



GlobalTop Technology Inc.

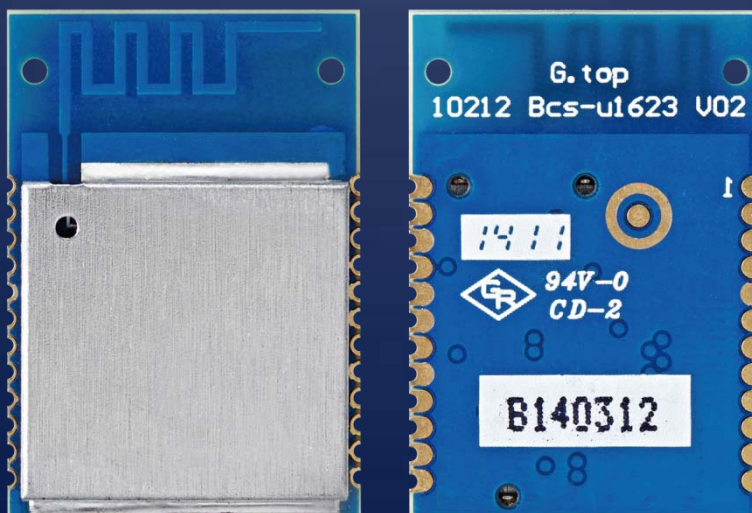
Orchid-1

BLE Module

Datasheet (Tape Reel)

Part Number: Bcs-u1623

Revision: V0F



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Version History

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| V0E | 2014/05/14 | Yingjie | Add 2.8 Operating conditions(UART) Modify TX,RX current Modify Power supply |
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1. Functional Description

1.1 Overview

Orchid-1 is a GlobalTop Bluetooth™ low energy module, which utilizes CSR1010 –the CSR new generation Bluetooth™ low energy chipset built with μEnergy platform, is designed specifically for the rapid development of cost-effective Bluetooth™ low energy applications. It enables ultra low power connectivity and basic data transfer for applications previously limited by the power consumption, size constraints and complexity of other wireless standards.

Orchid-1 provides everything required to create a Bluetooth™ low energy product with RF communication, baseband, MCU, Memory, qualified Bluetooth™ v4.0 stack and customer application running on a single mode module.

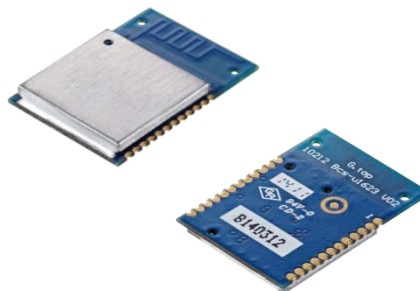
Due to its small size, outstanding performance at low power consumption and easy modular handling, Orchid-1 is leading the way for the new generation of Bluetooth™ low energy (BLE) modules.

Application

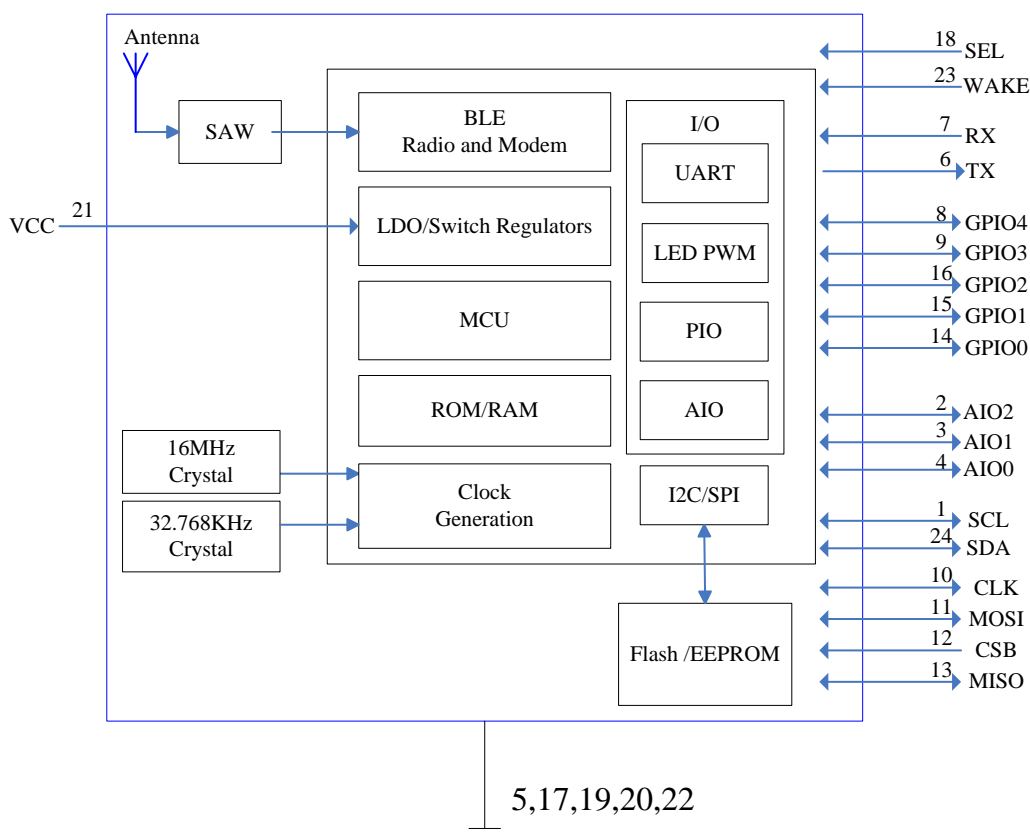
- ◆ Automotive
- ◆ Watches
- ◆ Healthcare
- ◆ Commercial
- ◆ Sports and fitness
- ◆ Asset management
- ◆ Home entertainment
- ◆ Human interface devices
- ◆ Office and mobile accessories

