ST866DL

GNSS Navigation and Positioning Module Manual

Revision History

Version NO.	Version	Date
V.1	New	July, 2023

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Catalogue

1. Module Description

1.1 Overview

ST866DL, a high-performance GNSS navigation and positioning module, has the advantages of high sensitivity and low power consumption, with the basis on high performance GNSS receiver chip, supinterface GPS, BEIDOU, GLONASS, GALILEO, QZSS and satellite enhancement system SBAS (W AAS, EGNOS, GAGAN, MSAS).

High integration, single chip receiver solution

Module integrate with external LNA

Built-in Power On Reset, no need for peripheral Reset circuit

Low power consumption

ST866DL, with compact size, using SMT pad, supports fully automatically integration of standard take& place and reflow welding , ROHS Process, having low cost, high performance, low power consumption and other characteristics. It can be widely used in portable equipment, such as PND, PAD, transceiver , wearable device, outdoor GPS tracker, bicycle navigator, drones, vehicle-mounted (cockpit) navigation equipment, including vehicle-mounted terminal, automobile data recorder,OBD and traffic warning system and so on.

1.2 Key Characteristics

Frequency[1]	GPS L1 1575.42MHz, C/A code; BDS (COMPASS/BD2) B1 1561.098 MHz;	
Refresh rate	Default 1Hz	
Sensitivity	Tracking	- 159dBm
	Capture	- 146dBm
	Hot Start	≤ 1s typ @- 130dBm

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Positioning time [2]	Cold start	≤36s typ @- 130dBm
	A-GNSS auxiliary [3]	≤ 10s
Horizontal positioning accuracy [4]	Autonomous positioning	3m
	Wide area difference	2.5 m
Speed measurement accuracy [5]	0. 1 m/s	
Azimuth accuracy [5]	0.5 degrees	
Height limit	> 18,000 m	
Speed limit	> 515 m/s	
Acceleration limit	>4G	
Output protocol	NMEA 0183	9600 bps, 8 data bits, no parity, 1 stop bits (default) 1Hz: GGA, GLL, GSA, GSV, RMC, VTG

1. Supinterface SBAS and QZSS

2. Strength of all satellites - 130dBm

3 Depending on data network speed and latency

4.CEP, 50%, 24 hours static, -130 dBm, > 6 SVs

5.50% @ 30 m/s

2. Technological Index

2.1 Electrical Limits

Parameters	Symbols	Minimum value	Maximum	Units
Module supply voltage (VCC)	Vcc	-0.3	3.6	V
Backup Battery voltage (VBAT)	Vbat	-0.3	3.6	V
Maximum acceptable ESD level	VESD(HBM)		2000	V
Storage temperature		- 40	+ 85	℃

2.2 Operating Conditions

Parameters	Symbols	Minimum value	Recommended value	Maximum value	Units
Supply voltage	Vcc	2.8	3.3	3.6	V
Vcc peak current (except antenna)	Ipeak			60	mA
Capture phase average current			23		mA
Tracking phase average current			20		mA
Active antenna output voltage	VCC_ RF		3.3		V
Antenna gain	Gant	15		30	dB
Operating temperature		- 40	25	+ 85	℃

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2.3 Appearance and Dimensions

