GPS Engine Board

EB-5084

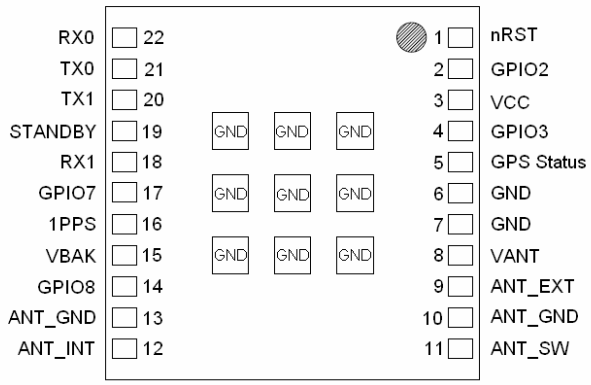
EB-5084 is a **15.24x15.24 mm** (0.6"x0.6") GPS engine that is to replace A1084 with much improved receiving sensitivity.
EB-5084 provides superior navigation performance under dynamic conditions in areas with limited sky view like urban canyons.

Its high receiving sensitivity up to **-165dBm** for weak signal operation without compromising accuracy. With pin locations compatible to A1084, there is nearly no extra effort for your system to upgrade to latest high sensitivity GPS receiver available in the industry.

Key Features :
- Small form factor: 15.24x15.24x 2.4 mm
- Lead-Free – RoHS/WEEE compliant
- High sensitivity -165dBm
- Tracks 66-Channel of satellites
- Fast Position Fix
- Low power consumption

Applications :
- Automotive and Marine Navigation / Tracking
- Emergency Locator
- Geographic Surveying
- Personal Positioning
- Sporting and Recreation

PIN Assignment :



EB-5084 Pin Assignment

RoHS Compliant

ELECTROSTATIC SENSITIVE DEVICES

Ultimate EB

TRANSYSTEM INC.

An A+ supplier of RF microwave & GPS products

Revision History

Rev.	Date	Description
0.1	10-15-2010	Initial draft
0.2	04-29-2011	Update packing description
	MM-DD-YYYY	

EB-5084 is ESD (electrostatic discharge) sensitive device and may be damaged with ESD or spike voltage. Please handle with care to avoid permanent malfunction or performance degradation.

Use of GPS Data and Services at the User's own risk

The GPS data and navigation services providers, system makers and integrated circuit manufacturers ("Providers") hereby disclaim any and all guarantees, representations or warranties with respect to the Global Positioning Systems (GPS) data or the GPS services provided herein, either expressed or implied, including but not limited to, the effectiveness, completeness, accuracy, fitness for a particular purpose or the reliability of the GPS data or services.

The GPS data or services are not to be used for safety of life applications or for any other application in which the accuracy or reliability of the GPS data or services could create a situation where personal injury or death may occur. Any use therewith are at the user's own risk. The Providers specifically disclaims any and all liability, including without limitation, indirect, consequential and incidental damages, that may arise in any way from the use of or reliance on the GPS data or services, as well as claims or damages based on the contravention of patents, copyrights, mask work and/or other intellectual property rights.

Transystem Inc. reserves the right to make change to specifications and product description without prior notification.

Table of Contents

1 Introduction

EB-5084 is a compact 15.24x15.24x2.4mm^3 GPS engine board designed to replace A1084. It provides superior navigation performance under dynamic conditions in areas with limited sky view like urban canyons. High sensitivity up to -165dBm for weak signal operation and 66 channels of satellite tracking gives your product best GPS accuracy. EB-5084 is the best choice for embedded GPS receivers.

