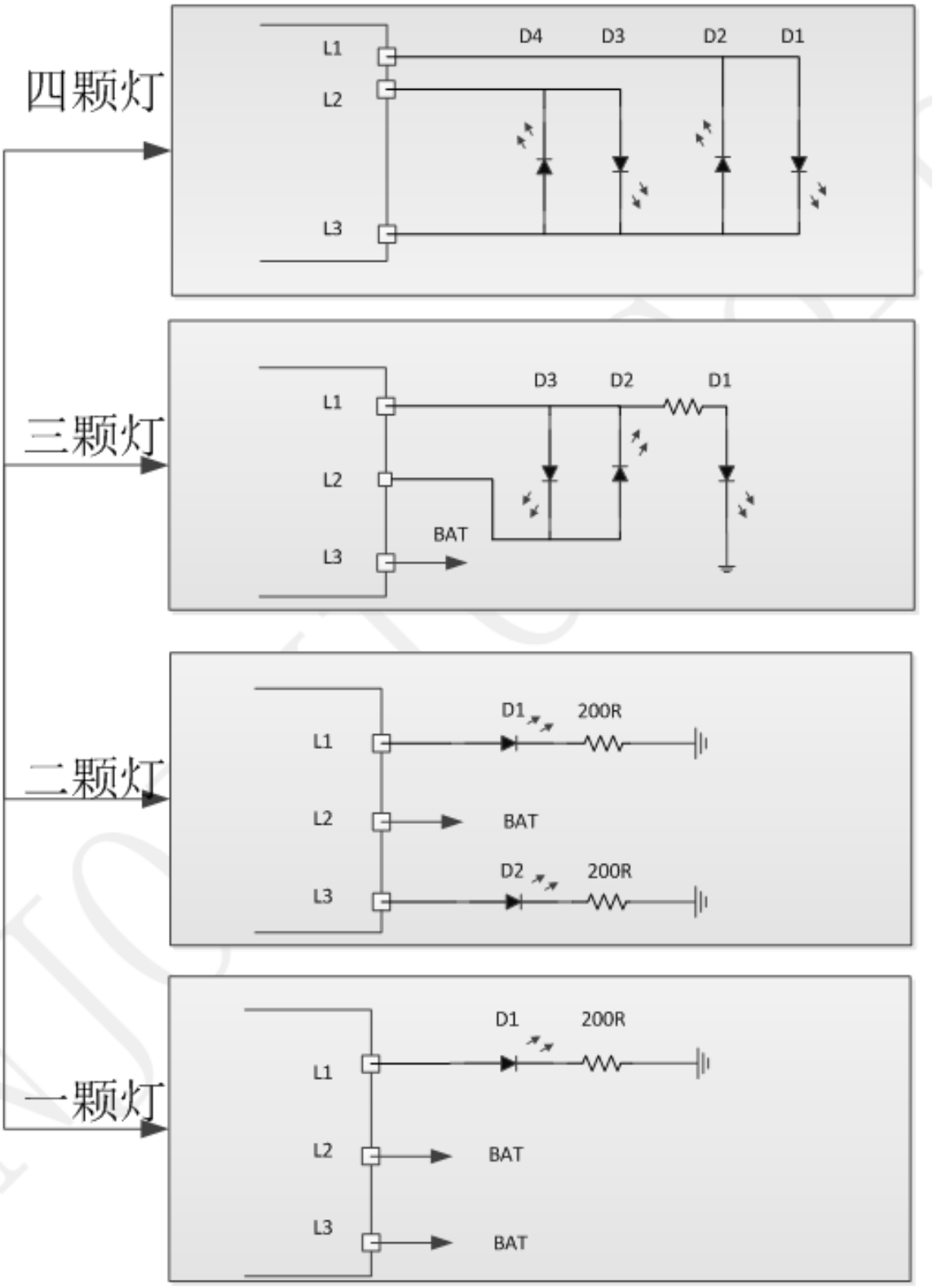


Figure 3 KEY button

The key connections are as shown in Figure 2 and recognize both long and short key operations.

