

# RXB070I

**2.4GHz Bluetooth  
Low Energy Module  
with Integrated Antenna**

Datasheet



## PRODUCT DESCRIPTION

The RYB070I is a Bluetooth Low Energy Module with Integrated Antenna. It is specially designed for smartphone peripheral applications. By using the AT command and Android/iOS APP source codes which are developed by REYAX, your products could be fast and easily connected with the smartphones.

## FEATURES

- Bluetooth v4.0 with Bluetooth Low Energy ( Bluetooth Smart )
- High-Performance and Low-Power TI CC2541 industry-standard chip
- Designed with PCB integrated antenna, Suitable for SMT
- Metal cover against EMI interference
- Transmitting, Receiving, Wake-up by only 2 UART pins
- Bluetooth Peer-to-Peer (P2P) Connection

## APPLICATIONS

- Smart phone/Tablet accessories
- Remote monitoring and control
- Indoor positioning

## SOFTWARE

- Standard Generic Attribute Profile (GATT)
- Android APP source code support
- Apple iOS APP source code support
- Control easily by AT commands
- Firmware upgrade over the UART interface

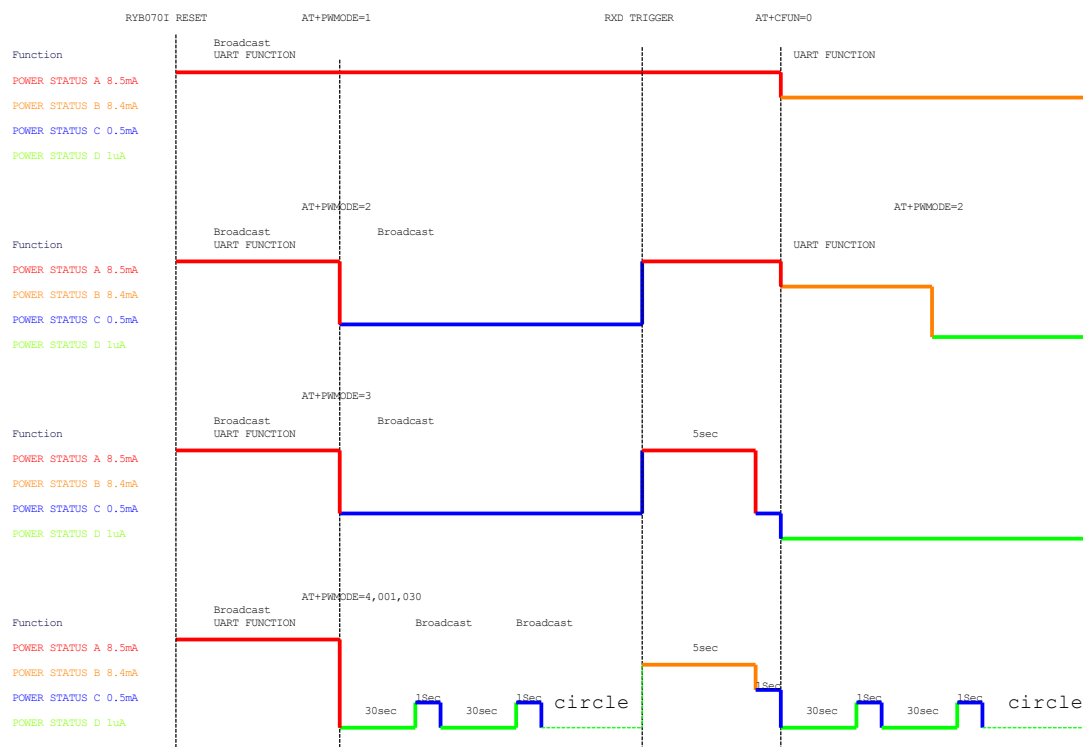
## CERTIFICATIONS TO BE APPROVED

- FCC CFR47 Part 15 (US)
- ETSI EN 300 328, EN300 440 class 2 (Europe)
- ARIB STD-T66 (Japan)
- NCC (Taiwan)

## SPECIFICATION

| Item                  | Min. | Typical | Max.  | Unit | Condition   |
|-----------------------|------|---------|-------|------|---|
| Operation Voltage     | 2    |         | 3.6   | V    | VDD   |
| RF Output Power       | -23  | 0       | 0     | dBm  |   |
| RF Sensitivity        |      | -94     |       | dBm  |   |
| Power Status A        |      | 8.5     |       | mA   | UART function is available<br>BLE is broadcasting |
| Power Status B        |      | 8.4     |       | mA   | UART function is available<br>No BLE broadcast    |
| Power Status C        |      | 0.5     |       | mA   | UART function is sleeping<br>BLE is broadcasting  |
| Power Status D        |      | 1       |       | uA   | UART function is sleeping<br>No BLE broadcast     |
| Wake Up Time          |      | 30      |       | ms   | From Power Status C/D to A/B                      |
| Baud Rate             |      | 9600    | 57600 | bps  |   |
| RF Frequency Range    | 2379 |         | 2496  | MHz  |   |
| Communication Range   |      | 10      |       | M    | Open Space  |
| Operating Temperature | -40  | 25      | +85   | °C   |   |
| Antenna               |      |         |       |      | Embedded PCB Antenna                              |
| Dimensions            |      |         |       |      | 16.7mm*13mm*2.2mm                                 |
| Weight                |      | 0.8     |       | g    |   |

## AVAILABLE POWER MODE AND POWER CONSUMPTION STATUS



## WAKE UP UART FUNCTIONS

When RXB0701 is on Power Status C or Power Status D, users could use pin7 RXD to wake up the UART function. It will need some time to work normally after leaving low energy mode. In the process of waking up the UART function, the AT command may not be recognized by RXB0701, so the data of former bytes may be garbled. Users just need to send the commands again.

