Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

Telit wireless solutions

SL869 Product Description

80405ST10105A r6 – 2014-09-15

Making machines talk.

APPLICABILITY TABLE

PRODUCT
SL869

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Notice

While reasonable efforts have been made to assure the accuracy of this document, Telit assumes no liability resulting from any inaccuracies or omissions in this document, or from use of the information obtained herein. The information in this document has been carefully checked and is believed to be entirely reliable. However, no responsibility is assumed for inaccuracies or omissions. Telit reserves the right to make changes to any products described herein and reserves the right to revise this document and to make changes from time to time in content hereof with no obligation to notify any person of revisions or changes. Telit does not assume any liability arising out of the application or use of any product, software, or circuit described herein; neither does it convey license under its patent rights or the rights of others.

It is possible that this publication may contain references to, or information about Telit products (machines and programs), programming, or services that are not announced in your country. Such references or information must not be construed to mean that Telit intends to announce such Telit products, programming, or services in your country.

Copyrights

This instruction manual and the Telit products described in this instruction manual may be, include or describe copyrighted Telit material, such as computer programs stored in semiconductor memories or other media. Laws in the Italy and other countries preserve for Telit and its licensors certain exclusive rights for copyrighted material, including the exclusive right to copy, reproduce in any form, distribute and make derivative works of the copyrighted material. Accordingly, any copyrighted material of Telit and its licensors contained herein or in the Telit products described in this instruction manual may not be copied, reproduced, distributed, merged or modified in any manner without the express written permission of Telit. Furthermore, the purchase of Telit products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Telit, as arises by operation of law in the sale of a product.

Computer Software Copyrights

The Telit and 3rd Party supplied Software (SW) products described in this instruction manual may include copyrighted Telit and other 3rd Party supplied computer programs stored in semiconductor memories or other media. Laws in the Italy and other countries preserve for Telit and other 3rd Party supplied SW certain exclusive rights for copyrighted computer programs, including the exclusive right to copy or reproduce in any form the copyrighted computer program. Accordingly, any copyrighted Telit or other 3rd Party supplied SW computer programs contained in the Telit products described in this instruction manual may not be copied (reverse engineered) or reproduced in any manner without the express written permission of Telit or the 3rd Party SW supplier. Furthermore, the purchase of Telit products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Telit or other 3rd Party supplied SW, except for the normal non-exclusive, royalty free license to use that arises by operation of law in the sale of a product.

Contents

1. Introduction 8
1.1. Scope 8
1.2. Audience 8
1.3. Contact Information, Support 8
1.4. Document Organization 9
1.5. Text Conventions 9
1.6. Related Documents 10
2. Overview 11
3. Technical Description 12
3.1. Receiver Architecture 13
3.2. Major Components 13
3.2.1. GNSS Chip 13
3.2.2. RF_IN 13
3.2.3. VCC 14
3.2.4. VBATT 14
3.2.5. Serial Interface 14
3.2.6. SAW Filter 14
3.2.7. TCXO 14
3.2.8. RTC 14
3.2.9. Memory 14
3.3. Physical Characteristics 14
3.4. Mechanical Specification 15
3.5. External Antenna Connection 15
3.6. Input/Output and Power Connections 15
3.7. Environmental 15
3.8. Compliances 15
3.9. Marking/Serialization 16
4. Performance Characteristics 17
4.1. TTFF (Time to First Fix) 17
4.1.1. Hot Start 17
4.1.2. Warm Start 17
4.1.3. Cold Start 17

