SiRF IV GPS Module

9101S4

Specifications Sheet V0.1

Features:

- ***SiRF StarIV ultra low power chipset***
- ***Compact module size for easy integration :15x14x2.8 mm***
- ***UART pins reserved for customizing special user applications***
- ***Fully utilized SS4 upgrade features***

1. Introduction

The 9101S4 GPS module is a high sensitivity, low power, Surface Mount Device (SMD) that fully utilized SiRFstarIV upgraded features. This 48-channel Global Positioning System (GPS) receiver is designed for a wide range of OEM applications and is based on the GPS signal search capabilities of the SiRFstarIV GSD4e ROM chipset, SiRF's newest chipset technology. The 9101S4 provides flexible bus interfaces (Optional : UART, I2C or SPI reserved for customizing special user applications) .

The 9101S4 is designed to allow quick and easy integration into GPS-related applications such as:

- Mobile gaming
- Cellular handsets
- Cameras
- Asset tracking
- Other location-aware consumer devices Premium on-chip software provides a new level of continuous location awareness by employing.
- Opportunistic ephemeris decode and advanced power management, which enable the GPS receiver to stay in a hot-start condition nearly continuously while consuming very little power
- Full support for client-based and server-based SiRFInstantFix™
- Dynamic contextual awareness, temperature monitoring, and MEMS sensors that work in concert to conserve power and boost performance
- Use of software control modules to achieve power saving state

1.1. Features

1.1.1 Performance

- Highest performance Solution :
- Highest performance navigation engine (PVT) tracks as low as -163dBm
- 48 track verification channels
- SBAS (WAAS or EGNOS)
- Active Jammer Remover
- Removes in-band jammers up to 80 dB-Hz
- Tracks up to 8 CW jammers
- Multimode A-GPS (Autonomous, MS-Based, and MS-Assisted) – Need operator support.
- SiRFGeoRecov™ Reverse EE makes positioning process being done under power saving mode.

- Reacquisition Time: 0.1 second
- RF Metal Shield for best performance in noisy environments

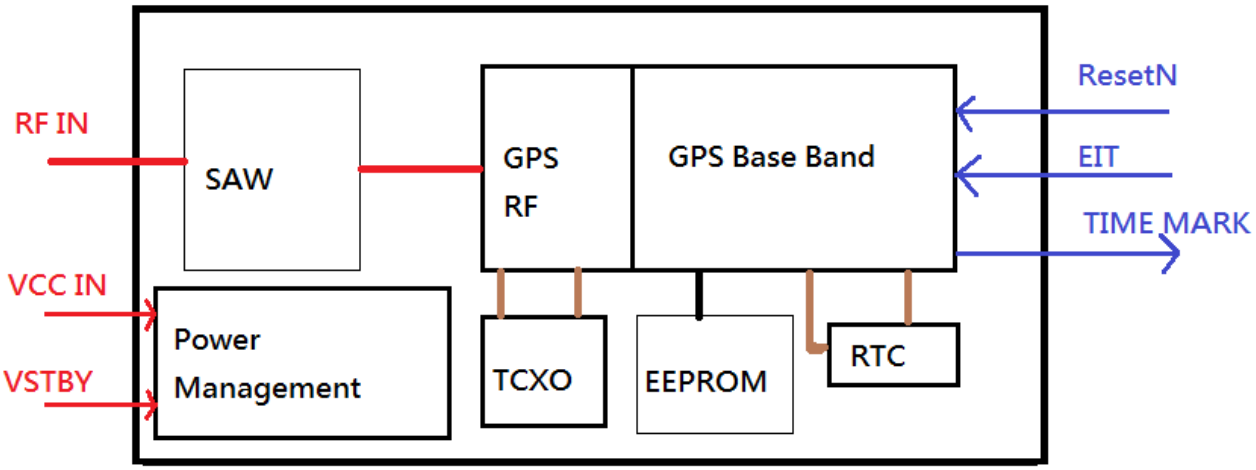
1.1.2 Hardware Software

- Based on the high performance features of the SiRF Star IV low power single chipset.
- Adaptive Micropower Controller
- Only 50 to 500μA maintains hot start capability
- <10mW required for TricklePower™ mode RoHS compliant (lead-free)
- SMT pads allow for fully automatic assembly processes equipment and reflow soldering
- Advanced Navigation Features
- Smart sensor I²C interface
- Interrupt input for context change detection

