



# **EA01-SG User Manual**

**NB-IoT Module**



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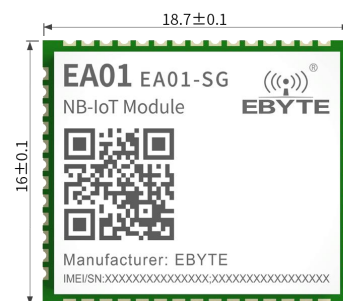
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# 1 Overview

## 1.1 Introduction

This NB+GPS/Beidou positioning module module uses XinYi Information Technology's XY1100 and GK9501 chipsolution.This chip is currently the world's first Single Die integratedCMOs PA mass-produced NB-IoT system single chip,which directlyintegrates the commercially available PA on the single Die.It is currentlythe world's most integrated NB-IoT chip. The chip integrates a dual-coreprocessor including ARM core and DSP core.The DSF core handles 3GPPprotocol and ARM handles application protocol.It is equipped withdual-core processor of Huawei LiteOS operating system to work at thesame time and run fast and stable.It supports different power consumptionmodes, such as deep sleep, normal sleep, standby, and low power. The lowest power consumption can reach 0.7uA.



GK9501 uses an integrated RF baseband design, integrating DC/DC, LDO, RF front-end, low-power application processor, RAM, Flash storage, RTC and power management. Support BDS/GPS/GLONASS/GALILEO/QZSS/SBAS.

## 1.2 Features

- Work at B3 B5 B8 frequency band
- Support TCP, UDP, MQTT,COAP, LwM2M and other protocols
- SupportTelecom Cloud CTWING,Unicom Cloud,China Mobile Onenet Cloud Platform,Alibaba Cloud, Baidu Cloud
- The current in the deep sleep state is less than 1uA, with a typical value of 0.7uA
- Support 3GPP standard R13
- Support 3GPP standards R13
- Support SMS in PDU format
- Support FOTA remote upgrade of Onenet and CTWING
- Support registration packet,heartbeat packet
- Support Modbus RTU/TCP conversion

- Support PSM、eDRX; Support PSM, eDRX
- Support BDS/GPS/GLONASS/GALILEO/QZSS/SBAS multi-system joint positioning and single system independent positioning
- D-GNSS differential positioning, A-GNSS assisted positioning, ephemeris prediction, DR integrated navigation application, the fastest data update rate 10Hz
- Support PPS output, the default period is 1s
- Support UART communication interface
- High sensitivity: capture cold start -149dBm, hot start -162dBm, tracking -166dBm
- Output format: Support NMEA0183 V4.1 and previous versions, the maximum fixed update frequency can reach 10Hz
- Support built-in RTC power supply and external power interface

### 1.3 Application

- Smart lighting
- Smart Home
- Smart fire protection
- Smart meter reading
- Smart parking
- Smart buildings
- Automatic data acquisition
- Health sensor
- Automobile testing equipment
- Smart robot
- Vehicle positioning and navigation equipment
- Wearable devices, such as GPS trackers, etc.
- UAV positioning, industrial computers, etc.

- Industry equipment that requires GNSS positioning or navigation

## 2 Parameters and pin definition

### 2.1 Main performance

Parameter	Description
Power supply	Supply voltage range: 3.1V ~ 4.2V Typical supply voltage: 3.6V
Operating Current	Emission current 300-600 ma (typical 400 Ma) Receive current 26-32ma (GPS off) Receive current 50-75ma (GPS on) Sleep current 1ua (Nb sleep + GPS off)
Nb band	699MHz~960MHz 1.71GHz~2.2GHz
GPS communication protocol	Supports NMEA0183 V4.1 and earlier with a maximum fixed update frequency of 10Hz
Supported positioning system	BDS/GPS/GLONASS/GALILEO/QZSS/SBAS
Support for peripheral interface	Uart (TXD/RXD) or GPIO
Certification	GPS certification (Pending);Nb Certification (Network Access License, Model Approval)
Serial Port	Nb serial port and GPS serial port, default 9600 bps, data bit 8 bit, stop bit 1, no check Nb serial port default 3.0V, GPS serial port default 2.8V, compatible with 3.3V

Transmitting Power	20dBm±2dB
USIM interface	Support for 1.8V/3V adaptive USIM card
Firmware upgrade	Upgrade the main at serial port, and support the FOTA upgrade of mobile cloud and telecom cloud
Physical Characteristics	Dimensions: (18.7 ± 0.15) mm × (16 ± 0.15) mm × (2.3 ± 0.2) mm
Temperature Range	Normal operating temperature: -35 ° C ~ + 75 ° C Extended operating temperature: -40 ° C ~ + 85 ° C Storage temperature: -40 ° C ~ + 90 ° C
Antenna interface	50 Ω characteristic impedance
RoHS	All devices are fully EU RoHS compliant
Weight	1.4g

## GPS performance parameters:

Categories	Index Item	Typical Value	Unit
Locating time (test condition 1)	Cold Start	27.5	S
	Hot Start	<1	S
	Recapture	<1	S
	A-GNSS	<10	S
Sensitivity (Test Condition 2)	Cold Start	-149	dBm
	Hot Start	-162	dBm
	Recapture	-164	dBm
	Track	-166	dBm
	Single transmission	-118	dBm

	128 retransmissions	-137	dBm
Accuracy  (T condition 3)	Horizontal Positioning Accuracy	2.5	m
	Height positioning accuracy	3.5	m
	Velocity positioning accuracy	0.1	m/s
	Timing Accuracy	30	ns