Symbol	Min. (mm)	Typ. (mm)	Max. (mm)
A	15.9	16.0	16.6
B	12.1	12.2	12.3
C	2.2	2.4	2.6
D	0.9	1.0	1.3
E	1.0	1.1	1.2
F	2.9	3.0	3.1
G	0.9	1.0	1.3
H		0.82	
K	0.7	0.8	0.9
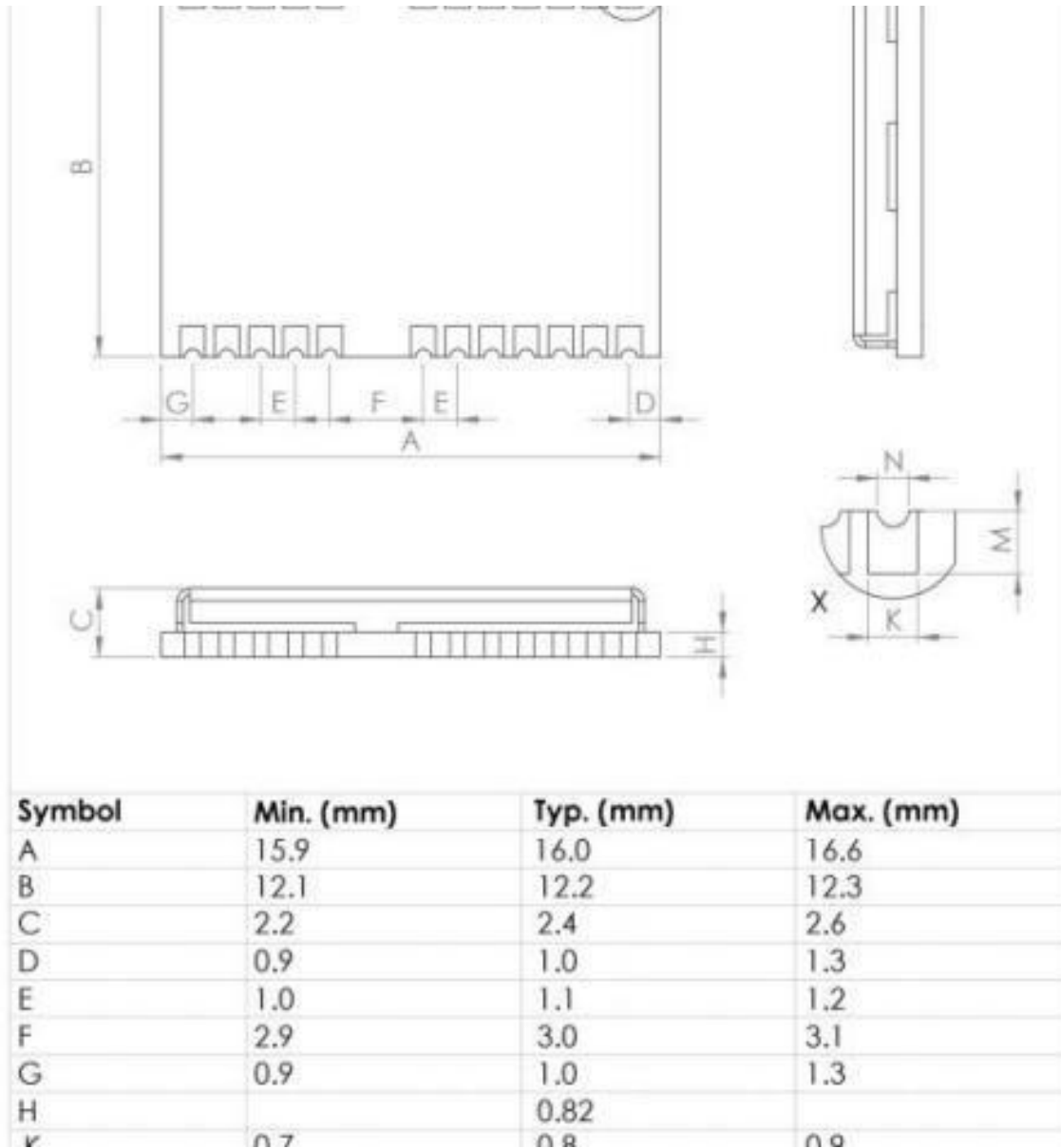
Table 2-1 Overall dimensions

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2.4 Pins and Description

Figure 2-2 Pin diagram

Pins NO.	Name	I/O	Description	Electrical Characteristic
1	nRESET	I	Module reset input, active in low level	Power-on self-reset, it is recommended to suspend
2	NC			No connection requirement
3	TIMEPULSE	O	Second pulse	Time pulse(1PPS),TTL level
4	NC			No connection requirement
5	NC			No connection requirement
6	NC			No connection requirement
7	NC			No connection requirement
8	RSV	I	Retaining pins	No connection requirement

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| 9	RF_ VCC	I	Rf power output	Active antenna power supply: 3.3V
10	GND	G	Ground	
11	RF_IN	I	Antenna signal input	Pay attention to ESD protection
12	GND	G	Ground	
13	GND	G	Ground	
14	NC			No connection requirement
15	NC			No connection requirement
16	NC			No connection requirement
17	NC			No connection requirement
18	NC			No connection requirement
19	NC			No connection requirement
20	TXD	O	Navigation data output	NMEA0183 protocol,TTL level
21	RXD	I	Interactive command input	Configure command input,TTL level
22	NC			No connection requirement (module supinterfaces FLASH ephemeris storage)
23	VCC	I	Module power input	Dc 3.3V
24	GND	G	Ground	

2.5 PCB Dimensions
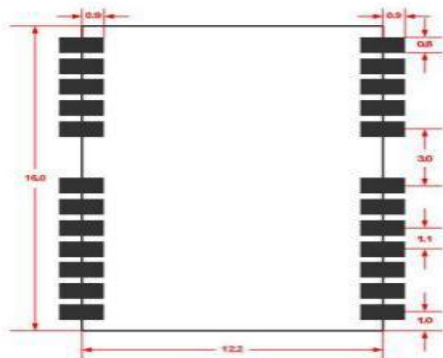
Figure 2-3 Recommended PCB package design (unit: mm)

3. Hardware Design

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3.1 Attentions of Design

In order to make ST866DL operate normally, need to connect with the following signals correctly:

✓   Provide a reliable power supply to the VCC pins.

