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Jupiter 20
GPS receiver module

Data Sheet

Related documents

- Jupiter 20 Integrator's manual LA000508
- Jupiter 20 Product brief LA000509
- Jupiter Series development kit guide LA000645
- SiRF Binary protocol reference manual
- Navman NMEA reference manual MN000315
- Jupiter 20 DR application note LA000433
- Low Power Operating Modes application note LA000513

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1.0 Introduction

The Jupiter 20 GPS receiver module is a very small surface mount receiver that is intended as a component for OEM (Original Equipment Manufacturer) products. The module provides a 12-channel receiver that continuously tracks all satellites in view and provides accurate positioning data.

2.0 Technical description

The highly integrated digital receiver incorporates and enhances the established technology of the SiRFstarIIe/LP chipset. It is designed to meet the needs of the most demanding applications, such as vehicle tracking in dense urban environments. The interface configuration allows incorporation into many existing devices and legacy designs.

The Jupiter 20 receiver decodes and processes signals from all visible GPS satellites. These satellites, in various orbits around the Earth, broadcast RF (radio frequency) ranging codes, timing information, and navigation data messages. The receiver uses all available signals to produce a highly accurate navigation solution. The 12-channel architecture provides rapid TTFF (Time To First Fix) under all start-up conditions. Acquisition is guaranteed under all initialisation conditions as long as visible satellites are not obscured.

The Jupiter 20 is available in three configurations:

- Jupiter 20 (standard) – GSW2.3 navigation software
- Jupiter 20S (high sensitivity) – with XTrac navigation software
- Jupiter 20D (Dead Reckoning) – with SiRFDRive software and gyro interface

Protocols supported are selected NMEA (National Marine Electronics Association) data messages and SiRF binary.

2.1 Product applications

The module is designed for high performance and maximum flexibility in a wide range of OEM configurations including hand-helds, sensors, and in-vehicle automotive products.

2.2 Receiver architecture

The functional architecture of the Jupiter 20 receiver is shown in Figure 2-1.