Note: The above results are for GPS/Beidou dual-mode operation

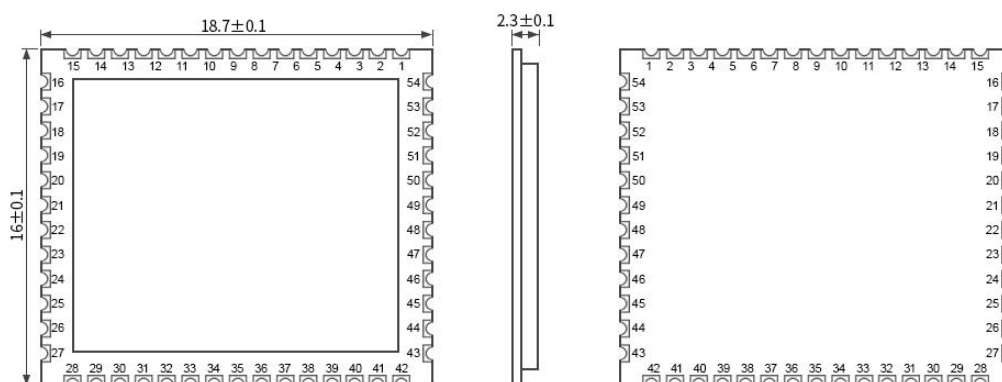
[Test condition 1]: The number of receiving satellites is greater than 6, the signal intensity of all satellites is -130 dBm, the average value is taken for 10 tests, and the positioning error is 10 meters.

[Test condition 2]: External LNA noise figure is 0.8, the number of receiving satellites is greater than 6, and the received signal strength value is locked within five minutes or under the condition of no loss of lock.

[Test condition 3]: Open and unshaded environment, continuous 24 hours boot test, 50 P.

[Test Condition 4]: The number of receiving satellites is greater than 6, and the signal intensity of all satellites is -130 dBm.

## 2.2 Pin assignment



pad quantity : 54  
Weight : 0.8±0.1g  
Unit:mm



## 2.3 Pin Type Definition

<b>Name</b>	<b>Description</b>
IO	Digital bidirectional port
DI	Digital input port
DO	Digital output port
AI	Analog input port
AO	Analog output port
PI	Power input port
PO	Power output port

## 2.4 Pin Description

Pin Number	Pin Name	I/O	Description	DC characteristic	Explain
4	LINK-B	DO	Socket1 Connection Status Indication	-	Active low
5	VDD_EXT	PO	3V output power supply	Vnom=3V	80mA max loading
10	DATA	DO	Socket data receiving and sending indication	-	Active low
11	LINK-A	DO	Socket0 Connection Status Indication	-	Active low
15	GNSS_ANT	AI	GPS antenna interface	-	50 Ω characteristic impedance
16	SIM_GND	GND	USIM card exclusive land	-	-
17	1PPS	DO	Second pulse output, user can set frequency, duration and so on by command	-	-
18	SIM_VDD	DO	USIM card power supply	1.8/3V adaptive	10mA max loading
19	SIM_CLK	DO	USIM card clock signal	-	-
20	SIM_RST	DO	USIM card reset signal	-	-
21	SIM_DATA	IO	USIM card data signal	-	Add 20K pull-up resistor to data links
22	TXD_GNSS	DO	GPS serial TXD	-	2.8V level compatible with 3.3V,
23	RXD_GNSS	DI	GPS serial port RXD	-	Default 9600 bps
29	TXD_DBG	DO	Module debugging serial port TXD, reserved	-	Reserved, Suspended is recommended
30	RXD_DBG	DI	Module debugging serial port RXD, reserved	-	
33	RXD	DI	Module data and at serial port RXD	-	3V voltage domain
34	TXD	DO	Module Data and at Serial TXD	-	
41	RF_ANT	AI/AO	RF antenna interface	-	50 Ω characteristic impedance
47	NETLIGHT	DO	Network Status Indication	-	Residence flash indication
52	VBKP	PI	RTC Auxiliary Power Input for GPS	-	3.0V-4.2V
53		DI	Reset/wake-up indicator, active high	VIL=0V	When the pulse width of the high level signal is greater than 100us and less than 5S, it is regarded as a wake-up signal.

	RST/WKUP			VIHmin=1.2V VIHmax=3.6v	When the high level signal width is more than 6 seconds, it is regarded as a reset signal. (Internal pull-down resistor)
54	IO_RST	DI	Restore Factory Parameter	-	Active low
50,51	VBAT	PI	Module main power supply	Vmax=4.2V Vmin=3.1V Vnom=3.6V	Supply at least 0.6a current
14,27,31, 40,42,44 ,45,48,49	GND	GND	Power Ground	-	-
3,6,8,9,12,38 ,39	RESERVED	-	Reservation	-	Stay in the air
1,2,7,12, 24,25,26, 28,32,35, 36,37,43, 46	NC	-	Empty Foot	-	-

Note:

- Data, socket data transceiver status indication, output high level when idle, the pin will continue to pull down for 500ms after the socket receives wireless data in the air, if there is wireless data coming within 500ms, then continue to pull down for 500ms again, if there is no data coming within 500ms, restore high level output; When the socket sends data, it will continue to pull down for 500ms, if there is data to send within 500ms, it will continue to pull down for 500ms again, and if there is no data to send within 500ms, it will restore the high level output.
- LINK-B, socket1 connection status indication, socke1 outputs high level when not connected, outputs low level after successful connection, and restores high level output after disconnection.
- LINK-a, socket0 connection status indication, socke0 output high level when not connected, output low level after successful connection, recover high level output after disconnection.
- IO\_RST: Restore the factory parameters. When the pin is pulled low for about 1 second, and the serial port returns to factory reset, the function of restoring factory parameters will be executed, and it will automatically restart to take effect.

