INJOINIC TECHNOLOGY

IP2368_DEMO Test Guidance Notes

Version/revision history

releases	dates	revision	Proposed/revised by
V1.0	2021.10.21	Initial release	IT360

catalogs

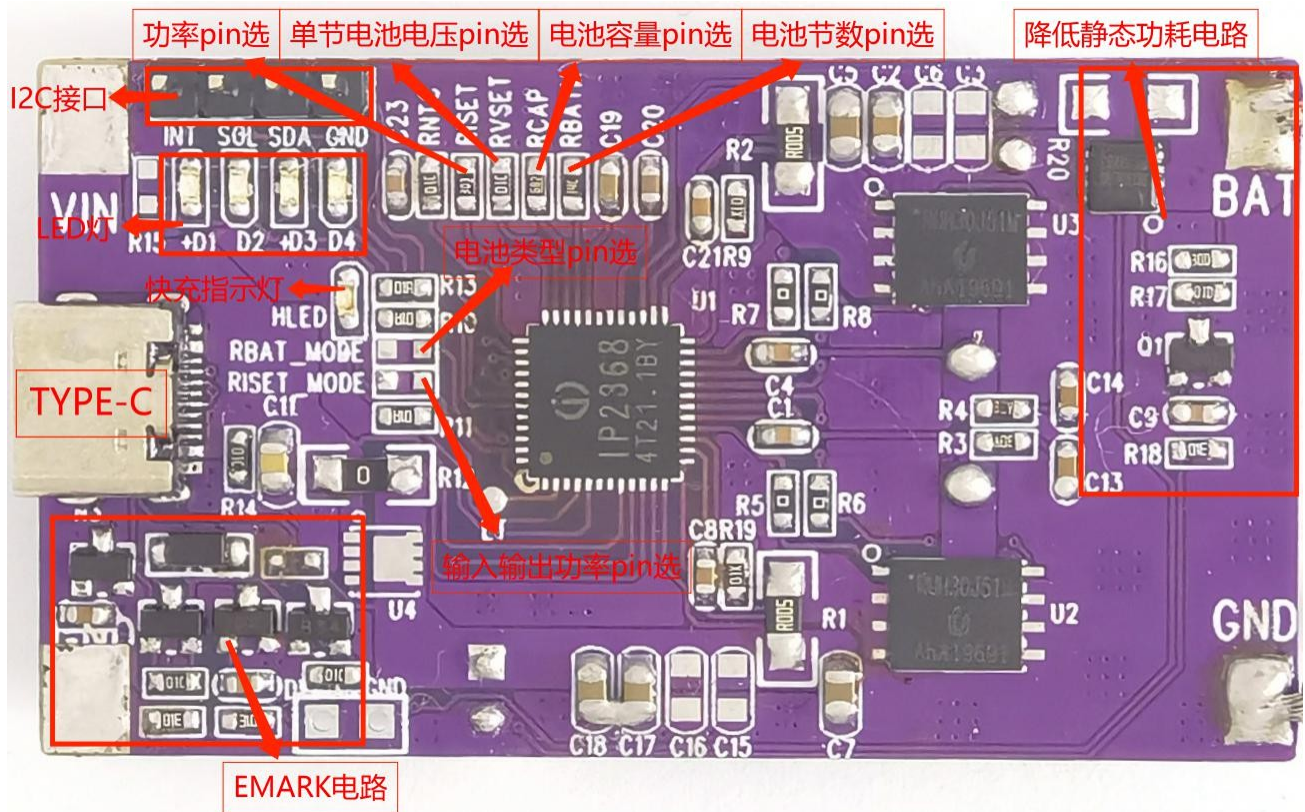# I. IP2368_DEMO Showcase

Figure 1 IP2368_DEMO Front Side

Figure 2 Back of IP2368_DEMO

IP2368_DEMO Function Introduction

- **Single TYPE-C I/O**
  - TYPE-C port input/output
- **Fast charging specifications**
  - Integrated QC2.0/QC3.0/QC3+ output fast charging protocols
  - Integrated FCP input/output fast charging protocol
  - Integrated AFC input/output fast charging protocol
  - Integrated SCP input/output fast charging protocol
  - Integrated DRP try.SRC protocol, PD3.0 input/output fast charging
  - Compatible with BC1.2, Apple fast charging phone
- **Integrated USB Power Delivery (PD2.0/PD3.0) protocols**
  - Supports PD2.0 bi-directional input/output protocols
  - Supports PD3.0 bi-directional input/output, customizable PPS outputs
  - Supports 5V, 9V, 12V, 15V, 20V voltage level inputs.
  - Supports 5V, 9V, 12V, 15V, 20V voltage level outputs
  - Bidirectional Marker Coding and Decoding (BMC) protocol with integrated hardware
  - Integrated Physical Layer Protocol (PHY)
  - Integrated Hardware CRC
  - Supports Hard Reset
- **Episode success rate control**
  - Integrated Bidirectional BUCK-BOOST Buck-Boost Power NMOS Driver
  - Integrated charge-pump control of external path NMOS
- **Charging Specifications**
  - Input power max. 100W
  - Adaptive charging current regulation
  - Supports 3.55V, 3.60V, 3.65V, 3.70V lithium iron phosphate batteries
  - Supports 4.15V, 4.20V, 4.3V, 4.35V, 4.40V lithium batteries
  - Supports 2/3/4/5/6 section tandem cells
- **Discharge specifications**
  - Output power up to 100W (EMARK circuit required)
  - Synchronized switching discharge 5V 2A with 97%+ efficiency
  - Support for line patching
- **Battery level display**
  - Built-in 14bit ADC and power meter
  - Supports 4 LED power display
  - Initial battery capacity PIN option
- **Other Functions**
  - Automatic detection of cell phone insertion and unplugging
  - Fast charging status indication
