ROHS，TS16949，ISO9001

ST100 (GD/ID)

Multi-system Multi-frequency GNSS Positioning Module Manual

28th Oct. 2022

www.xbteek.co

Revision History

Ver. NO.	Description	Date
V.1	Initial	20th July 2022
V.2	Some features and pin descriptions changed	28th Oct. 2022

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目录

Catalogue

Disclaimer 2
1. Introduction 4
1.1 Basic Characteristics 4
1.2 Overall Architecture Introduction 5
1.3 Performances 6
2. Pin Description and Application Interface 7
2.1 Module Interface Definition 7
2.2 Application Interfaces 12
2.2.1 RF Ports 12
2.2.2 Antenna Detection Interface 13
2.2.3 PPS 14
2.2.4 The Interface of Command Configuration 15
2.2.5 Power on/off and Reset 15
2.2.6 BOOT Interface 16
2.3 IMU Axial Information (ST100ID) 18
3. Electrical Specifications 18
3.1 Maximum Tolerance Value 18
3.2 Working Conditions 19
4. Mechanical Dimensions 19
5. Moisture Level 20
6. Package 20
7. Production 20

1. Introduction

This document mainly indicates two types modules of ST100 series: ST100GD and ST100ID.

Customers can choose the corresponding products according to different requirements.

1.1 Basic Characteristics

ST100 series, with built-in STA8100 positioning chip, supports L1+L5 band by default, and is a multi-system multi-frequency GNSS positioning module.

---ST100GD module, with built-in STA8100 positioning chip, can output positioning information and satellite original observation value.

---ST100ID module, with built-in STA8100 and ASM330 six-axis acceleration gyroscope chip, can output positioning information, satellite original observation value and IMU original data.

All modules of ST100 series, can be configured with NMEA-0183 or RTCM3.X format output.

RTCM data is the default output. The IMU data from the ST100ID module, can be configured with 50Hz, 100Hz and other frequency data output.

All modules of ST100 series, support UART communication interfaces.

Table 1-1 Default Satellites System and Frequency Bands (ST100)

	L1					L5			
	GPS	GLO	BEIDOU		GAL	GPS	BEIDOU	GAL	NAVIC
	L1	G1	B1I	B1c	E1	L5	B2a	E5a	L5
Support	●	●	●	●	●	●	●	●	○

● Supported, turned on by default

○ Subsequent support

Table 1-2 Supported Function(ST100)

Model	Original observed output	IMU data output	High Precision Algorithm SDK	Remarks
ST100GD	support	-	External algorithm to support	
ST100ID	support	support	External algorithm to support	

1.2 Overall Architecture Introduction

STA8100, the fifth generation dual-frequency mode high-precision positioning chip of STMicroelectronics, can support up to 80 tracking channels and 4 capture channels, supporting six satellites systems: GPS, Galileo, GLONASS, BeiDou, QZSS, NAVIC.

The ASM330 is a automotive 6-axis inertial module: 3D accelerometer and 3D gyroscope, from ST with an I2C/SPI serial port standard output. The device has a dynamic user-selectable full scale acceleration range of ±2/±4/±8/±16g, and an angular rate range of ±125/±250/±500/±1000/±2000/±4000dps.

