

MEB-1000 User Manual

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Prepared by RoyalTek Company LTD.

8F,256 Yang Guang Street, Neihu Chiu, Taipei, Taiwan

TEL: 886-2-77215000

FAX: 886-2-77215666

<http://www.royaltek.com/contact>

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1 Introduction

RoyalTek MEB-1000 small form factor board is the newest generation of RoyalTek GPS module. The module is powered by MediaTek MT3301 and MT3179. 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.

1.1 Product Features

- ◇ 32 parallel channels
- ◇ SMT type with stamp holes
- ◇ High quality stereo audio output
- ◇ TCXO design
- ◇ 0.1 second reacquisition time
- ◇ NMEA-0183 compliant protocol/ customize protocol
- ◇ Enhanced algorithm for navigation stability
- ◇ Excellent sensitivity for urban canyon and foliage environments.
- ◇ DGPS (WAAS, EGNOS) support
- ◇ Auto recovery while RTC crashes

1.2 Product Applications

- ◇ Automotive navigation
- ◇ Personal positioning and navigation
- ◇ Marine navigation
- ◇ Timing application

1.3 Product Pictures

(1) MEB-1000



Figure 1 MEB-1000 Picture

(2) MEB-1000 Interface board



Figure 2 MEB-1000 Interface Board

1.4 The interface Board Pin Definition

Table 1-1 J2 Connector

Pin #	Signal Name	I/O	Description	Characteristics
1	ANTPWR	I	DC Supply Voltage Output	3.3V±5%
2	NC			
3	VBAT	I	RTC Backup Battery Supply	DC +1.6 ~ +3.6V

4	VCC	I	DC Supply Voltage Output	3.3V±5%
5	Reset	I	External Reset Signal	
6	NC			
7	NC			
8	NC			
9	NC			
10	NC			
11	TX0	O	Serial Port 0	
12	RX0	I	Serial Port 0	
13	NC			
14	TX1	O	Serial Port 1	
15	RX1	I	Serial Port 1	
16	NC			
17	NC			
18	GND	G	Reference Ground	
19	Time Mark	O	One pulse per second	
20	GND	G	Reference Ground	

Table 1-2 Switch U4

Pin #	Signal Name	0/1	Description	Characteristics
1	GPIO-0		GPIO input/output	Switch: 0:Low 1:High CMOS TTL Level
2	GPIO-4		GPIO input/output	Switch: 0:Low 1:High CMOS TTL Level
3	N.C			
4	N.C			
5	GPS_3V3		Power supply for GPS section	Switch: 0:Low 1: DC 3.3V output
6	N.C			
7	N.C			
8	RF_Bias		RF_Bias voltage switch	0: open. No voltage provide antenna. 1:Provide 2.85V to

				antenna.
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Table 1-3 Connector:

Pin #	Description	Characteristics
J1	GPS RF Connector	1575.42MHz

1.5 RoyalTek Evaluation Kit MEV-1000 for MEB-1000

(Please refer to RoyalTek Evaluation Kit MEV-1000 for MEB-1000 Operational Manual for more information)

1.6 MEB-1000 System Block Diagram

System block diagram description:

