5V/2.4A Type-C Solution Power Bank

1. General Description

The SW6005 is a highly integrated power management IC for type-c power bank application, and supports A+B+C+L or A+A+B+C four ports. It integrates 2.4A switching charger, 2.4A synchronous boost, fuel gauge, segment/led driver and power controller. With simple external components, The SW6005 provides a turn-key high efficiency solution for type-c battery management.

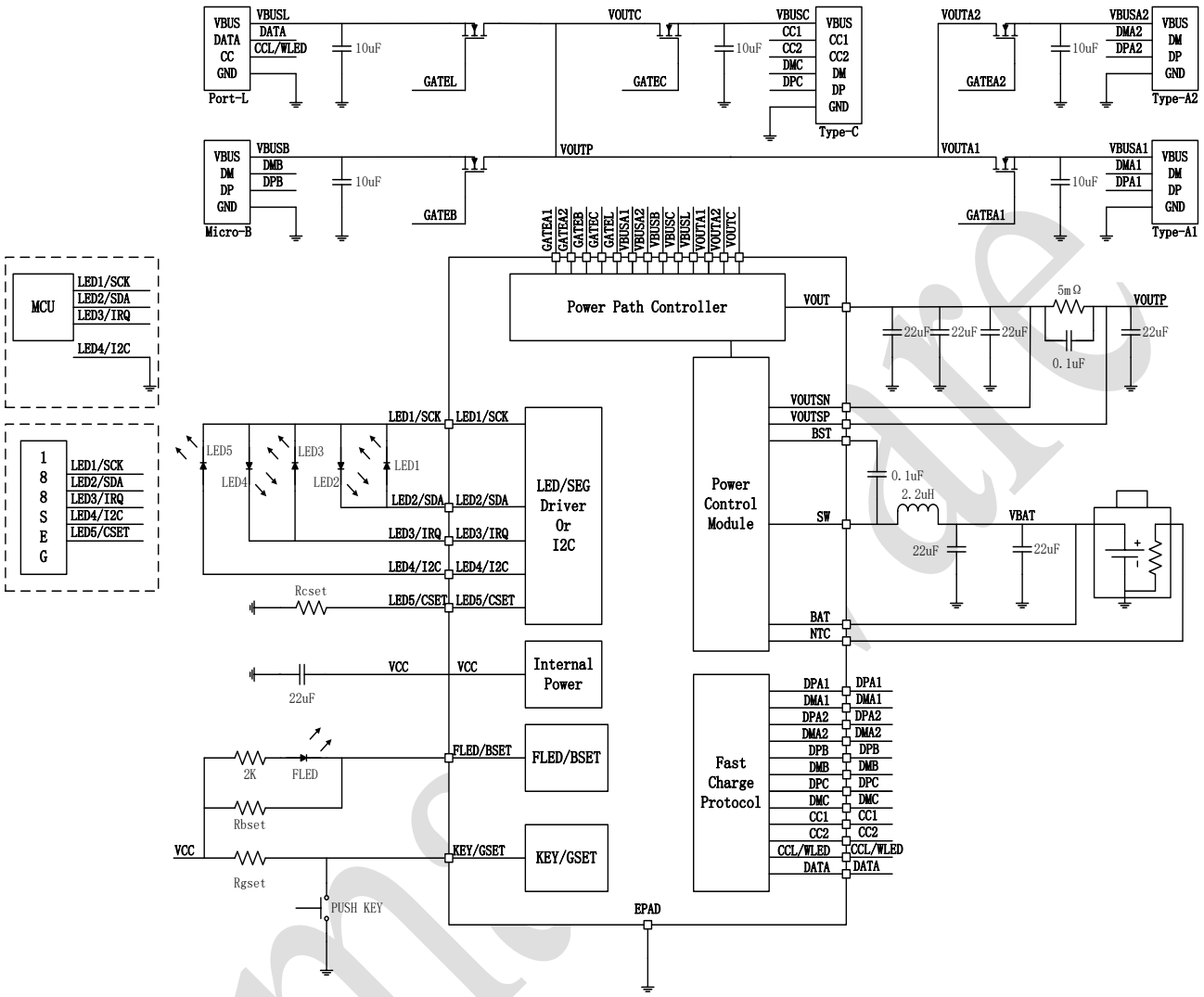
2. Applications

- Power Bank
- Battery Powered Device

3. Features

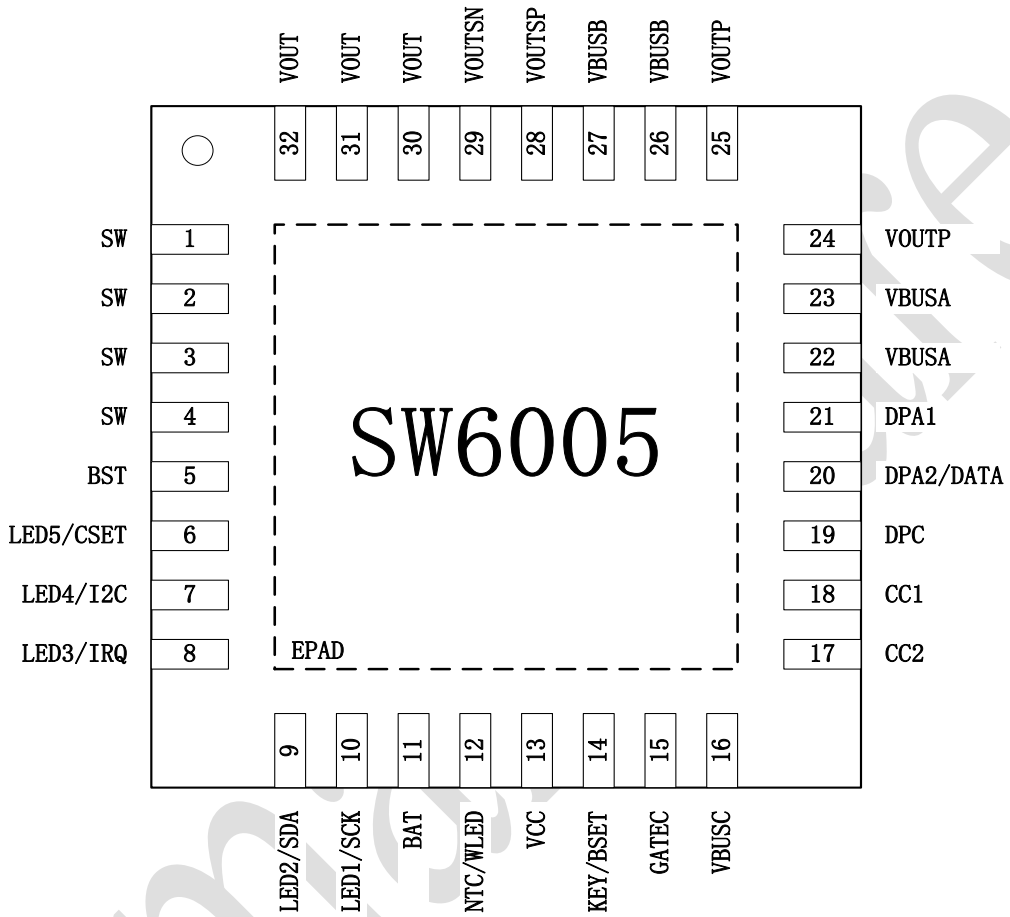
- **Switching Charger**
  - Current up to 2.4A , Efficiency up to 96%
  - Support 4.2/4.35/4.4/4.5V Battery Voltage
  - Support JEITA
  - Thermal Regulation
- **Synchronous Boost**
  - Current up to 2.4A, Efficiency up to 95%
  - Load Insert Detect and Light Load Detect
  - Support Small Current Charge Mode
- **Type-C Interface**
  - Support Type-C Specification
  - Support try.SRC Role
- **BC1.2 Module**
  - Support BC1.2 DCP
  - Support Apple & Samsung Device
- **Lightning Decryption**
  - Support Lightning Decryption
- **Fuel Gauge**
  - Include 12bit ADC
  - Support Coulometer
  - Support Segment Driver
  - Support 3~5 LEDs Driver
- **WLED Driver**
  - Support WLED Driver
- **Key Support**
  - Support Push Key
- **Protection**
  - Input Over Voltage Protection
  - Output Over Current Protection
  - Output Short Protection
  - Charger Over Voltage Protection
  - Over Temperature Protection
- **I2C Interface**
- **QFN-32(4x4mm) Package**