## 3 Explanation of Extended Instructions and Function

### 3.1 MegaByte Transparent Application Enable

At Command	Respond
AT+EBYTEAPP=<enable>/r/n	OK
AT+EBYTEAPP	ebyte app enable:<enable> OK

(1) The at command configures whether to use TCP, DUP, MQTT, and COAP passthrough applications. By default, at + EBYTEapp = 1 is enabled. When the mobile onenet cloud and the telecom cloud need to be accessed or the Socket extension at command is transmitted, at + EBYTEapp = 0 is required to close the transparent transmission application.

(2) Configuration Parameter Description

- < enable >, 0 means close the passthrough application, 1 means open the passthrough application.

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.**

### 3.2 Select a service that automatically connects

At Command	Respond
AT+POWONLINK=<type >/r/n	OK
AT+POWONLINK	power on link socket type: <type>

(1) The at command is configured to select the SOCKET for automatic connection upon power-on. By default, only the TCP/UDP channel is automatically connected upon power-on.

(2) Configuration Parameter Description

- < type > 1 indicates power-on to connect MQTT channel, and 2 indicates power-on to connect COAP channel.

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.**

### 3.3 Configure the DTU function application

At Command	Respond
AT+DTUUSER=<enable>/r/n	OK
AT+DTUUSER	DTU enable:< enable >

(1) The at command is configured to select whether to enter the transmission mode by default after power-on and power-on, and the default is to turn off the DTU application, that is, to turn on the at mode.

(2) Configuration Parameter Description

- < enable >, 0 means off, 1 means on, enter at + NRB command will save parameters to flash, and automatically restart effect.

### 3.4 Module Voltage Query

At Command	Respond
AT+VBAT=?	+VBAT:<value> OK

(1) VBat is the current power supply voltage of the module. The normal operating range is 3.1-4.2V.

### 3.5 At mode and data transparent transmission mode switch

At Command	Respond
ATD*98/r/n	CONNECTING OK
+++	OK

(1) Power-on operation is in the at command mode by default. In the at command mode, issue ATD \* 98/R/n or ATD \* 99/R/n to switch to the transparent transmission mode.

- (2) < + + + >: In the transparent transmission mode, the last three bytes of user data are "+ + +", or three bytes of "+ + +" are sent after the completion of user data transmission, which will end the transparent transmission mode.

### 3.6 Device software restart

At Command	Respond
AT+NRB/r/n	REBOOTING

After entering the at command, the device will be soft reset, and the at parameters will be saved to the flash. When the at parameters need to be memorized in case of power failure, the parameters shall be configured through at command first, and then the at + NRB parameters shall be memorized in the flash only after being input.

### 3.6 Application of power-saving lock WORKLOCK

At Command	Respond
AT+WORKLOCK =<enable>/r/n	OK

(1) As the Nb module is in deep sleep mode (chip power-down state) for a long time, in order to ensure that data interaction fails due to entering deep sleep in advance during application, input at + WORKLOCK = 1 and add a work lock to prevent entering deep sleep in advance. After data service interaction is completed, input at + WORKLOCK = 0 to release the lock module to enter deep sleep.

(2) The module supports serial port wake-up, which can be done by inputting an at command. After the at command is used to wake up the module, a work lock will be automatically added. Therefore, after the service interaction is finished, at + WORKLOCK = 0 must be inputted to release the lock to enter deep sleep.

**Note: After power on again, you must input at + WORKLOCK = 0 to enter deep sleep**

### 3.7 Serial port baud rate settings

At Command	Respond
AT+UARTSET =<rate>,<store>/r/n	OK

(1) This command is similar to the function of remote "at + NATSPEED", which is used to set the baud rate of at serial port and other parameters. The default value is 9600 baud rate. When the store is 0, the baud rate will take effect

dynamically. When the store is 1, the set baud rate will be divided by 2400 and saved in flash, and will be automatically restarted.

## (2) Description of parameter configuration

- < rate >: The baud rate, the highest 115200 currently supported.
- < store >: whether to save; default to not to save, that is, to dynamically switch the baud rate; If it is set to 1, it is saved in NV and restarted immediately; If it is set to 0, it means that the dynamic effect is valid and the baud rate of the other party needs to be switched synchronously.

## 3.8 Communication protocol type configuration

At Command	Respond
AT+PDUTYPE=<pdu_type>/r/n	OK
AT+PDUTYPE/r/n	type:<pdu_type> OK

(1) Currently, MQTT, COAP, and TCP/UDP are supported. Currently, the module supports two sockets, and allows TCP/UDP and one of MQTT and COAP to communicate at the same time. TCP/ODP always opens socket0, and one of MQTT and COAP opens socket1.

## (2) Configuration Parameter Description

- < PDU \_ type >, 0 indicates TCP or UDP based protocol, 1 indicates MQTT based protocol, and 2 indicates COAP based protocol.

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.**

## 3.10 Functional Configuration of TCP/UDP Passthrough Channel

### 3.10.1 TCP/UDP Address and Port Configuration

At Command	Respond
AT+SOCKADDR =<addr>,<port>,<local_port>,<type> /r/n	OK
AT+SOCKADDR /r/n	address:< addr >,port:< port >,local port:

	<local_port>,type:<type> OK
--	--------------------------------

(1) that socket0 address support the IP address and the domain name, the maximum byte length supports 50 byte, the soft restart, hardware reset and normal power-on of the equipment are automatically connected with the socket0, If the server does not release the link before connection, the terminal needs to disconnect the link successfully first and then connect to socket0.

(2) Configuration Parameter Description

- < addr >, which supports IP addresses or domain names, with a maximum byte length of 50 bytes.
- < Port >, the port of the remote server.
- < local \_ port >, local port, 0 means freely selected by tcpip, default is 0.
- < type >, 0 indicates the TCP protocol, 1 indicates the UDP protocol.

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.**

(3) actively reporting + XSSTate: < ID >, < state > when Socket connection state changes;

- < ID > Indicates the created socket ID. Currently, only 0 and 1 are supported. TCP/DUP channels can only use 0, and COAP, MQTT, and 100 million cloud channels use 1.
- < state > indicates the socket connection state, 1 indicates the connection state, and 0 indicates the disconnection state.

