

GGB-1916

GNSS/2.5G GSM/GPRS/Bluetooth Module

Datasheet



Document history

| Version | Date | Updates |
|---------|-------------------|---|
| 0.1 | May 25, 2016 | <ul style="list-style-type: none">• Creation. |
| 0.2 | August 26, 2016 | <ul style="list-style-type: none">• Correct pin assignment.• Add the information for internal verification test. |
| 0.3 | November 17, 2016 | <ul style="list-style-type: none">• Revised Bluetooth output power to Maximum 4dBm \pm 3dBm.• Revised GSM Sensitivity to \leq -107dBm @ 1900MHz.• Revised the values of the current consumption.• Add the current consumption of GGB-1916-A. |
| 1.0 | November 24, 2016 | <ul style="list-style-type: none">• Revised AT command of sleep mode. |
| 1.1 | November 29, 2016 | <ul style="list-style-type: none">• Revised the dimension of the box. |
| 1.2 | April 7, 2017 | <ul style="list-style-type: none">• Added the weight information.• Revised the dimension of the box. |
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Contents

| | | |
|-----------|---|-----------|
| 1. | INTRODUCTION | 5 |
| 1.1 | PRODUCT FEATURES | 5 |
| 1.2 | BLOCK DIAGRAM | 6 |
| 2. | PIN DEFINITION | 7 |
| 2.1 | PIN ASSIGNMENT..... | 7 |
| 2.2 | PIN DESCRIPTION..... | 7 |
| 3. | ELECTRICAL SPECIFICATIONS..... | 10 |
| 3.1 | ABSOLUTE MAXIMUM RATING | 10 |
| 3.2 | ELECTRICAL CHARACTERISTICS | 10 |
| 3.3 | TEMPERATURE CHARACTERISTICS | 13 |
| 4. | MECHANICAL SPECIFICATION..... | 13 |
| 4.1 | OUTLINE DIMENSIONS | 13 |
| 4.2 | RECOMMENDED LAYOUT PATTERN | 14 |
| 5. | PRODUCT HANDLING..... | 15 |
| 5.1 | ESD PRECAUTION | 15 |
| 5.2 | PACKAGING..... | 15 |
| 5.2.1 | <i>Tape and reel packaging</i> | <i>15</i> |
| 5.2.2 | <i>Box packaging</i> | <i>16</i> |
| 5.3 | MOISTURE SENSITIVITY LEVEL..... | 17 |
| 5.4 | REFLOW SOLDERING..... | 17 |
| 6. | PRODUCT MARKING AND ORDERING INFORMATION | 18 |
| 6.1. | PRODUCT MARKING | 18 |
| 6.2. | ORDERING INFORMATION | 18 |

Table index

TABLE 1: MODULE KEY FEATURES 5

TABLE 2: PIN DESCRIPTION..... 7

TABLE 3: ABSOLUTE MAXIMUM RATING 10

TABLE 4: ELECTRICAL CHARACTERISTICS..... 10

TABLE 5: CURRENT CONSUMPTION OF GGB-1916-A..... 11

TABLE 6: CURRENT CONSUMPTION OF GGB-1916-B..... 12

TABLE 7: TEMPERATURE CHARACTERISTICS 13

TABLE 8: ORDERING INFORMATION 18

Figure index

FIGURE 1: MODULE BLOCK DIAGRAM..... 6

FIGURE 2: PIN ASSIGNMENT..... 7

FIGURE 3: OUTLINE DIMENSIONS 13

FIGURE 4: RECOMMENDED LAND PATTERN DIMENSIONS 14

FIGURE 5: RECOMMENDED STENCIL DESIGN 14

FIGURE 6: TAPE DIMENSIONS (MM) 15

FIGURE 7: REEL DIMENSIONS (MM) 16

FIGURE 8: BOX PACKAGING..... 16

FIGURE 9: RECOMMENDED REFLOW PROFILE..... 17

FIGURE 10: LABEL OF GGB-1916 MODULE..... 18

1. Introduction

GGB-1916 module is a versatile module that integrates GNSS, 2.5G GSM/GPRS and classic Bluetooth in a miniature QFN (Quad Flat No leads) form factor. Its built-in highly integrated power management units and efficient DC/DC converters make not only switch individual features of the power by software commands but also perform brilliant low power consumption. All parts of RF functions are included, such as the transceiver and power amplifier of GSM, band pass filter of Bluetooth as well as SAW filter and LNA of GNSS. No abstruse RF knowledge is required. Just connect antennas to it. Besides, all functions of GNSS, A-GNSS, GSM and Bluetooth are software controlled via single UART port. These ease the use, shorten the development time and make the fast time to market.

1.1 Product features

Table 1: Module key features

| GNSS feature | Description | |
|--------------------|---|--|
| GPS, GALILEO, QZSS | L1 1575.42MHz, C/A code. | |
| GLONASS | L1 1598.0625MHz ~ 1605.375MHz, C/A code. | Switchable between GLONASS and BEIDOU. |
| BEIDOU | B1 1561.098MHz, C code. | |
| SBAS | WAAS, EGNOS, MSAS, SDCM, GAGAN | |
| A-GNSS | <ul style="list-style-type: none">● EPO (Extended Prediction Orbit) data service● EASY: Embedded Assist System which accelerates TTFF by predicting satellite navigation messages from received ephemeris. | |
| Channels | Support 99 channels (33 tracking, 99 acquisition) | |
| Update rate | 1 Hz default, up to 10 Hz | |
| Sensitivity | <ul style="list-style-type: none">● Tracking: up to -165 dBm● Acquisition: up to -148 dBm | |
| Antenna | Passive or active antenna support | |
| GSM/GPRS feature | Description | |
| Frequency bands | Quad-band GSM 850/E-GSM 900/DSC 1800/PCS 1900 | |
| Output power | <ul style="list-style-type: none">● Class 4 (2 W) for GSM 850 and E-GSM 900● Class 1 (1 W) for DCS 1800 and PCS 1900 | |
| GSM Sensitivity | <ul style="list-style-type: none">● ≤ -107 dBm (typ.) @ 850 MHz● ≤ -107 dBm (typ.) @ 900 MHz● ≤ -108 dBm (typ.) @ 1800 MHz● ≤ -107 dBm (typ.) @ 1900 MHz | |
| GPRS connectivity | GPRS multi-slot class 12 | |
| Audio | Analog interface. Integrated maximum 0.8W high power class AB | |

| | |
|-------------------|------------------------------|
| | speaker amplifier. |
| SIM interface | Support SIM card: 1.8V, 3.0V |
| SMS | Text and PDU mode |
| Bluetooth feature | Description |
| Output power | Maximum 4dBm \pm 3dBm. |
| version | Bluetooth specification 3.0 |

