# MEB-1315 User Manual

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# Content

# 1 1.Introduction

RoyalTek MEB-1315 small form factor board is the newest generation of RoyalTek GPS module. The module is powered by latest MTK single chip and RoyalTek proprietary navigation technology that provides you with stable and accurate navigation data. The smallest form factor and miniature design is the best choice to be embedded in a device such as portable navigation device, personal locator, speed camera detector and vehicle locator.

## Product Features

- ✧ SMT type with stamp holes
- ✧ Support USB/TTL interface
- ✧ TCXO design
- ✧ NMEA-0183 compliant protocol/ customize protocol
- ✧ Enhanced algorithm for navigation stability
- ✧ Excellent sensitivity for urban canyon and foliage environments.
- ✧ Auto recovery while RTC crashes

## 1.1 Product Applications

- ✧ Automotive navigation
- ✧ Personal positioning and navigation
- ✧ Marine navigation
- ✧ MID or Net book application

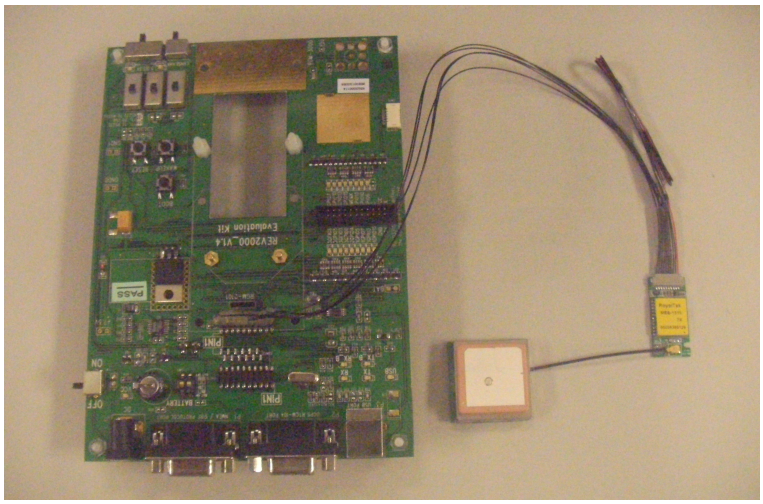
## 1.2 Product Pictures

**(1) MEB-1315**

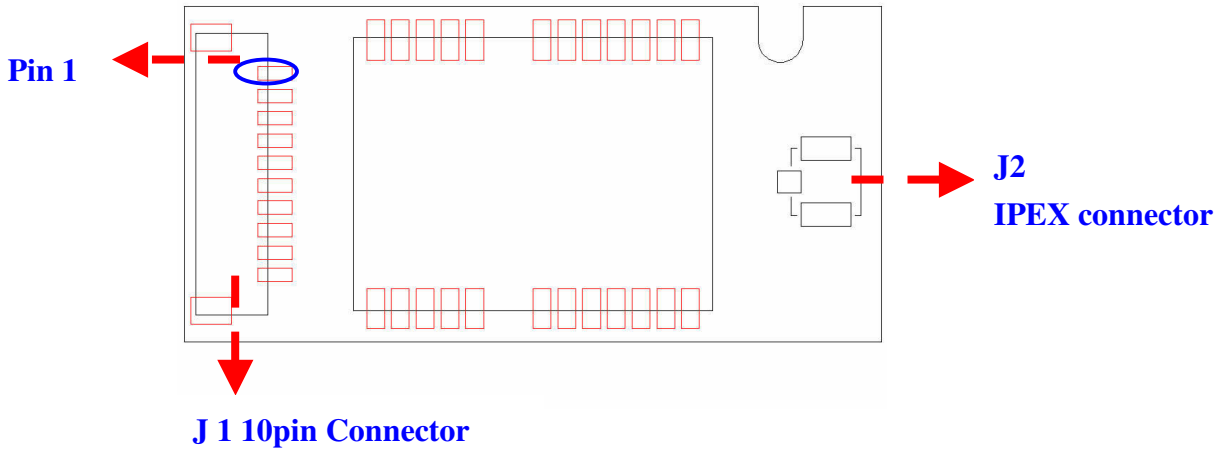