1.1 Key Features

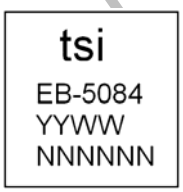
- Small form factor: 15.24x15.24x 2.4 mm
- Lead-Free – RoHS/WEEE compliant
- High sensitivity -165dBm
- Tracks 66-channel of satellites
- Fast Position Fix
- 3.0~4.2V wide power range
- Low power consumption
- -40˚C to 85˚C operation range

1.2 Applications

- Automotive and Marine Navigation / Tracking
- Emergency Locator
- Geographic Surveying
- Personal Positioning
- Sporting and Recreation

1.3 Labeling

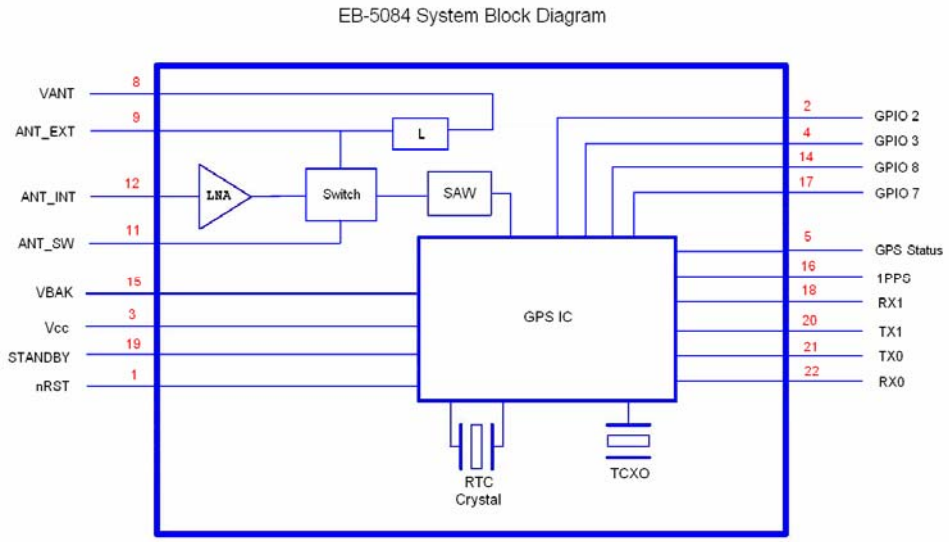
There are 4 lines of top marking on the GPS engine and they are :



Line #1: TSI company icon
Line #2: Model number, i.e. EB-5084
Line #3: Date code, the year and week when the product is built.
Line #4: Lot control code for TSI internal use

2 Technical Description

2.1 Block Diagram



2.2 Pin Definition

Pin#	Name	Type	Description
1	nRST	I	Input, active low to reset module - leave open if not used
2	GPIO 2	I/O	Reserved – leave open if not used
3	Vcc	P	3.0~4.2 VDC power supply
4	GPIO 3	I/O	Reserved – leave open if not used
5	GPS Status	O	Output, blinking when GPS has position fix, output High when GPS does not have position fix
6	GND	P	Ground for power supply
7	GND	P	Ground for power supply
8	VANT	P	Antenna power supply, 0~5V – leave open if not used
9	ANT_EXT	I	Active antenna input / Z=50 Ohm
10	ANT_GND	P	Antenna ground, connect to antenna shield
11	ANT_SW	I	Antenna switch input, LOW (<0.5V) or Open = passive antenna, pin #12 (ANT_INT) input HIGH (>2.2V) = active antenna, pin #9 (ANT_EXT)
12	ANT_INT	I	Passive antenna input / Z=50 Ohm
13	ANT_GND	P	Antenna ground, connect to antenna shield
14	GPIO 8	I/O	Reserved – leave open if not used
15	VBAK	P	Back-up power with "super cap" or battery, 2.0~4.3VDC Must not leave open
16	1PPS	O	1PPS (Pulse Per Second) output
17	GPIO 7	I/O	Reserved – leave open if not used
18	RX1	I	Serial input 1 – leave open if not used
19	STANDBY	I	Input, falling edge to put GPS to standby mode, leave open if not used
20	TX1	O	Serial output 1– leave open if not used
21	TX0	O	Serial output 0, default NMEA out port
22	RX0	I	Serial input 0, default NMEA in port

P: Power I: Input O: Output I/O: Input or Output

2.3 General Comment

Following comments should be considered for a design using EB-5084 module:

- Serial port default configuration: 9600 baud, 8 data bits, no parity, 1 stop bit, no flow control
- Antenna: Use antenna ground pins (pin #10, pin #13) close to the antenna input for RF ground.