1.2 Block diagram

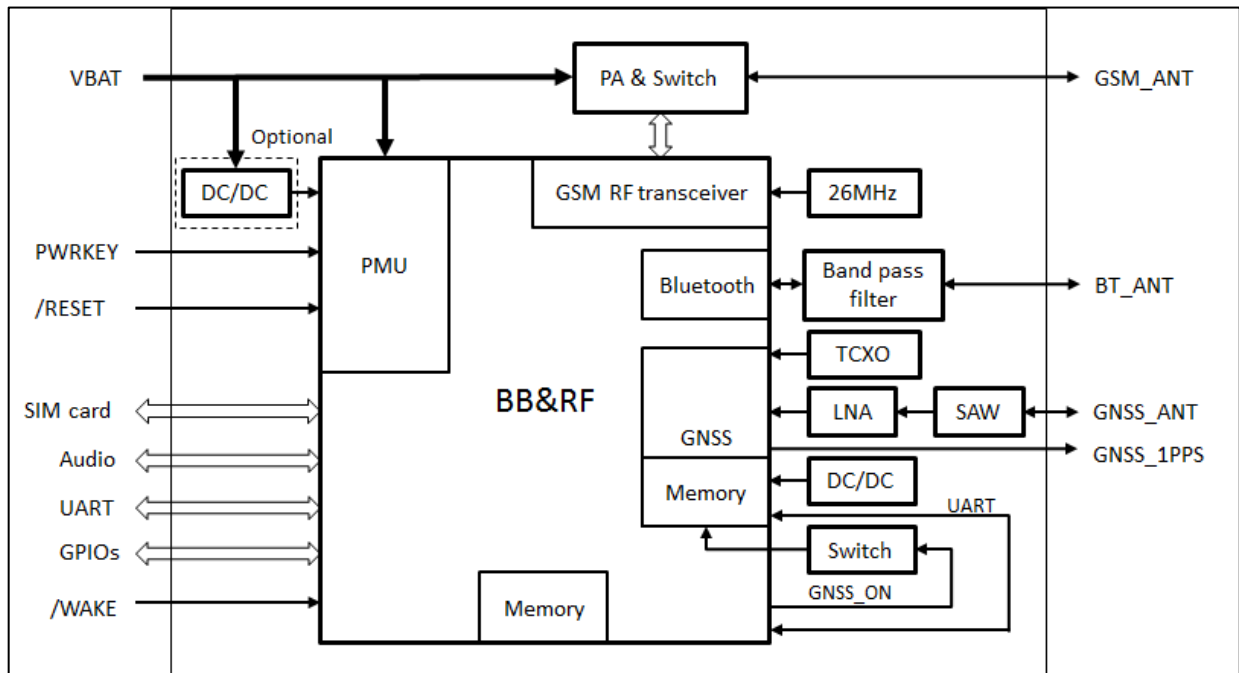


Figure 1: Module block diagram

2. Pin definition

2.1 Pin assignment

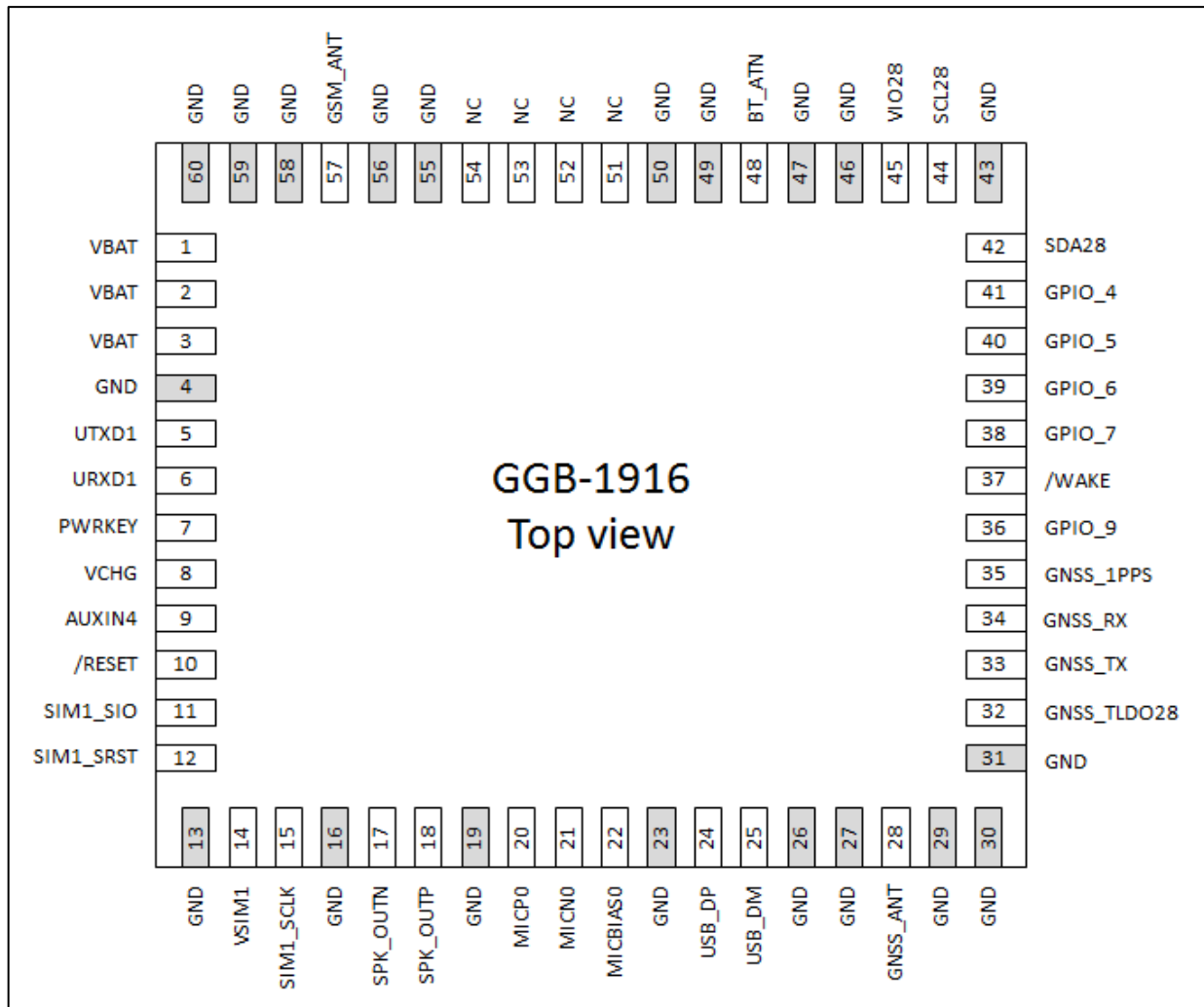


Figure 2: Pin assignment

2.2 Pin description

Table 2: Pin description

| Pin # | Name | I/O | Description | Remarks |
|-------|--------|-----|---|-----------|
| 1 | VBAT | I | Power supply input | |
| 2 | VBAT | I | Power supply input | |
| 3 | VBAT | I | Power supply input | |
| 4 | GND | | Ground | |
| 5 | UTXD1 | O | UART transmitted data. Power domain: VIO28. | IO Type 2 |
| 6 | URXD1 | I | UART received data. Power domain: VIO28. | IO Type 3 |
| 7 | PWRKEY | I | Power on/off key. This pin is internally pulled up to VBAT. | |

| | | | | |
|----|-------------|-----|--|-----------|
| 8 | VCHG | | Reserved pin. Leave unconnected. | |
| 9 | AUXIN4 | I | ADC channel | |
| 10 | /RESET | O | System reset. Power domain: 1.8V. | |
| 11 | SIM1_SIO | I/O | SIM data | |
| 12 | SIM1_SRST | O | SIM reset | |
| 13 | GND | | Ground | |
| 14 | VSIM1 | O | SIM power supply output. Automatically supply the right voltage (1.8V or 3V) to SIM card. | |
| 15 | SIM1_SCLK | O | SIM clock | |
| 16 | GND | | Ground | |
| 17 | SPK_OUTN | O | Negative voice output. Class AB, 0.8W @ 3.7V, 8ohm. | |
| 18 | SPK_OUTP | O | Positive voice output. Class AB, 0.8W @ 3.7V, 8ohm. | |
| 19 | GND | | Ground | |
| 20 | MICP0 | I | Microphone positive input | |
| 21 | MICN0 | I | Microphone negative input | |
| 22 | MICBIAS0 | O | Microphone bias output | |
| 23 | GND | | Ground | |
| 24 | USB_DP | | Reserved pin. Leave unconnected. | |
| 25 | USB_DM | | Reserved pin. Leave unconnected. | |
| 26 | GND | | Ground | |
| 27 | GND | | Ground | |
| 28 | GNSS_ANT | I | GNSS antenna pad (50 ohm impedance) | |
| 29 | GND | | Ground | |
| 30 | GND | | Ground | |
| 31 | GND | | Ground | |