1.2 Advantages

- Built-in LNA.
- Built-in internal ROM and based on Firmware 4.1.X
- It can remove in-band jammer up to 80db-Hz and track up to 8CW jammers, so the module can prevent GPS signal interference when design-in the electrical device with noisy electrical signal interferences such as Laptop, mobile phone, DSC, etc.
- Maintain tracking sensitivity as low as -163dBm, even without network assistance. (SiRF StarIII has only -159dBm sensitivity)
- Support SiRFaware technology :
- Support adaptive “Micro Power Controller” power management mode.
- Only 8mW Trickle Power, so user can leave power on all day instead of power off
- Suitable for battery drive devices that need lower power consumption application
- Ideal for high volume mass production(Taping reel package)
- Cost saving through elimination of RF and board to board digital connectors
- Flexible and cost effective hardware design for different application needs

1.3 Block Diagram



2. Specifications

2.1. Hardware Features

- Based on the high performance features of the SiRF Star IV low power single chipset
- SMT pads allow for fully automatic assembly processes equipment and reflow soldering
- RoHS compliant (lead-free). Halogen free is to be available

2.1.1 Module Specification

Feature	Content	Description
Chipset	GSD4e/ROM Base	SiRF starIV low power single chipset
General	Frequency	L1, 1575.42 MHz
	C/A code	1.023 MHz chip rate
	Channels	48
	Sensitivity	-163 dB
Accuracy	Position	<2.5 meters
	Velocity	0.01 meters/second
	Time	1 microsecond synchronized to GPS time
Datum	Default	WGS-84
	Other	Selectable for other Datum
Time to First Fix (TTFF/-122dBm) (Open Sky & Stationary Requirements)	Reacquisition	0.1 sec., average
	Snap start	1 sec., average
	Hot start	1 ~ 2 sec.
	Warm start	9 ~ 15 sec.
	Cold start	25 ~ 35 sec.
Dynamic Conditions	Altitude	18,000 meters (60,000 feet) max.
	Velocity	515 meters/second (1000 knots) max.
	Acceleration	4g, max.
	Jerk	20 meters/second3, max.
Power	Main power input	3.3 VDC input
	Power Consumption	Average 53mA (Tracking Mode)
	Backup Power(V RTC)	1.8~3.3 VDC battery input
Serial Port	Electrical interface Protocol messages	Default UART NMEA-0183@4800bps

2.1.2 Absolute Maximum Ratings

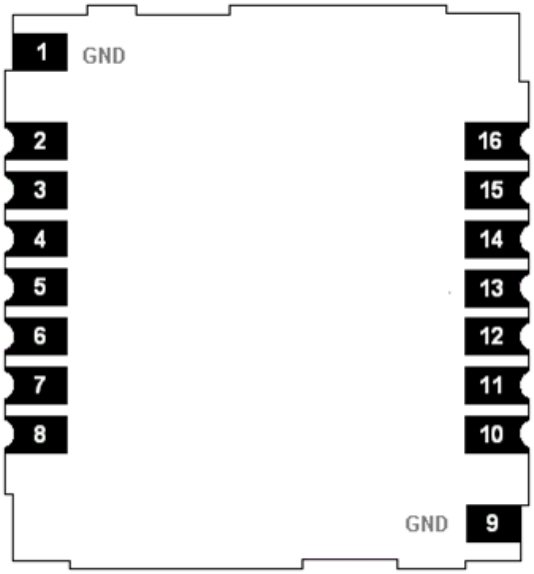
Parameter	Symbol	Max	Unit
LDO supply voltage	VCC IN	3.3	V
I/O supply voltage	VDD_IO	2.2	V
RTC supply voltage	V_RTC	3.3	V
Input pin voltage	VIO	3.6	V
Storage temperature	TSTG	150	°C

