IP5568

Support wireless charging TX/RX 、SCP、VOOC、Bi-directional PD3.0 and Fast Charge protocol Power Bank SOC

Features

- **Support multiple ports +wirelss charging simultaneously**
  - ✧ 2USB A output ports，1 USB B input port
  - ✧ 1 USB C input/output port，wireless charging TX/RX
- **5W/10W/15W wireless charging TX/RX**
  - ✧ Compliant with the WPC V1.2.4 specification，support 5w/7.5w/10w/15w TX
  - ✧ Support 5w/10w RX
  - ✧ integrate full bridge driver，integrate voltage/current demodulator
  - ✧ support FOD function
  - ✧ support 1~3 coils
- **Fast charge**
  - ✧ Every port support fast charge
  - ✧ Support QC2.0/QC3.0 output
  - ✧ Support FCP/AFC/SFCP input/output
  - ✧ Support SCP output
  - ✧ Support VOOC output
  - ✧ Support MTK PE1.1&2.0 output
  - ✧ Support USB C DRP input/output
  - ✧ Support 20W PDO customization
    PDO：5V 2.4A、9V 2.22A、12V 1.67A
    PPS 3.3V~11V 2A
  - ✧ Support BC1.2/Apple/Samsung
- **Integrated USB PD2.0/PD3.0 protocol**
  - ✧ Support PD2.0 input/output protocol
  - ✧ Support PD3.0 input/output and PPS output protocol
  - ✧ Support 5V/9V/12V voltage input/output
  - ✧ PPS support 5~11v adjustable voltage with 20mv/step
- **Charger**
  - ✧ Up to 5A charging current at battery port
  - ✧ Adaptive charging current adjustment
  - ✧ Support 4.2v/4.3v/4.35v/4.4v battery
- **Boost**
  - ✧ Output current：
    5V：3.1A   9V：2.0A   12V：1.5A
  - ✧ Support 20W power output capacity
    9V 2.22A   12V1.67A
  - ✧ Up to 95%@5V/2A efficiency with synchronous switching
  - ✧ Support line compensate
- **Battery level display**
  - ✧ Integrated 14bit ADC and coulometer
  - ✧ Support 1/2/4 LED battery level indicator
  - ✧ Support 88/188 nixie tube
  - ✧ Auto recognition of LED number
  - ✧ Adjustable battery level curve
- **Others**

- ✧ Support auto detect of plug in and out
- ✧ Fast charge status indicator
- ✧ Support Battery NTC and wireless charging NTC
- ✧ Enter standby mode automatically in light load
- ✧ Integrated torch-light driver
- **Multiple protection,high reliability**
  - ✧ Inuput overvoltage and undervoltage protection
  - ✧ Output overcurrent,overvoltage and short circuit protection
  - ✧ Battery overcharge,over discharge and overcurrent protection
  - ✧ Over temperature protection
  - ✧ 4KV ESD,Input voltage up to 20v（including CC pins）
- **Low BOM cost**
  - ✧ Integrated switch power MOSFET
  - ✧ Single inductor for charging and discharging
- **Package size：8mm × 8mm 0.4pitch QFN64**

Description

IP5568 is a power management SOC. It integrates wireless charging TX / Rx, qc2.0 / qc3.0 / SCP / vooc output fast charging protocol, FCP / AFC / SFCP input and output fast charging protocol, MTK PE + 1.1 & 2.0 output fast charging protocol, USB C / pd2.0 / pd3.0 input and output protocol, USB C pd3.0 PPS output protocol, and bc1.2 / apple / Samsung mobile phone charging protocol. It integrates the functions of synchronous up / down converter, lithium battery charging management, battery power indication, etc. to provide a complete power solution for fast charging mobile power bank. Two USB A ports, one USB B port and one USB C port can be connected at the same time,any single USB port can support fast charging. When two or more output ports are used at the same time, only 5V is supported. IP5568 supports wireless charging and simultaneous use of USB port, which only supports 5V.

Only one inductor is needed to realize the function of buck and boost, and only a few peripheral devices are needed in the application, which effectively reduces the size of the overall PCB and reduces the cost of BOM.

The synchronous switch boost system of IP5568 can provide the maximum output capacity of 22.5W, which can maintain the efficiency of more than 90% even when the battery voltage is low.

IP5568 charger provides charging current up to 5.0A. Built in IC temperature, battery temperature and input voltage control loop, intelligent regulation of charging current.

IP5568 integrates a 14bit ADC, which can accurately measure battery voltage and current. The algorithm of remaining battery capacity of IP5568 can accurately obtain battery level information. The battery level curve can be customized to accurately display the remaining battery capacity.

IP5568 supports 1 / 2 / 4 LED battery level indicator, and 88/188 digital tube battery level indicator. IP5568 supports lighting function and supports buttons.

Applications

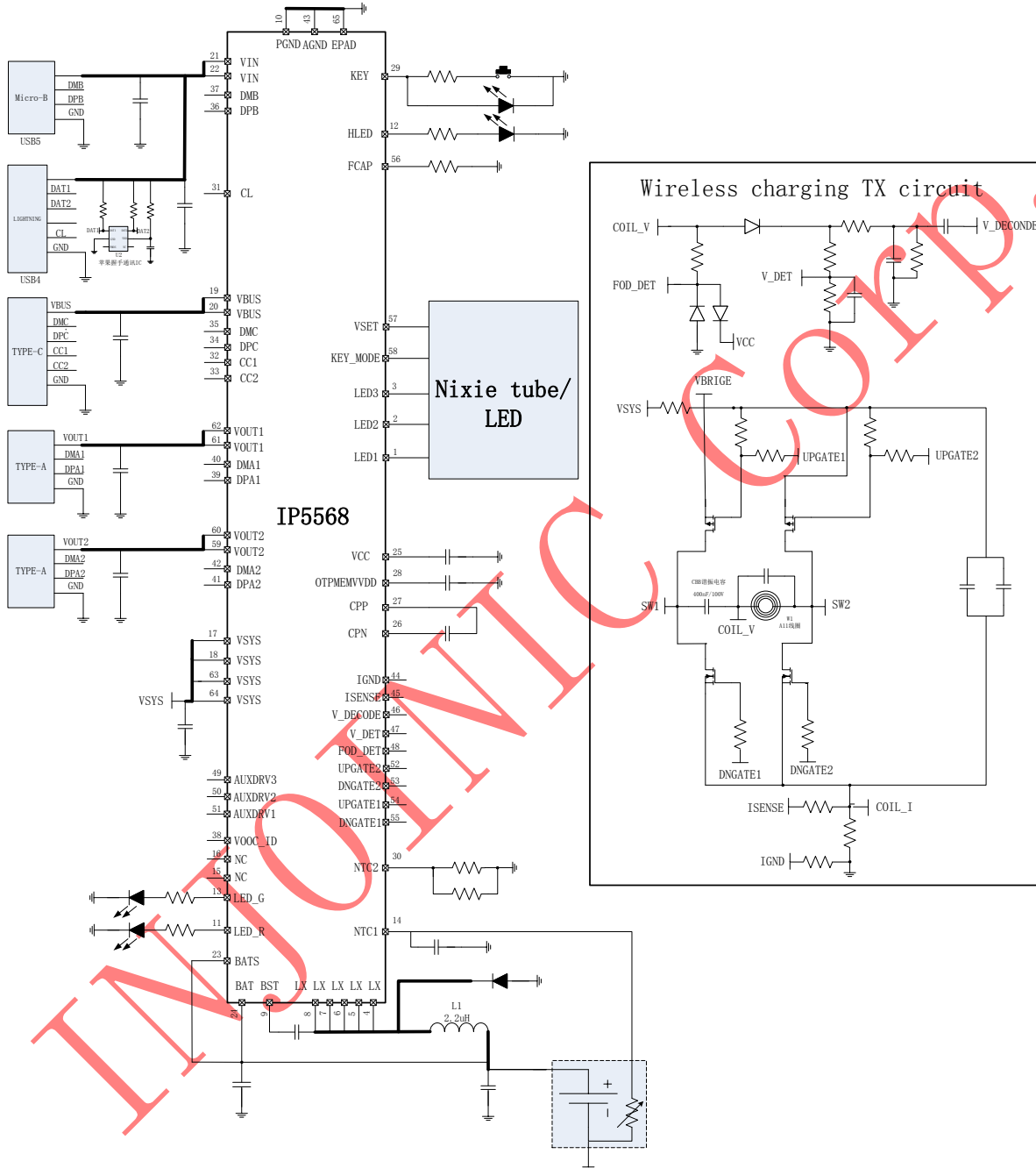- **Power bank with wireless charging**

Typical Application

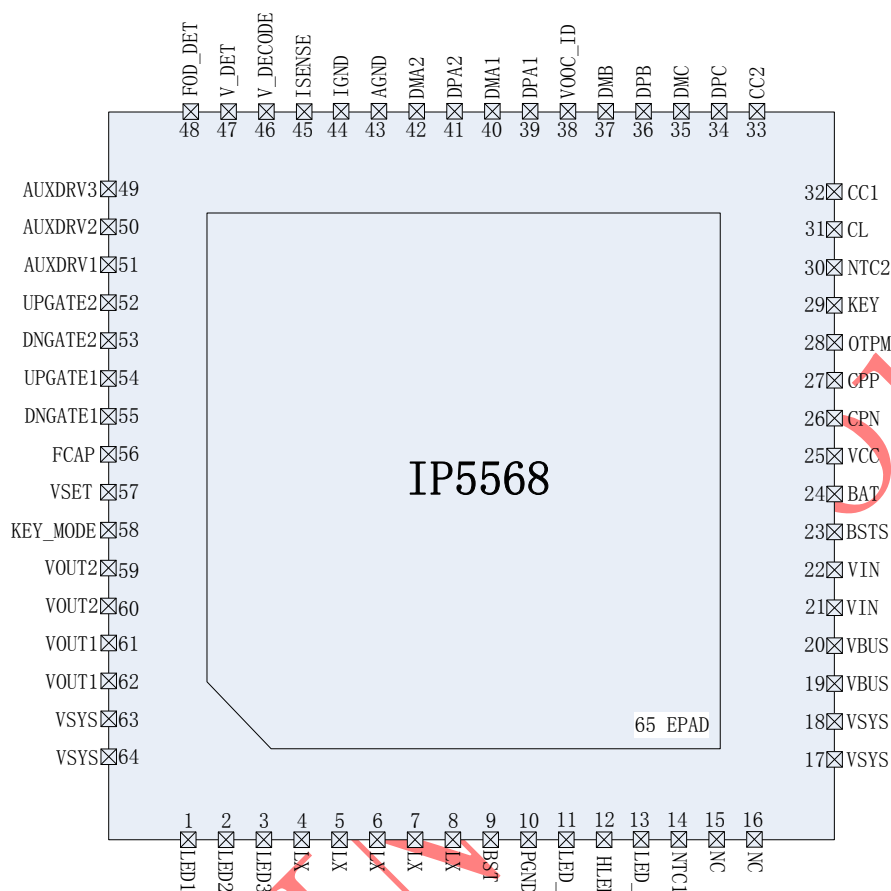图 1 **Simplified Application Diagram**

1. Pin Definition

Figure 2　IP5568 Pin Assignments

Pin Num	Pin Name	PIN 定义说明
1	LED1	Battery level display drive pin LED1
2	LED2	Battery level display drive pin LED2
3	LED3	Battery level display drive pin LED3
4、5、6、7、8	LX	DCDC switch node, connect to inductor
9	BST	Internal high voltage drive, serial capacitor to LX
10	PGND	Power Ground
11	LED_R	Wireless charging status indicator driver pin
12	HLED	Fast charge status indicator drive pin
13	LED_G	Wireless charging status indicator driver pin
14	NTC1	NTC1 PIN
15	NC	Not connected

16	NC	Not connected
17、18、63、64	VSYS	Public Node of system power input and output
19、20	VBUS	USB typec port power pin
21、22	VIN	microUSB power pin
23	BATS	Battery voltage sense pin
24	BAT	Battery supply pin
25	VCC	3.1V Voltage output pin
26	CPN	Internal chargepump flying capacitor connection pin
27	CPP	Internal chargepump flying capacitor connection pin，Connect 0.1uF capacitor between CPP and CPN
28	OTPMEMVDD	Internal chargepump output pin，connect 2.2uF capacitorto GND
29	KEY	Key detect pin, reused as WLED torch light function.
30	NTC2	NTC2 PIN
31	CL	CC signal of lightning input port, connecting the 8th pin of Apple lightning input port
32	CC1	USB typec cc1 pin
33	CC2	USB typec cc2 pin
34	DPC	USB typec port DP pin
35	DMC	USB typec port DM pin
36	DPB	MICRO USB port DP pin
37	DMB	MICRO USB port DM pin
38	VOOC_ID	VOOC ID pin
39	DPA1	VOUT1 port DP pin
40	DMA1	VOUT1 port DM pin
41	DPA2	VOUT2 port DP pin
42	DMA2	VOUT2 port DM pin
43	AGND	Analog ground
44	IGND	Wireless charging Current communication/demodulation sense pin
45	ISENSE	Wireless charging Current communication/demodulation sense pin
46	V_DECODE	Wireless charging voltage communication/demodulation pin
47	V_DET	Wireless charging Coil voltage detect input
48	FOD_DET	Wireless charging FOD detect pin
49	AUXDRV3	Wireless charging multi coil control pin3
50	AUXDRV2	Wireless charging multi coil control pin2
51	AUXDRV1	Wireless charging multi coil control pin1

52	UPGATE2	Wireless charging　　H brige PMOS driver PIN2
53	DNGATE2	Wireless charging　　H brige NMOS driver PIN2
54	UPGATE1	Wireless charging　　H brige PMOS driver PIN1
55	DNGATE1	Wireless charging　　H brige NMOS driver PIN1
56	FCAP	Battery capacity selection, different resistance connection, different battery capacity can be selected
57	VSET	Battery voltage selection, different resistance connection, different charging battery voltage can be selected
58	KEY_MODE	Key function definition pin, connecting different resistances, different key function definitions can be selected.Used as IO driver when making digital tube scheme
59、60	VOUT2	VOUT2 output port power pin
61、62	VOUT1	VOUT1 output port power pin
65(EPAD)	GND	GROUND