✓   Ground all GND pins of the module.

✓   Connect the RF_IN signal to the antenna, maintain a 50 ohm impedance match of the circuit.

✓   Make sure serial interface 1 is connected to a PC or an external processor, and the user can receive positioning information data. And software can be upgraded through this serial interface.

In order to obtain good performance, the design should also pay special attention to the following:

✓ Power supply: Good performance needs stable and low ripple power supply to ensure. The peak(the Maximum/minimum) of voltage ripple peak should not exceed 50mV.

  – Use LDO to ensure pure power supply

  – Place the LDO as close to the module as possible

  – Widen the power cables or use a split copper surface to transmit current

  – Do not route power cables through high-power and high-inductive devices such as magnetic coils

✓ UART interface: Ensure that the pin signals and baud rates of the main device and ST866DL module are consistent

✓ Antenna interface: pay attention to impedance matching of the antenna wire, as short and smooth as possible, avoid going acute Angle

✓ Antenna position: In order to ensure a good signal-to-noise ratio, ensure that the antenna has a good isolation from the electromagnetic radiation source, especially the electromagnetic radiation in the 1559~ 1620MHz frequency band

✓ Try to avoid running the wire directly below the ST866DL

✓ This module is temperature sensitive equipment, the drastic change of temperature will lead to its performance degradation, try to stay it away from high temperature airflow and large

 Power heater

3.2 Reset Signal

After power-on , ST866DL module needs to be reset correctly to work normally, and the chip provides self-reset function. In order to ensure effective reset, when power-on, the following time-sequence requirements must be met between the reset pin nRESET of the module and the power supply VCC. ST866DL can be reset by lowering the nRESET pin for more than 5ms during the normal operation of the module.
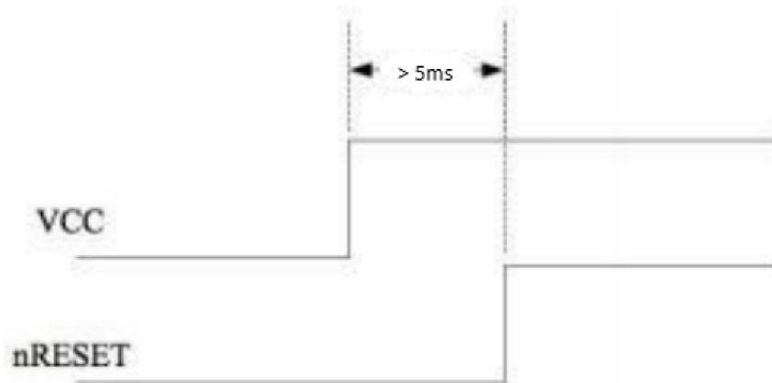

Figure 3-1 Module reset signal

3.3 Active Antenna Scheme

An active antenna, + 3/3.3V power supply, uses VCC_RF to power the antenna.

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A minimal design

Figure 3-2+ 3/3.3V active antenna scheme

Note: 1. Above supply power for active antennas, compatible with the antenna detection function

3.4 Passive Antenna Scheme

Figure 3-4 Passive antenna scheme

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4. Processing Requirement

4.1 Humidity Control

Module belongs to MSL Class 4, after unpacking the plastic sealing, it must be baked and dried before welding to use after more than 72Hr. Bake at no more than 80℃ and no less than 4Hr.