Highlights and Features

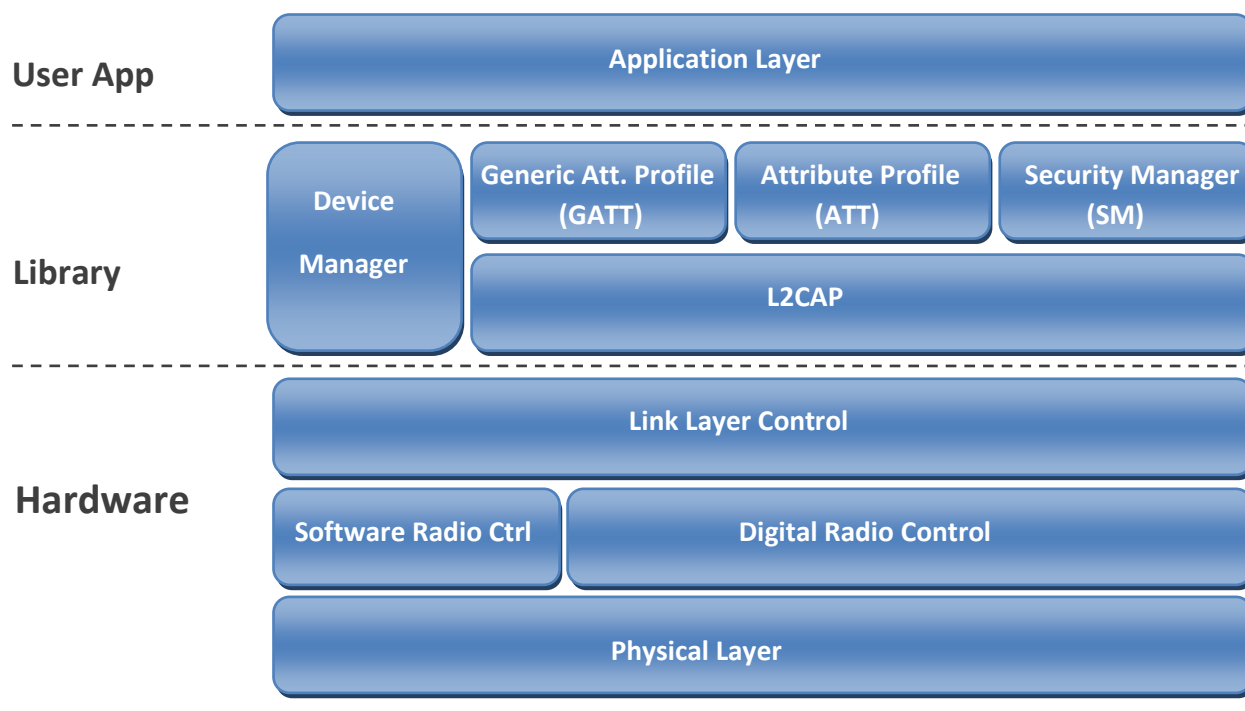
- ◆ Bluetooth v 4.0 Single-mode
 - ✧ Support master and slave modes
 - ✧ PCB-Print antenna
- ◆ Bluetooth Smart Profile Stack
 - ✧ Host stack including ATT, GATT, SMP, L2CAP, GAP
 - ✧ AES-128 Encryption Engine
- ◆ G.top Customization
 - ✧ SPP (Serial Port Profile)
 - ✧ Security
 - ✧ Lighting
 - ✧ Beacon with iBeacon Technology
- ◆ Radio Freq. Performance
 - ✧ Transmit power: 7.5dBm
 - ✧ Receiver sensitivity: -92.5dBm
 - ✧ RF Data rate: 1Mbps. GFSK Mod.
- ◆ Peripheral Interfaces
 - ✧ UART / SPI / I2C / GPIO
- ◆ Power Consumption
 - ✧ Transmit / Receive
20mA@Peak Current (Typ.)
 - ✧ Deep Sleep: 5uA (Typ.)
- ◆ Dimension
 - ✧ 16 x 23 x 2.3 mm
- ◆ Working Temperature
 - ✧ -20°C to +75°C