2.1.3 Electrical Characteristics

Operation Conditions				
Parameter	**Min**	**Typ**	**Max**	**Units**
Input Operation supply voltage	1.8	3.3	3.6	V
Peak supply current	--	70	--	mA
Sustained supply current	--	60	--	mA
Standby Backup current	--	1	--	uA
Input Backup battery voltage (V_RTC)	1.8	3.3	3.6	V
Input Backup battery current (V_RTC)	--	1.5	--	mA
I/O Input high level (VIH)	1.68	3.3	--	V
I/O Input low level (VIL)	-0.4	0.2	0.45	V
I/O Output high level (VoH)	1.68	3.3	3.4	V
I/O Output low level (VoL)	0	0.2	0.4	V

2.2. Pin Specification

2.2.1 Pin Location



2.2.2 Pin Assignment

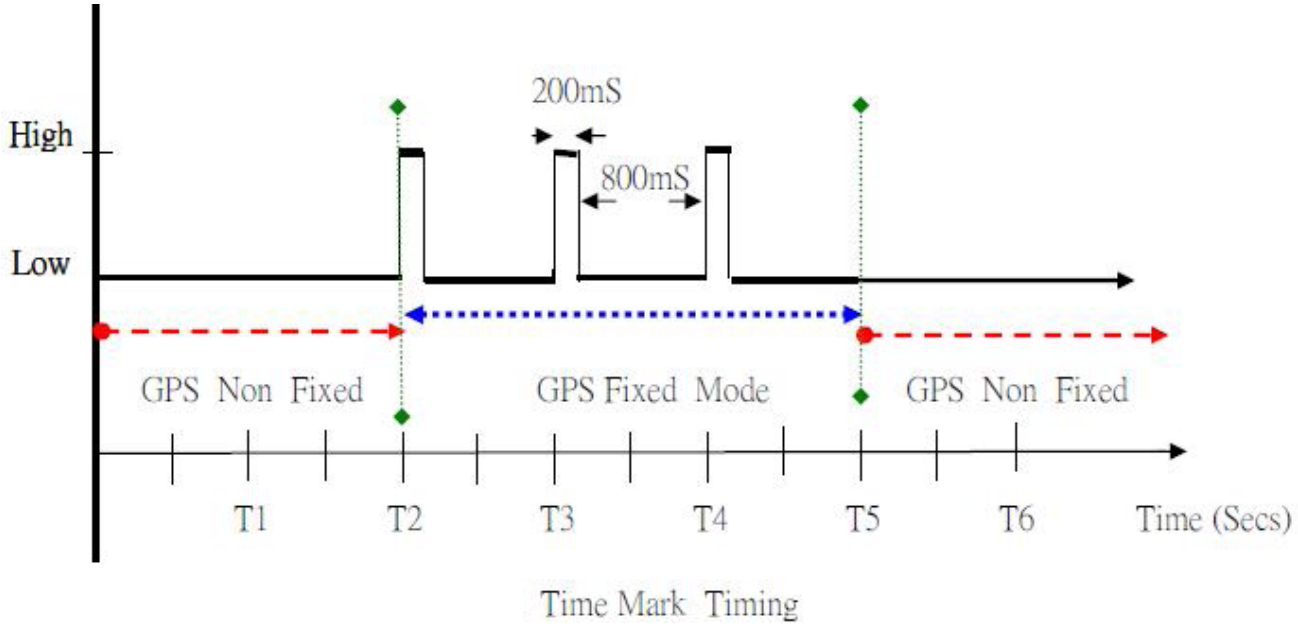
PIN	Name	Type	Description
1	GND	PWR	Ground
2	RF_IN	I	RF input
3	VSS	PWR	Ground
4	RESETN	I	External reset input, active low
5	VCCIN	PWR	DC +3.3V input
6	VSTBY	PWR	DC +3.3V input, RTC backup battery input
7	Reserved	N/A	Keep floating
8	Reserved	N/A	Keep floating
9	GND	PWR	Ground
10	TXA	O	UART_TX UART data transmit (TX)
11	RXA	I	UART_RX UART data transmit (RX)
12	Reserved	N/A	Keep floating
13	Reserved	N/A	Keep floating
14	TM	O	1 PPS time mark output.
15	Reserved	N/A	Keep floating
16	Reserved	N/A	Keep floating

