MEB-1280 User Manual

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文件編號：

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1 Introduction

RoyalTek MEB-1280 small form factor board is the newest generation of RoyalTek GPS module. RoyalTek proprietary navigation technology provides you 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-1280

Figure 1 MEB-1280 Picture

(2) MEB-1280 Interface board

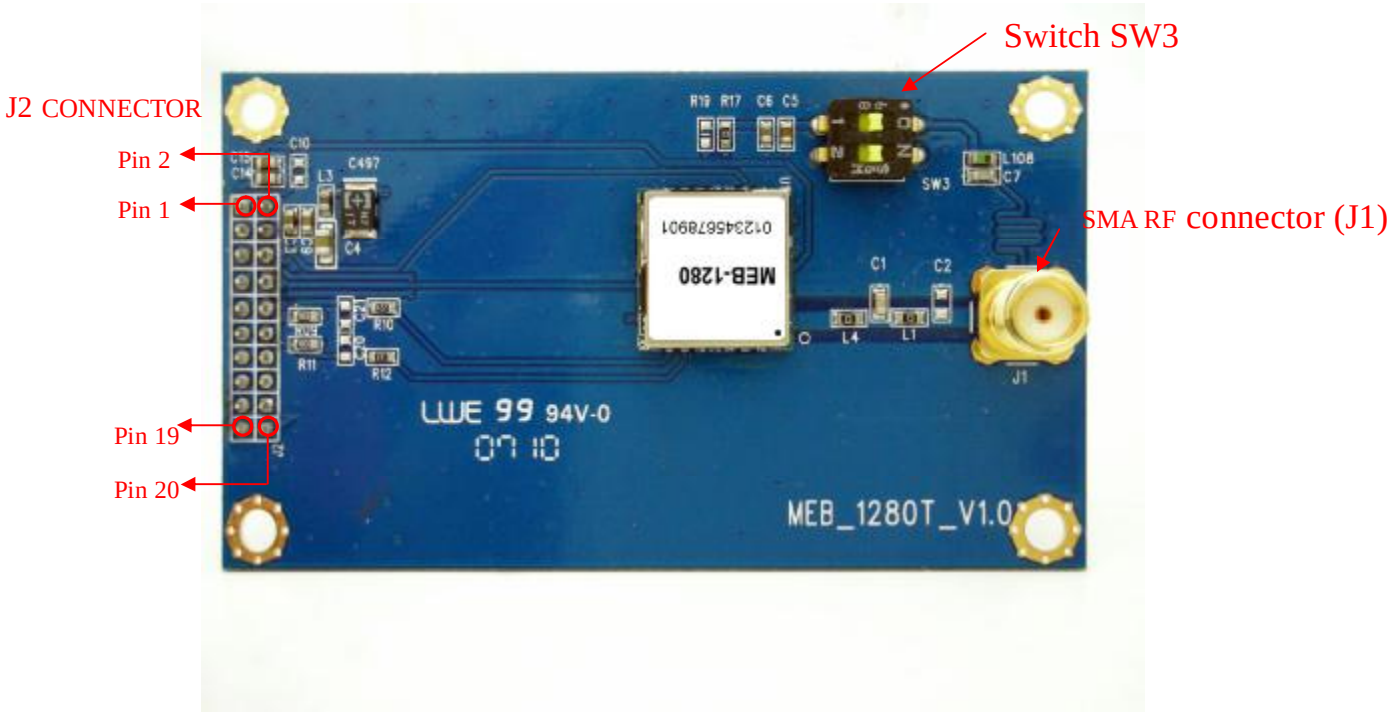


Figure 2 MEB-1280 Interface Board

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	$DC + 2.5 \sim +3.6V$
4	VCC	I	DC Supply Voltage Output	3.3V±5%
5	nRESET	I	System reset (Active low)	$3.6V \geq V_{IH} \geq 2V \quad -0.3V \leq V_{IL} \leq 0.8V$
6	NC			
7	GPIO5/SCS0#	I/O	General purpose I/O	$3.6V \geq V_{IH} \geq 2V \quad -0.3V \leq V_{IL} \leq 0.8V$ $3.15V \geq V_{OH} \geq 2.4V \quad -0.3V \leq V_{OL} \leq 0.4V$
8	GPIO6/SO	I/O	General purpose I/O	$3.6V \geq V_{IH} \geq 2V \quad -0.3V \leq V_{IL} \leq 0.8V$ $3.15V \geq V_{OH} \geq 2.4V \quad -0.3V \leq V_{OL} \leq 0.4V$
9	GPIO7/SIN	I/O	General purpose I/O	$3.6V \geq V_{IH} \geq 2V \quad -0.3V \leq V_{IL} \leq 0.8V$ $3.15V \geq V_{OH} \geq 2.4V \quad -0.3V \leq V_{OL} \leq 0.4V$
10	GPIO8/SCK	I/O	General purpose I/O	$3.6V \geq V_{IH} \geq 2V \quad -0.3V \leq V_{IL} \leq 0.8V$ $3.15V \geq V_{OH} \geq 2.4V \quad -0.3V \leq V_{OL} \leq 0.4V$
11	TX0	O	Serial Port 0	$3.15V \geq V_{OH} \geq 2.4V \quad -0.3V \leq V_{OL} \leq 0.4V$
12	RX0	I	Serial Port 0	$3.6V \geq V_{IH} \geq 2V \quad -0.3V \leq V_{IL} \leq 0.8V$
13	GPIO3	I/O	General purpose I/O	$3.6V \geq V_{IH} \geq 2V \quad -0.3V \leq V_{IL} \leq 0.8V$ $3.15V \geq V_{OH} \geq 2.4V \quad -0.3V \leq V_{OL} \leq 0.4V$
14	NC			
15	NC			
16	NC			
17	NC			
18	GND	G	Reference Ground	
19	PPS	I/O	One pulse per second	$3.6V \geq V_{IH} \geq 2V \quad -0.3V \leq V_{IL} \leq 0.8V$ $3.15V \geq V_{OH} \geq 2.4V \quad -0.3V \leq V_{OL} \leq 0.4V$

20	GND	G	Reference Ground	

Table 1-2 Switch SW3

Pin #	Signal Name	0/1	Description	Characteristics
1	VCC_ANT_2V85		Bias voltage switch for Active Antenna	0: open. No voltage provide antenna. 1:Provide 2.85V to antenna.

Table 1-3 J1 Connector:

Pin #	Description	Characteristics
J1	GPS RF Connector	1575.42MHz

VCC(+3.3V DC power Input)

This is the main DC power supply input pin. It provides voltage to module.

GND

GND provides the ground .

RX0(NMEA), RX1(DGPS)

This is the main receiver channel and is used to receive software commands to the board from application software.

TX0(NMEA), TX1(DGPS)

This is the main transmitting channel and is used to output navigation and measurement data to application software.

Reset

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

Time Mark (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.

VBAT (Backup battery voltage Output)

This is the backup battery voltage output that powers the SRAM and RTC of module when main power is removed.

GPIO Functions

Several I/Os are connected to the digital interface connector for custom applications. (GPIO5、GPIO6、GPIO7、GPIO8 could be used as serial interface between module and serial flash)

ANTPWR (External GPS Antenna Power Output)

This pin is reserved to supply the power of GPS external Antenna (3.3V)

Switch (SW3)

The switch pin1 is switched to provide voltage bias for active antenna.

If you use active antenna (bias 2.85V), you can use switch pin1 to provide voltage. If you use passive antenna, you have to set the switch to 0.

RF connector (J1):

This pin receives signal of GPS analog.

1.5 RoyalTek Evaluation Kit MEV-1000 for MEB-1280

(Please refer to RoyalTek Evaluation Kit MEV-1000 for MEB-1280 Operational Manual for more information)

1.6 MEB-1280 System Block Diagram

System block diagram description:

(1) External antenna.