For example, socket0 will actively report + XSSTate: 0,1 after successful connection, and will actively report + XSSTate: 0,0 when the server or terminal disconnects socket0.

3.10.2 Opening and Closing TCP/UDP Connections to socket0

At Command	Respond
AT+SOCKONOFF=<enable>,<on-off>/r/n	+XSSTATE:< id>,<state> OK

- < enable >, indicates whether the TCP/UDP channel is enabled, 1 indicates enabled, and 0 indicates not enabled. The default is to enable open TCP/UDP channels.
- < on-off >, which turns socket0 on or off, 1 on, 0 off.



**Note:** In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.

### 3.11 Configuration of heartbeat pack function

#### 3.11.1 Configure TCP/UDP Heartbeat Packet Content

At Command	Respond
AT+HEARTINFO=<type>,<data>/r/n	OK
AT+HEARTINFO /r/n	<data> OK

- < type >, 0 means the heartbeat bag type is in hex format, 1 means the heartbeat type is in ASCII code (string) format.
- < data >: refers to the data content of the transmitted heartbeat packet. The maximum length is less than 40. The default value is "Ebyte nbiot heart rate data" ".

**Note:** In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.

#### 3.11.2 Send Heartbeat Packet Command

At Command	Respond
AT+SENDHEART=<send>/r/n	OK

- (1) Input at command at + SENDHEart = 1, then the sending of heartbeat packet can be completed.
- (2) If PDU \_ type selects TCP/UDP, the TCP/UDP heartbeat packet will be sent; if MQTT is selected, the MQTT heartbeat packet will be sent ( "PINGRESP" will be printed on the serial port after successful sending).

## 3.12 Function Configuration of Registration Package

### 3.12.1 Registration Package Mode Configuration

At Command	Respond
AT+REGMOD=<mode>/r/n	OK
AT+REGMOD/r/n	OK mode: <mode>

- < mode >, 0 indicates that the registration packet is closed, 1 indicates that the IMei registration packet is added before each packet of data sent,

2 means that a custom registration packet is added before each packet of data to be sent; 3 means that an IMei registration packet is sent only when the server is linked for the first time; 4 means that a custom registration packet is sent only the first time it is linked to the server;

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.**

### 3.12.2 Custom registration package data content configuration

At Command	Respond
AT+REGINFO=<type>,<data>/r/n	OK
AT+REGINFO /r/n	OK < data >

- < type >, 0 indicates that the registration package type is in hex format, and 1 indicates that the registration package type is in ASCII code (string) format.
- < data > refers to the data content of the registration packet sent. The maximum length is less than 40. The default value is "Ebyte Register packet" .

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.**

## 3.13 Modbus RTU/TCP conversion function

### 3.13.1 Function Description

Aft that Modbus RTU/TCP conversion function is started, unde the receiving state, when the data format of the Modbus RTU is wirelessly received, the data format is automatically converted into the data format of the Modbus TCP for serial port prin;In that transmit state, when the serial port receives the data format of the Modbus RTU, the data format is automatically convert into the data format of the Modbus TCP for wireless transmission;

### 3.13.2 Modbus RTU/TCP Enable Configuration

At Command	Respond
AT+MODBUS=<enable>,<Id> /r/n	OK
AT+MODBUS /r/n	OKenable:< enable>,Id:< Id >

#### (1) Description of parameter configuration

- < enable >, 0 turns off the modbus RTU/TCP conversion function, and 1 turns on the modbus RTU/TCP conversion function.
- < Id >, Indicating the modbus TCP transaction identifier, (0 ~ 65535) 2 bytes in length.

#### (2) Transaction ID Id Function Description

- In the modbus TCP to modbus RTU state, when Id = 0, any received modbus TCP will be converted to the corresponding RTU protocol, otherwise only the transaction ID matches.
- When the modbus RTU is in the state of being converted to modbus TCP, it indicates the ID of the converted modbus TCP transaction

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.**

## 3.14 MQTT Application Configuration

### 3.14.1 Instructions for Using MQTT Instruction Set

First, at + MQTTMode command configures the working mode soft reset of MOTT to be re-enabled; secondly, at + PDUTYPE confirms whether the data frame type is mqtt transmission or not; thirdly, at + MQTTCONN configures the three elements of the connection; and thirdly, at plus MQTTSUBTOP and at plusThe MQTTPUBTOP command configures the subject of subscription and publication. Finally, the ATD \* 98 enters the transmission mode for service interaction. After the interaction is completed, the + + +

input to enter the at command mode. The at + WORKLOCK = 0 command is input to release the lock and enter the deep sleep mode.

### 3.14.2 MQTT Mode Configuration

At Command	Respond
AT+MQTTMODE=<mode>/r/n	OK
AT+MQTTMODE /r/n	OKmode:< mode >

- < type >, 0 means to disable the mqtt function, 1 means to access the Alibaba Cloud platform, 2 means to access the onenet platform and other Internet of Things platforms that support the standard MQTT protocol, and 3 means to access Baidu Cloud platform.

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.**

### 3.14.3 MQTT Address and Port Configuration

At Command	Respond
AT+MQTTADDR=<addr>,<port>/r/n	OK
AT+MQTTADDR /r/n	OK address: <addr>,port: <port>

(1) When the mqtt mode is 0, entering this instruction will prompt "mqtt closed" ";When the mqtt mode is 1, configure the address and port of the Alibaba Cloud Platform;When the mqtt mode is 2, configure the address and port of onenet platform or other platforms;When the mqtt mode is 3, configure the address and port of Baidu cloud platform;

Note: Baidu cloud, onenet, MQTT three platform domain name address generally will not change, if the domain name really changes can also be modified by instructions.