2.2.3 Pin Comparison (Ct-G301 vs. Ct-G431 vs. Ct-G432)

PIN	Ct-G301	Ct-G432
1	RF_GND	RF_GND
2	RF_IN	RF_IN
3	VSS	VSS
4	RESETN	RESETN
5	VCCIN	VCCIN
6	VSTBY	VSTBY
7	RXB	BOOTSEL
8	TXB	Reserved
9	GND	GND
10	TXA	TXA
11	RXA	RXA
12	Reserved	Reserved
13	Reserved	Reserved
14	TM	TM
15	Reserved	Reserved
16	GPS Status	Reserved

2.2.4 TM (Time Mark):

When GPS is fixed, the TM cycle will be shown as below:



Time Mark Timing

2.3 Recommended GPS Antenna Specifications

This 9101S4 receiver is designed for use with passive antenna

Parameter	Specifications
Antenna Type	Right-hand circular polarized passive antenna
Frequency	1575.42 ± 1.023 MHz

2.4 Physical Characteristics

The Physical dimensions of the 9101S4 GPS Module are as follow:

Items	Description
Length	15.0 mm ± 0.3mm
Width	14.0 mm ± 0.3mm
Height	2.80 mm ± 0.3mm
Weight	1.8 g

2.5 Environmental Characteristics

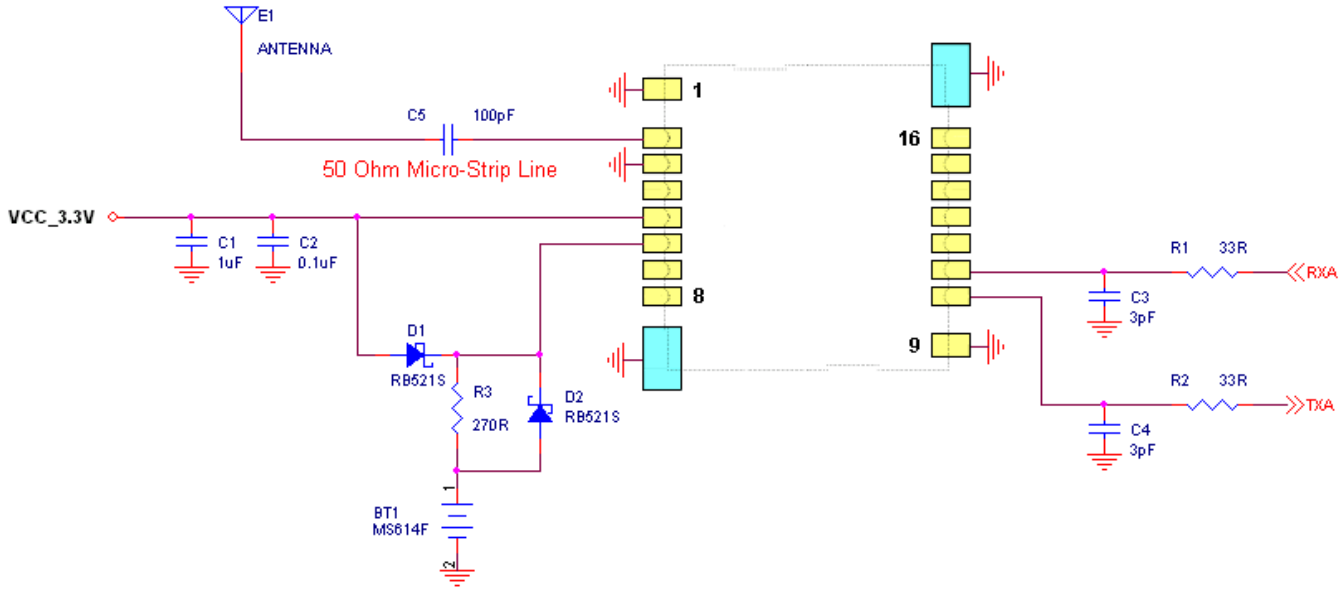
Items	Description
Operating temperature rage	-40 deg. C to +85 deg. C
Storage temperature range	-40 deg. C to +100 deg. C
Humidity	Up to 95% non-condensing or a wet bulb temperature of +35 deg. C