| 32 | GNSS_TLDO28 | O | 2.8V power output for GNSS active antenna. Do not use for the other purposes, otherwise GNSS may fail to function properly. | |
| 33 | GNSS_TX | O | GNSS transmitted data. Internally connected to the baseband. For normal operation, please leave unconnected. Power domain: 2.8V. | IO Type 2 |
| 34 | GNSS_RX | I | GNSS received data. Internally connected to the baseband. For normal operation, please leave unconnected. Power domain: 2.8V. | IO Type 3 |
| 35 | GNSS_1PPS | O | GNSS 1PPS output, default 100ms pulse/sec when 3D position fix is available. Power domain: 2.8V. | |
| 36 | GPIO_9 | I/O | General purpose input/output. Power domain: VIO28. | IO Type 2 |

| | | | | |
|----|---------|-----|--|-----------|
| 37 | /WAKE | I | Falling edge triggered input with an internal pull-up resistor. Pull this pin from high level to low level to wake up the module from sleep mode. Power domain: VIO28. | IO Type 2 |
| 38 | GPIO_7 | I/O | General purpose input/output. Power domain: VIO28. | IO Type 2 |
| 39 | GPIO_6 | I/O | General purpose input/output. Power domain: VIO28. | IO Type 2 |
| 40 | GPIO_5 | I/O | General purpose input/output. Power domain: VIO28. | IO Type 2 |
| 41 | GPIO_4 | I/O | General purpose input/output. Power domain: VIO28. | IO Type 2 |
| 42 | SDA28 | I/O | I ² C data. Power domain: VIO28. | IO Type 2 |
| 43 | GND | | Ground | |
| 44 | SCL28 | O | I ² C clock. Power domain: VIO28. | IO Type 2 |
| 45 | VIO28 | O | 2.8V power output. | |
| 46 | GND | | Ground | |
| 47 | GND | | Ground | |
| 48 | BT_ANT | I/O | Bluetooth antenna pad (50 ohm impedance). | |
| 49 | GND | | Ground | |
| 50 | GND | | Ground | |
| 51 | NC | | Not connected | |
| 52 | NC | | Not connected | |
| 53 | NC | | Not connected | |
| 54 | NC | | Not connected | |
| 55 | GND | | Ground | |
| 56 | GND | | Ground | |
| 57 | GSM_ANT | I/O | GSM antenna pad (50 ohm impedance). | |
| 58 | GND | | Ground | |
| 59 | GND | | Ground | |
| 60 | GND | | Ground | |