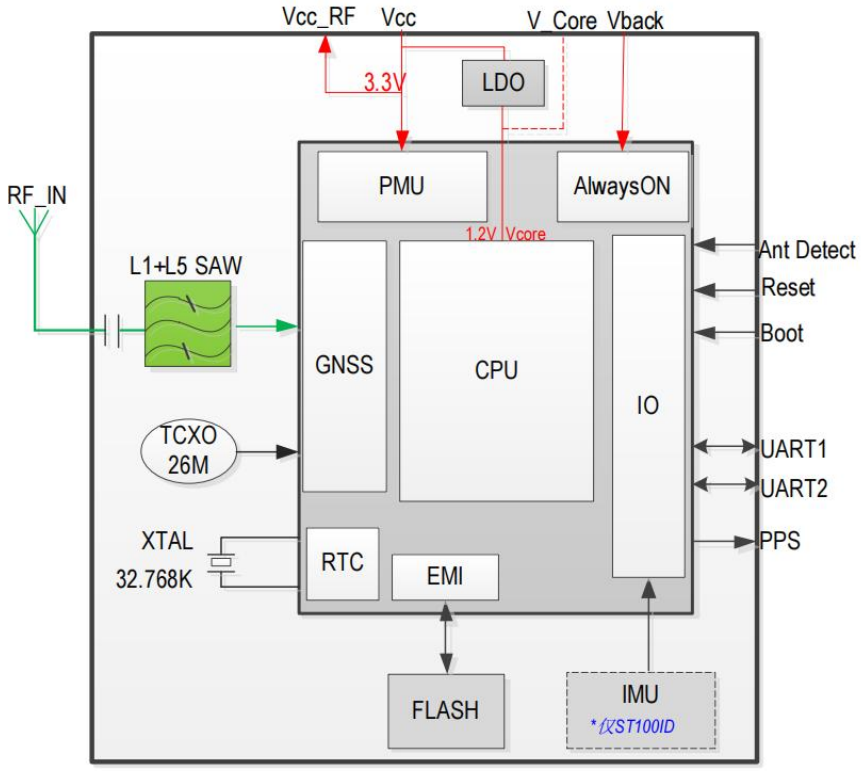


Figure 1-1 Overall Architecture for ST100ID Module

1.3 Performances

Table 1-3 Performance list of ST100 modules

Dimensions		22mm*17mm
Weight		TBD
Encapsulation		LGA 54
Temperature range		Operating: -40 ° C ~+105 ° C
		Store: -40℃~+105℃
GNSS	Signals	GPS/QZSS:L1 C/A, L5
		BeiDou: B1I,B1c, B2a
		Galileo:E1, E5a
		GLONASS: L1OF①
	SBAS	WAAS, EGNOS, MSAS, GAGAN
	ChannelsNumbers	80
	Sensitivity	Capture: -146 DBM
		Track: -157dBm
		Recapture: -153dBm
	Position accuracy	Autonomous <1.0m CEP50 RTK/PPP-RTK: < 10cm CEP50②
	TTFF	Cold start: <36s
		Warm start: <30s
		Hot start: <3s
	Refresh rate	GNSS RAW: 10Hz (Max.)
		PVT: 10Hz (Max.)

		IMU RAW: 100Hz （Max.）
Interface	UART	2
	PPS	1
Agreement		NMEA-0183 / RTCM3.X
Antenna interface		External, active
		Gain: 25dB-40dB
Electrical Characteristics	Voltage range	3.0V to 3.6V DC
	Power Consumption	800mW （Typ.）

① : Require software configuration to achieve.

② : Need external algorithm support

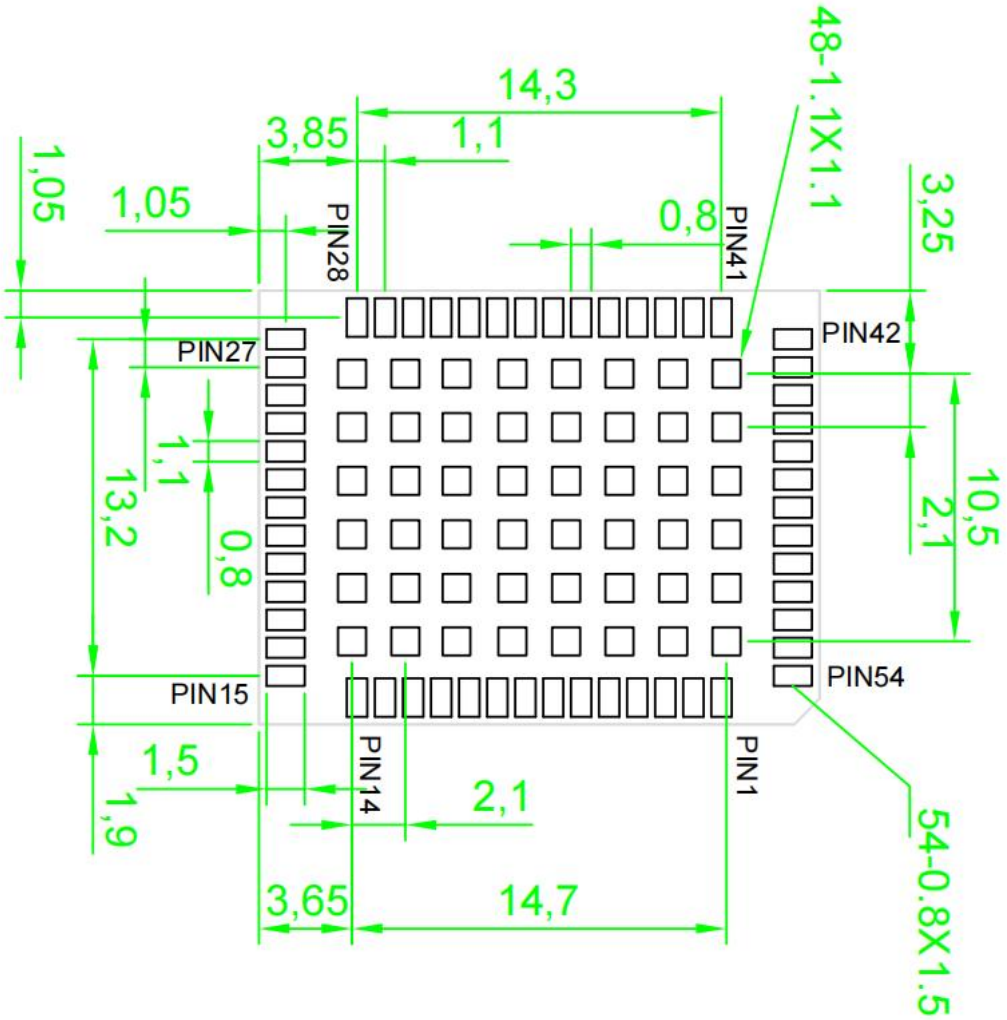
2. Pin Description and Application Interface