  - Supports battery temperature detection
  - Intelligent load recognition, light load automatically into standby
- **Multi-protection, high reliability**
  - Input over-voltage and under-voltage protection
  - Output over-current, over-voltage, short-circuit protection
  - Battery overcharge, overdischarge, overcurrent protection
  - IC Over Temperature Protection
  - Charge and Discharge Battery Temperature NTC Protection
  - ESD 4KV, Input (with CC/DP/DM pins) withstanding 35V

- **BOM Minimalist**
  - ■ Built-in switching power MOS driver
  - ■ Single inductor for charging and discharging

IP2368 has only 1 TYPE-C input/output interface. Maximum support for 100W input and output, 60W or more output need to add EMARK circuit, support input and battery power setting mode PIN selection, support maximum power or maximum current setting PIN selection; support 2-6 battery PIN selection, support ordinary lithium batteries and lithium iron phosphate two different types of batteries PIN selection; support different battery capacity PIN selection; support a single battery voltage PIN selection; plus reduce static power consumption circuit can reduce the standby power consumption below 1uA, automatically enter the sleep state when no load. PIN selection; plus reduce static power consumption circuit can reduce standby power consumption to less than 1uA, when no load, automatically enter the sleep state.

The IP2368's high level of integration and rich functionality requires only one inductor to realize the bi-directional buck-boost function, which requires very few peripheral devices in the application, effectively reducing the size of the overall solution and lowering the BOM cost.

IP2368's synchronized switching charging system provides up to 5.0A charging current. Built-in IC temperature, battery temperature and input voltage control loops intelligently regulate charging current.

The IP2368 has a built-in 14bit ADC to accurately measure battery voltage and current.The IP52368 has a built-in power meter algorithm to accurately obtain battery level information.

IP2368 supports 4 LEDs power display and fast charging light display.