4. Functional Block Diagram



5. Pin Configuration and Function

5.1. Pin Configuration



5.2. Pin Descriptions

Pin	Name	Function Description
1, 2, 3, 4	SW	Switching node.
5	BST	Bootstrap pin for high side NMOS.
6	LED5/CSET	Led5 for segment driver and battery capacity set.
7	LED4/I2C	Led4 for segment driver, led driver or i2c set.
8	LED3/IRQ	Led3 for segment driver, led driver or irq.
9	LED2/SDA	Led2 for segment driver, led driver or i2c data.
10	LED1/SCK	Led1 for segment driver, led driver or i2c clock.
11	BAT	Battery voltage sense pin.
12	NTC/WLED	Negative temperature coefficient (NTC) thermistor input,

		and flash led driver.
13	VCC	Internal power.
14	KEY/BSET	Push key input, and battery voltage set.
15	GATEC	Type-C port power path control pin.
16	VBUSC	Type-C port voltage sense pin.
17	CC2	Type-C port configure channel CC2.
18	CC1	Type-C port configure channel CC1.
19	DPC	Type-C port DP pin.
20	DPA2/DATA	Type-A2 port DP, or lightning decryption pin.
21	DPA1	Type-A1 port DP pin.
22, 23	VBUSA	Type-A port output pin.
24, 25	VOUTP	Input and output common pin.
26, 27	VBUSB	Micro-B port input pin.
28	VOUTSP	Current sense positive pin.
29	VOUTSN	Current sense negative pin.
30, 31, 32	VOUT	Boost output and charger input.
	EPAD	Exposed pad.

6. Absolute Maximum Ratings

Parameters	Symbol	MIN	MAX	UNIT
Input Voltage	VBUSB	-0.3	16	V
Output Voltage	VOUT/VOUTSP/VOUTSN/ VOUTP/VBUSA	-0.3	7	V
Input/Output Voltage	VBUSC	-0.3	16	
SW Voltage	SW	-0.3	12	V
BST Voltage	BST-SW	-0.3	6	V
Power Path Control Voltage	GATEC	-0.3	21	V
Other Pin Voltage		-0.3	6	V
Junction Temperature		-40	+150	°C
Storage Temperature Range		-60	+150	°C
ESD(HBM)		-4	+4	KV

【Notice】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 my affect device reliability.

7. Recommended Operating Conditions

Parameters	Symbol	MIN	Typical	MAX	UNIT
Input Voltage	VBUSB/VBUSC	4.5		5.5	V
Battery Voltage	BAT	2.8		4.5	V

8. Electrical Characteristics

(V_{IN} = 5V, V_{BAT} = 3.7V, T_A = 25°C, unless otherwise specified.)

Parameters	Symbol	Test Conditions	MIN	TYP	MAX	UNIT
Power Supply						
VBUSB/VBUSC Input Voltage	$V_{BUSB/C}$	V_{BUSB}/V_{BUSC}	4		5.5	V
VBUSB/VBUSC Input UVLO Threshold	V_{BUSB/C_UVLO}	VBUSB/VBUSC Voltage Falling	4.0	4.125	4.25	V
VBUSB/VBUSC Input UVLO Hysteresis	V_{BUSB/C_UVLO_HYS}	VBUSB/VBUSC Voltage Rising	150	275	400	mV
VBUSB/VBUSC Input OVP Threshold	V_{BUSB/C_OVP}	VBUSB/VBUSC Voltage Rising	5.5	5.6	5.7	V
VBUSB/VBUSC Input OVP Hysteresis	V_{BUSB/C_OVP_HYS}	VBUSB/VBUSC Voltage Falling	200	300	400	mV
VCC Output Voltage	V_{CC}	Boost or V_{BUSB}/V_{BUSC} Insert	4.5	5	5.35	V
		Power Off		V_{BAT}		V
VCC Output current	I_{CC}	Boost or V_{BUSB}/V_{BUSC} Insert	40	60	80	mA
		Power Off	40	60	80	mA
Power MOS Rdson						
High Side NMOS	R_{DSON_H}		12	14	17	mΩ
Low Side NMOS	R_{DSON_L}		10	12	15	mΩ
Peak Current Limit for High Side NMOS	I_{PEAK_H}	Charge Mode	6	7	9	A
Peak Current Limit for Low Side NMOS	I_{PEAK_L}	Boost Mode	7	8	10	A
Charge Mode						
Trickle Charge End Voltage	V_{TC}		2.9	3	3.1	V
Trickle Charge Current(IBAT)	I_{TC}	V_{BAT} < 1.5V	40	70	100	mA