2.4 Specifications

Item	*Description*
General	L1 frequency, C/A code (SPS) 66 independent tracking channels
Sensitivity*	-165dBm /Tracking; -148dBm /Acquisition
Update Rate	Up to 10Hz
Accuracy	<3m CEP (50%) without SA 2.5m DGPS (WAAS, EGNOS, MSAS, RTCM)
Acquisition (open sky)	Cold Start: 35sec Warm Start: 34sec Hot Start: 1.5sec
Reacquisition	< 1sec
Dynamics	Altitude: 18000m (max.) Velocity: 515m/sec (max.) Vibration: 4G (max.)
NMEA	NMEA0183 v3.1 GGA, GSA, GSV, RMC (Default) / GLL, VTG (Optional)
Datum	Default WGS-84
Antenna	External active or passive antenna
Power Supply	DC 3.0V ~ 4.2V
Current	35mA @ 3.3V / Tracking
Interface	UART, Baud rate : 4800/9600(Default)/…/115200
Mounting	SMT
Dimension	15.24x15.24x2.4 mm (0.6”x0.6”x0.095”)
Operating Temp.	-40˚C to 85˚C
Storage Temp.	-40˚C to 85˚C
Operating Humidity	≦95%, non condensing

3 Electrical Characteristics

3.1 Absolute maximum ratings

Symbol	Parameter	Min	Max	Unit
Vcc	power supply	-0.3	+4.2	V
Vin	voltage to any pin	-0.3	+3.6	V
Iov	input current on any pin	-10	10	mA
Itdv	absolute sum of all input currents during overload condition		200	mA
Tst	storage temperature	-40	85	°C
Vant	antenna supply voltage	0	5.5	V
Iant	antenna supply current	0	50	mA

Table 5: Absolute maximum ratings

Note:
(1) Stresses beyond absolute maximum ratings may cause permanent damage to the device.
(2) Exposure to absolute maximum rating conditions for extended period may affect device reliability.

3.2 Operating Conditions

Pin	Description	Min	Typical	Max
15	Vbak	2.0V		4.3V
	Standby Current (1)		20μA	
3	Vcc	3.0V	3.3V	4.2V
	Peak Acquisition Current (2)			30mA
	Tracking Current (3)		23mA	

Table 6: Electrical characteristics

Note:
(1) During standby state: RTC block and core powered on and clock off.
(2) Peak acquisition current is the maximum current with passive antenna.
(3) Tracking current is the average current with passive antenna includes tracking and post acquisition portion.

3.3 DC Electrical Characteristics

Symbol	Parameter	Min	Max	Unit
1PPS, GPS Status, TX1, TX0, GPIO 2,3,7,8	Voh	2.4	3.9	V
	Vol	-0.3	0.4	V
RX1, RX0, STANDBY, ANT_SW	Vih	2.0	3.6	V
	Vil	-0.3	0.8	V
nRST	for safe reset		0.2	V

4 Serial Port Interface

EB-5084 provides 2- wire digital UART port for communication of GPS position data using NMEA protocol or MTK extension protocol. UART port is capable of 4800 to 115200 baud rate.

4.1 Protocol

EB-5084 is default to support standard NMEA-0183 protocol. In addition, a series of MTK extensions (PMTK messages) have been developed that can be used to provide extended capabilities common to many applications. Please refer to “GPS Engine Board UART Port Command” for detailed command information.

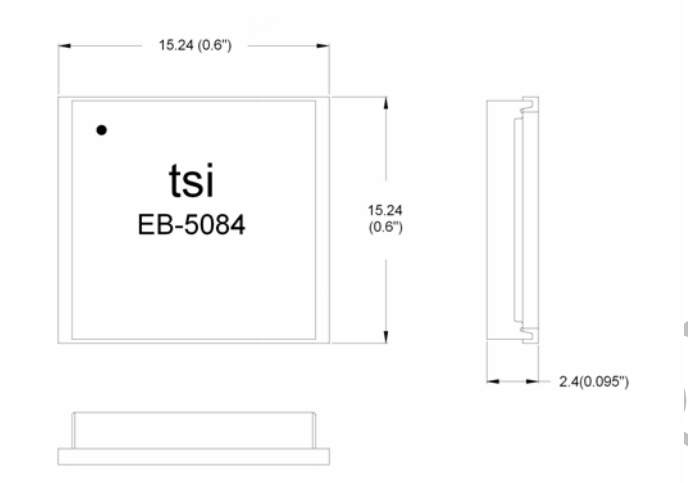
4.1.1 NMEA Protocol

EB-5084 is capable of supporting following NMEA formats:

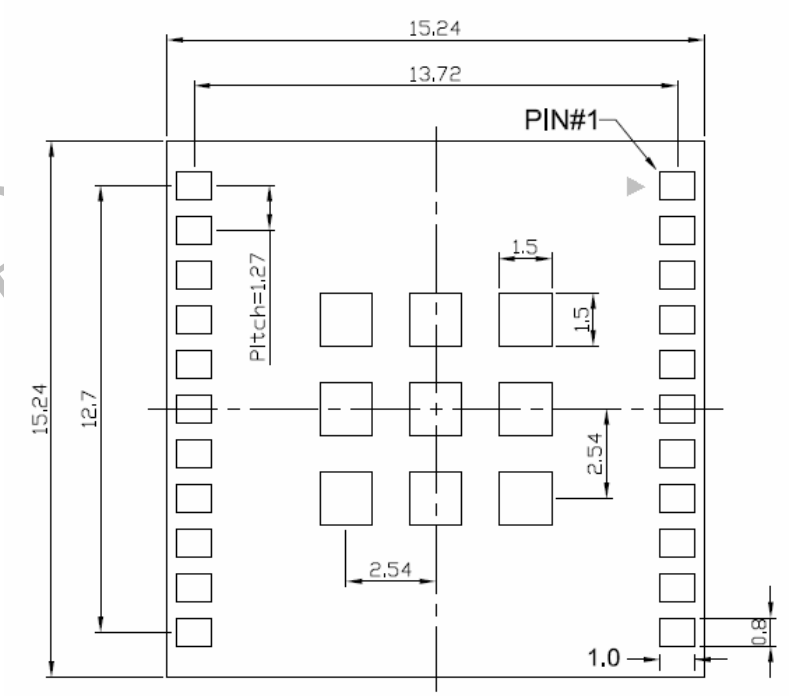
NMEA Prefix	Format	Direction
$GPGGA	GPS fix data	Out
$GPGLL	Geographic position Latitude / Longitude	Out
$GPGSA	GNSS DOP and active satellites	Out
$GPGSV	Satellites in view	Out
$GPRMC	Recommended minimum specific GNSS data	Out
$GPVTG	Velocity and track over ground	Out
$GPZDA	Date and time	Out

5 Dimension and Package

5.1 Mechanical Dimension



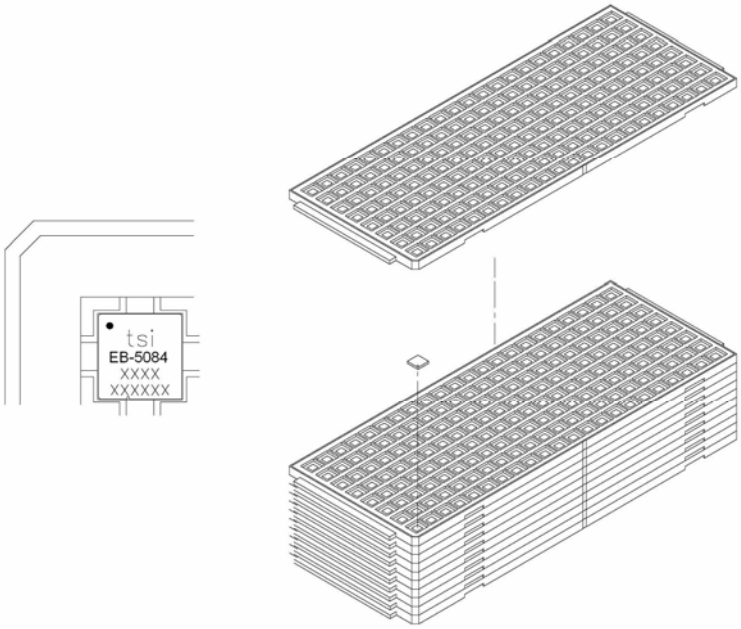
5.2 Recommend Layout Pattern



Solder pad size (outer pads):1.0 x 0.8
Solder pad size (outer pads):1.5 x 1.5
ALL dimensions in [mm]
EB-5084 Layout Pattern

5.3 Packing

EB-5084 GPS modules come in tray package suitable for pick and place machines. Each tray contains total 50 pieces of EB-5084 and maximum 10 trays are stacked together before sealed in ESD protective vacuum dry pack to provide protection against moisture and ESD during storage and shipment.