- (1) External antenna.
- (2) 4 Mega bits flash memory
- (3) 31 pin I/O pin

Antenna

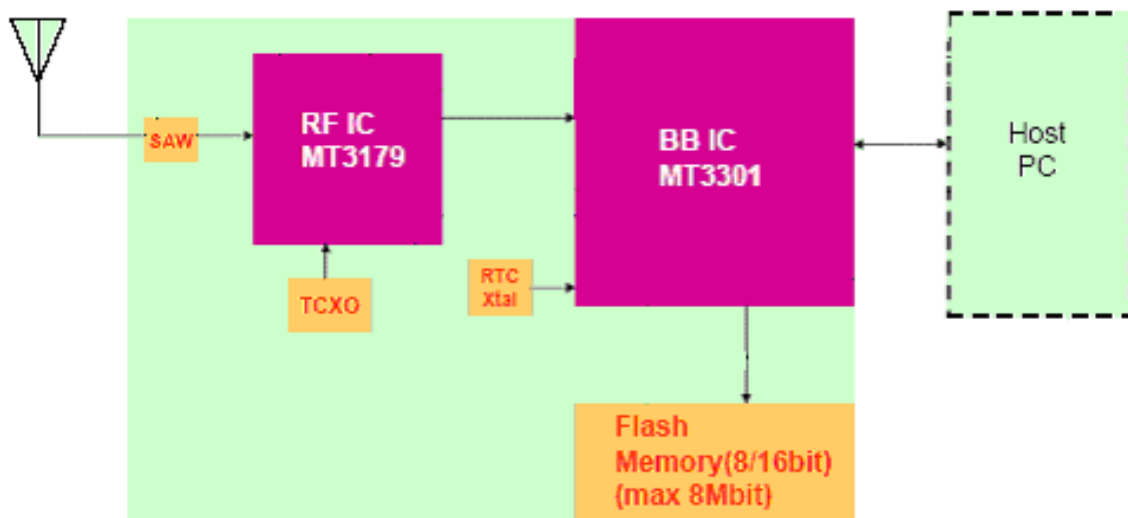


Figure 3 Block Diagram

1.7 MEB-1000 Technical Specification

Impedance : 50Ω

No	Function	Specification
GPS receiver		
1	Chipset	MediaTek MT3179 (RF)& MT3301 (Digital)
2	Frequency	L1 1575.42MHz.
3	Code	C.A. Code.
4	Channels	32
5	Sensitivity (Acquisition)	-130dBm.
6	Cold start	36 sec (open sky)
7	Warm start	35 sec (open sky)
8	Hot start	1 sec (open sky)

9	Reacquisition	< 1sec
10	Position accuracy	3 meters 2D RMS(w/o aid)
11	Maximum altitude	18000 m
12	Maximum velocity	515 m/s
13	Trickle power mode	N/A
14	Update rate	1Hz
15	Testability	N/A
16	Protocol setup	It can store the protocol setup in the SRAM and Flash memory.
17	DGPS	1.WAAS, EGNOS 2.RTCM protocol
Interface		
18	LNA	No LNA
19	I/O Pin	31pin
Mechanical requirements		
20	Weight	≤ 3.5g
Power consumption		
21	Vcc	DC 3.3 ±5%
22	Current	GPS : < 65mA@3.3V (ACQ w/o ext. Antenna) < 40mA@3.3V (Tracking w/o ext. Antenna)
Environment		
23	Operating temperature	-30 ~ 85°C
24	Storage temperature	-40 ~ 85°C