When RXB0701 is on PWMODE =2 / 3 / 4, the status will be as follows after trigger by the RXD (pin7) :

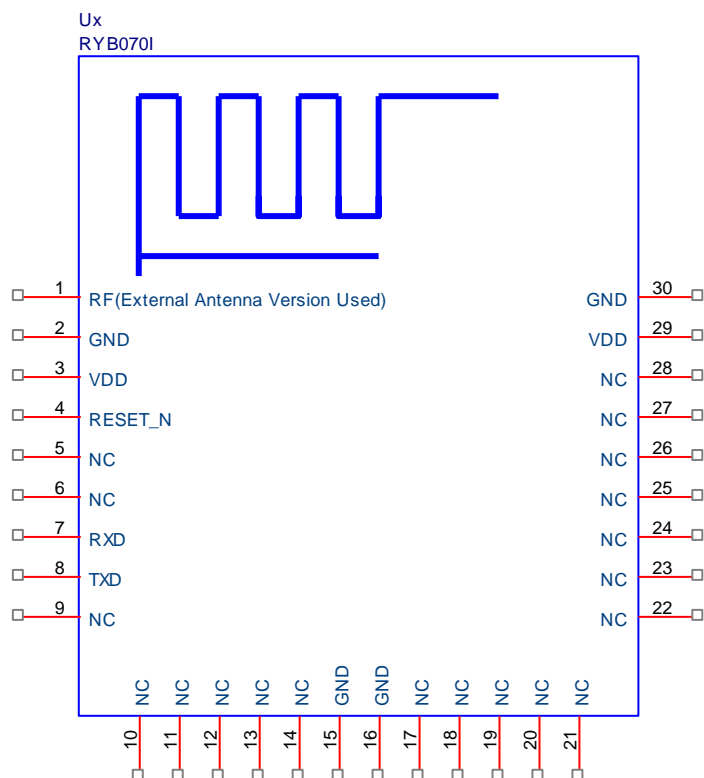
**PWMODE =2 :** RXB0701 will become PWMODE =1 from PWMODE =2.

Send PWMODE =2 commands again to get back to power saving status.

**PWMODE =3 :** RXB0701 will become Power Status A. It will return to Power Status C if there's no any communication on UART after 5 seconds.

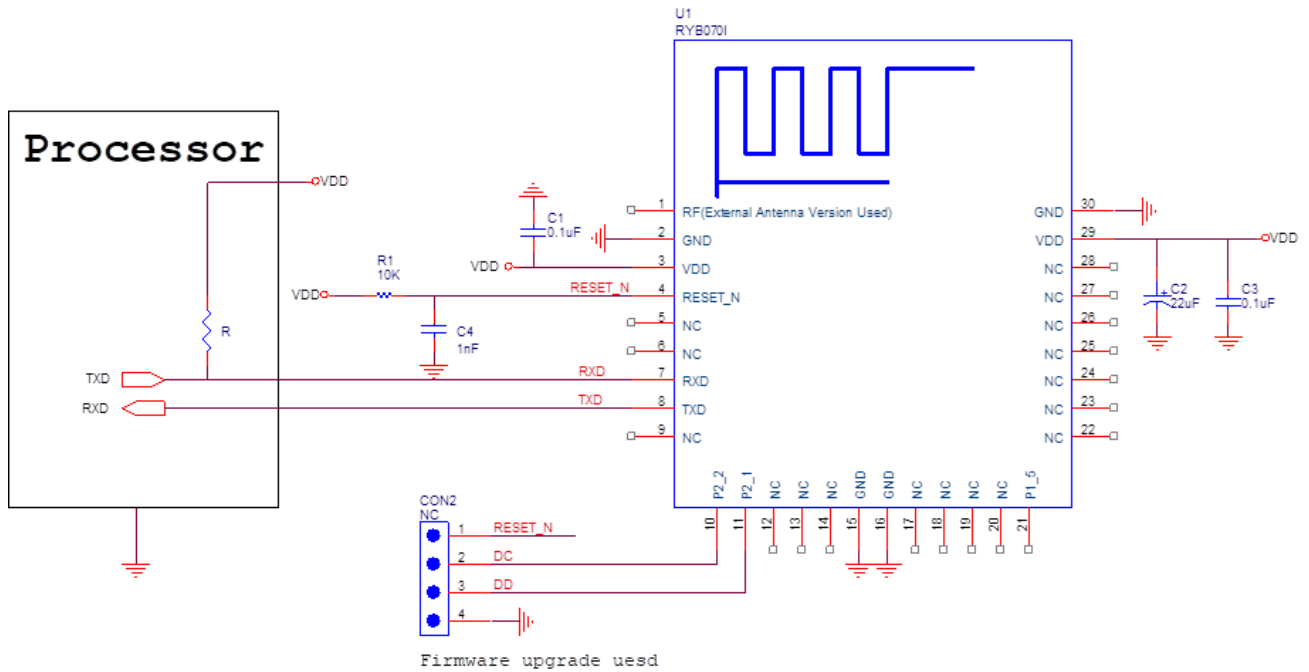
**PWMODE =4 :** RXB0701 will become Power Status A, but will still do BLE broadcast and sleep on schedule as the setting. When it is on Power Status A, it will leave PWMODE=4 after sending PWMODE=1.

