PD Solution for Fast Charge Application

1. General Description

The SWSW3522 is a highly integrated power management IC for fast charge application. It integrates 3.5A synchronous buck, PPS/PD/QC/AFC/FCP/SFCP fast charge protocol, CC/CV mode. With simple external components, The SW3522 provides a turn-key high efficiency solution for fast charge application.

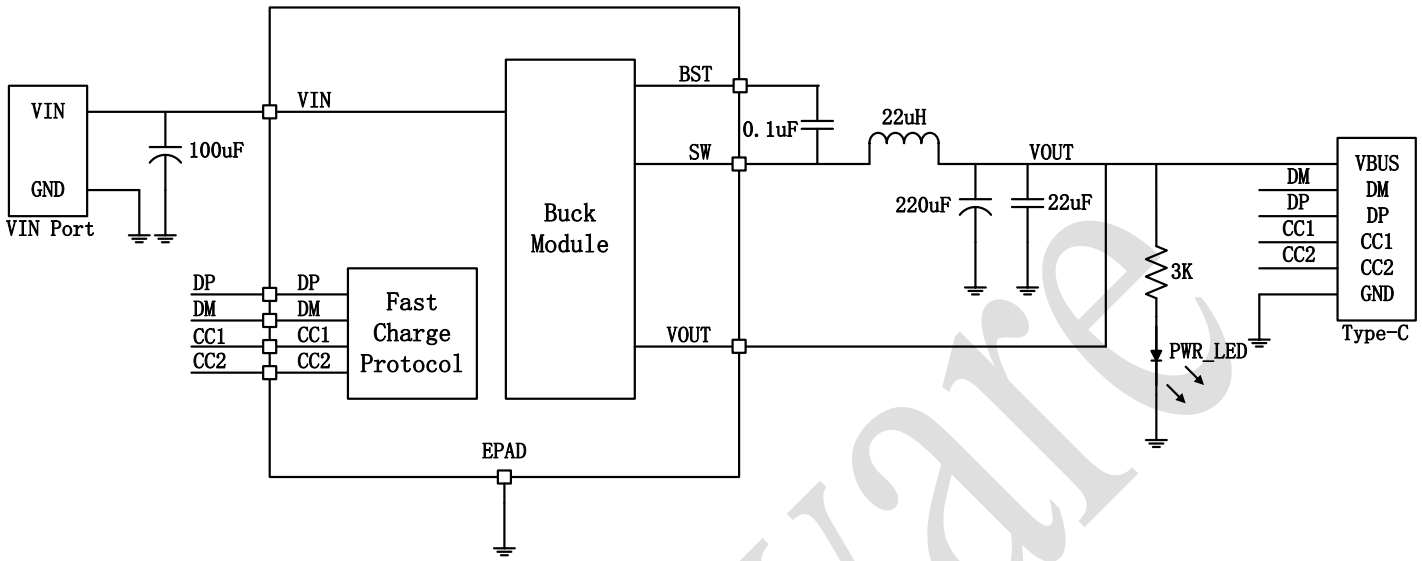
2. Applications

- Car Charger
- Adapter

3. Features

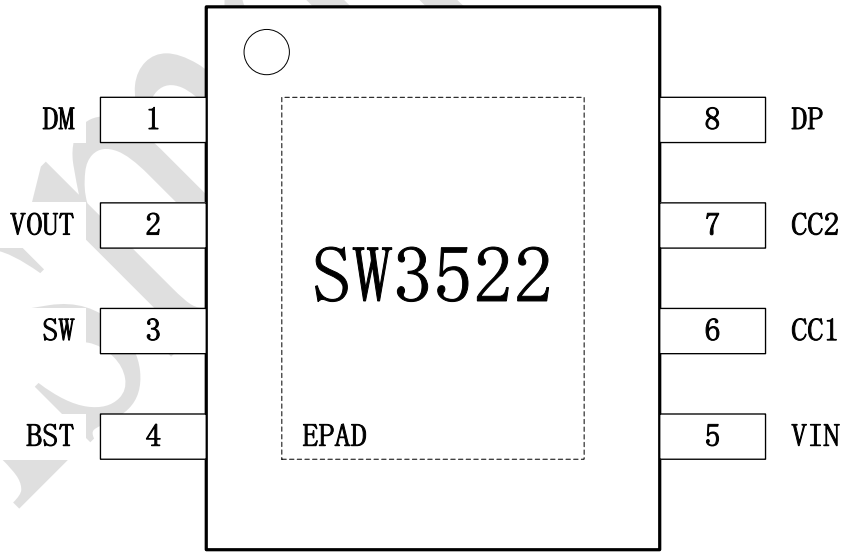
- **Synchronous Buck**
  - Current up to 3.5A
  - Input Voltage 6~35V
  - Support CC/CV Mode
  - Support Wire Drop Compensation
- **Output Fast Charge Protocol**
  - Support PPS/PD3.0/PD2.0
  - Support QC4+/QC4/QC3.0/QC2.0
  - Support AFC
  - Support FCP
  - Support SFCP
- **Type-C Interface**
  - Support USB Type-C Specification
  - Support DFP Role
- **BC1.2 Module**
  - Support BC1.2 DCP
  - Support Apple & Samsung Device
- **Protection**
  - Softstart
  - Input Over Voltage Protection
  - Input Under Voltage Protection
  - Output Over Current Protection
  - Output Short Protection
  - Over Temperature Protection
- **ESOP8 Package**

4. Functional Block Diagram



5. Pin Configuration and Function

5.1. Pin Configuration



5.2. Pin Descriptions

Pin	Name	Function Description
1	DM	Type-C port DM pin.