(2) 4 Mega bits flash memory

(3) 28 pin I/O pin

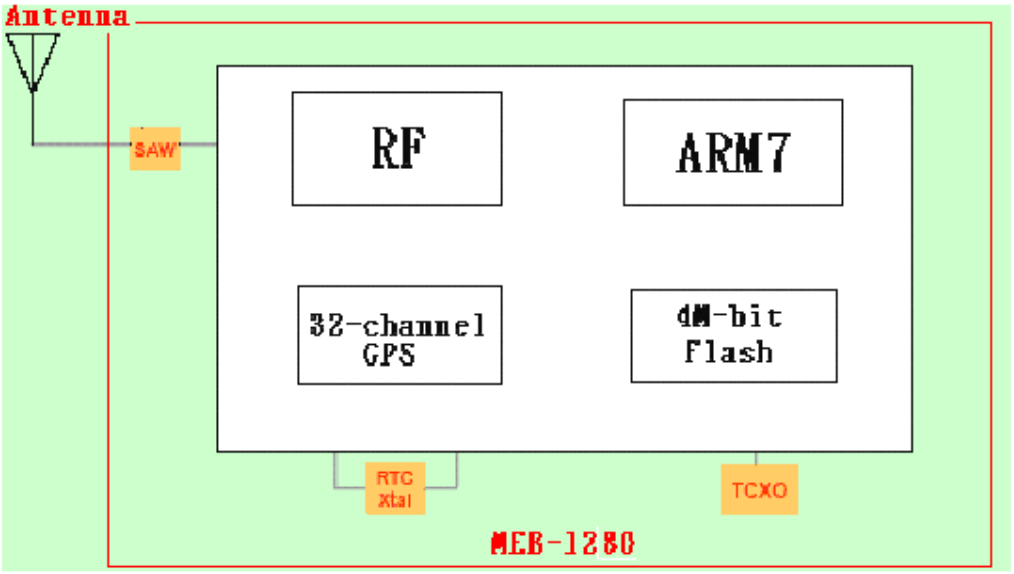


Figure 3 Block Diagram

1.7 MEB-1280 Technical Specification

Impedance：50Ω

No	Function	Specification
GPS receiver		
1	Frequency	L1 1575.42MHz.
2	Code	C.A. Code.
3	Channels	32
4	Chipset Sensitivity	-158 dBm
5	Cold start	36 sec (open sky)
6	Warm start	33 sec (open sky)
7	Hot start	1 sec (open sky)
8	Reacquisition	< 1sec
9	Position accuracy	3 meters 2D RMS (w/o aid)
10	Maximum altitude	18000 m

11	Maximum velocity	515 m/s
12	Trickle power mode	N/A
13	Update rate	1Hz
14	Testability	N/A
16	DGPS	1.WAAS, EGNOS 2.RTCM protocol
Interface		
17	I/O Pin	28pin
Mechanical requirements		
18	Weight	0.8g±0.05g
Power consumption		
19	Vcc	DC 3.3 ±5%
20	Current (Average)	GPS : < 65mA@3.3V (ACQ w/o ext. Antenna) < 40mA@3.3V (Tracking w/o ext. Antenna)
Environment		
21	Operating temperature	-40 ~ 85℃
22	Humidity	≦95%