- Pressing a key for longer than 30ms but less than 2s is considered a short press, and a short press will turn on the power display light and boost output.
- Pressing a button for longer than 2s is a long press, which turns the lighting LED on or off.
- Key presses of less than 30ms will not respond.
- Two short key presses in a row within 1s will turn off the boost output, power display and illumination LED. Lamp display mode

Light display mode



■ 4 Light mode

discharger

Electricity C (%)	D1	D2	D3	D4
C≥75%	resonant	resonant	resonant	resonant
50%≤C<75%	resonant	resonant	resonant	go out (of a fire etc)
25% ≤ C < 50%	resonant	resonant	go out (of a fire etc)	go out (of a fire etc)
3% ≤ C < 25%	resonant	go out (of a fire etc)	go out (of a fire etc)	go out (of a fire etc)
0% < C < 3%	1.5Hz Flashing	go out (of a fire etc)	go out (of a fire etc)	go out (of a fire etc)

recharge batteries

Electricity C (%)	D1	D2	D3	D4
brimming with	resonant	resonant	resonant	resonant
75%≤C	resonant	resonant	resonant	0.5Hz Flashing
50%≤C<75%	resonant	resonant	0.5Hz Flashing	go out (of a fire etc)
25% ≤ C < 50%	resonant	0.5Hz Flashing	go out (of a fire etc)	go out (of a fire etc)
C < 25%	0.5Hz Flashing	go out (of a fire etc)	go out (of a fire etc)	go out (of a fire etc)

■ 3 Light mode

The three-light display is similar to the four-light display, and each light corresponds to the battery level in the following table

	D1	D2	D3	D4
Three lights.	3%	66%	100%	not
Four lights	25%	50%	75%	100%

■ 2 Light mode

	statuses	D1	D2
recharge batteries	Charging process	blinking	go out (of a fire etc)
	brimming with	resonant	go out (of a fire etc)
discharger		go out (of a fire etc)	resonant
	low power	go out (of a fire etc)	blinking

■ 1 Light mode

	statuses	D1
recharge batteries	Charging process	blinking
	fill up to the brim	resonant
discharger	Normal discharge	resonant
	low power	blinking

Battery internal resistance setting

The IP5219 can adjust the uniformity of the LED power display by setting the internal battery resistance via the RSET pin. The RSET resistor size and the set internal battery resistance are shown in the table below.

RSET end resistance Kohm	Corresponding battery set internal resistance (mOhm)
10K	45
43K	67.5
120K	112.5
200K	90
NC	22.5

Automatic phone insertion detection

The IP5219 automatically detects when the phone is plugged in, instantly wakes up from standby and turns on the 5V boost to charge the phone, eliminating the need for button operation and supporting a buttonless mold solution.

Battery Type Selection

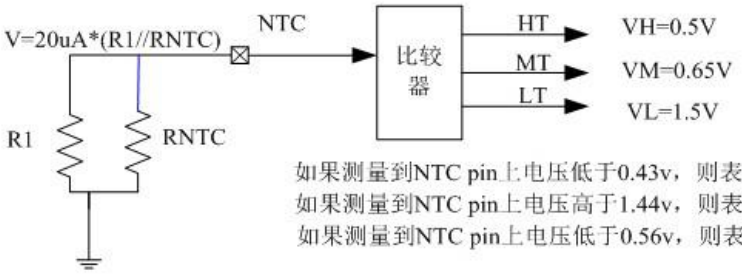
The IP5219 can set the battery type via the VSET pin. When VSET is left open, it is set to 4.2V battery; when VSET is connected to GND, it is set to 4.35V battery; when VSET is connected to BAT, it is set to 4.4V battery.

Battery Platform Selection

The IP5219 can set the battery platform via the VTHS pin. When VTHS is connected to VREG, it is set to the high platform 3.7V battery; when VSET is connected to GND, it is set to the low platform 3.6V battery.