		1.5V< V_{BAT} < 3V	200	300	400	mA
Constant Current Charge Current Termination Charge Current Target Charge Voltage	I_{CC} I_{END} V_{BAT_FULL}	V_{BUSB} = 5V	1.8	2	2.1	A
		V_{BUSC} = 5V	2.2	2.4	2.6	A
			200	230	260	mA
			4.16	4.2	4.24	V
Recharge Threshold Switching Frequency Trickle Charge Over Time	V_{BAT_RECH} F_{CHG} t_{TC_OT}		4.05	4.1	4.15	V
			450	500	550	KHz
			30	40	50	Min
Constant Charge Over Time	t_{CC_OT}		30	33	36	Hour
Thermal Regulation Threshold	T_{REGU_CHG}		100	115	130	℃
Hold Voltage Threshold	V_{HOLD}		4.4	4.5	4.6	V
Boost Mode						
VBAT Input Voltage	V_{BAT}		2.9		4.5	V
VBAT Input UVLO Threshold	V_{BAT_UVLO}	V_{BAT} Voltage Falling	2.8	2.9	3.0	V
VBAT Input UVLO Hysteresis VOUT Output Voltage VOUT Output Current	$V_{BAT\_UVLO\_HYS}$ V_{OUT} I_{OUT}	V_{BAT} Voltage Rising	400	500	600	mV
		V_{OUT}=5V, I_{OUT}=0A	5.05	5.15	5.25	V
		V_{OUT}=5V	2.4		2.7	A
Light Load Current						
Light Load Time	t_{LIGHT_LOAD}		28	32	40	S
Quiescent Current	I_Q	V_{BAT}=3.7V	25	32	40	uA
Wire Drop Compensation	V_{OUT_WDC}	0A<I_{OUT}<1A		0		mV
VOUT Output Voltage Switching Frequency	V_{OUT} F_{BST}	1A<I_{OUT}<2A	30	50	70	mV
		I_{OUT}>2A	70	100	130	mV
			450	500	550	KHz
Thermal Regulation Threshold **Type-C** CC Current Source	T_{REGU_BST} I_{CC_SOURCE}		100	115	130	℃
		Power Level=3.0A	310	330	350	uA
CC Termination Resistor **BC1.2**	R_D		4.9	5.1	5.3	kΩ
DP/DM Voltage	DP DM	Apple 2.4A Mode	2.55	2.7	2.85	V
		Apple 2.4A Mode	2.55	2.7	2.85	V

LED						
Segment Source Current	I_{SEG}		6	10	14	mA
LED Source Current	I_{LED}		2	4	6	mA
LED Flicker Frequency	f_{LED}		0.8	1	1.2	Hz
WLED						
WLED Resistor	R_{WLED}		10	20	30	Ω
KEY						
Short Key Time	T_{SHORT}		24	32	500	mS
Long Key Time	T_{LONG}		1.5	2	3	S
Double Short Key						
I2C						
Rate	f_{CLK}			100	400	Kbit/S
Thermal Shutdown						
Thermal Shutdown Threshold	T_{SHDT}	Temperature Rising	135	150	165	℃
Thermal Shutdown Hysteresis	T_{SHDT_HYS}	Temperature Falling	55	70	85	℃
Parameters						
Power Supply						
VBUSB/VBUSC Input Voltage	$V_{BUSB/C}$	V_{BUSB}/V_{BUSC}	4		5.5	V
VBUSB/VBUSC Input UVLO Threshold	V_{BUSB/C_UVLO}	VBUSB/VBUSC Voltage Falling	4.0	4.125	4.25	V
VBUSB/VBUSC Input UVLO Hysteresis						
VBUSB/VBUSC Input OVP Threshold	V_{BUSB/C_OVP}	VBUSB/VBUSC Voltage Rising	5.5	5.6	5.7	V
VBUSB/VBUSC Input OVP Hysteresis						
VCC Output Voltage	V_{CC}	Boost or V_{BUSB}/V_{BUSC} Insert	4.5	5	5.35	V
Long Key Time	T_{LONG}	Power Off		V_{BAT}		V
VCC Output current	I_{CC}	Boost or V_{BUSB}/V_{BUSC} Insert	40	60	80	mA
I2C						
Power MOS Rdson						
High Side NMOS						

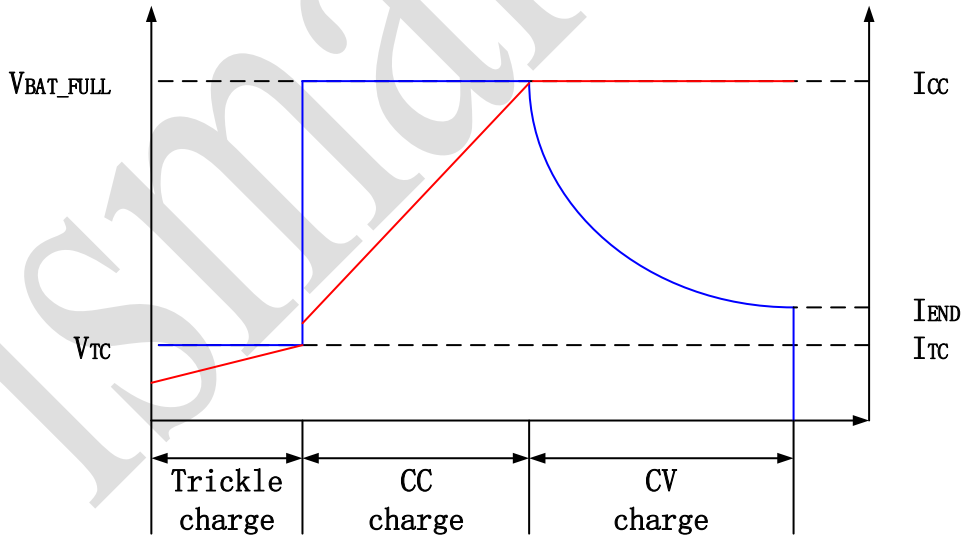
Low Side NMOS	R_{DSON_L}		10	12	15	mΩ
Peak Current Limit for High Side NMOS	I_{PEAK_H}	Charge Mode	6	7	9	A

9. Functional Description

9.1. Charge Mode

The SW6005 integrates a switching charger with efficiency is up to 96%. The switching charger supports 4.2V/4.35V/4.4V/4.5V battery voltage. Its switching frequency is up to 500KHz, so a small size inductor with inductance of 1.0uH can be used.

The switching charger charges battery in three charge phases: trickle charge(TC), constant current charge(CC) and constant voltage charge(CV). When battery voltage is lower than 3V, charger enters into trickle charge while the charge current is small current. When battery voltage rises to 3V, charge enters into constant current charge while charge current is fast charge current. When battery voltage rises to target charge voltage, charger enters into constant voltage charge while charge current falls so as battery voltage stays to target voltage. When charge current falls to termination charge current, charge cycle completes and charger stops. When battery voltage is lower than recharge threshold, charger automatically restarts.



The battery target voltage can be set by KEY/BSET pin. When KEY/BSET is pulled up to VCC with a 10KΩ resister, 4.2V is set; when selecting a 15KΩ resister, 4.35V is set; when selecting a 5.6KΩ resister, 4.4V is set; when selecting a 3KΩ resister, 4.5V is set.