4.2. AGPS ... 17
4.2.1. Local AGPS ... 17
4.2.2. Server-Based AGPS ... 18
4.3. Time Mark Pulse (1PPS) ... 18
4.4. Differential Aiding ... 18
4.4.1. Satellite Based Augmentation Systems (SBAS) ... 18
4.4.2. RTCM ... 18
4.5. Reduced Power Modes ... 19
4.5.1. Adaptive Channel Management ... 19
4.5.2. Duty Cycling ... 19
4.6. Timing ... 19
4.7. Dead Reckoning (DR) ... 20
4.8. Performance Data ... 21
4.9. SL869-T Timing Performance Data ... 21
4.10. Dynamic Constraints ... 22
5. Electrical Requirements ... 23
5.1. Power Supply ... 23
5.1.1. VCC ... 23
5.1.2. VBATT ... 23
5.2. External Antenna Voltage ... 23
5.3. RF (Radio Frequency) Input ... 23
5.4. Antenna Gain ... 23
5.5. Burnout Protection ... 23
5.6. Jamming Performance ... 24
5.7. Flash Upgradability ... 24
5.8. Data Input/Output Specifications ... 24
5.8.1. Voltages and Currents ... 25
5.8.2. DC Electrical Characteristics ... 26
5.8.3. Pinout Description ... 27
6. Software Interface ... 28
6.1. NMEA Output Messages ... 28
6.1.1. Standard Messages ... 28
6.1.2. Proprietary Messages ... 28
6.2. NMEA Commands ... 28

7. Mechanical Drawing 29

8. Evaluation Kit 32

9. Product Compatibility 33

10. Product Handling 34

10.1. Product Packaging and Delivery 34
10.2. Moisture Sensitivity 36
10.3. ESD Sensitivity 36
10.4. Safety 36
10.5. Disposal 36

11. Conformity Assessment 37

11.1. CE Conformity Declaration 37
11.2. R&TTE Notifed Body Opinion 38
11.3. RoHS Declaration 39

12. Glossary and Acronyms 40

13. Safety Recommendations 42

14. Document History 43

1. Introduction

1.1. Scope

Scope of this document is to give an overview of SL869 GNSS family of modules.

- SL869 is a standalone GNSS module
- SL869-T is a GNSS Timing module that also supports TRAIM
- SL869-DR is a GNSS Dead Reckoning module that supports MEMS Gyro plus Wheel Ticks or CAN Bus configurations

1.2. Audience

This document is intended for customers developing applications using SL869.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

TS-EMEA@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4. Document Organization

This document contains the following chapters:

“Chapter 1: “Introduction” provides a scope for this document, target audience, contact and support information, and text conventions.

“Chapter 2: “Overview” gives an overview of the features of the product.

“Chapter 3: “Technical Description” describes the features of the product.

“Chapter 4: “Performance Characteristics” describes in details the characteristics of the product.

“Chapter 5: “Electrical Requirements” describes in details the electrical characteristics of the product.

“Chapter 6: “Software Interface” provides information on default serial configuration.

“Chapter 7: “Mechanical Drawings” provides info about Hardware interfaces.

“Chapter 8: “Evaluation Kit” provides some fundamental hints about evaluation Kit.

“Chapter 9: “Product Compatibility” describes the compatibility between SL869 and JN3.

“Chapter 10: “Product Handling” describes the packaging and mounting of the module

“Chapter 11: “Conformity” shows a Declaration of Conformity and CETECOM ICT Certificate,

“Chapter 12: “ROHS Declaration” states that the Telit SL869 module is fully compliant to EU Directives.

“Chapter 13 “Glossary and Acronyms” contain the explanation of acronyms used in the present document

“Chapter 14: “Safety Recommendation” provides some safety recommendations that must be follow by the customer in the design of the application that makes use of the SL869.

“Chapter 15: “Document History” provides the history of the present document.

1.5. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.6. Related Documents

- SL869 Hardware User Guide, 1VV0301001
- SL869 Software User Guide, 1VV0301002
- SL869 EVK User Guide, 1VV0301004
- SL869 Timing Software User Guide, 1VV0301094
- SL869 DR Hardware User Guide, 1VV0301xx
- SL869 DR EVK User Guide, 1VV0301098

2. Overview

The SL869 represents a new age of receiver that can simultaneously search and track satellite signals from multiple satellite constellations. This multi-GNSS receiver uses the entire spectrum of GNSS systems available: GPS, GLONASS, Galileo and QZSS.

Operation in a high interference signal environment is common practice in today's electronic age. By incorporating 3-stage rejection architecture, the SL869 is able to remove interfering signals pre- and post-correlation.