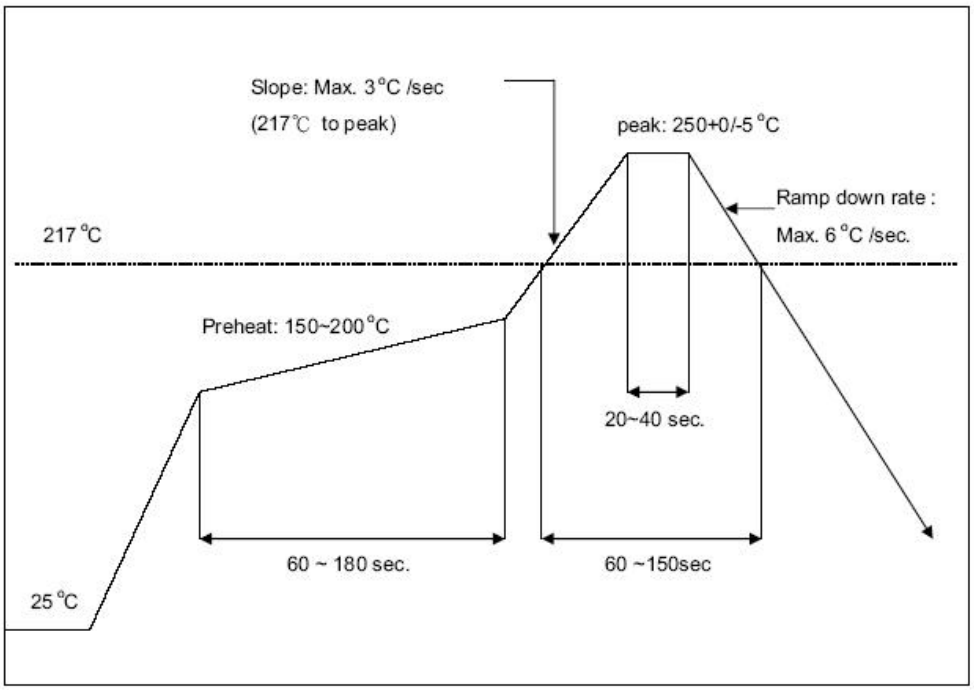
6 Recommended IR Profile

Follow below IR profile for reflow during SMT assembly for EB-5084.

Ramp-down rate : 6 °C /sec. max.