Input charge current is set to 2A for Micro-B and Lightning port, and 2.4A for Type-C port.

The switching charger has battery temperature protection and support JEITA. It monitors battery

temperature by measuring the voltage of NTC pin which connects to a negative temperature coefficient (NTC) thermistor. When battery temperature is abnormal,charger will reduce charge current, reduce target charge voltage or stop to protect battery.While using a typical NTC thermistor of 103AT, When battery temperature is lower than 5℃, charger will reduce charge current by half; When battery temperature continues to fall to lower than 0℃, charger will stop; When battery temperature rises to 5℃, charger will restart and reduce charge current by half; When battery temperature continues to rise to higher than 10℃, charge current will return to normal; When battery temperature is higher than 45℃, charger will reduce target charge voltage by 0.1V; When battery temperature continues to rise to higher than 50℃, charger will stop; When battery temperature falls to 45℃, charger will restart and reduce target charge voltage by 0.1V; When battery temperature continues to fall to lower than 40℃, target charge voltage will return to normal. Resisters can be in series or parallel with the NTC thermistor to change the protection temperature range. JEITA function can be disabled if not needing.

The switching charger integrates thermal regulation. When die temperature rises to the charge thermal regulation threshold, charge current will automatically fall down so the die temperature stops increasing. If temperature continues rising to thermal shutdown temperature, charger will stop and the SW6005 powers off.

The switching charger integrates over time protection. When charging remains in trickle charge beyond the trickle charge over time, t_{TC_OT}, or charging remains in constant current charge beyond the constant current charge over time, t_{CC_OT}, charger will terminate. Charger will restart only when re-inserting the adapter.

9.2. Boost Mode

The SW6005 integrates a synchronous boost with output current up to 2.4A and efficiency is up to 95%.

The synchronous boost works in PSM/PWM mode. It works in PSM mode when in light load and in PWM mode in heavy load to make a better efficiency. It will automatically change in these two modes base on output current.

The synchronous boost has battery temperature regulation and protection. When battery temperature is abnormal,boost will stop to protect battery. While using a typical NTC thermistor of 103AT, When battery temperature is higher than 60℃ or lower than -20℃, boost will stop and turn off. When battery temperature enters into normal range, boost will not automatically restart except a start condition such as short key or load detect occur. Resisters can be in series or parallel with the NTC thermistor to change the protection temperature range.

The synchronous boost integrates thermal regulation. When die temperature rises to boost thermal regulation threshold, output voltage will automatically fall down so as die temperature stop increasing. If die temperature still rises to thermal shutdown threshold, boost will stop and turn off. When die temperature falls to thermal shutdown hysteresis, boost will not automatically restart except a start condition such as short key or load detect occur.

The synchronous boost integrates input under voltage, output over voltage, output overload and short protection.

9.3. Power Path

The SW6005 supports Type-A+Micro-B+Type-C+Lightning. Type-A and Type-C port supports BC1.2, and Lightning port supports lightning cable decryption. Besides, DPA2/DATA can be configured to BC1.2 function of the expanded Type-A port, so to supports Type-A1+Type-A2+Micro-B+Type-C.

When short key occurs or load inserts, Type-A port will turn on to power supply extern device, and light load detection will turn off Type-A/Type-C port while light load current is about 60mA. When SOURCE is attached, Type-C port will turn on and charger will automatically turn on to charge battery. When SINK is attached, Type-C port will turn on and boost will automatically turn on to supply device. When SINK is unattached, Type-C port will turn off and boost will automatically turn off. Type-C port also support light load detection. When SINK is light load, Type-C port and boost will turn off to reduce power consumption.When adapter inserts, Micro-B/Lightning port will turn on and charger will automatically turn on.

The SW6005 supports charging the battery and supplying extern device simultaneously, and light load detection for output ports will be disabled at this moment. This function can be disabled if not needing.

The SW6005 supports Type-A/Type-C ports supplying extern devices simultaneously.

9.4. Small Current Charge Mode

The SW6005 supports small current charge mode. This mode is set by register in I2C mode, and set by pin in segment/led mode.

In small current charge mode, SW6005 can charge small current device such as bluetooth headset. When enter into small current charge mode, light load detect will be disabled for two hours, and double short key will also quit this mode. Besides, fuel gauge display will also change to indicate it is in small current charge mode. Small current charge mode is set when LED2/SDA pin connects a 100KΩ resister to ground.

9.5. Type C Interface

The SW6005 integrates Type-C logic controller include try.SRC role. When SOURCE is attached, charger will automatically turn on to charge battery. When SOURCE is detached, charger will automatically turn off. When SINK is attached, boost will automatically turn on to supply device. When SINK is detached, boost will turn off .

When SINK is attached and boost turns on , the SW6005 works in SOURCE role, and will broadcast power level of 3A. if adapter inserts in Micro-B or Lightning port and boost not turns on, the SW6005 will also broadcast power level of 3A.

9.6. BC1.2 Module

The SW6005 integrates BC1.2 controller, and automatically detects apple and samsung devices:

Apple 2.4A mode: DP=2.7V, DM=2.7V;

Samsung 2A mode: DP=1.2V, DM=1.2V;

9.7. Lightning Decryption

The SW6005 integrates lightning decryption. DPA2/DATA pin can be configured to BC1.2 function of the expanded Type-A port or lightning decryption. This configuration is set by register in I2C mode, and set by pin in segment/led mode. DPA2/DATA pin is set to lightning decryption when LED1/SCK pin connects a 100KΩ resister to ground, or BC1.2 function of the expanded Type-A port.

9.8. Fuel Gauge

The SW6005 integrates coulometer to obtain accurate battery capacity.

The coulometer supports battery maximal capacity self-learning, and can learn the battery current maximal capacity in one complete charge cycle .

The battery initial capacity can be set by a resister which connecting LED5/CSET pin to ground. The relation between initial capacity Cset and resister Rcset is:

$$Rset=(Cset +2000)*5/3$$

While Cset unit is mAh, and Rset unit is Ω.

The constant charge time can be set by register in I2C mode, and set by LED3/IRQ pin in segment/led mode.

9.9. ADC

The SW6005 integrates 12 bit ADC, and samples VOUT voltage/IOUT current/battery voltage/NTC voltage/chip temperature.

ADC channel	Range	Step
VOUT voltage	0~16.384V	4mV
IOUT current	0~6.4A	25/16mA
Battery voltage	0~4.915V	1.2mV
NTC voltage	0~4.505V	1.1mV
Chip temperature	-100~200℃	1/6.82℃

9.10. NTC Function

The SW6005 integrates NTC function. It monitors battery temperature and protects when battery temperature is abnormal. NTC Pin will source a current to a NTC thermistor of 103AT, and measure the voltage to calculate battery temperature. NTC Pin will source 80uA for higher accuracy when NTC thermistor is in low resistance, and 40uA/20uA for wider range in high resistance. It sources 80uA in default mode. While sourcing 80uA, When NTC voltage is higher than 1.764V, it changes to 40uA. While sourcing 40uA, When NTC voltage is lower than 0.718V, it changes to 80uA; When NTC voltage is high than 1.7V, it changes to 20uA; While sourcing 20uA, When NTC voltage is lower than 0.678V, it changes to 40uA.

