



# PD-enabled dual-port charging solution for multiple fast charging protocols

## 1. Overview

SW3517S is a highly integrated dual-port charging chip with multiple fast charging protocols, supporting any port fast charging output of A+C port and independent current limiting of dual ports. It integrates 5A high efficiency synchronous buck converter, supports PPS/PD/QC/AFC/FCP/SCP/PE/SFCP and other fast charging protocols, maximum output PD 100W (20V@5A) CC/CV mode, and dual-port management logic. Only a small number of peripheral devices are required to form a complete high performance multi-fast charging protocol dual-port charging solution.

## 2. Applications

- car charger
- Adapter
- Plug and Play

## 3. Specification

### • Synchronous Buck

#### Converters

- Output current up to 5A
- Input voltage range 6~40V
- Supports CC/CV mode
- Supports dual-port independent current limiting
- Support line loss compensation
- Supports temperature control

### • Fast charging protocol

- Support PPS/PD3.0/PD2.0
- Support QC4+/QC4/QC3.0/QC2.0
- AFC support
- Support FCP
- SCP support
- Support PE2.0/PE1.1

- Support SFCP

### • Type-C interface

- Built-in USB Type-C interface logic
- Support for the DFP/Source role

- **BC1.2 Module**

- Supports BC1.2 DCP mode
- Support Apple / Samsung high current charging mode recognition