1.8 Application Circuit

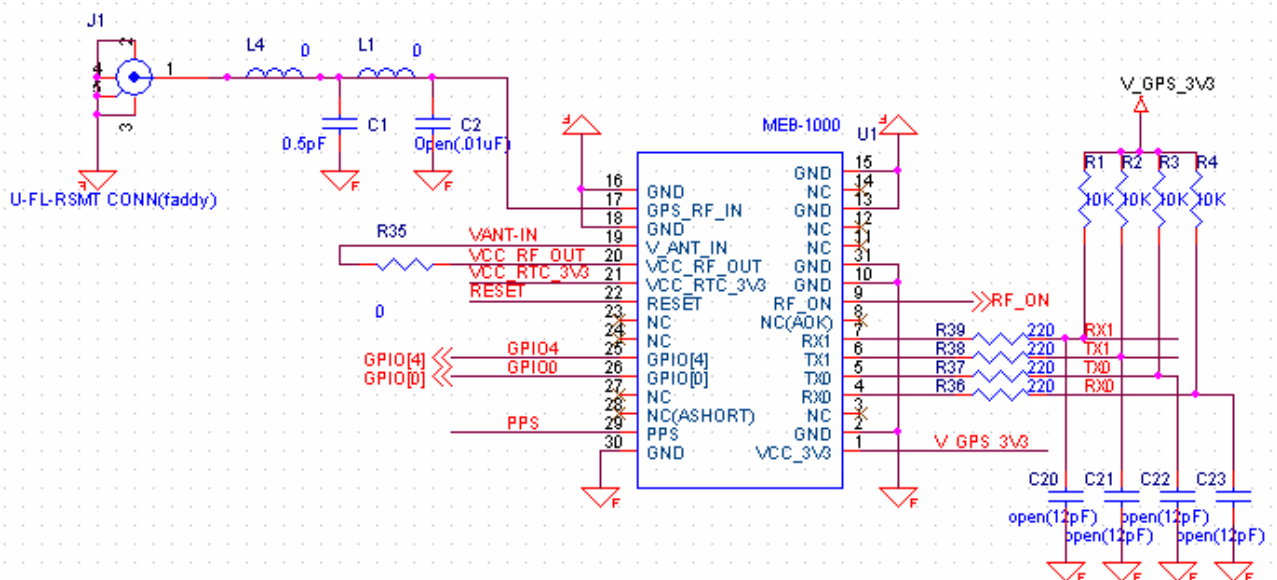


Figure 4 Application Circuit

Note:

(1) Serial Interface:

- (I)The TXA & RXA pin is recommended to connect to serial resistance(220 Ω) and pull up (10K Ω). It can increase the stability of serial data.
- (II)The TXB & RXB pin is recommended to connect to serial resistance(220 Ω) and pull up (10K Ω), if use the DGPS output.
If no use DGPS output, it don't connect anything.

(2) Backup Battery:

It's recommended to connect a backup battery to V_RTC_3V3. In order to enable the warm start and hot start features of the GPS receiver. If you don't intend to use a backup battery, connect this pin to GND or open. If you use backup battery, should be add a bypassing capacitor (10uF) at V_RTC_3V3 pin. It can reduce noise and increase the stability.

(3) GPS_RF_IN:

Connecting to the antenna has to be routed on the PCB. The transmission line must to controlled impedance to connect RF_IN to the antenna or antenna connector of your choice. (Impedance 50 Ω)

(4) Power:

Connect V_GPS_3V3 pin to DC 3.3V. The power supply must add bypassing

capacitor(10uF and 1uF).It can reduce the Noise from power supply and increase power stability.

(5) Active antenna bias voltage:

The Vcc_RF_OUT pin(pin 20) is provide voltage 2.85V. If you use active antenna, you can connect this pin to V_ANT_IN pin (pin 19) to provide bias voltage of active antenna. The bias voltage will be through GPS_RF_IN pin to provide active antenna bias voltage from Vcc_RF_OUT pin.

If your bias voltage of active antenna isn't 2.85V, you can input bias voltage to V_ANT_IN pin (pin 19).And input bias voltage of you need. The input bias voltage will through GPS_RF_IN pin to provide active antenna bias voltage from V_ANT_IN pin.

PS:

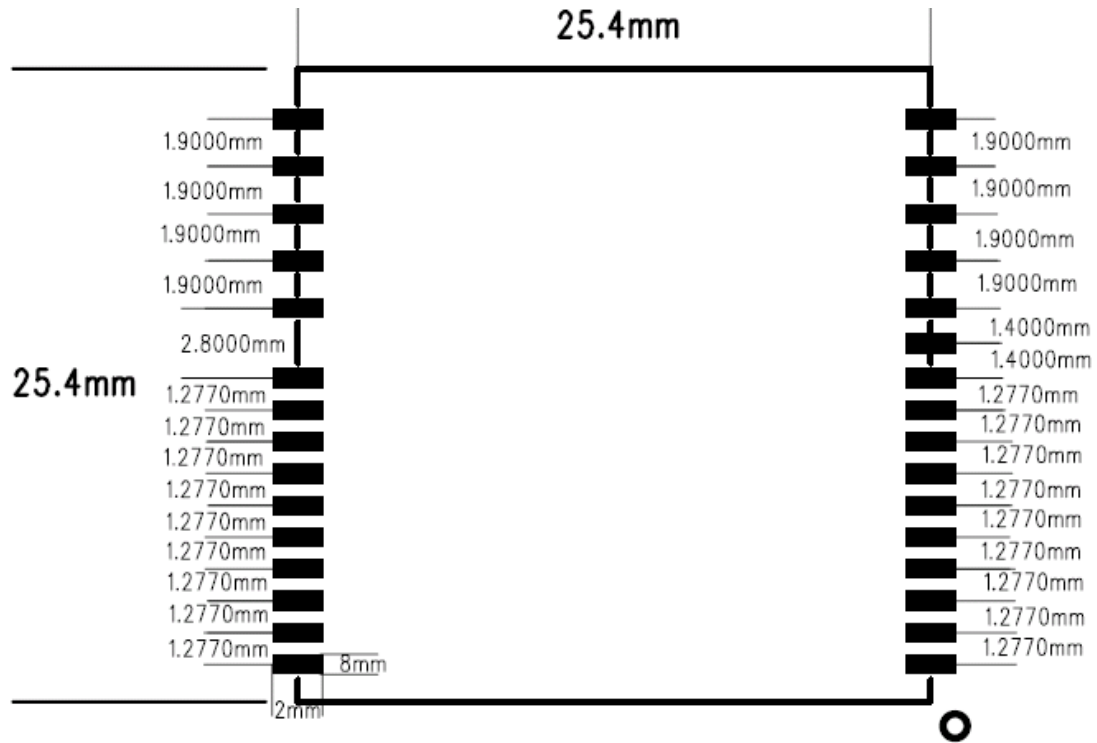
- (1) The maximum power consumption of active antenna is about 100mW.
- (2) Suggest input gain > 20dB , and NF < 1.5 dB .