2.1 Module Interface Definition

Table 2-1 Descriptions of Signal Direction Parameters

Types	Description
AI	Analog input
DI	Digital input
DO	Digital output
DIO	Digital input/output
PI	Power input
PO	Power output

Table 2-2 Pin Arrangement &Descriptions



Pin	Signals	Directions	Level	Function Description	Pin Description
1	GND	GND	-	Ground	/
2	RF_IN	AI	-	RF signal input	/
3	GND	GND		Ground	/
4	ANT_DETECT	DI	VCC	Detection for antenna open circuit ----pull up inside 4.7K resistor. External input in low level, indicating antenna open-circuit	Be unconnected if not in use
5	RSV	-	-	-	-

6	ANT_SHORT	DI	VCC	Antenna short circuit detection ---pull up inside 4.7K resistor, External input in low level, indicating antenna short-circuit	Be unconnected if not in use
7	VCC_RF	PO		Power output, power voltage is determined by VCC, can be used to feed the active antenna or power the external LNA	Be unconnected if not in use
8	RSV	-	-	-	-
9	RSV	-	-	-	-
10	RSV	-	-	-	-
11	RSV	-	-	-	-
12	GND	GND	-	Ground	/
13	RSV	-	-	-	-
14	GND	GND	-	Ground	/
15	RSV	-	-	-	-
16	RSV	-	-	-	-
17	RSV	-	-	-	-
18	RSV	-	-	-	-
19	RSV	-	-	-	-
20	RSV	-	-	-	-
21	RSV	-	-	-	-
22	RSV	-	-	-	-

23	RSV	-	-	-	-
24	RSV	-	-	-	-
25	RSV	-	-	-	-
26	UART2_RXD	DI	VCC	Serial port 2, receive	Can be used for RTCM/NMEA data output, can not be used in input operations of command configuration
27	UART2_TXD	DO	VCC	Serial 2, send	
28	RSV	-	-	-	-
29	RSV	-	-	-	-
30	RSV	-	-	-	-
31	RSV	-	-	-	-
32	GND	GND	-	Ground	/
33	VCC	PI	3.0 V ~ 3.6 V	Main power supply, VCCtyp = DC3.3 V	It is recommended to reserve the power filter input
34	VCC	PI	3.0 V ~ 3.6 V	Main power supply, VCCtyp = DC3.3 V	/
35	V_CORE	PI	1.14 V ~ 1.3 V	External core power input pin. Power supply voltage 1.14V-1.3V, 1.25V recommended, rated 500mA to power supply	Be unconnected if not in use; when there is an external input power source, the core of the chip in the module, power in 1.2V. LDO keep off to reduce the up rise heating temperature. It is recommended to reserve power supply source filter input.
36	V_BCKUP	PI	1.7 V ~ 3.6 V	Backup power supply, V_BCKUPtyp=DC 3.3 V	V_BACKUP cannot be unconnected and must be connected with externally power supply or access VCC power network