Operating on a single 3.3V power supply, this module combines a GNSS engine, TCXO, SAW Filter, RTC and LDO. Communication is done over a UART serial port using NMEA message format.

The SL869 shares the same form factor as the Telit Jupiter JN3 and SL869 V2 families, 16mm x 12.2mm, commonly used in the industry.

The SL869 product family; SL869, SL869-T and SL986-DR offers default configurations to meet specific market needs.

As a the **Standard GNSS Module**, the **SL869** offering high sensitivity, low power consumption, jamming immunity and fast time to first fix.

As a **Timing Module**, the **SL869-T** provides best-in-class timing performance with an extremely stable synchronized 1PPS output and TRAIM (Time-Receiver Autonomous Integrity Monitor) integrity monitoring.

As a **DR Module**, the **SL869-DR** receiver provides the user with accurate estimates of vehicle's position and velocity when GNSS information is lost or not available by combining speed and heading sensor data into the solution. The result is improved navigation in harsh urban canyon environments.

3. Technical Description

High-speed Location Engine – An ARM9 core with embedded Flash memory offers enhanced sensitivity, fast time to first fix and improved position accuracy.

Battery Backup is supported via a separate pin for applications that use a battery backup source.

Jammer Immunity – Three stage jamming rejection approaches, actively identify and remove jammers pre- and post-correlation. This feature maximizes GPS performance.

High Performance Solution:

- High sensitivity navigation engine (PVT) tracks as low as -161dBm
- 32 track verification channels
- SBAS: WAAS, EGNOS, and MSAS

3.1. Receiver Architecture

The functional architecture of the SL869 receiver is shown in Figure 1.

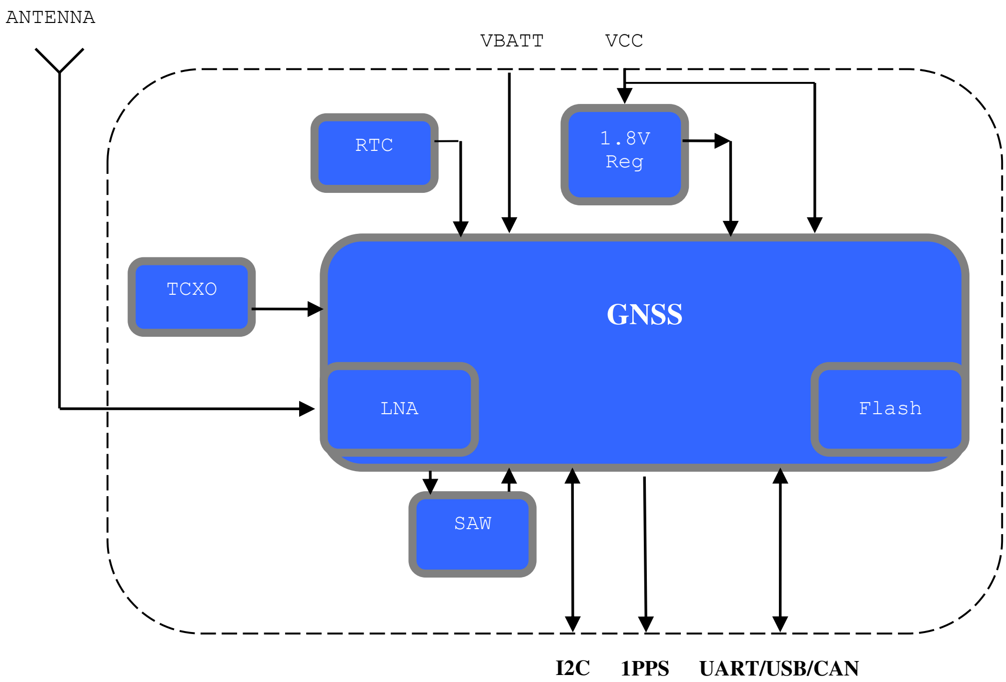

Figure 1 SL869 Architecture

Note: LNA is included in the GNSS chip for passive antenna operation.

3.2. Major Components

All power supply components are on board including capacitors.