1.2 System Block Diagram



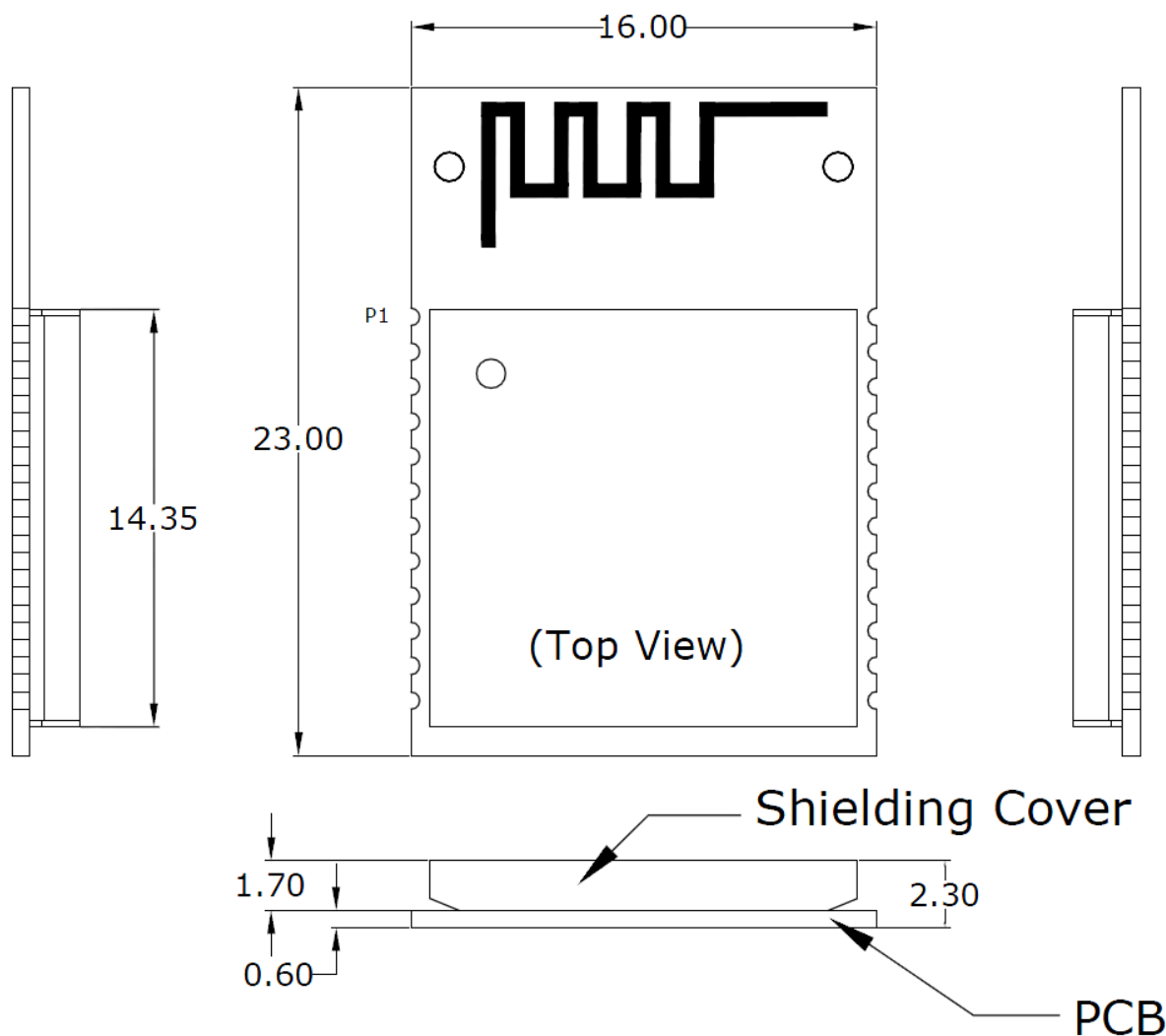
1.3 Bluetooth Smart Stacks



2. Specifications

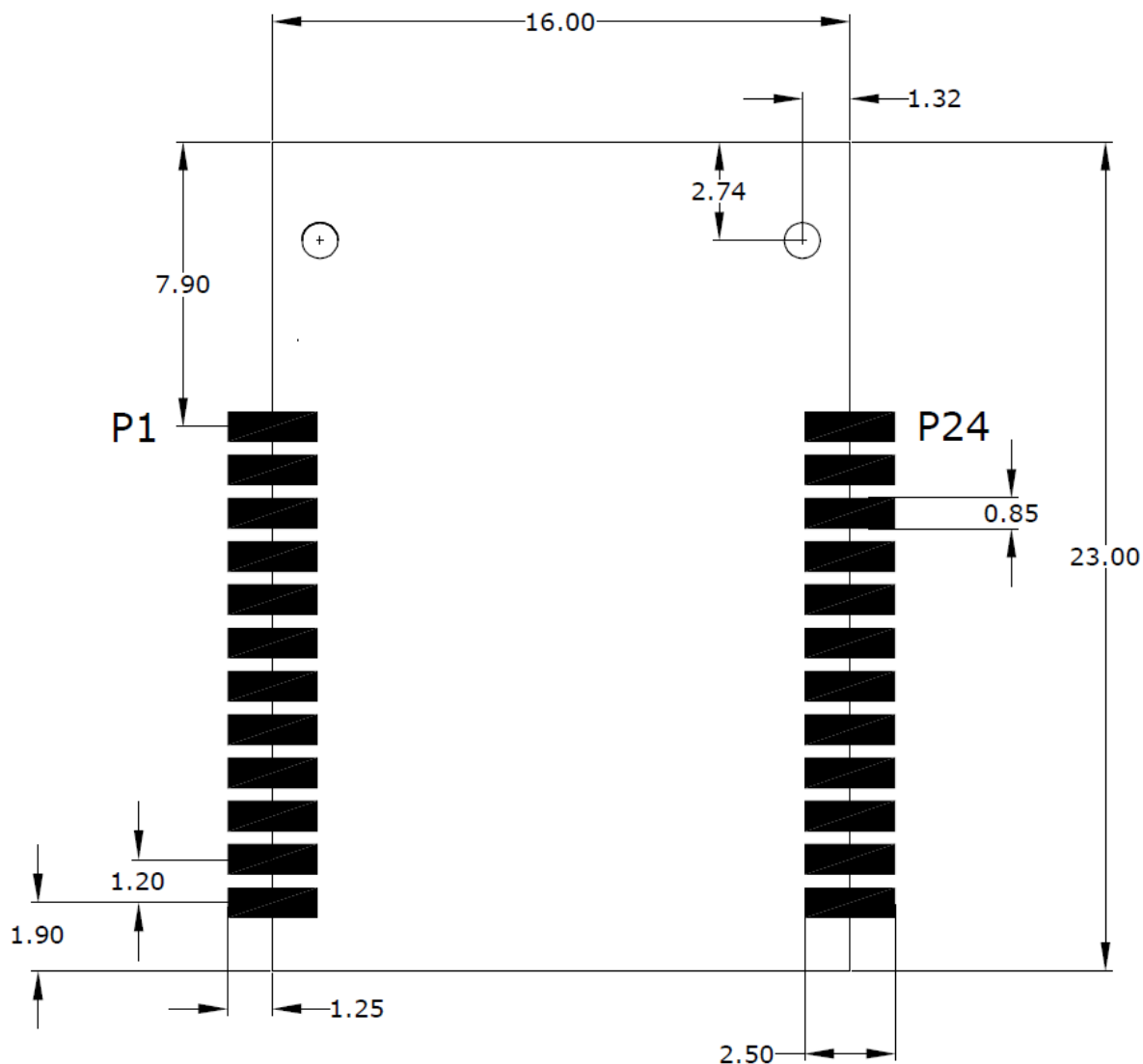
2.1 Mechanical Dimension

Dimension: (Unit: mm, Tolerance: +/- 0.2mm)



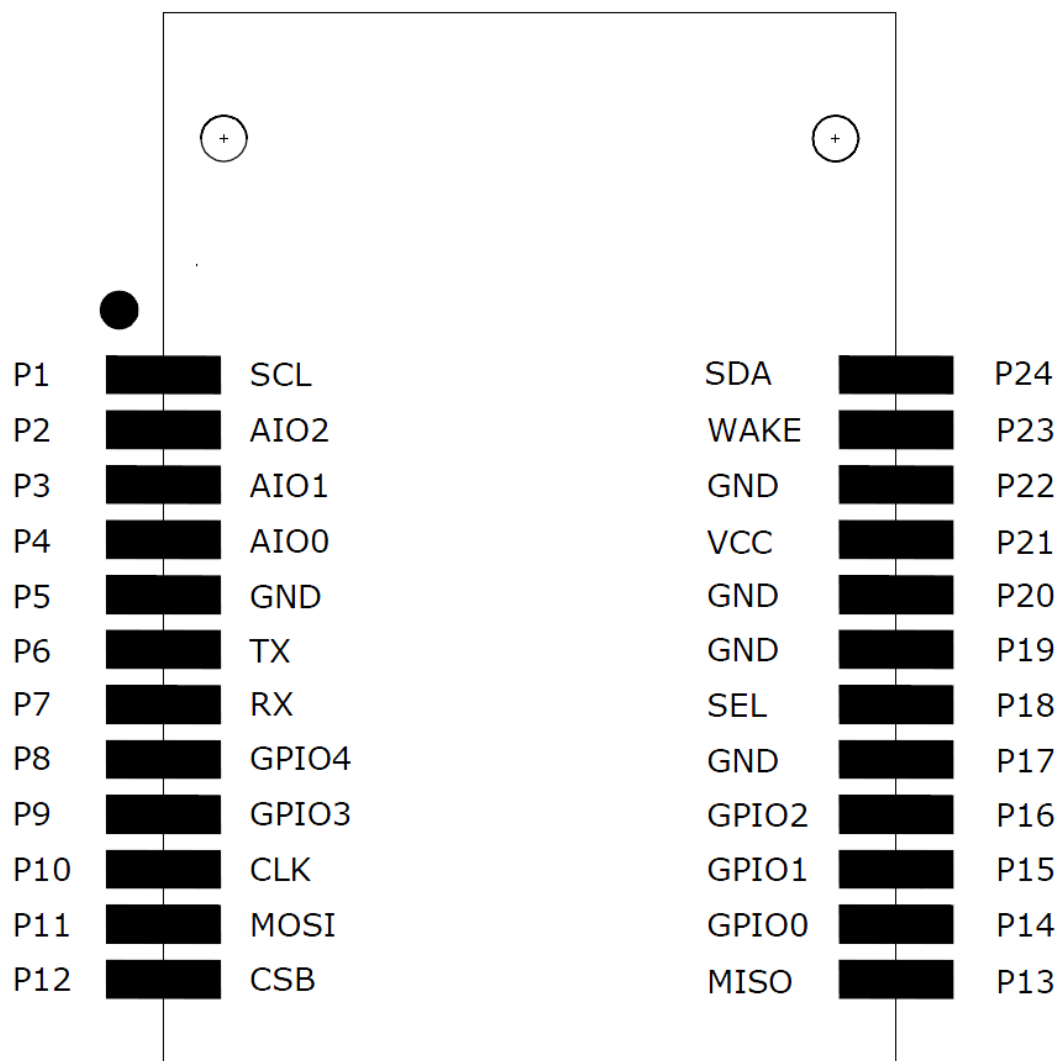
2.2 Recommended PCB Pad Layout

(Unit: mm, Tolerance: 0.1mm)