- **Fast charging indicator**

- Built-in fast charging indicator driver

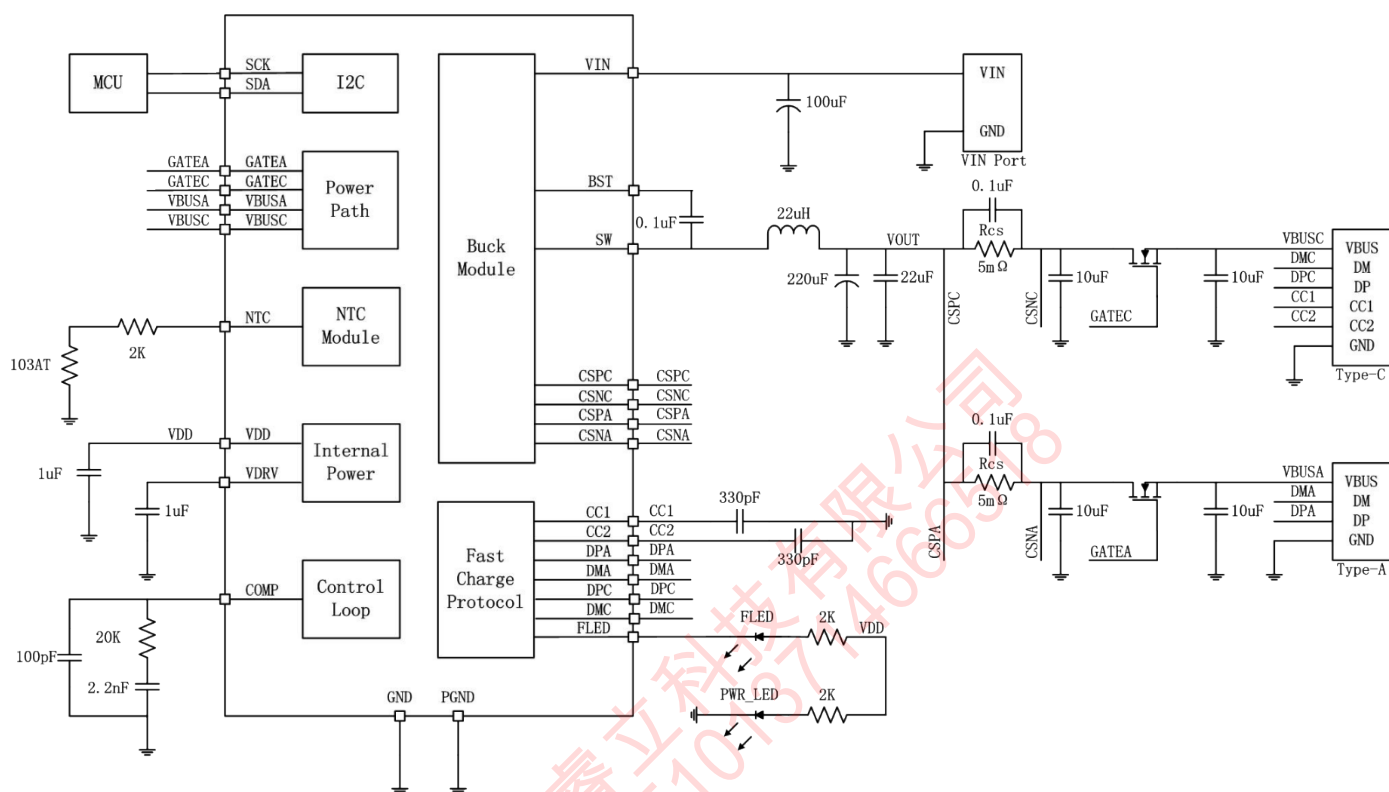
- **Protection mechanism**

- Soft Start
- Input overvoltage protection
- Input undervoltage protection
- Output overcurrent protection
- Output short circuit protection
- Over temperature protection