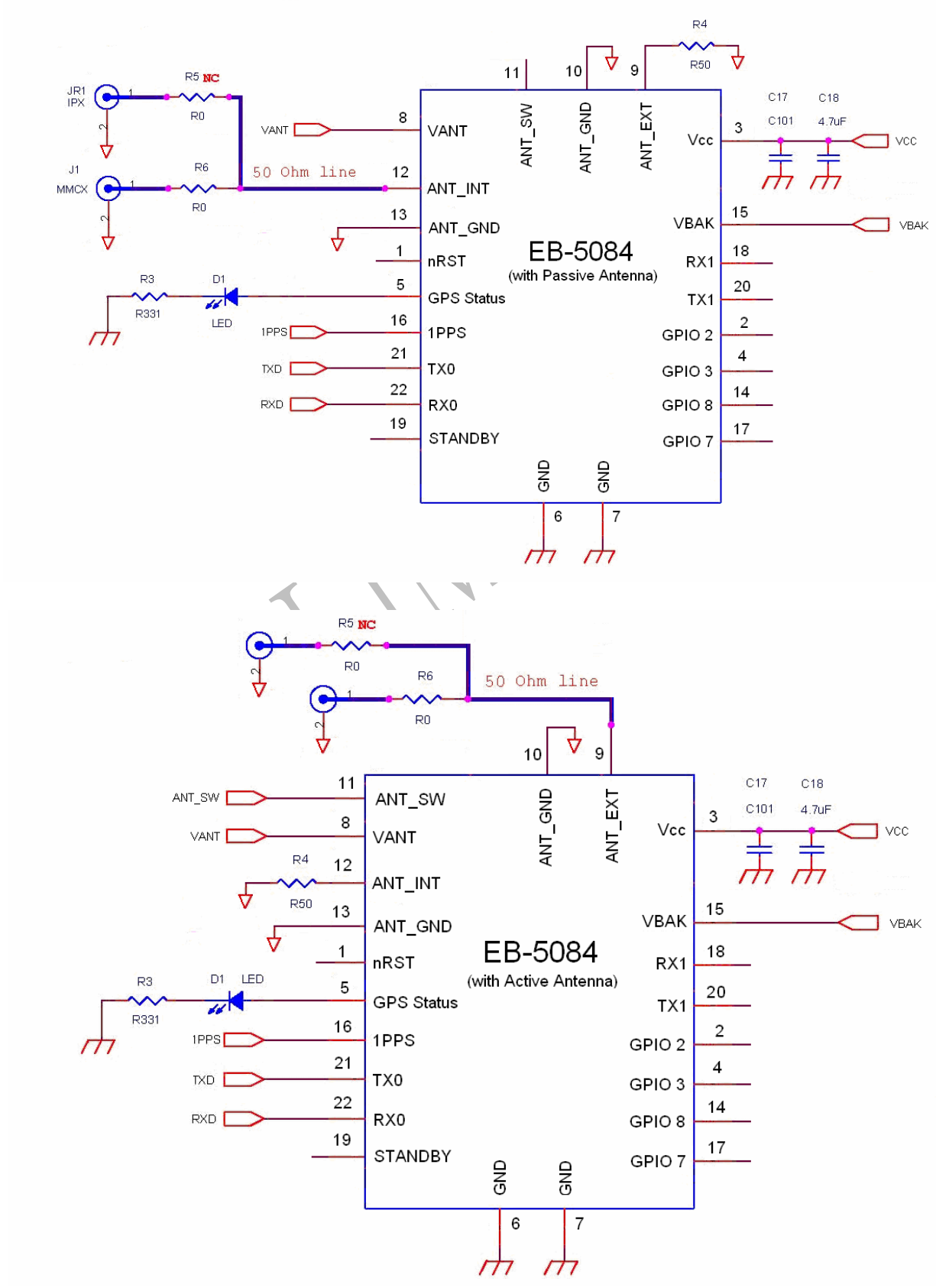
Time 25 °C to peak temperature : 8 minutes max.

Cycle interval : 5 minus



7 Application Information

7.1 Minimum Configuration



7.2 General Antenna Selection

In general, GPS antenna plays a very important role in the overall quality / sensitivity of the GPS system. Losses through a bad antenna or long cable or un-matched trace or a bad antenna position can't be compensated afterwards.

It is recommend to terminate unused antenna input with 50 Ω ± 10% load. Do not feed antenna supply voltage into terminated antenna input as this may cause excess heat and damage the module or your system.

7.3 Passive Antenna

A on-module LNA is provided to support the use of passive antenna through pin #12, (ANT_INT). For passive antenna connected to pin #12, special care should be taken to establish proper grounding through nearby ANT_GND pin.

7.4 Active Antenna

EB-51084 supports active antenna directly by offering an antenna voltage feed pin (VANT, pin #8) along with a signal path without LNA.

Follow below recommendations when choosing active antenna for EB-5080 for best system performance. Transystem also offers active antenna products for optimal performance with EB-5080. For details, please contact your local Transystem distributors directly.

- Use active antenna that works with 3~5V power supply
- Active antenna current draw $\leqq$ 50mA
- Receiving frequency 1575.42 ± 1.032MHz
- Polarization RHCP (right hand circular polarized)
- Output impedance = 50 Ohm
- 15dB $\leqq$ LNA Gain $\leqq$ 20dB
- Noise figure $\leqq$ 1.5dB
- Use Ipex or MMCX type of surface mount connector on the main PCB

7.5 Improved TTFF

In order to improve the TTFF (Time To First Fix), it is recommended to support the RTC with a back-up power supply when no system power is available. (see section 7.9 Battery Back-up).