2. IP Series Products List

Power Bank IC

IC Part No.	boost/charge		Main feature								Package	
	boost	charge	LED number	light	key	I2C	DCP	USB C	QC Certificate	PD3.0 /PPS	Package	Compatibility
IP5303T	1.0A	1.2A	1,2	√	√	-	-	-	-	-	ESOP8	PIN2PIN
IP5305T	1.0A	1.2A	1,2,3,4	√	√	-	-	-	-	-	ESOP8	
IP5306	2.4A	2.1A	1,2,3,4	√	√	√	-	-	-	-	ESOP8	
IP5406T	2.4A	2.1A	1,2,4	√	√	-	-	-	-	-	ESOP8	
IP5407	2.4A	2.1A	1,2,4	√	√	-	-	-	-	-	ESOP8	
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	
IP5310	3.1A	3.0A	1,2,3,4	√	√	√	√	√	-	-	QFN32	
IP5506	2.4A	2.1A	Nixie Tube	√	√	-	-	-	-	-	ESOP16	
IP5508	2.4A	2.1A	Nixie Tube	√	√	-	√	-	-	-	QFN32	
IP5330	3.1A	3.0A	Nixie Tube	√	√	-	√	√	-	-	QFN32	
IP5322P	18W	4.0A	1,2,3,4	√	√	√	√	-	√	-	QFN32	
IP5332	18W	4.0A	1,2,3,4	√	√	√	√	√	√	√	QFN32	
IP5328P	18W	4.0A	1,2,3,4	√	√	√	√	√	√	√	QFN40	
IP5356	22.5W	5.0A	Nixie Tube	√	√	√	√	√	√	√	QFN40	
IP5358	22.5W	5.0A	Nixie Tube	√	√	-	√	√	√	√	QFN48	
IP5568	22.5W	5.0A	Nixie Tube	√	√	-	√	√	√	√	QFN64	

USB Charging Port Control IC

IC Part No.	Channel	Standards Supported											Package
		BC1.2 & APPLE	QC3.0 & QC2.0	FCP	SCP	AFC	SFCP	MTK PE+ 2.0&1.1	USB C	NTC	QC Certificate	PD3.0	
IP2110	1	√	-	-	-	-	-	-	-	-	-	-	SOT23-5
IP2111	1	√	-	-	-	-	-	-	-	-	-	-	SOT23-6
IP2112	2	√	-	-	-	-	-	-	-	-	-	-	SOT23-6
IP2161	1	√	√	√	-	√	√	-	-	-	√	-	SOT23-6
IP2163	1	√	√	√	-	√	√	√	-	√	√	-	SOP8
IP2701	1	√	√	√	-	√	√	-	√	-	-	-	SOP8
IP2703	1	√	√	√	-	√	√	√	√	√	-	-	DFN10
IP2705	1	√	√	√	-	√	√	√	√	√	-	-	DFN12

IP2707	2	√	√	√	-	√	√	√	√	√	-	-	QFN16
IP2716	1	√	√	√	√	√	-	1.1	√	-	√	√	QFN32

3. Marking described

IP5568
LLLLLLNN

Note:
1、 (i) ——Injoinic Logo
2、IP5568——Part Number
3、LLLLLL——Manufacture lot number
4、 NN ——Internal tracking number
5、 ● ——Pin1 location

4. Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Input Voltage Range	V_{IN}, V_{BUS}	-0.3 ~ 16	**V**
Junction Temperature Range	T_J	-40 ~ 150	℃
Storage Temperature Range	Tstg	-60 ~ 150	℃
Thermal Resistance (Junction to Ambient)	$θ_{JA}$	26	℃/**W**
ESD (Human Body Model)	ESD	4	**KV**

*Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to Absolute Maximum Rated conditions for extended periods may affect device reliability.
*Voltages are referenced to GND unless otherwise noted.

5. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input Voltage	V_{IN}, V_{BUS}	4.5	5/9/12	14	V
Battery Voltage	Vbat	3.0	3.7	4.4	V

*Devices' performance cannot be guaranteed when working beyond those Recommended Operating Conditions.

6. Electrical Characteristics

Unless otherwise specified, TA=25℃，L=2.2uH

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Charging System						
Input voltage	V_{IN} V_{BUS}		4.5	5/9/12	14	V
Input Over Voltage	V_{IN} V_{BUS}		13.5	14.5	15.5	V
Constant Charge Voltage	V_{TRGT}	R_{VSET} = 115K	4.16	4.20	4.24	V
		R_{VSET} = 82K	4.26	4.30	4.34	V
		R_{VSET} = 51K	4.31	4.35	4.39	V
		R_{VSET} = 20K	4.36	4.40	4.44	V
Charge Current	I_{CHRG}	VIN =5V, input current	1.7	2.0	2.3	A
		VBUS =5V, input current	2.3	2.6	2.9	A
		VIN or VBUS >=9V, input current	1.7	2.0	2.3	A
		VIN or VBUS >=12V, input current	1.3	1.5	1.7	A
Trickle Charge Current	I_{TRKL}	VIN=5V，BAT<1.5V	70	120	170	mA
		VIN=5V，1.5V<=BAT<3.0V	100	200	300	mA
Trickle Charge Stop Voltage	V_{TRKL}		2.9	3	3.1	V
Charge Stop Current	I_{STOP}	VIN=5V, battery current	250	400	550	mA
Recharge Voltage Threshold	V_{RCH}		4.05	4.1	4.15	V
Charge Safety Time	T_{END}		20	24	27	Hour
Boost System						
Battery operation voltage	V_{BAT}		3.0		4.5	V
Battery input current	I_{BAT}	VBAT=3.7V ， VSYS=5.1V ， fs=325KHz,Iout=0mA		15		mA
DC output voltage	QC2.0 V_{OUT}	V_{OUT}=5V@1A	4.95	5.12	5.25	V
		V_{OUT}=9V@1A	8.70	9	9.30	V
		V_{OUT}=12V@1A	11.60	12	12.40	V
	QC3.0 V_{OUT}	@1A	4.95		12.25	V

	QC3.0 Step			200		mV
Output voltage ripple	ΔV_{OUT}	VBAT=3.7V，VOUT=5.0V，fs=325KHz		100		mV
		VBAT=3.7V，VOUT=9.0V，fs=325KHz		150		mV
		VBAT=3.7V，VOUT=12V，fs=325KHz		200		mV
Boost output current	I_{out}	V_{OUT}=5V		3.1		A
		V_{OUT}=9V		2.0		A
		V_{OUT}=12V		1.5		A
Boost efficiency	η_{out}	V_{BAT}=3V，V_{OUT}=5V，I_{OUT}=2A		94		%
		V_{BAT}=3V，V_{OUT}=9V，I_{OUT}=2A		92		%
		V_{BAT}=3V，V_{OUT}=12V，I_{OUT}=1.5A		91		%
Boost overcurrent shut down threshold	I_{shut}	VBAT=3.7V，Vout=5V	3.4	3.8	4.2	A
		VBAT=3.7V，Vout=9V	2.1	2.4	2.7	A
		VBAT=3.7V，Vout=12V	1.55	1.7	2.0	A
Output light load shutdown current	I_{LOAD}	VBAT=3.7V	50	80	100	mA
Load overcurrent detect time	T_{UVD}	Duration of output voltage under 4.2V，output voltage setting >=5v		30		ms
Load short circuit detect time	T_{OCD}	Duration of output current above 4.4A，output voltage setting >=5v	150		200	us
Control System						
Switch frequency	fs	Discharge switch frequency	300	325	350	KHz
		Charge switch frequency	450	500	550	KHz
NMOS on resistance	r_{DSON}	Upper NMOS		9	11	mΩ
NMOS on resistance		Lower NMOS		9	11	mΩ
VCC output voltage	V_{CC}	VBAT=3.7V	2.95	3.1	3.25	V
Battery port standby current	I_{STB}	VIN=0V, VBAT=3.7V, average current		80		uA
VCC output current	I_{LDO}	VBAT=3.7V	40	50	80	mA
LED light driving current	I_{WLED}			10	15	20	mA
LED display driving current	I_{LED1} I_{LED2}	Voltage decrease 10%	5	7	9	mA

	I_{LED3}					
Light load shut down detect time	$T1_{load}$	boost Iout current continued lessthan 80mA	25	32	44	s
Output port light load shut down detect time	$T2_{load}$	Vout1/Vout2/VBUS output current continued lessthan 80mA	14	16	18	s
Short press on key wake up time	$T_{OnDebounce}$		60		500	ms
Time of WLED turn on	$T_{Keylight}$	Long press key time	1.2	2	3	s
Thermal shut down temperature	T_{OTP}	Rising temperature	130	140	150	℃
Thermal shut down hysteresis	ΔT_{OTP}			40		℃

7. Function Description

Block diagram
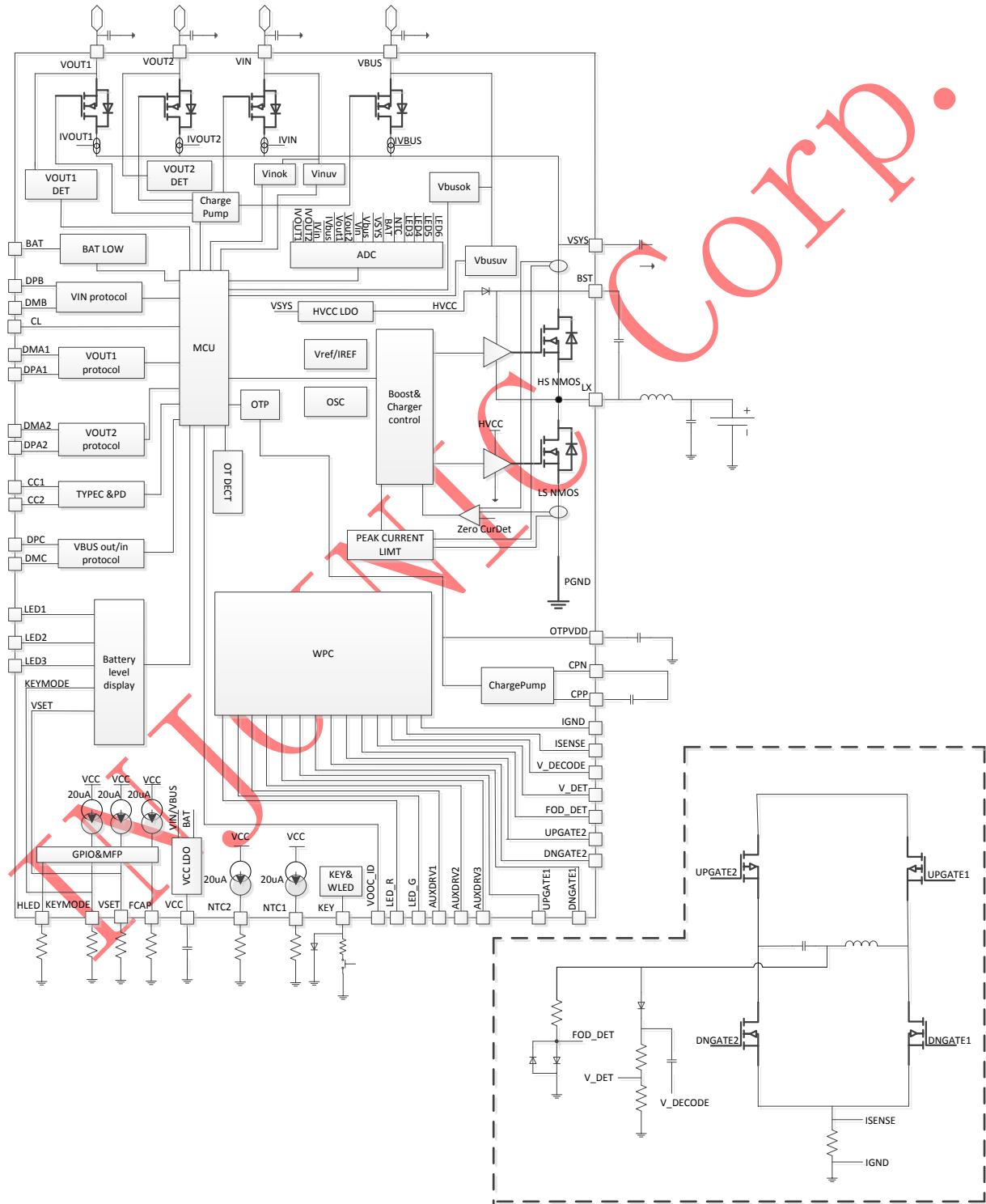
Low power lock out and activation

The first time IP5568 access to the battery, whatever the battery voltage, IC is in lock out state, battery level indicator LED will flash four times, or the digit 0 of the nixie tube flashes 4 times for prompt; Under non-charging state, if the battery voltage is too low to trigger the low power shutdown, IP5568 will enter lock out state too.

In low battery state, to decrease the quiescent power, IP5568 do not support plug in detect function or key press activation function. During which, key press action will not trigger boost output, and battery level indicator LED will flash four times

Under the lock out state, only by entering charging status can activate IP5568 's full function.

Charge

IP5568 integrated a constant current and constant voltage Li battery charging management system with synchronous switch, adaptive to various charging voltage.

When the battery voltage is lower than 3V, trickle charging less than 200mA charging current is applied; when the battery voltage is higher than 3V, enters constant current charging stage, the maximum charging current at battery port is 5.0A; when the battery voltage is near the preset battery voltage, enters constant voltage charging stage; when the charging current is less than 400mA and battery voltage is near the constant voltage charging stage, the charging process is stopped. When the charging stage is accomplished, once the battery voltage falls under 4.1V, battery charging stage will be restarted.

IP5568 adopted switch charging technology, switch frequency is 500kHz. During 5V input voltage, maximum input power is 10W; During the fast charging state, maximum input power is 18W. The highest charging current is up to 5.0A, charging efficiency can be up to 94%, such can reduce 3/4 charging time.

IP5568 will adjust charge current automatically applicable to adaptors with different load capacity.

IP5568 supports charging the battery and phone at the same time,output voltage is 5v.

Boost

IP5568 Integrated a synchronized switch converter which supports high voltage output, providing 5V~12V output voltage output, load capacity can be: 5V/3.1A, 7V/2.4A,9V/2.0A and 12V/1.5A. 325kHz switching frequency. Internal soft start function. In avoid of large rush current causing device failure at start up stage, built-in overcurrent, short circuit, overvoltage and over temperature protection function, make insurance of the stability and reliability of power system.