2.6 ESD Specification

Air Discharge : 2 ; 4 ; 8 KV (direct)

Contact Discharge : 2 ; 4 KV (direct / indirect)

2.7 Reference design



- Pin 2/9101S4, (RF_IN) traces should be kept at 50ohm.

3. Software

The firmware used on 9101S4 module is GSD4e, the software for SiRF StarIV low power single chipset receivers, and its features include:

- Excellent sensitivity
- High configurability
- Supports use of SBAS(satellite-based augmentation systems), WAAS, EGNOS, MSAS, GAGAN,
- Enhanced Navigation Performance
- Improved Jamming Mitigation
- Improved Ephemeris Availability

The default configuration is as following description:

Items	Description
Core of firmware	SiRF GSD4e/ROM_4.1.X
Baud rate	4800 bps(Default ,Configurable up to 115200 bps)
Code type	NMEA-0183 ASCII
Datum	WGS-84
Protocol message	GGA(1s), GSA(1s),GSV(5s), RMC(1s)
Output frequency	1Hz

3.1 Software Interface

The host serial I/O port of the module's serial data interface supports full duplex communication between the module and the user. The default serials are shown in Table 3-1.

Port	Protocol	Description
UART/I2C/SPI	NMEA 0183, 4800 bps	GGA(1s), GSA(1s), GSV(5s), RMC(1s)

Table 3-1 9101S4 GPS module default baud rates

3.2 NMEA output messages

The output NMEA-0183 messages for the receiver are listed in Table 3-2.

