DYA441

AIS Class

B Module

DYA441 AIS Class B Module

Hardware Design Manual V1.3

CONTENT

1. PRODUCT DESCRIPTION

The DYA441 is an AIS Class B terminal module based on the Automatic Identification System (AIS). Using the DYA441 module for communication, users can focus on the application without concerning themselves with the AIS network, achieving rapid development.

The DYA441 device can automatically send and receive AIS information and is configured and used via a serial port. It features ultra-high sensitivity, stable transmission and reception, flexible application, low power consumption, and a small size, making it easy to embed into mobile devices.

2. PRODUCT FEATURES

◆ Complies with ITU-R M.1371-5 specification

◆ Complies with NMEA0183 protocol

◆ Ultra-compact size for easy integration into mobile devices

◆ Low power consumption operation mode

◆ Ultra-high sensitivity: -115dBm

◆ Operating voltage: 3.5-4.2V

◆ Interface method: Pin header plug-in
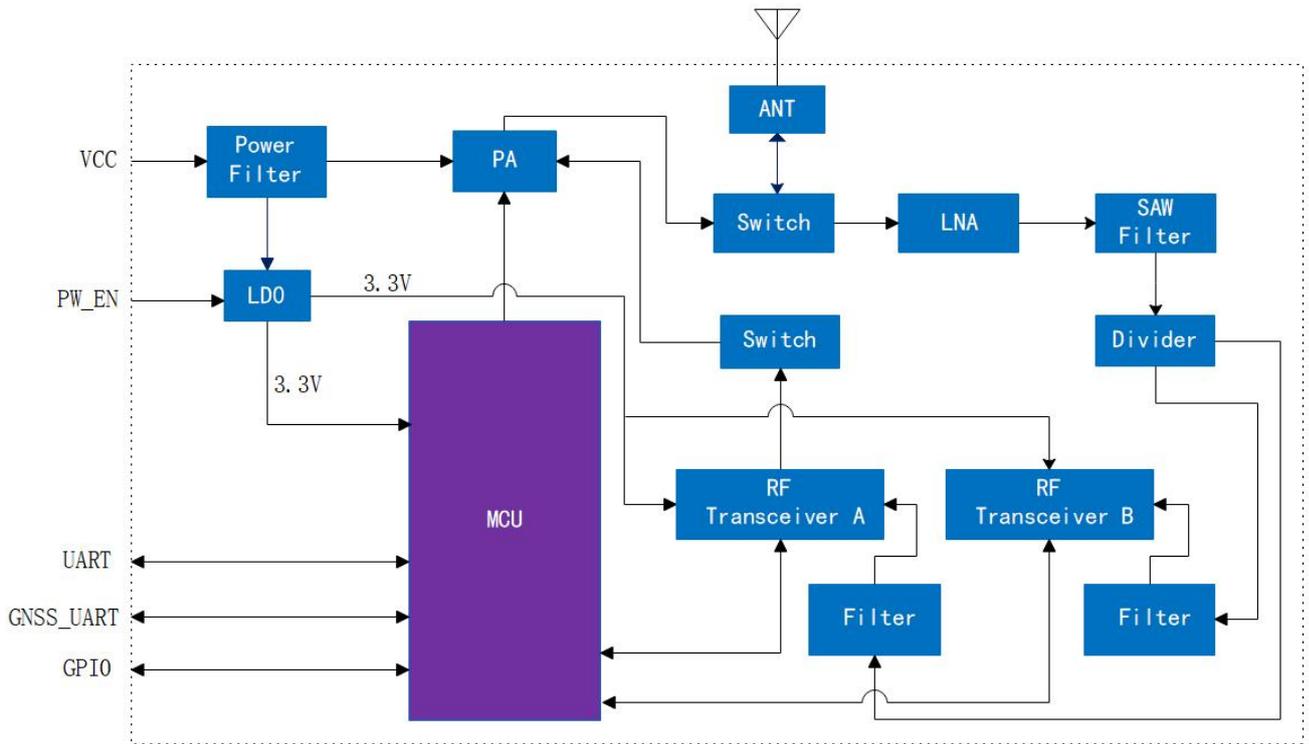
◆ Dimensions: 53.7mm * 32mm