3.2.1. GNSS Chip

This single chip GNSS device includes an integrated Baseband and RF section. The LNA amplifies the GPS signal and provides enough gain for the receiver to use a passive antenna. A very low noise design is utilized to provide maximum sensitivity. Flash memory is integrated so external memory is not required.

3.2.2. RF_IN

This GNSS RF signal input supports both active and passive antennas. An external BIAS-T and antenna voltage supply are required for an active antenna.

3.2.3. VCC

This is the primary 3.0V to 3.6V supply voltage for the module. The SL869 includes a switching voltage regulator that supplies 1.8V to the GNSS device.

3.2.4. VBATT

The Battery Backup supply voltage is 2.5V to 3.6V. It is a typical low current supply for ensuring that the RTC is kept running and critical data is maintained to enable HOT/WARM starts.

3.2.5. Serial Interface

The SL869 host serial port is the primary communications port which outputs data and accepts commands in NMEA format.

- Main Serial Interface: Standard asynchronous RX/TX 8-bit protocol on pins 20 & 21.
- Secondary Serial Interface: Normally not used, but can be utilized for RTCM differential corrections into the receiver. If debug is enabled, the debug data is output on this port.
- Tertiary Serial Interface: Hardware controlled through USB_DETECT on pin 7. This port is only used as a USB Port. See the HW User Guide for more details.

3.2.6. SAW Filter

This filters the GNSS signal and removes unwanted signals caused by external influences that would corrupt the operation of the receiver. The integrated LNA outputs to the SAW filter which then feeds the GNSS receiver.

3.2.7. TCXO

This highly stable 26 MHz oscillator controls the down conversion process for the RF block.

3.2.8. RTC

The 32 KHz Real Time Clock allows Hot/Warm starts.

3.2.9. Memory

The SL869 has an integrated 2Mbyte Flash device for operational software and satellite data storage.

3.3. Physical Characteristics

The SL869 receiver has advanced miniature packaging with a base metal of copper and an Electro less Nickel Immersion Gold (ENIG) finish.

It has a tin-plated shield and 24 interface pads. These pads are castellated edge contacts.

3.4. Mechanical Specification

The physical dimensions of the SL869 are as follows:

- length: 16.0 mm ± 0.1 mm
- width: 12.2 mm ± 0.1 mm
- thickness: 2.55 mm ± 0.22 mm
- weight: 1 g max

Refer to Figure 2 for the SL869 mechanical layout drawing.

3.5. External Antenna Connection

The RF connection for the external antenna has a characteristic impedance of 50 ohms.

3.6. Input/Output and Power Connections

The I/O (Input / Output) and power connections use surface mount pads.

3.7. Environmental

The environmental operating conditions of the SL869 are as follows:

- temperature: –40ºC to +85ºC (measured on the shield)
- humidity: up to 95% non-condensing or a wet bulb temperature of +35ºC

3.8. Compliances

The SL869 complies with the following:

- Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
- Manufactured in an ISO 9000: 2000 accredited facility
- Manufactured to TS 16949 requirement (upon request)

Moreover, the SL869 module is conform to the following European Union Directives:

- Low Voltage Directive 2006/95/EEC and product safety
- Directive EMC 2004/108/EC for conformity for EMC

3.9. Marking/Serialization

The SL869 supports a 2D barcode indicating the unit serial number below. The Telit 13-character serial number convention is:

- characters 1 and 2: year of manufacture (e.g. 13 = 2013, 14 = 2014)
- characters 3 and 4: week of manufacture (01 to 52, starting first week in January)
- character 5: manufacturer code
- characters 6 and 7: product and type
- character 8: product revision
- characters 9-13: sequential serial number

4. Performance Characteristics

4.1. TTFF (Time to First Fix)

TTFF is the actual time required by a GPS receiver to achieve a valid position solution. This specification will vary with the operating state of the receiver, the length of time since the last position fix, the location of the last fix, and the specific receiver design.

Please refer to section 4.8 for performance data.