#### (2) Description of parameter configuration

- < addr >, which represents the IP address or domain name of the server and has a maximum length of 50 bytes.
- < port > for the server port.

### 3.14.4 Configuration of Three Elements of MQTT Connection

At Command	Respond
AT+MQTTCONN=<value0>,<value1>,<value2>/r/n	OK

AT+MQTTCONN /r/n	OK<value0><value1><value2>
------------------	----------------------------

(1) The length of each of the three elements is not more than 40 bytes.

(2) Refer to the corresponding application guidance for the description of the three element values of each platform.

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.**

### 3.14.5 MQTT Subscription Topic Configuration

At Command	Respond
AT+MQTTSUBTOP=< topicName>, <qos>/r/n	OK
AT+MQTTSUBTOP /r/n	OK qos:< qos > < topicName>

- < topicName >: a string within 200 bytes of the content of the subscription topic.
- < QoS >: quality of service support QoS = 0, QoS = 1, QoS = 2.

### 3.14.6 MQTT Publishing Topic Configuration

At Command	Respond
AT+MQTTPUBTOP=< topicName>, <qos>/r/n	OK
AT+MQTTPUBTOP /r/n	OK qos:< qos > < topicName>

- < topicName >: a string within 200 bytes of the content of the publication topic.
- < QoS >: quality of service support QoS = 0, QoS = 1, QoS = 2.

### 3.14.7 MQTT and Server keepalives Settings

At Command	Respond
AT+MQTTALIVE=< alive_time >/r/n	OK
AT+MQTTALIVE /r/n	OK

	keep alive time:< alive_time >
--	--------------------------------

- < alive \_ time >: The time to keep the server alive, the unit is second, the data range is 2 bytes, the default is 600 seconds (10 minutes).

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically.**

### 3.15 COAP function configuration

#### 3.15.1 COAP Function Description

- At first, at + COAP ADDR command configures address and port of COAP server and opens COAP function at the same time, at + NRB soft reset restarts to be effective;
- Second, the at + PDUTYPE instruction selects the data protocol type as COAP
- Condly, at + ADDOPTion, at + ADDTOKen and at + COAPMINUS instructions add or delete option or token in the message;
- Finally, the at + COAPHEADER instruction sends the message without load;ATD \* 98 enters the transparent transmission mode to input serial port transparent transmission data. At this time, the data to be sent is loaded COAP message (serial port transparent transmission data is the payload of COAP message).

#### 3.15.2 COAP Address Parameter Configuration

At Command	Respond
AT+COAPADDR=<addr>,<port>,<local_port>,<enable>/r /n	OK
AT+COAPADDR /r/n	OK address: <addr>,port: <port> , local port:<local_port >,enable<enable>

- < addr >, supporting IP address or domain name, maximum byte length 50 bytes
- < port >, the port of the server
- < local \_ port >, local port
- < enable >, COAP enable, 0 means to turn off COAP function, 1 means to turn on COAP function

**Note: In case of power-down saving, enter at + NRB command to save the parameters to flash and restart automatically**

3.15.3 Instruction for adding option in COAP message

At Command	Respond
AT+ADDOPTION=<index>,< type>,< value>/r/n	OK
AT+ADDOPTION /r/n	OK  index: <index>, type:<type>, value:<value>

- < index >, the sequence number of option, range 0 to 7, the maximum number of options can be configured, and the storage space is 1024 bytes.
- < type >, the number of option, as shown in the following figure:

No.	C	U	N	R	Name	Format	Length	Default
1	x			x	If-Match	opaque	0-8	(none)
3	x	x	-		Uri-Host	string	1-255	(see below)
4				x	ETag	opaque	1-8	(none)
5	x				If-None-Match	empty	0	(none)
7	x	x	-		Uri-Port	uint	0-2	(see below)
8				x	Location-Path	string	0-255	(none)
11	x	x	-	x	Uri-Path	string	0-255	(none)
12					Content-Format	uint	0-2	(none)
14		x	-		Max-Age	uint	0-4	60
15	x	x	-	x	Uri-Query	string	0-255	(none)
17	x				Accept	uint	0-2	(none)
20				x	Location-Query	string	0-255	(none)
35	x	x	-		Proxy-Uri	string	1-1034	(none)
39	x	x	-		Proxy-Scheme	string	1-255	(none)
60			x		Size1	uint	0-4	(none)

For example, type = 11 indicates that the option resource type is Uri-Path.

- < value >, the specific content of the option, for example, the specific value of the Uri-Path option is \ temperature.

If the data type of value is Uint, the data range is 0-4294967295, and the data length is only

Holds 0-4 bytes.

A plurality of options can be configured, and the maximum number of options can be 8. For example, enter the following commands in turn:

AT+ADDOPTION=0,3,iot.eclipse.org

AT+ADDOPTION=1,7,5683

AT+ADDOPTION=2,11,\temperature

At + ADDOPTion read instruction return

index: 0, type: 3, value: iot.eclipse.org

index: 1, type: 7, value: 5683

index: 2, type: 11, value: \temperature

### 3.15.4 Instructions for Adding Token in COAP Message

At Command	Respond
AT+ADDTOKEN =<token>/r/n	OK
AT+ADDTOKEN /r/n	OK  <token>

- < token > and the data format is hex.

The parameter to be entered in the column is 0x7A5B69EF

AT+ADDTOKEN=7A5B69EF

Read instruction at + ADDTOKen

AT+ADDTOKEN

7A5B69EF

### 3.15.5 Remove the option or token instruction from the message

At Command	Respond
AT+COAPMINUS=<token>,<option>/r/n	OK

- < token > = 1, remove the token in the message
- < option > = 1, remove the option in the message

### 3.15.6 Send command of COAP without payload message

At Command	Respond
------------	---------



AT+COAPHEADER =<type>,<code>/r/n	OK
AT+COAPHEADER /r/n	OK type:<token>,code:<code>

- < type >: Configure the type of the sent message.