- **I2C Interface**

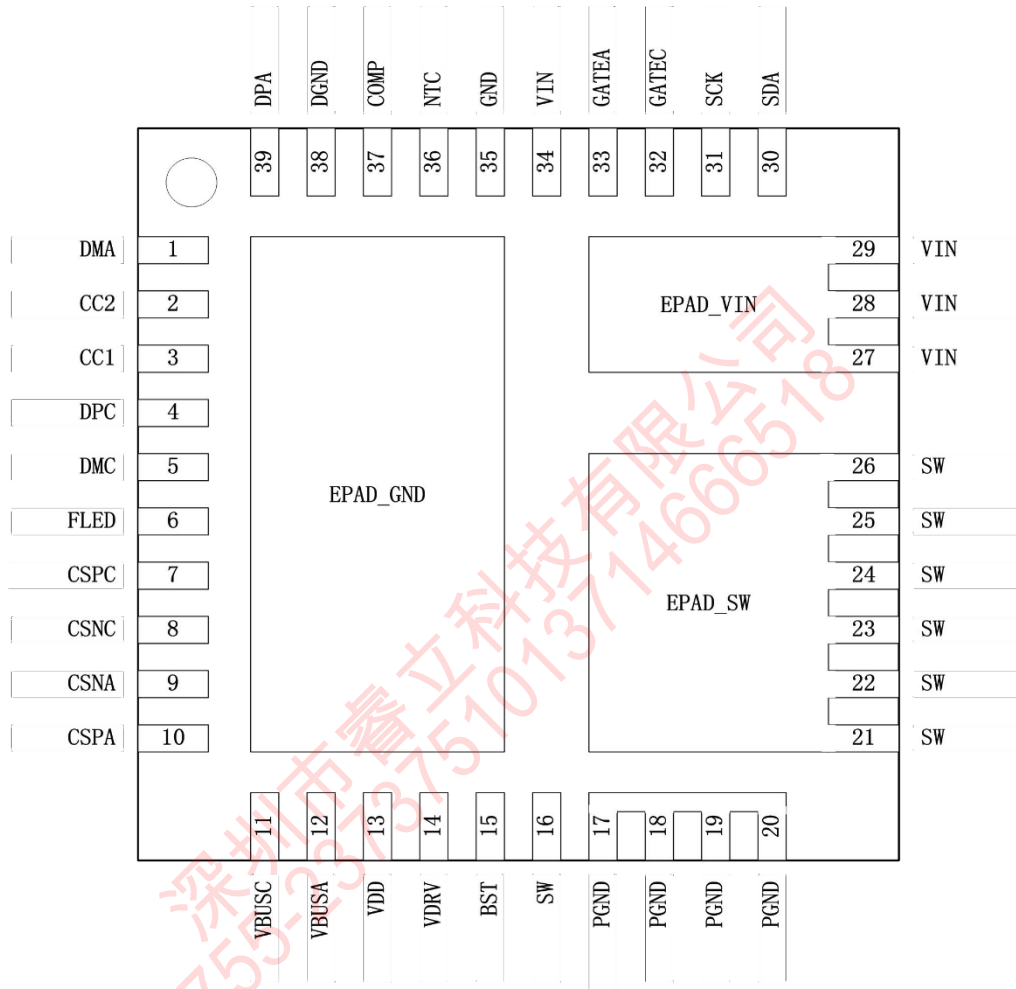
- **QFN-39(5x5mm) package**

#### 4. Functional Block Diagram



## 5. Pin definition and functional description

### 5.1 Pin Definition



### 5.2 Pin Description

Pin	Name	Function Description
1	DMA	Type-A port DM signal.
2	CC2	Type-C configuration channel 2.
3	CC1	Type-C configuration channel 1.
4	DPC	Type-C port DP signal.
5	DMC	Type-C port DM signal.
6	FLED	Fast charging indication.
7	CSPC	Type-C port output current detects the positive side.
8	CSNC	The negative side of the Type-C port output current detection.
9	CSNA	Type-A port output current detects the negative side.
10	CSPA	Type-A port output current detects the positive side.
11	VBUS	Type-C port load access detection pins.

12	VBUSA	Type-A port load access detection pins.
13	VDD	Internal working power supply.
14	VDRV	Drive power.
15	BST	The upper N-tube drives the Bootstrap pin.
16, 21, 22. 23, 24, 25, 26	SW	Open nodes.
17, 18, 19, 20	PGND	Power Ground.
27, 28, 29, 34	VIN	Input power.
30	SDA	I2C data signal.
31	SCK	I2C clock signal.
32	GATEC	Type-C port path control.
33	GATEA	Type-A port path control.
35	GND	Digital Land.
36	NTC	Board-level temperature detection pins.
37	COMP	External compensation pins.
38	DGND	Ground.
39	DPA	Type-A port DP signal.
	EPAD_SW	Switching node EPAD.
	EPAD_VIN	Input power EPAD.
	EPAD_GND	Heat sink EPAD.

## 6. Limit parameters

Parameters	Symbol	MIN	MAX	UNIT
Input Voltage	VIN	-0.3	40	V
Output Voltage	CSPA/CSNA/CSPC/ CSNC/VBUSA/VBUSC	-0.3	22	V
SW pin voltage	SW	-0.3	40	V
BST Pin Voltage	BST-SW	-0.3	6	V
Pass-through control voltage	GATEA/GATEC	-0.3	27	V
Other pin voltages		-0.3	6	V
Tem perat ure savi ng		-40	+150	°C
Storage temperature		-60	+150	°C
ESD (HBM)		-4	+4	KV

Note] Voltage, current and temperature conditions beyond this range may cause permanent damage

to the device.

## 7. Recommended Parameters

Parameters	Symbol	MIN	Typical	MAX	UNIT
Input Voltage	VIN	5		36	V

## 8. Electrical Characteristics

( $V_{IN} = 12V$ ,  $T_A = 25^{\circ}C$ , unless otherwise noted.)

Parameters	Symbol	Test Conditions		MIN	TYP	MAX	UNIT
Power supply							
VIN input power	VIN			5		36	V
VIN Input Undervoltage Threshold	VIN_UVLO	VIN input voltage drop		4.9	5	5.1	V
VIN Input Undervoltage Threshold Hysteresis	VIN_UVLO_HYS	VIN input voltage rise		0.85	1	1.15	V
VIN Input Overvoltage Threshold	VIN_OVP	VIN input voltage rise		36	37.5	39	V
VIN Input Overvoltage Threshold Hysteresis	VIN_OVP_HYS	VIN input voltage drop		1.2	1.5	1.8	V
VDD Output Voltage	VDD	VIN=12V		4.9	5	5.1	V
VDD Output Current	IDD	VIN=12V			50		mA
VDRV Output Voltage	VDRV	VIN=12V		4.9	5	5.1	V
No-load current	IQ	VIN=12V, IOUT=0mA			2	4	mA
Buck converters							
Switching frequency	FCHG			110	125	140	KHz
Output Voltage	VOUT	VOUT=5V, IOUT=0V		5.0	5.1	5.2	V
		VOUT=9V, IOUT=0V		8.9	9.1	9.3	V
		VOUT=12V, IOUT=0V		11.9	12.1	12.3	V
		VOUT=15V, IOUT=0V		14.8	15.1	15.4	V
		VOUT=20V, IOUT=0V		19.8	20.1	20.4	V
CC current limit	ICC	RCS=5mΩ	When single port output	3.0	3.3	3.6	A
			For two-port output	2.4	2.7	3.0	A
Line loss compensation	VOUT_WDC	RCS=5mΩ				200	mV
Thermostatic temperature value	TREGU_CHG			105	120	135	℃
Light load detection							
Light load current detection threshold	ILIGHT_LOAD	RCS=5mΩ		10	15	25	mA