1.8 Application Circuit

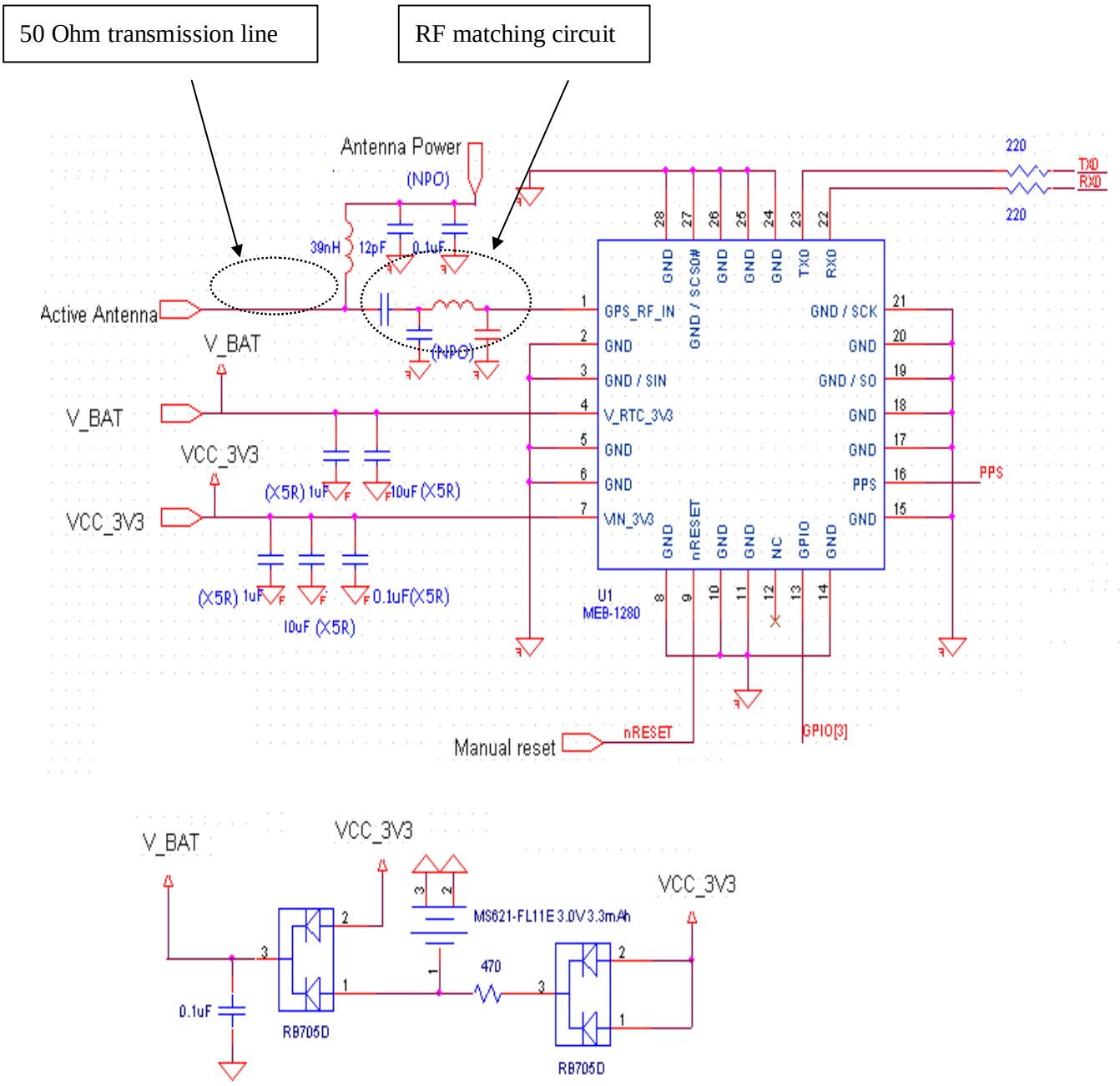


Figure 4 Application Circuit

Note:

(1) Serial Interface:

The TX0 & RX0 pin is recommended to connect to serial resistance(220Ω) and pull up (10KΩ). It can increase the stability of serial data.

(2) V_BAT:

It's recommended to connect a backup battery to V_RTC_3V3. The supply voltage should be between 2.5V and 3.6V to enable the warm start and hot start features of the GPS receiver. If you use backup battery, you should add a bypassing capacitor (10uF and 1uF) at V_RTC_3V3 pin. It can reduce noise and increase the stability.