**Pin 1**

**(2) MEB-1315 Interface board**


**(3) Connection with REV-2000 evaluation Kit**



## 1.3 The interface Board Pin Definition

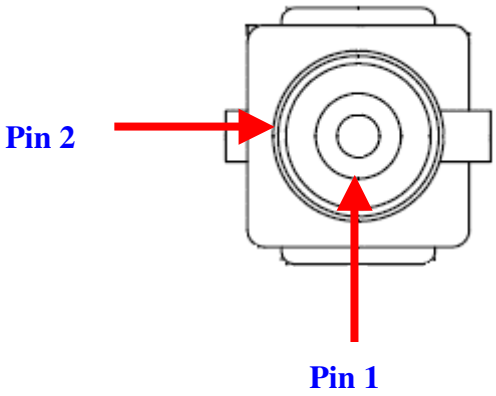



### (1) J1 Pin Definition:

| Contact Number | Signal Name | Descriptions | Characteristic |
|---|---|---|---|
| 1 | N.C. | Connect to Test point | Non-Used |
| 2 | D+ | USB Device Port Data + | I/O |
| 3 | D- | USB Device Port Data - | I/O |
| 4 | VDDBUS | Device power Supply | Power：3V3±5% |
| 5 | GND | GND | GND |
| 6 | N.C. | N.C. | Non-Used |
| 7 | TXA | Data Transport out | Output<br>VOH (max. +3.1V；min. +2.4 V)<br>VOL (max. +0.4V；min. -0.3 V) |
| 8 | RXA | Data Receiver in | Input<br>VIH (max. +3.6V；min. +2.0 V)<br>VIL (max. +0.8V；min. -0.3 V) |
| 9 | N.C. | Connect to Test point | Non-Used |
| 10 | GND | GND | GND |

VOH：Output High-level Voltage
VOL：Output Low-level Voltage
VIH：Input High-level Voltage
VIL ：Input Low-level Voltage

**(2) J2 IPEX connector**

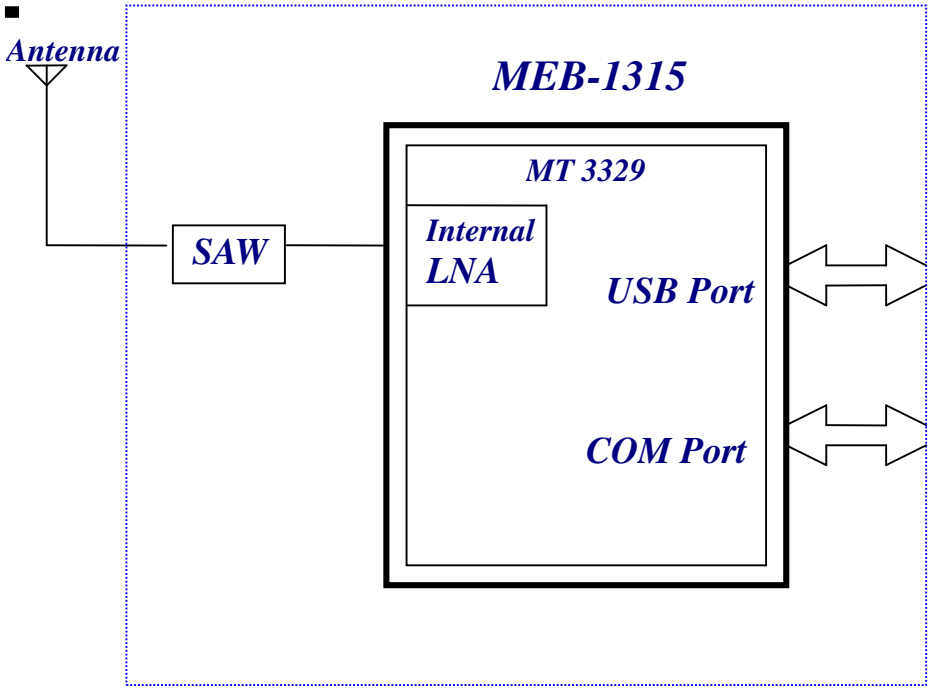



| Pin# | Signal Name | Descriptions | Characteristic |
|---|---|---|---|
| 1 | RF Signal | RF Signal feed in | RF Signal |
| 2 | GND | GND | GND |

## 1.4 MEB-1315 Series Block Diagram

System block diagram description:

a. External antenna.
b. 4 Mega bits flash memory.
c. 22 pin I/O pin.