37	GND	GND	_	Ground	/
38	RSV	_	_	-	-
39	RSV	_	_	-	-
40	RSV	_	_	-	-
41	GND	GND	_	Ground	/
42	UART1_TXD	DO	VCC	Serial Port 1 Send, Antenna short circuit detection ---pull down inside 4.7K resistor, Outside the module, can not use strong pull-up to avoid to enter the BOOT mode when power on.	Can be used for RTCM/NMEA data output, command configuration and firmware upgrade
43	UART1_RXD	DI	VCC	Serial port 1, receive	
44	RSV	_	_	-	-
45	RSV	_	_	-	-
46	RSV	_	_	-	-
47	RSV	_	_	-	
48	GND	GND	_	Ground	/
49	RESET_N	DI	V_BCKUP	Reset input	Input in low, reset module, pull up the internal 10K resistor to V_BCKUP
50	BOOT	DI	-	Forced to download mode switch	Module reset or power on; detect this pin in high, enter forced download mode. Internally, there are 4.7K pull-downs. Be unconnected if not in use.

51	RSV	-	-	-	-
52	RSV	-	-	-	-
53	TIMEPULSE	DO	VCC	Sync pulse output	Be unconnected if not in use;
54	RSV	-	-	-	-

2.2 Application Interfaces

2.2.1 RF Ports

PIN2 of ST100 module is the RF signal input pin. When the module is integrated and applied, the gain of the whole RF receiving link cannot exceed 50dB (as shown in Figure 2-1). A total gain of 30dB- 40dB is recommended before entering the RF input port of the module. If the active antenna gain is less than 20dB, the external LNA needs to be added to improve the signal-to-noise ratio.

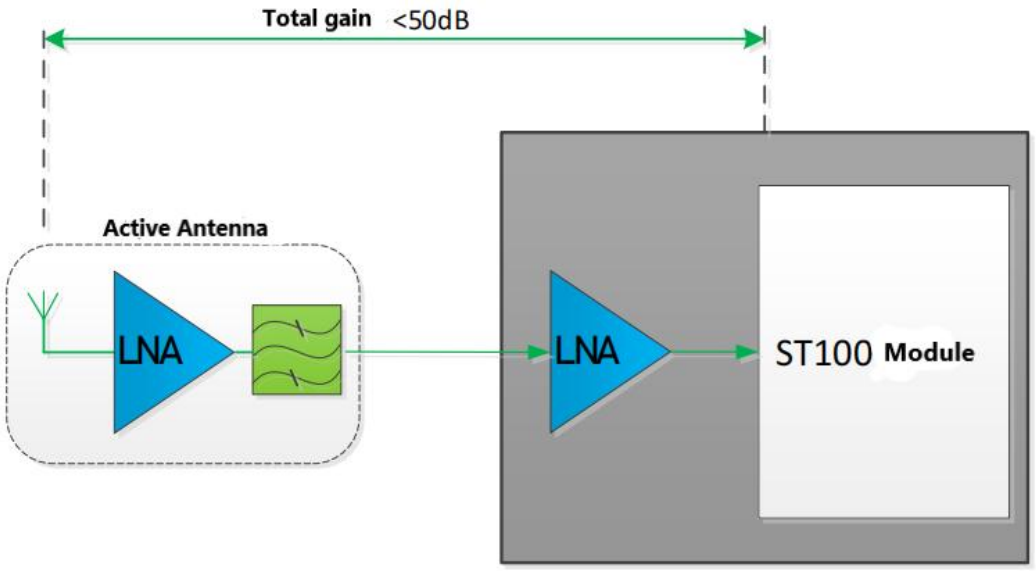
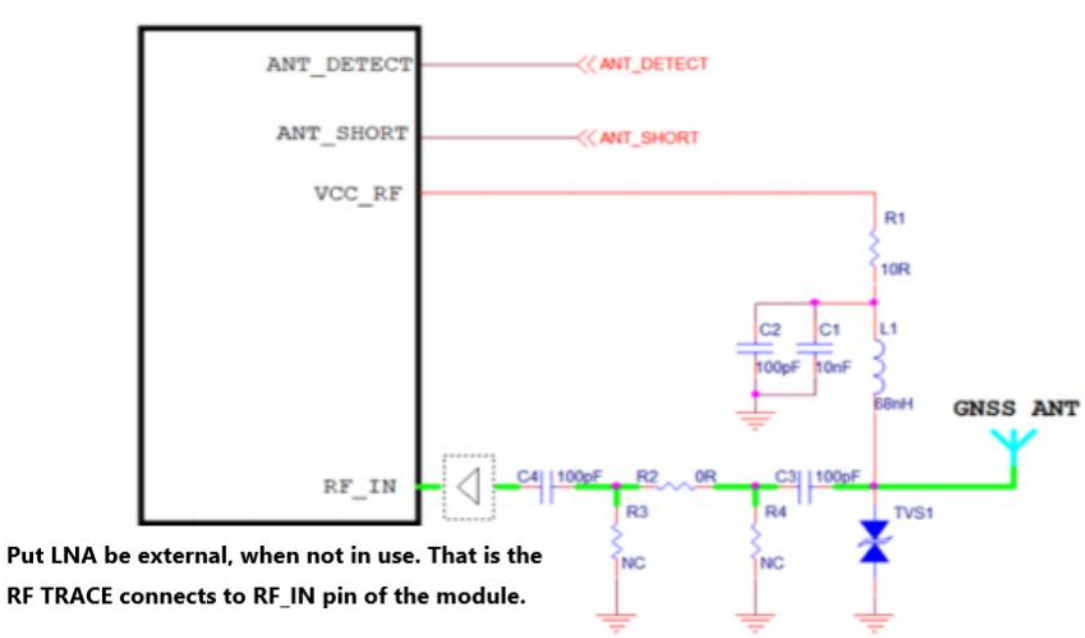