Boost system output current can be auto-modulated according to the temperature, ensuring the IC is under the preset temperature.
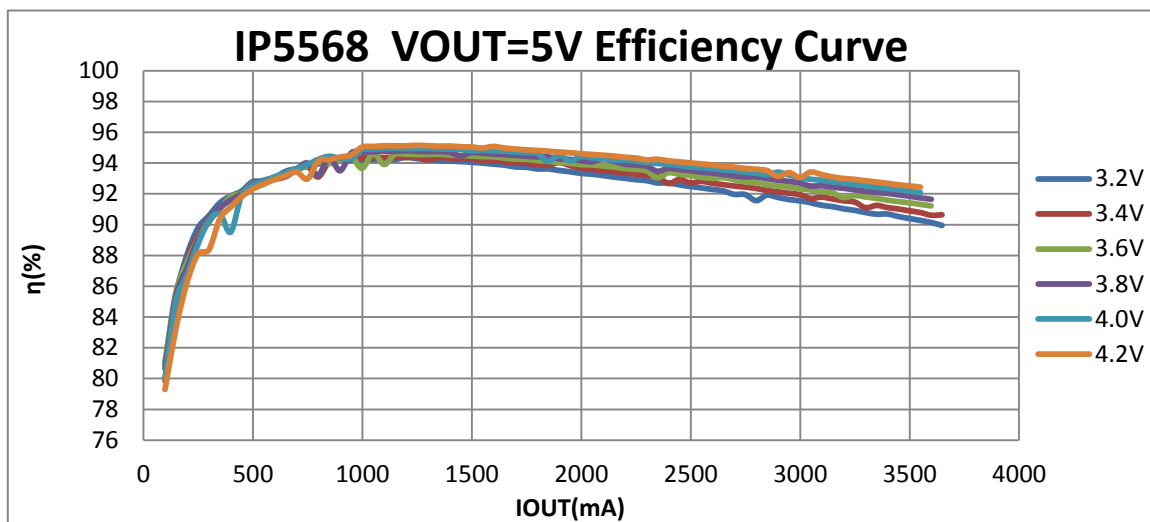
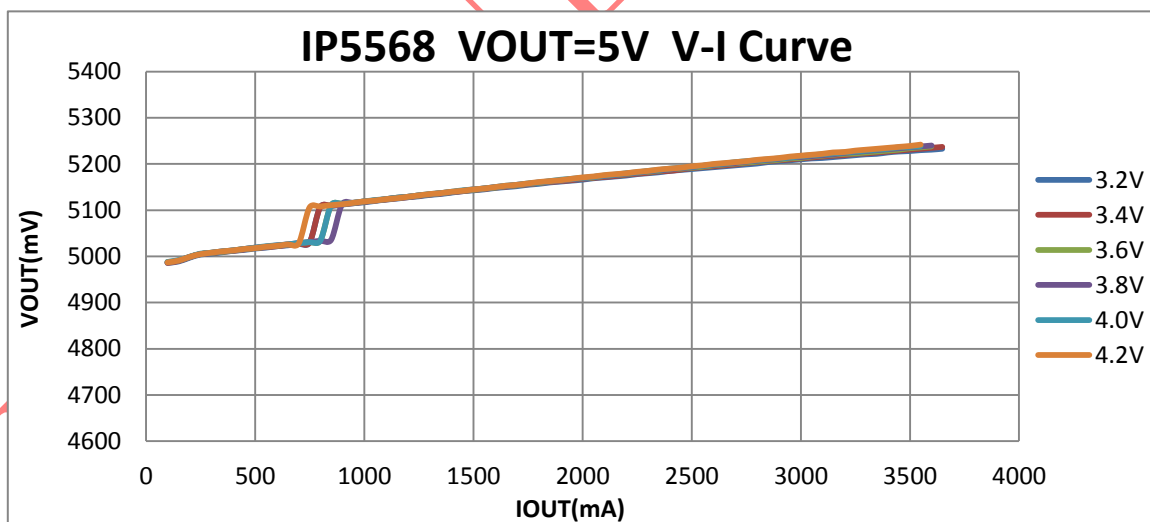Figure 3   IP5568 VOUT=5V Efficiency Curve
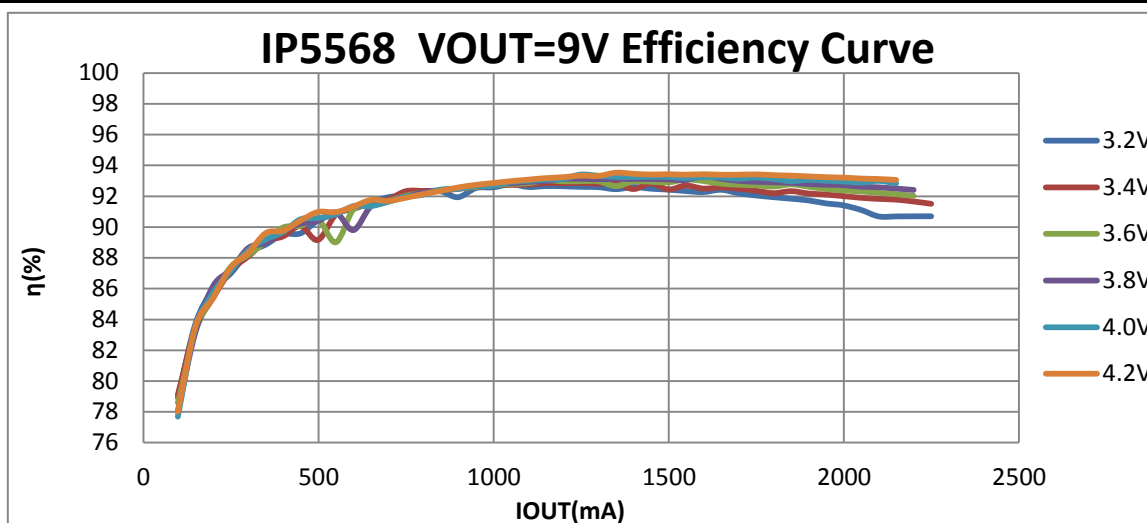

Figure 4   IP5568 VOUT=5V V-I Curve

IP5568 VOUT=9V Efficiency Curve

Figure 5   IP5568 VOUT=9V Efficiency Curve

IP5568 VOUT=9V V-I Curve

Figure 6   IP5568 VOUT=9V V-I Curve
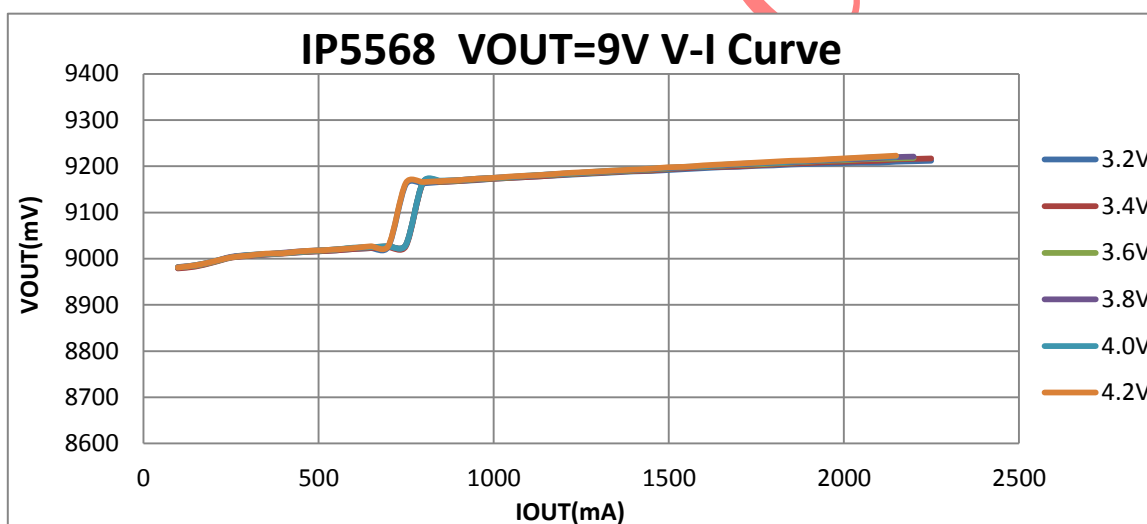
IP5568 VOUT=12V Efficiency Curve

Figure 7   IP5568 VOUT=12V Efficiency Curve
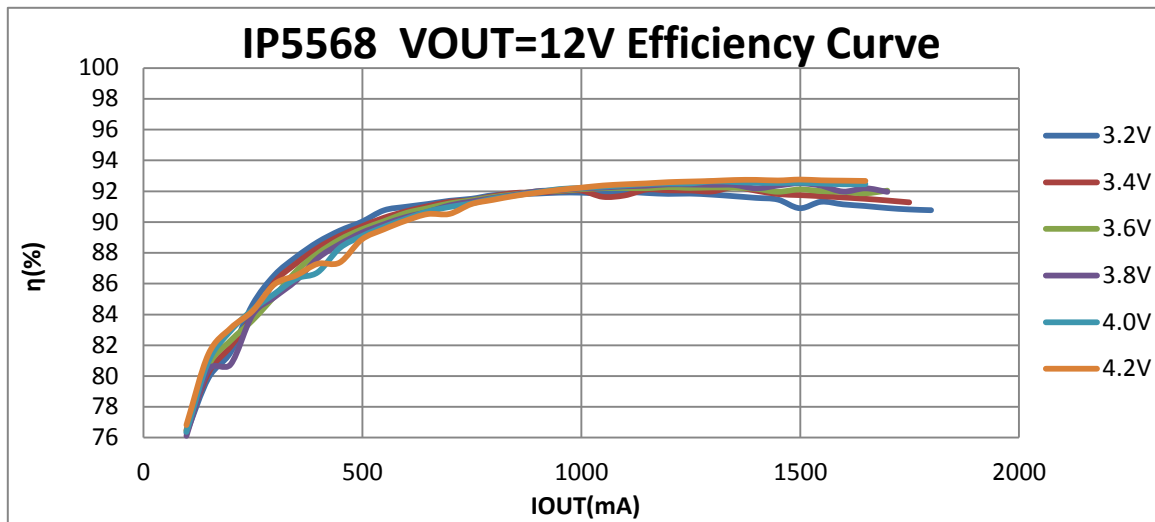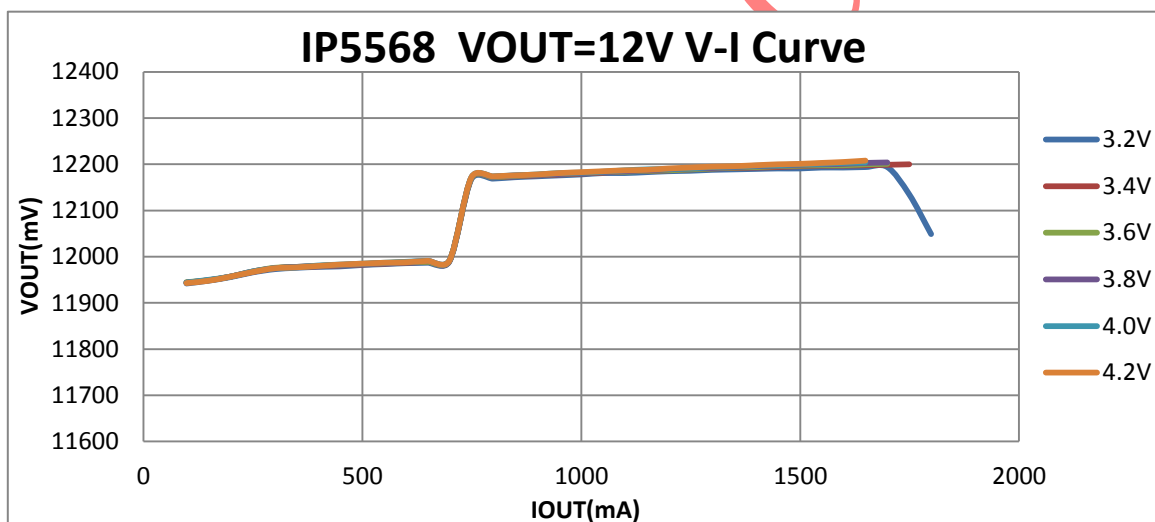
IP5568 VOUT=12V V-I Curve

Figure 8   IP5568 VOUT=12V V-I Curve

USB C

IP5568 integrated USB C DRP port, auto-switching the internal pull-up and pull-down circuit on CC1 and CC2 by distinguishing the role of the attached device. Support Try.SRC function, when the attached device is also DRP device, IP5568 will supply power for the opposite device.

When worked as DFP, the output current can be set as three levels; when worked as UFP, the current capability from the opposite device can be detected.
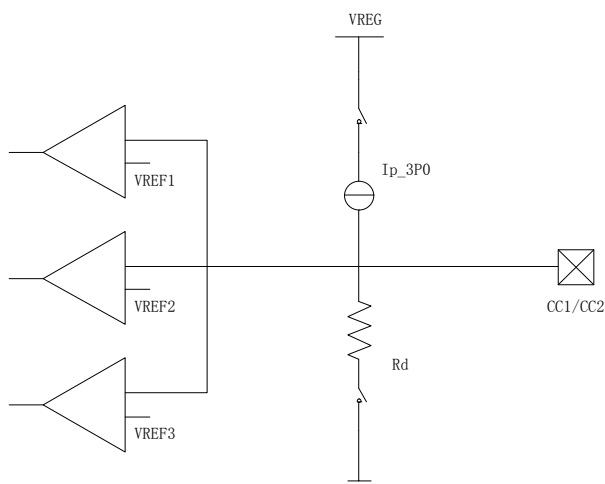
Figure 9 CC internal circuit

Pull-up and pull-down ability:

Name	Value
Ip_3P0	330uA
Rd	5.1K

Comparator Threshold of pull-up Ip:

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 of Pull-down Resistor Rd:

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	

USB C detects cycle:

Figure 4-36 DRP Timing
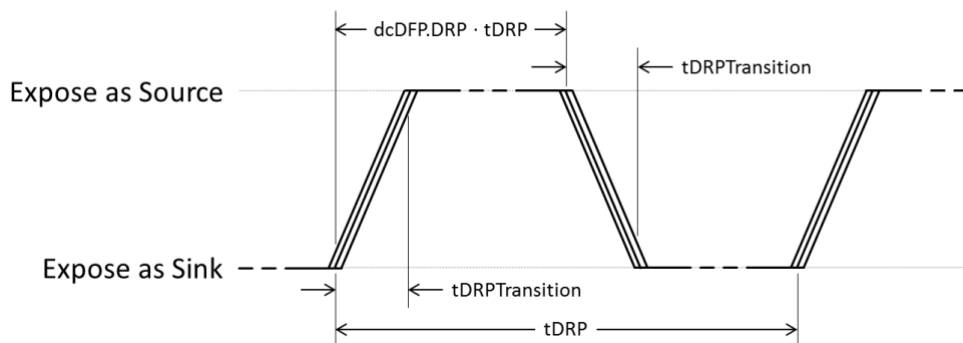
Table 4-21 DRP Timing Parameters

	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 Try.SNK state.