2	VOUT	Output voltage sense pin.
3	SW	Switching node.
4	BST	Bootstrap pin for high side NMOS.
5	VIN	Input power.
6	CC1	Type-C configure channel CC1.
7	CC2	Type-C configure channel CC2.
8	DP	Type-C port DP pin.
	EPAD	Exposed pad.

6. Absolute Maximum Ratings

Parameters	Symbol	MIN	MAX	UNIT
Input Voltage	VIN	-0.3	35	V
Output Voltage	VOUT	-0.3	22	V
SW Voltage	SW	-0.3	35	V
BST Voltage	BST-SW	-0.3	6	V
CC1/CC2/DP/DM Voltage	CC1/CC2/DP/DM	-0.3	25	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	VIN	5		32	V

8. Electrical Characteristics

(V_{IN} = 12V, T_A = 25°C, unless otherwise specified.)

Parameters	Symbol	Test Conditions	MIN	TYP	MAX	UNIT
Power Supply						
VIN Input Voltage	V_{IN}		5		32	V

VIN Input UVLO Threshold	V_{IN_UVLO}	VIN Voltage Falling	5.2	5.3	5.4	V
VIN Input UVLO Hysteresis	$V_{IN\_UVLO\_HYS}$	VIN Voltage Rising	0.4	0.6	0.8	V
VIN Input OVP Threshold	V_{IN_OVP}	VIN Voltage Rising	29.6	30.8	32	V
VIN Input OVP Hysteresis	$V_{IN\_OVP\_HYS}$	VIN Voltage Falling	0.4	0.8	1.2	V
Quiescent Current	I_Q	V_{IN}=12V, I_{OUT}=0mA		2	4	mA
Synchronous Buck						
Switching Frequency	F_{CHG}		110	125	140	KHz
Output Voltage	V_{OUT}	V_{OUT}=5V	5.0	5.1	5.2	V
		V_{OUT}=9V	8.9	9.1	9.3	V
		V_{OUT}=12V	11.9	12.1	12.3	V
		V_{OUT}=15V	14.8	15.1	15.4	V
		V_{OUT}=20V	19.8	20.1	20.4	V
CC Current Limited	I_{CC}	V_{OUT}=5V	3.0	3.4	3.8	A
		V_{OUT}=9V	3.0	3.4	3.8	A
		V_{OUT}=12V	2.5	2.8	3.2	A
		V_{OUT}=15V	2.0	2.4	2.8	A
		V_{OUT}=20V	1.5	1.8	2.2	A
Wire Drop Compensation	V_{OUT_WDC}				200	mV
High Side NMOS	R_{DSON_H}		30	32	35	mΩ
Low Side NMOS	R_{DSON_L}		20	22	25	mΩ
Type-C						
CC Current Source	I_{CC_SOURCE}	Power Level=3.0A	310	330	350	uA
BC1.2						
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
Thermal Shutdown						
Thermal Shutdown Threshold	T_{SHDT}	Temperature Rising	135	150	165	℃
Thermal Shutdown Hysteresis	T_{SHDT_HYS}	Temperature Falling	35	50	65	℃

9. Functional Description

9.1. Synchronous Buck

The SW3522 integrates a high efficiency synchronous buck with inner NMOS and output current up to 3.5A and efficiency up to 94%(VIN=12V, VOUT=5V, IOUT=3A).

The synchronous buck works in PSM/PWM mode with switching frequency of 125KHz. 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 buck supports CC/CV mode. When output current is lower than CC limited current, output voltage will keep constant. When output current reaches CC limited current, output voltage will drop to keep output current constant.

The synchronous buck supports wire drop compensation. Output voltage will linear increase according to output current and the maximum increased voltage is limited to 200mV.

The synchronous buck integrates input over voltage, input under voltage, output over current and short protection.

9.2. Type C Interface

The SW3522 integrates Type-C logic controller and supports DFP/SOURCE role. When UFP is attached, Type-C port will automatically turn on to supply device. When UFP is detached, Type-C port will automatically turn off.

When SINK is attached and Type-C port turns on , the SW3522 will broadcast power level of 3A.

9.3. PD Fast Charge

The SW3522 integrates PPS/PD3.0/PD2.0 fast charge protocol. PPS supports 3.3~11V@3A, 3.3~16V@2A output voltage. PD3.0/PD2.0 supports 5V@3A, 9V@3A, 12V@2.5A, 15V@2A, 20V@1.5A.