Light load detection shutdown time	iLIGHT_LOAD		1.5	2	3	S
<b>Type-C interface</b>						
CC pin output current	ICC_SOURCE	Power Level=3.0A	310	330	350	uA
<b>BC1.2</b>						
DP/DM Voltage	DP	Apple 2.4A Mode	2.55	2.7	2.85	V
	DM	Apple 2.4A Mode	2.55	2.7	2.85	V
<b>PE</b>						
Current Threshold	IREF		150	250	350	mA
Exit time	iPLUG_OUT		160	200	240	mS
<b>I2C</b>						
Speed	fCLK			100	400	Kbit/S
<b>Thermal shutdown protection</b>						
Overheat shutdown threshold	TSHDT	Temperature rise	135	150	165	°C
Overheating shutdown lag	TSHDT_HYS	Temperature drop	35	50	65	°C

## 9. Function Description

### 9.1 Buck converters

The SW3517S integrates a high efficiency switching buck converter. With built-in dual N power tubes, load capability up to 5A and efficiency >95% (VIN=12V, VOUT=5V, IOUT=5A)

The buck converter switches at 125KHz with PFM/PWM automatic switching mode, operating in PFM mode for light loads and PWM mode for medium and heavy loads.

The buck converter supports CC/CV mode. When the load current is less than the CC current limit, the buck circuit outputs the set voltage. When the load reaches the CC limit value, the output current will be limited at the CC limit value and the output voltage will drop. For single port output, the CC limit is 3.3A; for dual port output, each port is individually limited to 2.7A.

The buck converter supports line loss compensation. The output compensation voltage increases linearly according to the load current, and the maximum compensation when the CC current limit is reached is 200mV.

The buck converter supports temperature control. When the chip temperature exceeds 120°C, the output voltage starts to drop; if the over-temperature continues to exceed 150°C, the chip enters the over-temperature shutdown mode. After entering the over-temperature shutdown mode, the temperature drops below the



over-temperature threshold hysteresis, the chip automatically turns on, and the buck converter starts back to the default state.

The buck converter includes input overvoltage/input undervoltage/output overcurrent/output short circuit protection.

## 9.2 Passage control

SW3517S supports Type-A+Type-C dual port output and any port supports fast charging output.

Type-A port supports QC3.0/QC2.0/AFC/FCP/SCP/PE2.0/PE1.1/SFCP fast charging output.

Type-C port support PPS/PD3.0/PD2.0/QC4+/QC4/QC3.0/QC2.0/AFC/FCP/SCP/PE2.0/PE1.1/SFCP fast charging transmission

Out.

By default, the Type-A port outputs 5V, and Type-C has no output. When single port output, fast charging output is supported. When dual-port output, support

5V output, while each port is individually current-limited.

Load access will open the closed Type-A port to external discharge. In single-port output, the Type-A port returns to the default 5V output after no-load detection; in multi-port, no-load detection will close the Type-A port. The current threshold of no-load detection is about 15mA, UFP device access will open the Type-C port for external discharge, UFP device removal will close the Type-C port, and the Type-C port path will be closed when the Type-C port is empty.

## 9.3 Type-C interface

The SW3517S integrates a Type-C interface controller that supports the DFP/Source role and automatically discharges UFP devices when they are plugged in. The path is automatically closed when the UFP device is moved out.