USB C detects state transition:

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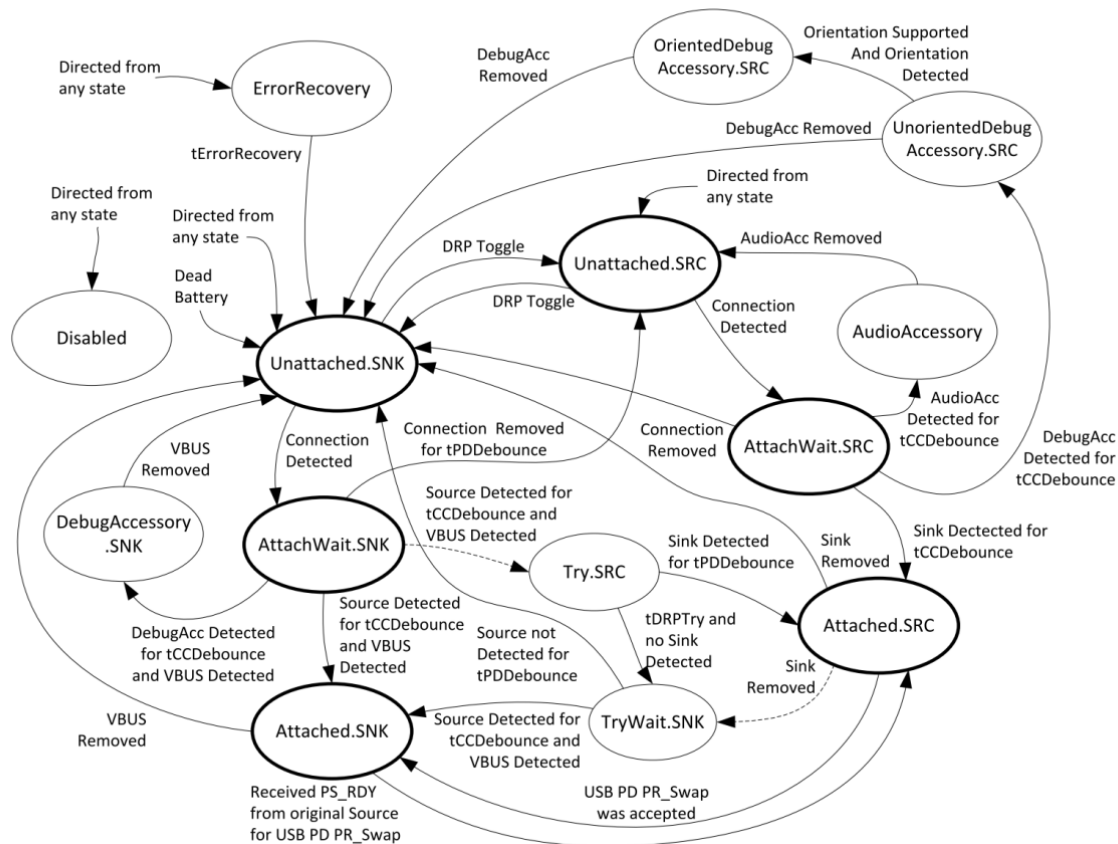
USB C PD

IP5568 integrated USB C Power Delivery PD2.0/PD3.0/PPS (Programmable Power Supply) protocol, integrate physical (PHY) layer for data transmitting/receiving across the cc wire, hardware biphase mark coding (BMC) module and hardware CRC protect the data integrity.

Support PD2.0/PD3.0 bi-directional input/output and PPS output protocol. Input and output voltage support 5V/9V/12V. Output source cap: 5V/2.4A，9V/2.0A，12V/1.5A .PPS 3.3~5.9V/3A , 5~11V/1.5A output voltage adjustable with 20mV/step. Support up to 18W power level. Support 20W PDO customization.

* Part Number:

    IP5568_20W_188

    IP5568_20W_LED

    IP5568_188_FAST_20W

Output source cap：5V 2.4A、9V 2.22A、12V 1.67A   PPS 3.3V~11V   2A

Fast Charge Protocol

IP5568 support multi fast charge protocols: QC2.0/QC3.0, FCP, AFC, SFCP, MTK, Apple, Samsung.

Low-voltage SCP protocol is supported by default. If you need high-voltage SCP protocol, you can apply for

customization.

SFCP/MTK/PPS protocol is not supported by default in standard products. If necessary, you can apply for the customization of SFCP/MTK/PPS protocol.

Input QC2.0/QC3.0/MTK protocol is not support for charging the power bank. External fast charging protocol IC is not supported.

Input fast charge protocol of FCP, AFC, SFCP are supported for charging the power bank.

If the power bank is to charge for the phone, when IP5328P enter discharge mode, it will detect the fast charge type and request on DP, DM, which support fast charge for devices of QC2.0/QC3.0, FCP, AFC, SFCP, MTK, and Apple 2.4A mode, Samsung 2.0A mode and BC1.2 1.0A mode.

For Apple 2.4A mode: DP=DM=2.7V

For Samsung 2.0A mode: DP=DM=1.2V

For BC1.2 1.0A mode: DP short to DM

Under BC1.2 mode, when the DP voltage is detected in the range of 2V~0.325V for 1.25s, fast charge will be initially determined, then the short status between DP and DM will be disconnected, and DM pull-down 20kOhm to GND at the same time. After which, if in the following 2ms the DP voltage is in range of 2V~0.325V and DM lower than 0.325V, fast charge handshake is accomplished successfully. Then QC2.0/QC3.0 device can request for desired voltage according to the QC standards. Any time DP lower than 0.325V will force to exit the fast charge mode, the ouput voltage will fall back to default 5V.

QC2.0/QC3.0 output voltage request rule:

DP	DM	Result
0.6V	GND	5V
3.3V	0.6V	9V
0.6V	0.6V	12V
0.6V	3.3V	Continuous Mode
3.3V	3.3V	sustain

Continuous mode is supported by QC3.0, voltage can be adjusted by 0.2V/step according to QC3.0 request under the continues mode.

Fast charging protocol supported by each port of IP5568

protocols	VOUT1 output	VOUT2 output	Micro USB input	Typec output	TypeC input
QC2.0	√	√	-	√	-
QC3.0	√	√	-	√	-
AFC	√	√	√	√	√
FCP	√	√	√	√	√
SFCP	√	√	√	√	√
SCP	√	-	-	-	-
VOOC	√	-	-	-	-
MTK PE1.0	√	√	-	√	-
MTK PE2.0	√	√	-	√	-
PD2.0	-	-	-	√	√
PD3.0	-	-	-	√	√
PPS	-	-	-	√	-

supported：√

not supported：-

Charge and Discharge Path Management

Standby:

If VIN or VBUS is attached ，IP5568 will start the charging process directly.

If USB C UFP device is attached on VBUS or sink device is attached on VOUT port, IP5568 will start discharge function automatically.

If key is pressed, the VOUT1、VOUT2 and USB C port will open only when load is detected on the according port, or the output on these port will be closed.

Discharge:

In the case of no key action, only the output path of the output port plugged in the electrical equipment will be opened; the output path of the output port not connected to the equipment will not be opened. When the output current of the opened output port is less than about 80mA, it will automatically close after a period of time.

Any port of Vout1, vout2 and USB C can support the output fast charging protocol. However, since this application is a single inductance application, it can only support one voltage output, so it can only support the fast charging output when only one output port is open. When two or three outlets are used at the same time, the quick charge function will be automatically turned off.

According to the connection shown in the "typical application diagram", when any output port has entered the fast charging output mode, when the other output port is plugged in with electrical equipment, all the output ports will be closed first, the high-voltage fast charging function will be closed, and then the output ports with equipment will be opened. In this case, all the output ports only support the charging of apple, Samsung and bc1.2 modes. When the number of electrical equipment is reduced to only one, after 16 seconds, all output ports will be closed first, the high-voltage fast charging function will be turned on, and then the output port of the last electrical equipment will be turned on, so as to reactivate the equipment to request fast charging. When only one output port is open and the total output current is less than about 80mA for about 32S, the output port and discharge function will be closed and the standby mode will be entered.

When the wireless charging TX, VOUT1, VOUT2, and VBUS have any two outputs at the same time, the boost output can only be 5v.

When the wireless charging TX, VOUT1, VOUT2, and VBUS have only one outputs, boost can output the quick charging.

TX can only transmit 10w/15W power when VOUT1, VOUT2 and VBUS are shut down.

Charging：

Any port of VIN port and VBUS port can be charged by inserting the power supply. If both ports are connected to the power supply for charging, the first inserted power supply will be used for charging.

In the single charging mode, the fast charging mode of the power supply will be automatically identified, and the appropriate charging voltage and current will be automatically matched

When only VIN and TX work, and VIN can apply for 9V high voltage, the wireless charging TX can transmit 10w power. When VIN can apply 12V high voltage, the wireless charging TX can transmit 15w power.

When only VBUS and TX work, and VBUS can apply for 9V high voltage, the wireless charging TX can transmit 10w power. When VBUS can apply 12V high voltage, the wireless charging TX can transmit 15w power.

Charging and discharging at the Same Time：

When the charging power supply and the electrical equipment are plugged in at the same time, the charging and discharging mode will be automatically entered. In this mode, the chip will automatically turn off the internal

fast charge input request. When the vsys voltage is only 5V, turn on the discharge path to supply power to the electrical equipment; if the vsys voltage is greater than 6.0v, for safety reasons, the discharge path will not be turned on. In order to ensure the normal charging of electrical equipment, ip5568 will increase the charging undervoltage loop to more than 4.9v to ensure the priority of power supply to electrical equipment.

In the process of charging and discharging, if the charging power is unplugged, ip5568 will turn off the charging function and restart the discharging function to supply power to the electric equipment. For the sake of safety, and in order to be able to reactivate the mobile phone to request fast charging, the voltage will drop to 0V for a period of time during the conversion process.

In the process of charging and discharging, if the electric equipment is unplugged, or the electric equipment is full and stops pumping for 16s, the corresponding discharge path will be automatically closed. When the discharge paths are closed and the state returns to single charging mode, the charging undervoltage loop will be reduced, and the fast charging will be automatically reactivated to accelerate the charging of mobile power supply.

Wireless charging power supply:

The power supply of wireless charging TX is directly powered from VSYS node. When wireless charging TX and wired port work at the same time, wireless charging only supports 5W, wired port output only 5V, no fast charging.

Automatic detection of mobile phone

Auto detection on sink device/phone attachment：

IP5568 support auto detection on sink device/phone attachment/ plug in, once the attachment is detected, the boost will be turned on charging the sink device/phone, so non-key solution are supported.

Auto detection on sink device/phone fully charged：

IP5568 measures the output current of each port through the on-chip ADC. When the output current of a single port is less than about 80mA and lasts for about 16s, the output port will be closed. When the total current is less than about 80mA for about 32S, it is considered that all output cell phones are full or unplugged, and the boost output will be automatically turned off.

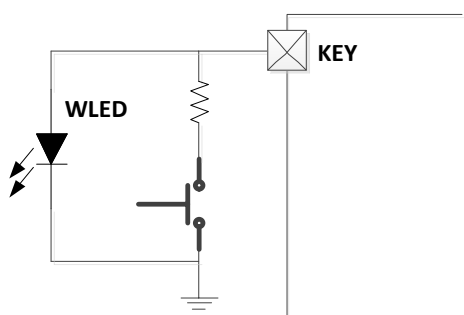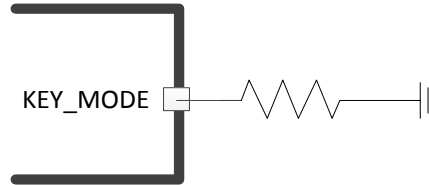## KEY\Key_mode selection\LED and nixie tube selection

Figure 10   KEY circuit

Key circuit is illustrated in Figure 4, which can recognize short press or long press operation.

- Short press : pressed time in range of 60ms~2s
- Long press :pressed time longer than 2s
- No response on press time less than 30ms
- Long 10s press will reset the whole system

KEY_MODE

IP5568 outputs 20uA current on the key mode pin, and different resistance is connected externally to get different voltage. Different key definition, led and nixie tube display can be selected for IC internal detection of key mode voltage. Pay attention to 1% precision resistance for external resistance.

KEY_MODE pin external resistance	Key_mode ideal voltage（v）	KEY_MODE voltage range (v)	KEY function definition	LED or nixie tube display
20K	0.4	0~0.6	Short press: turn on Double short press in 1s: turn off Long press:turn on or turn off the lighting	LED
51K	1.02	0.6~1.3	Short press: turn on Double short press in 1s: no definition Long press: turn on or turn off the lighting	LED
82K	1.64	1.3~2.1	Short press: turn on Double short press in 1s: turn on or turn off the lighting Long press:no definition	LED
115K	2.3	>2.1	Short press: turn on Double short press in 1s: turn on or turn off the lighting Long press:turn off	LED

In the nixie tube application, key_mode pin is used as the driving pin of the nixie tube, and there is no key mode selection. The default key mode is: short press to turn on, two consecutive short press to shut down, and long press for 2s to turn on and off the flashlight.

In the application of wireless charging TX / Rx, the default key mode is: short press to turn on, double short press in 1s to turn off, long press for 2s to switch between wireless charging and Rx, no flashlight application.

Fast Charge state indication

HLED is used for indication for the present fast charge mode, either in fast charging or discharging mode, when the system enters fast charge mode and in non-5V mode, the light LED will turn on.
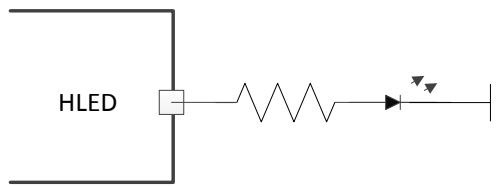
Figure 11   fast charge state indication

Coulombmeter and battery level display

IP5568 has built-in coulombmeter function, which can realize accurate calculation of the remaining battery capacity.

IP5568 supports 4 LED, 2 LED and 1 LED mode automatic selection.

IP5568 supports 88/188 nixie tube to display the remaining battery capacity .

The part number of IP5568 + wireless TX supporting LED   is IP5568 _LED.

The part number of IP5568 + wireless TX supporting nixie tube is IP5568 _188.

The part number of IP5568 + wireless TX /RX supporting LED   is IP5568 _RX_LED.

The part number of IP5568 + wireless TX /RX supporting nixie tube   is IP5568 _RX_188.