NTC Functionality

The IP5219 has an integrated NTC function to detect the battery temperature; the IP5219 outputs 20uA of current at the NTC PIN during operation, and detects the voltage



at the NTC PIN pin to determine the current battery temperature.

Figure 4 Battery NTC Comparison

When the NTC detects a temperature in the range of -10 to 45 degrees Celsius, it charges and discharges normally. When the temperature is higher than 45 degrees, the charging current is reduced by half, when the temperature is higher than 55 degrees, the charging and discharging is stopped, when the temperature is lower than -10 degrees, the charging and discharging is stopped.

If the solution does not require NTC, the NTC pin must be connected to GND, The NTC pin should not be floating, otherwise it may cause abnormal charging and discharging.

LIGHT Lighting

IP5219 built-in MOS tube, LIGHT PIN can directly drive the lighting LED, the maximum driving current 100mA. when long press KEY key more than 2s, can turn on or off the LED lighting. When the LIGHT function is not needed, connect the LIGHT to GND, IP5219 will automatically detect that there is no LIGHT lighting function.

VREG

VREG is a 3.1V LDO, IC operating state VREG output 3.1V Sleep state no output, load capability 5mA.

10 Typical Application Schematic

The IP5219 requires only inductors, capacitors, and resistors to achieve a fully functional mobile power solution.