Attention!
If not provide the Pin 4 (V_RTC_3V3) voltage then the MEB-1280 could not be work.

(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 50Ω).
We suggest to use active antenna (Input gain > 20dB~30dB，and NF < 1.5 dB)

(4) VCC_3V3:

Connect VIN_3V3 pin to DC 3.3V. The power supply must add bypassing capacitor(10uF 、 1uF 、 0.1uF).It can reduce the Noise from power supply and increase power stability.

(5) GPIO[3]:

Connected GPIO to the digital interface connector for custom applications. If no use GPIO function, it doesn't connect anything.

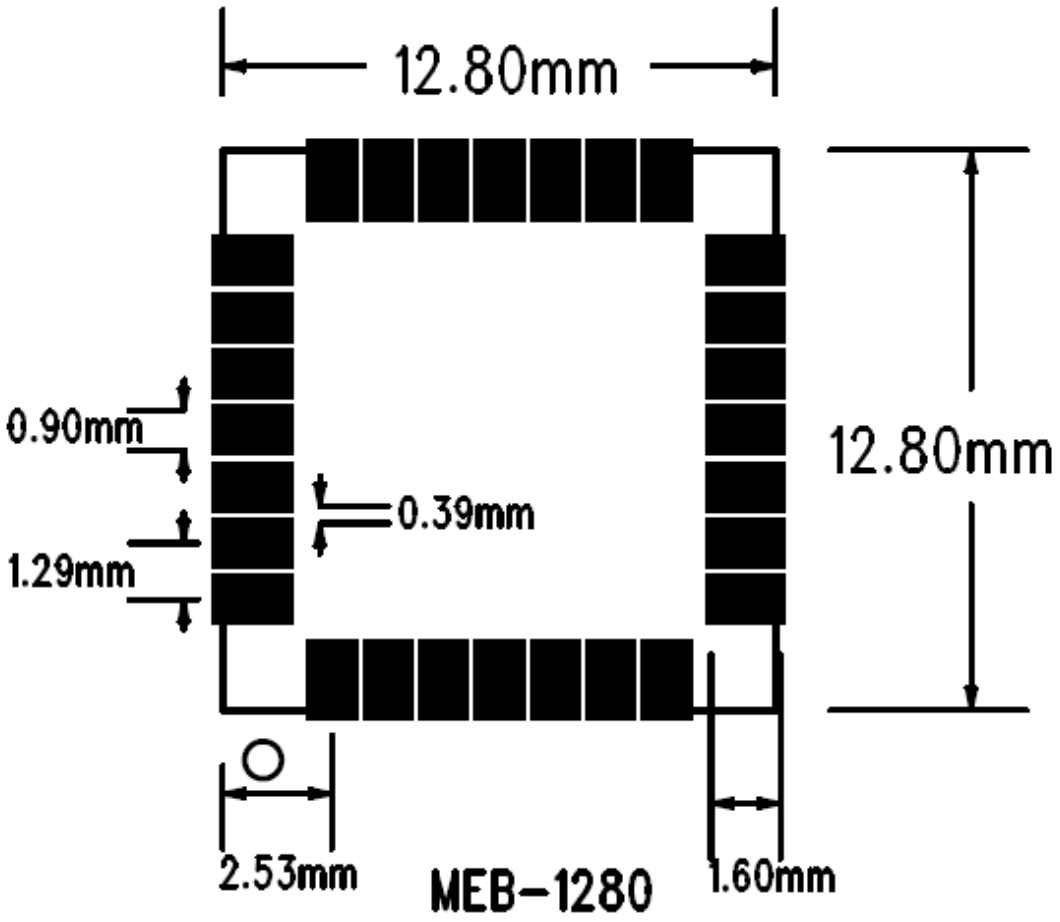
(6) PPS:

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

(7) Manual reset:

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

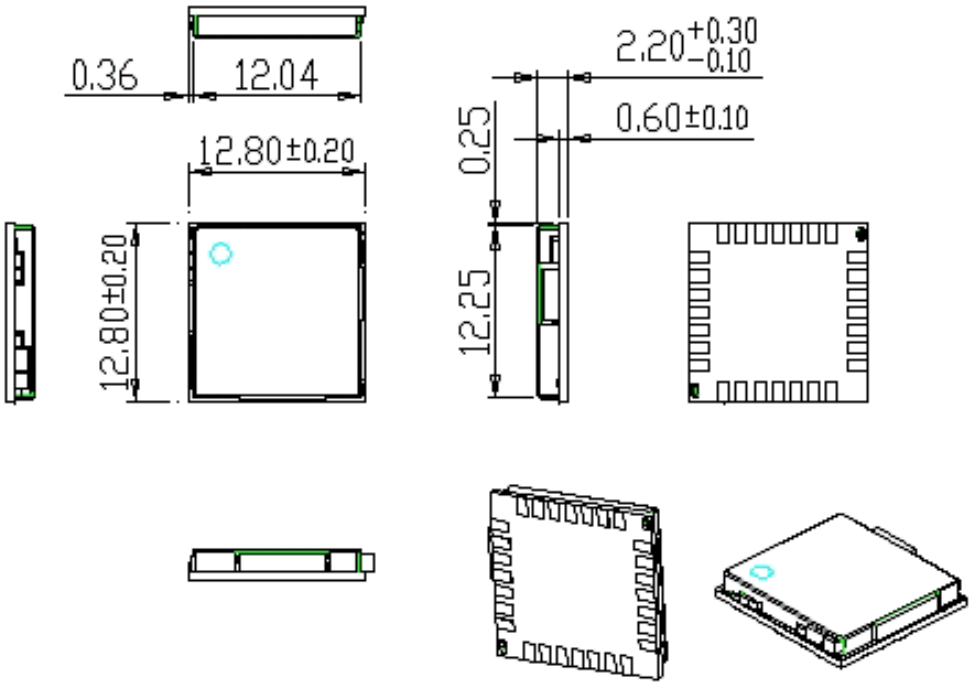
1.9 Recommended Layout PAD



TOP View

Figure 5 Recommended Layout Pad

1.10 Mechanical Layout



Unit：mm

Figure 6 Mechanical Layout

1.11 Hardware Interface

Interface Pin Number:

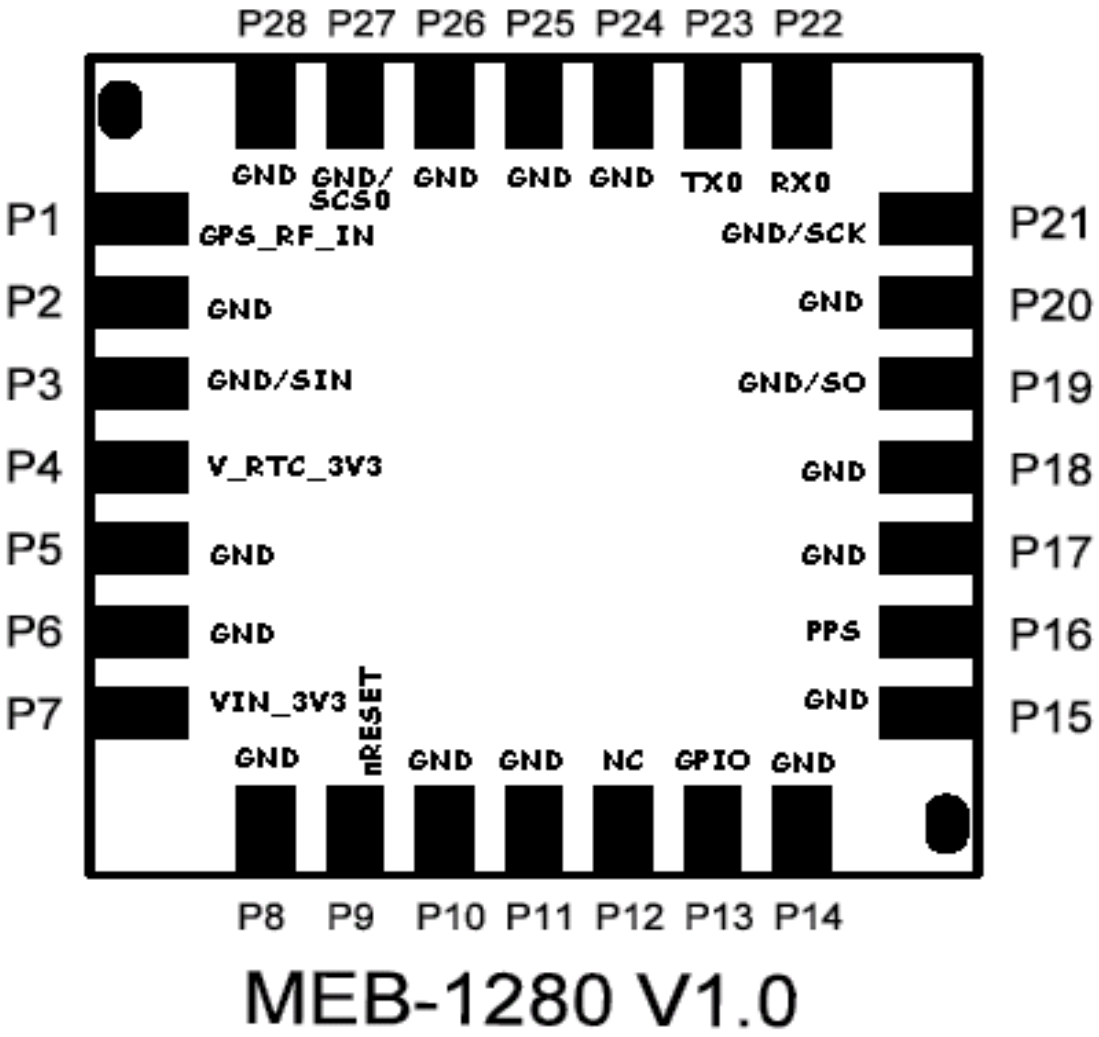


Figure 7 Interface Pin Number

Table 1-4 Pin Definition

Pin	Signal Name	I/O	Description	Characteristics
1	GPS_RF_IN	I	GPS Signal input	50 Ω @1.57542GHz
2	GND	G	Ground	Reference Ground
3	GND/SIN	G	Ground	Reference Ground/Serial communication