Type = 0, con frame, a request that needs to be acknowledged, if a con request is sent, then the other party must respond.

Type = 1, non frame, a request that does not need to be acknowledged, if a non request is sent, then the other party does not have to respond

Type = 2, ACK frame, acknowledgement message, response to the con message.

Type = 3, RST frame, Reset message, when the message received by the receiver contains an error, the receiver parses the message or no longer cares what the sender sent, then the reset message will be sent.

- < code >: Configure the function code for sending the message.

Code = 1, get method, used to get a resource

Code = 2, post method, used to create a resource

Code = 3, put method, used to update a resource

Code = 4, delete method, used to delete a resource

For example, if at + COAPHEADER = 0, 1 is input, a frame of COAP get message can be sent. The message includes a fixed header and may have option or token.

### 3.11.7 COAP Data Receiving Instruction

- The serial port prints the Head information of the received COAP data frame: response code: < code >, type: < type >, tid: < tid > ends with carriage return and line feed.

< code >, which indicates the function code of the server response;< type >, indicating the type of the received message;< tid >, which indicates the message ID (decimal format) of the received message;

- If there is token in the received message, the serial port prints the token: < token > ends with carriage return and line feed, and < token > is in the form of hex string.
- If there is option in the received message, the serial port prints option type: < type >, value: < value > and ends with carriage return and line feed.
- If there is Payload in the received message, the serial port prints Payload: < Payload > ends with carriage return

and line feed.

## 4 GNSS-Related at Command

### 4.1 Configure GNSS command parameter

At Command	Respond
AT+GNSSCMD=<nmeacmd>/r/n	OK
AT+GNSSCMD/r/n	OK Command list

(1) This at command is mainly used to configure GNSS command parameters. For details of command parameters, see GNSS Command Manual.

(2) Description of parameter configuration

< nmeacmd >, for details of GNSS commands, refer to the GNSS Command Manual.

Example: at + GNSSCMD = \$PGKC030,1,1 \* 2C

### 4.2 NMEa statements for configuring at serial port output

At Command	Respond
AT+NMEAPRINT=<nmea_item>/r/n	OK
AT+ NMEAPRINT/r/n	OK Nmea item

(1) The at command mainly configures the at serial port to output NMEa statements, including GLL, RMC, VTG, GGA, GSA, GSV and so on.

(2) Description of parameter configuration

< NMEA \_ item >, select the NMEa statement to be output, null means no statement is output, GLL/RMC/VTG/GGA/GSA/GSV means corresponding statement is output, default is null.

Example: at + NMEAPRINT = GLL/RMC/GSA, which means to output statements such as GLL RMC GSA.

At + NMEAPRINT = GGA/GSA/GSV, which means to output statements such as GGA GSA GSV.

### 4.3 How to configure NMEa statement output

At Command	Respond
AT+NMEAOP=<mode>/r/n	OK
AT+ NMEAOP/r/n	OK NMEA output mode: <mode>

(1) The at instruction mainly configures the output mode of the NMEa statement to select at serial port output or socket output.

(2) Description of parameter configuration

< mode >, 0 for at serial port output, 1 for SOCKET channel output. Default at serial output.

### 4.4 Control GNSS power

At Command	Respond
AT+GNSSVCC=<mode>/r/n	OK
AT+GNSSVCC/r/n	OK GNSS power mode:<mode>

(1) The at command mainly configures the power supply mode of GNSS. The default power supply is turned on, and the GNSS power supply needs to be turned off after the service interaction is completed.

(2) Description of parameter configuration

< mode >, 0 means to turn off the GNSS power supply, 1 means to supply only the GNSS auxiliary power supply, and 2 means to supply both the GNSS main power supply and the auxiliary power supply.

The default value is 2, and at + NRB is saved in flash

## 5 3GPP Standard Directives & Operator Cloud Platform Standard

### Directives

See EA01-S 3GPP and Operator Cloud Platform Standard Instruction Manual for this part of function

## 6 Power Up Process and Deep Sleep Instruction

First, the serial port reports "System power on mode: < mode >" to indicate the power-on mode of the module.

< mode > = 0, normal power-on mode;

< mode > = 1, indicating that the reset pin is powered on by hardware reset;

< mode > = 2, indicating software reset and power-on;

< mode > = 3, indicating that the RTC wakes up from deep sleep and is powered on;

< mode > = 4, indicating that the RX pin of the serial port is in deep sleep to wake up and is powered on;

< mode > = 5, indicating that the watchdog is reset and powered on;

Secondly, the serial port "report" TCPIP is OK "that the success of the network, TCP/UDP link is ready.

Finally, the serial port reports "+ XSSState: < ID >, < state >" indicating whether the Socket of TCP/UDP is successfully connected.

< ID > Indicates the created socket ID. Currently, only 0 and 1 are supported. TCP/DUP channels can only use 0, and COAP and MQTT channels use 1.

< state > indicates the socket connection state, 1 indicates the connection state, and 0 indicates the disconnection state.

At Command	Respond
ATD*98/r/n	CONNECTING OK
+++	OK

(1) Power-on operation is in the at command mode by default. In the at command mode, issue ATD \* 98/R/n or ATD \* 99/R/n to switch to the transparent transmission mode;

(2) < + + + >: In the transparent transmission mode, the last three bytes of the user data are "+ + +", or three bytes of "+ + +" are sent after the transmission of the user data is completed, and the transparent transmission mode is ended;

**Finally, if deep sleep is required after data communication is completed, enter "+ + +" to exit the transmission mode and enter the at command mode. Enter at + WORKLOCK = 0 to enter deep sleep. When data needs to be sent next time, an at command is input to wake up the module from deep sleep, and an at + SOCKONOFF command is called to open the socket0 of the TCP/UDP to enter a transmission mode for data interaction after the power-on process is completed.**

If the user does not need to enter the deep sleep mode, other operations are not carried out, and the data is transmitted and received in real time in the transmission mode.