3. Electrical specifications

3.1 Absolute maximum rating

Table 3: Absolute maximum rating

| Parameter | Symbol | Minimum | Maximum | Unit |
|-------------------------------------|-------------------|---------|---------|------|
| Power supply input | VBAT | -0.3 | 4.3 | V |
| Digital input voltage for IO Type 2 | VIN2 | -0.3 | 3.08 | V |
| Digital input voltage for IO Type 3 | VIN3 | -0.3 | 3.63 | V |
| Storage temperature | TA _{stg} | -40 | 85 | °C |

3.2 Electrical characteristics

Table 4: Electrical characteristics

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|--|---------------------|------------|------|------|------|------|
| Power supply input | VBAT | | 3.4 | 3.8 | 4.2 | V |
| TCXO LDO output | TLDO28 | | 2.66 | 2.8 | 2.89 | V |
| TCXO LDO output current | I _{TLDO28} | | | | 20 | mA |
| 2.8V power output | VIO28 | | 2.66 | 2.8 | 2.94 | V |
| 2.8V output current | I _{VIO28} | | | 50 | 80 | mA |
| Module peak of current consumption through all VBAT pins | I _{PEAK} | | | | 2 | A |
| Shutdown current | I _{OFF} | Power off | | 152 | | μA |
| High level input voltage | V _{IH} | IO Type 2 | 2.1 | | 3.08 | V |
| | | IO Type 3 | 2.1 | | 3.6 | |
| Low level input voltage | V _{IL} | | -0.3 | | 0.7 | V |
| High level output voltage | V _{OH} | | 2.38 | 2.8 | 2.94 | V |
| Low level output voltage | V _{OL} | | 0 | | 0.42 | V |

Table 5: Current consumption of GGB-1916-A

| GSM | Bluetooth | GNSS | Can CPU sleep ^{*1?} | Typical current |
|--|---------------------|-------------|------------------------------|----------------------|
| Normal mode (AT+CFUN=1) | Off | Off | No | 9.2 mA ^{*2} |
| Radio off (AT+CFUN=0) | Off | Off | Yes | 0.76 mA |
| Radio off (AT+CFUN=0) | Off | Off | No | 8.9 mA |
| GSM sleep, DRX=2 ^{*3} | Off | Off | Yes | 1.41 mA |
| GSM sleep, DRX=5 ^{*3} | Off | Off | Yes | 1.05 mA |
| GSM sleep, DRX=9 ^{*3} | Off | Off | Yes | 0.96 mA |
| GSM talk mode @ 850MHz ^{*4} | Off | Off | Yes/No | 189 mA |
| GSM talk mode @ 900MHz ^{*4} | Off | Off | Yes/No | 191 mA |
| GSM talk mode @ 1800MHz ^{*5} | Off | Off | Yes/No | 123 mA |
| GSM talk mode @ 1900MHz ^{*5} | Off | Off | Yes/No | 115 mA |
| GPRS 4Tx + 1Rx @ 850MHz ^{*6} | Off | Off | Yes/No | 400 mA |
| GPRS 4Tx + 1Rx @ 900MHz ^{*6} | Off | Off | Yes/No | 402 mA |
| GPRS 4Tx + 1Rx @ 1800MHz ^{*7} | Off | Off | Yes/No | 258 mA |
| GPRS 4Tx + 1Rx @ 1900MHz ^{*8} | Off | Off | Yes/No | 231 mA |
| Radio off (AT+CFUN=0) | Off | Acquisition | Yes | 23.9 mA |
| Radio off (AT+CFUN=0) | Off | Acquisition | No | 31.9 mA |
| Radio off (AT+CFUN=0) | Off | Tracking | Yes | 22.4 mA |
| Radio off (AT+CFUN=0) | Off | Tracking | No | 29.9 mA |
| Radio off (AT+CFUN=0) | On, connectable | Off | Yes | 0.78 mA |
| Radio off (AT+CFUN=0) | On, connectable | Off | No | 8.9 mA |
| Radio off (AT+CFUN=0) | On, connected, idle | Off | Yes | 0.98 mA |
| Radio off (AT+CFUN=0) | On, connected, idle | Off | No | 9 mA |

<Note>

1. Sleep mode can be enabled by AT command "AT+LSSLEEP=1". When CPU is sleep, it cannot respond to any AT commands via URXD1 pin.
2. Tested with DRX = 5. The module is powered on in the mode of normal GSM (AT+CFUN=1), Bluetooth off, GNSS off and CPU sleep disabled.
3. @ 850MHz, 900MHz, 1800MHz, 1900MHz.
4. PCL = 5, Maximum TX power (32.3 dBm typ.)
5. PCL = 0, Maximum TX power (29 dBm typ.)
6. Maximum TX power (28.9 dBm typ.)
7. Maximum TX power (26.5 dBm typ.)
8. Maximum TX power (27.9 dBm typ.)

Table 6: Current consumption of GGB-1916-B

| GSM | Bluetooth | GNSS | Can CPU sleep ^{*1?} | Typical current |
|--|---------------------|-------------|------------------------------|-----------------------|
| Normal mode (AT+CFUN=1) | Off | Off | No | 12.4 mA ^{*2} |
| Radio off (AT+CFUN=0) | Off | Off | Yes | 0.57 mA |
| Radio off (AT+CFUN=0) | Off | Off | No | 12 mA |
| GSM sleep, DRX=2 ^{*3} | Off | Off | Yes | 1.4 mA |
| GSM sleep, DRX=5 ^{*3} | Off | Off | Yes | 0.99 mA |
| GSM sleep, DRX=9 ^{*3} | Off | Off | Yes | 0.86 mA |
| GSM talk mode @ 850MHz ^{*4} | Off | Off | Yes/No | 210 mA |
| GSM talk mode @ 900MHz ^{*4} | Off | Off | Yes/No | 210 mA |
| GSM talk mode @ 1800MHz ^{*5} | Off | Off | Yes/No | 144 mA |
| GSM talk mode @ 1900MHz ^{*5} | Off | Off | Yes/No | 133 mA |
| GPRS 4Tx + 1Rx @ 850MHz ^{*6} | Off | Off | Yes/No | 416 mA |
| GPRS 4Tx + 1Rx @ 900MHz ^{*6} | Off | Off | Yes/No | 419 mA |
| GPRS 4Tx + 1Rx @ 1800MHz ^{*7} | Off | Off | Yes/No | 265 mA |
| GPRS 4Tx + 1Rx @ 1900MHz ^{*8} | Off | Off | Yes/No | 237 mA |
| Radio off (AT+CFUN=0) | Off | Acquisition | Yes | 23.7mA |
| Radio off (AT+CFUN=0) | Off | Acquisition | No | 34.9 mA |
| Radio off (AT+CFUN=0) | Off | Tracking | Yes | 22 mA |
| Radio off (AT+CFUN=0) | Off | Tracking | No | 32.7 mA |
| Radio off (AT+CFUN=0) | On, connectable | Off | Yes | 0.6 mA |
| Radio off (AT+CFUN=0) | On, connectable | Off | No | 12.1 mA |
| Radio off (AT+CFUN=0) | On, connected, idle | Off | Yes | 0.84 mA |
| Radio off (AT+CFUN=0) | On, connected, idle | Off | No | 12.2 mA |

