

PRODUCT SPECIFICATION

6223B-UUD

Wi-Fi Single-band 1x1 + Bluetooth 4.2

Combo Module

Version:v1.8



6223B-UUD Module Datasheet

| Ordering Information | Part NO. | Description |
|----------------------|---------------|---|
| | FG6223BUUD-00 | RTL8723DU, 802.11b/g/n Wi-Fi 1T1R, BLE4.2, 15X13mm, USB, Dual ANT |

Customer: _____

Customer P/N: _____

Signature: _____

Date: _____

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Revision History

| Version | Date | Contents of Revision Change | Draft | Checked | Approved |
|---------|------------|---|-------|---------|----------|
| V1.0 | 2019/07/04 | Initial release | Lsp | Lsp | Stone |
| V1.1 | 2019/09/12 | Refine section 1. | Lsp | Lsp | Stone |
| V1.2 | 2019/09/18 | Add power consumption; Refine section 2. | Lsp | Lsp | Stone |
| V1.3 | 2020/04/29 | Add thermal pad. Refine section 4, 5, 9 and 11. | Lsp | Lsp | Stone |
| V1.4 | 2020/11/09 | Add module photo; correct package info. | Lsp | Lsp | Stone |
| V1.5 | 2020/11/20 | Refine section 9. | Lsp | Lsp | Stone |
| V1.6 | 2021/10/08 | Refine thermal pad dimension due to DFM requirement. | Lsp | Lsp | Qjp |
| V1.7 | 2022/02/07 | 1.Update the specification format 2.Add power up/down timing requirment 3.change RF power tolerance to ± 2 dbm 4.Update power supply DC Characteristics and power consumption | fc | LXY | QJP |
| V1.8 | 2022/03/07 | Add ID setting information | fc | Lsp | QJP |
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1. General Description

1.1 Introduction

The 6223B-UUD is a low-cost and low-power consumption module which has all of the Wi-Fi and Bluetooth functionalities. The module is based on Realtek RTL8723DU chipset that highly integrated single-chip 802.11b/g/n 1T1R WLAN, and an integrated Bluetooth 2.1/4.2 single chip with USB 2.0 multi-function. The wireless module complies with IEEE 802.11 b/g/n 1x1 standard and it can achieve up to a speed of 150Mbps to connect the wireless LAN. The integrated module provides USB interface for Wi-Fi and Bluetooth.

This compact module is a total solution for a combination of Wi-Fi and Bluetooth V4.2 technologies.

1.2 Description

| | |
|-----------------------|--|
| Model Name | 6223B-UUD |
| Product Description | Support Wi-Fi/Bluetooth functionalities |
| Dimension | L x W x H: 15 x 13 x 2.3 (typical) mm |
| Wi-Fi Interface | Support USB |
| BT Interface | USB |
| OS supported | Android /Linux/ Win CE /iOS /XP/WIN7/WIN10 |
| Operating temperature | 0°C to 70°C |
| Storage temperature | -55°C to 125°C |

2. Features

General

- Complete 802.11n solution for 2.4GHz band
- 20MHz and 40MHz bandwidth transmission
- DSSS with DPSK and DQPSK, CCK modulation with long and short preamble
- Supports multiple Low Energy states

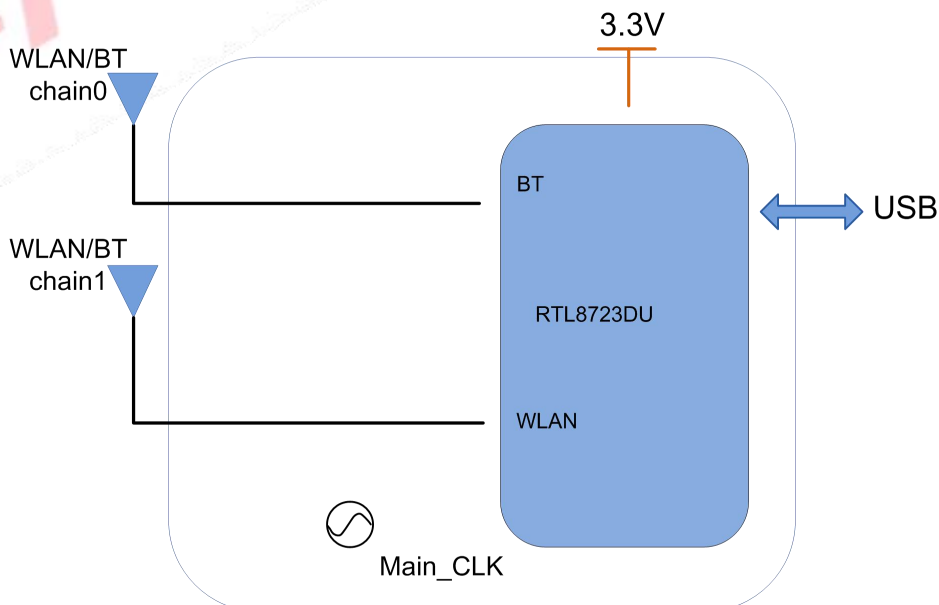
PHY Features

- Compatible with IEEE 802.11b standard to provide wireless 11Mbps data rate
- Compatible with IEEE 802.11g standard to provide wireless 54Mbps data rate
- Compatible with IEEE 802.11n standard to provide wireless 150Mbps data rate
- CMOS MAC, Baseband PHY, and RF in a single chip for IEEE 802.11b/g/n compatible WLAN