Figure 2-1 System Links RF

The ST100 module can output 3.3V feed voltage through VCC_RF to an external active antenna or LNA. The recommended antenna interface circuit is shown as below. The 10Ω resistor, for antenna short-circuit current limiting, uses 0805 or larger package; and the 68nH (or 47nH) self-resonant frequency of choke inductance is of no less than 1.7GHz and a rated current of no less than 300mA.



Put LNA be external, when not in use. That is the RF TRACE connects to RF_IN pin of the module.

2.2.2 Antenna Detection Interface

ST100 module can detect the status of antenna open circuit and short circuit, and the data can be feedback and output through specific message information of UART port. The reference antenna detection and control circuit is shown in Figure 2-3, and the corresponding antenna monitoring state combination is shown in Table 2-1. ANT_SHORT and ANT_DETECT can be optionally connected to ST100. The external controller can receive serial port information to analyze the antenna status, and then ANT_OFF of the external controller can control the power supply of the antenna be enable. Users can also refer to this circuit, and achieve

the antenna condition monitoring function and antenna feed control by the external controller.

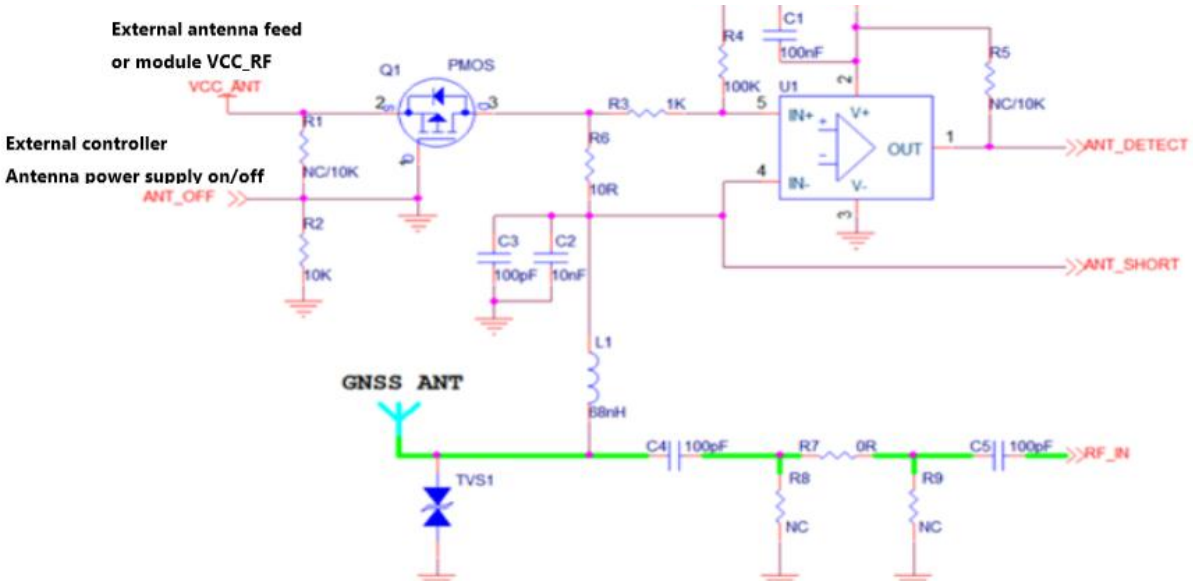


Figure 2-3 External Antenna Detection

Table 2-3 Antenna Status Table

ANT_SHORT	ANT_DETECT	Antenna status
0	1	Short Circuit
1	1	Normal
1	0	Open Circuit
0	0	Abnormal power supply