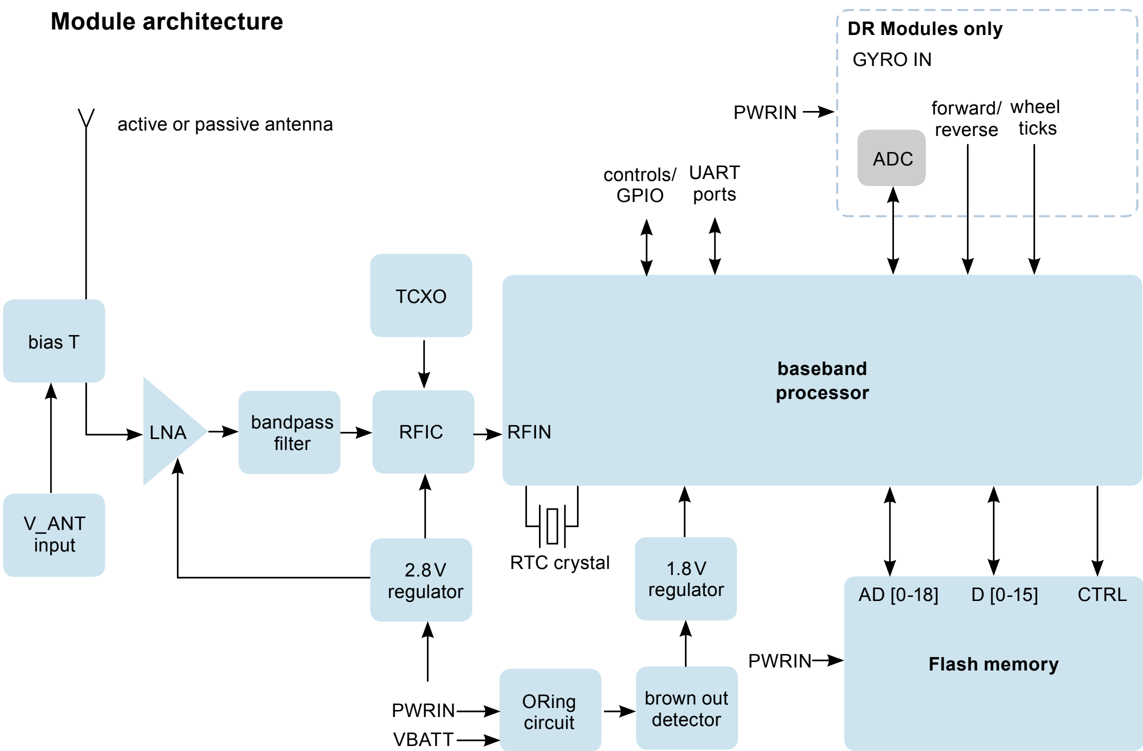

Figure 2-1: Jupiter 20 module architecture

2.3 Major components of the Jupiter 20

LNA (Low Noise Amplifier): This amplifies the GPS signal and provides enough gain for the receiver to use a passive antenna. A very low noise design is utilised to provide maximum sensitivity.

Bandpass filter (1.575 GHz): This filters the GPS signal and removes unwanted signals caused by external influences that would corrupt the operation of the receiver.

RFIC (Radio Frequency Integrated Circuit): The RFIC (SiRFstarII GRF 2i/LP) and related components convert the GPS signal into an intermediate frequency and then digitise it for use by the baseband processor.

TCXO (Temperature Compensated Crystal Oscillator): This highly stable 24.5535 MHz oscillator controls the down conversion process for the RFIC block. Stability in this frequency is required to achieve a fast TTFF.

Baseband processor: The SiRFstarII GSP 2e/LP processor is the main engine of the GPS receiver. It runs all GPS signal measurement code, navigation code, and other ancillary routines, such as power saving modes. The normal I/O of this processor is via the two serial ports.

Flash memory: The Flash memory stores software and also some long term data.

RTC (Real Time Clock) crystal: The 32 kHz crystal operates in conjunction with the RTC inside the baseband processor. It provides an accurate clock function when main power has been removed, if the battery backup is connected.

Reset generator: There are two voltage threshold reset generators in the Jupiter 20. The first provides a reset to the baseband block if the main power drops below a low limit threshold. The second shuts off the supply to the RTC in case the backup battery drops below a lower threshold. This is used to compensate for a slow SiRF rise-time backup voltage.

Regulators: The regulators provide a clean and stable voltage supply to the components in the receiver.

DR (Dead Reckoning) components: The Jupiter 20D has additional components allowing direct connection to a turn rate gyro. The gyro input takes the form of a high resolution ADC (Analogue to Digital Converter), where the analogue signal is digitised and prepared for use by the SiRFDRive DR software running in the baseband processor.

2.4 Physical characteristics

The Jupiter 20 receiver is packaged on a miniature printed circuit board with a metallic RF enclosure on one side. The standard or DR configuration must be selected at the time of ordering and is not available for field retrofitting.

A lead-free RoHS compliant product has been available since the end of 2005.

2.5 Mechanical specification

The physical dimensions of the Jupiter 20 are as follows:

length:	25.4 mm ± 0.1 mm
width:	25.4 mm ± 0.1 mm
thickness:	3.0 mm max
weight:	4.0 g max

Refer to Figure 8-1 for the Jupiter 20 mechanical drawing.

2.6 External antenna surface mount pads

The RF surface mount pad for the external antenna has a characteristic impedance of 50 ohms.

2.7 I/O and power connections

The I/O (Input Output) and power connections use surface mount pads with edge plating around the edge of the module.