While using a typical NTC thermistor of 103AT, protection threshold and NTC voltage in discharge mode is as below:

Threshold Description	NTC Temperature/℃	NTC Voltage/V	NTC Current/uA
NTC Low Temperature Protection	-20	1.355	20
NTC High Temperature Protection	60	0.242	80

Protection threshold and NTC voltage in Charge mode is as below:

Threshold Description	NTC Temperature/℃	NTC Voltage/V	NTC Current/uA
NTC Low Temperature Protection	0	1.091	40

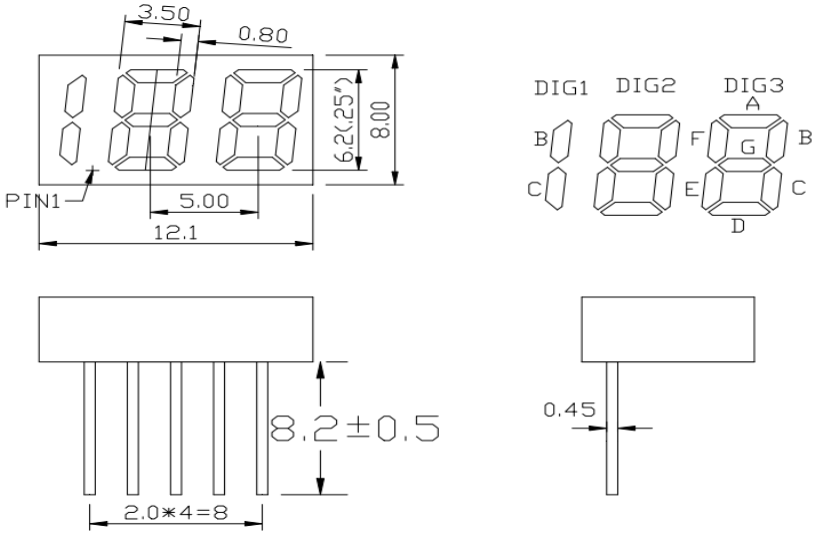
NTC JEITA Low Temperature for Reducing Current	5	1.764/0.882	80/40
NTC JEITA Low Temperature for Returning to Normal	10	1.437/0.718	80/40
NTC JEITA High Temperature for Returning to Normal	40	0.466	80
NTC JEITA High Temperature for Reducing Target Voltage	45	0.393	80
NTC High Temperature Protection	50	0.333	80

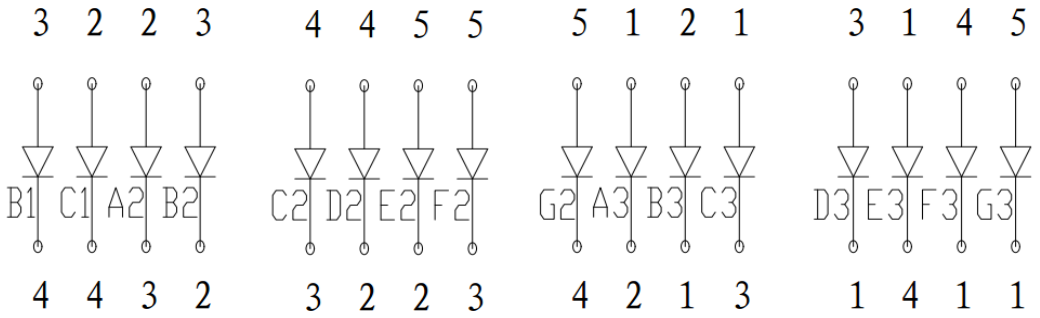
Resisters can be in series or parallel with the NTC thermistor to change the protection temperature range. If not needing NTC protection, NTC pin should connect a 10KΩ resister to ground.

9.11. Segment Driver

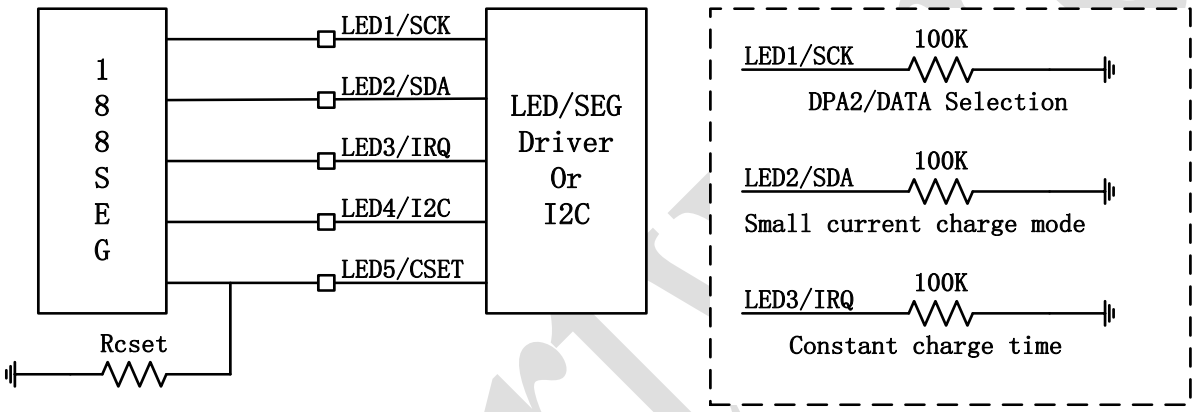
The SW6005 integrates 188 segment driver.

The 188 segment type is YF2252S-5. Its mechanical outline and circuit diagram is as below:





The 188 segment driver connection is as below:



In discharge mode, segment will keep on to indicate battery capacity. When battery capacity is lower than 5%, segment will flicker with frequency of 1Hz. When battery is low power, segment 0% will flicker 5 times to indicate battery needs to charge and then power off.

