SiRF Star III LowPower GPS Module

User's Manual Ver 1.04

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1. Introduction

1.1. Overview

Modulestek GPS module **MG-S02** is a high sensitivity, compact size, plug & play also the Low Power consumption GPS module board designed for a broad spectrum of OEM system applications. This product is based on the SiRF Star III technology and it will track up to 20 satellites at a time while providing fast time-to-first-fix. Its far reaching capability meets the sensitivity & accuracy requirements of car navigation as well as other location-based applications, such as AVL system. Handheld navigator, PDAs, Wrist Watches, Personal Locators, Toll collection, Fleet Management, pocket PC, or any battery operated navigation system.

The **MG-S02** design utilizes the latest surface mount technology and high level circuit integration to achieve superior performance while minimizing dimension and power consumption. This hardware capability combined with software intelligence makes the board easy to be integrated and used in all kinds of navigation applications or products.

1.2. Main Feature

- Built-in high performance SiRF Star III Low power chipset.
- Current consumption 40mA
- 20 channels parallel.
- Average Cold Start in 42 seconds.
- -159 dBm sensitivity in tracking mode
- NMEA0183 compliant protocol
- Extreme fast TTFF at low signal level

2. Technical Specifications

2.1. Electrical Characteristics

General		Accuracy	
GPS Chip	SiRF Star III	Position	
Frequency	L1, 1575.42MHz	10 meters, 2D RMS 7 meters 2D RMS, WAAS corrected 1-5 meters, DGPS corrected	
C/A Code	1.023MHz chip rate	Velocity	0.1 m/sec
Channels	20 CH	Time	1ms synchronized to GPS time
		Datum	
		WGS-84	
Sensitivity		Dynamic Conditions	
To – 159Bm Tracking, Superior Urban Canyon Performance		Altitude	<18,000 m (60,000 feet)
Acquisition Rate		Velocity	<515 m/sec (1,000 knots)
Cold Start	42 sec, average	Acceleration	<4g
Warm Start	38 sec, average	Motional Jerk	<20 m/sec
Hot Start	1 sec, average	GPS Protocol	
Reacquisition	0.1sec, average	Default: NMEA-0183, GGA(1), GSA(1), GSV(1), RMC(1), Band rate 9600 bps, Data bit : 8, stop bit : 1	
Accuracy	Snap start 2 sec, average		
Power			
Operation Power	3.3VDC+10%		
Current Consumption	40mW	Device Size	
Backup Power	3.3V	19.0 (L) x 19.0 (W) x 2.6 (H) mm	
Environmental			
Operating Temperature	- 10 ℃ to + 60 ℃	Accessories	
Relative Humidity	5% to 95% non-condensing		

3. Applications

MG-S02 module board receiver is a high performance, ultra low power consumption, plug &play product. These applications are as follow.