3. INTERNAL BLOCK DIAGRAM

Figure 1: Internal Block Diagram

4. KEY SPECIFICATIONS

Parameter	Description
Transmit/Receive Frequency	AIS Channel 1: 161.975MHz AIS Channel 2: 162.025MHz
Modulation	GMSK
Modulation Rate	9.6Kbps
Transmit Power	33dBm ± 1.5dBm
Receiver Sensitivity	Better than -115dBm
Power Supply	3.5V ~ 4.2V Typical supply voltage: 4V
Power Requirements	Maximum pulse current not less than 2A
Power Consumption	Transmit state: Peak current 2A Receive state: 60 ± 10mA
Debug Serial Port	3.3V TTL level For software debugging, baud rate 38400
GNSS Serial Port	3.3V TTL level Supports receiving GNSS module information, baud rate 9600
GNSS Interface Level	3.3V TTL level
Antenna Interface	I-PEX connector
Antenna Interface Impedance	50Ω characteristic impedance
Temperature Range	Operating temperature: -25℃ ~ +70℃ Storage temperature: -30℃ ~ +80℃
Logic Level Parameters	VIL (Input Low) Max = 0.8V VIH (Input High) Min = 2.0V VOL (Output Low) Max = 0.4V VOH (Output High) Min = 2.4V

Table 1: Module Key Specifications
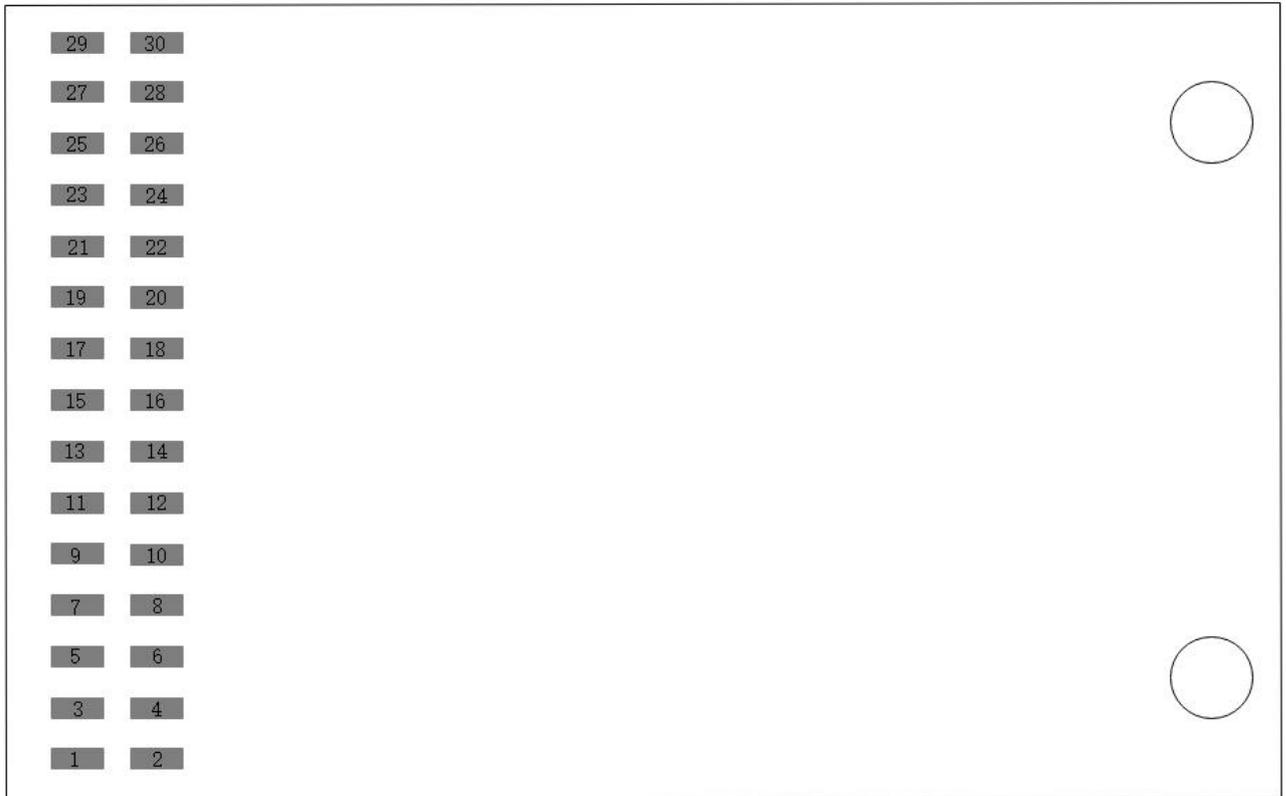
5. APPLICATION INTERFACE