<Note>

1. Sleep mode can be enabled by AT command "AT+LSSLEEP=1". When CPU is sleep, it cannot respond to any AT commands via URXD1 pin.
2. Tested with DRX = 5. The module is powered on in the mode of normal GSM (AT+CFUN=1), Bluetooth off, GNSS off and CPU sleep disabled.
3. @ 850MHz, 900MHz, 1800MHz, 1900MHz.
4. PCL = 5, Maximum TX power (32.3 dBm typ.)
5. PCL = 0, Maximum TX power (29 dBm typ.)
6. Maximum TX power (28.9 dBm typ.)
7. Maximum TX power (26.5 dBm typ.)
8. Maximum TX power (27.9 dBm typ.)

3.3 Temperature characteristics

Table 7: Temperature characteristics

| Parameter | Symbol | Minimum | Typical | Maximum | Unit |
|------------------------------|------------------|---------|---------|---------|------|
| Normal operating temperature | T _{opr} | -20 | 25 | 85 | °C |
| Storage temperature | T _{stg} | -40 | 25 | 85 | °C |

4. Mechanical specification

4.1 Outline dimensions

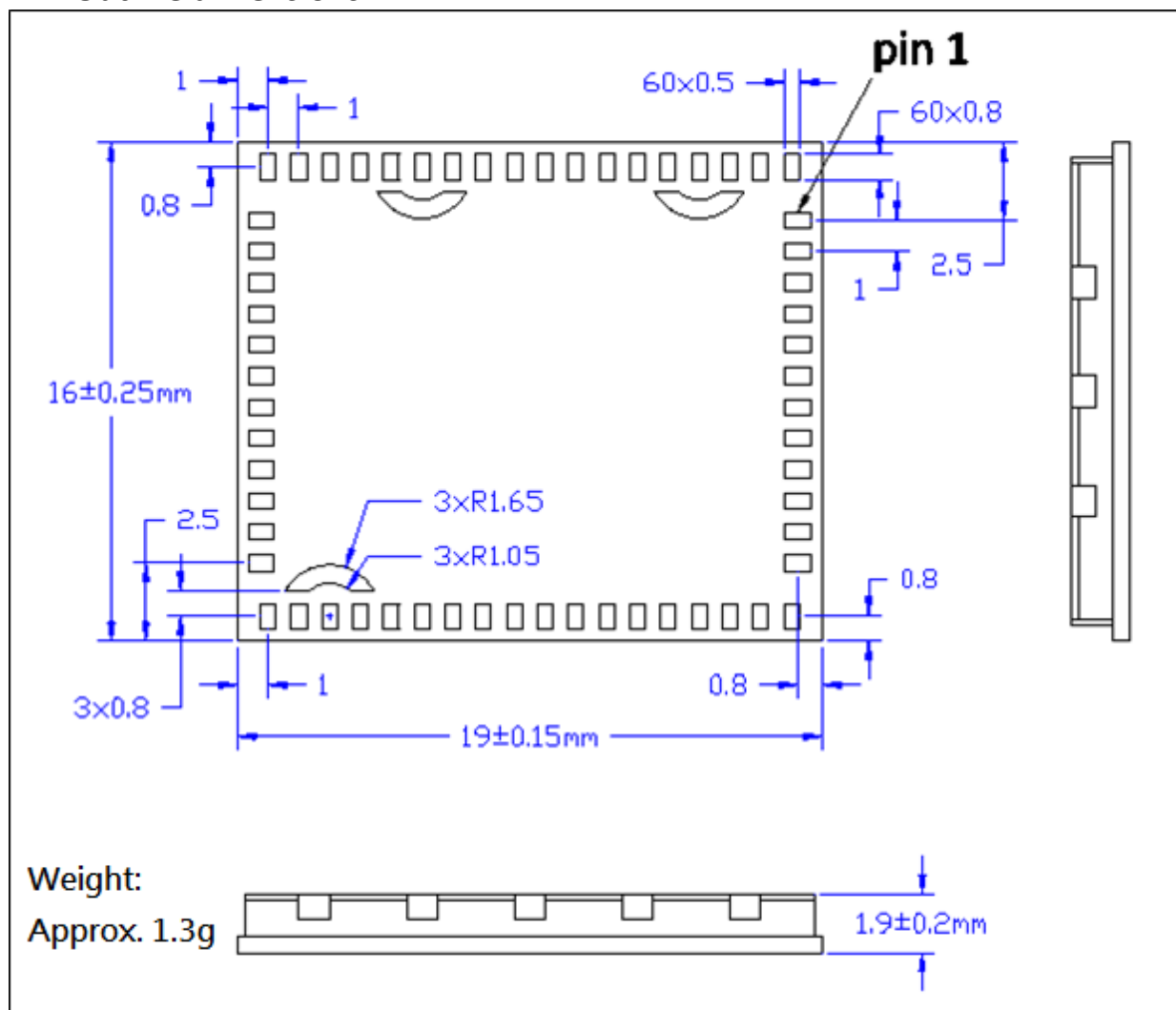


Figure 3: Outline dimensions

4.2 Recommended layout pattern

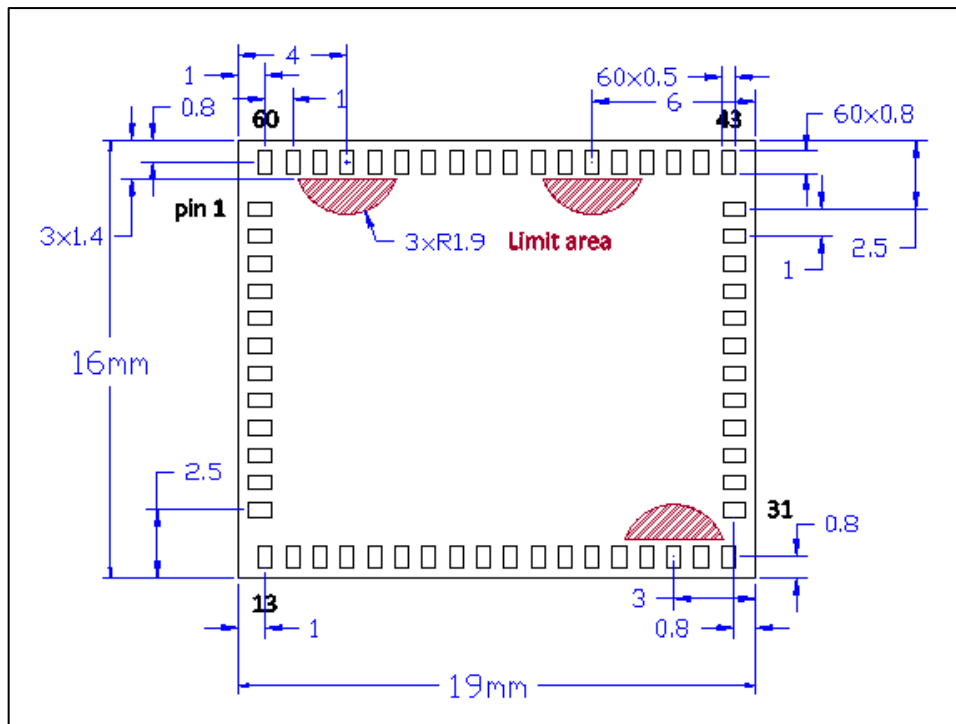


Figure 4: Recommended land pattern dimensions

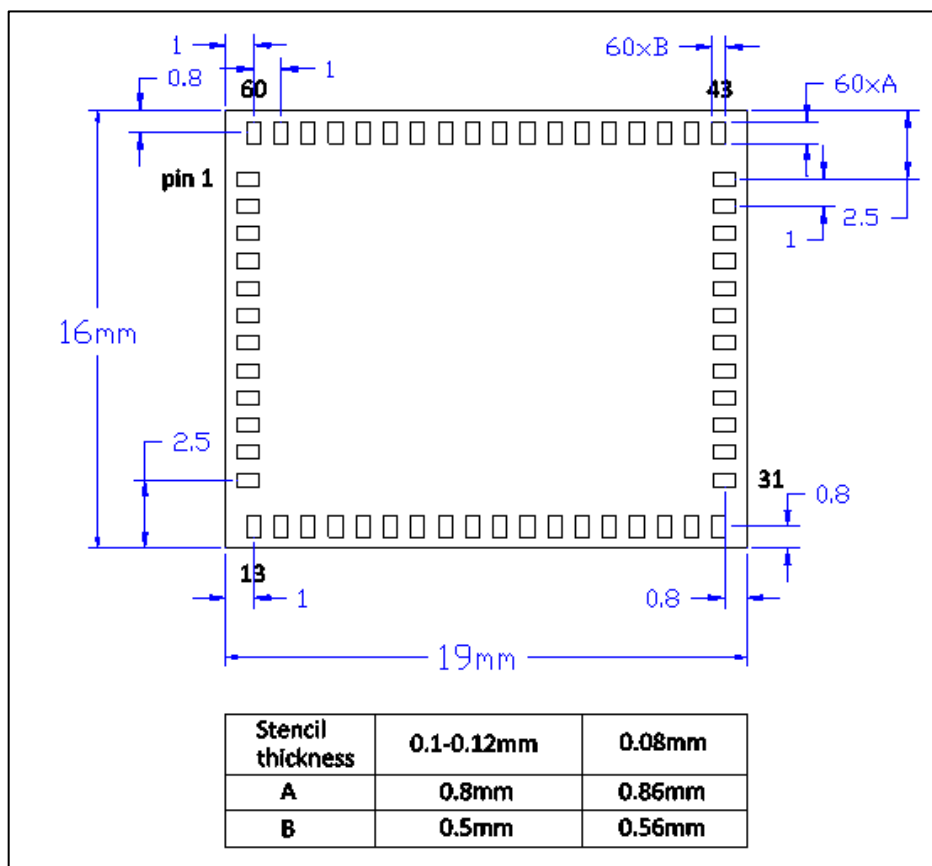


Figure 5: Recommended stencil design

5. Product handling

5.1 ESD precaution

GGB-1916 modules are electrostatic sensitive devices. Handling the modules without proper ESD protection may result in severe damage to them. ESD protection must be implemented throughout the processing, handling and even when the modules are being returned for repair.

5.2 Packaging

The modules are sealed in a moisture barrier ESD bag with the appropriate units of desiccant and a humidity indicator card. It should not be opened until the modules are ready to be soldered onto the application.

5.2.1 Tape and reel packaging

The modules are deliverable in quantities of 1,000 pieces on a reel of 330mm in diameter.