Bluetooth Features

- Compatible with Bluetooth v2.1, V4.2 Systems
- Supports Bluetooth 4.0 Low Energy (BLE)
- Bluetooth 4.0 Dual Mode support: Simultaneous LE and BR/EDR
- Complies with USB2.0 for WLAN and BT controller

3. Block Diagram



4. General Specification

4.1 WI-FI Specification

| Feature | Description | | |
|---|---|---------------|-------------|
| WLAN Standard | IEEE 802.11 b/g/n Wi-Fi compliant | | |
| Frequency Range | 2.400 GHz ~ 2.4835 GHz (2.4 GHz ISM Band) | | |
| Number of Channels | 2.4GHz: Ch1 ~ Ch14 | | |
| Test Items | Typical Value | | EVM |
| Output Power | 802.11b /11Mbps : 17dBm ± 2 dB | | EVM ≤ -10dB |
| | 802.11g /54Mbps : 15dBm ± 2 dB | | EVM ≤ -25dB |
| | 802.11n /MCS7 : 14dBm ± 2 dB | | EVM ≤ -28dB |
| Spectrum Mask | Meet with IEEE standard | | |
| Freq. Tolerance | ± 20ppm | | |
| Receive Sensitivity (11b,20MHz) @8% PER | - 1Mbps | PER @ -92 dBm | ≤-83 |
| | - 11Mbps | PER @ -83 dBm | ≤-76 |
| Receive Sensitivity (11g,20MHz) @10% PER | - 6Mbps | PER @ -88 dBm | ≤-85 |
| | - 54Mbps | PER @ -71 dBm | ≤-68 |
| Receive Sensitivity (11n,20MHz) @10% PER | - MCS=0 | PER @ -87 dBm | ≤-85 |
| | - MCS=7 | PER @ -68 dBm | ≤-67 |
| Receive Sensitivity (11n,40MHz) @10% PER | - MCS=0, | PER @ -84 dBm | ≤-82 |
| | - MCS=7, | PER @ -66 dBm | ≤-64 |
| Antenna | External antenna | | |

4.2 Bluetooth Specification

| Feature | Description |
|------------------------------|----------------------|
| General Specification | |
| Bluetooth Standard | Bluetooth V4.2, V2.1 |
| Host Interface | USB |

| | | | |
|---|--|---------------------|-----------------|
| Frequency Band | 2402 MHz ~ 2480 MHz | | |
| Number of Channels | 79 channels for BDR+EDR, 40 channels for BLE | | |
| Modulation | GFSK, $\pi/4$ -DQPSK, 8-DPSK | | |
| RF Specification | | | |
| | Min(dBm) | Typical(dBm) | Max(dBm) |
| Output Power (Class 1.5) | 3 | 6 | 9 |
| Output Power (Class 2) | | 2 | |
| Sensitivity @ BER=0.1% for GFSK (1Mbps) | | -86 | |
| Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps) | | -86 | |
| Sensitivity @ BER=0.01% for 8DPSK (3Mbps) | | -80 | |
| Sensitive @PER=30.8% FOR BLE | | -90 | |
| Maximum Input Level | GFSK (1Mbps):-20dBm | | |
| | $\pi/4$ -DQPSK (2Mbps) :-20dBm | | |
| | 8DPSK (3Mbps) :-20dBm | | |