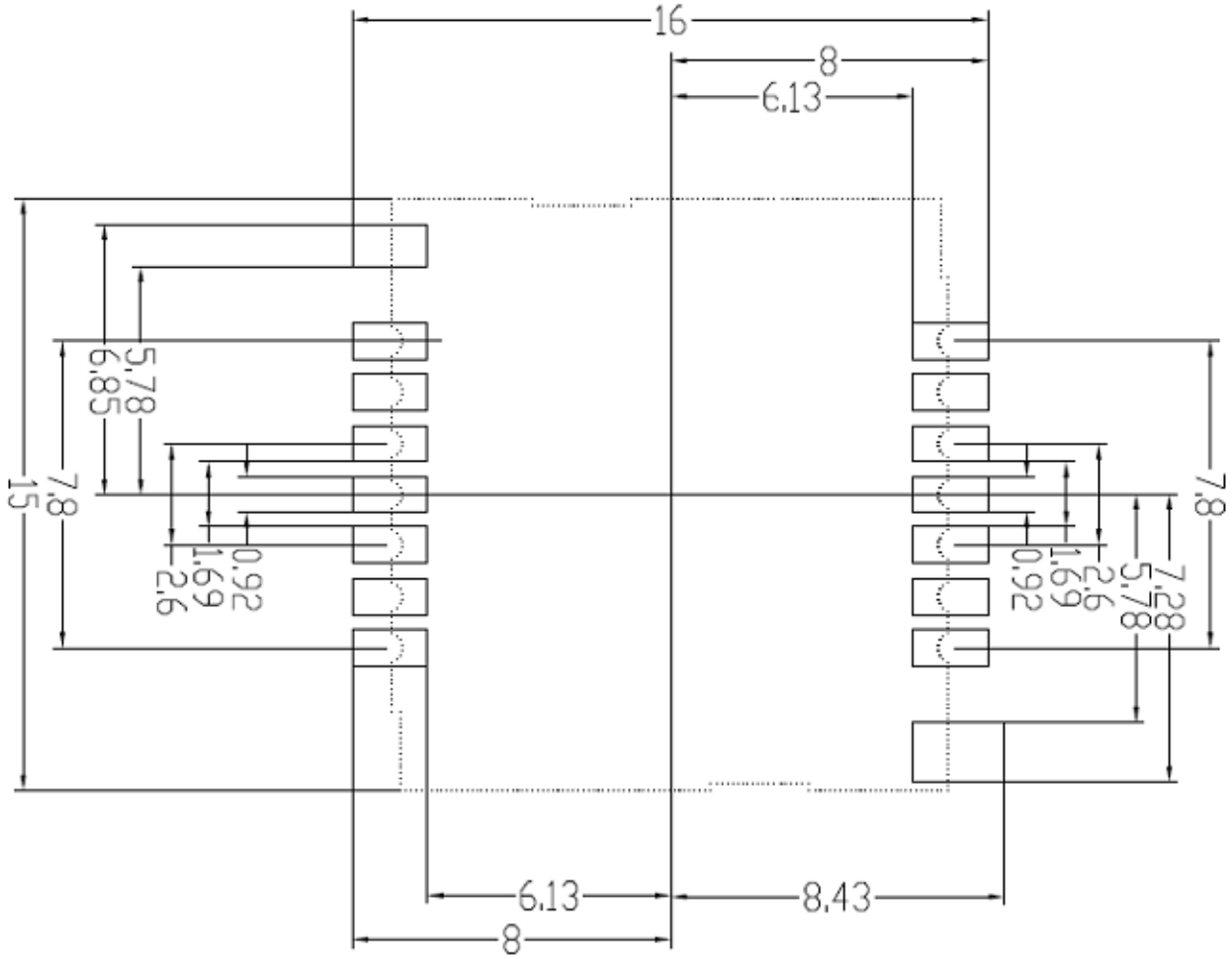
Option	Description
GGA	Time, position, and fix related data for a GPS receiver.
GSA	GPS receiver operating mode, satellites used in the position solution, and DOP values.
GSV	The number of GPS satellites in view satellite ID numbers, elevation, azimuth, and SNR values.
RMC	Time, date, position, course and speed data provided by the GPS receiver.