Battery level display for LED mode

IP5568 4LED、2LED、1LED battery level display

Figure 12   4LED、2LED、1LED circuits

4LED display mode：

During charging

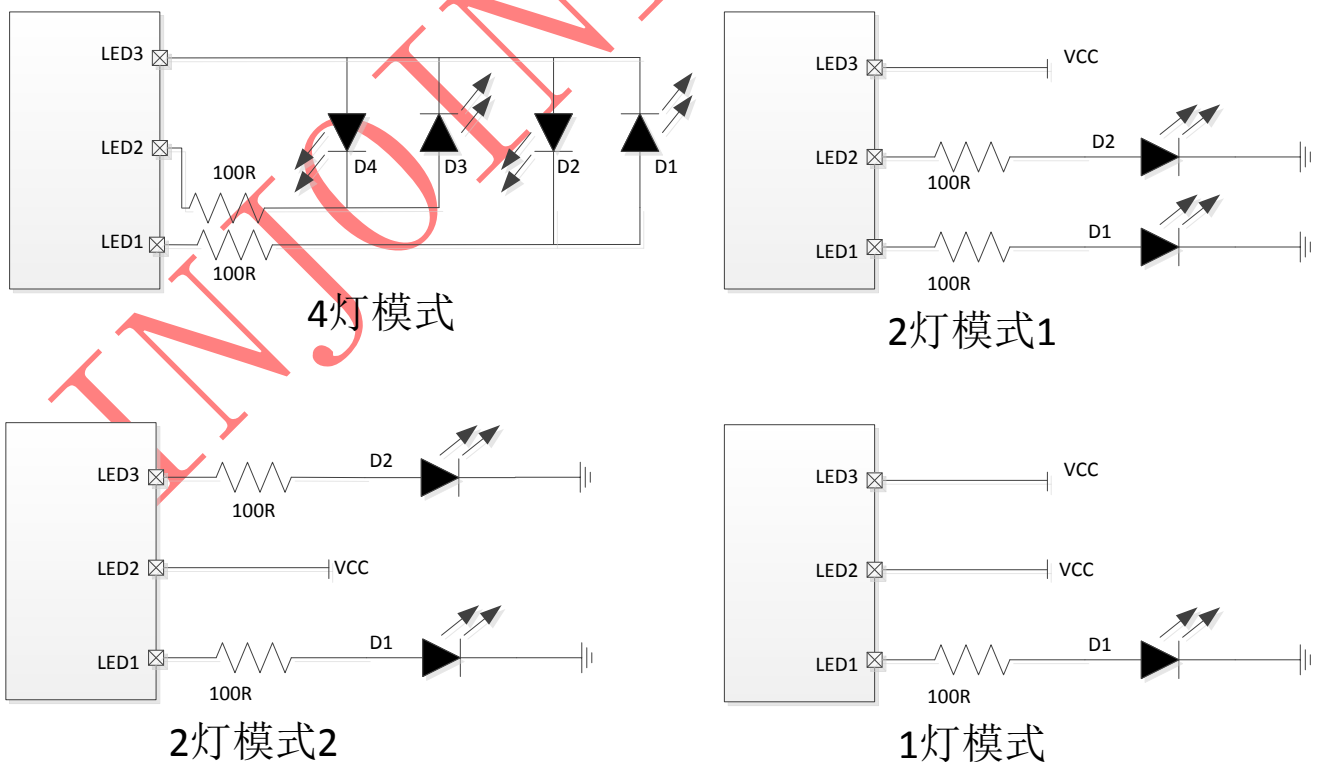| Battery capacity (C) (%)	D1	D2	D3	D4
Fully charged	ON	ON	ON	ON
75%≤C	ON	ON	ON	0.5Hz Flash
50%≤C＜75%	ON	ON	0.5Hz Flash	OFF
25%≤C＜50%	ON	0.5Hz Flash	OFF	OFF
C＜25%	0.5Hz Flash	OFF	OFF	OFF

During discharging

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%	1.0Hz Flash	OFF	OFF	OFF
C=0%	OFF	OFF	OFF	OFF

2 LED display mode 1 is bi-color LED:

During charging:

Battery capacity (C) (%)	D1	D2
Fully charged	OFF	ON
66%≤C＜100%	OFF	0.5Hz Flash
33%≤C＜66%	0.5Hz Flash	0.5Hz Flash
C＜33%	0.5Hz Flash	OFF

During discharging:

Battery capacity (C) (%)	D1	D2
66%≤C＜100%	OFF	ON
33%≤C＜66%	ON	ON
C＜33%	ON	OFF
C＜3%	1.0Hz Flash	OFF

2 LED mode 2 display：

During charging: D1 LED flash on cycle of 2s (1s on and 1s off), when fully charged, constantly on;

During discharging: D2 LED is constantly on, when voltage lower than 3.2V, flash on cycle of 1s (0.5s on and 0.5s off), when voltage is lower than 3.0V, system is power down.

1 LED mode 1 display:

During charging: LED flash on cycle of 2s (1s on and 1s off), when fully charged, constantly on;

During discharging: LED is constantly on, when voltage lower than 3.2V, flash on cycle of 1s (0.5s on and 0.5s off), when voltage is lower than 3.0V, system is power down.

188 nixie tube display mode

The 188 nixie tube model IP5568 supported as below

Nixie Tube	During charging		During discharging	
	Not fully charged	Fullly charged	Battery capacity <5%	Battery capacity>5%
188（YF2252SR-5）	0-99%　0.5HZ Flash	constantly on 100%	0-5% 1.0Hz Flash	5%-100% constantly on

5pin 188 nixie tube：

(未注尺寸公差 Unspecified Tolerances is：±0.2   发光颜色：红色
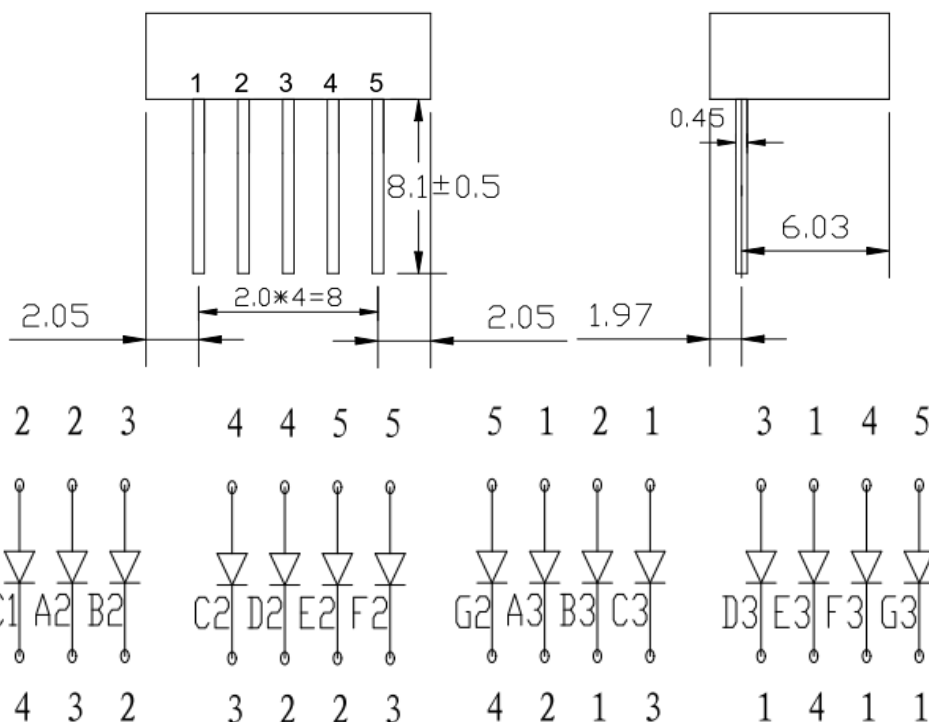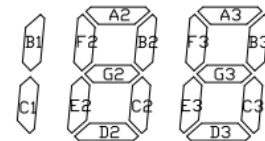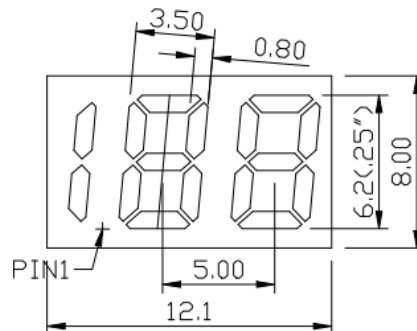
Figure 13   5pin 188 nixie tube circuit

	IP5568 display driver pin	nixie tube pin	备注
The sequence mapping relationship between IP5568 display driver pin and nixie tube pin	LED1(1 pin)	1 pin	
	LED2(2 pin)	2 pin	
	LED3(3 pin)	3 pin	
	KEY_MODE(58 pin)	4 pin	
	VSET(57 pin)	5 pin	

Coulombmeter

IP5568 supports the external resistor setting of the initial capacity of thebattery, and uses the integration of the current and time at the port of the battery to manage the remaining capacity of the battery, which can accurately display the current remaining capacity of the battery.IP5568 supports the automatic calibration of the total capacity of the current battery in a complete charging process from 0% to 100%, and more reasonable management of the actual capacity of the battery.

Ip5568 external pin sets the initial cell capacity formula: battery capacity = R8 * 0.2 (mAH). Up to 25000mah.
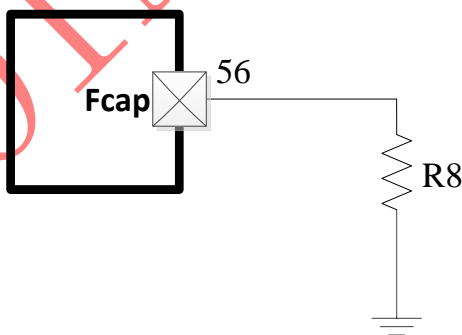
Figure 14   battery initial capacity circuit

Typical battery capacity config table

R8 resistance (ohm)	battery initial capacity (mAH)
25k	5000mAH
40k	8000mAH
50k	10000mAH
60k	12000mAH
100k	20000mAH
125K	25000mAH

FCAP also reserves a special function. If R8 resistance = 1K, the cell capacity is 10000mah by default, and DPA2 pin is used as serial port print port output.

FCAP is the drive pin in TXRX scheme, and the battery capacity is 10000mAH by default.

VSET（**Battery full voltage selection**）

IP5568 sets the battery type by outputting 20uA current on Vset pin and connecting different resistance to GND, so as to change the threshold value of battery level display, the constant voltage to charge the battery and the protection voltage. The resistance of Vset external to GND and the set battery type are shown in the table below

VSET pin external resistance to GND(ohm)	VSET PIN voltage	VSET voltage judgement range	Battery full voltage selection
115k	2.30v	>2.1v	4.20V
82k	1.64v	1.3v~2.1v	4.30V
51k	1.02v	0.6v~1.3v	4.35V
20k	0.40v	0.3v~0.6v	4.40V

VSET pin is used to set the battery full voltage only when the LED mode   is displayed; when the nixie tube is applied, Vset is used as the driving pin of the nixie tube, and the default battery full voltage is 4.2V

NTC function

IP5568 integrates NTC function, which can detect battery temperature and wireless charging coil temperature. IP5568 has two NTCs, NTC1detects battery temperature and NTC2 detects wireless charging coil temperature. When IP5568 is working, NTC1and NTC2 pin output 20uA current, and generate voltage through external NTC resistance. IC internal detects the voltage of NTC1 and NTC2 pin to determine the current battery temperature and wireless charging coil temperature.

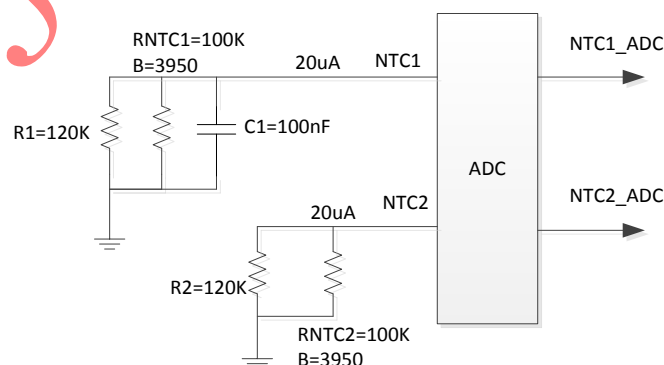   * The 100nF capacitance of NTC1 must be close to IC PIN.

Figure 15 NTC circuit

In the state of charge:

When NTC1 pin detects that the voltage is 1.96v, it represents low temperature of battery - 10 ℃; when NTC1 voltage is higher than 1.96v, it stops charging; when NTC1 voltage is lower than 1.85v, it resumes charging.

When NTC1 pin detects that the voltage is 0.64v, it means the battery temperature is 45 degrees; when NTC1 voltage is lower than 0.64v, the charging current is reduced by half; when NTC1 voltage is higher than 0.7V, the charging current is restored to normal value.

When NTC1 pin detects that the voltage is 0.47v, it represents the battery temperature of 55 ℃; when NTC1 voltage is lower than 0.47v, it stops charging; when NTC1 voltage is higher than 0.7V, it restores the charging current to normal value

In the state of discharge:

When NTC1 pin detects that the voltage is 2.13v, it represents low temperature of battery - 20 ℃; when NTC1 voltage is higher than 2.13v, it stops discharging; when NTC1 voltage is lower than 2.04v, it resumes discharging.

When NTC1 pin detects that the voltage is 0.47v, it represents the battery high temperature of 55 ℃; when NTC1 voltage is lower than 0.47v, it stops discharging; when NTC1 voltage is higher than 0.55v, it resumes discharging.

NTC2 pin is used to detect the temperature of wireless charging coil. When NTC2 pin detects that the voltage is 0.3V, it means that the coil temperature exceeds 70 degrees, and the wireless charging TX will be turned off. When NTC2 voltage is higher than 0.55v (coil temperature is lower than 50c), recover wireless charging TX.

*The above temperature range refers to NTC resistance zl104fbxv050 (B = 3950). Other models have differences and need to be adjusted.

If NTC is not required in the application, 51K resistance shall be connected to the ground at NTC pin, and floating or direct grounding is not allowed.

VCC

VCC is a normally open 3.1V LDO with a load capacity of 50mA.

Wireless charging TX fuction

IP5568 is integrated with 5W / 7.5w/10w/15w wireless charging TX drive control circuits, and ip5568 is internally integrated with two symmetrical half bridge modules (drive of upper PMOS and lower NMOS).

IP5568 is integrated with two ask demodulation modules, which can respectively collect coil voltage and current for ask communication demodulation and decoding. Current decoding, direct sampling current value for digital demodulation and decoding. Voltage decoding, without amplification, can be directly sent to the chip after filtering and isolation for digital demodulation and decoding.

IP5568 can detect the voltage and current of the coil through the built-in ADC.

When ip5568 is turned on, the wireless charging will work all the time.

IP5568 can drive two LED outputs to indicate wireless charging status. The corresponding relationship between LED status and wireless charging system status is as follow

状态	LED_R	LED_G
wireless charging Abnormal (FOD etc.)	ON	OFF
Charging completed	ON	ON
Charging	OFF	1Hz Flash
PING	OFF	ON

Wireless charging TX circuit

Wireless charging RX function

IP5568 supports wireless RX 5W / 10W charging function. TX and Rx share a coil and a resonant capacitor, and switch TX and Rx modes by pressing the key (long press 2s). After IP5568 is powered on, the wireless charging is TX mode by default.

When in Rx mode, the two LED indicators of wireless charging will flash together (the display mode can be customized) to indicate that the wireless charging is working in Rx state. When using the wireless RX charging function, the button function defaults to double-click shutdown without flashlight function.

The RX output of wireless charging is directly connected to VIN network to provide power for system charging. USB charging port is preferred for system charging. When Rx is working, insert usb-b or usb-c, the wireless RX charging function will be automatically turned off, and the usb-b or usb-c will be automatically switched to charge the system, and the wireless TX charging function will be turned on at the same time

Wireless charging RX circuit

8. PCB Layout

Here below lists essential precautions that may affect the function and performance on PCB layout, more details will be attached in another document if any.

Location of VOUT1/VOUT2 capacitor

IP5568 integrated USB output power path. The 10uF capacitance of VOUT1/VOUT2 must be close to IC PIN. As the layout allows, the position of the capacitance closer to the IC is better.