- Car Navigation
- Wrist Watch
- Solar Operated Device
- Marine Navigation
- Fleet Management
- AVL and Location-Based Services
- Radar detector with GPS function
- Hand-Held Device for Personal Positioning and Navigation
- Ideal for PAD, Pocket PC and Other Computing Devices at GPS Application
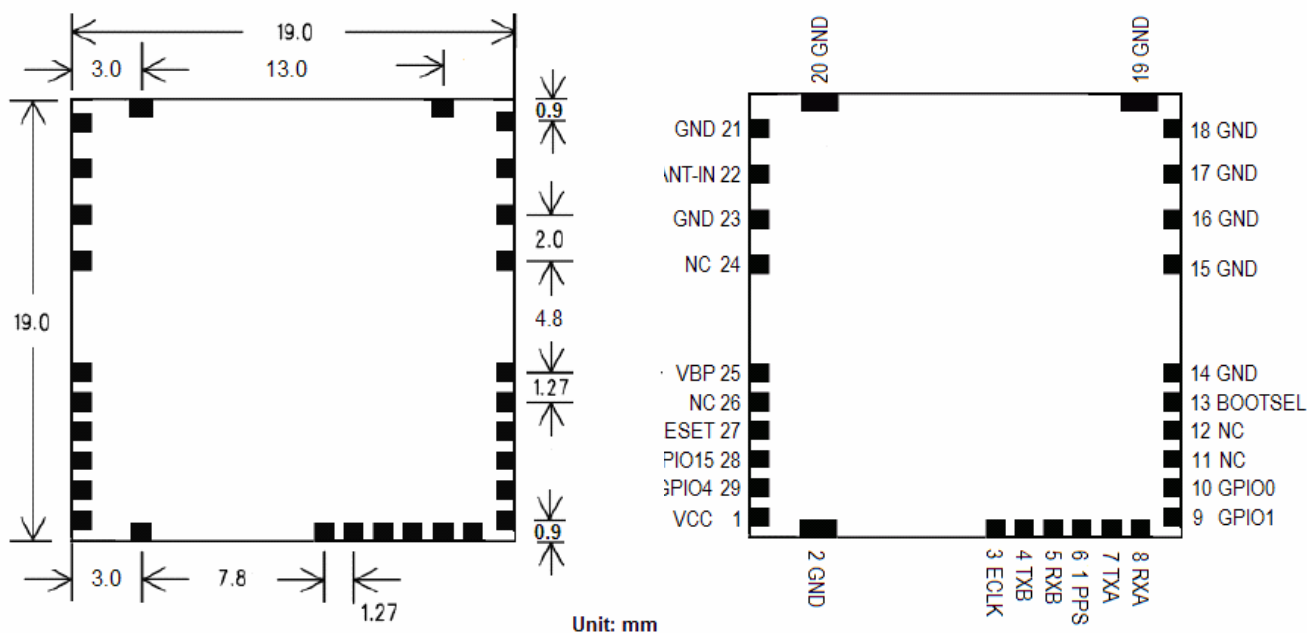
4. Mechanical Dimensions

4.1. MG-S02

Figure 1: Board dimensions (in mm)

5. Board connections

PIN	Signal name	I/O	Description	Note
1	**VCC**	**I**	**Supply Voltage (3.0V~3.6V)**	
2	**GND**			
3	**ECLK**	**I**	**External CMOS clock source**	
4	**TXB**	**O**	**Serial outputs for channel B**	
5	**RXB**	**I**	**Serial inputs for channel B**	
6	**1 PPS**	**I/O**	**One pulse per second**	
7	**TXA**	**O**	**Serial outputs for channel A**	
8	**RXA**	**I**	**Serial inputs for channel A**	
9	**GPIO1**	**I/O**	**LED Status**	**Leave unconnected if not used**
10	**GPIO0**	**I/O**		**Leave unconnected if not used**
11	**NC**			
12	**NC**			
13	**BOOTSEL**	**I**	**Module boots into special debug mode if VCC during reset**	**Leave unconnected if not used**
14	**GND**			
15	**GND**			
16	**GND**			
17	**GND**			
18	**GND**			
19	**GND**			
20	**GND**			
21	**GND**			
22	**ANT-IN**	**I**	**GPS signal from antenna**	**50Ω (1.57542 GHz)**
23	**GND**			
24	**NC**			
25	**VBP**	**I**	**Backup Voltage supply for RTC and SRAM**	**Leave unconnected if not used**
26	**NC**			
27	**RESET**	**I/O**	**Active low reset**	**Leave unconnected if not used**
28	**GPIO15**	**I/O**		**Leave unconnected if not used**
29	**GPIO4**	**I/O**	**GPS Status**	**GPS fixed: Clock("H" 500ms; "L" 500ms)** **GPS unfixed: "H"**

RESET

An external reset is initiated by pulling RESET low for at least 1 µs. If not used, RESET can be left unconnected since there is an internal 10k pull-up resistor. RESET is also used in Push-to-Fix mode in order to wake up the unit and request a position fix. Minimum pulse width is 1 µs.

BOOTSEL

The boot signal BOOTSEL forces special debug mode when restarted with a reset signal or power-up. If not used, BOOTSEL can be left unconnected since there is an internal 100k pull-down resistor.

RF IN

The line on the PCB from the antenna (or antenna connector) has to be a controlled impedance line (Microstrip at 50Ω).

VBAT

This is the battery backup supply that powers the SRAM and RTC when power is removed. Without an external backup battery or on board battery, engine board will execute a cold start after every turn on. To achieve the faster start-up offered by a hot or warm start, either a backup battery must be connected or battery installed on board.

TIMEMARK

This pin provides one pulse per second output from the engine board which is synchronized to within one microsecond of GPS time. The output is TTL negative level signal with negative logic.