## PIN DESCRIPTION

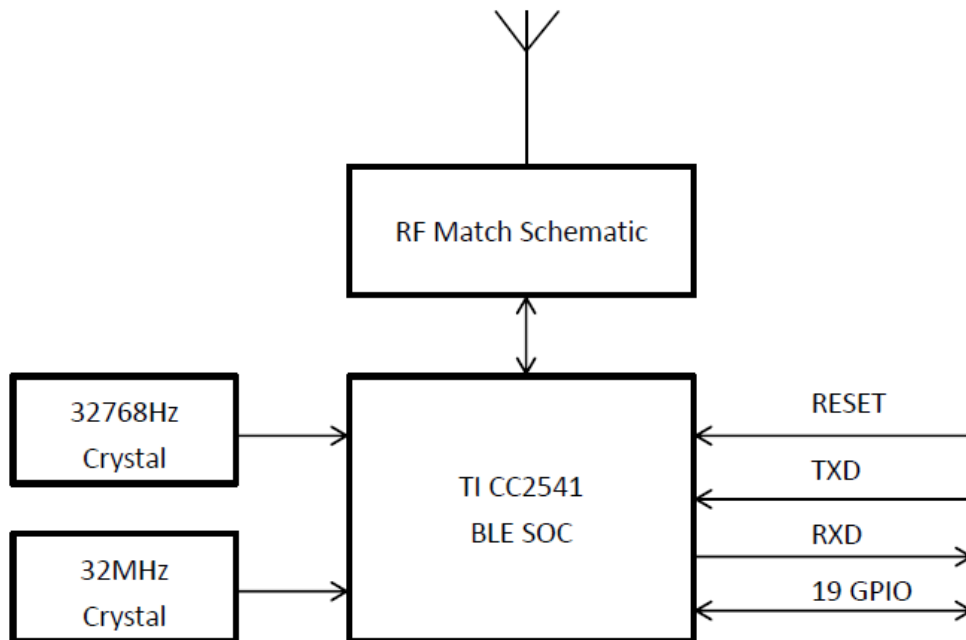


| Pin | Name    | I/O | Condition                     |
|-----|---------|-----|-------------------------------|
| 1   | RF      |     | External Antenna Version Used |
| 2   | GND     | -   | Ground                        |
| 3   | VDD     | I   | Power Supply                  |
| 4   | RESET_N | I   | Low Reset                     |
| 5   | NC      | -   | Leave Unconnected.            |
| 6   | NC      | -   | Leave Unconnected.            |
| 7   | RXD     | I   | UART Data Input               |
| 8   | TXD     | O   | UART Data Output              |
| 9   | NC      | -   | Leave Unconnected.            |
| 10  | NC      | -   | Leave Unconnected.            |
| 11  | NC      | -   | Leave Unconnected.            |
| 12  | NC      | -   | Leave Unconnected.            |
| 13  | NC      | -   | Leave Unconnected.            |
| 14  | NC      | -   | Leave Unconnected.            |
| 15  | GND     | -   | Ground                        |
| 16  | GND     | -   | Ground                        |
| 17  | NC      | -   | Leave Unconnected.            |
| 18  | NC      | -   | Leave Unconnected.            |
| 19  | NC      | -   | Leave Unconnected.            |
| 20  | NC      | -   | Leave Unconnected.            |
| 21  | NC      | -   | Leave Unconnected.            |
| 22  | NC      | -   | Leave Unconnected.            |
| 23  | NC      | -   | Leave Unconnected.            |
| 24  | NC      | -   | Leave Unconnected.            |
| 25  | NC      | -   | Leave Unconnected.            |
| 26  | NC      | -   | Leave Unconnected.            |
| 27  | NC      | -   | Leave Unconnected.            |
| 28  | NC      | -   | Leave Unconnected.            |
| 29  | VDD     | I   | Power Supply                  |
| 30  | GND     | -   | Ground                        |

## APPLICATION CIRCUIT



## BLOCK DIAGRAM



## REFLOW SOLDERING

Consider the "IPC-7530 Guidelines for temperature profiling for mass soldering (reflow and wave) processes, published 2001. **Only single reflow soldering processes are recommended for REYAX modules. Repeated reflow soldering processes and soldering the module upside down are not recommended.**

### Preheat phase

Initial heating of component leads and balls. Residual humidity will be dried out. Please note that this preheat phase will not replace prior baking procedures.

- Temperature rise rate: max. 3 °C/s If the temperature rise is too rapid in the preheat phase it may cause excessive slumping.
- Time: 60 - 120 s If the preheat is insufficient, rather large solder balls tend to be generated. Conversely, if performed excessively, fine balls and large balls will be generated in clusters.
- End Temperature: 150 - 200 °C If the temperature is too low, non-melting tends to be caused in areas containing large heat capacity.

### Heating/ Reflow phase

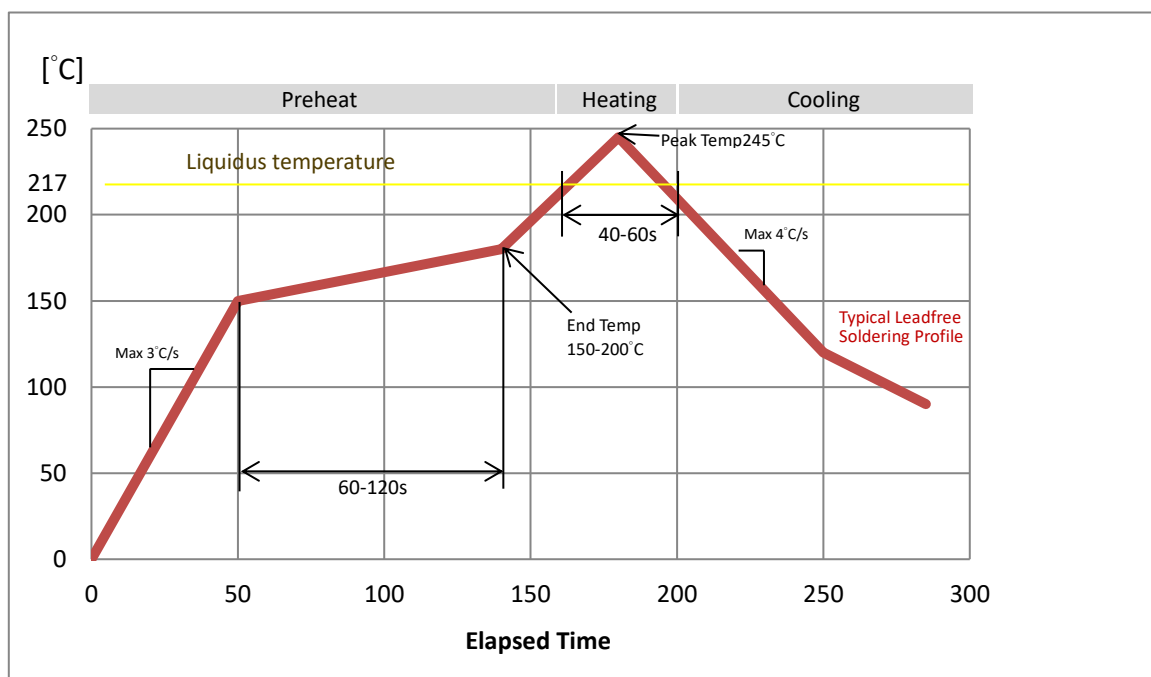
The temperature rises above the liquidus temperature of 217°C. Avoid a sudden rise in temperature as the slump of the paste could become worse.