4.1.1. Hot Start

A hot start results from a software reset after a period of continuous navigation, or a return from a short idle period (i.e. a few minutes) that was preceded by a period of continuous navigation. In this state, all of the critical data (position, velocity, time, and satellite ephemeris) is valid to the specified accuracy and available in memory.

4.1.2. Warm Start

A warm start typically results after a period of continuous navigation is followed by an extended period of continuous RTC operation with an accurate last known position available in memory. In this state, position and time data are present and valid but ephemeris data validity has expired.

4.1.3. Cold Start

A cold start acquisition results when either position or time data is unknown. Almanac information is used to identify previously healthy satellites.

4.2. AGPS

GPS aiding, also known as Assisted GPS (AGPS), is a method by which TTFF is reduced using information from a source other than broadcast GPS signals. The form of assisted GPS data supported and used by the module is predicted ephemeris data.

Ephemeris predictions is a method of GPS aiding that effectively reduces the TTFF through the use of predicted ephemeris data as a substitute for broadcast ephemeris data to produce a navigation solution. In this way, every start is potentially a hot start.

There are two sources of predicted ephemeris – locally predicted ephemeris and server-based predicted ephemeris data.

4.2.1. Local AGPS

Proprietary algorithms within the module perform ephemeris prediction locally from captured broadcast ephemeris data from tracked satellites. The algorithms predict ephemeris for up to five days.

4.2.2. Server-Based AGPS

Server-based ephemeris predictions are generated by a third party and are maintained on Telit AGPS servers in a file. The predicted ephemeris file is obtained from the AGPS server and is injected into the module over the Host port. These predictions do not require local broadcast ephemeris collection, and they are valid for up to seven days.

The module supports server-based AGPS as standard. Contact TELIT for support regarding this service.

4.3. Time Mark Pulse (1PPS)

For standard SL869 modules, a 1PPS time mark is output whenever the receiver has a navigation fix of 2D fix or better. For SL869-T timing modules, the 1PPS time mark pulse is output all the time. The 1PPS output at a 50% duty cycle, has a default pulse width of 500ms.

4.4. Differential Aiding

The module supports differential GPS (DGPS) operation. DGPS improves position accuracy by correcting GPS signal errors caused by ionospheric disturbances as well as timing and satellite orbit errors.

4.4.1. Satellite Based Augmentation Systems (SBAS)

The SL869 is capable of receiving WAAS, EGNOS, and MSAS satellite differential corrections, which are regional implementations of SBAS for North America, Europe, and Eastern Asia, respectively.

4.4.2. RTCM

The SL869 accepts RTCM SC-104 standard differential corrections data, which are typically received by an RTCM radio beacon receiver. RTCM corrections are accepted over a serial port. The module supports message types 1 and 9.

4.5. Reduced Power Modes

The SL869 supports operational modes in that allow it to provide positioning information at reduced overall current consumption.

4.5.1. Adaptive Channel Management

The SL869 supports an adaptive channel management algorithm which dynamically switches off a GNSS constellation and reduces the number of tracked satellites when conditions allow.

4.5.2. Duty Cycling

The SL869 supports power cycling of the RF chain such that satellites are tracked for shorter periods of time between positioning updates.

4.6. Timing

The SL869-T (Timing Module) provides an independent and highly accurate 1PPS output, synchronized to GNSS time or UTC within <20 nanoseconds (average over 24 hr. period) and a Timing Receiver Autonomous Integrity Monitoring (TRAIM) algorithm for maintaining PPS integrity. In addition, the 1PPS output remains accurate with only one satellite in track.

- Self-Survey Mode – The accuracy and integrity of a timing solution is highly dependent on the accuracy of the reference position. Automatic self-survey mode offers a commanded reference position determination, cable delay compensation and the ability to remove delays between antenna and module.
- Cable Delay Compensation – The ability to compensate for RF cable loss is critical in GNSS receivers used in accurate timing applications. The SL869 has the ability to advance or delay the 1PPS signal to compensate for any delay in the RF path into the receiver.
- TRAIM – Timing Receiver Autonomous Integrity Monitoring is the ability of a GNSS receiver to identify, isolate and remove from the solution any satellite that is experiencing Time-Of-Week (TOW) transmission errors.