4.2 Reflow Soldering Requirement

Preheating stage	Up Rate of temperature	Less than 3 ° C /s
	End temperature of preheat	150-160 ° C
Constant temperature stage	Up Rate of temperature	(150℃ -183 ℃ range) less than 0.3℃/s;
	Up Rate of temperature	(183℃-217℃ range) less than 3.5 ℃/s
	Constant temperature time	60 – 120 seconds
	End temperature of constant temperature	217°C
Molten tin stage	Tin melting time	40-60 seconds
	Peak temperature	245°C
Cooling stage	Descent rate of temperature	Not higher than 4°C/s

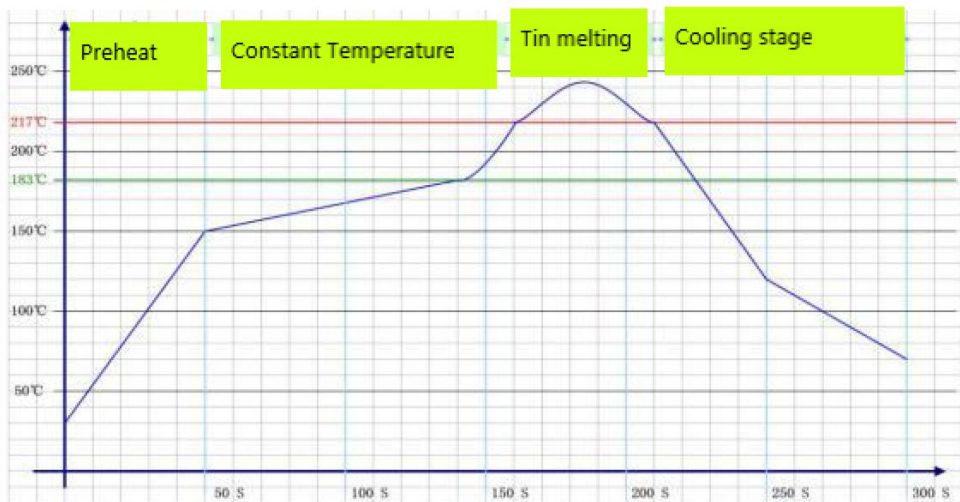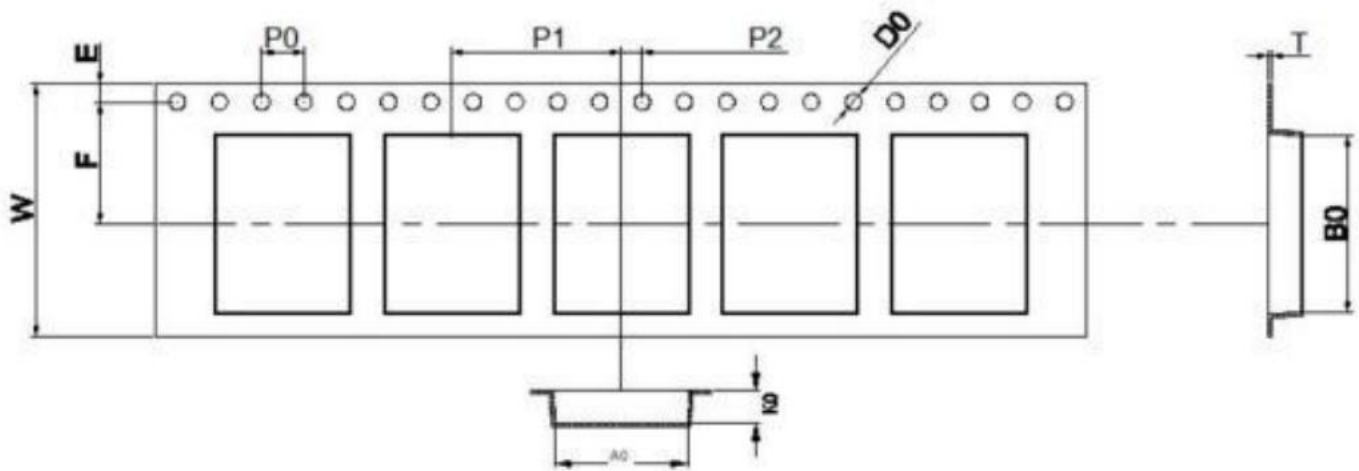Figure 4-1 Reflow temperature curve