5.1 Pin Assignment

Figure 2: Pin Assignment Diagram

5.2 Pin Definitions

Pin Name	Pin No.	I/O	Description
Power Related			
VCC	1, 3	POWER	Module power supply, 3.5V~4.2V, typical 4V, requires 2A current.
GND	2, 4, 5, 7, 13, 19, 28, 29	POWER	Module power ground.
PWR_EN	6	I	Module power enable control, active high, range 1.5V~5.5V.
GNSS Related			
GNSS_RX1 GNSS_TX1	21 23	I O	Primary GNSS serial port, 3.3V domain.
GNSS_1PPS	25	I	GNSS 1PPS input, 3.3V domain.
GNSS_EN	27	O	GNSS enable reserved, default high (active), can be left unconnected, 3.3V domain.
GNSS_RX2 GNSS_TX2	9 11	I O	Secondary GNSS serial port, 3.3V domain. [(Function not yet developed.)]
AIS Serial Port			
AIS_RX AIS_TX	15 17	I O	Module data serial port, 3.3V domain.
Button Related			
SOS	8	I	SOS alarm reserved, active low, can be left unconnected, 3.3V domain. Hold low for 3 seconds to toggle SOS state (between alarm and non-alarm). Can trigger SOS alarm even in silent mode (Silence_PK1 low).
Silence_PK1	10	I	Silent function reserved, active low, can be left unconnected, 3.3V domain. Hold low for silent mode (module does not

			send AIS data). Hold high for non-silent mode (module sends AIS data as required).
Indicator Related			
LED1	12	O	Error indicator reserved, active high, can be left unconnected, 3.3V domain.
LED2	14	O	AIS transmit indicator reserved, active high, can be left unconnected, 3.3V domain.
LED3	16	O	Silent mode indicator reserved, active high, can be left unconnected, 3.3V domain.
LED4	18	O	Operation indicator reserved, active high, can be left unconnected, 3.3V domain.
RX_LED	20	O	AIS receive indicator reserved, active high, can be left unconnected, 3.3V domain.
Programming Related			
NRST_MCU SWCLK_MCU SWDIO_MCU GND VCC_3V3	22 24 26 28 30	I I I/O GND O	Programming pin, recommended to provide interface on baseboard. Note: VCC_3V3 is the module's power output pin. It has limited current capability and is reserved for specific purposes only. It is not recommended for use. This pin is an OUTPUT. Supplying power to this pin is strictly prohibited, as it may damage the device.