(6) GPIO:

The GPIO pin is recommended to connect to serial resistance(220Ω),if use the GPIO function.

If no use GPIO function, it don't connect anything.

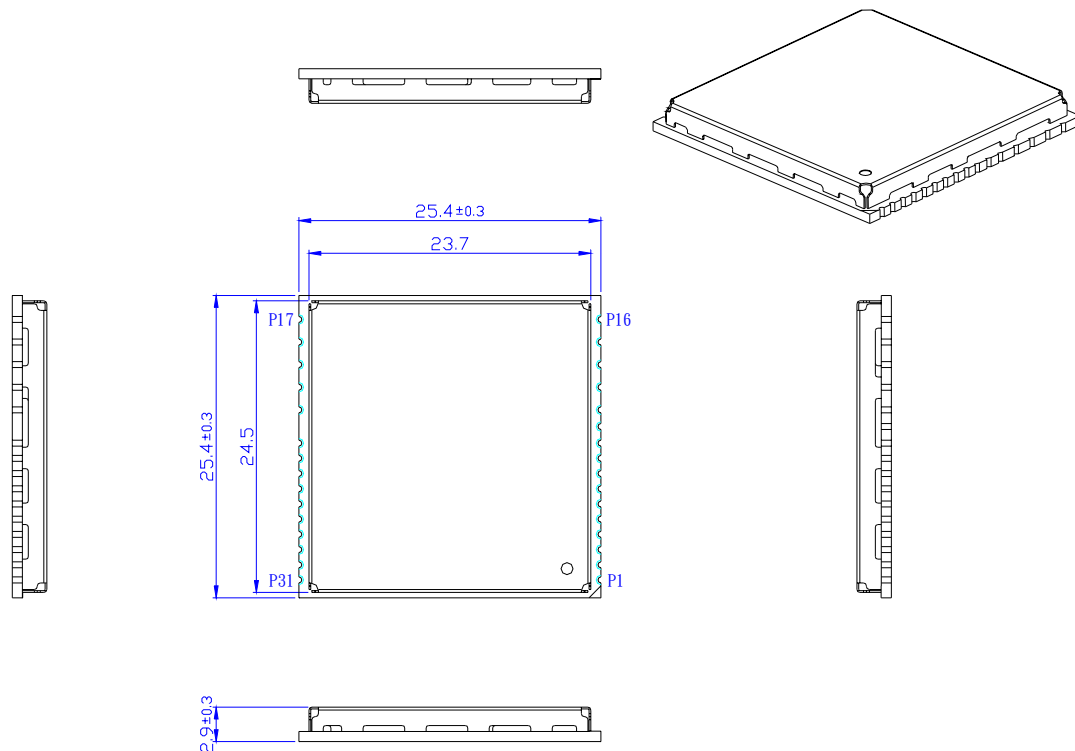
1.9 Recommended Layout PAD



TOP View

Figure 5 Recommended Layout Pad

1.10 Mechanical Layout



Unit : mm

Figure 6 Mechanical Layout

1.11 Hardware Interface

Interface Pin Number:

TOP VIEW

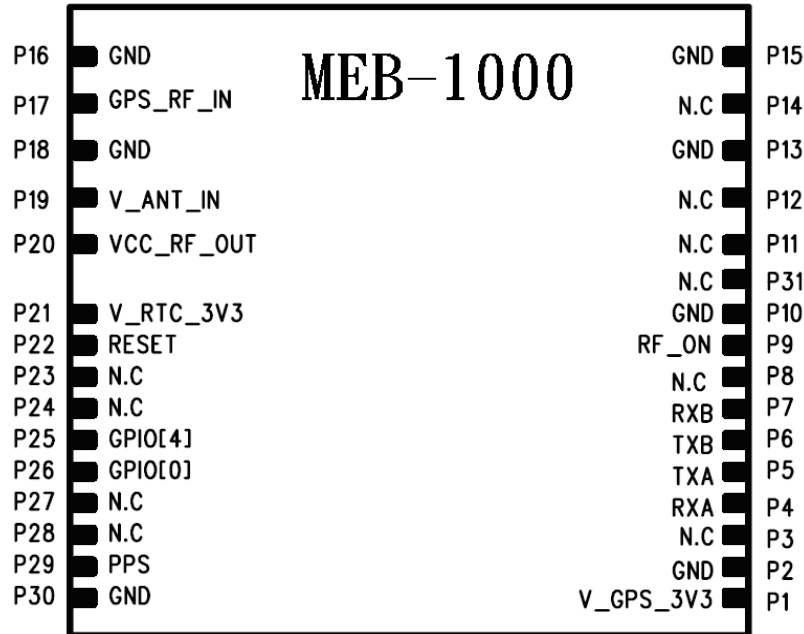


Figure 7 Interface Pin Number

Table 1-4 Pin Definition

Pin #	Signal Name	I/O	Description	Characteristics
1	V_GPS_3V3	I	DC Supply Voltage input	DC +3.3V±5%
2	GND	G	Ground	Reference Ground
3	N.C			
4	RXA	I	Serial port A	$3.6V \geq V_{IH} \geq 2V$ $-0.3V \leq V_{IL} \leq 0.8V$
5	TXA	O	Serial port A	$3.15V \geq V_{OH} \geq 2.4V$ $-0.3V \leq V_{OL} \leq 0.4V$
6	TXB	O	Serial port B	$3.15V \geq V_{OH} \geq 2.4V$ $-0.3V \leq V_{OL} \leq 0.4V$
7	RXB	I	Serial port B	$3.6V \geq V_{IH} \geq 2V$ $-0.3V \leq V_{IL} \leq 0.8V$
8	N.C			
9	RF_ON	O	Indicates power state of RF part	$V_{OH} = 2.85V$ $V_{OL} = 0V$
10	GND	G	Ground	Reference Ground
11	N.C			
12	N.C			
13	GND	G	Ground	Reference Ground

14	N.C			
15	GND	G	Ground	Reference Ground
16	GND	G	Ground	Reference Ground
17	GPS_RF_IN	I	GPS Signal input	50 Ω @1.57542GHz
18	GND	G	Ground	Reference Ground
19	V_ANT_IN	I	Active Antenna Bias voltage	Receiving DC power supply for active antenna bias.
20	VCC_RF_OUT	O	Supply Antenna Bias voltage	$V_O = 2.85V \pm 5\%$ Current < 35mA
21	V_RTC_3V3	I	Backup voltage supply	DC +1.6 ~ +3.6V Current ≤ 10uA
22	Reset	I	Reset (Active low)	$3.6V \geq V_{IH} \geq 2V$ $-0.3V \leq V_{IL} \leq 0.8V$
23	N.C			
24	N.C			
25	GPIO4	I/O	General purpose I/O	$3.6V \geq V_{IH} \geq 2V$ $-0.3V \leq V_{IL} \leq 0.8V$ $3.15V \geq V_{OH} \geq 2.4V$ $-0.3V \leq V_{OL} \leq 0.4V$
26	GPIO0	I/O	General purpose I/O	$3.6V \geq V_{IH} \geq 2V$ $-0.3V \leq V_{IL} \leq 0.8V$ $3.15V \geq V_{OH} \geq 2.4V$ $-0.3V \leq V_{OL} \leq 0.4V$
27	N.C			
28	N.C			
29	PPS	O	One pulse per second	$3.15V \geq V_{OH} \geq 2.4V$ $-0.3V \leq V_{OL} \leq 0.4V$
30	GND	G	Ground	Reference Ground
31	N.C			