2.2.3 PPS

Module output PPS signal, default design is 0.5s in high level, 0.5s in low level.

The PPS accuracy is 20nS.

Pulse width and polarity can be configured by instruction.

2.2.4 The Interface of Command Configuration

ST100 configuration commands are inputted through serial port UART1, only UART1 can be used for firmware upgrade.

Note: The default output format of the serial port, baud rate 460800bps, 8bits, no parity bit, 1 stop bit.

2.2.5 Power on/off and Reset

Boot timing and reset: VCC and VCC_BCKUP can be powered on at the same time, or VCC_BCKUP can maintain normal power supply. There is CORE voltage and IO voltage monitoring POR inside the chip can be powered on and RESET. And can lower the RESET to the power-on delay- reset, or control the pin to reset through the external controller.

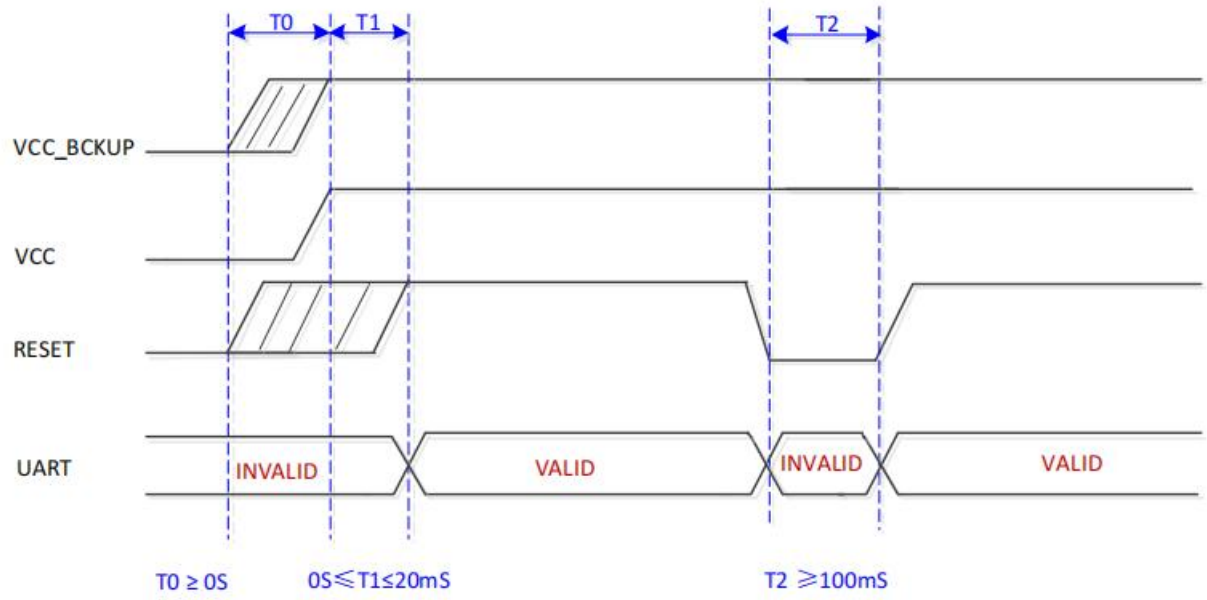


Figure 2-4 Power-on and Reset Timing-sequence Diagram

Shutdown and restart timing sequence: When VCC is powered off, VCC_BACKUP can be power off at the same time or maintain VCC and VCC_BCKUP should be lower than 100mV, delay 1S to restart.

The startup rising edge time and power-off falling edge time of VCC and VCC_BCKUP should be less than 50mS to prevent the chip from operating in the abnormal voltage state.