5. ID setting information

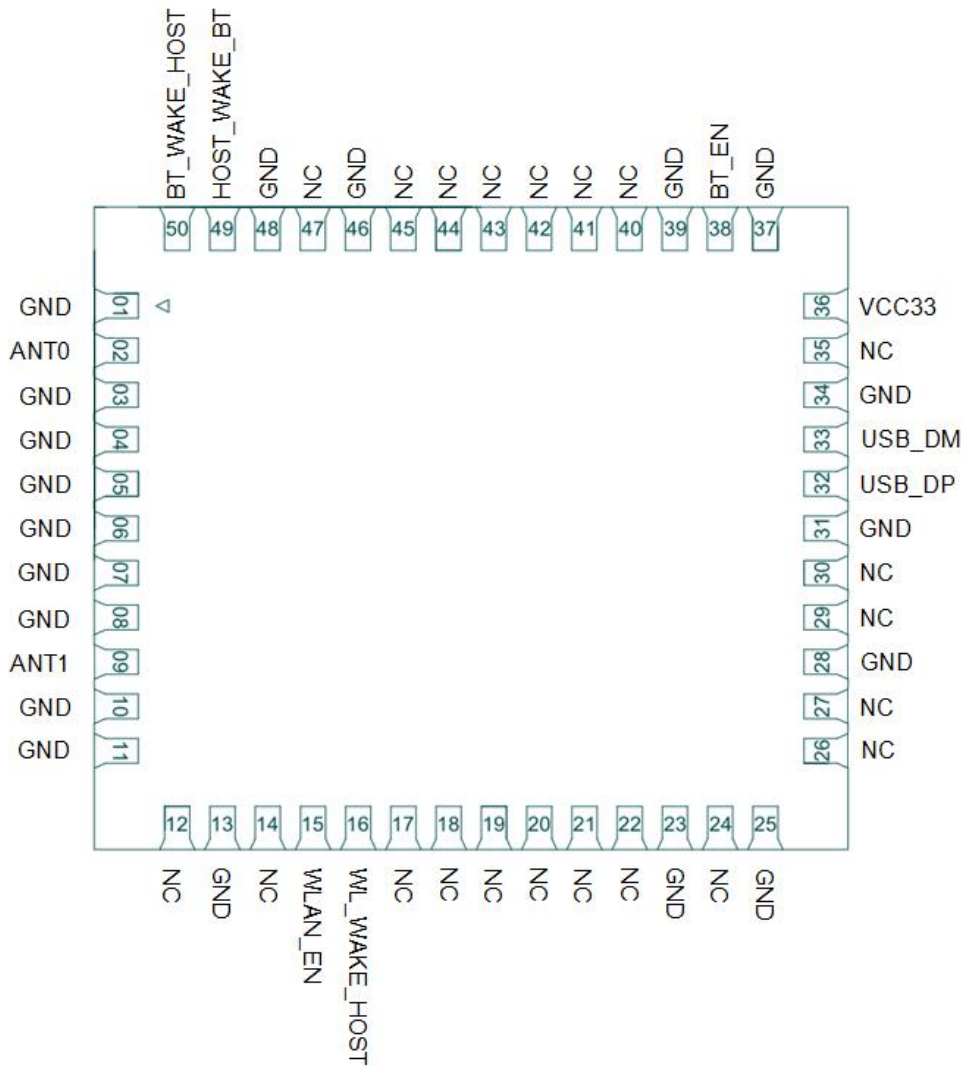
WI-FI

| | |
|------------|-------|
| Vendor ID | 0BDAh |
| Product ID | D723h |

6. Pin Definition

6.1 Pin Outline

< TOP VIEW >



6.2 Pin Definition details

| NO. | Name | Type | Description | Voltage |
|-----|------|------|----------------------------|---------|
| 1 | GND | — | Ground connections | |
| 2 | ANT0 | I/O | RF I/O port chain0, for BT | |
| 3~8 | GND | — | Ground connections | |

| | | | | |
|-------|--------------|-----|--|------|
| 9 | ANT1 | I/O | RF I/O port chain1, for Wi-Fi 2.4GHz | |
| 10~11 | GND | — | Ground connections | |
| 12 | NC | — | No connect | |
| 13 | GND | — | Ground connections | |
| 14 | NC | — | No connect | |
| 15 | WLAN_EN | I | Enable pin for WLAN device ON: pull high ; OFF: pull low (Internal 100Kohm pull-up to 3.3V) | 3.3V |
| 16 | WL_WAKE_HOST | O | WLAN to wake-up HOST (Internal 100Kohm pull-up to 3.3V) | 3.3V |
| 17~22 | NC | — | No connect | |
| 23 | GND | — | Ground connections | |
| 24 | NC | — | No connect | |
| 25 | GND | — | Ground connections | |
| 26~27 | NC | — | No connect | |
| 28 | GND | — | Ground connections | |
| 29~30 | NC | — | No connect | |
| 31 | GND | — | Ground connections | |
| 32 | USB_DP | I/O | USB2.0 differential pair D+ | |
| 33 | USB_DM | I/O | USB2.0 differential pair D- | |
| 34 | GND | — | Ground connections | |
| 35 | NC | — | No connect | |
| 36 | VCC33 | P | Main power input 3.3V | 3.3V |
| 37 | GND | — | Ground connections | |
| 38 | BT_EN | I | Enable pin for Bluetooth device ON: pull high ; OFF: pull low (Internal 100Kohm pull-up to 3.3V) | 3.3V |
| 39 | GND | — | Ground connections | |
| 40~45 | NC | — | No connect | |
| 46 | GND | — | Ground connections | |
| 47 | NC | I | No connect (IC GPIO8) | 3.3V |
| 48 | GND | — | Ground connections | |
| 49 | HOST_WAKE_BT | I | HOST wake-up Bluetooth device | 3.3V |
| 50 | BT_WAKE_HOST | O | Bluetooth device to wake-up HOST (SoC internally pull-down, avoid external pull-high) | 3.3V |

P:POWER I:INPUT O:OUTPUT

7. Electrical Specifications

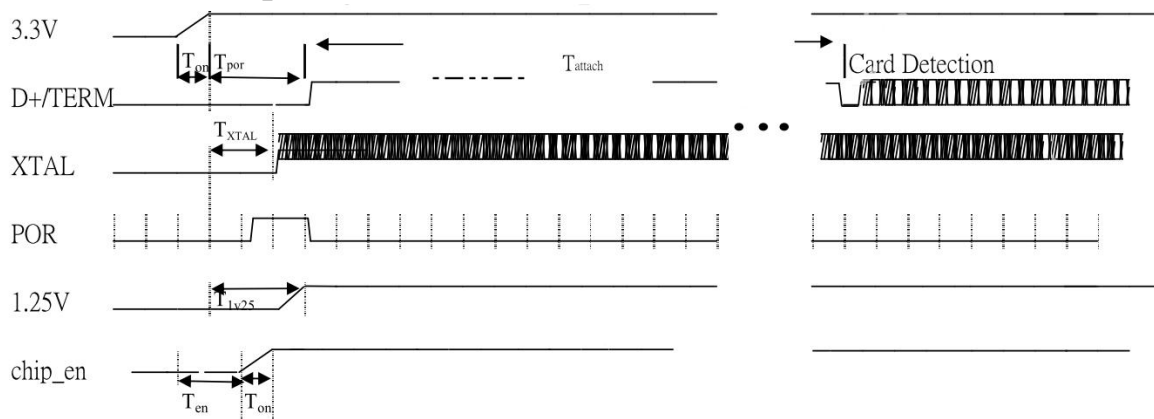
7.1 Power Supply DC Characteristics

| | MIN | TYP | MAX | Unit |
|-----------------------|------|------------|-----|-------|
| Operating Temperature | 0 | 25 | 70 | deg.C |
| VCC33 | 3.0 | 3.3 | 3.6 | V |
| VDDIO | 1.62 | 1.8 or 3.3 | 3.6 | V |