The TYPE-C input and output ports support a wide range of fast charging, with the specific protocols listed in the table below:

Input Port	Supported fast charging protocols
Type-C port input	PD, AFC, SCP, FCP
Type-C port output	PD, QC2.0, QC3.0, QC3+, FCP, AFC, SCP

IP2368_DEMO Pin Selection Function Introduction

The default model of IP2368_DEMO is IP2368_COUT, which supports charging and discharging functions and has multiple pin selections. Customers can select the desired configuration by changing the corresponding resistor values on the demo board. The default configuration of IP2368_DEMO board is:

Input side or battery side power setting: Maximum input and output power setting of input side: 100W
Battery type setting: 4.2V
Battery capacity setting: 5000mAh Battery type setting: ordinary lithium battery Battery section setting: four sections

The PIN-optional configurations are as follows:

1. Input-side or battery-side power setting (RISET_MODE) and maximum power setting (RISET)

The IP2368 sets whether the input or battery power setting is set by determining the resistance of the RISET_MODE pin connection.

RISET_MODE is left blank by default and RISET sets the maximum input power;

RISET_MODE connects 1k to ground and RISET sets the maximum battery current;

RISET defaults to 30K, which corresponds to 100W maximum power. Maximum power configuration table:

RISET_MODE Suspension RISET Setting constant current maximum input power		RISET_MODE 1K to Ground RISET Setting constant current maximum input power	
RISET	Maximum input power during charging PCCIN=4*RISET Unit mW step=1W	RISET	Maximum input power during charging PCCIN=4*RISET Unit mW step=1W
5K	20W	5K	1A
7.5K	30W	10K	2A
11.2K	45W	12.5K	2.5A
15K	60W	15K	3A
≥25K	100W	≥25K	5A

Attention:

1. When setting the input power, the minimum step is 1W and the maximum input power is 100W; when setting the battery current, the minimum step is 100mA and the maximum input current is 5A; after the RISET is larger than 25K, it will be set to the maximum 100W or 5A charging;

2、When RISET resistance is greater than 33K, it will be detected that RISET resistance is open-circuit, and to ensure the charging safety, the charging status indicator will be abnormal alarm;

3、The standard product will automatically adjust the charging current according to the power supply capacity of the charger used; if the power supply capacity of the charger used is less than the RISET

The set charging power automatically reduces the charging current;

IP2368_COUT supports the C port discharge output function, the PDO of the discharge output can also be set through the ISET pin, the output power and the input power setting formula is the same; when the set power is greater than 60W, the output broadcasting capacity will be limited to 60W when the E-MARK cable is not recognized, the output PDO: 5V/3A, 9V/3A, 12V/3A, 15V/3A, 20V/3A. When the E-MARK cable is recognized (EMARK circuit is required), broadcast capacity can be up to 100W, and the output PDO: 5V/3A, 9V/3A, 12V/3A, 15V/3A, 20V/5A;

2. Battery type (RBAT_MODE) and full voltage setting (RVSET)

The IP2368 sets the battery type by determining the resistance of the RBAT_MODE pin connection.

RBAT_MODE is empty by default, choose ordinary lithium battery, RVSET set single cell full voltage range 4.15V~4.40V; RBAT_MODE connect 1K to ground, choose lithium iron phosphate battery, RVSET set single cell full voltage range 3.55V~3.70V;

RVSET defaults to 10K, corresponding to a battery voltage of 4.2 V. Single cell full voltage configuration table:

RBAT_MODE Overhang Set to normal lithium battery		RBAT_MODE to 1K to ground Set to lithium iron phosphate battery	
RVSET	Single cell full voltage $VTRGT=4000+0.02*RVSET$ Unit mV step=10mV	RVSET	Single cell full voltage $VTRGT=3500+0.01*RVSET$ Unit mV step=10mV
7.5K	4.15V	7.5K	3.55V
10K	4.20V	10K	3.60V
15K	4.30V	15K	3.65V
17.5K	4.35V	≥20K	3.70V
≥20K	4.40V		

Attention:

1, RVSET set single battery full voltage, the actual BAT output voltage should also be multiplied by the number of battery sections;

2、Single battery full voltage voltage setting step is 10mV, in order to ensure the accuracy, RVSET to use 1% precision resistor;

When RVSET resistance is greater than 33K, it will be detected that RVSET resistance is open-circuit, in order to ensure the charging safety, the charging status indicator will be abnormal alarm;

3. Battery capacity setting (RCAP)

The IP2368 can be set to different battery capacities by changing the resistance value of the RCAP.