- Limit time above 217 °C liquidus temperature: 40 - 60 s
- Peak reflow temperature: 245 °C

### Cooling phase

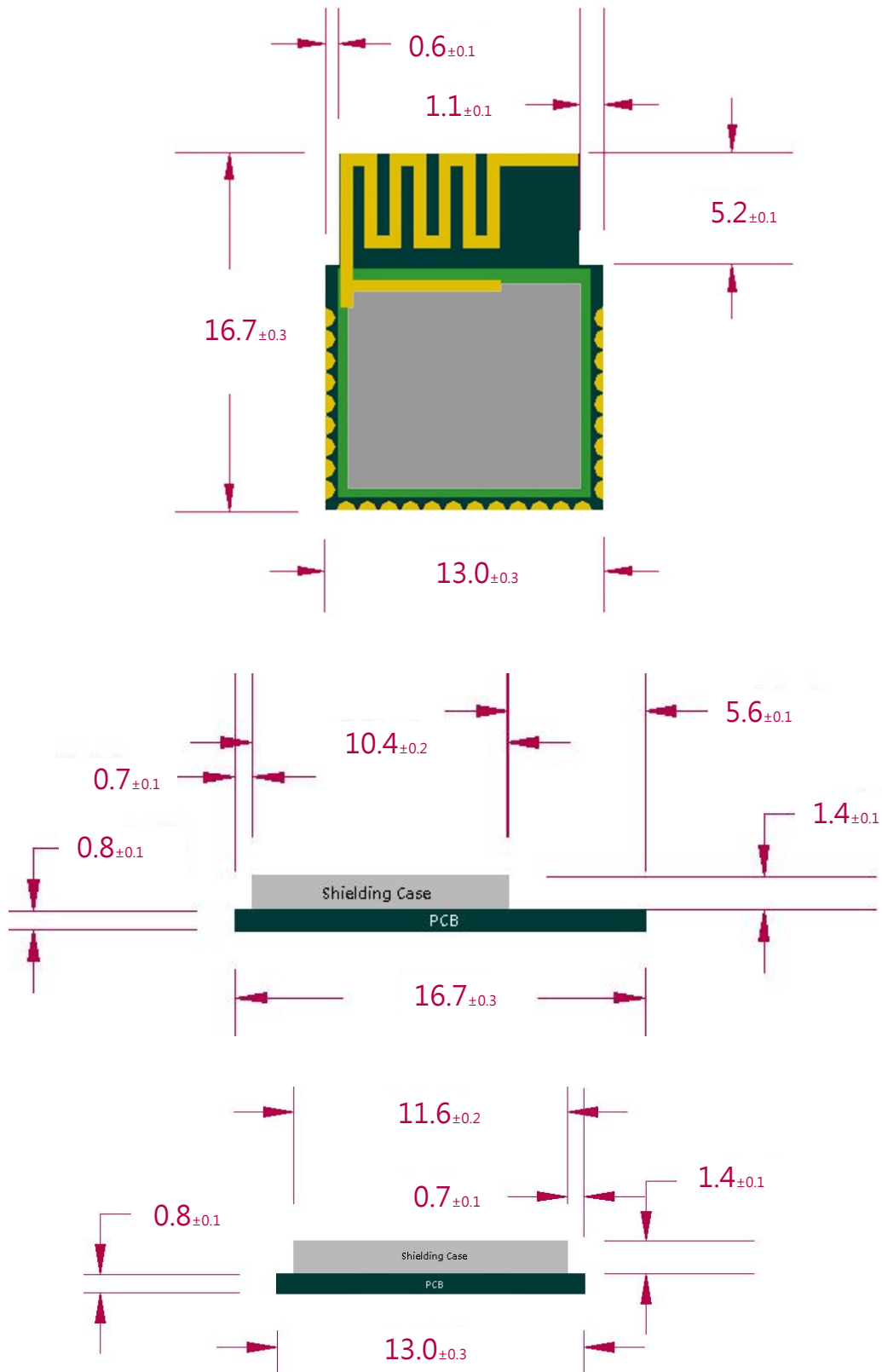
A controlled cooling avoids negative metallurgical effects (solder becomes more brittle) of the solder and possible mechanical tensions in the products. Controlled cooling helps to achieve bright solder fillets with a good shape and low contact angle.

- Temperature fall rate: max 4 °C/s To avoid falling off, the REYAX module should be placed on the topside of the motherboard during soldering.