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2.8 Environmental

The environmental operating conditions of the Jupiter 20 are as follows:

temperature: –40°C to +85°C
humidity: up to 95% non-condensing or a wet bulb temperature of +35°C
altitude: –304 m to 18 000 m
vibration: random vibration IEC 68-2-64
max. vehicle dynamics: 500 m/s
shock (non-operating): 18 G peak, 5 ms

2.9 Compliances

The Jupiter 20 complies with the following:

- Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
- CISPR22 and FCC: Part 15, Class B for radiated emissions
- Automotive standard TS 16949
- Manufactured in an ISO 9000 : 2000 accredited facility

2.10 Marking/Serialisation

The Jupiter 20 supports a code 128 barcode indicating the unit serial number. The Navman 13-character serial number convention is:

characters 1 and 2: year of manufacture (e.g. 06 = 2006, 07 = 2007)
characters 3 and 4: week of manufacture (1 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

3.0 Performance characteristics

3.1 TTFF (Time To First Fix)

TTFF is the actual time required by a GPS receiver to achieve a 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.

3.1.1 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 SRAM (Static Random Access Memory). Battery backup of the SRAM and RTC during loss of power is required to achieve a hot start.

3.1.2 Warm start

A warm start typically results from user-supplied position and time initialisation data or 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.

3.1.3 Cold start

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

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3.2 Acquisition times

Table 3-1 shows the corresponding TTFF times for each of the acquisition modes.

Mode	J20		J20S		J20D	
	Typ	90%	Typ	90%	Typ	90%
TTFF hot (valid almanac, position, time & ephemeris)	8 s	12 s	8 s	12 s	8 s	12 s
TTFF warm (valid almanac, position & time)	38 s	42 s	38 s	40 s	35 s	40 s
TTFF cold (valid almanac)	44 s	55 s	45 s	56 s	52 s	70 s
re-acquisition (<10 s obstruction with valid almanac, position, time & ephemeris)	100 ms	100 ms	100 ms	100 ms	100 ms	100 ms

Table 3-1: TTFF acquisition times

3.3 Timing 1PPS output

The 1PPS (Pulse Per Second) output of the Jupiter 20 receiver is < 1 μs, typical ± 300 ns in reference to UTC (Coordinated Universal Time). This feature is currently only available on the Jupiter 20 standard module.

3.4 Battery backup (SRAM/RTC backup)

During powered down conditions, the SRAM and RTC may be kept operating by supplying power from the VBATT as shown in Table 4-1. The Jupiter 20 can accept slow VBATT supply rise time (unlike many other SiRFstarII based receivers) due to an on-board voltage detector.

3.5 TricklePower mode

During normal mode of operation the Jupiter 20 is continuously running, providing a navigation solution at the maximum rate of once per second. This continuous mode provides no power saving.

The TricklePower mode of operation can be enabled to reduce the average power consumption. The main power is supplied to the module continuously. An internal timer wakes the processor from sleep mode. The module computes a navigation position fix, after which the processor reverts to sleep mode. The duty cycle is controlled by a user-configurable parameter.

If ephemeris data becomes outdated, the TricklePower mode will attempt to refresh the data set within every 30-minute period, or for every new satellite that comes into view.

With TricklePower set to a 20% duty cycle, a power saving of 50% can easily be achieved with minimal degradation in navigation performance.

3.5.1 Adaptive TricklePower mode

In Adaptive TricklePower mode, the processor automatically returns to full power when signal levels are below the level at which they can be tracked in TricklePower mode. This is the default behaviour when TricklePower is active.

3.5.2 Push-To-Fix mode

Unlike TricklePower, the operation in this mode is not cyclic. This mode always forces the GPS software to revert to a continuous sleep mode after a navigation position fix. It will stay in sleep mode until woken by activation of the reset input, and compute a fresh position.

If the ephemeris data becomes invalid, the RTC has the ability to self activate and refresh the data, thus keeping the restart TTFF very short.

This mode yields the lowest power consumption of the module, and is ideal where a battery powered application requires very few position fixes.

For further information on the TricklePower and Push-To-Fix modes refer to the Low Power Operating Modes application note (LA000513).

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3.6 Differential aiding

3.6.1 Differential GPS (DGPS)

DGPS specification improves the Jupiter 20 horizontal position accuracy to <4 m 2 dRMS.