Table 2: Module Pin Definitions

5.3 Power Supply Circuit

It is recommended to use an LDO for power supply for lower noise, which benefits reception performance. The power input voltage range is 3.5V~4.2V. The power supply must be able to provide 2A current to prevent the module voltage from dropping below 3.5V during transmission, which would cause abnormal module restart. To ensure better power supply performance, it is recommended to connect a 220uF capacitor, a 10uF capacitor, and a 100nF filter capacitor in parallel near the VCC input of the module. The reference circuit is shown in Figure 3 below.
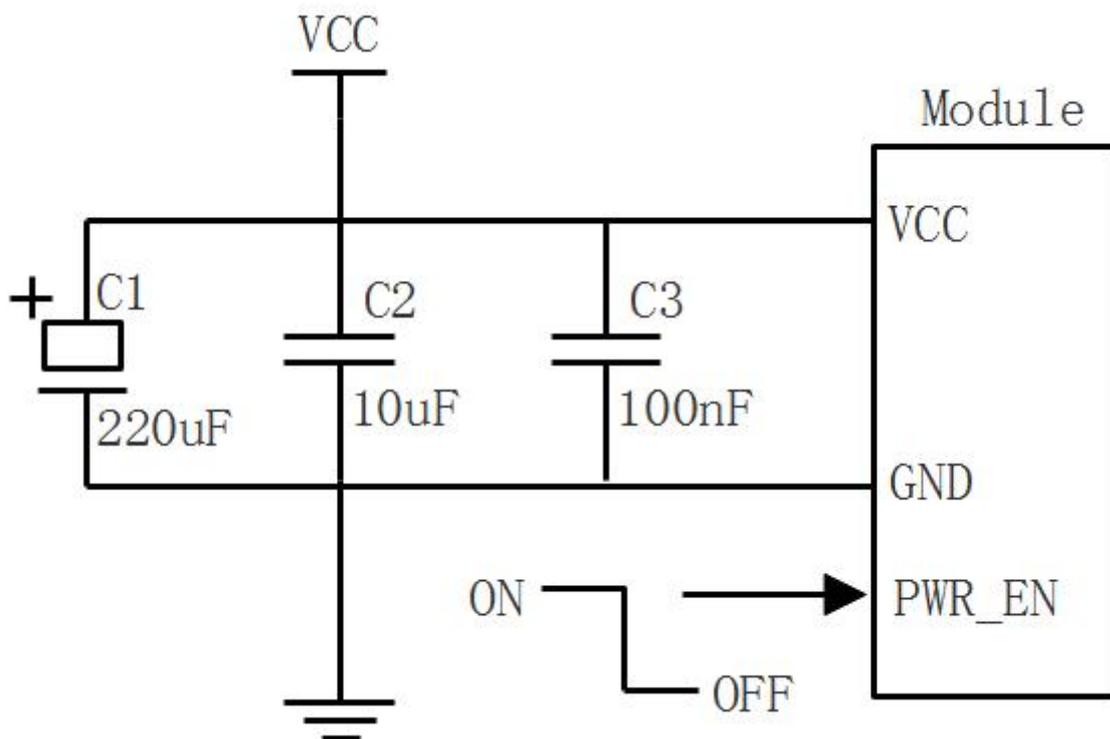

Figure 3: Power Supply Circuit

5.4 Power-On Control

The prerequisite for normal operation of the module is that the power enable control is effective, i.e., PWR_EN is high level (1.5V~5.5V).

Special Note:

During power-on, there is a timing requirement for the control of PWR_EN. PWR_EN must be delayed by at least 15ms relative to VCC power-on, otherwise the module may fail to start.
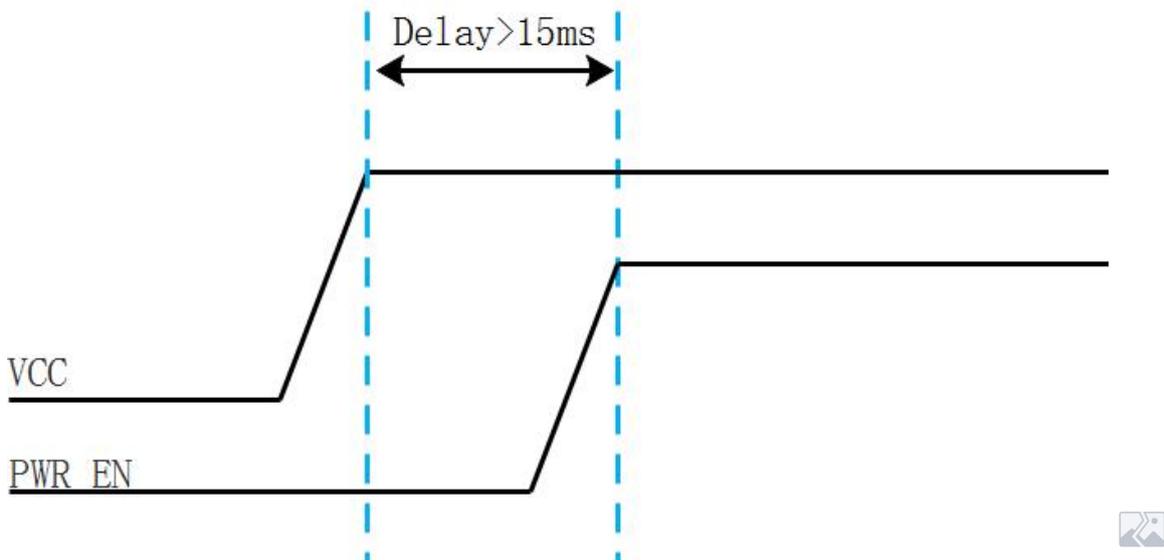