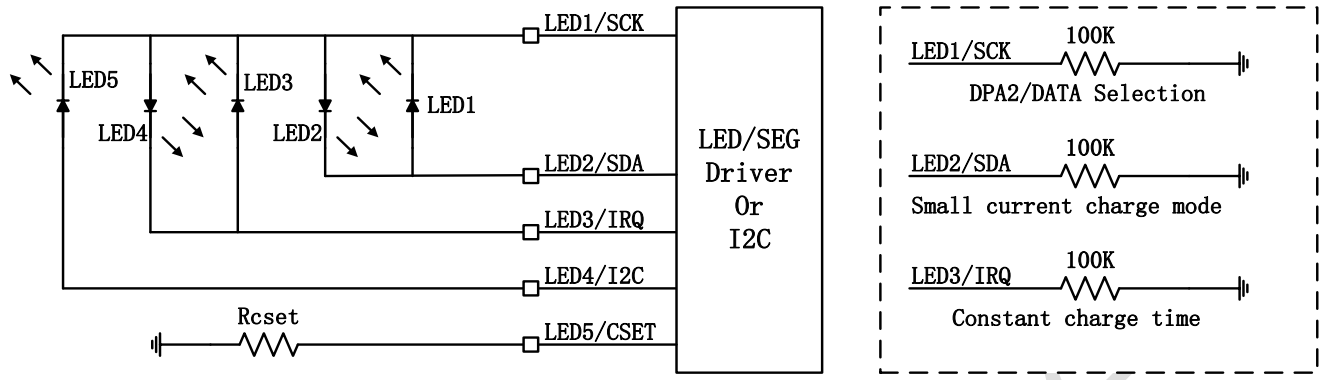
In charge mode, segment units will flicker to indicate battery capacity.

In abnormal situation such as output over current, output short, input over voltage, chip over temperature and NTC protection, segment will flicker 5 times to indicate abnormal situation and then power off.

9.12. Led Driver

The led driver supports 3/4/5 LEDs.

When connecting 5 LEDs, the LEDs connect way is as below:



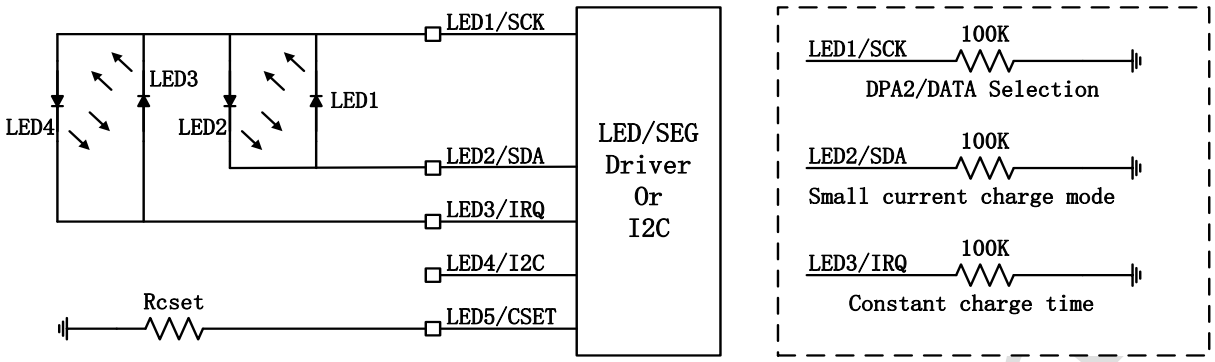
When discharging, battery capacity is shown as:

Capacity	LED1	LED2	LED3	LED4	LED5
80~100%	On	On	On	On	On
60~80%	On	On	On	On	Off
40~60%	On	On	On	Off	Off
20~40%	On	On	Off	Off	Off
5~20%	On	Off	Off	Off	Off
1~5%	Flicker	Off	Off	Off	Off
0%	Off	Off	Off	Off	Off

When charging, battery capacity is shown as:

Capacity	LED1	LED2	LED3	LED4	LED5
100%	On	On	On	On	On
80~99%	On	On	On	On	Flicker
60~80%	On	On	On	Flicker	Off
40~60%	On	On	Flicker	Off	Off
20~40%	On	Flicker	Off	Off	Off
0~20%	Flicker	Off	Off	Off	Off

When connecting 4 LEDs, the LEDs connect way is as below:



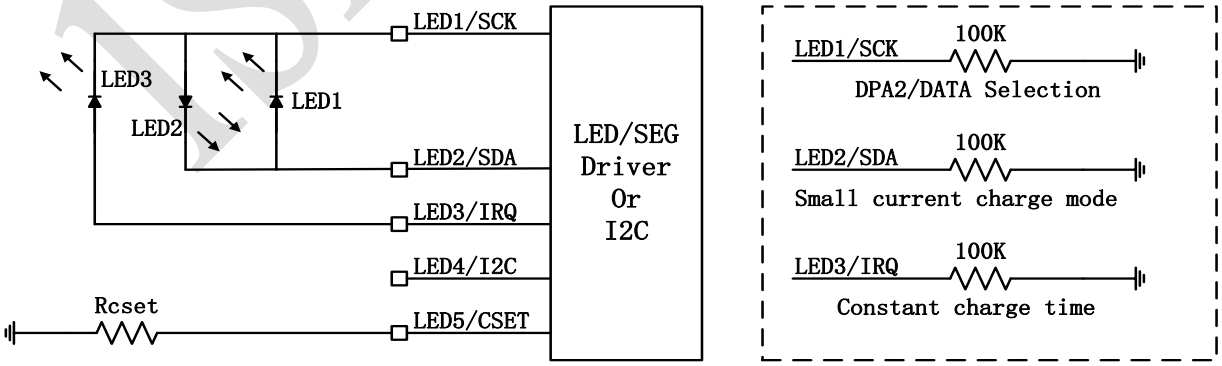
When discharging, battery capacity is shown as:

Capacity	LED1	LED2	LED3	LED4
75~100%	On	On	On	On
50~75%	On	On	On	Off
25~50%	On	On	Off	Off
5~25%	On	Off	Off	Off
1~5%	Flicker	Off	Off	Off
0%	Off	Off	Off	Off

When charging, battery capacity is shown as:

Capacity	LED1	LED2	LED3	LED4
100%	On	On	On	On
75~99%	On	On	On	Flicker
50~75%	On	On	Flicker	Off
25~50%	On	Flicker	Off	Off
0~25%	Flicker	Off	Off	Off

When connecting 3 LEDs, the LEDs connect way is as below:



When discharging, battery capacity is shown as:

Capacity	LED1	LED2	LED3
66~100%	On	On	On
33~66%	On	On	Off
5~33%	On	Off	Off
1~5%	Flicker	Off	Off
0%	Off	Off	Off

When charging, battery capacity is shown as:

Capacity	LED1	LED2	LED3
100%	On	On	On
66~99%	On	On	Flicker
33~66%	On	Flicker	Off
0~33%	Flicker	Off	Off

The led driver supports low power indication. When battery is low power, LED1 will flicker 5 times to indicate battery needs to charge and then power off.

In abnormal situation such as output over current, output short, input over voltage, chip over temperature and NTC protection, all LED will flicker 5 times to indicate abnormal situation and then power off.

9.13. WLED Driver

The SW6005 integrates flash light driver, and controlled by long key.

9.14. KEY

The SW6005 integrates key function. It supports push key, and supports short key, long key and double short key.