(Top view)

2.3 Pin Configuration



(Top view)

2.4 Pin Assignment

| Pin | Name | I/O | Description & Note |
|-----|-------|-----|--|
| 1 | SCL | I/O | I2C - Serial Clock Line |
| 2 | AIO2 | I/O | Analogue Input/Output |
| 3 | AIO1 | I/O | Analogue Input/Output |
| 4 | AIO0 | I/O | Analogue Input/Output |
| 5 | GND | P | Ground |
| 6 | TX | O | UART transmit data output |
| 7 | RX | I | UART receive data input |
| 8 | GPIO4 | I/O | Parallel Input/Output |
| 9 | GPIO3 | I/O | Parallel Input/Output |
| 10 | CLK | I/O | SPI clock |
| 11 | MOSI | I | SPI_ Master out Slave in |
| 12 | CSB | I/O | SPI chip select |
| 13 | MISO | O | SPI _ Master in Slave out |
| 14 | GPIO0 | I/O | Parallel Input/Output |
| 15 | GPIO1 | I/O | Parallel Input/Output |
| 16 | GPIO2 | I/O | Parallel Input/Output |
| 17 | GND | P | Ground |
| 18 | SEL | I | Operation mode / SPI interface enable |
| 19 | GND | P | Ground |
| 20 | GND | P | Ground |
| 21 | VCC | PI | Supply voltage |
| 22 | GND | P | Ground |
| 23 | WAKE | I | Operation mode /Wake-up interrupt (option) |
| 24 | SDA | I/O | I2C- Serial Data Line |

2.5 Description of I/O Pin

GND, Pin5, 17, 19, 20, 22

Ground

SCL, Pin1

I2C bus_ Serial Clock Line, followed I2C specification and can support 100 kHz and 400 kHz speed.

AIO2, AIO1, AIO0, Pin2, 3, 4

These Pin are analogue general purpose I/O.

The behavior of these I/O pins can be configured by customized firmware for different applications.

Keeps it floating if not used.

TX, Pin6

This is the UART transmit pin of the module which outputs data to Host.

RX, Pin7

This is the UART receive pin of the module which is used to receive commands from Host.

GPIO4, GPIO3, GPIO0, GPIO1, GPIO2, Pin 8, 9,14,15,16

These Pins are parallel general purpose I/O.

The I/O behavior of this pin can be configured by custom firmware for different applications.

Keep it floating if not used.

CLK, Pin10

SPI bus_ Serial Clock Line.

MOSI, Pin11

SPI bus_ Master out Slave in.

CSB, Pin12

SPI bus_Chip select.

MISO, Pin13

SPI bus_ Master in Slave out.

SEL, Pin18

The pin is used to set the operation mode (4.7K Ohm to GND) or SPI Mode (4.7K Ohm to VCC) .
Please make sure the SEL setting here as below.

| SEL(Pin18) | Pull low | Pull high |
|------------|----------------|-------------------------------------|
| | Operation Mode | SPI Mode (for Firmware download) |

VCC, Pin21

The main DC power supply of the module, the voltage should be kept between from 1.8V to 3.6V
(Typical: 3V).

WAKE, Pin23

The pin is connected to ground via 4.7Kohm.

SDA, Pin24

I2C bus_ Serial Data Line, follow I2C specification and can support 100 kHz and 400 kHz speed.

2.6 Specification

| | Description |
|---------------------|---|
| BLE Solution | CSR 1010 |
| Frequency | 2402-2480MHz |
| Sensitivity | -92.5dBm(chipset ability) |
| Power Output | 7.5dBm(chipset ability) |
| RF Data rate | 1Mbps, GFSK, 250KHz deviation |
| Channel Spacing | 2MHz |
| Modulation | GFSK |
| Power Supply | 2.5V to 3.6V@20mA(Typ.) |
| Current Consumption | Deep Sleep: 5 μ A (Typ.) RX / TX active :20mA@ peak current (Typ.) |
| Working Temperature | -20 °C to +75 °C |
| Storage Temperature | -30 °C to +85 °C |
| Dimension | 16 x23 x 2.3 mm, SMD |
| Weight | 1.3g |

2.7 Absolute Maximum Ratings

The voltage applied for VCC should not exceed 3.6VDC.

| | Symbol | Min. | Typ. | Max. | Unit |
|----------------------|--------|------|------|------|------|
| Power Supply Voltage | VCC | 2.5 | 3.0 | 3.6 | V |

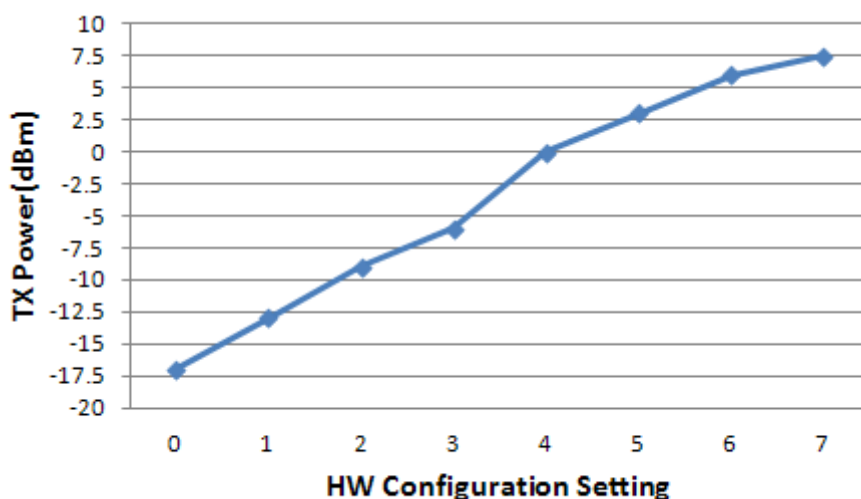
2.8 Operating Conditions

| | Condition | Min. | Typ. | Max. | Unit |
|---------------------|--------------|----------|------|---------|------|
| GPIO Input L Level | VCC=1.8~3.6V | -0.4 | — | 0.3xVCC | V |
| GPIO Input H Level | VCC=1.8~3.6V | 0.7xVCC | — | VCC+0.4 | V |
| GPIO Output L Level | VCC=1.8~3.6V | - | — | 0.4 | V |
| GPIO Output H Level | VCC=1.8~3.6V | 0.75xVCC | — | - | V |
| AIO Input Voltage | - | 0 | — | 1.35 | V |
| AIO Output Voltage | - | 0 | — | 1.35 | V |