When the UFP device is connected, the SW3517S will broadcast 3A current capability on the CC pin.

## 9.4 PD Fast Charging

SW3517S integrates PPS/PD3.0/PD2.0 fast charging protocols, PPS output supports up to 3.3~21V@3A, PD3.0/PD2.0 output supports 5V/9V/12V/15V@3A, 20V@5A, and up to 100W output.

## 9.5 QC Fast Charge

SW3517S integrates QC fast charging protocol, supports QC4+/QC4/QC3.0/QC2.0, supports Class A/Class B. QC2.0 output supports 5V/9V/12V/20V. QC3.0 output supports 3.6V~20V, 200mV/Step.

QC2.0/QC3.0 requests the appropriate output voltage based on the DP/DM voltage, as follows:

Access devices		SW3517S	
DP	DM	VOUT	Note
3.3V	3.3V	20V	
0.6V	0.6V	12V	
3.3V	0.6V	9V	
0.6V	3.3V	Continuous Mode	0.2V/Step
0.6V	GND	5V	

## 9.6 AFC Fast Charging

SW3517S integrates AFC fast charging protocol and supports 5V/9V/12V output.

## 9.7 FCP Fast Charging

SW3517S integrates FCP fast charging protocol and supports 5V/9V/12V output.

## 9.8 SCP Fast Charging

SW3517S integrates with SCP fast charging protocol and the output supports 5V@4.5A, 4.5V@5A.

## 9.9 PE fast charging

SW3517S integrates PE2.0 and PE1.1 fast charging protocols, PE2.0 output supports 5V~20V, 500mV/Step, PE1.1 output supports 5V/7V/9V/12V.

## 9.10 SFCP Fast Charging

SW3517S is integrated with SFCP fast charging protocol and supports 5V/9V/12V output.

## 9.11 BC1.2 Functions

The SW3517S includes the USB Smart Adaptive Function Module, which not only supports the BC1.2 function and the Chinese cell phone charger standard, but is also well compatible with the high current output recognition of Apple and Samsung:

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

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

## 9.12 Fast charging indicator

The SW3517S has an integrated fast charging indicator driver FLED pin, which pulls the FLED low to turn on the fast charging indicator when fast charging is output.

## 9.13 ADC

SW3517S has an internal 12 bit ADC to capture input voltage/output voltage/type-A port output current/type-C port output current/board level temperature. The board-level temperature is converted by collecting the voltage of 103AT NTC resistor, and the detection accuracy at high temperature is improved by connecting 2K resistors in series. Specifically:

ADC pass-through	Scope	Step
Input Voltage	0~40.96V	10mV

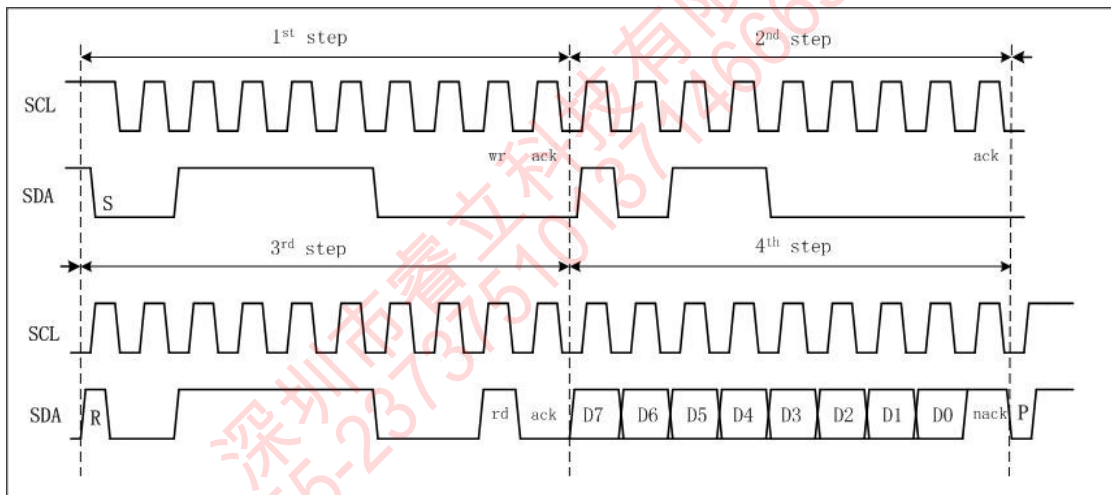
Output Voltage	0~24.576V	6mV
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Type-A port output current	0~10.24A	2.5mA
Type-C port output current	0~10.24A	2.5mA
NTC Voltage	0~2.048V	0.5mV