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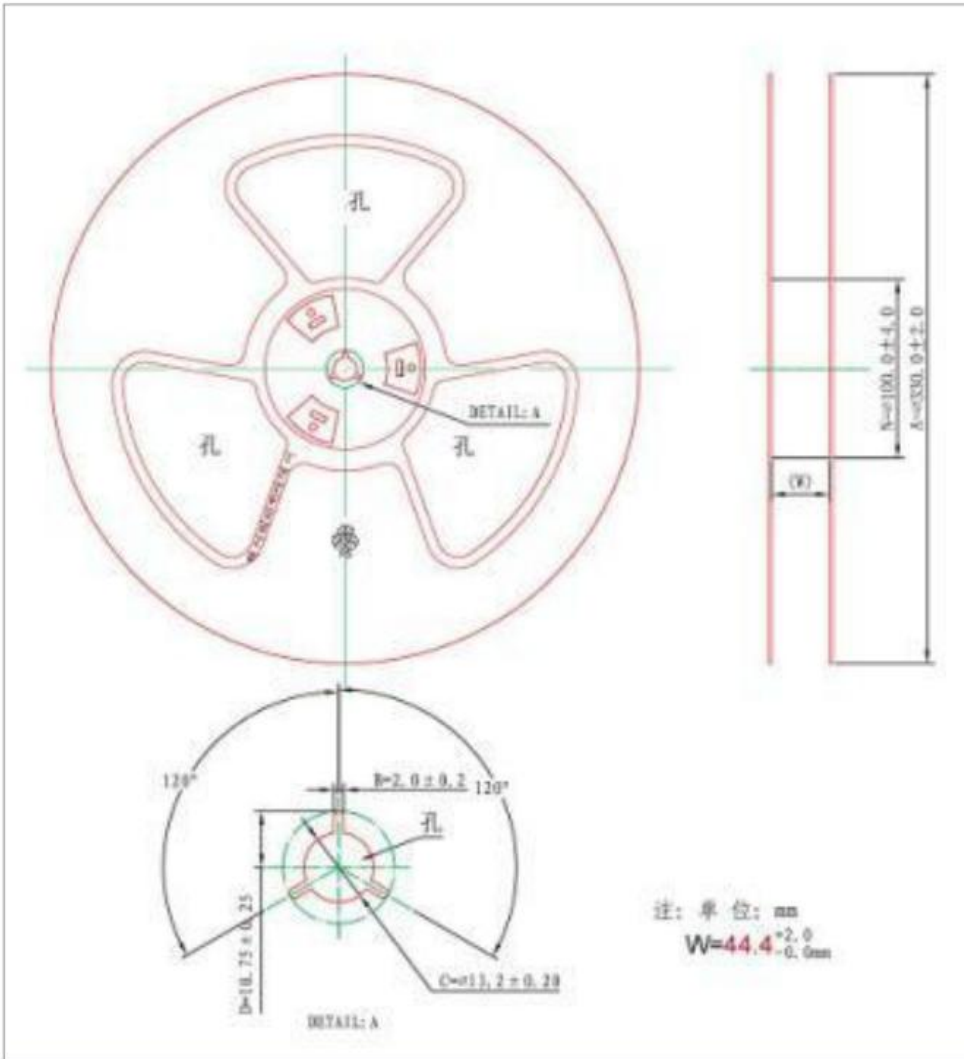# 5. Package and Transportation

5.1 Packing Dimension

The module pack on the reel, and the MPQ of 1 inner packing box is 1K;

1 outer packing box contains 3 inner packing boxes, and the MOQ quantity is 3K.
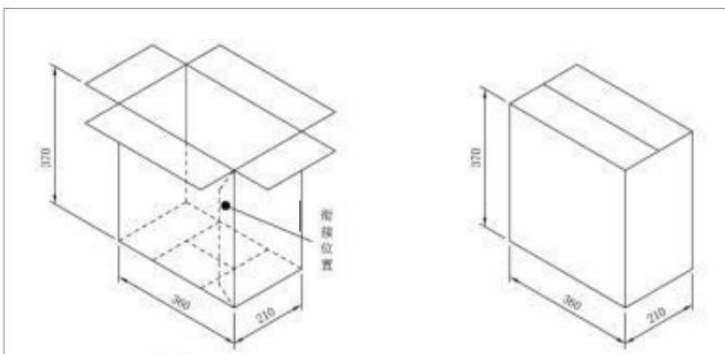
Carrier tape Dimension as below:

D.	1.50±0.10	W	24.00±0.30
A.	12.60±0.10	E	1.75±0.10
B.	16.80±0.10	F	11.50±0.10
K.	3.10±0.10	R.	4.00±0.10
T	0.30±0.05	P.	16.0±0.10
		P.	2.00±0.10

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Pallet Dimension as below:

Outer Box Dimension as below:

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5.2 Anti-static Protection Requirement

The module is electrostatic sensitive product. The RF circuit on the module contains electrostatic sensitive components. Pay attention to ESD protection during welding, installation, and transportation. Do not touch the RF_IN or other pins with bare hands; otherwise, the module may be damaged.

ESD CAUTION

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