## 1.5 MEB-1315 Technical Specification

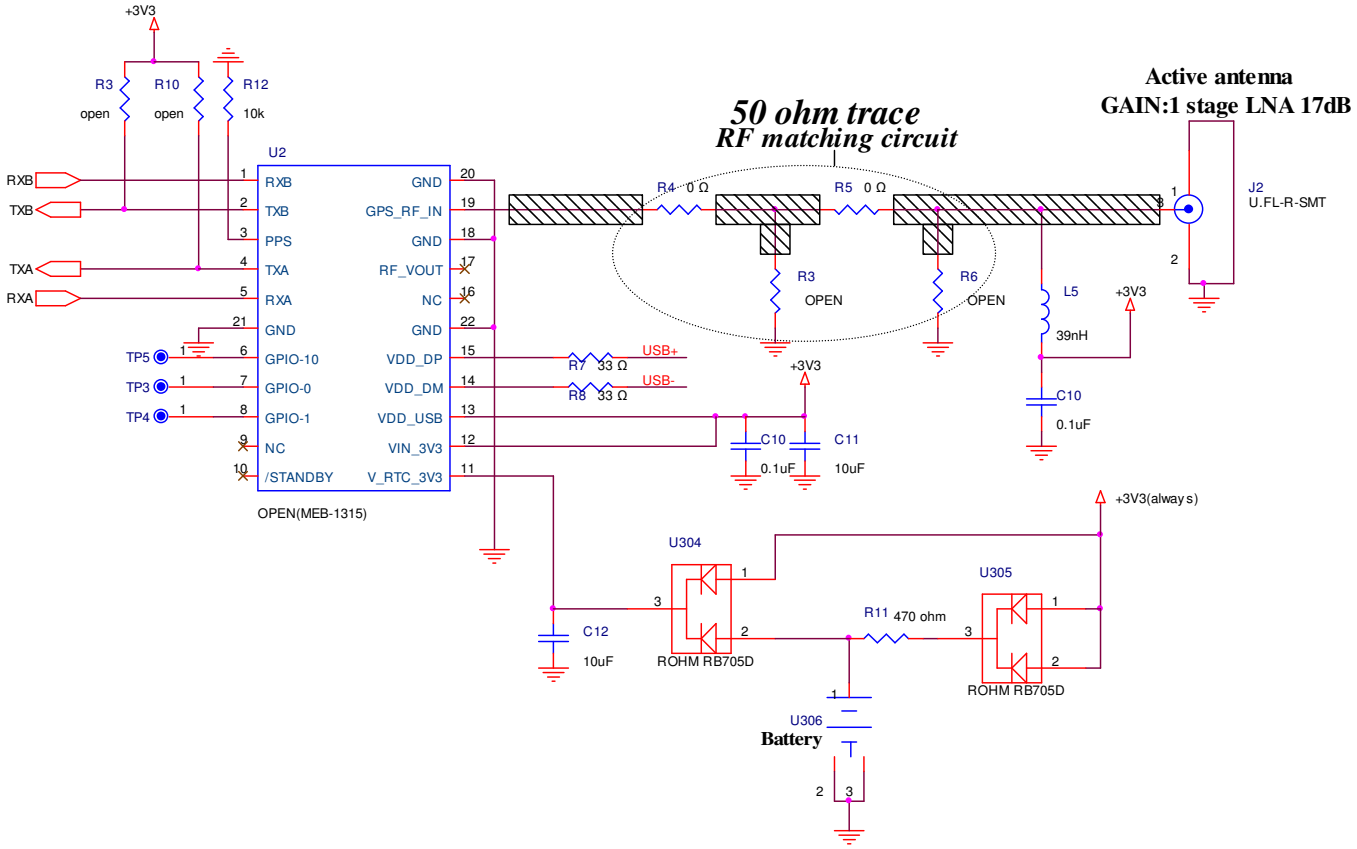
**Impedance：50Ω**

| No | Function | Specification |
|---|---|---|
| **GPS** | | |
| 1 | Chipset | - MTK MT3329<br>The single chip solution is offered as a 81-pin TFBGA (6.2x6.2x1.3mm)<br>Internal Memory: Flash type on 4Mb |
| 2 | Frequency | - L1, 1,575.42 MHz |
| 3 | Channel | - 22 tracking/ 66 acquisition-channel |
| 4 | C/A Code | - 1,023 MHz |
| 5 | Sensitivity | Tracking – 165 dBm/Acquisition -148dBm |
| 6 | TTFF Fix time(chipset open sky) | - Hot start: 1s<br>- Warm start: 33s<br>- Cold start: 36s |
| 7 | Accuracy | - Position: within 10m for 90%<br>- Velocity: 0.1m/s |
| 8 | Interface Protocol | -NMEA 0183 standard V3.01 and backward compliance<br>GGA(1),GLL(1),GSA(1),GSV(1),RMC(1),VTG(1),<br>9600bps |
| 9 | TCXO | - 16.369MHz |
| 10 | Navigation applications | - SBAS (WAAS, EGNOS, GAGAN, MSAS), DGPS (RTCM), and AGPS. |
| 11 | LNA (INTERNAL) | Gain: 19 dB (Typ.)<br>Noise Figure ≦ 2.5 dB(Max) |
| **Interface** | | |
| 12 | I/O Pin | 22pin USB/TTL |
| **Power consumption** | | |
| 13 | Voltages | 3.3V±5% |
| 14 | System Currents | Avg. 55mA @3.3V w/o ext. Antenna |
| **Environment** | | |
| 15 | Temperature | - Operating : -40 ~ 85℃<br>- Storage : -40 ~ 85℃ |
| 16 | Humidity | ≦95% |

| **Mechanical requirements** | | |
|---|---|---|
| 17 | Dimension (mm) | -13±0.2 x 15±0.2 x 2.3 ±0.2mm |
| 18 | Weight | ≦0.8g |

## 1.6 Application Circuit

Reference schematic:




**Note:**

(1) Ground Planes:

These pins(18、20、21、22) should be connected to ground.