6. Electrical Specification

Absolute Maximum Ratings

Parameter	Min	Max	Unit
Power supply voltage(VCC,VCC-RF)		3.6	V
Input/Output Pin voltage		5.25	V
RTC Voltage		2.0	V
Latch-up Current		±200	mA
Storage temperature	-65	150	℃

Warning － Stressing the device beyond the "Absolute Maximum Ratings" may cause permanent damage. These are stress ratings only. Operation beyond "Operating conditions" is not recommended and extended exposure beyond the "Operating condition" may affect device reliability. This module is not protected against over voltage, reversed voltage or short current of RF_IN port.

7. Operating Conditions

(Test Temperature: 25℃)

Parameter	Condition	Min	Typ	Max	Unit
Operating supply voltage	VCC	3.0	3.3	3.6	V
Operating supply ripple voltage				50	mV
Backup battery input voltage	V−BAT	1.9		3.0	V
I/O input low level				0.3x VCC	V
I/O input high level		0.7x VCC			V
I/O output high level	Loh=2mA	2.4	2.8		V
I/O output low level	Lol=2mA		0.2	0.4	V
Antenna input voltage	V_ANT	2.7	2.8	3.0	V
Sustained supply current	VCC=3.3V		40		mA
Peak supply current	VCC=3.3V		47		mA
Operating temperature	VCC=3.3V	−40	25	+85	℃

8. Application Schematic
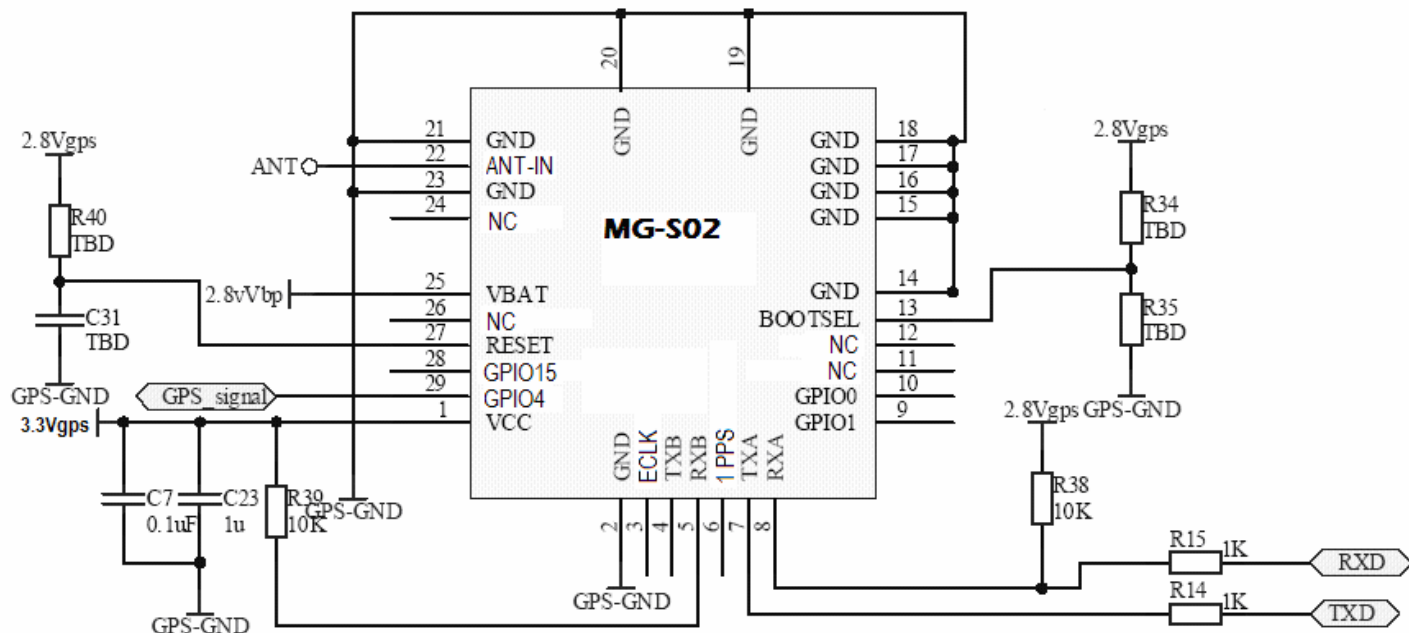
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