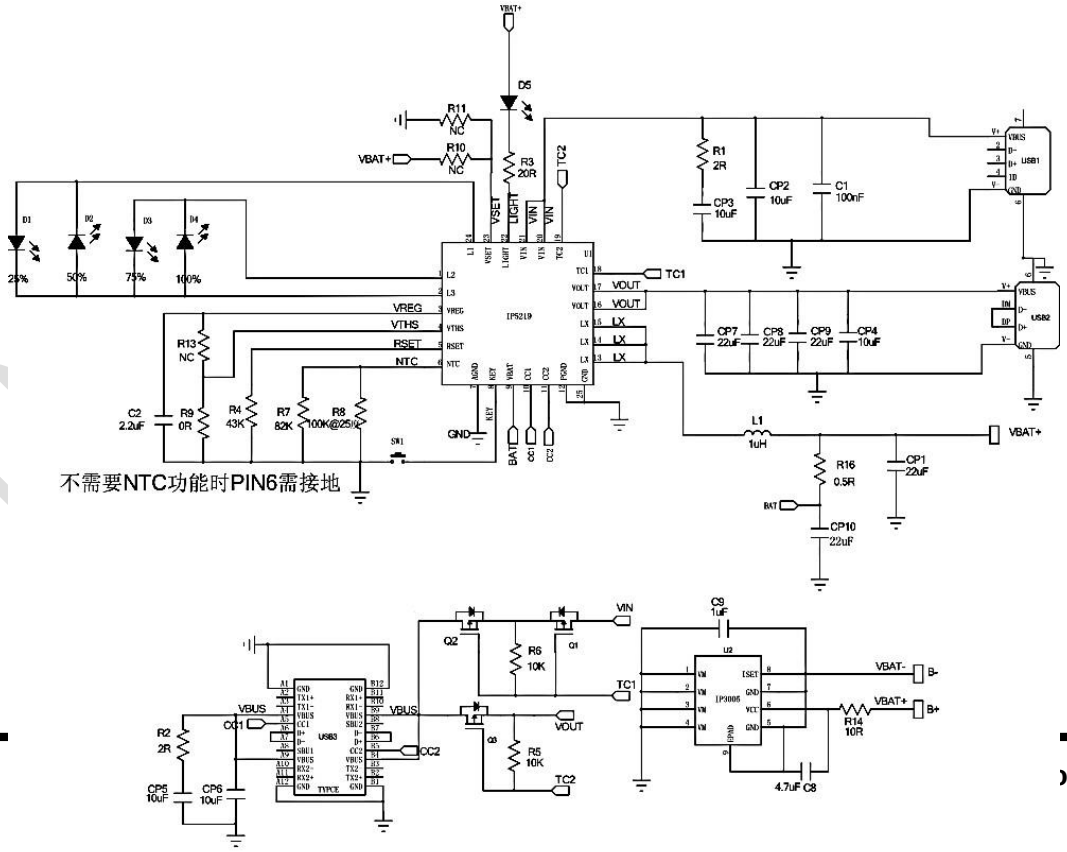


Figure 7 4LED Power Display Typical Application Schematic

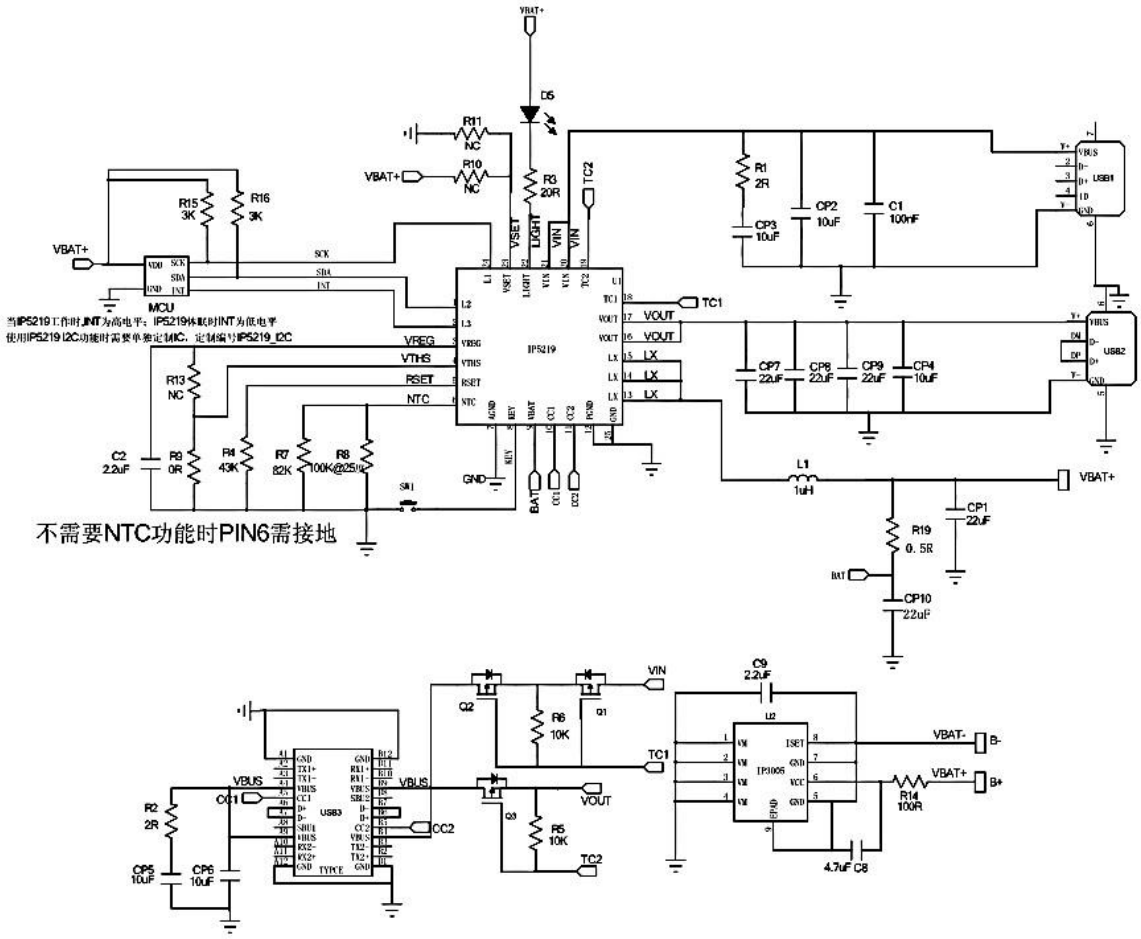


Figure 8 I2C Typical Application Schematic

Inductor Recommended Models

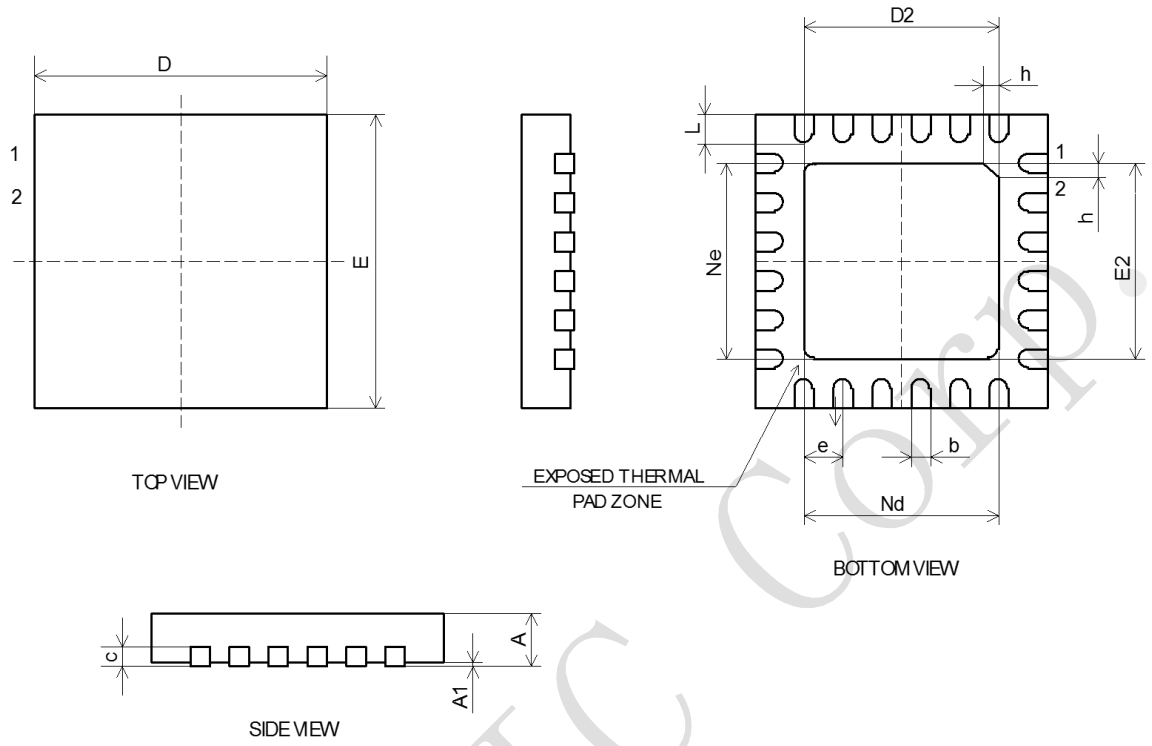
SPM70701R0

DARFON PIN	Inductance (uH)	Tolerance	DC Resistance (mΩ)		Heat Rating Current DC Amp.	Saturation Current DC Amps.	Measuring Condition
			Typ.	Max.	Idc(A)Max.	Isat(A)Max.	
SPM70701R0	1.0	± 20%	8.5	8	12	15	

Lithium IC Recommended Models

INJOINIC	Pack age	Overcharge Detection Voltage [VCU] (V)	Overdischarge Detection Voltage [VDL] (V)	Overcurrent Detection Current [IOV] (A)
IP3005A	ESOP8	4.28V	2.5V	7A

11 Package Information



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	-	0.02	0.05
b	0.18	0.25	0.30
c	0.18	0.20	0.25
D	3.90	4.00	4.10
D2	2.40	2.50	2.60
e	0.50BSC		
Ne	2.50 BSC		
Nd	2.50 BSC		
E	3.90	4.00	4.10
E2	2.40	2.50	2.60
L	0.35	0.40	0.45
h	0.30	0.35	0.40

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