7.2 Power Consumption

| Test Item | Test Condition | MIN | TYP | MAX | Unit |
|-----------------------------------|-----------------------------------|-----|-----|-----|------|
| Current Consumption (VCC=3.3V) | Non-Associated | - | 78 | - | mA |
| | BT Associated Idle(WLAN off) | - | 50 | - | mA |
| | WLAN & BT Associated Idle | - | 75 | - | mA |
| | Rx Throughput (802.11b 11Mbps) | - | 113 | - | mA |
| | Rx Throughput (802.11g 54Mbps) | - | 94 | - | mA |
| | Tx Throughput (802.11b 11Mbps) | - | 227 | - | mA |
| | Tx Throughput (802.11g 54Mbps) | - | 198 | - | mA |

7.3 Power-on sequence



T_{on} : the main power ramp on duration

T_{por} : the power on reset releases and power management unit executes power on tasks

T_{attach} : USB attach state

$T_{k-state}$: the duration from resistor attached to USB host starting card detection procedure

The power on flow description:

After main 3.3V ramp up, the internal power on reset is released by power ready detection circuit and the power management unit will be enabled. The power management unit enables the internal regulator and clock circuits.

The power management unit also enables the USB circuits.

USB analog circuits attach resistors to indicate the insertion of the USB device.

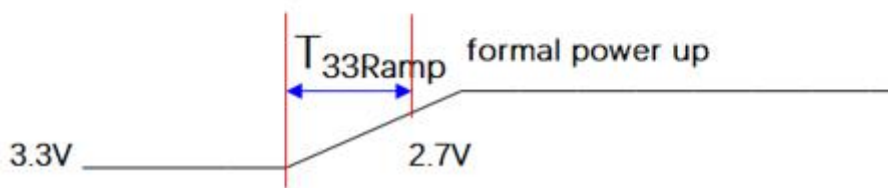
The typical timing range:

| | Unit | Min | Typical | Max |
|--------------|------|-----|---------|-----|
| T_{on} | ms | 0.2 | 1.5 | 5 |
| T_{por} | ms | -- | 2 | 10 |
| T_{xtal} | ms | -- | 1.5 | 8 |
| T_{attach} | ms | 100 | 250 | -- |
| T_{1v25} | ms | -- | 2 | 5 |
| T_{en} | ms | 0 | 0 | 5 |

7.4 Interface Circuit time series

7.4.1 module power-on&off time sequence

| | Min | Typical | Max | Unit |
|--------------------|-----|---------|-----|------|
| T33 power on ramp | 0.2 | 0.5 | 2.5 | ms |
| T33 power off ramp | 0.2 | 5 | 10 | ms |



Note:

1.上下电时序请满足表格要求；

The power up ramp and power down ramp must meet the following table.

2.上下电过程如有较长时间中间电压停留都会有几率导致 efuse 被窜写；

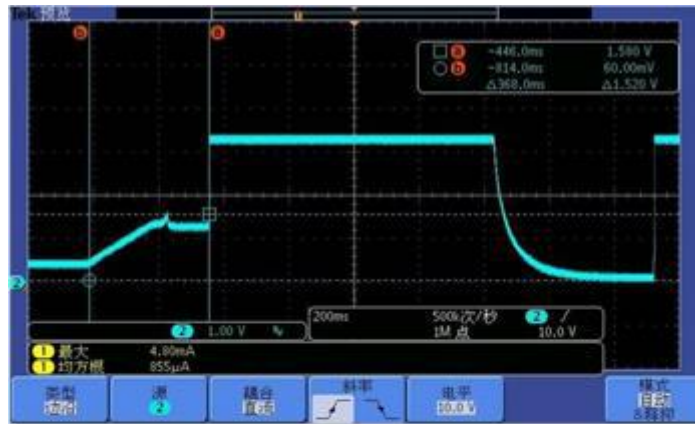
If climbing process for a long time during power-on and power-off , It may cause efuse to be overwritten.

3.建议主芯片上电完成后，再给模组上电；

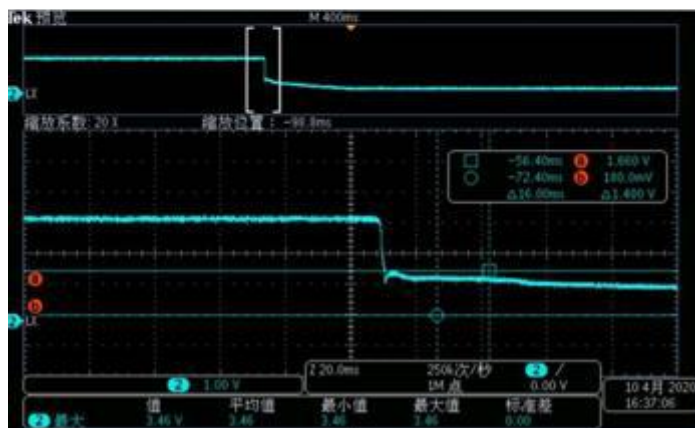
it is recommended to power on the module after platform side.

4.如有下图所示异常上下电时序，务必做相应调整符合时序规格；

If power on/off timing as below shown, must modify to meet the timing specification.