## 7 Hardware Design

- It is recommended to use DC regulated power supply to supply power to the module, the ripple coefficient of the power supply should be as small as possible, and the module should be reliably grounded;
- Please pay attention to the correct connection of the positive and negative poles of the power supply, if reversed, it may cause permanent damage to the module;
- Please check the power supply to ensure that it is between the recommended power supply voltage, if it exceeds the maximum value, it will cause permanent damage to the module;
- Please check the stability of the power supply, and the voltage can not fluctuate frequently;
- When designing power supply circuit for modules, it is often recommended to keep more than 30% margin, which is conducive to long-term and stable work of the whole machine;
- The module should be as far away as possible from the power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference;
- High-frequency digital wiring, high-frequency analog wiring and power supply wiring must be kept away from the lower part of the module. If it is really necessary to pass through the lower part of the module, it is assumed that the module is welded on the Top Layer. The copper shall be laid on the Top Layer (all copper shall be laid and well grounded) at the contact part of module. It must be close to the digital part of module and wired on the Bottom Layer;
- Assuming that the module is soldered or placed on the Top Layer, random wiring on the Bottom Layer or other layers is also wrong, which will affect the stray and receiving sensitivity of the module to varying degrees;
- It is assumed that the performance of the module will also be greatly affected by the presence of large electromagnetic interference devices around the module, and it is recommended to keep away from the module according to the intensity of the interference, and if the situation allows, appropriate isolation and shielding can be done;
- High frequency digital, high frequency analog, power supply traces) will also greatly affect the performance of the module, according to the strength of the interference, it is recommended to keep away from the module, if the situation allows, appropriate isolation and shielding can be done;
- Antenna installation structure has a greater impact on module performance, be sure to ensure that the antenna is exposed, preferably vertically upward. When the module is installed inside the casing, a high-quality antenna extension line can be used to extend the antenna to the outside of the casing;
- The antenna must not be installed inside the metal shell, which will lead to a great reduction in transmission

distance.

## 8 Frequently Asked Questions

### 8.1 Transmission distance is not ideal

- When there is a straight line communication obstacles, the communication distance will be a corresponding attenuation;
- Temperature, humidity, the same frequency interference, will lead to communication packet loss rate increased;
- The ground absorbs and reflects radio waves, and the test effect near the ground is poor;
- Seawater has a very strong ability to absorb radio waves, so the effect of seaside testing is poor;
- There are metal objects near the antenna, or placed in the metal shell, the signal attenuation will be very serious;
- Power register setting error, over the air rate setting is too high;
- At room temperature, the low voltage of the power supply is lower than the recommended value, and the lower the voltage, the smaller the power;
- The matching degree between the used antenna and the module is poor or the quality of the antenna itself is poor.

### 8.2 Vulnerability of module

- Please check the power supply to ensure that it is between the recommended power supply voltage, if it exceeds the maximum value, it will cause permanent damage to the module;
- Please check the stability of the power supply, and the voltage can not fluctuate frequently;
- Please ensure that the process of installation and use of anti-static operation, high-frequency devices electrostatic sensitivity;
- Please ensure that the humidity should not be too high during installation and use, and some components are humidity sensitive devices;
- If there is no special need, it is not recommended to use it at too high or too low temperature.

## 8.3 Bit Error Rate Too High

- There is the same frequency signal interference nearby, away from the interference source or modify the frequency, channel to avoid interference;
- Power supply is not ideal may also cause garbled, be sure to ensure the reliability of the power supply;
- Poor quality or too long extension lines and feeders can also cause high bit error rate.