3.6.2 Satellite Based Augmentation Systems (SBAS) including WAAS and EGNOS

SBAS improves horizontal position accuracy by correcting GPS signal errors caused by ionospheric disturbances, timing and satellite orbit errors. The Jupiter 20 is capable of receiving WAAS and EGNOS differential corrections. Both SBAS and DGPS should improve position accuracy. However, other factors can affect accuracy, such as GDOP (Geometric Dilution of Precision), multipath, distance from DGPS reference station and latency of corrections. Note also that XTrac does not support differential aiding.

3.7 Navigation modes

The Jupiter 20 GPS receiver supports 3D (three-dimensional) and 2D (two-dimensional) modes of navigation.

3D navigation: The receiver defaults to 3D navigation when at least four GPS satellites are being tracked. In 3D navigation, the receiver computes latitude, longitude, altitude, and time from satellite measurements.

2D navigation: When less than four GPS satellite signals are available, or when a fixed altitude value can be used to produce an acceptable navigation solution, the receiver will enter 2D navigation mode using a fixed value of altitude determined by the host. Forced operation in 2D mode can be commanded by the host.

In 2D navigation, the navigational accuracy is primarily determined by the relationship of the fixed altitude value to the true altitude of the antenna. If the fixed value is correct, the specified horizontal accuracies apply. Otherwise, the horizontal accuracies will degrade as a function of the error in the fixed altitude.

3.8 Core processor performance

The standard Jupiter 20 with GSW2 software runs at a CPU clock speed of 12.28 MHz. Using XTrac software (Jupiter 20S), the clock speed increases to 24.5 MHz. An SDK (Software Development Kit) is available from SiRF to customise the Jupiter 20 firmware. Using the SiRF SDK the clock speed can be increased up to 49 MHz.

The processing power used by the navigation software is shown in Table 3-2.

Parameter	J20/J20D	J20S
typical performance	2-3 MIPS	4-5 MIPS
peak performance	6-7 MIPS	8-9 MIPS

Table 3-2: Software processing performance

3.9 Sensitivity

The GPS receiver performance of the Jupiter 20 is shown in Table 3-3.

Parameter	J20/J20D		J20S	
acquisition sensitivity	–135 dBm	33 dBHz	–135 dBm	33 dBHz
navigation sensitivity	–141 dBm	28 dBHz	–152 dBm	17 dBHz
tracking sensitivity	–143 dBm	26 dBHz	–154 dBm	15 dBHz

Table 3-3: GPS receiver performance

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3.10 Dynamic constraints

The Jupiter 20 receiver is programmed to deliberately lose track if any of the following limits are exceeded:

Velocity: 500 m/s max
Acceleration: 4 G (39.2 m/s^2) max
Vehicle jerk: 5 m/s^3 max
Altitude: 18 000 m max (referenced to MSL)

3.11 Position and velocity accuracy

The position and velocity accuracy of the Jupiter 20 are shown in Table 3-4, assuming full accuracy C/A code (Clear/Acquisition). These values are the same in normal operation and when TricklePower is active.

Parameter	J20/J20D	J20S
horizontal CEP	2.1 m	2.2 m
horizontal (2 dRMS)	5.2 m	5.5 m
vertical VEP	2.5 m	2.5 m
velocity 2D (2 sigma)*	0.1 m/s	0.15 m/s
**at a velocity greater than 5 km/h*		

Table 3-4: Position and velocity accuracy

4.0 Electrical requirements

4.1 Power supply

4.1.1 Primary power

The Jupiter 20 GPS receiver is designed to operate from a single supply voltage, meeting the requirements shown in Table 4-1.

Parameter	J20	J20S	J20D
input voltage	2.9 to 3.6 VDC	2.9 to 3.6 VDC	2.9 to 3.6 VDC
current (typ) at full power (3.3 V)	75 mA	85 mA	80 mA
current (max)	100 mA	100 mA	100 mA
current (typ) at 20% TricklePower™	35 mA	60 mA	35 mA
battery backup voltage	2.4 V to 3.6 V		
battery backup current	<10 µA typ at 25°C		
maximum rise time	unlimited		
ripple	not to exceed 50 mV peak to peak		

Table 4-1: Operating power for the Jupiter 20

4.1.2 Low supply voltage detector

The module will enter a reset mode if the main supply drops below 2.8 V.