Recommended soldering profile

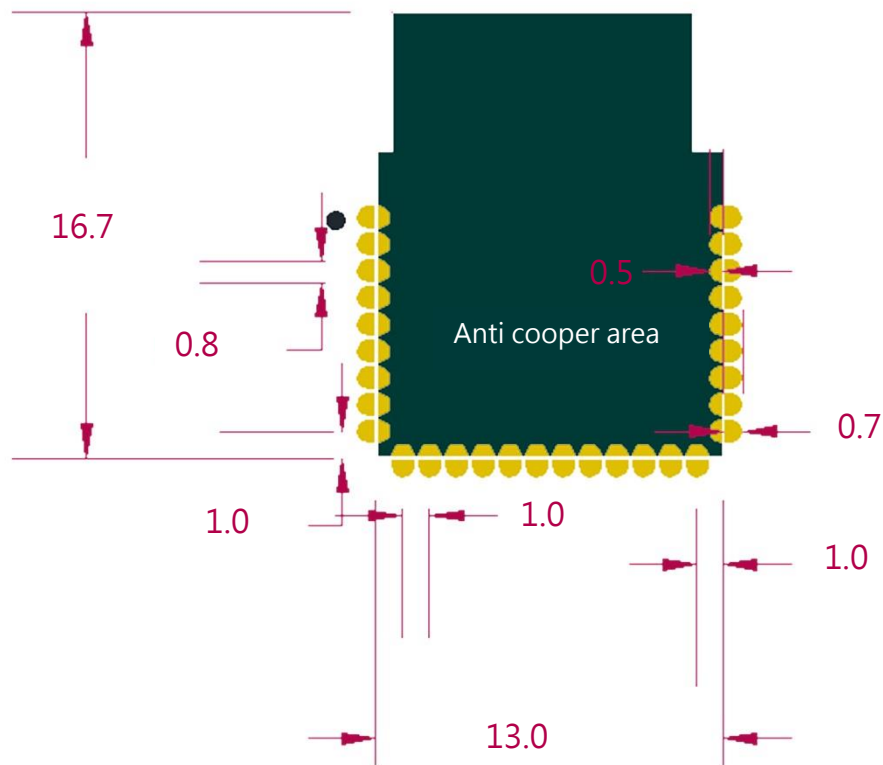
## DIMENSIONS



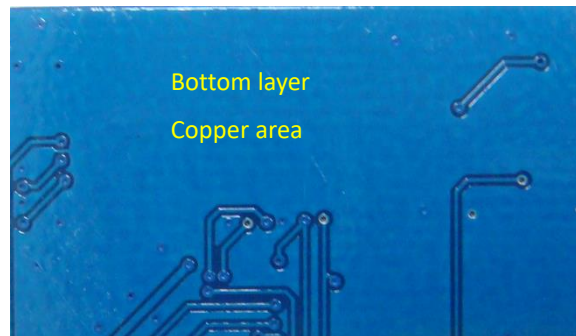
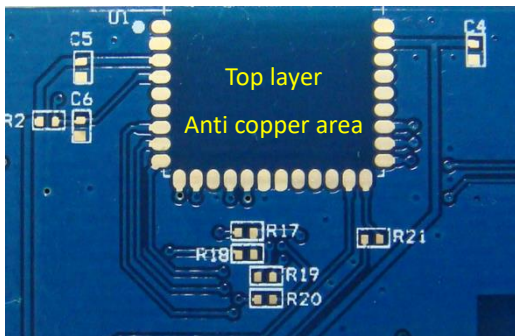
Unit : mm



## LAYOUT FOOTPRINT RECOMMENDATIONS



Unit : mm



## AT COMMAND

It is required to key in “**enter**” or “**\r\n**” in the end of all AT Commands.

Add “**?**” in the end of the commands to ask the current setting value.

1. **AT** to test if the module responds

| Syntax | Response |
|--------|----------|
| AT     | +OK      |

2. **Software RESET**

| Syntax   | Response |
|----------|----------|
| AT+RESET | +RESET!  |

3. **AT+NAME** to set the broadcast name

| Syntax   | Response                 |
|--|--------------------------|
| AT+NAME=<name><br><name> at most 20 ASCII characters<br><br>Example: set the broadcast name<br>as “REYAX_BLE_RYB070I”<br>AT+NAME= REYAX_BLE_RYB070I<br><br>* It will work after sending <i>AT+RESET</i> or<br>pressing RESET bottom. | +OK                      |
| AT+NAME?   | +NAME= REYAX_BLE_RYB070I |

4. **AT+ATTR** to set the device name

| Syntax  | Response                 |
|---|--------------------------|
| AT+ATTR=<attribute><br><attribute> at most 20 ASCII characters<br><br>Example: set the device name<br>as “REYAX_BLE_RYB070I”<br>AT+ATTR= REYAX_BLE_RYB070I<br><br>* It will work after sending <i>AT+RESET</i> or<br>pressing RESET bottom.<br><br>* Some iOS APP use this name to recognize<br>the Bluetooth device. | +OK                      |
| AT+ATTR?  | +ATTR= REYAX_BLE_RYB070I |

5. **AT+CRFOP** to set the RF output power

| Syntax   | Response |
|--|----------|
| AT+CRFOP= <power><br><power> range 1 to 3<br>1 : 0dBm (default)<br>2 : -6dBm<br>3 : -23dBm<br><br>Example: set the output power as -6dBm<br>AT+CRFOP=2 | +OK      |
| AT+CRFOP?  | +CRFOP=2 |

6. **AT+CFUN** to set the BLE broadcast (Advertising) ON/OFF

| Syntax   | Response |
|--|----------|
| AT+CFUN= <Advertising><br><Advertising> is the switch of BLE broadcast<br>0 : BLE broadcast off<br>1 : BLE broadcast on (default)<br><br>Example: set the BLE broadcast off<br>AT+CFUN=0 | +OK      |
| AT+CFUN?   | +CFUN=0  |

7. **AT+CNE** to set the BLE can be connected or not

| Syntax   | Response |
|--|----------|
| AT+CNE= <Connect><br><Connect> set the BLE can be connected or not<br>0 : Reject other Bluetooth devices connecting.<br>1 : Accept other Bluetooth devices connecting (default)<br><br>Example : Reject other Bluetooth devices connecting<br>AT+CNE=0 | +RESET!  |
| AT+CNE=0   | +RESET!  |

8. **AT+PWMODE** to set the power mode

| Syntax   | Response   |
|--|------------|
| <p>AT+PWMODE=&lt;mode&gt;<br/>                     &lt;mode&gt; is the power saving mode<br/>                     1 : Power Saving Mode 1 (default)<br/>                     2 : Power Saving Mode 2<br/>                     3 : Power Saving Mode 3<br/>                     4 : Power Saving Mode 4 (Only in Peripheral mode)</p> <p>Example: use Power Saving Mode 3<br/>                     AT+PWMODE=3</p>  | +OK        |
| AT+PWMODE?   | + PWMODE=3 |
| <p>Users could set the cycle time to switch the BLE broadcast ON/OFF in Power Saving Mode 4.<br/>                     AT+PWMODE=4&lt;,time of BLE broadcast ON&gt;,&lt;time of BLE broadcast OFF&gt;<br/>                     (Unit of time: Second)</p> <p>The second must be three-digit number.<br/>                     The minimum is 1 second, the maximum is 600 seconds. (001~600)</p> <p>Example: Setting the BLE broadcast cycle time as ON for 3 seconds and OFF for 5 seconds.<br/>                     AT+PWMODE=4,003,005</p> <p>If users don't set the parameter of time, the default is:<br/>                     ON for 5 seconds and OFF for 10 seconds.</p> |            |

9. **AT+CONNECT?** to inquire the connection status

| Syntax      | Response  |
|-------------|---|
| AT+CONNECT? | +CONNECT=0 (unconnected)<br>+CONNECT=1 (connecting) |

10. AT+IPR to set the UART baud rate

| Syntax   | Response |
|--|----------|
| <p>AT+IPR=&lt;rate&gt;</p> <p>&lt;rate&gt; is the UART baud rate</p> <p>4 : 9600 (default)</p> <p>5 : 19200</p> <p>6 : 38400</p> <p>7 : 57600</p> <p>Example: set the baud rate as 57600, it will memorize the setting and reset the module.</p> <p>AT+IPR=7</p> | +OK      |
| AT+IPR?  | +IPR=7   |