V_GPS_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 ground .

RXA

This is the main receiver channel and is used to receive software commands to the board from PowerGPS software or from user written

software.

RXB

This is the auxiliary receiving channel and is used to input differential corrections to the board to enable DGPS navigation.(Option)

TXA

This is the main transmitting channel and is used to output navigation and measurement data to PowerGPS or user written software.

TXB

For user's application (not currently used).

RF_ON

This pin indicates state of RF voltage.

GPS_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).

V_ANT_IN

This pin is reserved as external DC power supply input for active antenna.

If using 2.85V active antenna, pin 20 has to be connected to pin 19.

If using 3.3V or 5V active antenna ,this pin has to be connected to 3.3V or 5V power supply.

PS: The current must be $\leq 100\text{mA}$ and voltage $\leq 12\text{V}$,if using external power supply.

VCC_RF_OUT

This pin can provide power 35mA@2.85V for active antenna.

Reset

This pin provides an active-low reset input to the board. It causes the board to reset and start searching for satellites. If not utilized, it may be left open.

PPS

This pin provides one pulse-per-second output from the board, which is synchronized to GPS time. This is not available in Trickle Power mode.

V_RTC_3V3 (Backup battery)

This is the battery backup input that powers the SRAM and RTC when main power is removed. Typical current draw is 10uA.

The supply voltage should be between 1.6V and 3.6V.

GPIO Functions

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

2 Software Interface

2.1 NMEA V3.1 Protocol

Its output signal level is TTL: 4800 bps (default), 8 bit data, 1 stop bit and no parity. It supports the following NMEA-0183

Messages: GGA, GSA, GSV, RMC .

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

Table 2-1 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

GGA-Global Positioning System Fixed Data

Below table 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 2-2 GGA Data Format

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Position	161229.48 7		hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.341 6		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 2-3 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 GPS PPS Mode, fix valid
6	Dead Reckoning Mode, fix valid

GSA-GNSS DOP and Active Satellites

Below table 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 2-4 GSA Data Format

Name	Example	Units	Description
Message ID	\$GPGSA		GSA protocol header
Mode 1	A		See Table 4-2
Mode 2	3		See Table 4-1
Satellite Used	07		Sv on Channel 1
Satellite Used	02		Sv on Channel 2
....		
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 2-5 Mode 1

Value	Description
1	Fix not available
2	2D

3	3D
---	----

Table 2-6 Mode 2

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

GSV-GNSS Satellites in View

Below table 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 2-7 GGA Data Format

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
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(Maximum 90)
Azimuth	048	degrees	Channel 1(True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
....		
Satellite ID	27		Channel 4(Range 1 to 32)
Elevation	27	degrees	Channel 4(Maximum 90)
Azimuth	138	degrees	Channel 4(True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
Checksum	*71		
<CR> <LF>			End of message termination

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

RMC-Recommended Minimum Specific GNSS Data

Below table contains the values of the following example:

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

Table 2-8 GGA Data Format

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC Position	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	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation		degrees	E=east or W=west
Mode	A		A=Autonomous, D=DGPS, E=DR
Checksum	*10		