4	V_RTC_3V3	I	Backup voltage supply	DC + 2.5 ~ +3.6V Current ≤ 10uA
5	GND	G	Ground	Reference Ground
6	GND	G	Ground	Reference Ground
7	VIN_3V3	I	DC Supply Voltage input	DC +3.3V±5%
8	GND	G	Ground	Reference Ground
9	nRESET	I	System reset (Active low)	$3.6V \geq V_{IH} \geq 2V$ $-0.3V \leq V_{IL} \leq 0.8V$
10	GND	G	Ground	Reference Ground
11	GND	G	Ground	Reference Ground
12	NC			
13	GPIO	I/O	General purpose I/O	$3.6V \geq V_{IH} \geq 2V$ $-0.3V \leq V_{IL} \leq 0.8V$ $3.15V \geq V_{OH} \geq 2.4V$ $-0.3V \leq V_{OL} \leq 0.4V$
14	GND	G	Ground	Reference Ground
15	GND	G	Ground	Reference Ground
16	PPS	I/O	One pulse per second	$3.6V \geq V_{IH} \geq 2V$ $-0.3V \leq V_{IL} \leq 0.8V$ $3.15V \geq V_{OH} \geq 2.4V$ $-0.3V \leq V_{OL} \leq 0.4V$
17	GND	G	Ground	Reference Ground
18	GND	G	Ground	Reference Ground
19	GND/SO	G	Ground	Reference Ground/ Serial communication
20	GND	G	Ground	Reference Ground
21	GND/SCK	G	Ground	Reference Ground/ Serial communication
22	RX0	I	Serial port A	$3.6V \geq V_{IH} \geq 2V$ $-0.3V \leq V_{IL} \leq 0.8V$
23	TX0	O	Serial port A	$3.15V \geq V_{OH} \geq 2.4V$ $-0.3V \leq V_{OL} \leq 0.4V$
24	GND	G	Ground	Reference Ground
25	GND	G	Ground	Reference Ground
26	GND	G	Ground	Reference Ground
27	GND/SCS0	G	Ground	Reference Ground/ Serial communication
28	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 .

RX0

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

TX0

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

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).

PPS

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

Reset

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

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 2.5V and 3.6V.

GPIO Functions

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

SIN、SO、SCK、SCS0 (option)

Synchronous serial interface I/Os are connected to the digital interface connector

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	161229.487		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 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

[1]Depending 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

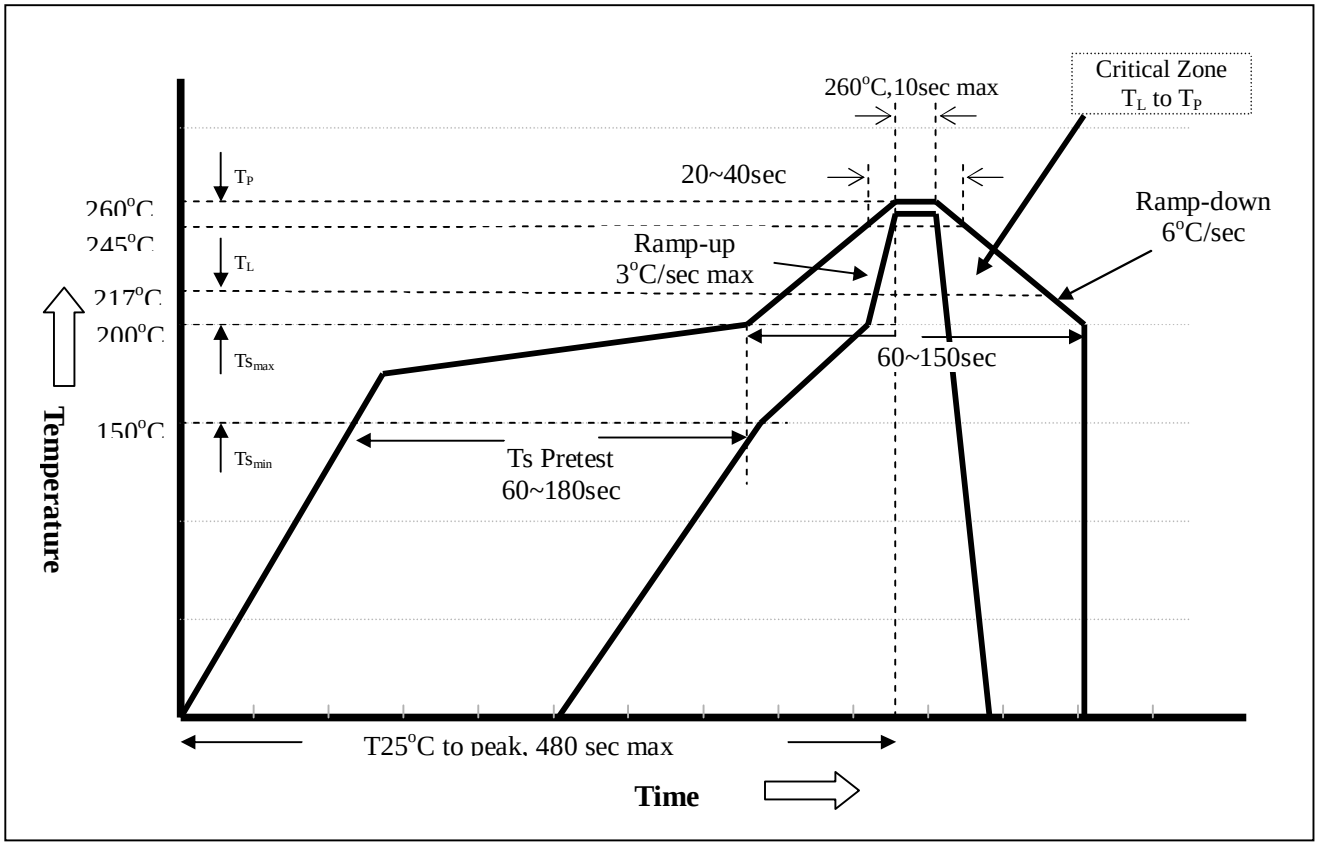
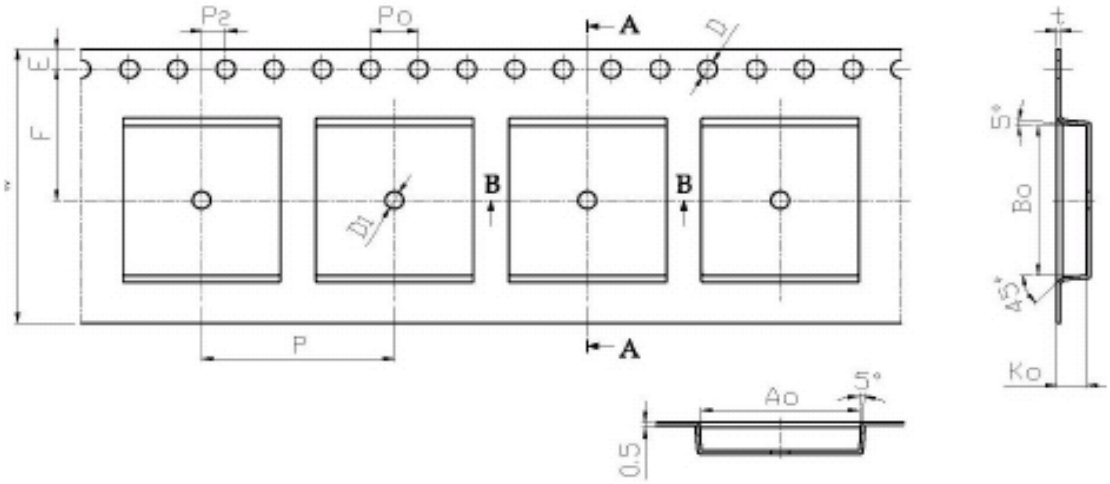