(2) Serial Interface:

(Ⅰ)The TXA pin is the serial output data. Default output GPS protocol. (NMEA Sentence).

(Ⅱ). The RXA pin is the serial input data. Default output GPS protocol. (NMEA Sentence).

(Ⅲ) The TXB pin is the serial output data (Default Null)

(Ⅳ) The RXB pin is the serial input data (Default Null).

(3) Backup Battery:

It's recommended to connect a backup battery to V_RTC_3V3 pin.

In order to enable the features of the warm start and hot start of the GPS receiver.

(4) RF_IN:

Connecting to the antenna has to be routed on the PCB. The transmission line must to be control impedance from RF_IN pin to the antenna or antenna connector of

your choice. (Impedance 50Ω)

(5) Power:

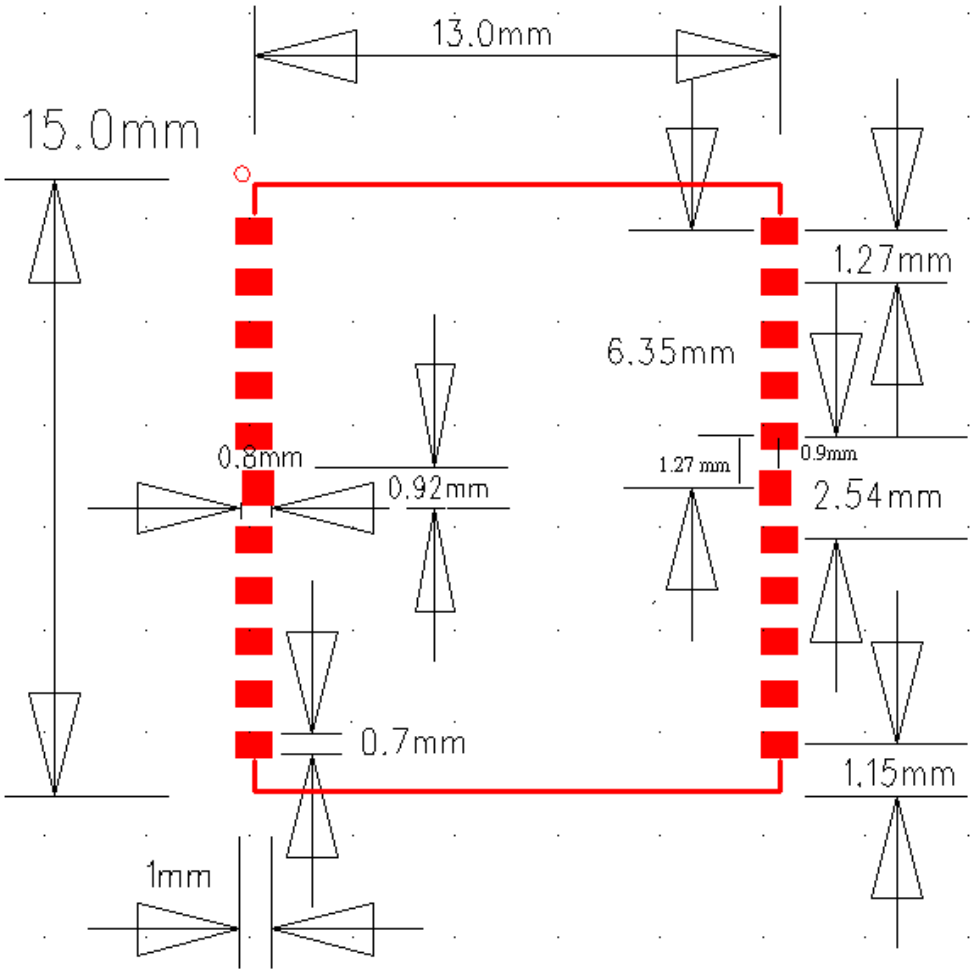
Connect VIN_3V3 pin to DC 3.3V. The power supply must add bypass capacitor (10uF and 1uF). It can reduce the Noise from power supply and increase power stability.

(6) GPIO:

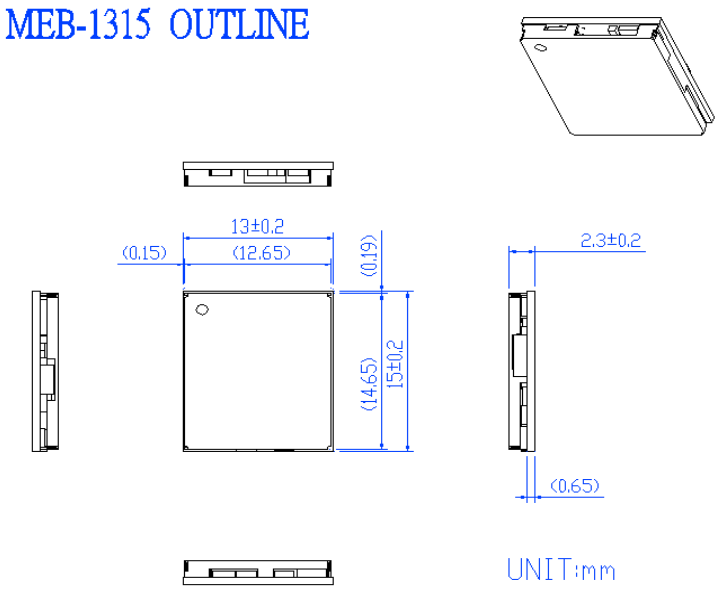
The GPIO function is for customer application.