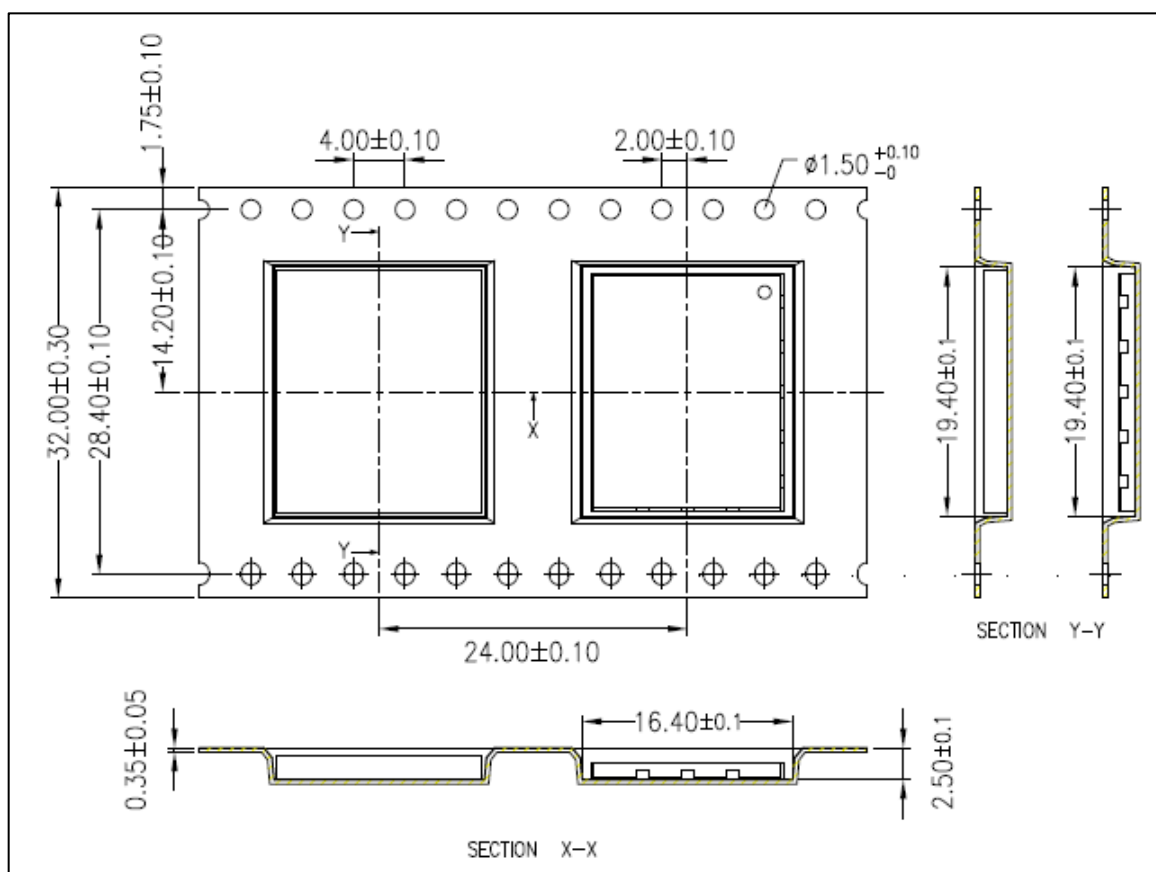


Figure 6: tape dimensions (mm)

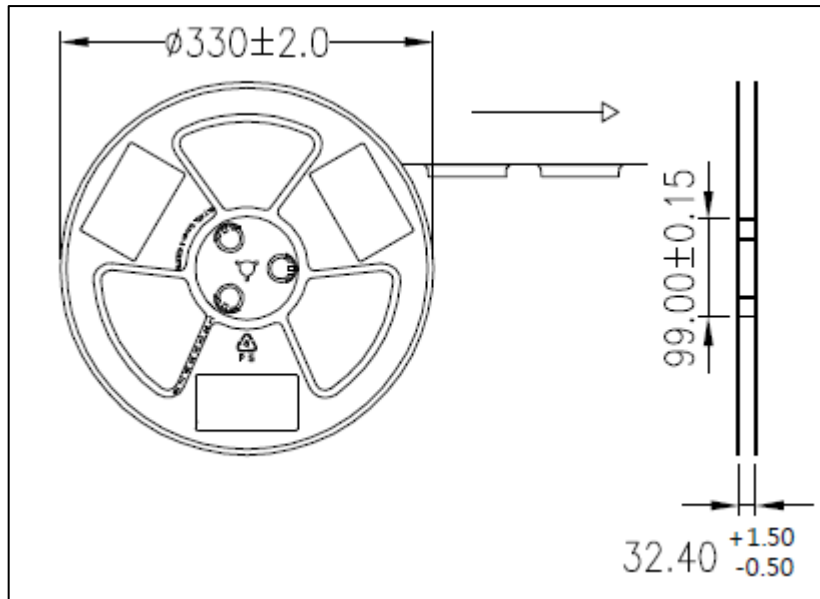


Figure 7: reel dimensions (mm)

5.2.2 Box packaging

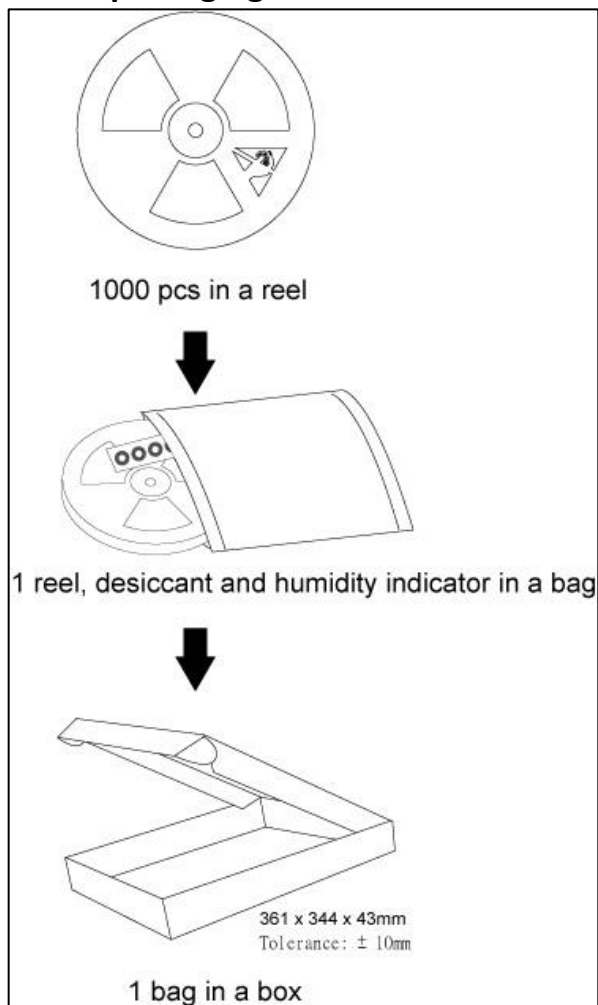


Figure 8: Box packaging

5.3 Moisture sensitivity level

The moisture sensitivity level of the module is 3. After the sealed bag is opened, modules should be mounted within 168 hours at factory conditions of $\leq 30^{\circ}\text{C}$ and 60% RH or stored at $\leq 20\%$ RH.