9.4. QC Fast Charge

The SW3522 integrates QC4+/QC4/QC3.0/QC2.0 fast charge protocol. It supports Class A/Class B, while QC2.0 supporting 5V/9V/12V/20V output voltage and QC3.0 supporting 3.6V~20V output voltage, 200mV/Step.

QC2.0/QC3.0 will output voltage base on DP/DM voltage:

Device		SW3522	
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	

9.5. AFC Fast Charge

The SW3522 integrates AFC fast charge protocol, and supports 5V/9V/12V output voltage.

9.6. FCP Fast Charge

The SW3522 integrates FCP fast charge protocol, and supports 5V/9V/12V output voltage.

9.7. SFCP Fast Charge

The SW3522 integrates SFCP fast charge protocol, and supports 5V/9V/12V output voltage.

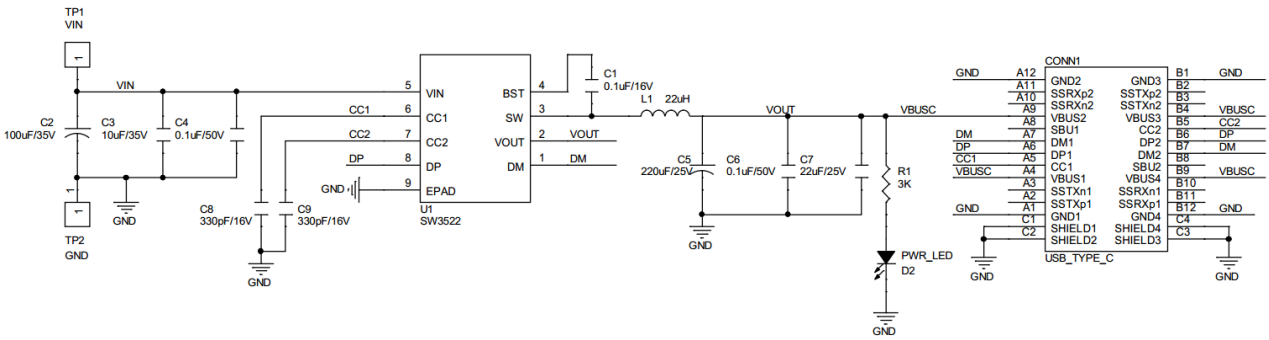
9.8. BC1.2 Module

The SW3522 integrates BC1.2 controller, and automatically detects apple and samsung devices:

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

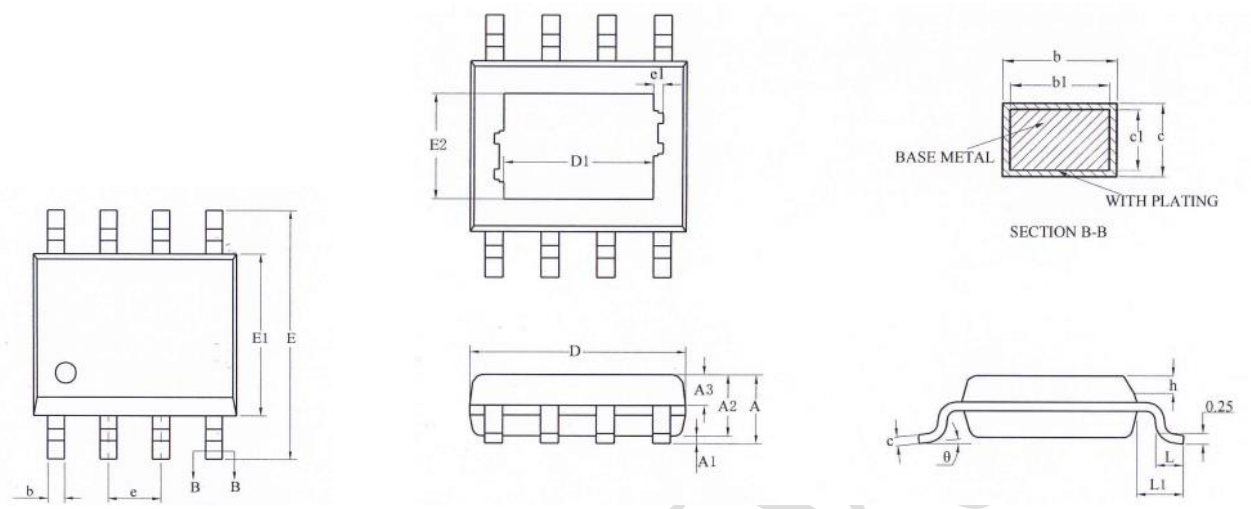
Samsung 2A mode: DP=1.2V, DM=1.2V;

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	-	-	1.65
A1	0.05	-	0.15
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	-	0.47
b1	0.38	0.41	0.44
c	0.20	-	0.24
c1	0.19	0.20	0.21
D	4.80	4.90	5.00
D1	3.10REF		
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
E2	2.21REF		
e	1.27BSC		
e1	0.10REF		
h	0.25	-	0.50
L	0.50	0.60	0.80
L1	1.05REF		
θ	0	-	8°

12. Revision History

V1.0 Initial version.

V1.1 Add drain-source on resistance of power MOS.

V1.2 Modify company logo.

V1.3 Update document template.

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