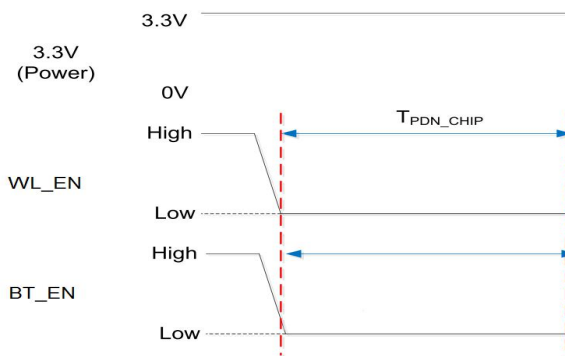


异常上电时序



异常下电时序

7.4.2 Power Off by WL_EN and BT_EN sequence

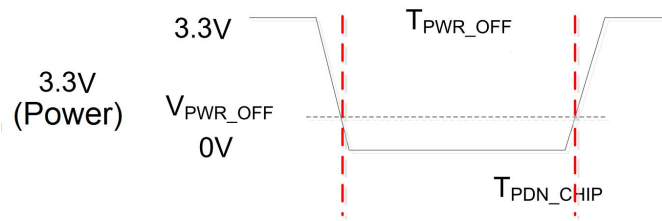


Power off by WL_EN and BT_EN timing parameters:

| | Min | Typical | Max | Unit | Description |
|-----------------------|-----|---------|-----|------|--------------------------------|
| T _{PDN_CHIP} | 100 | 200 | -- | ms | WL_EN, BT_EN keep low duration |

WL_EN and BT_EN can externally shutdown the chipset when both WL_EN and BT_EN are pulled low. The keeping low duration must be more than T_{PDN_CHIP}.

7.4.3 Power Off by 3.3V power sequence



Power off by WL_EN and BT_EN timing parameters:

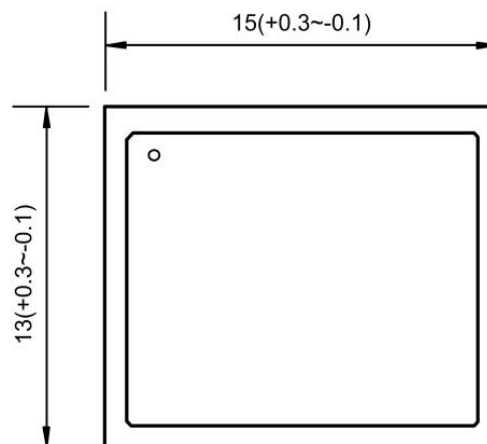
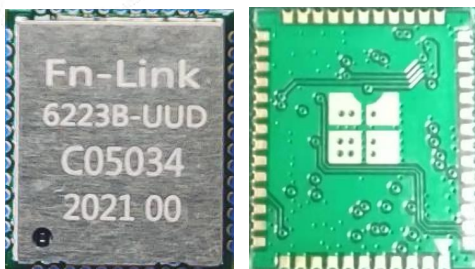
| | Min | Typical | Max | Unit | Description |
|----------------------|-----|---------|-----|------|------------------------|
| T _{PWR_OFF} | 100 | 200 | -- | ms | 3.3V power off time |
| V _{PWR_OFF} | -- | -- | 0.7 | V | 3.3V power off voltage |

When 3.3V power off and on afterward, the voltage of 3.3V power must keep lower than V_{PWR_OFF}, and the 3.3V power keeping off duration must be more than T_{PWR_OFF}.

8. Size reference

8.1 Module Picture

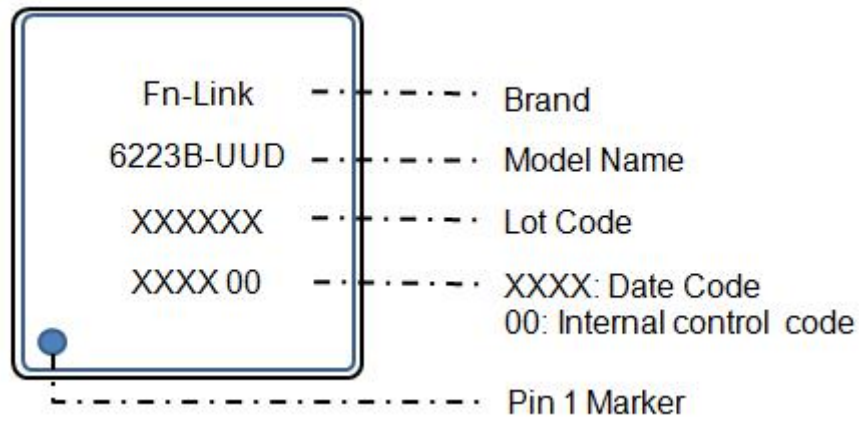
L x W : 15 x 13 (+0.3/-0.1) mm



| | |
|-------------------------|-------|
| H: 2.3 (± 0.2) mm | |
| Weight | 0.85g |