11. AT+ADDR to inquire MAC address

| Syntax   | Response           |
|----------|--------------------|
| AT+ADDR? | +ADDR=123456ABCDEF |

12. AT+ENTER to set if needed to key in ENTER(0x0D 0x0A) in the end of the commands

| Syntax   | Response |
|--|----------|
| <p>AT+ENTER=&lt;state&gt;</p> <p>&lt;state&gt; is whether needed to key in ENTER(0x0D 0x0A) in the end of the commands.</p> <p>0 : no need</p> <p>1 : needed (default)</p> <p>Example: setting there's no need to key in ENTER(0x0D 0x0A) in the end of the commands, it will memorize the setting and reset the module.</p> <p>AT+ENTER=0</p> | +OK      |
| AT+ENTER?  | +ENTER=0 |

13. **AT+AUE** to set if the module follows the Connection Parameter Update Request automatically

| Syntax  | Response |
|---|----------|
| <p><b>AT+AUE =&lt;0/1&gt;</b><br/>                     &lt;0/1&gt; is the switch of this function<br/>                     0 : Not to follow automatically (default)<br/>                     1 : Following automatically</p> <p>Example: Setting the module not to follow the Connection Parameter Update Request automatically, it will memorize the setting and reset the module.</p> <p><b>AT+AUE=0</b></p> <p><b>* Setting the module follow the Connection Parameter Update Request may cause the BLE connection unstable in iOS.</b></p> | +OK      |
| AT+AUE?   | +AUE=0   |

14. **AT+CGMS?** to inquire the firmware version

| Syntax   | Response               |
|----------|------------------------|
| AT+CGMS? | +CGMS=RYB070I_56312E34 |

15. **AT+ROLE** to set the role as Peripheral or Central

| Syntax  | Response |
|---|----------|
| <p><b>AT+ROLE= &lt;role&gt;</b><br/>                     &lt;role&gt; is Peripheral or Central<br/>                     0 : Peripheral (default)<br/>                     1 : Central</p> <p>Example: set the role as Central, it will memorize the setting and reset the module.</p> <p><b>AT+ROLE=1</b></p> | +OK      |
| AT+ROLE?  | +ROLE=1  |

16. AT+SCAN to scan the Peripherals near by the Central

| Syntax  | Response   |
|---------|--|
| AT+SCAN | <p>+ &lt;MAC&gt;, &lt;rssi&gt;<br/>                     +Found &lt;Quantity&gt;<br/>                     + &lt;NO.&gt;:&lt;MAC&gt;</p> <p>&lt;MAC&gt; MAC address<br/>                     &lt;rssi&gt; output power of Peripherals: -xxdBm<br/>                     &lt;Quantity&gt; quantity of found Peripherals;<br/>                     the maximum is 8.<br/>                     &lt;NO.&gt; item number of Peripherals: 1~8</p> <p>+123456ABCDEF,-79dBm<br/>                     +1237F3AB54CA,-60dBm<br/>                     +Found 2<br/>                     +1:123456ABCDEF<br/>                     +2:1237F3AB54CA</p> |

17. AT+CON The Central connect to a Peripheral by MAC address

| Syntax   | Response   |
|--|------------|
| <p>AT+CON=&lt;MAC&gt;<br/>                     &lt;MAC&gt; MAC address</p> <p>Example: the Central connect to the Peripheral<br/>                     whose MAC address is 123456ABCDEF<br/>                     AT+CON=123456ABCDEF</p> | +Connected |

18. AT+CONT The Central connect to a Peripheral by the item number from AT+SCAN

| Syntax  | Response   |
|---|------------|
| <p>AT+CONT=&lt;NO.&gt;<br/>                     &lt;NO.&gt; the item number of the Peripherals: 1~8</p> <p>Example: the Central connect to the Peripheral<br/>                     whose item number is 2 from AT+SCAN<br/>                     AT+CONT=2</p> | +Connected |

19. AT+DISCON to disconnect the Peripheral from the Central

| Syntax    | Response      |
|-----------|---------------|
| AT+DISCON | +Disconnected |

20. Other response messages

| Syntax                        | Response                      |
|-------------------------------|-------------------------------|
| After RESET                   | +READY<br>+ENTER=1<br>+ROLE=0 |
| The data has been transmitted | +>>>>                         |
| BLE is connecting             | ++++++                        |
| BLE is unconnected            | +-----                        |

*\* Our Company is not responsible for any technical malfunction or other problems if users modify the module by themselves.*



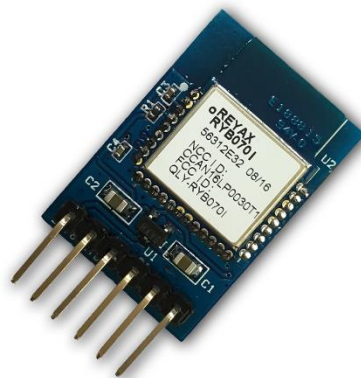
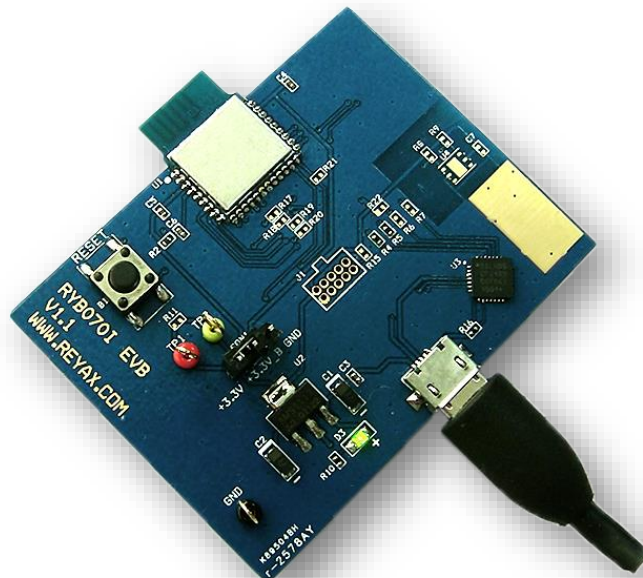
## TRANSMISSION DATA SIZE

[1] The maximum transmission data size from RYB0701 to smartphones APP is as follows:

- When **AT+ENTER=1 (default)**, it is needed to add `0x0D 0x0A` (2 bytes) in the end of each data, so the maximum data size is 18 bytes each time.
- When setting **AT+ENTER=0**, it is no need to add `0x0D 0x0A` (2 bytes) in the end of each data, so the maximum data size is 20 bytes each time.