4.7. Dead Reckoning (DR)

When GPS signals are blocked (e.g. tunnels or parking structures) the SL869-DR (Dead Reckoning) Module allows uninterrupted vehicle navigation based on heading and distance data provided by external sensors.

The SL869-DR supports sensor or message based capability. The table below provides a list of sensor-based DR configurations supported. In addition, an accelerometer (optional) can be used for automatic tilt compensation for ease of installation.

Note: The CAN configurations can utilize a built-in CAN Bus translator to reduce overall BOM cost.

DR Configuration	Yaw Rate Sensor	Distance Sensor	Other Sensors
Classic	MEMS Gyro (1 or 3 axis)	Discrete Odometer	Discrete Reverse Signal
CAN Gyro	CAN Gyro	CAN Odometer	CAN Reverse Signal
Differential Wheel Pulse (DWP)	CAN DWP (ABS)	CAN Odometer	CAN Reverse Signal
Mixed	MEMS Gyro (1 or 3 axis)	CAN Odometer	CAN Reverse Signal

Table 1: DR Configuration Options

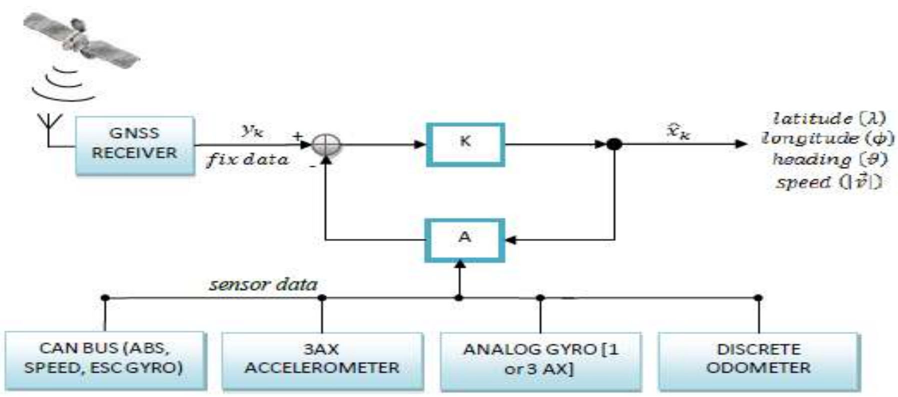

Figure 2: DR Sensor Interface

4.8. Performance Data

Parameter	Description	Performance			
		Min	Typical	Max	Units
Horizontal Position Accuracy[1]	Autonomous	-	<1.5	-	m
GPS Only Time to First Fix[2]	Hot Start	-	<1	-	s
	Warm Start	-	<35	-	s
	Cold Start	-	<35	-	s
GPS + GLO Time to First Fix	Hot Start	-	<1.75	-	s
	Warm Start	-	<32	-	s
	Cold Start	-	<32	-	s
GPS Only Sensitivity[3]	Acquisition	-146		-	dBm
	Tracking	-162	-	-	dBm
	Navigation	-158	-	-	dBm
GPS + GLO Sensitivity[3]	Acquisition	-146		-	dBm
	Tracking	-158	-	-	dBm
	Navigation	-156	-	-	dBm
[1]50%, 24 hr. static, -130 dBm, Full Power					
[2]Minimum 500 trials, -130 dBm					
[3]In-line LNA used with 1dB noise figure (NF) and 20dB gain.					

Table 2 – SL869 Performance Data

4.9. SL869-T Timing Performance Data

PPS Accuracy (nsec)	Simulator			Open Sky	
	GPS Only	GPS + GLO	GPS (1 SV)	GPS Only	GPS + GLO
PPS Error (50%)	3.8	3.8	3.7	3.9	3.9
PPS Error (90%)	7.4	7.1	10.3	8.2	11.9
PPS Error (100%)	12.5	10.9	13.5	18	18.9

Table 3 – SL869 Timing (PPS) Accuracy (CDF)

Note: To calculate the CDF the RF & HW path delay is totally compensated and position hold enabled.