If the GPIO function is not used, it won't connect anything.

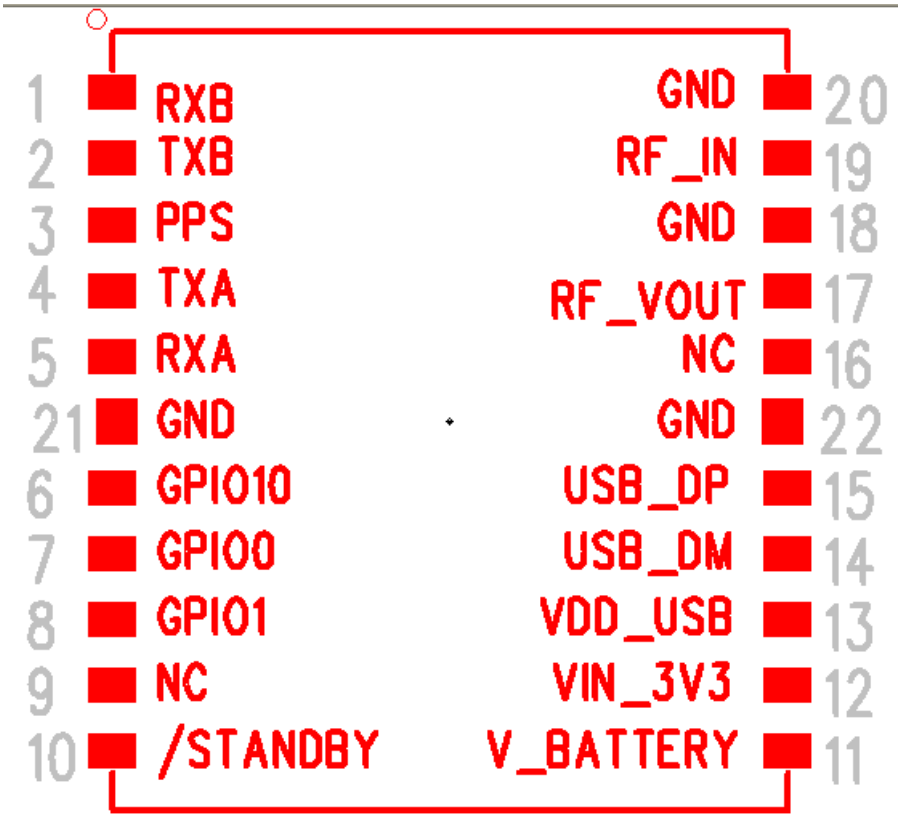
## 1.7 Recommend Layout PAD



## 1.8 Mechanical Dimension



### 1.9 Hardware interface




**Pin definition**

| Pin | Signal Name | I/O | Description | Characteristics |
|---|---|---|---|---|
| 1. | RXB | I | Serial port B | $3.6 \geq V_{IH} \geq 2.0V$ , $-0.3V \leq V_{IL} \leq 0.8V$ |
| 2. | TXB | O | Serial port B | $3.1V \geq V_{OH} \geq 2.4V$ , $-0.3 \leq V_{OL} \leq 0.4V$ |
| 3. | PPS | O | One pulse per second | $3.1V \geq V_{OH} \geq 2.4V$ , $-0.3 \leq V_{OL} \leq 0.4V$ |
| 4. | TXA | O | Serial port A | $3.1V \geq V_{OH} \geq 2.4V$ , $-0.3 \leq V_{OL} \leq 0.4V$ |
| 5. | RXA | I | Serial port A | $3.6 \geq V_{IH} \geq 2.0V$ , $-0.3V \leq V_{IL} \leq 0.8V$ |
| 6. | GPIO[10] | I/O | General purpose I/O | $3.6 \geq V_{IH} \geq 2.0V$ , $-0.3V \leq V_{IL} \leq 0.8V$<br>$3.1V \geq V_{OH} \geq 2.4V$ , $-0.3 \leq V_{OL} \leq 0.4V$ |
| 7. | GPIO[0] | I/O | General purpose I/O | $3.6 \geq V_{IH} \geq 2.0V$ , $-0.3V \leq V_{IL} \leq 0.8V$<br>$3.1V \geq V_{OH} \geq 2.4V$ , $-0.3 \leq V_{OL} \leq 0.4V$ |
| 8. | GPIO[1] | I/O | General purpose I/O | $3.6 \geq V_{IH} \geq 2.0V$ , $-0.3V \leq V_{IL} \leq 0.8V$<br>$3.1V \geq V_{OH} \geq 2.4V$ , $-0.3 \leq V_{OL} \leq 0.4V$ |
| 9. | N.C | x | x | x |
| 10. | N.C | x | x | x |