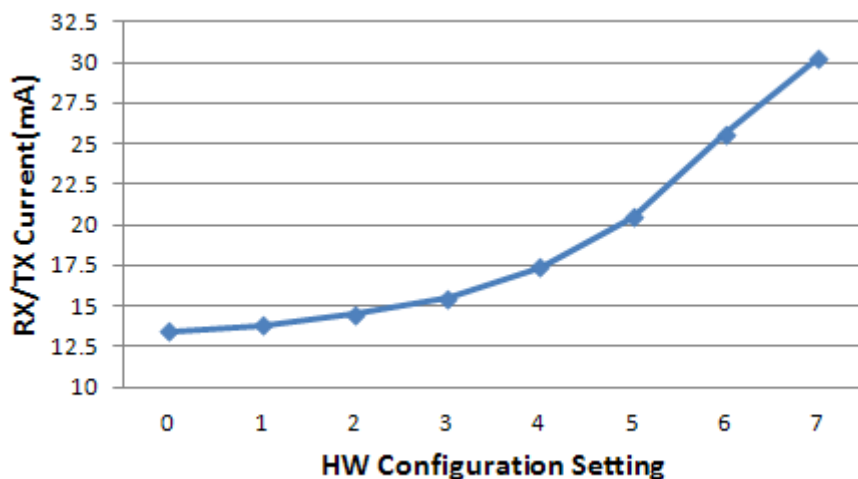
2.9 UART Setting Conditions

| Parameter | | Possible Values |
|---------------------|---------|-------------------------------|
| Baud rate | Minimum | 1200 baud ($\leq 2\%$ Error) |
| | Maximum | 9600 baud ($\leq 1\%$ Error) |
| Parity | — | None, Odd or Even |
| Number of stop bits | — | 1 or 2 |
| Bits per byte | — | 8 |

2.10 TX Power vs. HW Configuration Setting

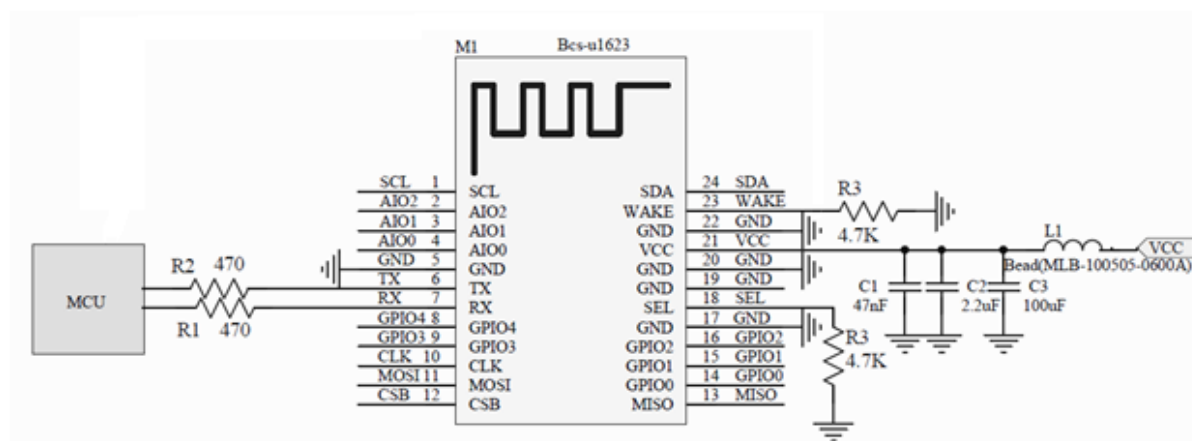


2.11 RX/TX Current vs. HW Configuration Setting



This chapter introduces the reference schematic design for the best performance. Additional tips and cautions on design are detail documented on Application Note, which is available upon request.

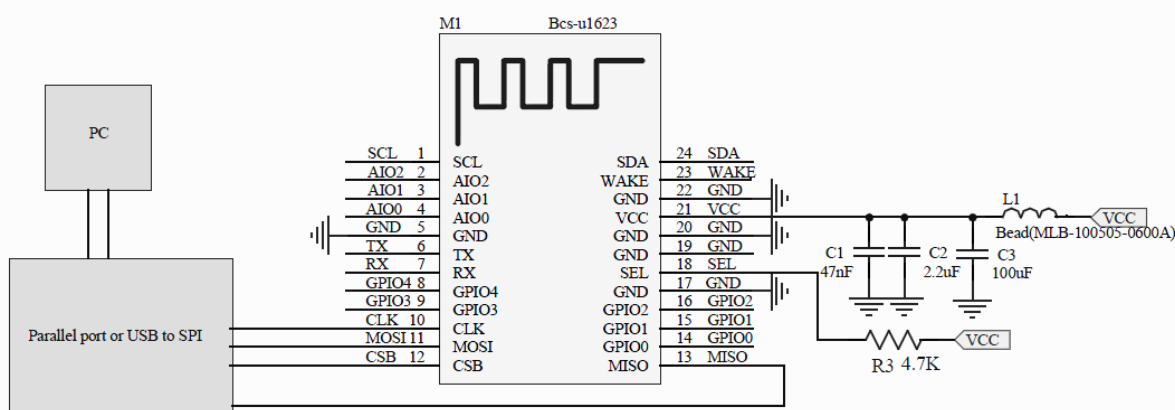
3.1 Reference Design Circuit (Operation mode)



Note:

1. Ferrite bead L1 is added for power noise reduction. You may use other component with impedance of 600Ω at 100 MHz, IDC Max. 200mA.
2. C1, C2 and C3 bypass capacitors should be placed in proximity to the module.
3. Damping resistors R1 and R2 can be modified based on system application for EMI.

3.2 SPI Firmware Download



Note:

1. Ferrite bead L1 is added for power noise reduction. You may use other component with impedance of 600Ω at 100 MHz, IDC Max. 200mA.
2. C1, C2 and C3 bypass capacitors should be placed in proximity to the module.

✖If you need more support and information on antenna implementation, please contact us at sales@gtop-tech.com.

4. Packing and Handling

BLE modules, like any other SMD devices, are sensitive to moisture, electrostatic discharge, and temperature. By following the standards outlined in this document for GlobalTop BLE modules storage and handling, it is possible to reduce the chances of them being damaged during production set-up. This document will go through the basics on how GlobalTop packages its modules to ensure they arrive at their destination without any damages and deterioration to performance quality. It includes cautionary notes for prior to the surface mount process.



Please read the sections II to V carefully to avoid permanent damages due to moisture intake.



BLE modules contain highly sensitive electronic circuits and are electronic sensitive devices. Improper handling without ESD protections may lead to permanent damages to the modules. Please read section VI for more details.

4.1 Moisture Sensitivity

GlobalTop BLE modules are moisture sensitive, and must be pre-baked before going through the solder reflow process. It is important to know that:

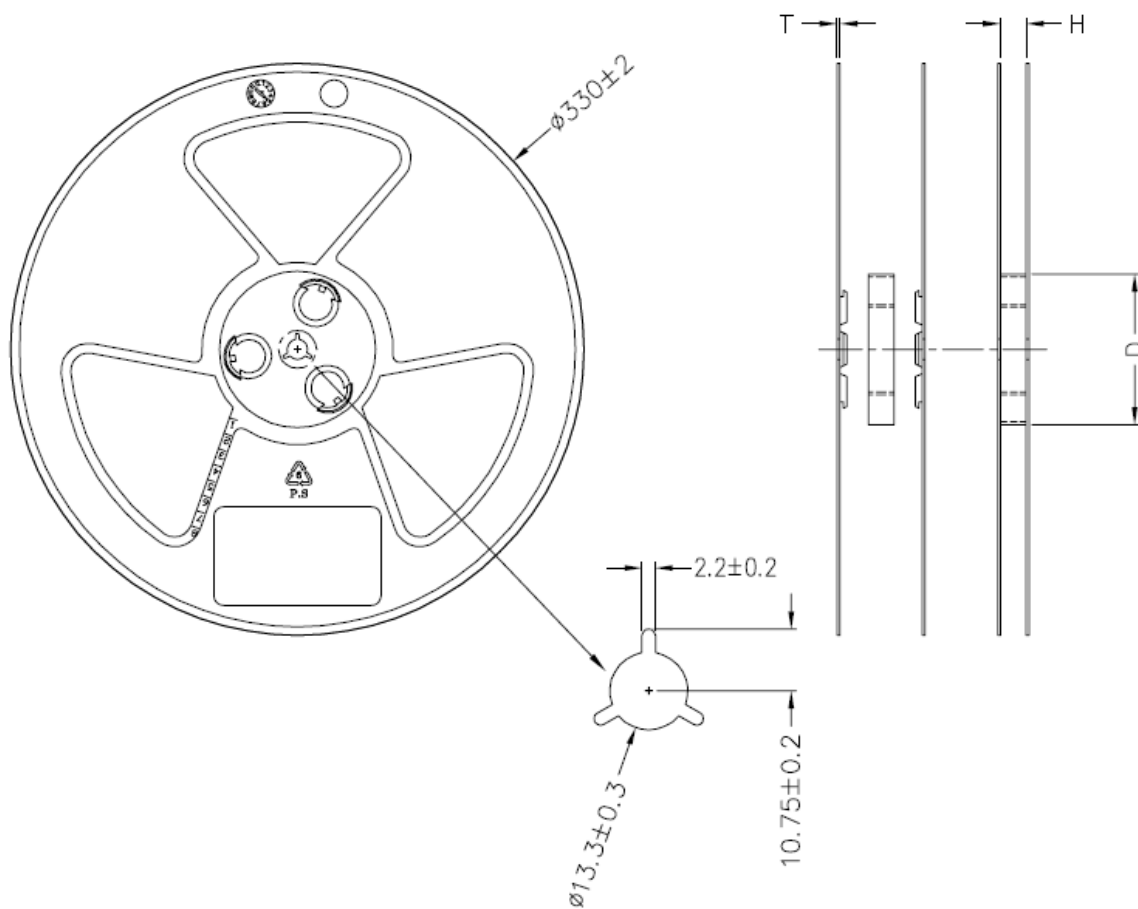
GlobalTop BLE modules must complete solder reflow process in 72 hours after pre-baking.

This maximum time is otherwise known as “Floor Life”

If the waiting time has exceeded 72 hours, it is possible for the module to suffer damages during the solder reflow process such as cracks and delaminating of the SMD pads due to excess moisture pressure.

4.2 Tape Reel Packing Information

750pcs/Reel

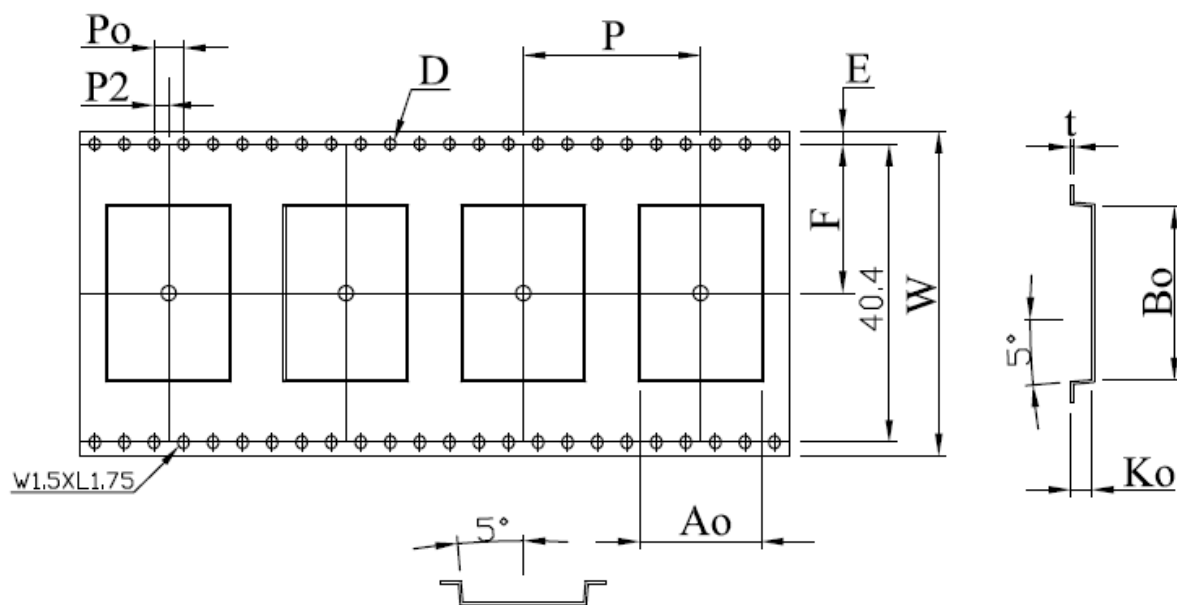


Spec: H: 44.5 ± 1.5 , T: 2.2 ± 0.2 D: 99 ± 1.5

Note: 13" Reel, Material: P.S

Unit: (mm)

Figure 1: Reel Dimension



| | |
|-------|-----------------|
| A_o | 16.4 ± 0.10 |
| Bo | 23.5 ± 0.10 |
| Ko | 2.8 ± 0.10 |
| W | 44 ± 0.30 |
| P | 24 ± 0.10 |
| F | 20.2 ± 0.10 |

Unit: (mm)

Figure 2: Tape Dimension

The moisture color coded card provides an insight to the relative humidity in percentage (RH). When the BLE modules are taken out, it should be around or lower than 30% RH level.

Outside each electrostatic bag is a caution label for moisture sensitive device.