8.2 Marking Description

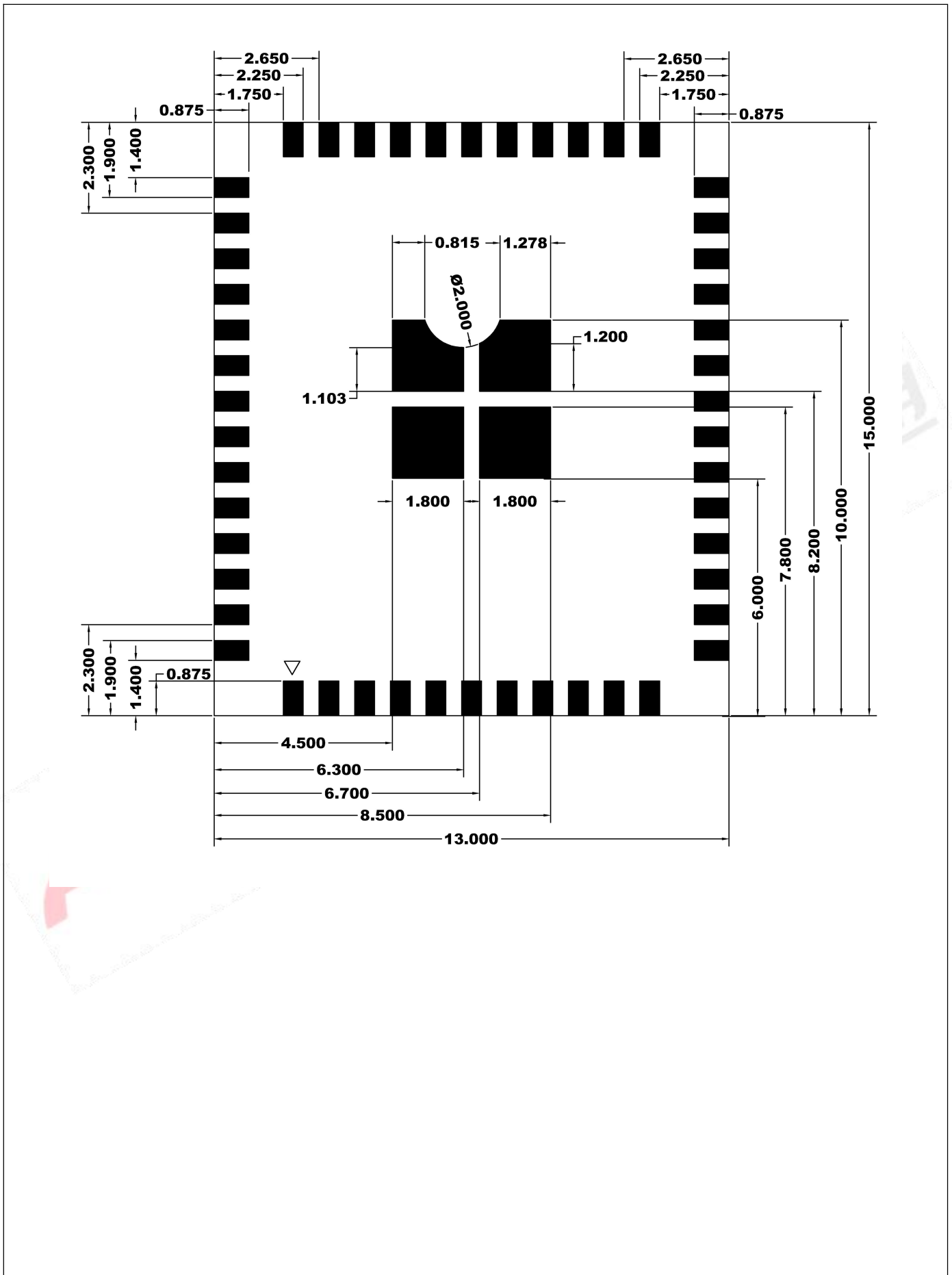
< TOP VIEW >



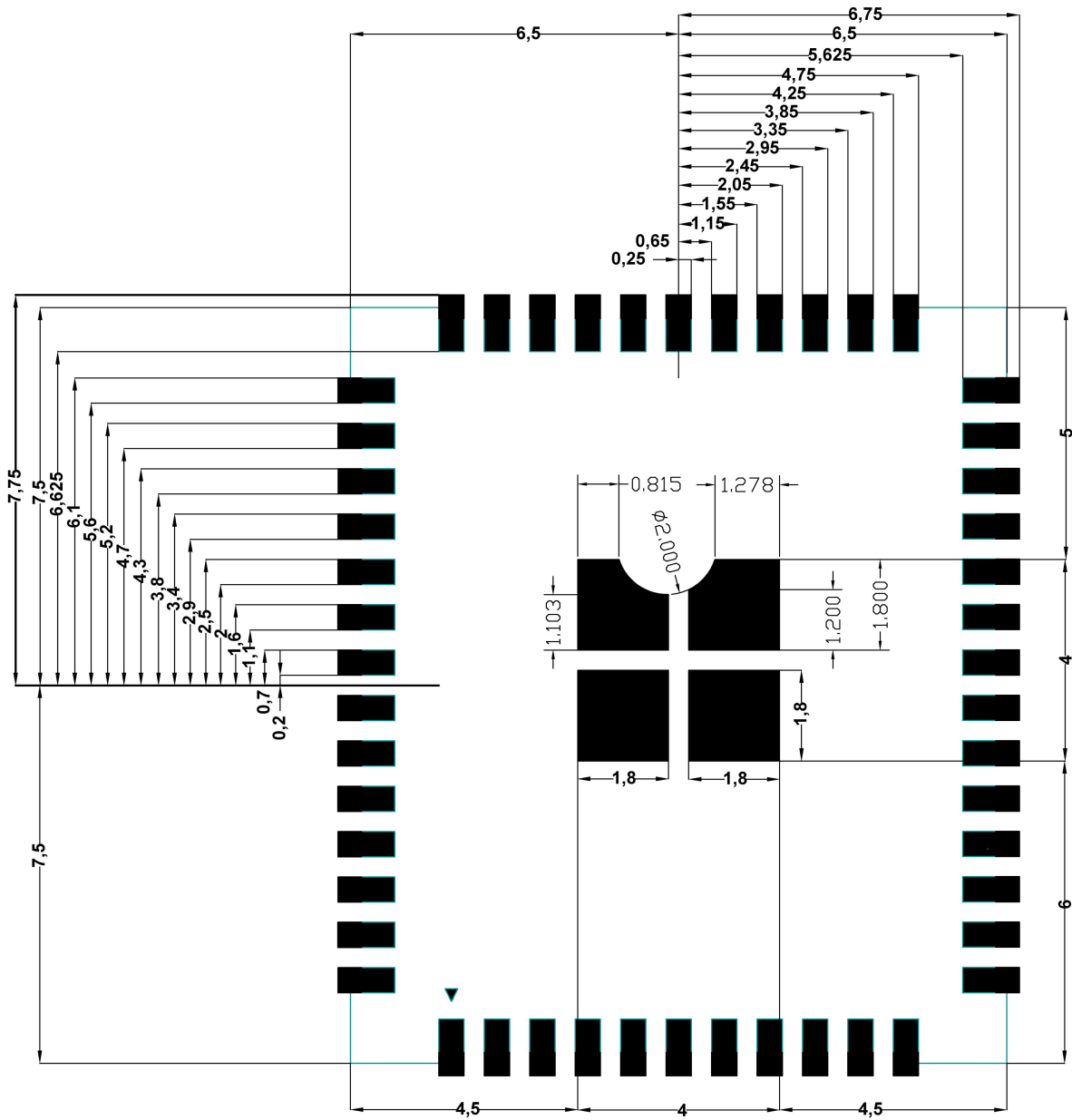
Note: Internal control code 00 for dual-ant version.