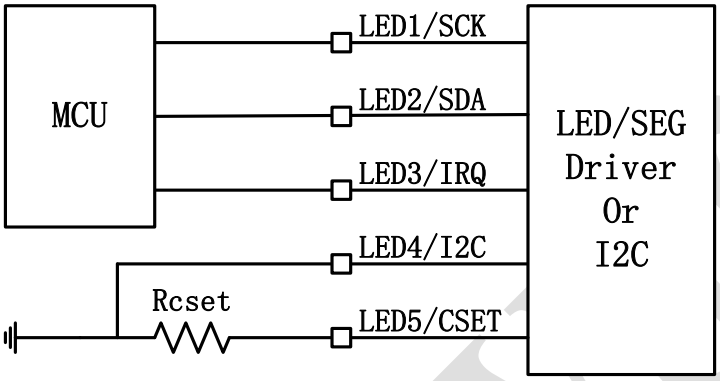
Short key: Type-A port, Type-C port of light load and segment/led driver will turn on;

Long key: WLED driver will turn on or turn off; When in small current charge mode, enter or quit small current charge mode, and not control WLED.

Double short key: Type-A, Type-C output port and segment/led driver will turn off ;

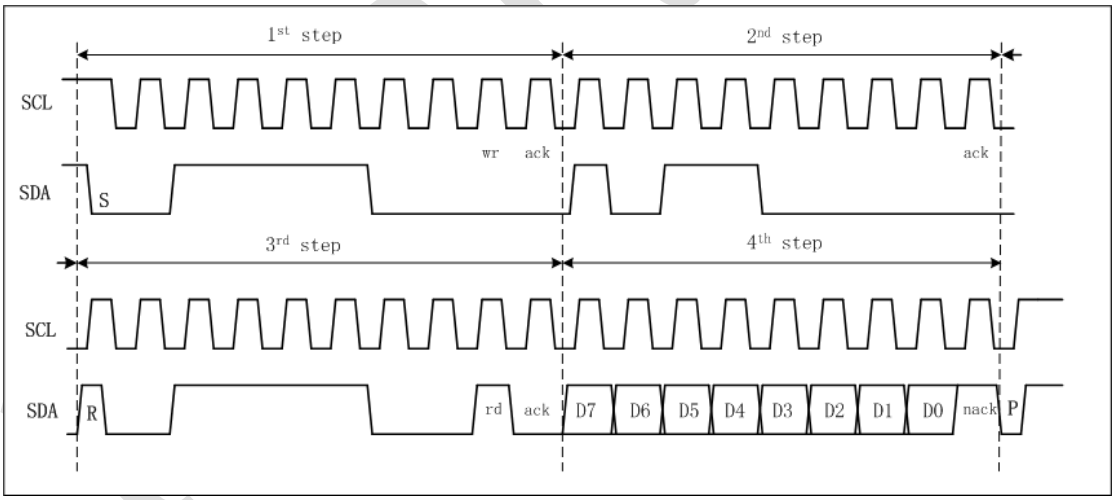
9.15. I2C Interface

The SW6005 integrates I2C interface, supports 100K/400K rate. I2C interface and Segment/led driver are shared the same four pins, identifying by seting led4/i2c pin. When using as I2C interface, LED4/I2C should connect to ground. Small current charge mode, DPA2/DATA selection and constant charge time of fuel gauge are set by registers in I2C mode.



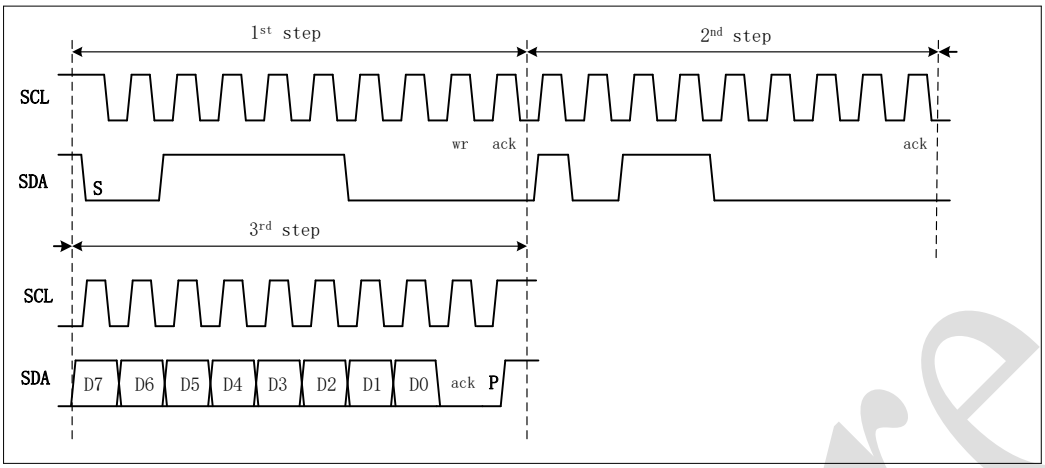
Read Timing:

Slave address ： 0x3C
Register address： 0xB0

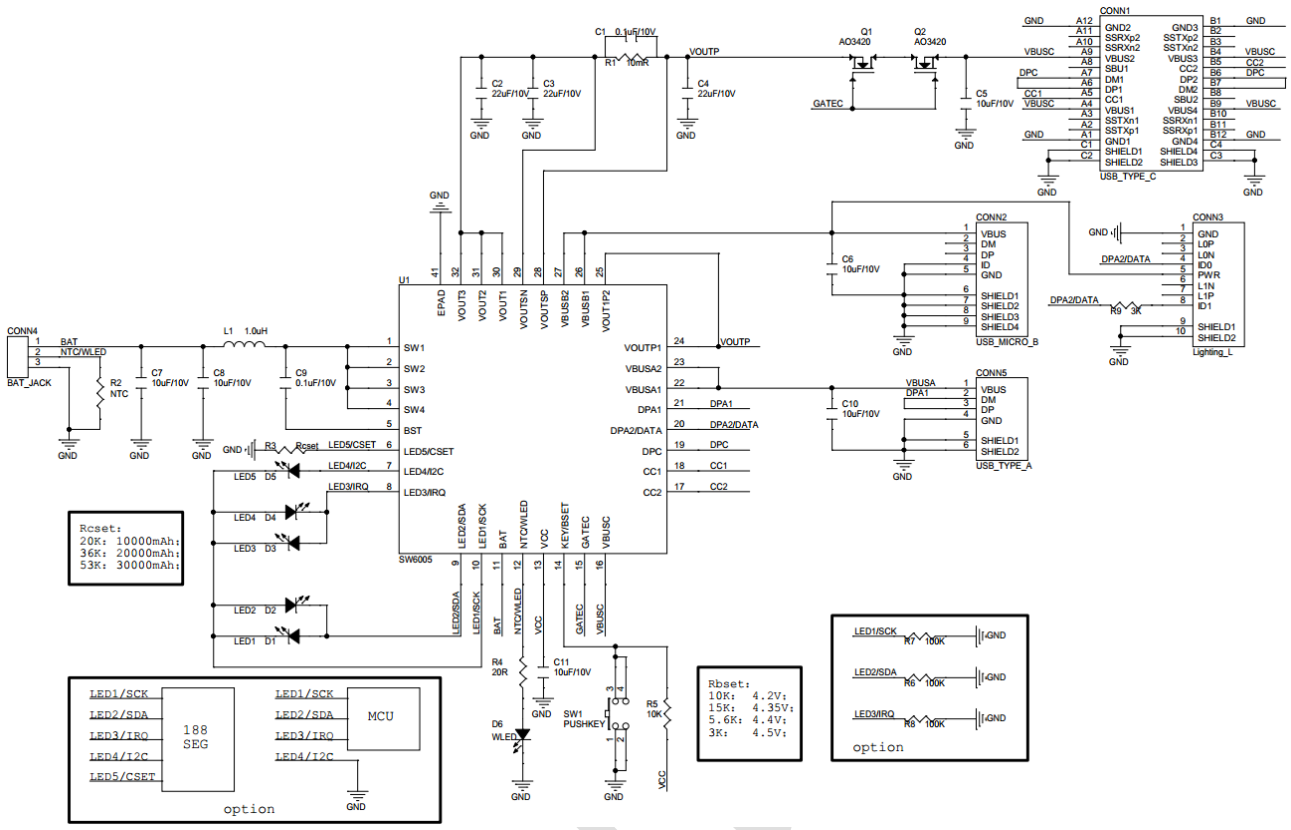


Write Timing:

Slave address ： 0x3C
Register address： 0xB0

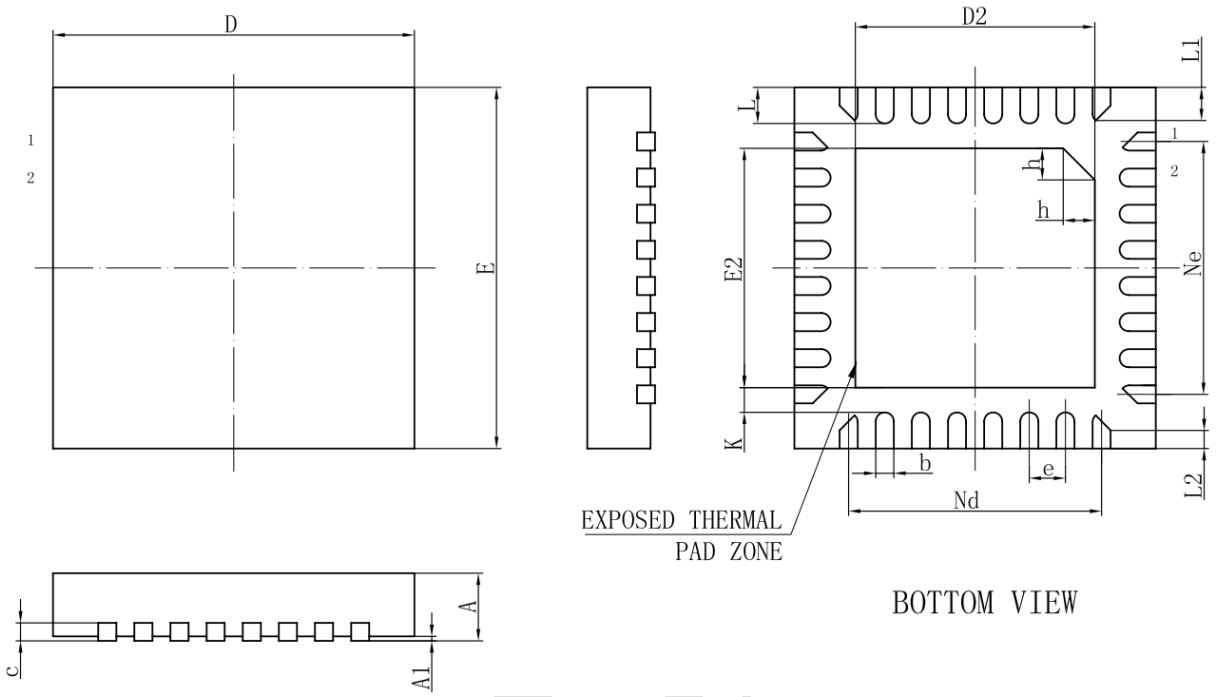


10. Typical Application Circuits



11. Mechanical and Packaging

11.1. Package Summary



11.2. Package Outline and Dimensions

Symbol	Dimension in Millimeters		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	3.90	4.00	4.10
D2	2.60	2.65	2.70
e	0.40BSC		
Nd	2.80BSC		
E	3.90	4.00	4.10
E2	2.60	2.65	2.70
Ne	2.80BSC		
K	0.20	-	-
L	0.35	0.40	0.45
L1	0.30	0.35	0.40
L2	0.15	0.20	0.25
h	0.30	0.35	0.40

12. Revision History

V1.0 Initial version.
V1.1 Modify company logo.
V1.2 Modify description of no using NTC function.
V1.3 Update document template.

Disclaimer

Zhuhai iSmartWare Technology Co., Ltd. (hereinafter referred to as "iSmartWare") may modify or update the products, services and this document provided at any time without prior notice. Customers should obtain the latest relevant information before placing an order and confirm that such information is complete and up-to-date.

The information contained in this document is for your convenience only, and iSmartWare makes no representations or warranties, express or implied, written or oral, statutory or otherwise, for such information, including but not limited to the purpose, characteristics, conditions of use, merchantability of the product. etc. iSmartWare does not assume any responsibility for this information and the consequences caused by the unreasonable use of this information.

iSmartWare assumes no obligation for application assistance or customer product design. Customers are solely responsible for their products and applications using iSmartWare. Customers should provide sufficient design and operation security verification, and guarantee that when integrating iSmartWare products into any application, they will not infringe third-party intellectual property rights, and iSmartWare will not be responsible for any infringements.

When resale of iSmartWare products, if there are differences or false components compared with the product parameters and their statements, all express or implied authorizations of iSmartWare related products will be automatically lost, and this is unfair and fraudulent. For business behavior, iSmartWare reserves the right to protect its rights in all legal ways. iSmartWare assumes no responsibility or liability for any such misrepresentation.

This document is only allowed to be reproduced without any tampering with the content and with relevant authorizations, conditions, restrictions and statements, otherwise iSmartWare has the right to pursue its legal responsibility. iSmartWare assumes no responsibility or liability for such tampered documents. Reproduction of information involving third parties is subject to additional restrictions.