Figure 4: Power-On Timing Diagram

5.5 Serial Ports

5.5.1 Serial Port Logic Levels

The module has serial ports: debug serial port, GNSS serial port. The logic levels are as follows.

Parameter	Min	Max	Unit
VIL	-	0.8	V
VIH	2.0	3.3	V
VOL	-	0.4	V
VOH	2.4	-	V

Table 3: Serial Port Logic Levels

5.5.2 Debug Serial Port

• AIS_RX: Receives TXD data from the terminal equipment (module protocol commands).

• AIS_TX: Sends data to the RXD end of the terminal equipment (GNSS data, AIS data, debug information, module protocol commands, etc.).

• Baud rate: 38400.

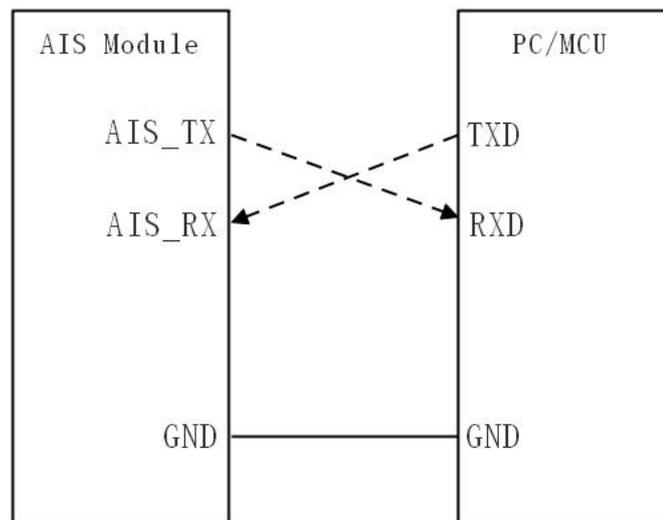The debug serial port reference design is shown below:

Figure 5: Debug Serial Port Connection Diagram

5.5.3 GNSS Serial Port

• GNSS_RX1: Receives GNSS data from the GNSS module (must comply with NMEA-0183 protocol).

• GNSS_TX1: Sends data to the RXD end of the GNSS module.

• Baud rate: 9600.

The secondary GNSS serial ports GNSS_TX2, GNSS_RX2 are not yet developed.

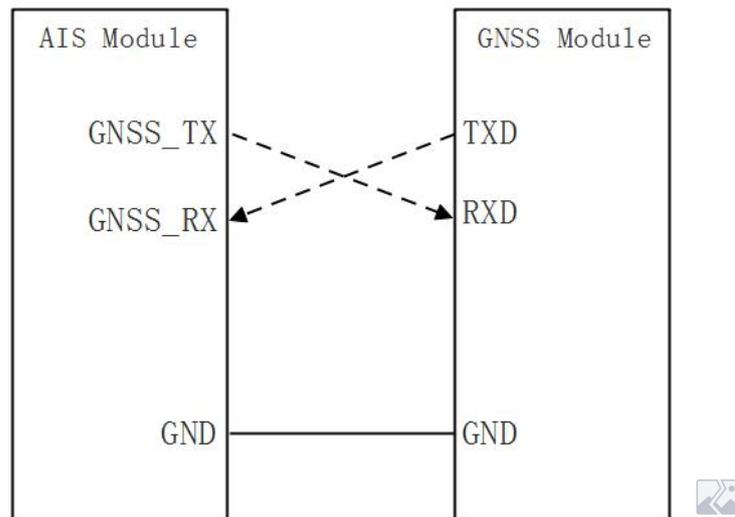The connection diagram between the AIS Module and the GNSS Module is shown below:

Figure 6: GNSS Serial Port Connection Diagram

5.6 Antenna Interface

The module's antenna interface is an I-PEX connector with a characteristic impedance of 50Ω. It requires connection to a feeder and antenna with the same 50Ω characteristic impedance.

6. ELECTRICAL PERFORMANCE AND RELIABILITY

6.1 Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" in Table 4 may cause permanent damage to the device.

Note: These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Parameter	Min	Max	Unit
VCC	-0.3	6	V
PWR_EN	-0.3	6	V
Digital Input Pin Voltage	-0.3	3.6	V

Table 4: Absolute Maximum Ratings

6.2 Operating and Storage Temperature

The operating and storage temperature range of the module is shown in the table below.

Parameter	Min	Max	Unit
Operating Temperature	-25	70	°C
Storage Temperature	-30	80	°C

Table 5: Operating and Storage Temperature Range

6.3 Current Consumption

The average power consumption values are shown in the table below.

Parameter	Mode	Description	Typ.	Max	Unit
Ivcc	Active	RF Transmit (33dBm)		2000	mA
	Active	RF Receive Mode (Average)	60		mA
	PowerDown	PWR_EN not enabled state		500	nA

Table 6: Module Average Power Consumption

7. MECHANICAL DIMENSIONS

Describes the mechanical dimensions of the module. All dimensions are in millimeters (mm). The tolerance is ±0.1mm.
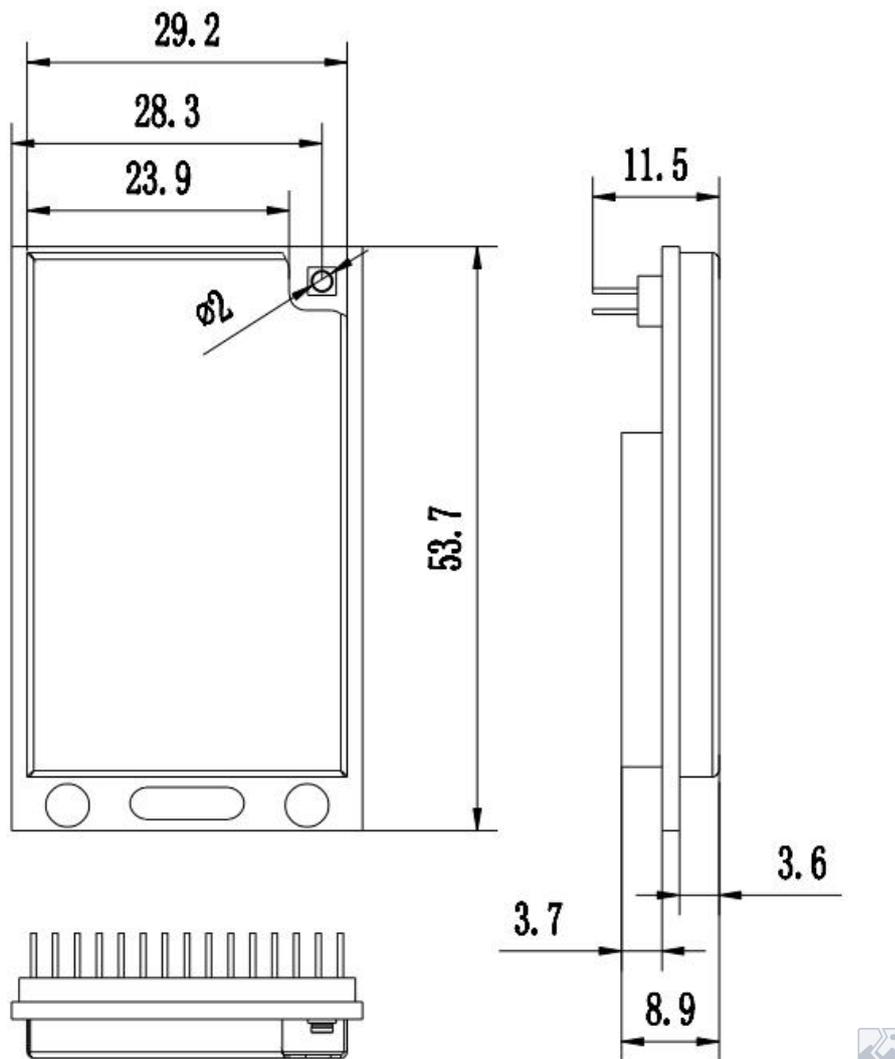
7.1 Module Mechanical Dimensions Diagram
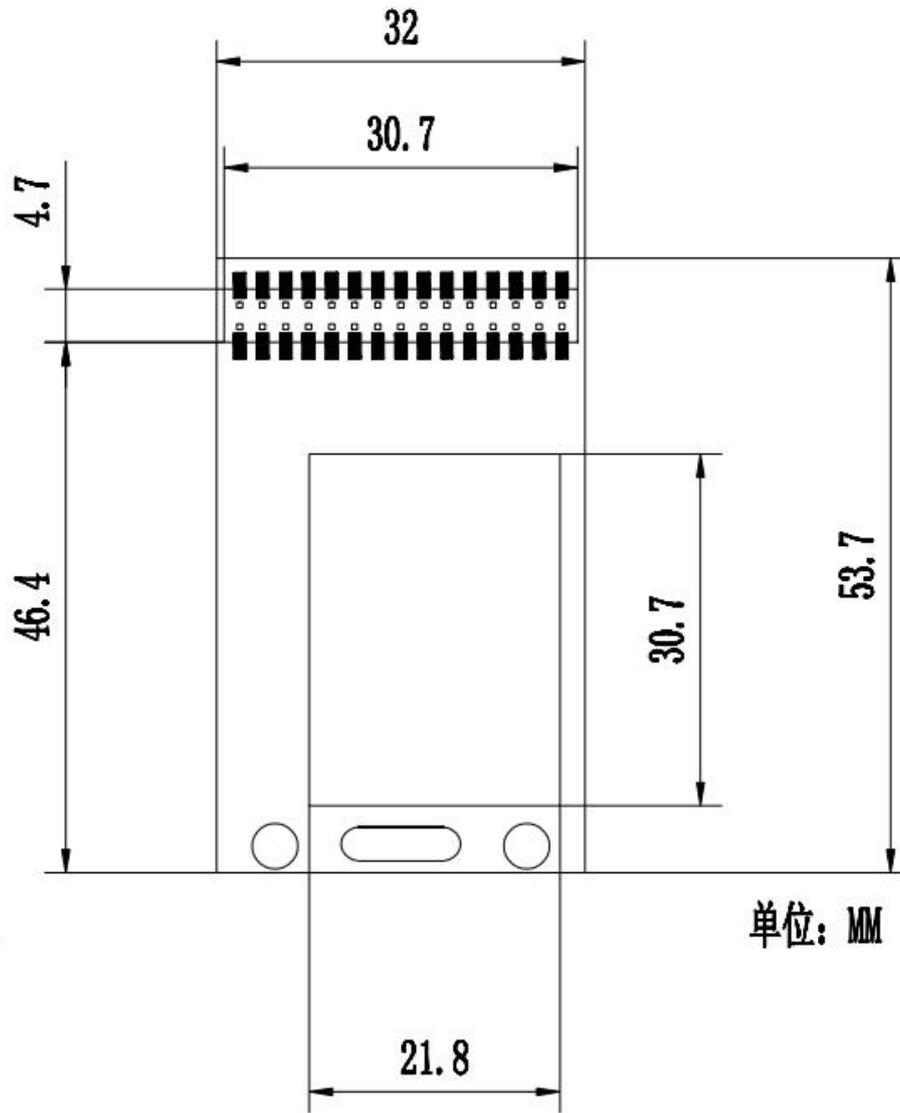