4.10. Dynamic Constraints

The SL869 receiver will lose track if any of the following limits are exceeded:

- ITAR limits: velocity greater than 515 m/s AND altitude above 18,000 m
- altitude: 100,000 m (max) or -1500 m (min)
- velocity: 600 m/s (max)
- acceleration: 2 G (max)

5. Electrical Requirements

5.1. Power Supply

5.1.1. VCC

This is the main power input. The supply voltage must be in the range 3.0V to 3.6V. Reference the HW User Guide for additional details.

5.1.2. VBATT

The battery backup power input range is 2.5V to 3.6V. It is required for HOT/WARM starts and retention of GPS data.

5.2. External Antenna Voltage

The SL869 requires an external antenna Bias-T to provide the voltage to the antenna.

5.3. RF (Radio Frequency) Input

The RF input is 1575.42 MHz to 1606 MHz (L1 Band) at a level between -135 dBm and -165 dBm into 50 Ohm impedance.

5.4. Antenna Gain

The receiver module will operate with a passive antenna with Isotropic gain down to a minimum of -6dBi. Active antennas are supported.

An active antenna between 20dB to 25dB (exiting the cable) will offer the best performance.

Note: The recommended total external gain range includes all external gain; antenna, external LNA, and any passive loss due to cables, connectors, filters, matching networks, etc.

5.5. Burnout Protection

The receiver accepts without risk of damage a signal of +10 dBm from 0 to 2 GHz carrier frequency, except in band 1560 to 1590 MHz where the maximum level is –10 dBm.

5.6. Jamming Performance

In-band jammers can be detected and removed using a 3-stage approach (RF, DSP and SW) pre-and post-correlation. This is over and above the excellent SAW filter response that exists before the GPS LNA input.

Note: The spectral purity of oscillators and RF transmitters in the host system will determine if harmonics are formed that are equal to the frequencies above.

Compact wireless product design requires close monitoring of jamming issues.

5.7. Flash Upgradability

The firmware programmed in the Flash memory may be upgraded via the serial port TX/RX pads. There are two different methods and two different firmware upgrade tools.

1. Using the TeseoII XLoader, the user can load firmware by driving the Serial BOOT select line low at startup, then downloading the code from a PC with suitable software. In normal operation this pad should be left floating for minimal current drain. It is recommended that in the user's application, the BOOT select pad is connected to a test pad for use in future software upgrades.
2. Using the Teseo2 Firmware Upgrade Tool, the user can reflash the receiver without driving the BOOT select line low, however this method only works if an existing firmware is already running and the NMEA port is available.

   Refer to the User Guides for additional information on both modes.

5.8. Data Input/Output Specifications

All communications between the SL869 receiver and external devices are through the I/O surface mount pads. These provide the contacts for power, ground, serial I/O and control. Power requirements are discussed in the following sections.

5.8.1. Voltages and Currents

Parameter	Symbol	Min	Typ	Max	Unit
Power Supply Voltage	VCC	3.0	3.3	3.6	V
Operating Temperature	T_{OPR}	-40		85	^{0}C
Current Consumption Navigation/Tracking: • GPS + GLO • GPS Only • GLO Only Acquisition: • GPS + GLO • GPS Only Low Power Mode: • GPS + GLO • GPS Only	ICC		42 38 67 58 30 22		mA
Battery Backup Supply	VBATT	2.5	3	3.6	V
Battery Backup Current	IBATT		73		uA
Operating temperature is ambient. Low Power mode uses a 500ms duty cycle setting.					

Table 4 – Power Requirements

Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Power Supply Voltage	VCC	3.6	V
Input Pin Voltage	VIO_IN	3.6	V
Output Pin Voltage	VIO_OUT	3.6	V
Storage Temperature	T_{stg}	-40°C to +85°C	^{0}C
Warning – Stressing the device beyond the “Absolute Maximum Ratings” may cause permanent damage. These are stress ratings only. Operation beyond the “Operating Conditions” is not recommended and extended exposure beyond the “Operating Conditions” may affect device reliability.			

Table 5 – Digital Core and I/O Voltage (Volatile)