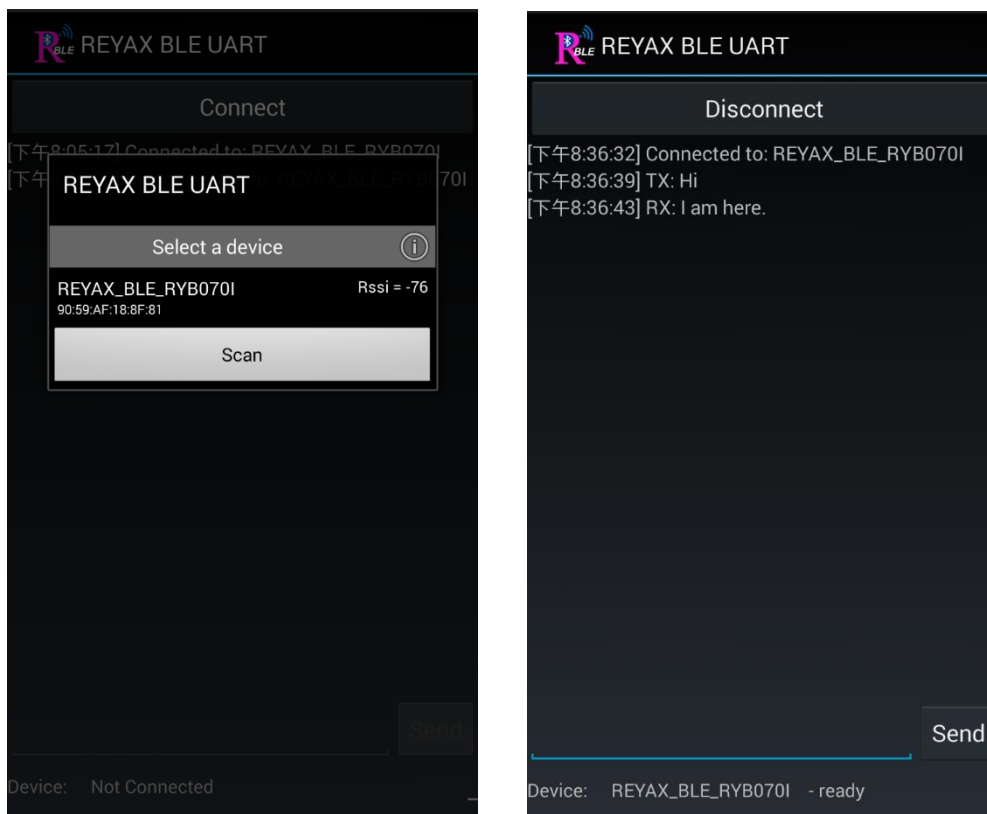
[2] The maximum transmission data size from smartphone APP to RYB0701 is 20 bytes each time.

## EVALUATION KIT FOR RYB0701

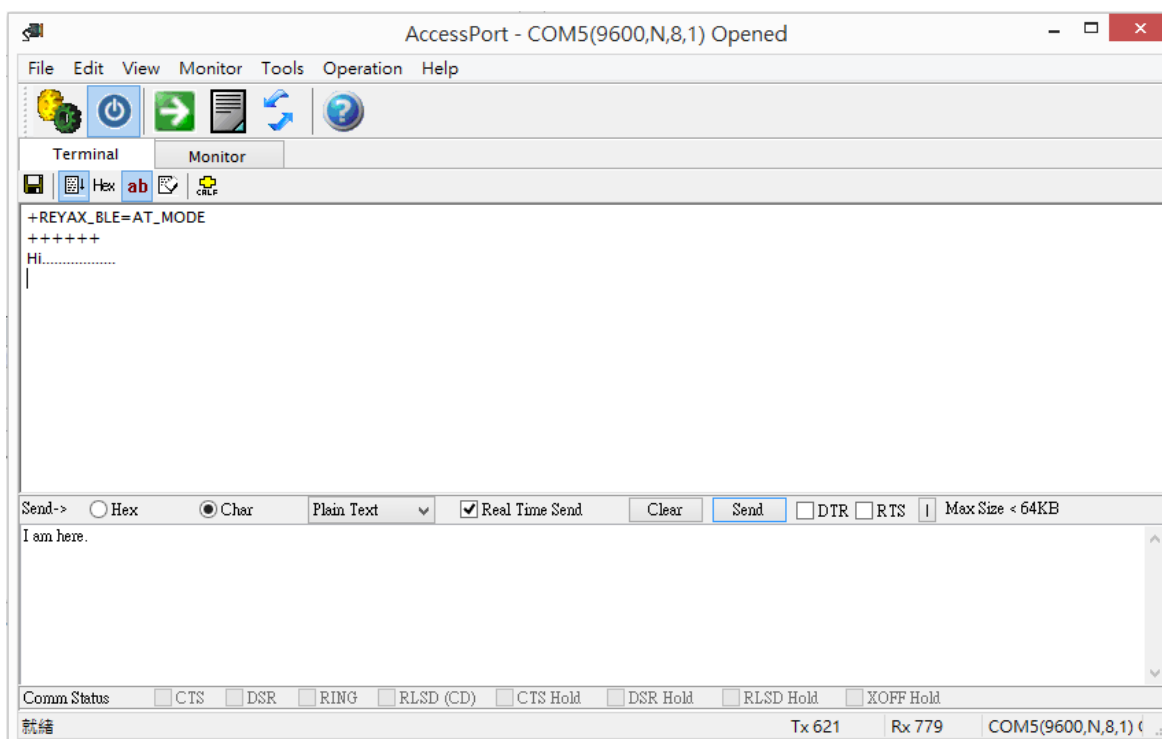


## APPLICATION TEST

Open the smartphone APP and connect to REYAX\_BLE\_RYB070I, send data string (Ex. "Hi") to the Hyper-terminal on PC, and then sent from the PC Hyper-terminal to smartphone APP (Ex. "I am here.")