3 RoHS Reflow Diagram

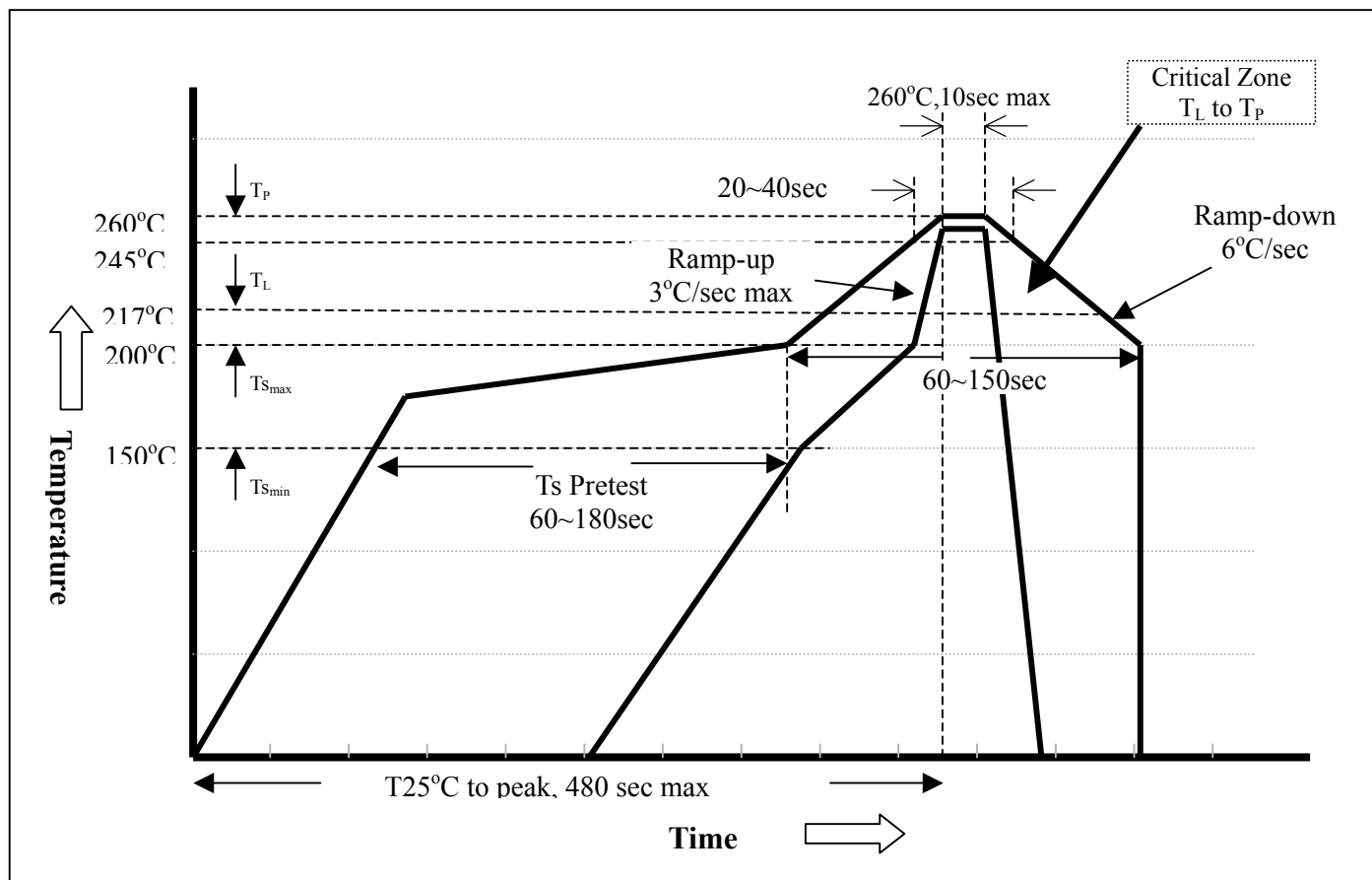


Figure 8 RoHS Reflow Diagram

4 Package Specification and Order Information

Shipment Method: Tape and reel

SMT type with stamp holes (31 holes)