8.3 Physical Dimensions

<TOP View>



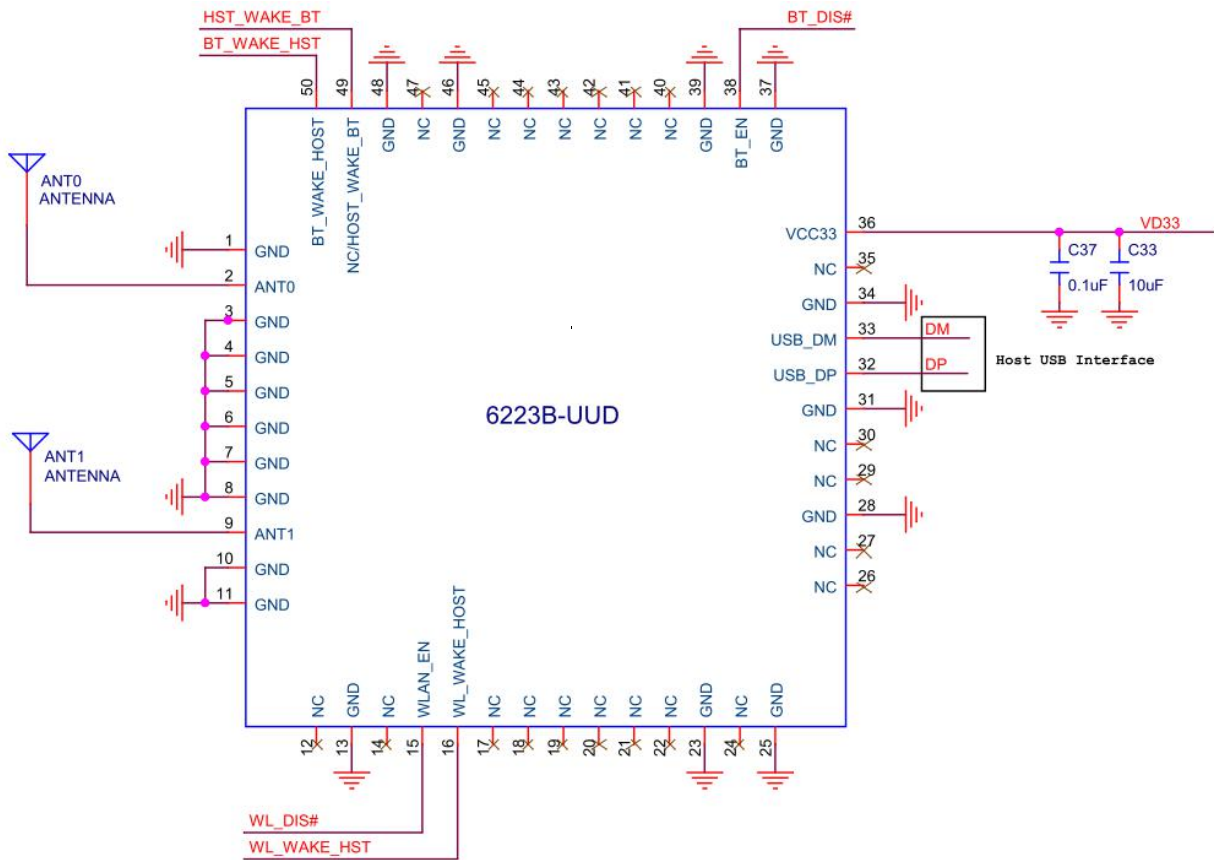
8.4 Layout Recommendation



9. The Key Material List

| Item | Part Name | Description | Manufacturer |
|------|----------------|------------------------|------------------------------|
| 1 | Chipset | RTL8723DU-CG (Realtek) | Realtek |
| 2 | Crystal | 2520, 40MHz, 10ppm | ECEC, TKD, Hosonic, JWT, TXC |
| 3 | Power Inductor | 0603, 2.2uH, 20% | Kenker, Sunlord, Ceaiya |
| 4 | PCB | FR4, 4 Layer, Green | XY-PCB, GDKX, Sunlord, SLPCB |