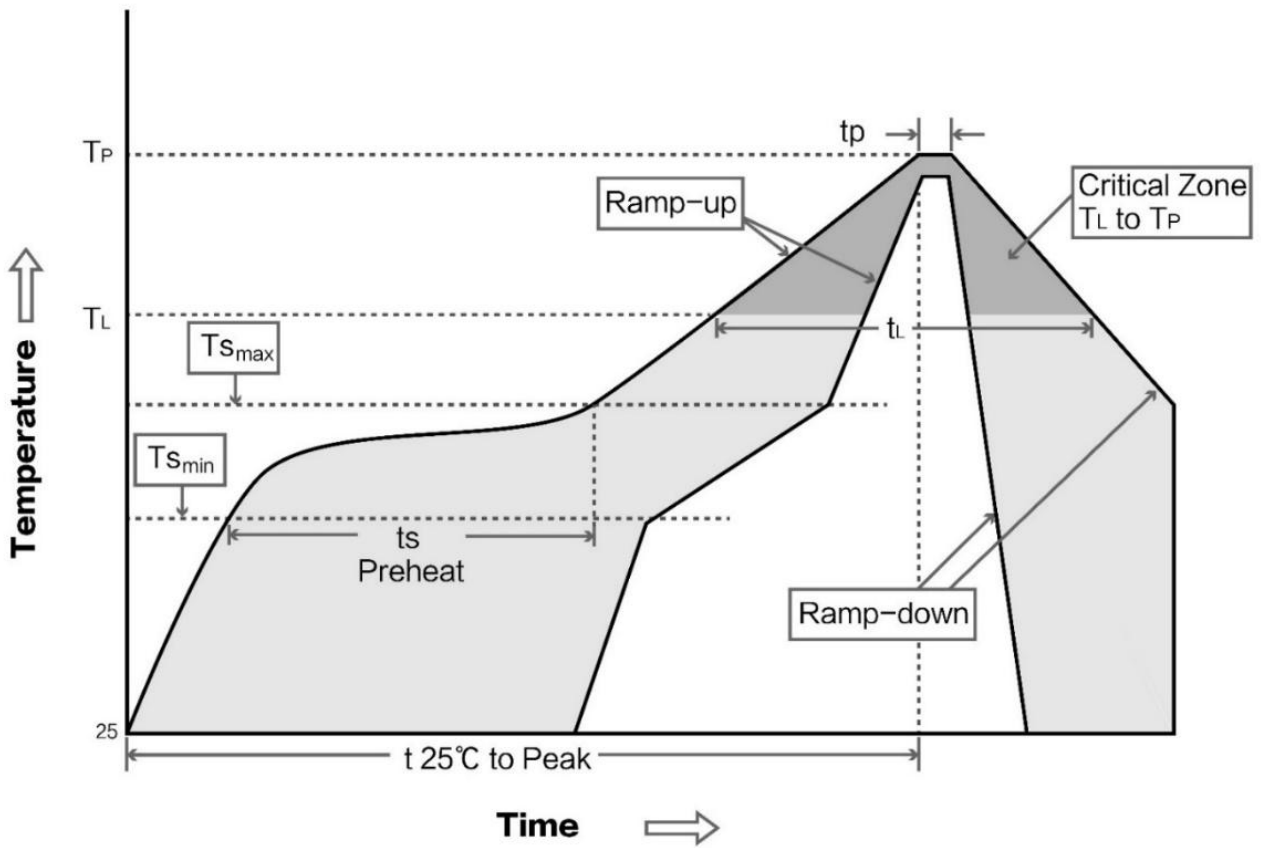
## 9 Welding Operation Instruction

### 9.1 Reflow Temperature

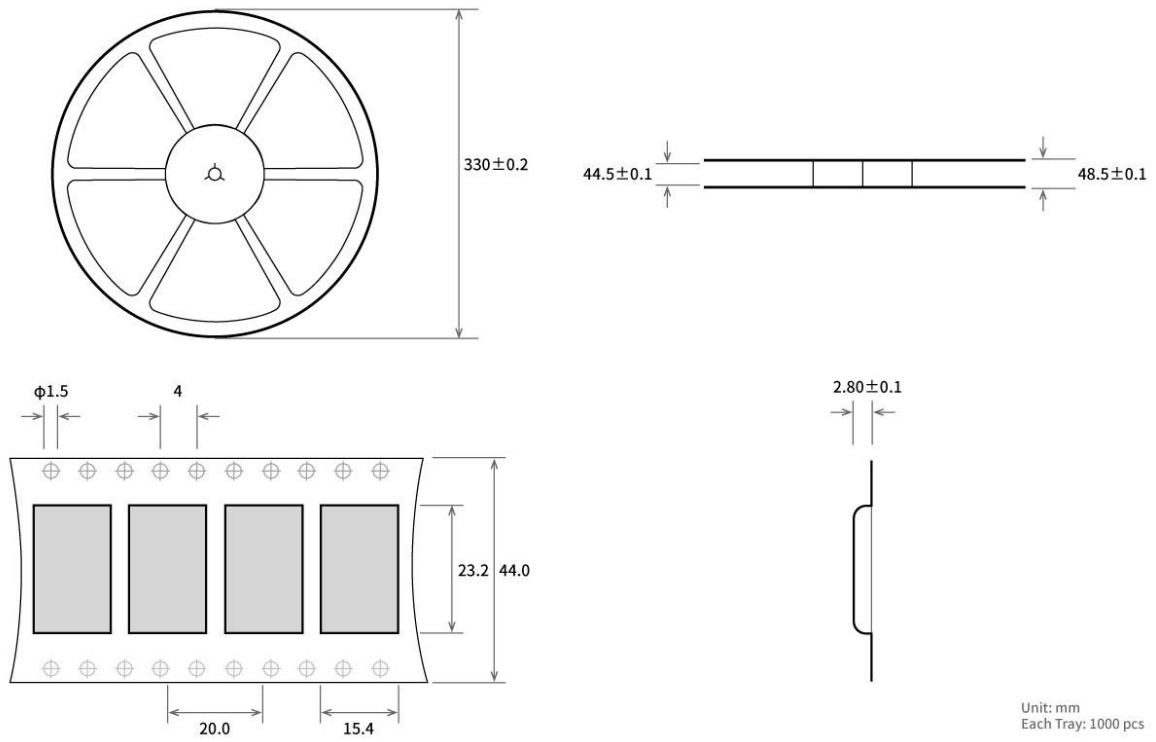
Profile Feature	Curve Characteristic	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (T <sub>smin</sub> )	Minimum preheat temperatures	100°C	150°C
Preheat temperature max (T <sub>smax</sub> )	Maximum preheat temperatures	150°C	200°C
Preheat Time (T <sub>smin</sub> to T <sub>smax</sub> )(ts)	Warm-up Time	60-120 sec	60-120 sec
Average ramp-up rate(T <sub>smax</sub> to T <sub>p</sub> )	Average rate of rise	3°C/second max	3°C/second max
Liquidous Temperature (TL)	Liquid-phase temperature	183°C	217°C
Time (t <sub>L</sub> ) Maintained Above (TL)	Time above liquidus	60-90 sec	30-90 sec
Peak temperature (T <sub>p</sub> )	Peak temperature	220-235°C	230-250°C
Average ramp-down rate (T <sub>p</sub> to T <sub>smax</sub> )	Average rate of descent	6°C/second max	6°C/second max
Time 25°C to peak temperature	Time from 25 ° C to peak temperatures	6 minutes max	8 minutes max



## 9.2 Reflow Profile



# 10 Batch Packaging Method



## Revision History

Version	Date of revision	Revision Description	Maintainer
1.0	2020-09-28	Initial version	Ver

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