Table 3-2 NMEA-0183 Output messages

4. Mechanical drawing and footprint

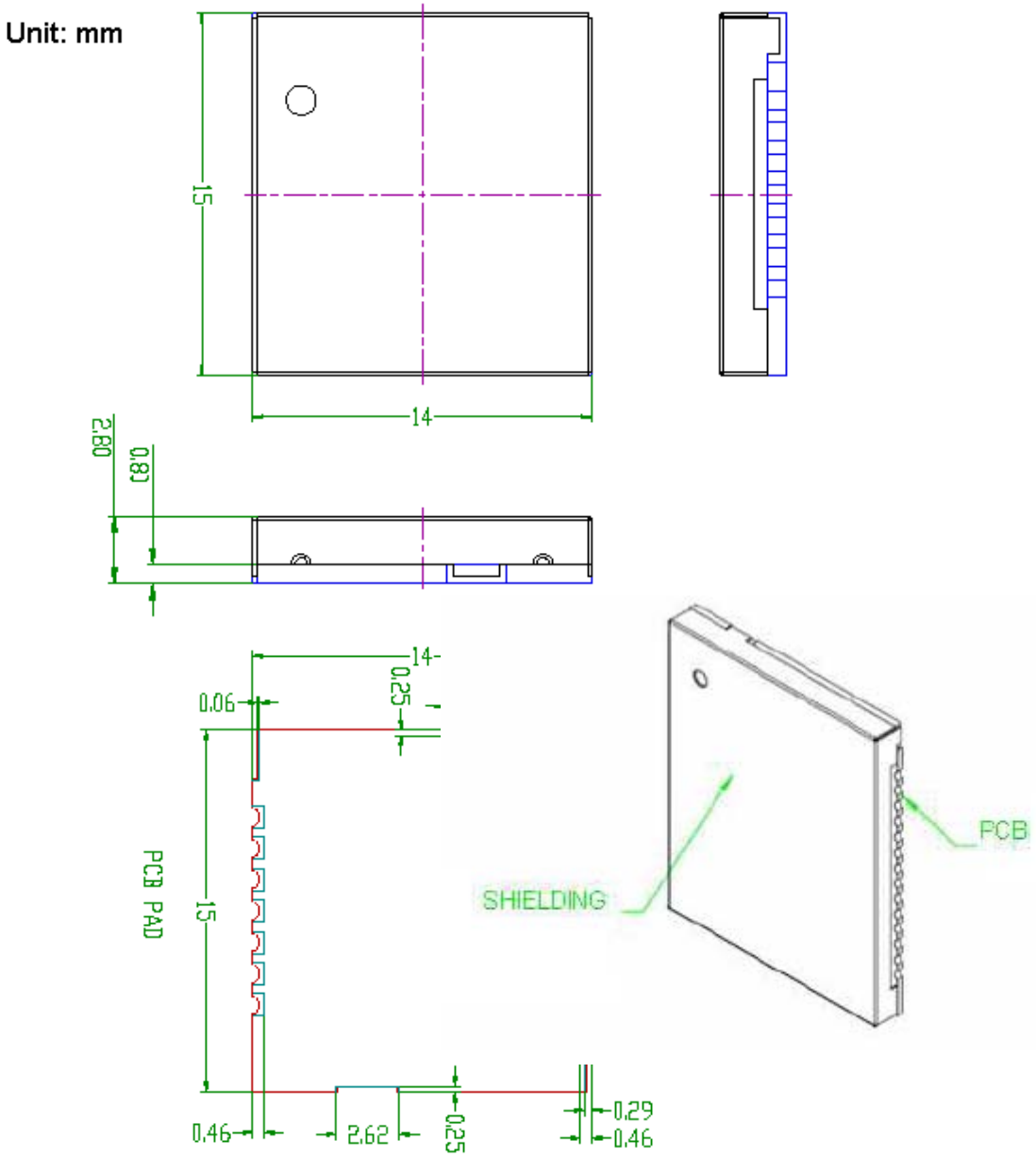
Items	Description
Length	15.0 ± 0.3 mm
Width	14.0 ± 0.3 mm
Height	2.80 ± 0.3 mm

4.1 Recommended Footprint (Top view)



Note: 1. Tolerance of recommended pad: 1.87 * 0.92 (+/- 0.1 mm)
2. Recommended pad for pin 9 is 2.3 * 1.5 mm (+/- 0.1 mm)