10. Reference Design

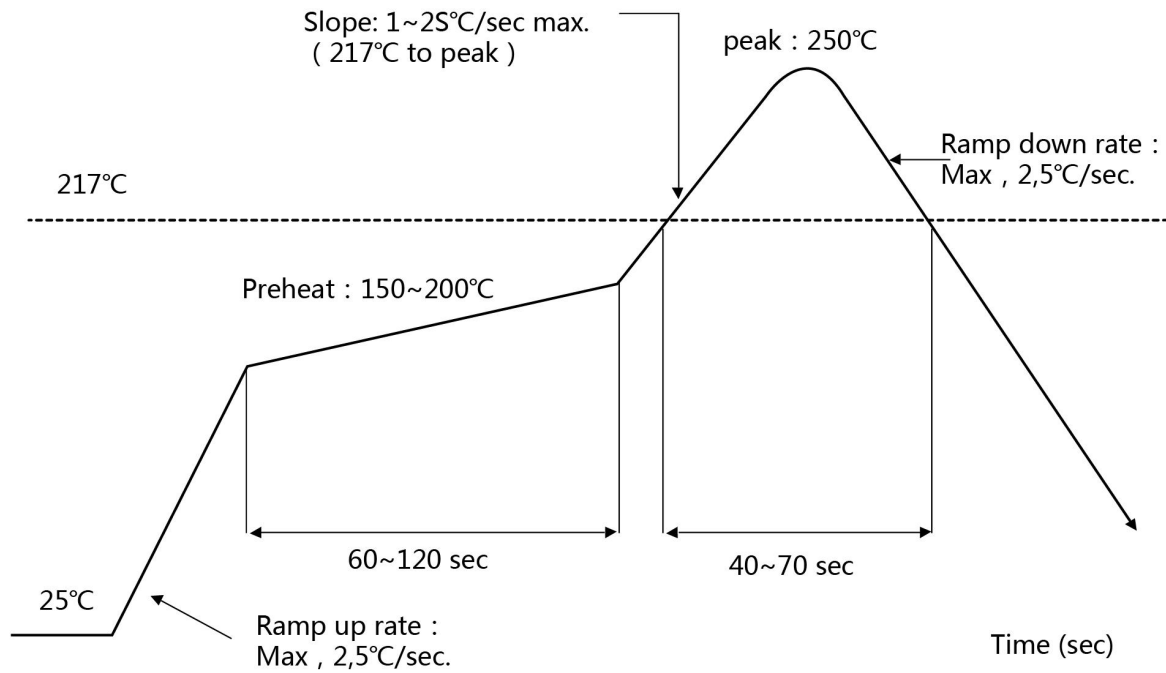


11. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times



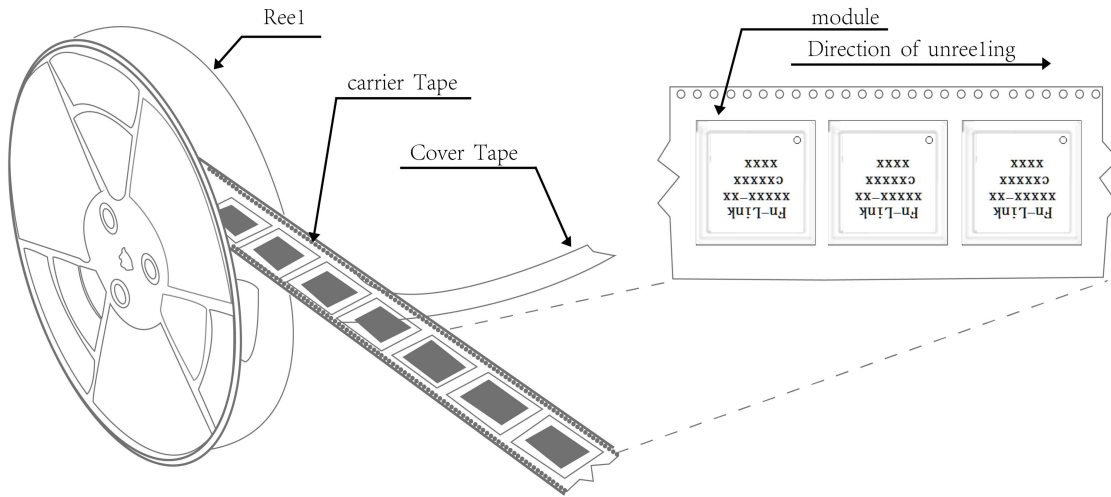
12. RoHS compliance

All hardware components are fully compliant with EU RoHS directive

13. Package

13.1 Reel

A roll of 1500pcs



13.2 Packaging Detail

the take-up package



Using self-adhesive tape

Size of black tape: 24mm*24.4m. The cover tape: 21.3mm*24.4m

Color of plastic disc: blue



NY bag size:450x415mm



Internal box size: 350x350x35mm



Carton size: 370x360x210mm

14. Moisture sensitivity

The Modules is a Moisture Sensitive Device level 3, in according with standard IPC/JEDEC J-STD-020, take care

all the relatives requirements for using this kind of components.

Moreover, the customer has to take care of the following conditions:

- a) Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH)
- b) Environmental condition during the production: 30°C / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5
- c) The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition
- b) "IPC/JEDEC J-STD-033A paragraph 5.2" is respected
- d) Baking is required if conditions b) or c) are not respected
- e) Baking is required if the humidity indicator inside the bag indicates 10% RH or more