RCAP defaults to 6.2K, corresponding to 5000mAh capacity. Typical battery capacity configuration table:

R26 Resistance value (ohms)	Corresponding set cell capacity (mAH)

6.2k	5000mAH
12.4k	10000mAH
18.7k	15000mAH
24.9k	20000mAH
30.9K	25000mAH

Note: The cell capacity in the table refers to the cell capacity of a single battery;

4. Battery series quantity setting (RBATM)

The IP2368 has the option to set the number of cells in series with different external resistors via the RBATM;

RBATM default 13K, corresponding to 4-string configuration. Battery string quantity configuration table:

RBATM (ohms)	Number of cells in series (strings)
6.2K	2 strings
9.1K	3 strings
13K	4 strings
18K	5 strings
27K	6 strings

# LED Indicators and I2C Usage Instructions

IP2368_BZ models support charging LEDs and do not support I2C communication IP2368_COUT models support charging and discharging LEDs and do not support I2C communication IP2368_I2C_COUT models do not support LEDs and support I2C communication.

When the IP2368_I2C_COUT model is used, a pull-down resistor is required when I2C_INT is not connected to the IO port of the MCU.

The LED PIN and I2C PIN are multiplexed as follows:

LED PIN	I2C PIN
LED1	I2C_SCL
LED2	I2C_SDA
LED3	I2C_INT

The IP2368 supports 4, 2, or 1 power indicator light programs with the following connections.

4灯模式

2灯模式1

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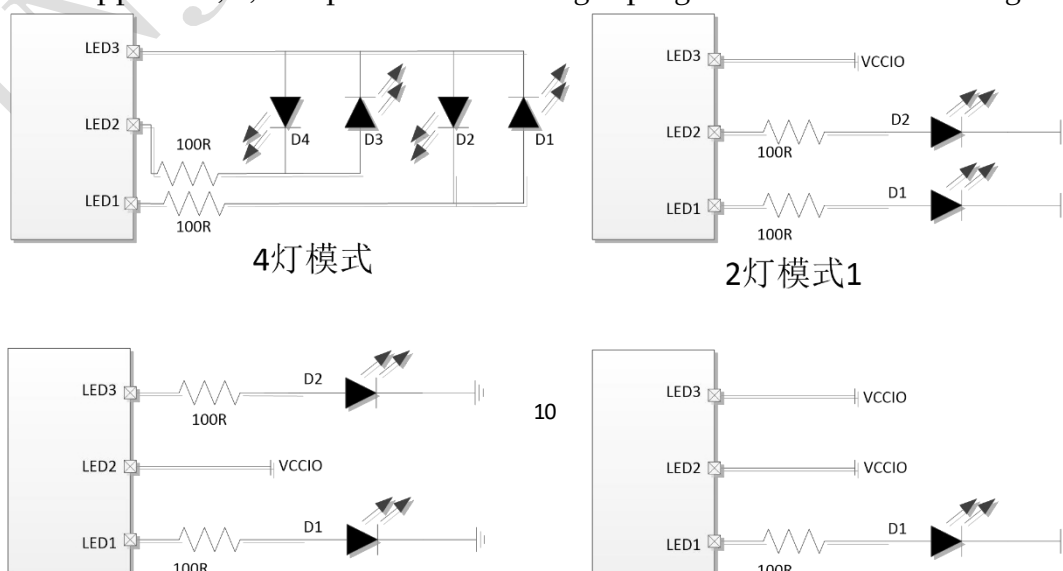
V. Reduced Static Power Circuit Description

The IP2368 standard uses the following dummy coil circuit to reduce the quiescent current to less than 1uA after the system is in standby mode, and when plugged into VBUS for charging. ISET_MODE can output a high level to conduct the battery and charge normally.

The IP2368_COUT and IP2368_I2C_COUT models require customization and schematic modification if static power reduction circuitry is to be added.