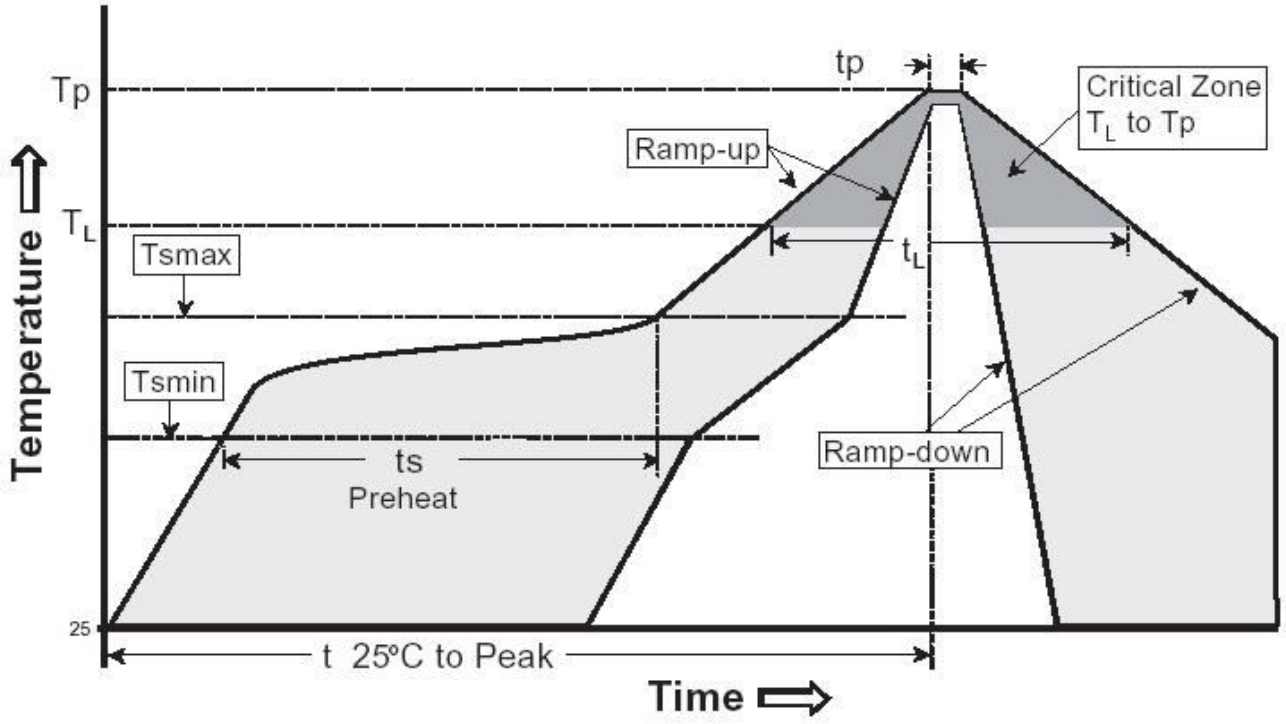
4.2 Outline Drawing



5. RoHS soldering profile

5.1 Reflow profile

High quality, low defect soldering requires identifying the optimum temperature profile for reflowing the solder paste. To have the correct profile assures components, boards, and solder joints are not damaged and reliable solder connection is achievable. Profiles are essential for establishing and maintaining processes. You must be able to repeat the profile to achieve process consistency. The heating and cooling rise rates must be compatible with the solder paste and components. The amount of time that the assembly is exposed to certain temperatures must first be defined and then maintained.



Preheat (Tsmax – Tsmin, ts)	150~200℃ ; 60~180seconds
Time maintained above (TL, tL)	217℃ ; 60~150seconds
Peak Temperature (Tp)	255~260℃ ; 10~20seconds
Ramp-down rate	6℃/second max.
Time 25℃ to Peak Temperature	8 minutes max.
Maximum number of reflow cycles	≤3

5.2 Storage & baking condition

1. Calculated shelf life in sealed bag: 6 months at <40℃ and <90% relative humidity(RH).
2. After bag is opened, devices that will be subjected to reflow soldering or other high temperature process must be:
   2-1. Mounted within: 24 hours of factory conditions ≦30℃ /60% RH, or
   2-2. Stored at <10% RH under the protection against humidity and static electricity
3. Devices require bake before mounting, if:
   3-1. Humidity indicator Card is >60% when read at 23±5℃
   3-2. 2-1 or 2-2 not met
4. If baking is required, devices may be baked for 24 hours at 125±5℃

Note: if device containers cannot be subjected to high temperature or if shorter bake times are desired, reference IPC/JEDEC J-STD-020 for bake procedure

6 Appendix

6.1 Application Note

- The layout design prefers that the ground plane should cover all the module PCB.
- All connection traces to the ground plane should be designed a short as possible.