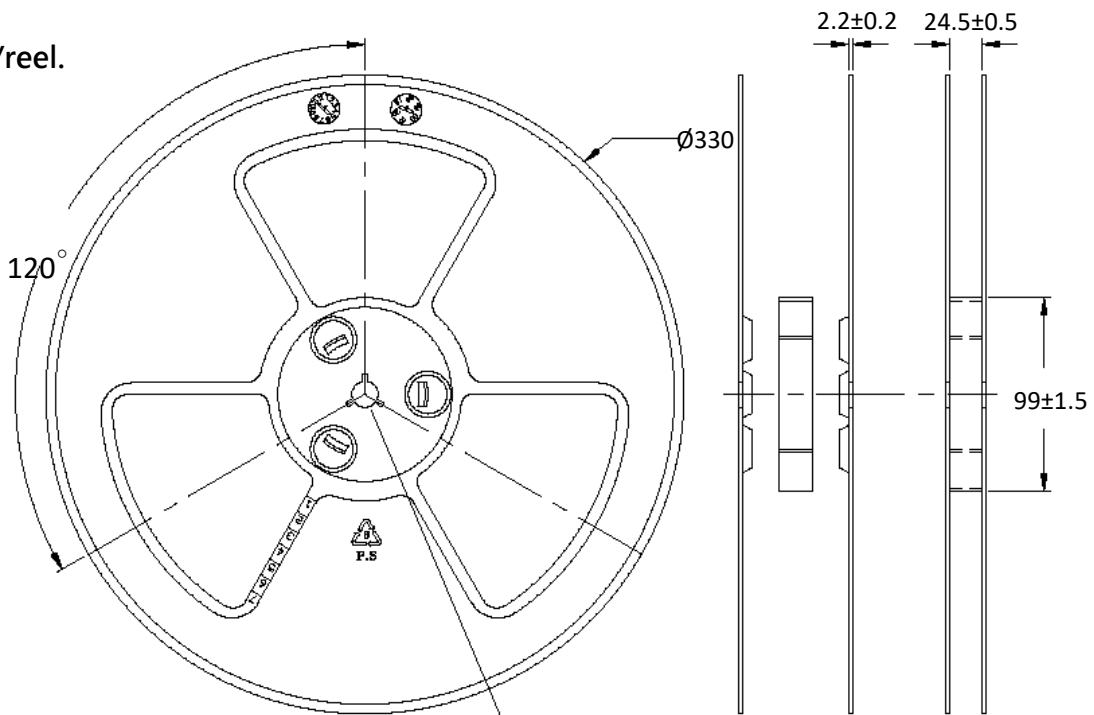


The free Hyper-terminal software for Windows, *Access Port*, please download by the following link.  
<http://www.sudt.com/en/ap/>



## PACKING INFORMATION

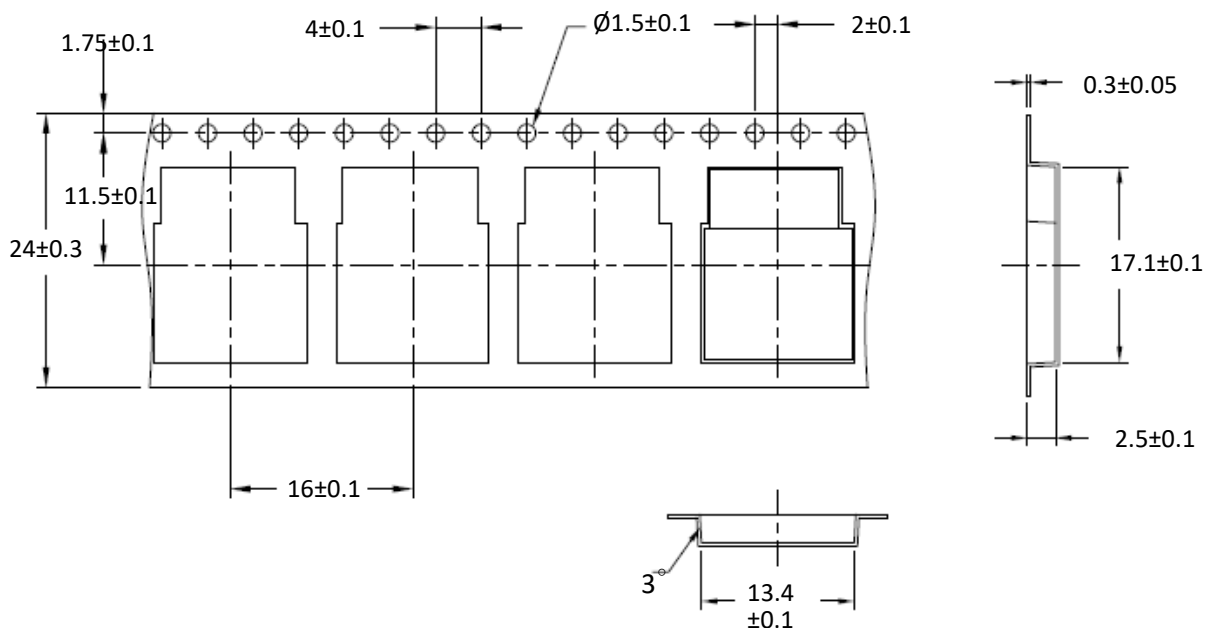
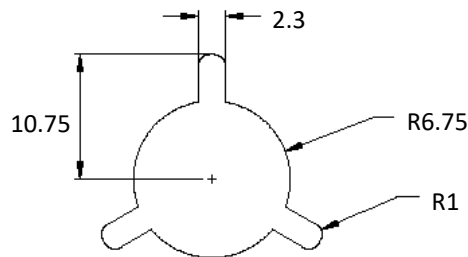
500pcs/reel.



Item : 13" × 4" REEL

Material : P.S

Unit : (mm)



## CERTIFICATIONS

### Taiwan NCC Statement 低功率電波輻射性電機管理辦法:

第十二條 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。



### FCC Statement:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX FCC ID : QLY-RYB070I ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.



**IC Statement:**

This device complies with Industry Canada license-exempt RSS standard(s).

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le present appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.



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**Website:** <http://reyax.com>