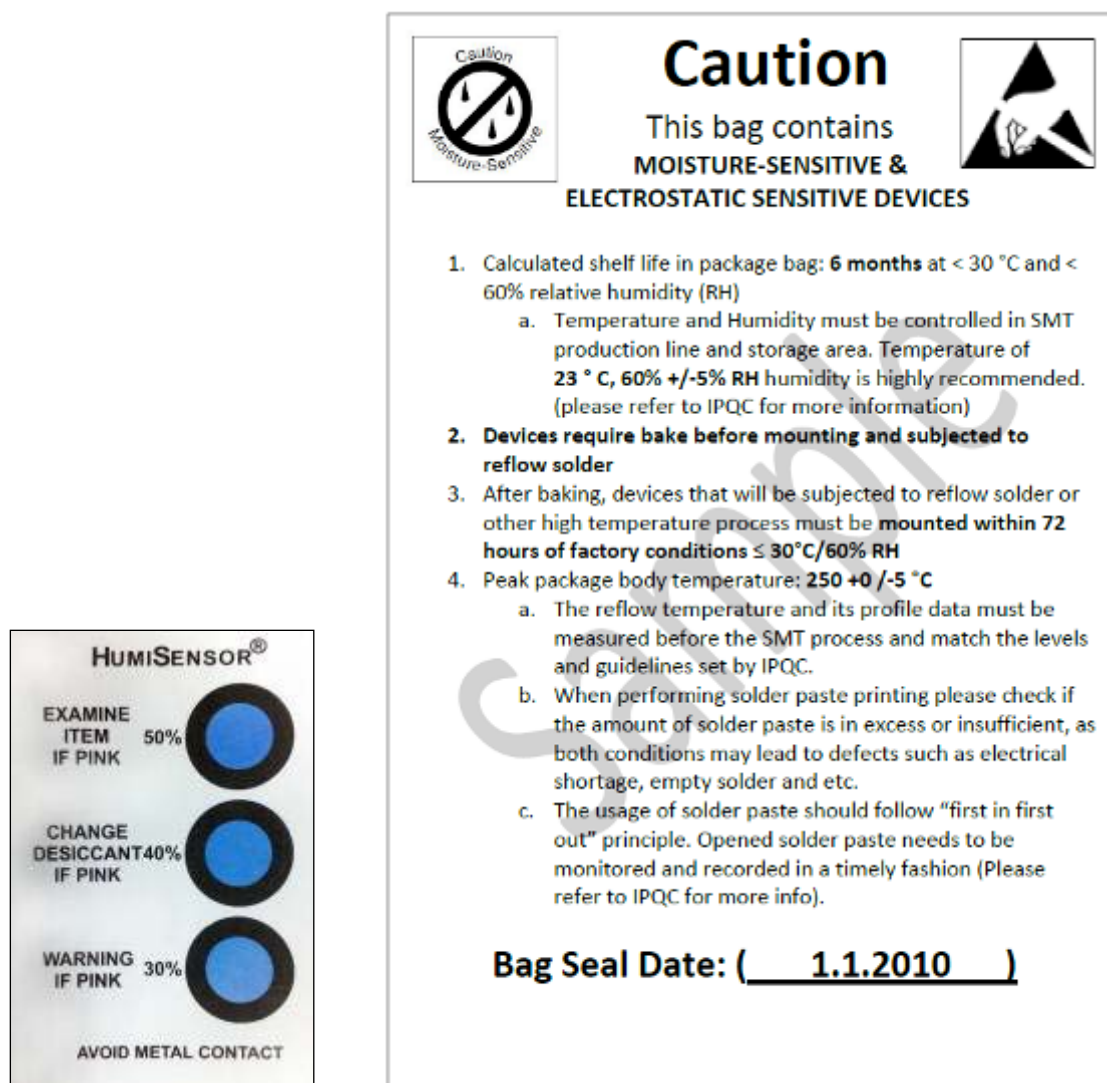


Figure 3: Example of moisture color coded card and caution label

4.3 Storage and Floor Life Guideline

Since GlobalTop BLE modules must undergo solder-reflow process in 72 hours after it has gone through pre-baking procedure, therefore if it is not used by then, it is recommended to store the BLE modules in dry places such as dry cabinet.

The approximate shelf life for GlobalTop BLE modules packages is 6 months from the bag seal date, when store in a non-condensing storage environment (<30°C/60% RH)



It is important to note that it is a required process for GlobalTop BLE modules to undergo pre-baking procedures, regardless of the storage condition.

4.4 Drying

Because the vapor pressures of moisture inside the BLE modules increase greatly when it is exposed to high temperature of solder reflow, in order to prevent internal delaminating, cracking of the devices, or the “popcorn” phenomenon, it is a **necessary requirement** for GlobalTop BLE module to undergo pre-baking procedure before any high temperature or solder reflow process.

The recommendation baking time for GlobalTop BLE modules is as follows:

✓ **60°C for 8 to 12 hours**

Once baked, the module’s floor life will be “reset”, and has additional 72 hours in normal factory condition to undergo solder reflow process.



Please limit the number of times the BLE modules undergoes baking processes as repeated baking process has an effect of reducing the wetting effectiveness of the SMD pad contacts. This applies to all SMT devices.



Oxidation Risk: Baking SMD packages may cause oxidation and/or inter metallic growth of the terminations, which if excessive can result in solder ability problems during board assembly. The temperature and time for baking SMD packages are therefore limited by solder ability considerations. The cumulative bake time at a temperature greater than 90°C and up to 125°C shall not exceed 96 hours. Bake temperatures higher than 125°C are now allowed.

4.5 ESD Handling



Please carefully follow the following precautions to prevent severe damage to BLE modules.

GlobalTop BLE modules are sensitive to electrostatic discharges, and thus are Electrostatic Sensitive Devices (ESD). Careful handling of the BLE modules, must follow the standard ESD safety practices:

- ✓ Unless there is a galvanic coupling between the local GND and the PCB GND, then the first point of contact when handling the PCB shall always be between the local GND and PCB GND.
- ✓ Please do not touch the mounted PCB antenna to prevent electrostatic discharge from the RF input

5. Reflow Soldering Temperature Profile

The following reflow temperature profile was evaluated by GlobalTop and has been proven to be reliable qualitatively. Please contact us beforehand if you plan to solder this component using a deviated temperature profile as it may cause significant damage to our module and your device.

All the information in this sheet can only be used only for Pb-free manufacturing process.

5.1 SMT Reflow Soldering Temperature Profile (Reference Only)

Average ramp-up rate (25 ~ 150°C): 3°C/sec. max.

Average ramp-up rate (270°C to peak): 3°C/sec. max.

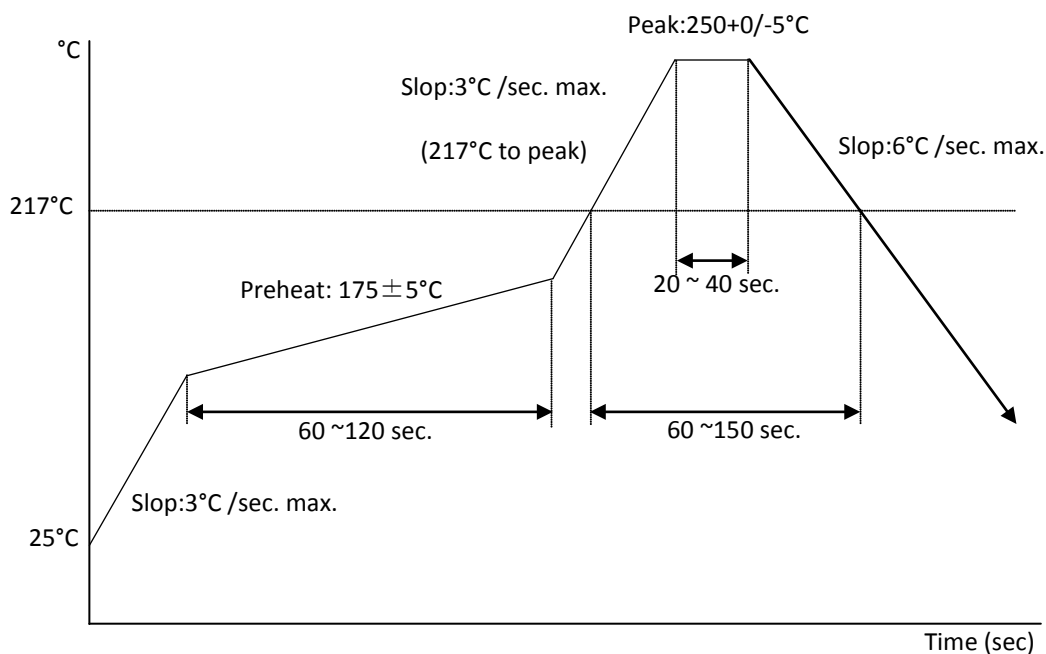
Preheat: 175 ± 25°C, 60 ~ 120 seconds

Temperature maintained above 217°C: 60~150 seconds

Peak temperature: 250 +0/-5°C, 20~40 seconds

Ramp-down rate: 6°C/sec. max.