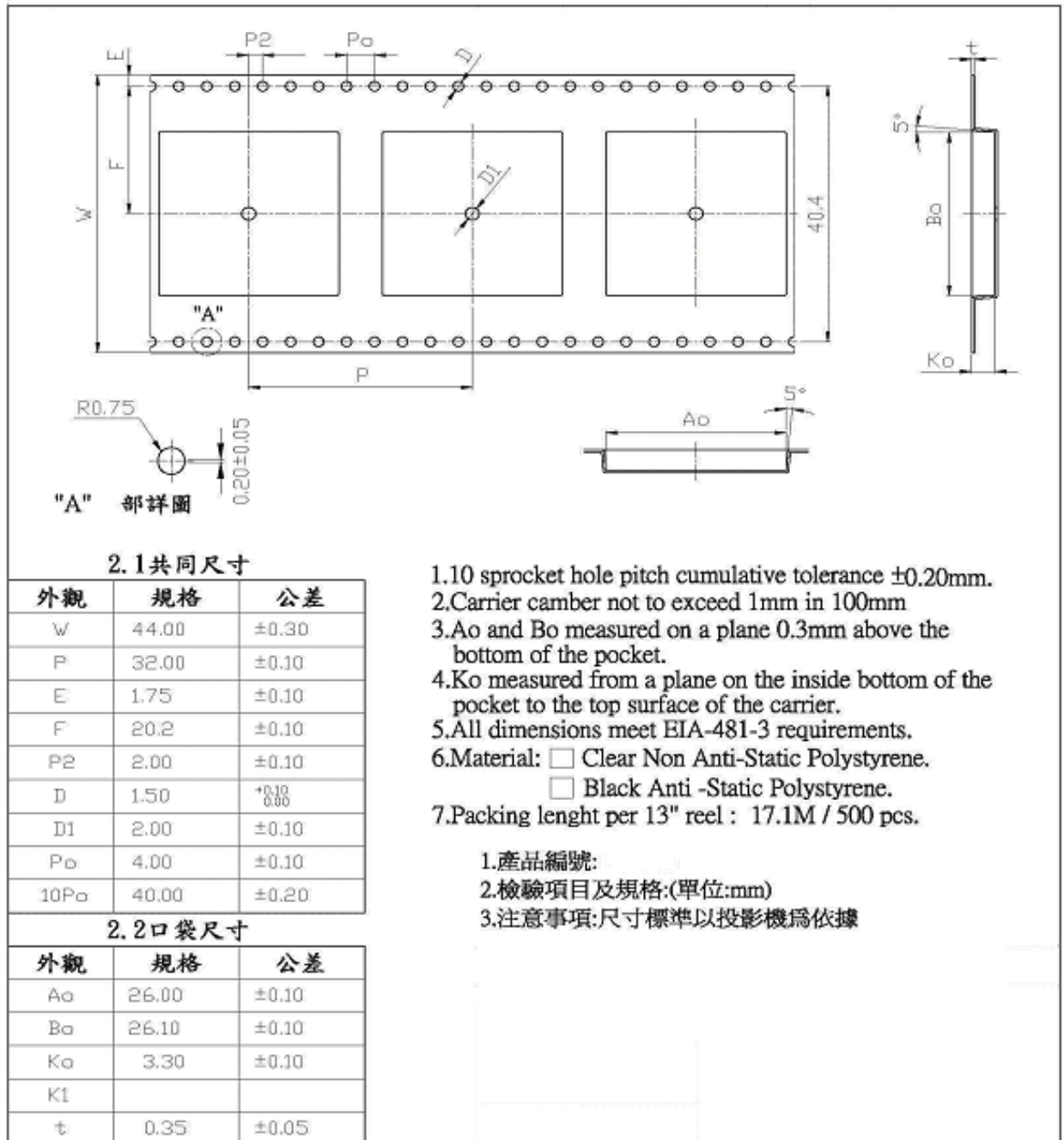


Figure 9 Tape & Reel Packaging Information

5 Contact Information

Contact: sales@royaltek.com

Headquarter:

Address: 8F, 256 Yang Guang Street, Neihu Chiu, Taipei, Taiwan

Tel: 886-2-77215000

Fax: 886-277215666

Web Site: <http://www.royaltek.com>

Web Site Customer Service: <http://www.royaltek.com/contact>

6 Revision History

Title	MEB-1000 GPS Receiver Module		
Doc Type	User Manual		
Revision Number	Date	Author	Change notice
1.0	2007/05/25	Amy Liu	Initial Release

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