7.6 VANT Pin (antenna voltage input pin)

The supply voltage for active GPS antenna on the ANT_EXT port has to be fed into the VANT pin (pin #8). The maxi-mum current is 50 mA. Short circuit between VANT and GND may damage the EB-5084 GPS receiver module. Caution should be taken to avoid it or by use of antenna current limiter if needed.

7.7 1PPS pin

GPS also provides accurate timing information due to the synchronized atomic clocks in the GPS satellites. In addition to the current date and time is transmitted in NMEA sentences (UTC), an accurate timing signal is provided via the 1PPS pin (pin #16) of the EB-5084 GPS receiver.
Under good signal conditions the 1PPS signal comes between 620ns and 710ns after the full GPS system second which is accurately (around 10ns) synchronized to UTC. Therefore the 1 second clock can be derived and maintained within around 90ns under good signal conditions.

The 1PPS signal accuracy directly relates to the position accuracy. The GPS signals travel at the speed of light, therefore a position inaccuracy directly translates into 1PPS inaccuracies.

10 m position deviation ≈ 33 ns 1PPS deviation (typically)
100 m position deviation ≈ 333 ns 1PPS deviation (typically)

The 1PPS signal is provided on an “as it is” basis with no accuracy specification.

7.8 Reset Signal

The nRST pin (pin #1) can be used to reset the EB-5084 module. Resetting the module will result in a restart of the complete firmware.

The EB-5084 is equipped with a voltage monitoring circuit that generates a proper power-on reset signal at the appropriate threshold and delay. Usually there is no need to deal with the reset input externally, thus the general advice is to leave this pin open.

7.9 Battery Back-up

VBAK input (pin #15) provides back-up power for the RTC and SRAM of the GPS receiver module. Typical quiescent current <1.2uA allows the use of a separate battery or a “Supercap”. The VBAK pin draws 3mA maximum under normal operation.

7.10 General GPS Receiver User's Tips

In general, GPS receiver performs best in open space where it can see clean sky. Weather condition will affect GPS reception – rain & snow contribute to worsen sensitivity.

If the satellite signals can not be locked or experiencing receiving problem (while in urban area), following steps are suggested:

- Use of external active antenna if that option exists.
- Move to another open space or reposition GPS receiver toward the direction with least blockage.
- Move the GPS receiver away from the interference sources.
- Wait until the weather condition is improved.

Some vehicles using heavy metallic sun protecting coating on windshields may affect GPS signal reception.

- Driving in and around high buildings may affect signal reception.
- Driving in tunnels or in building structure may affect signal reception.
- When GPS receiver is moving, it will take longer time to get position fix. Wait for satellite signals to be locked at a fixed point when first power-on the GPS receiver to ensure quick GPS position fix.

8 Quality and Reliability

Each module is electrically tested prior to packing and shipping to ensure state of the art product quality and best GPS receiver performance and accuracy.

8.1 Environmental Conditions

Operating temperature	-40 ~ +85°C
Operating humidity	Max. 95%, non-condensing
MSL JEDEC (Moisture Sensitivity Level)	3
Storage temperature	-40 ~ +85°C
Storage	12 months in original package.

8.2 How to avoid ESD damage

- Any person handling the module should be grounded either with a wrist strap or ESD-protective footwear used in conjunction with a conductive or static-dissipative floor or floor mat.
- The work surface where devices are placed for handling, processing, testing, etc., must, be made of static-dissipative material and be grounded to ESD ground.
- All insulator materials must either be removed from the work area or must be neutralized with an ionizer. Static-generating clothing must be covered with an ESD-protective smock.
- When module are being stored, transferred between operations or workstations, or shipped, they must be kept in a Faraday shield container with inside surfaces (surfaces touching the module) that are static-dissipative.

Contact Information

Transystem Inc.
No. 1-2 Li-Hsin Rd. I, ,
Hsinchu 300, Taiwan, R.O.C.
t : +886.3.578.0393
f : +886.3.578.4111
sales@transystem.com.tw
www.transystem.com.tw