If it is necessary to place the capacitor close to the USB port, the capacitor can be increased by 2.2uF near the USB port.
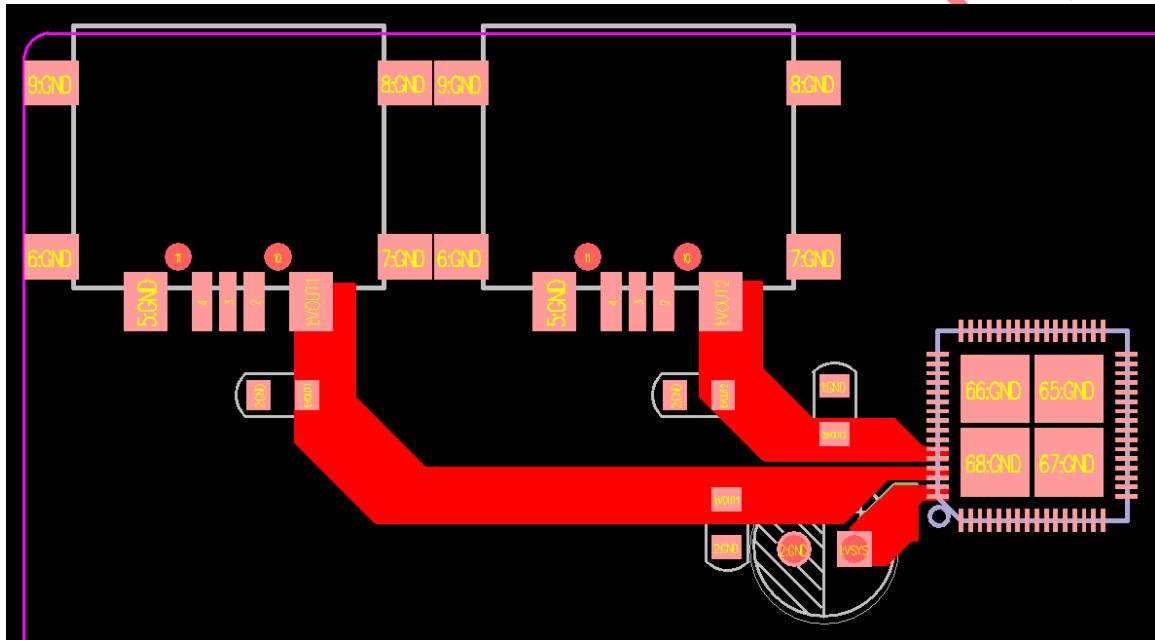
Location of VSYS capacitor

The power and current of the chip are relatively large, and the position of the capacitor on the vsys network will affect the stability of the DCDC. The capacitors on the vsys network need to be as close to the vsys pin and EPAD of the IC as possible, and copper is laid on a large area, and more vias are added to reduce the area of current loop between the capacitors and the IC and reduce parasitic parameters.

Vsys pins are distributed on both sides of the chip, and capacitors need to be placed near the pins on both sides, and the vsys pins on both sides are connected by a wide (no less than 100mil) copper laying on the PCB
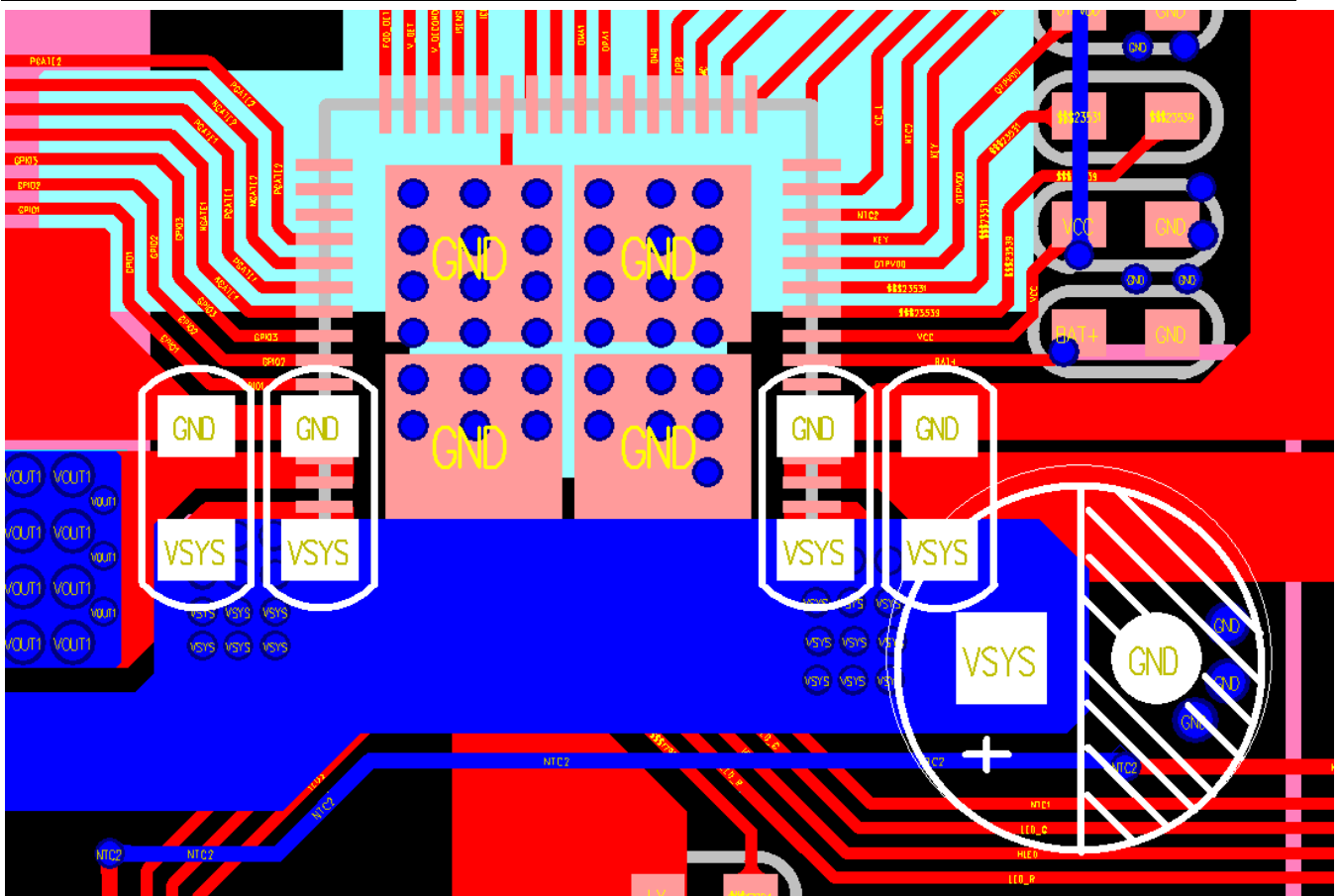
Location of NTC1 capacitor

The 100nF capacitance of NTC1 must be close to IC PIN.
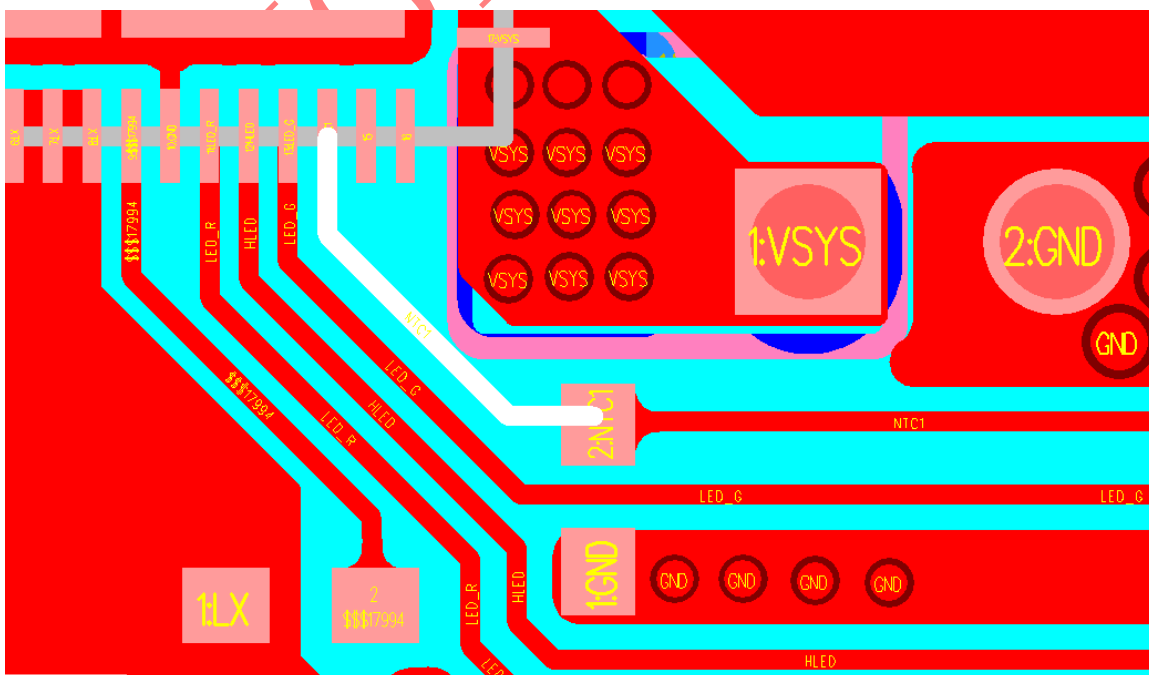
9. Typical Application Diagram

Total solution of fast charge power bank is merely realized by passive devices of MOSFET, inductor, capacitor and resistor.

Power bank+wireless charging TX+LED application

A、If there is both USB-B and LIGHTNING ports in the application:
1、USB-B and LIGHTNING do not plug in at the same time. It can be make restrictions on the mold. At the same time, Omitting D12/D13;
2、If there is a case of simultaneous insertion, D12/D13 not to be omitted;

B、If there is only USB-B or LIGHTNING ports in the application:
Omitting D12/D13;
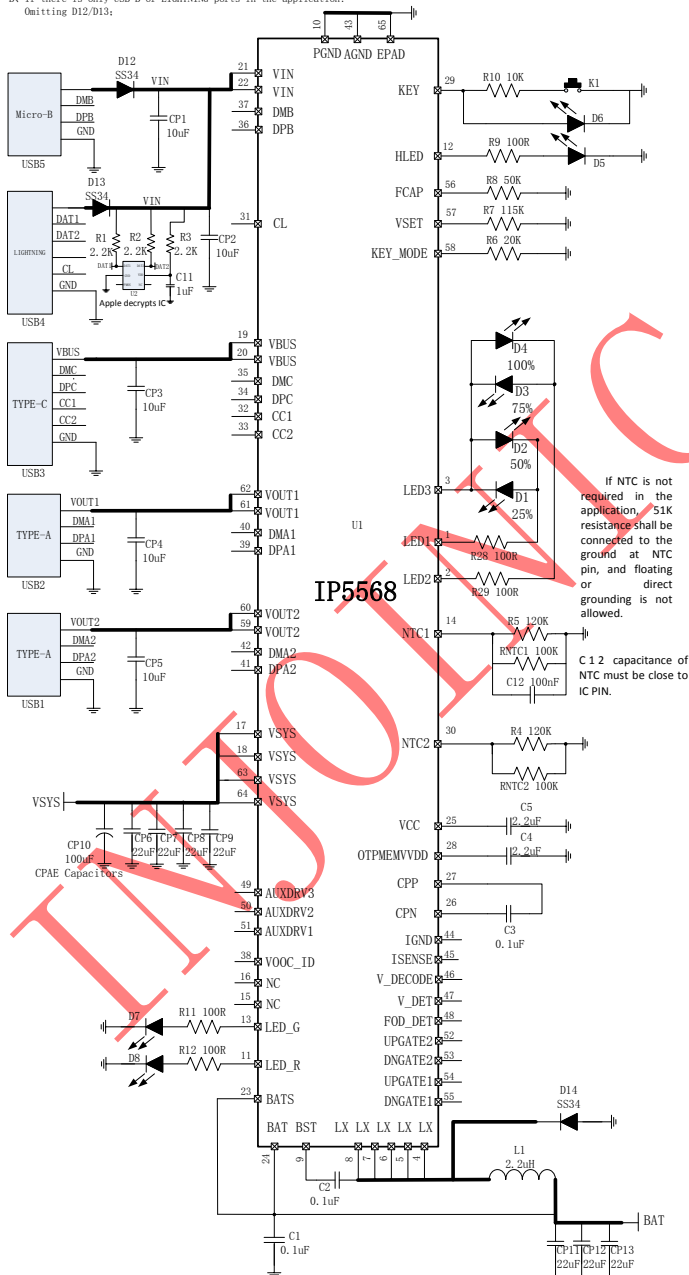
FCAP R8 (ohm)	Battery initial capacity (mAH)
25K	5000mAH
40K	8000mAH
50K	10000mAH
60K	12000mAH
100K	20000mAH
125K	25000mAH

VSET R7 (ohm)	Battery full voltage selection
115K	4.20V
82K	4.30V
51K	4.35V
20K	4.40V

key_mode R6 (ohm)	ON	OFF	lighting	LED or nixie tube display
20K	short	Double	Long	LED
51K	short	-	Long	LED
82K	short	-	Double	LED
115K	short	Long	Double	LED
"-"not definition				

If NTC is not required in the application, 51K resistance shall be connected to the ground at NTC pin, and floating or direct grounding is not allowed.

C12 capacitance of NTC must be close to IC PIN.