| | | | | |
|---|---|---|---|---|
| 11. | V_BATTERY | I | Backup voltage supply | DC + 2.5 ~ +3.6V<br>Current ≤ 6uA(Max) |
| 12. | VIN_3V3 | I | DC Supply Voltage input | DC +3.3V±5% |
| 13. | VDD_USB | I | DC Supply for USB | DC +3.3V±5% |
| 14. | USB_DM | I/O | USB_D- | Standard USB Interface |
| 15. | USB_DP | I/O | USB_D+ | Standard USB Interface |
| 16. | N.C | x | x | x |
| 17. | RF_VOUT | O | Supply Antenna | 2V8@20mA |
| 18. | GND | G | Ground | Reference Ground |
| 19. | RF_IN | I | GPS Signal input | 50 Ω @1,575.42GHz |
| 20. | GND | G | Ground | Reference Ground |
| 21. | GND | G | Ground | Reference Ground |
| 22. | GND | G | Ground | Reference Ground |

**VIN_3V3(+3.3V DC power Input)**

This is the DC power supply input pin for GPS system. It provides voltage to module.

**GND**

GND provides the reference ground.

**RXA/B & TXA/B**

This is as NEMA output and PMTK command input.

**VDD_USB (+3.3V DC power Input)**

This is the DC power supply input pin for USB.

**VDD_DP & VDD_DM**

This interface is automatically converted to COM port to HOST operating system. Users can update firmware through this interface.

**RF_IN**

This pin receives GPS analog signal. The line on the PCB between the antenna(or antenna connector) has to be a controlled impedance line (Microstrip at 50Ω).

**RF_VOUT**

This pin can provide maximum power 2.8V(TYP) for active antenna.

**PPS**

This pin provides one pulse-per-second output from the board, which is synchronized to GPS time. This pin must pull down.

**V_RTC_3V3 (Backup battery)**

This is the battery backup input, when main power is removed. Current draw is 6uA(Max).

The supply voltage should be between 2.5V and 3.6V.

**GPIO Functions**

Several I/Os are connected to the digital interface connector for customer applications.

# 2 2. Software Interface

**NMEA Protocol**

NMEA Output Messages: the Engine board outputs the following messages as shown in Table 1:

**Table 1 NMEA-0183 Output Messages**

| NMEA Record | Description |
|---|---|
| GGA | Global positioning system fixed data |
| GSA | GNSS DOP and active satellites |
| GSV | GNSS satellites in view |
| RMC | Recommended minimum specific GNSS data |
| GLL | Geographic position – latitude/longitude |
| VTG | Course over ground and ground speed |

**GGA-Global Positioning System Fixed Data**

**Table 2 contains the values of the following example:**

**$GPGGA, 161229.487, 3723.2475, N, 12158.3416, W, 1, 07, 1.0, 9.0, M, , , ,0000*18**

**Table 2 GGA Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGGA | | GGA protocol header |
| UTC Position | 161229.487 | | hhmmss.sss |
| Latitude | 3723.2475 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | Dddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| Position Fix Indicator | 1 | | See Table 2-1 |
| Satellites Used | 07 | | Range 0 to 12 |
| HDOP | 1.0 | | Horizontal Dilution of Precision |
| MSL Altitude | 9.0 | meters | |
| Units | M | meters | |
| Geoid Separation | | meters | |

| | | | |
|---|---|---|---|
| Units | M | meters | |
| Age of Diff. Corr. | | second | Null fields when DGPS is not used |
| Diff. Ref. Station ID | 0000 | | |
| Checksum | *18 | | |
| ＜CR＞＜LF＞ | | | End of message termination |

**Table 3 Position Fix Indicators**

| Value | Description |
|---|---|
| 0 | Fix not available or invalid |
| 1 | GPS SPS Mode, fix valid |
| 2 | Differential GPS, SPS Mode, fix valid |
| 3-5 | Not Supported |
| 6 | Dead Reckoning Mode, fix valid |

**GSA-GNSS DOP and Active Satellites**

Table 4 contains the values of the following example:

$GPGSA, A, 3, 07, 02, 26, 27, 09, 04, 15, , , , , , 1.8,1.0,1.5*33

**Table 4 GSA Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGSA | | GSA protocol header |
| Mode 1 | A | | See Table 5 |
| Mode 2 | 3 | | See Table 6 |
| ID of Satellite Used | 07 | | Sv on Channel 1 |
| ID of Satellite Used | 02 | | Sv on Channel 2 |
| …. | | | …. |
| ID of Satellite Used | | | Sv on Channel 12 |
| PDOP | 1.8 | | Position Dilution of Precision |
| HDOP | 1.0 | | Horizontal Dilution of Precision |
| VDOP | 1.5 | | Vertical Dilution of Precision |
| Checksum | *33 | | |
| ＜CR＞＜LF | | | End of message termination |

| | | | |
|---|---|---|---|
| > | | | |

**Table 5 Mode 1**

| Value | Description |
|---|---|
| M | Manual-forced to operate in 2D or 3D mode |
| A | Automatic-allowed to automatically switch 2D/3D |

**Table 6 Mode 2**

| Value | Description |
|---|---|
| 1 | Fix not available |
| 2 | 2D |
| 3 | 3D |

**GSV-GNSS Satellites in View**

Table 7 contains the values of the following example:

$GPGSV, 2, 1, 07, 07, 79, 048, 42, 02, 51, 062, 43, 26, 36, 256, 42, 27, 27, 138, 42*71

$GPGSV, 2, 2, 07, 09, 23, 313, 42, 04, 19, 159, 41, 15, 12, 041, 42*41

**Table 7 GSV Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGSV | | GSV protocol header |
| Total Number of Messages[1] | 2 | | Range 1 to 3 |
| Messages Number[1] | 1 | | Range 1 to 3 |
| Satellites in View | 07 | | |
| Satellite ID | 07 | | Channel 1(Range 1 to 32) |
| Elevation | 79 | degrees | Channel 1(Range 00 to 90) |
| Azimuth | 048 | degrees | Channel 1(True, Range 000 to 359) |
| SNR (C/No) | 42 | dBHz | Channel 1(Range 0 to 99, null when not tracking) |
| Satellite ID | 27 | | Channel 4(Range 01 to 32) |

| | | | |
|---|---|---|---|
| Elevation | 27 | degrees | Channel 4(Range 00 to 90) |
| Azimuth | 138 | degrees | Channel 4(True, Range 000 to 359) |
| SNR (C/No) | 42 | dB-Hz | Channel 4(Range 00 to 99, null when not tracking) |
| Checksum | *71 | | |
| ＜CR＞＜LF＞ | | | End of message termination |

[1]Depending on the number of satellites tracked multiple messages of GSV data may be required.

**RMC-Recommended Minimum Specific GNSS Data**

Table 8 contains the values of the following example:

$GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13, 309.62, 120598, ,*10

**Table 8 RMC Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPRMC | | RMC protocol header |
| UTC Time | 161229.487 | | hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |
| Latitude | 3723.2475 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | dddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| Speed Over Ground | 0.13 | knots | True |
| Course Over Ground | 309.62 | degrees | |
| Date | 120598 | | ddmmyy |
| Magnetic Variation | | degrees | |
| Variation sense | | | E=east or W=west (Not shown) |
| Mode | A | | A=Autonomous, D=DGPS, E=DR |
| Checksum | *10 | | |
| <CR><LF> | | | End of message termination |

**VTG-Course Over Ground and Ground Speed**

Table 9 contains the values of the following example:

$GPVTG,79.65,T,,M,2.69,N,5.0,K,A*38

**Table 9 VTG Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPVTG | | VTG protocol header |
| Course over rgound | 79.65 | degrees | Measured heading |
| Reference | T | | True |
| Course over ground | | degrees | Measured heading |
| Reference | M | | Magnetic |
| Speed over ground | 2.69 | Knots | Measured speed |
| Units | N | | Knots |
| Speed over ground | 5.0 | Km/hr | Measured speed |
| Units | K | | Kilometer per hour |
| Mode | A | | A-autonomous, D=DGPS, E=DR |
| Checksum | *38 | | |
| <CR><LF> | | | End of message termination |
| | | | |
| | | | |
| | | | |

**GLL-Geographic Position – Latitude/Longitude**

Table 10 contains the values of the following example:

$GPGLL,2503.6319,N,12136.0099,E,053740.000,A,A*52

**Table 10 GLL Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGLL | | GLL protocol header |
| Latitude | 2503.6319 | | ddmm.mmmm |
| N/S indicator | N | | N=north or S=south |
| Longitude | 12136.0099 | | Dddmm.mmmm |
| E/W indicator | E | | E=east or W=west |
| UTC Time | 053740.000 | | hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |
| Mode | A | | A=autonomous, D=DGPS, E=DR |
| Checksum | *52 | | |
| <CR><LF> | | | End of message termination |