The modules require baking before mounting if above conditions are not met. If baking is required, the modules may be baked for:

- a. 192 hours at $40^{\circ}\text{C} + 5^{\circ}\text{C} / -0^{\circ}\text{C}$ and $< 5\%$ RH
- b. 24 hours at $125^{\circ}\text{C} + 5^{\circ}\text{C} / -0^{\circ}\text{C}$

5.4 Reflow soldering

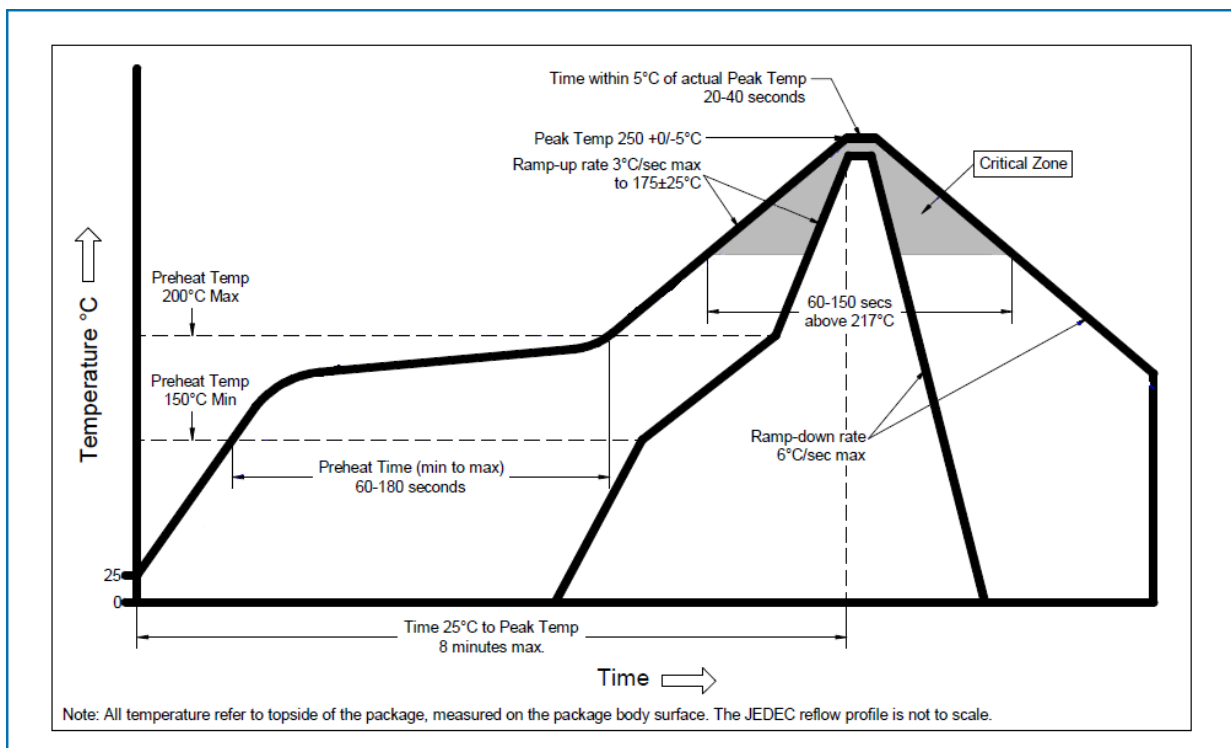


Figure 9: Recommended reflow profile

6. Product marking and ordering information

6.1. Product marking

The marking of GGB-1916 is engraved on the metal shielding that has product information, such as LOCOSYS logo, product name, serial number, IMEI number, MAC address and manufacturing date.

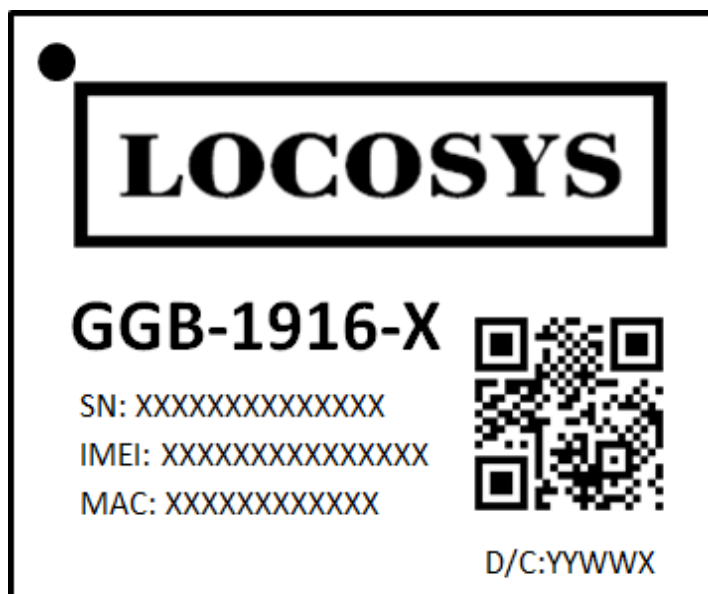


Figure 10: Label of GGB-1916 module

6.2. Ordering information

Table 8: Ordering information

| Product name | Description | Remark |
|--------------|--|-------------|
| GGB-1916-A | Built-in high efficient DC/DC converter to save power. | |
| GGB-1916-B | Without high efficient DC/DC converter. | Recommended |