Figure 8 RoHS Reflow Diagram

4 Package Specification and Order Information

Shipment Method: Tape and reel

SMT type with stamp holes



2.1共同尺寸

外觀	規格	公差
W	24.00	±0.30
P	16.00	±0.10
E	1.75	±0.10
F	11.50	±0.10
P2	2.00	±0.10
D	1.50	+0.10 −0.00
D1	1.50	±0.10
Po	4.00	±0.10
10Po	40.00	±0.20

2.2口袋尺寸

外觀	規格	公差
Ao	13.10	±0.10
Bo	13.10	±0.10
Ko	2.50	±0.10
t	0.30	±0.05

1.10 sprocket hole pitch cumulative tolerance ±0.20mm.
2.Carrier camber not to exceed 1mm in 250mm
3.Ao and Bo measured on a plane 0.3mm above the bottom of the pocket.
4.Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
5.All dimensions meet EIA-481-B requirements.
6.Material: ☐ Clear Non Anti-Static Polystyrene.
☑ Black Anti -Static Polystyrene.
7.Packing lenght per 22" reel : 73.8 Meters.
8.Component load per 13" reel : 1500 pcs.

1.產品編號: 12812822
2.檢驗項目及規格:(單位:mm)
3.注意事項:尺寸標準以投影機爲依據

Unit：mm

Figure 9 Tape & Reel Packaging Information

5 Contact Information

Contact: sales@royaltek.com

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6 Revision History

Title	MEB-1280 GPS Receiver Module		
Doc Type	User Manual		
Revision Number	Date	Author	Change notice
1.0	2007/05/15	Luke Hou	Formal release
1.1	2007/06/08	Luke Hou	Update Application Circuit
1.2	2008/04/02	Amy Liu	Modify Application Circuit