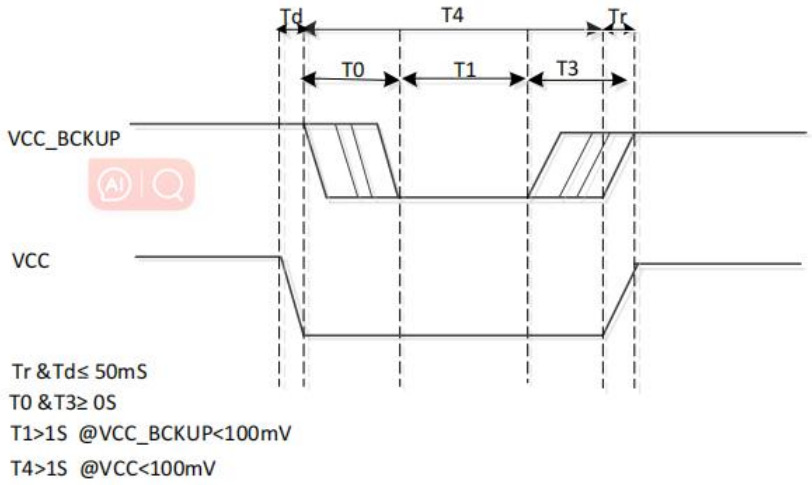


Figure 2-5 Startup Timing-sequence(After Shutdown)

Note: When VCC is powered off and V_BCKUP is not, GNSS module can save ephemeris data and time to shorten the next startup positioning time.

2.2.6 BOOT Interface

The BOOT pin can be used when the internal Flash of the module fails to start normally and needs to be re-burned by the external master. When the module VCC is powered on, trigger the reset of the internal POR of the chip or the external reset pin, the status of the BOOT pin is collected at the rising edge of the reset to ensure whether the chip enters the normal FLASH startup mode or the download and burn mode. Table 2-4 shows the BOOT sampling timing-sequence and boot status, as shown in Figure 2-6 and Figure 2-7.

Table 2-4 Description of BOOT Pins

BOOT pin	Operating mode	Description
Low level	Normal start	The chip boots from FLASH and enters normal GNSS operating mode

High level	Download mode	Boot from UART1 and burn the image file by the external controller

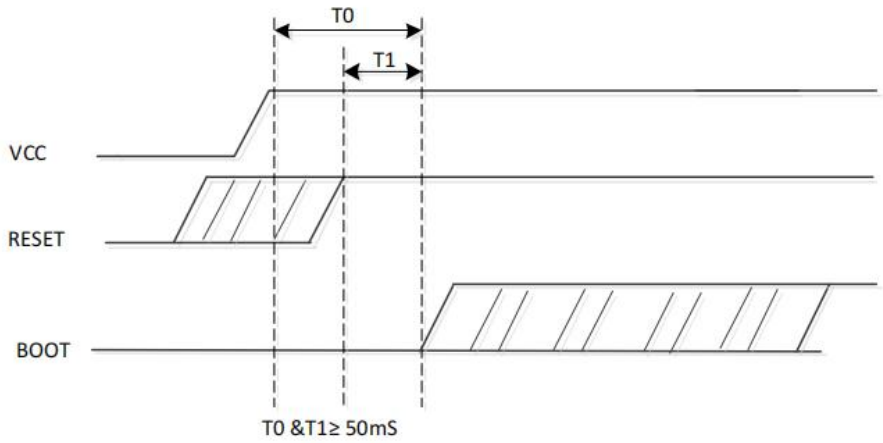


Figure 2-6 Timing Sequence Diagram of Normal Startup

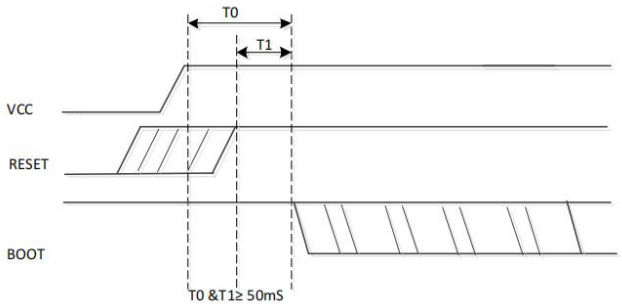


Figure 2-7 Download Pattern Timing Sequence Chart

2.3 IMU Axial Information (ST100ID)

The XYZ axial information of the ST100 (ID) module as below:

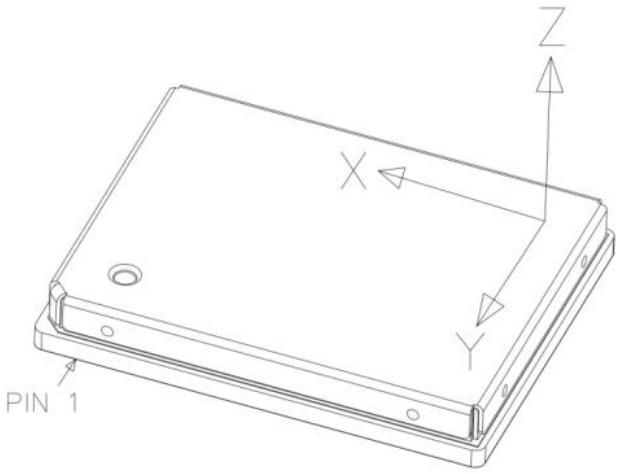


Figure 2-8 Axial Information of the IMU Module

3. Electrical Specifications

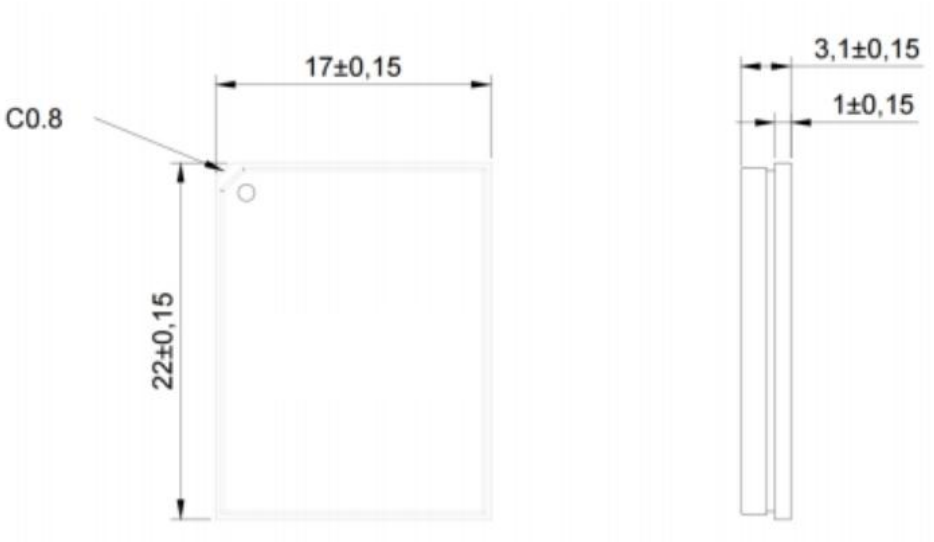
3.1 Maximum Tolerance Value

Parameters	Symbols	Minimum value	Maximum	Units
Supply voltage	VCC	- 0.3	3.6	V
Backup supply voltage	V_BCKUP	- 0.3	3.6	V
Digital signal voltage	DIO	- 0.2	VCC + 0.3	V
Analog signal voltage		- 0.2	2.0	V
ESD Indicator (HBM)			2	KV
Storage temperature		- 40	+ 105	℃
Operating temperature		- 40	+ 105	℃

3.2 Working Conditions

Parameters	Symbols	Minimum value	Recommended value	Maximum value	Units
Supply voltage	VCC	3.0	3.3	3.6	V
Backup supply voltage	V_BCKUP	1.7	3.3	3.6	V
VCC current @3.3V	IVCC		260	450	mA
V_CORE current @1.2V	ICORE		240	450	mA
V_BCKUP current	I_V_BCKUP		50	100	uA
Digital Signal VIH	VIH	VCC * 0.8		VCC	V
Digital Signal VIL	VIL	0		VCC * 0.2	V
Digital signal VOH	VOH	VCC * 0.8		VCC	V
Digital Signal VOL	VOL	0		VCC * 0.2	V
Analog signal voltage	AI	0.0		2.0	V

4. Mechanical Dimensions



Overall Dimensions

5. Moisture Level

The humidity sensitive level of the module is 3. Please refer to IPC/JEDEC J-STD-020 for relevant operation and precautions.

6. Package

See "ST100 Module Packaging Specification" for details.

7. Production

See SMT Mounting Process and Baking Specification for ST100 Modules for details.

Shenzhen Simple Technology Electronics Co., LTD.

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