Wireless charging TX circuit
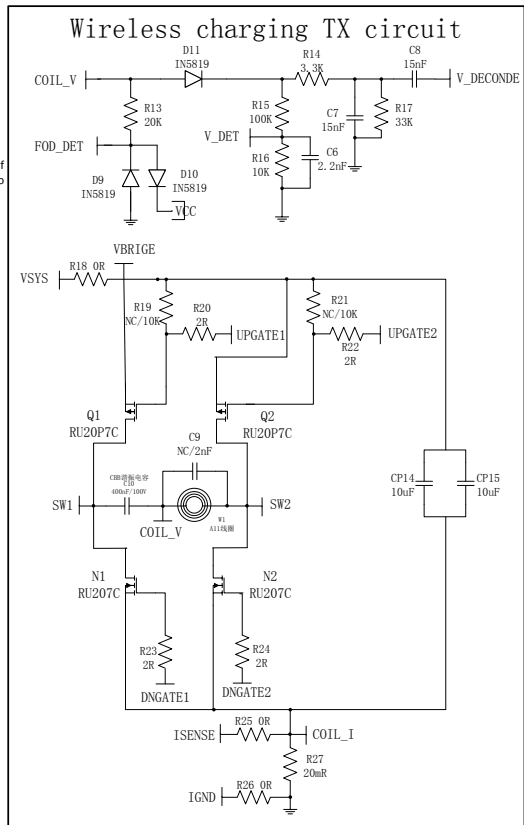
Figure 16   IP5568_LED application circuit（power bank+wireless charging TX）

BOM list1

No.	Part Name	Type	Location	Num	Note
1	IC	QFN64 IP5568	U1	1	
2	SMT capacitor	0603 100nF 10% 16V	C1	1	
3	SMT capacitor	0603 100nF 10% 25V	C2 C3	2	
4	SMT capacitor	0603 2.2uF 10% 16V	C4 C5	2	
5	SMT capacitor	0805 22uF 10% 16V	CP11 CP12 CP13	3	
6	SMT capacitor	0805 22uF 10% 25V	CP6 CP7 CP8 CP9	4	
7	SMT capacitor	0805 10uF 10% 25V	CP1 CP2 CP3 CP4 CP5	5	
8	CPAE Capacitors	100uF 25V 10%	CP10	1	
9	SMT resistor	0603R 100R 1%	R9	1	
10	SMT resistor	0603R 100R 1%	R28 R29	2	
11	SMT LED	0603 blue LED	D1 D2 D3 D4	4	
12	SMT Schottky	SS34	D12 D13 D14	3	
13	Apple decrypts IC		U2	1	Apple decrypts IC circuit BOM
14	SMT resistor	0603R 2.2K 1%	R1 R2 R3	3	
15	SMT capacitor	0603 1uF 10% 25V	C11	1	
16	SMT resistor	0603R 20K 1%	R6	1	
17	SMT resistor	0603R 10K 1%	R10	1	
18	SMT resistor	0603R 50K 1%	R8	1	
19	SMT resistor	0603R 115K 1%	R7	1	
20	SMT resistor	0603R 120K 1%	R4 R5	2	NTC circuit BOM
21	SMT capacitor	0603 100nF 10% 16V	C12	1	
22	NTC thermal resistor	100K@25℃ B=3950	RNTC1 RNTC2	2	
23	SMT LED	0603 red LED	D5	1	
24	LED	5MM LED	D6	1	
25	inductor	2.2uH 10*10	L1	1	
26	key	SMT 3*6 key	K1	1	
27	Output USB connector	AF10 8 USB	USB1 USB2	2	
28	Input USB connector	MICRO-7-DIP-5.9	USB5	1	
29	USB C connector	USB C connector	USB3	1	
30	LIGHTNING connector	Apple lightning connector	USB4	1	
31	SMT capacitor	0603 2.2nF 10% 50V	C6	1	Wireless charging circuit BOM
32	SMT capacitor	0603 15nF 10% 50V	C7 C8	2	
33	SMT capacitor	0603 NC/2nF 10% 50V	C9	1	
35	SMT capacitor	0805 10uF 10% 25V	CP14 CP15	2	

36	SMT resistor	0603R 100R 1%	R11 R12	2
37	SMT resistor	0603R 20K 1%	R13	1
38	SMT resistor	0603R 3.3K 1%	R14	1
39	SMT resistor	0603R 100K 1%	R15	1
40	SMT resistor	0603R 10K 1%	R16	1
41	SMT resistor	0603R NC/10K 1%	R19 R21	2
42	SMT resistor	0603R 33K 1%	R17	1
43	SMT resistor	0805R 0R 1%	R18	1
44	SMT resistor	0603R 0R 1%	R25 R26	2
45	SMT resistor	0603R 2R 1%	R20 R22 R23 R24	4
46	SMT resistor	1206R 20mR 1%	R27	1
47	SMT LED	0603 red LED	D7	1
48	SMT LED	0603 green LED	D8	1
49	SMT diode	SOD-123 IN5819	D9 D10 D11	3
50	SMT PMOS	SOP-23 RU20P7C	Q1 Q2	2
51	SMT NMOS	SOP-23 RU207C	N1 N2	2
52	CBB resonant capacitor	400nF 100V	C10	1
53	Coil	A11	W1	1

Power bank+wireless charging TX+Nixie Tube application

A、If there is both USB-B and LIGHTNING ports in the application:
  1、USB-B and LIGHTNING do not plug in at the same time. It can be make
  restrictions on the mold. At the same time,Omitting D12/D13;
  2、If there is a case of simultaneous insertion，D12/D13 not to be omitted;

B、If there is only USB-B or LIGHTNING ports in the application:
  Omitting D12/D13;
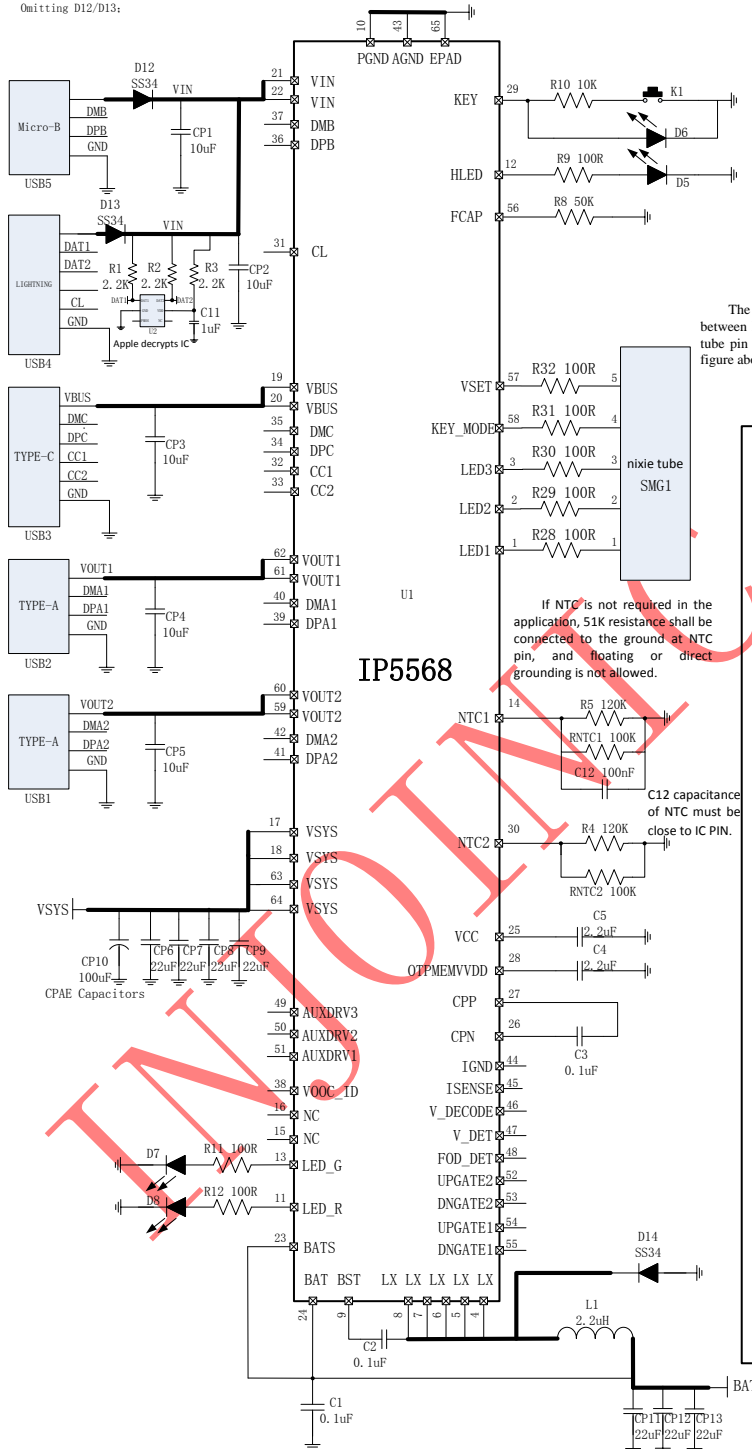
FCAP R8 (ohm)	Battery full voltage selection (mAH)
25K	5000mAH
40K	8000mAH
50K	10000mAH
60K	12000mAH
100K	20000mAH
125K	25000mAH

The sequence mapping relationship between IP5568 display driver pin and nixie tube pin must be strictly according to the figure above.

If NTC is not required in the application, 51K resistance shall be connected to the ground at NTC pin, and floating or direct grounding is not allowed.

C12 capacitance of NTC must be close to IC PIN.
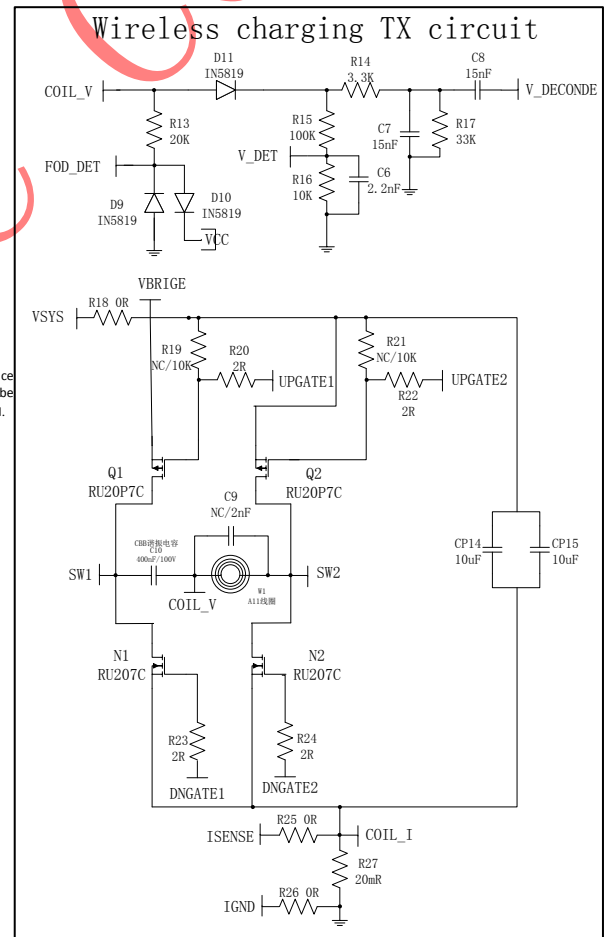
Wireless charging TX circuit

Figure 17   IP5568_188 nixie tube application circuit（power bank+wirelesss charging TX）

BOM list2

No.	Part Name	Type	Location	Num	Note
1	IC	QFN64 IP5568	U1	1	
2	SMT capacitor	0603 100nF 10% 16V	C1	1	
3	SMT capacitor	0603 100nF 10% 25V	C2 C3	2	
4	SMT capacitor	0603 2.2uF 10% 16V	C4 C5	2	
5	SMT capacitor	0805 22uF 10% 16V	CP11 CP12 CP13	3	
6	SMT capacitor	0805 22uF 10% 25V	CP6 CP7 CP8 CP9	4	
7	SMT capacitor	0805 10uF 10% 25V	CP1 CP2 CP3 CP4 CP5	5	
8	CPAE Capacitors	100uF 25V 10%	CP10	1	
9	SMT resistor	0603R 100R 1%	R9	1	
10	SMT resistor	0603R 100R 1%	R28 R29 R30 R31 R32	2	
11	STM nixie Tube	YF2252SR-5	SMG1	1	
12	SMT Schottky	SS34	D12 D13 D14	3	
13	Apple decrypts IC		U2	1	Apple decrypts IC circuit BOM
14	SMT resistor	0603R 2.2K 1%	R1 R2 R3	3	
15	SMT capacitor	0603 1uF 10% 25V	C11	1	
16	SMT resistor	0603R 10K 1%	R10	1	
17	SMT resistor	0603R 50K 1%	R8	1	
18	SMT resistor	0603R 120K 1%	R4 R5	2	NTC circuit BOM
19	SMT capacitor	0603 100nF 10% 16V	C12	1	
20	NTC THERMAL RESISTOR	100K@25℃ B=3950	RNTC1 RNTC2	2	
21	SMT LED	0603 red led	D5	1	
22	LED	5MM LED	D6	1	
23	inductor	2.2uH 10*10	L1	1	
24	key	SMT 3*6key	K1	1	
25	output USB	AF10 8 USB	USB1 USB2	2	
26	input usb	MICRO-7-DIP-5.9	USB5	1	
27	USB C CONNECTOR	USB C CONNECTOR	USB3	1	
28	LIGHTNING CONNECTOR	apple lightning connector	USB4	1	
29	SMT capacitor	0603 2.2nF 10% 50V	C6	1	Wireless charging circuit BOM
30	SMT capacitor	0603 15nF 10% 50V	C7 C8	2	
31	SMT capacitor	0603 NC/2nF 10% 50V	C9	1	
32	SMT capacitor	0805 10uF 10% 25V	CP14 CP15	2	
33	SMT resistor	0603R 100R 1%	R11 R12	2	
35	SMT resistor	0603R 20K 1%	R13	1	
36	SMT resistor	0603R 3.3K 1%	R14	1	
37	SMT resistor	0603R 100K 1%	R15	1	

38	SMT resistor	0603R 10K 1%	R16	1	
39	SMT resistor	0603R NC/10K 1%	R19 R21	2	
40	SMT resistor	0603R 33K 1%	R17	1	
41	SMT resistor	0805R 0R 1%	R18	1	
42	SMT resistor	0603R 0R 1%	R25 R26	2	
43	SMT resistor	0603R 2R 1%	R20 R22 R23 R24	4	
44	SMT resistor	1206R 20mR 1%	R27	1	
45	SMT LED	0603 red led	D7	1	
46	SMT LED	0603 green led	D8	1	
47	SMT diode	SOD-123 IN5819	D9 D10 D11	3	
48	SMT PMOS	SOP-23 RU20P7C	Q1 Q2	2	
49	SMT NMOS	SOP-23 RU207C	N1 N2	2	
50	CBB resonant capacitor	400nF 100V	C10	1	
51	Coil	A11	W1	1	

Power bank+wireless charging TX/RX+LED application

VSET R7 (ohm)	Battery full voltage selection
115K	4.20V
82K	4.30V
51K	4.35V
20K	4.40V

Figure 18　IP5568_RX_LED LED application circuit（power bank+wireless charging TX/RX）

BOM list3

No.	Part Name	Type	Location	Num	Note
1	IC	QFN64 IP5568	U1	1	
2	SMT capacitor	0603 100nF 10% 16V	C1	1	
3	SMT capacitor	0603 100nF 10% 25V	C2 C3	2	
4	SMT capacitor	0603 2.2uF 10% 16V	C4 C5	2	
5	SMT capacitor	0805 22uF 10% 16V	CP11 CP12 CP13	3	
6	SMT capacitor	0805 22uF 10% 25V	CP6 CP7 CP8 CP9	4	
7	SMT capacitor	0805 10uF 10% 25V	CP1 CP2 CP3 CP4 CP5	5	
8	CPAE Capacitors	100uF 25V 10%	CP10	1	
9	SMT resistor	0603R 100R 1%	R6 R28 R29	3	
10	SMT LED	0603 blue	D1 D2 D3 D4	4	
11	SMT LED	0603 red led	D5	1	
12	SMT Schottky	SS34	D12 D13 D19	3	
13	Apple decrypts IC		U2	1	Apple decrypts IC circuit BOM
14	SMT resistor	0603R 2.2K 1%	R1 R2 R3	3	
15	SMT capacitor	0603 1uF 10% 25V	C11	1	
16	SMT resistor	0603R 10K 1%	R10	1	
17	SMT resistor	0603R 115K 1%	R7	1	
18	SMT resistor	0603R 120K 1%	R4 R5	2	NTC circuit BOM
19	SMT capacitor	0603 100nF 10% 16V	C17	1	
20	NTC THERMAL RESISTOR	100K@25℃ B=3950	RNTC1 RNTC2	2	
21	inductor	2.2uH 10*10	L1	1	
22	key	SMT 3*6key	K1	1	
24	output USB	AF10 8 USB	USB1 USB2	2	
25	input usb	MICRO-7-DIP-5.9	USB5	1	
26	USB C CONNECTOR	USB C CONNECTOR	USB3	1	
27	LIGHTNING CONNECTOR	apple lightning connector	USB4	1	
28	SMT capacitor	0603 2.2nF 10% 50V	C6	1	Wireless charging circuit BOM
29	SMT capacitor	0603 15nF 10% 50V	C7 C8	2	
30	SMT capacitor	0603 NC/2nF 10% 50V	C9	1	
31	SMT capacitor	0603 NC 10% 50V	C11 C12	2	
32	SMT capacitor	0805 10uF 10% 25V	CP14 CP15	2	
33	SMT capacitor	0603 33nF 1%	C13 C14	2	
34	SMT capacitor	0603 470nF 1%	C15 C16	2	
35	SMT resistor	0603R 1M 1%	R43	1	
36	SMT resistor	0603R 100R 1%	R11 R12	2	
37	SMT resistor	0603R 20K 1%	R13	1	