Time 25°C to peak temperature: 8 minutes max.



| | Details | Suggestions | Notes |
|---|---|--|---|
| 1 | Before proceeding with the reflow-soldering process, the BLE module must be pre-baked. | Pre-bake Time: 6 Hours @ 60°±5°C or 4 Hours @ 70°±5°C | The maximum tolerated temperature for the tray is 100°C. After the pre-baking process, please make sure the temperature is sufficiently cooled down to 35°C or below in order to prevent any tray deformation. |
| 2 | Because PCBA (along with the PCB antenna) is highly endothermic during the reflow-soldering process, extra care must be paid to the BLE module's solder joint to see if there are any signs of cold weld(ing) or false welding. | The parameters of the reflow temperature must be set accordingly to module's reflow-soldering temperature profile. | Double check to see if the surrounding components around the BLE module are displaying symptoms of cold weld(ing) or false welding. |
| 3 | Special attentions are needed for PCBA board during reflow-soldering to see if there are any symptoms of bending or deformation to the PCBA board, possibility due to the weight of the module. If so, this will cause concerns at the latter half of the production process. | A loading carrier fixture must be used with PCBA if the reflow soldering process is using rail conveyors for the production. | If there is any bending or deformation to the PCBA board, this might causes the PCBA to collide into one another during the unloading process. |
| 4 | Before the PCBA is going through the reflow-soldering process, the production operators must check by eyesight to see if there are positional offset to the module, because it will be difficult to readjust after the module has gone through reflow-soldering process. | The operators must check by eyesight and readjust the position before reflow-soldering process. | If the operator is planning to readjust the module position, please do not touch the PCB antenna |
| 5 | Before handling the PCBA, they must be cooled to 35°C or below after they have gone through the reflow-soldering process, in order to prevent positional shift that might occur when the module is still hot. | 1. Can use electric fans behind the Reflow machine to cool them down. 2. Cooling the PCBA can prevent the module from shifting due to fluid effect. | -- |

Other Cautionary Notes on Reflow-Soldering Process:

1. Module must be pre-baked **before** going through SMT solder reflow process.
2. The usage of solder paste should follow “first in first out” principle. Opened solder paste needs to be monitored and recorded in a timely fashion manner (refer to IPQC standards for related documentation and examples)
3. Temperature and humidity must be controlled within SMT production line and storage area. Temperature of 23°C, 60±5% RH humidity is recommended. (please refer to IPQC standards for related documentation and examples)
4. When performing solder paste printing, please notice if the amount of solder paste is in excess or insufficient, as both conditions may lead to defects such as electrical shortage, empty solder and etc.
5. Make sure the vacuum mouthpiece is able to bear the weight of the BLE module to prevent positional shift during the loading process.
6. Before the PCBA is going through the reflow-soldering process, the operators should check by eyesight to see if there are positional offset to the module.
7. The reflow temperature and its profile data must be measured before the SMT process and match the levels and guidelines set by IPQC.
8. If SMT protection line is running a double-sided process for PCBA, please process BLE module during the second pass only to avoid repeated reflow exposures of the BLE modules. Please contact GlobalTop beforehand if you must process BLE modules during the 1st pass of double-side process.

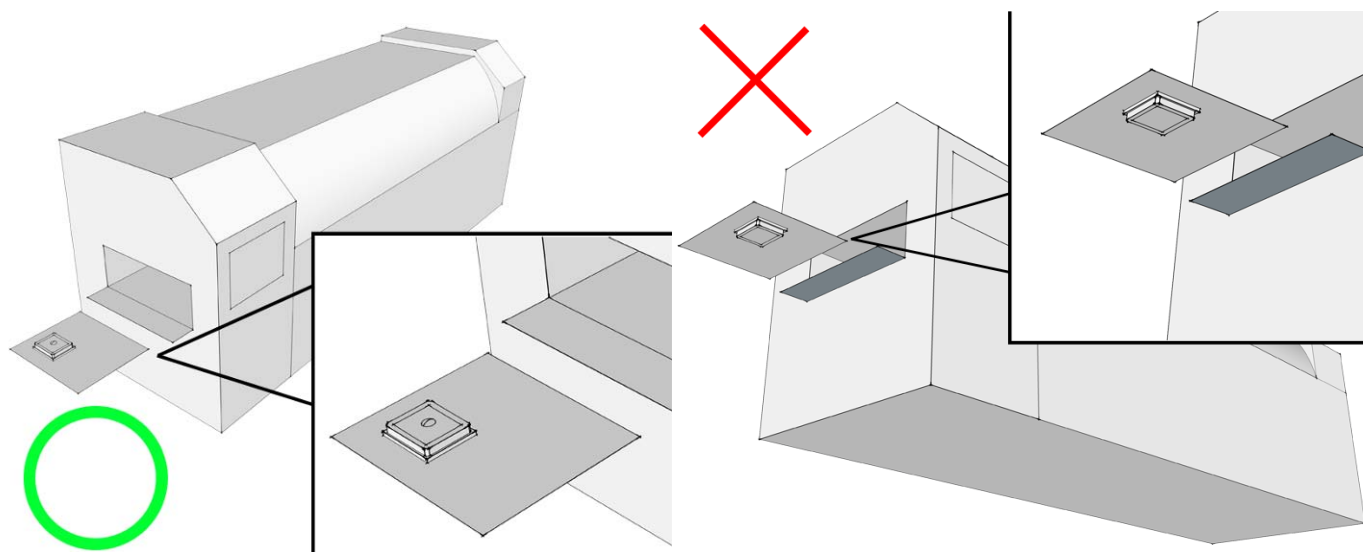


Figure 4: Place BLE modules right-side up when running reflow-solder process, do not invert.

5.2 Manual Soldering

Soldering iron:

Heat Temperature: under 380°C Time: under 3 sec.

Notes:

1. Please do not directly touch the soldering pads on the surface of the PCB board, in order to prevent further oxidation
2. The solder paste must be defrosted to room temperature before use so it can return to its optimal working temperature. The time required for this procedure is unique and dependent on the properties of the solder paste used.
3. The steel plate must be properly assessed before and after use, so its measurement stays strictly within the specification set by SOP.
4. Please watch out for the spacing between soldering joint, as excess solder may cause electrical shortage
5. Please exercise with caution and do not use extensive amount of flux due to possible siphon effects on neighboring components, which may lead to electrical shortage.
6. Please do not use the heat gun for long periods of time when removing the shielding or inner components of the BLE module, as it is very likely to cause a shift to the inner components and will leads to electrical shortage.

6. Contact Information

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