Figure 7: Top and Side View Dimensions Diagram

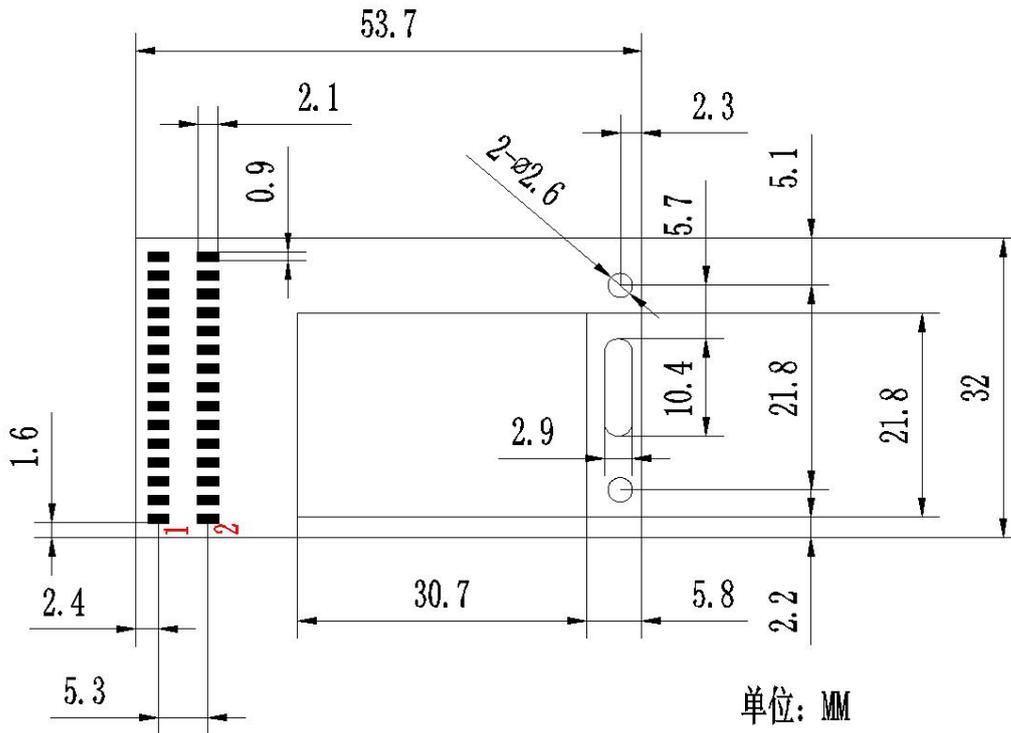Figure 8: Bottom View Dimensions Diagram

7.2 Recommended Footprint

Figure 9: Recommended Footprint

7.3 Module Top/Bottom View

Figure 10: Module Top View

Figure 11: Module Bottom View

8. ORDERING INFORMATION

8.1 Ordering Information

Information	Description
DYA441	AIS Class B Module, CSTDMA, 2W

Table 7: Ordering Information

9. FAQ

A. Why can't the module send AIS information?

✓ Is the antenna installed?

✓ Incorrect power connection, preventing normal module operation.

✓ Is the power enable pin pulled high? Is the timing sequence operation followed?

✓ Is the power supply capacity insufficient? Does the voltage drop below the normal operating level when sending AIS information?

✓ Is the module in normal mode? If not, the module will not actively send AIS data.

✓ If the silent pin is used, check if it is at low level.

✓ Is the MMSI number written as 0? If set to 0, the device will not send information.

B. Why can't the module receive AIS information?

✓ Is the antenna installed?

✓ Is the antenna mismatched or incorrectly installed?

✓ Check if the debug software serial port and baud rate are selected correctly.

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