## 3 RoHS Reflow Diagram

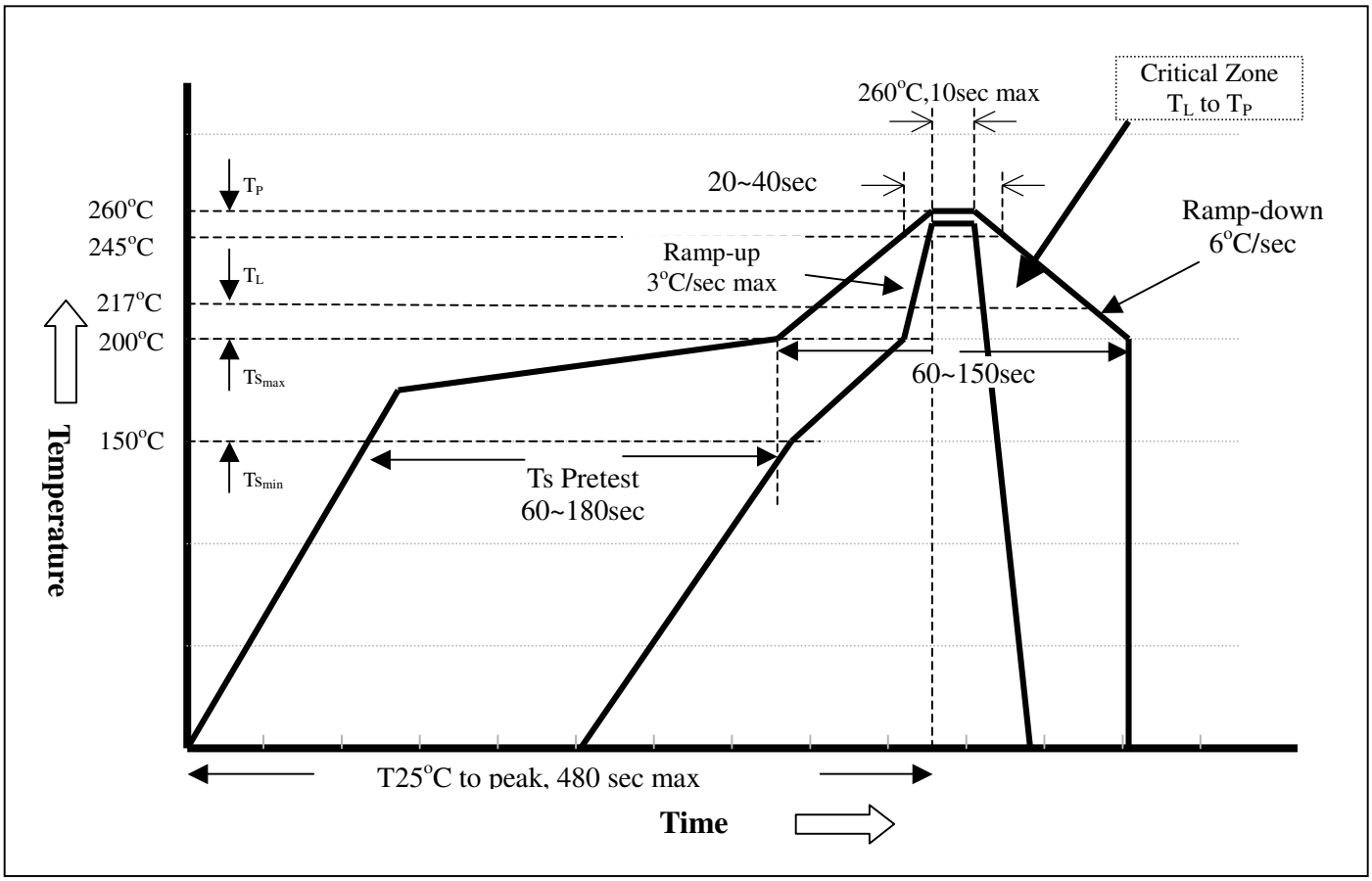
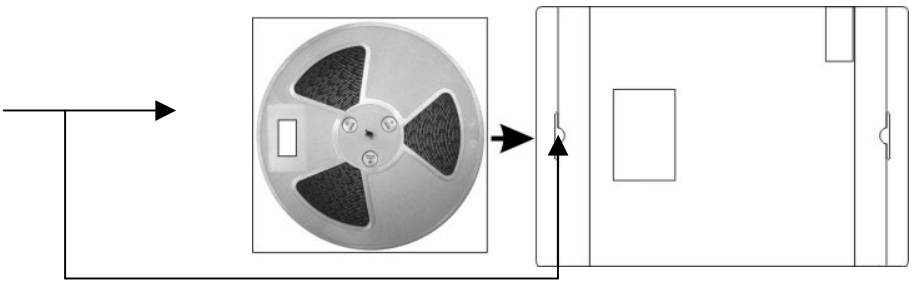



**Figure 1 RoHS Reflow Diagram**

## 4 Package Specification and Order Information

Shipment Method: Tape and reel

SMT type with stamp holes (22 holes)



## 5 Contact Royaltek

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## 6 Revision History

| Title | MEB-1315 GPS Receiver Module | | |
|---|---|---|---|
| Doc Type | User Manual | | |
| Revision Number | Date | Author | Change notice |
| 1.0 | 2009/01/16 | May Chen | Final Version |