## 9.14 I2C Interface

The SW3517S supports I2C interface and supports 100K/400K communication rate. Read operation:

Slave address : 0x3C

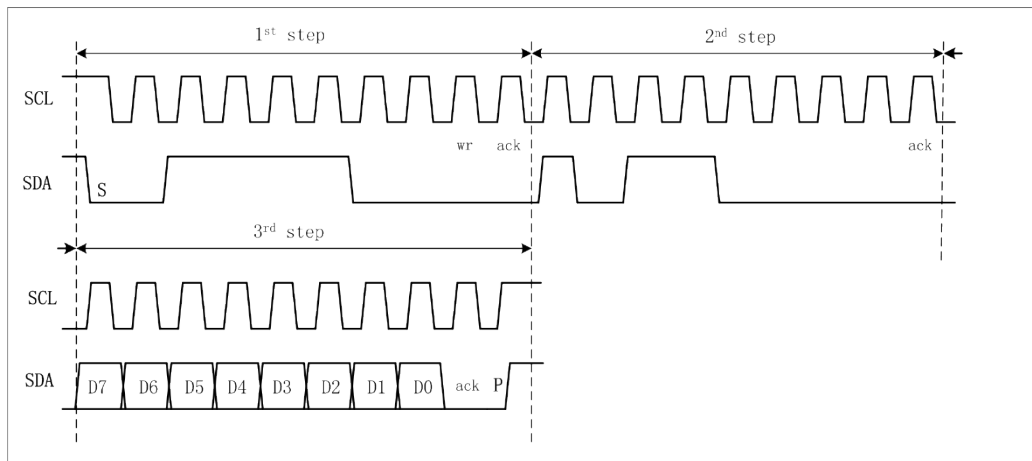


Register address : 0xB0

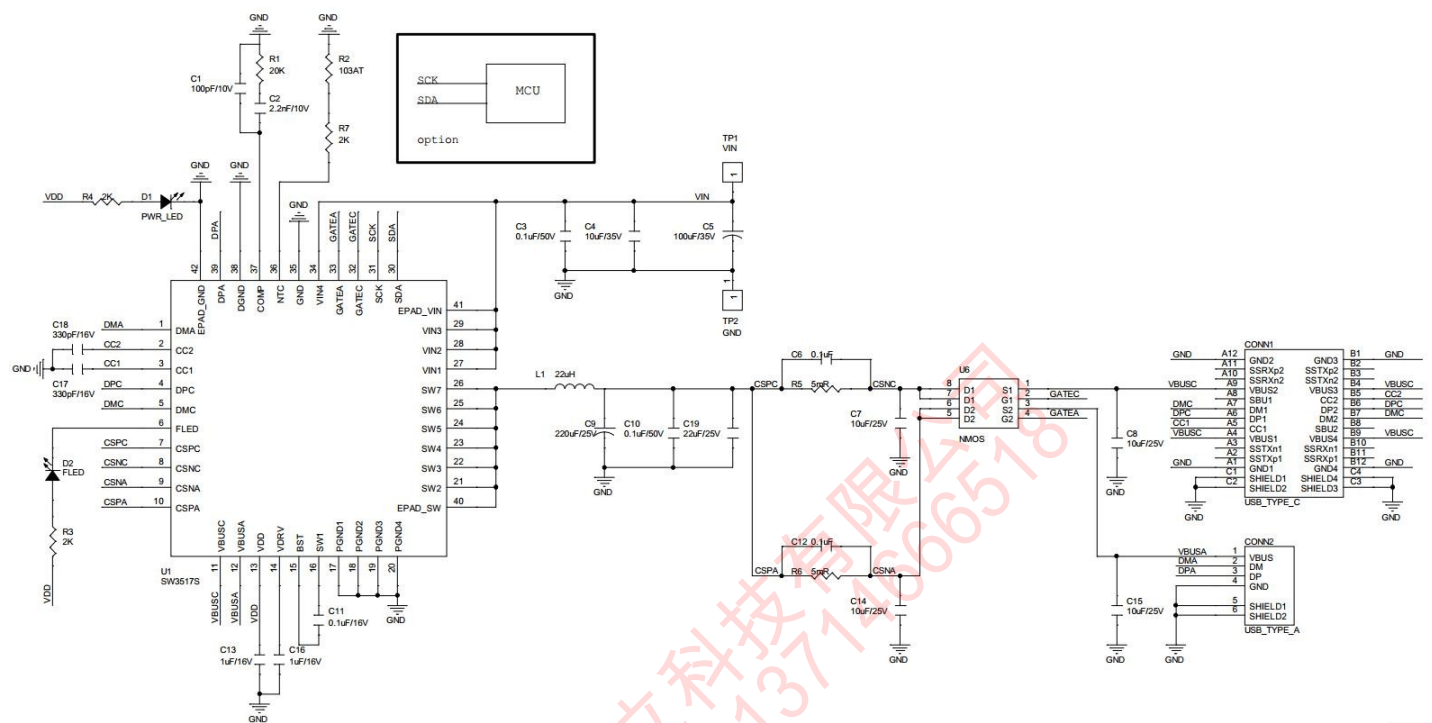
Write operation:

Slave address : 0x3C

Register address : 0xB0

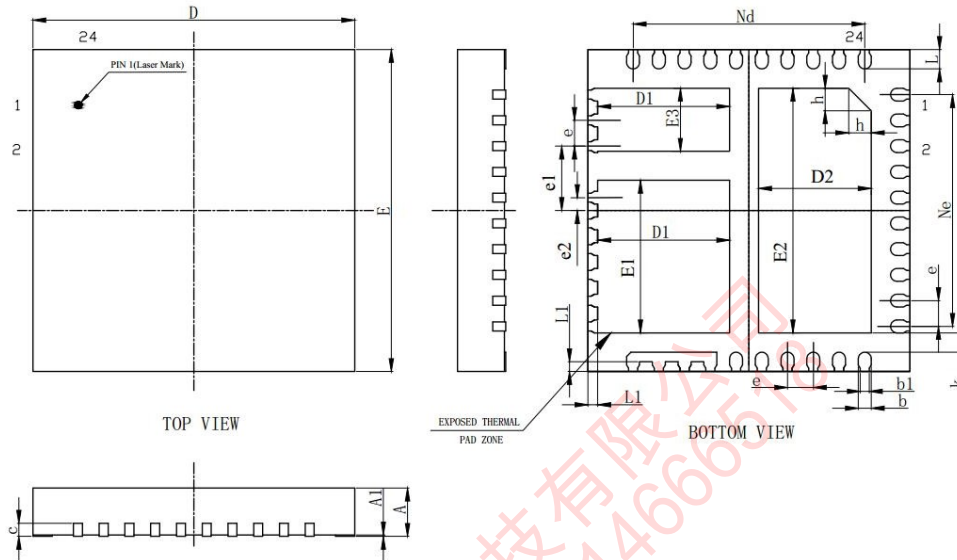


## 10. Typical Application Circuit Diagram



## 11. Mechanical size

### 11.1 Package diagram



### 11.2 Package Size

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
b1	0.14REF		
c	0.203REF		
D	4.90	5.00	5.10
D1	2.00	2.05	2.10
D2	1.65	1.75	1.85
e	0.40BSC		
e1	1.00BSC		
e2	0.20BSC		
Nd	3.60BSC		
Ne	3.60BSC		
E	4.90	5.00	5.10
E1	2.27	2.37	2.47
E2	3.70	3.80	3.90
E3	0.88	0.98	1.08
L	0.25	0.30	0.35
h	0.30	0.35	0.40
k	0.25	0.30	0.35



## 12. Version History

V1.0 Initial version;

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