38	SMT resistor	0603R 3.3K 1%	R14	1
39	SMT resistor	0603R 100K 1%	R15	1
40	SMT resistor	0603R 10K 1%	R16 R28 R29 R30 R31 R42 R44	7
41	SMT resistor	0603R 20K 1%	R40 R41	2
43	SMT resistor	0603R NC/10K 1%	R19 R21	2
44	SMT resistor	0603R 33K 1%	R9 R17	2
45	SMT resistor	0603R 0R 1%	R25 R26 R32 R33	4
46	SMT resistor	0603R 2R 1%	R20 R22 R23 R24	4
47	SMT resistor	1206R 20mR 1%	R27	1
48	SMT resistor	0603R 5.1K 1%	R36	1
49	SMT resistor	0603R 1K 1%	R35	1
50	SMT LED	0603 red led	D7	1
51	SMT LED	0603 green led	D8	1
52	SMT diode	SOD-123 IN5819	D9 D10 D11	3
53	SMT NMOS	SOP-23 RU207C	N1 N8	2
54	SMT PMOS	SOT-23 RU20P7C	Q1 Q2 Q3 Q4 Q5 Q6 Q8	7
55	SMT PMOS	SOT-23 BSS84	Q7	1
56	SMT NMOS	SOT-23 2N7002	N2 N3 N4 N5 N6 N7	6
57	SMT diode	SS34	D14 D15 D16 D17	4
58	SMT diode	SOD-123 15V	D18	1
59	CBB resonant capacitor	400nF 100V	C10	1
60	Coil	A11	W1	1

Power bank+wireless charging TX/RX+Nixie Tube application
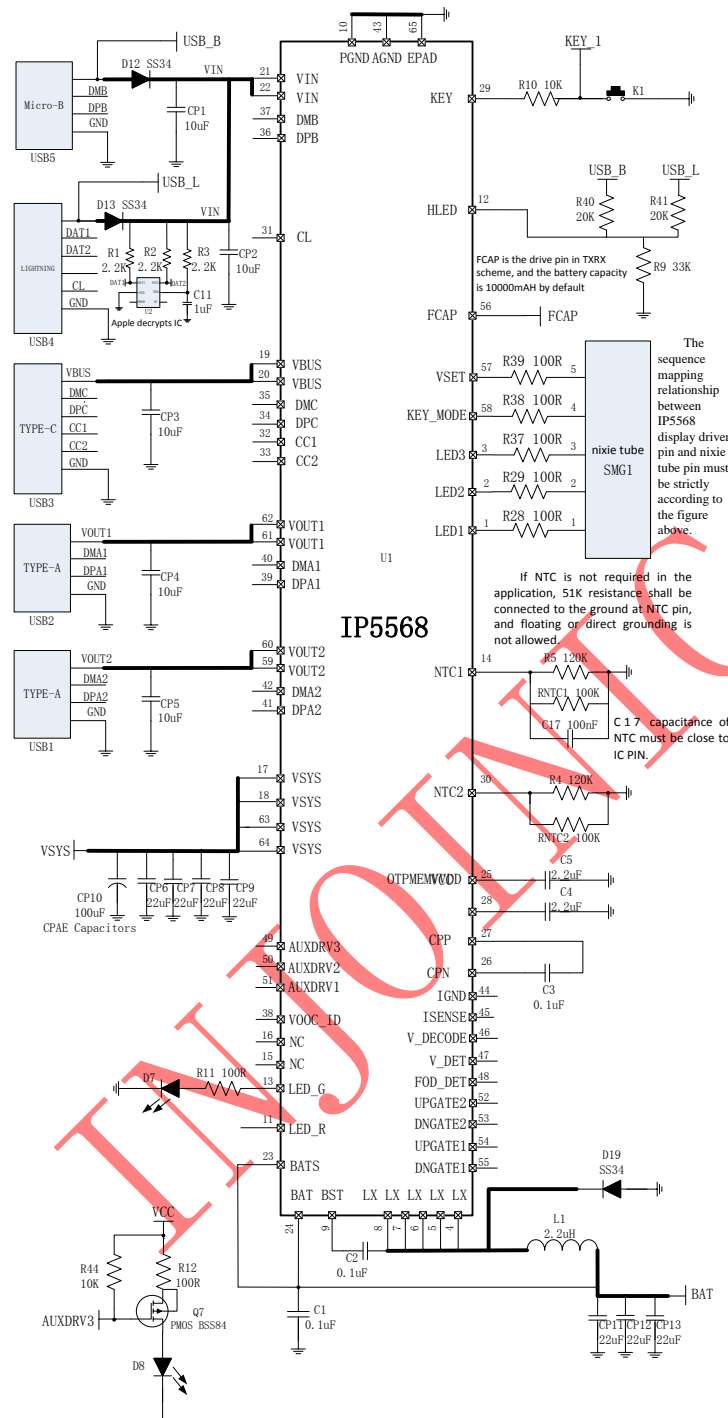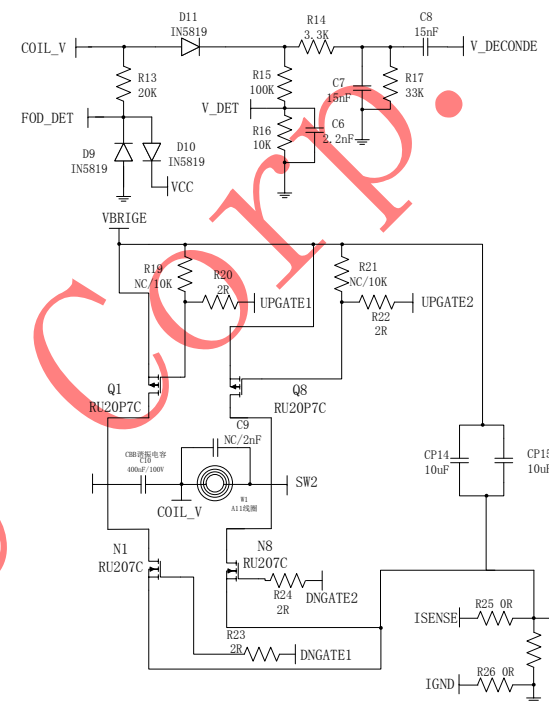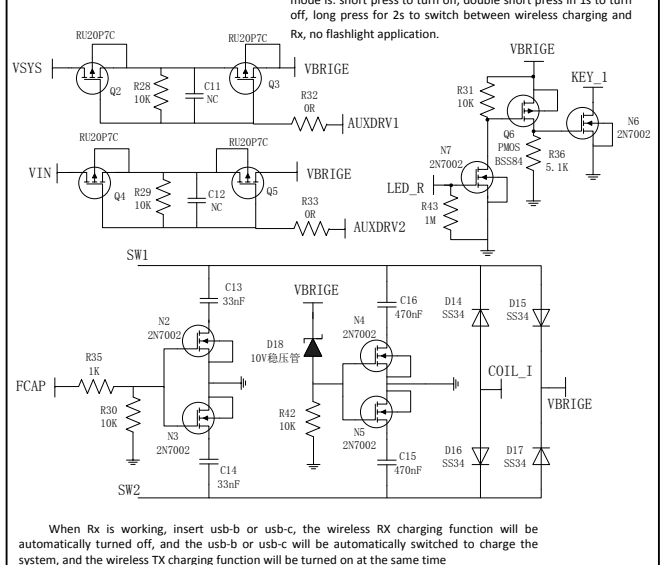

Figure 19   IP5568_RX_188 nixie tube allpication circuit（power bank+wirelesss charging TX/RX）

BOM list4

No.	Part Name	Type	Location	Num	Note
1	IC	QFN64　IP5568	U1	1	
2	SMT capacitor	0603 100nF 10% 16V	C1	1	
3	SMT capacitor	0603 100nF 10% 25V	C2 C3	2	
4	SMT capacitor	0603 2.2uF 10% 16V	C4 C5	2	
5	SMT capacitor	0805 22uF 10% 16V	CP11 CP12 CP13	3	
6	SMT capacitor	0805 22uF 10% 25V	CP6 CP7 CP8 CP9	4	
7	SMT capacitor	0805 10uF 10% 25V	CP1 CP2 CP3 CP4 CP5	5	
8	CPAE Capacitors	100uF 25V 10%	CP10	1	
10	SMT resistor	0603R 100R 1%	R28 R29 R37 R38 R39	5	
11	SMT nixie tube	YF2252SR-5	SMG1	1	
12	SMT Schottky	SS34	D12 D13 D19	3	
13	Apple decrypts IC		U2	1	Apple decrypts IC circuit BOM
14	SMT resistor	0603R 2.2K　1%	R1 R2 R3	3	
15	SMT capacitor	0603 1uF 10% 25V	C11	1	
16	SMT resistor	0603R 10K　1%	R10	1	
17	SMT resistor	0603R 120K 1%	R4 R5	2	NTC circuit BOM
18	SMT capacitor	0603 100nF 10% 16V	C17	1	
19	NTC THERMAL RESISTOR	100K@25℃ B=3950	RNTC1　RNTC2	2	
20	inductor	2.2uH 10*10	L1	1	
21	key	SMT 3*6key	K1	1	
22	output USB	AF10 8 USB	USB1 USB2	2	
24	input usb	MICRO-7-DIP-5.9	USB5	1	
25	USB C CONNECTOR	USB C CONNECTOR	USB3	1	
26	LIGHTNING CONNECTOR	apple lightning connector	USB4	1	
27	SMT capacitor	0603 2.2nF 10% 50V	C6	1	Wireless charging circuit BOM
28	SMT capacitor	0603 15nF 10% 50V	C7 C8	2	
29	SMT capacitor	0603 NC/2nF 10% 50V	C9	1	
30	SMT capacitor	0603 NC 10% 50V	C11 C12	2	
31	SMT capacitor	0805 10uF 10% 25V	CP14 CP15	2	
32	SMT capacitor	0603 33nF 1%	C13 C14	2	
33	SMT capacitor	0603 470nF 1%	C15 C16	2	
34	SMT resistor	0603R 1M 1%	R43	1	
35	SMT resistor	0603R 100R 1%	R11 R12	2	
36	SMT resistor	0603R 20K 1%	R13	1	
37	SMT resistor	0603R 3.3K 1%	R14	1	
38	SMT resistor	0603R 100K 1%	R15	1	

39	SMT resistor	0603R 10K 1%	R16 R28 R29 R30 R31 R42 R44	7
40	SMT resistor	0603R 20K 1%	R40 R41	2
41	SMT resistor	0603R NC/10K 1%	R19 R21	2
42	SMT resistor	0603R 33K 1%	R17 R9	2
43	SMT resistor	0603R 0R 1%	R25 R26 R32 R33	4
44	SMT resistor	0603R 2R 1%	R20 R22 R23 R24	4
45	SMT resistor	1206R 20mR 1%	R27	1
46	SMT resistor	0603R 5.1K 1%	R36	1
47	SMT resistor	0603R 1K 1%	R35	1
48	SMT LED	0603 red led	D7	1
49	SMT LED	0603 green led	D8	1
50	SMT diode	SOD-123 IN5819	D9 D10 D11	3
51	SMT NMOS	SOP-23 RU207C	N1 N2	2
52	SMT PMOS	SOT-23 RU20P7C	Q1 Q2 Q3 Q4 Q5 Q6 Q8	7
53	SMT PMOS	SOT-23 BSS84	Q7	1
54	SMT NMOS	SOT-23 2N7002	N2 N3 N4 N5 N6 N7	6
55	SMT diode	SS34	D14 D15 D16 D17	4
56	SMT diode	SOD-123 15V	D18	1
57	CBB resonant capacitor	400nF 100V	C10	1
58	Coil	A11	W1	1

电感推荐型号

DARFON PIN	Thickness (mm)	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.	
SPM70702R2MESQ	5	2.2	±20%	9	10.2	10.5	13.5	100kHz/1.0V
SPM10102R2MESN	4	2.2	±20%	6	7	12	18	100kHz/1.0V
SHC1004-2R2M	4	2.2	±20%	7	9	12	24	

10.Package
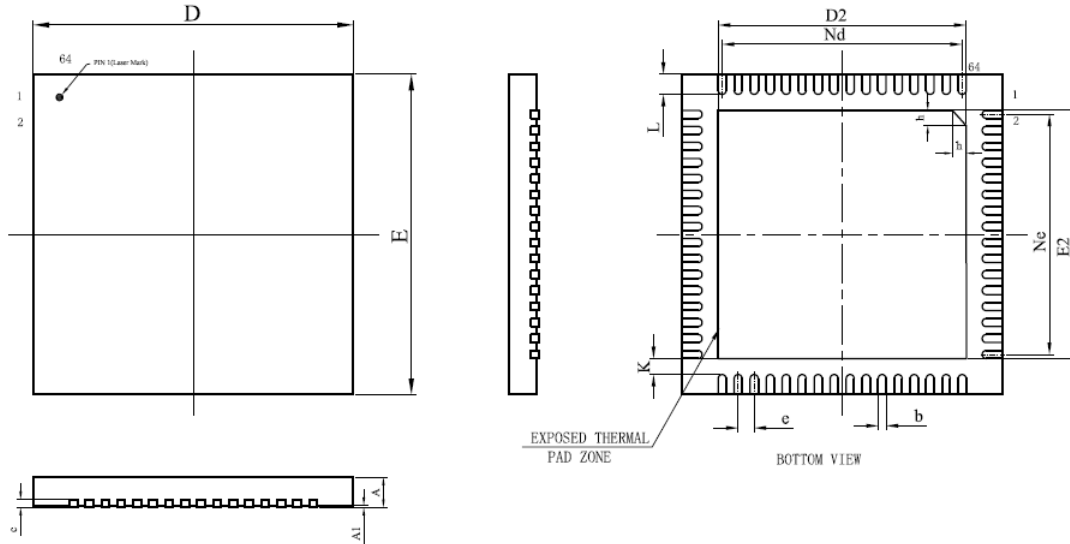
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	-	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	7.90	8.0	8.10
D2	6.10	6.20	6.30
e	0.4 BSC		
Nd	6.00BSC		
E	7.90	8.0	8.10
E2	6.10	6.20	6.30
Ne	6.00BSC		
L	0.45	0.50	0.55
K	0.20	-	-
h	0.30	0.35	0.40

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