4.1.3 VCC_RF power supply

The VCC_RF (pad 20) provides a regulated 2.8 V power source. The specifications for this supply are as follows:

voltage: 2.8 V ± 2%
current max: 25 mA for J20/J20S; 5 mA for J20D

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4.1.4 External antenna voltage

DC power is supplied to the external antenna through the antenna power input pad (VANT). The receiver does not use this supply. The DC supply to the RF connection does not current limit in the event of a short circuit. Reference designs for antenna current limit are available in the Jupiter 20 Integrator's manual (LA000508).

The external antenna characteristics are as follows:

voltage (typ): 3.3 V

voltage max: 12 V

current max: 100 mA

Warning: if the antenna or its cable develops a short circuit and the external antenna current is not limited, the GPS receiver will experience permanent damage.

4.1.5 RF (Radio Frequency) input

RF input is 1575.42 MHz (L1 Band) at a level between –135 dBm and –152 dBm into a 50 ohm impedance. This input may have a DC voltage impressed upon it to supply power to an active antenna. The maximum input return loss is –9 dB.

4.1.6 Antenna gain

The receiver will operate with a passive antenna of unity gain. However, GPS performance will be optimum when an active antenna is used. The gain of this antenna should be in the range of 20 dB to 30 dB.

4.1.7 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 will be –10 dBm.

4.1.8 Jamming performance

The typical jamming performance of the receiver based upon a 3 dB degradation in C/N_0 (Carrier to Noise power ratio) performance is shown in Table 4-2. This is with reference to the external antenna.

Frequency MHz	Jamming signal power dBm
1400	–19
1425.42	–16
1530	–27
1555	–69
1575.42	–114
1625.42	–33
1725.42	–19

Table 4-2: Typical jamming performance

4.1.9 Flash upgradability

The firmware programmed in the Flash memory may be upgraded via the serial port. The user can control this by pulling the Serial BOOT pad (3) high at startup, then downloading the code from a PC with suitable software (e.g. SiRFFlash). In normal operation this pad should be left floating for minimal current drain. It is recommended that in the user's application, the BOOT pad is connected to a test pad for use in future software upgrades.

4.1.10 Reset input

This active low input (pad 22) allows the user to restart the software from an external signal. It is also used to initiate a 'push-to-fix' navigation cycle. In normal operation this pad should be left floating or activated by an open drain driver. Active pull-up is not recommended.

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4.2 Data input output specifications

All communications between the Jupiter 20 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 Section 4.1.

4.2.1 Voltage levels

The I/O connector voltage levels measured at PWR_IN = 3 V are shown in Table 4-3.

Signal	Parameter	Value
TXD & RXD GPIOs SPI bus	V_{IH} (min)	2.0 V
	V_{IH} (max)	PWR_IN +0.1 V
	V_{IL} (min)	0.1 V
	V_{IL} (max)	0.8 V
	V_{OH} (min) at I_{OH} 2 mA	2.0 V
	V_{OH} (max)	PWR_IN
	V_{OL} (min)	0
	V_{OL} (max) at I_{OL} –2 mA	1.0 V
Reset input*	max capacitance Cmax	100 pF
	input current max	–600 µA
	pulse time min	200 µs
*Reset input should not be driven high by external circuits. It is recommended that this input is driven low by an open drain interface.		

Table 4-3: Interface voltage levels

4.2.2 I/O surface mount pads

Details of the surface mount pad functions are shown in Table 4-4 and 4-5.

Pad No.	Name	Type	Description
8*	GYRO_IN	I	gyro input (analogue 0–5 V)
27*	FWD/REV	I	fwd/rev input (low=forward, high=reverse)
28*	WHEEL_TICKS	I	wheel tick input
* See also Table 4-5 for J20/J20S pad functions			

Table 4-4: J20D receiver pad functions

Pad No.	Name	Type	Description
1	PWRIN	P	main power input (3.3 V)
2	GND	P	ground
3	BOOT	I	serial boot (high for serial boot, low or open circuit for normal operation)
4	RXA	I	CMOS level asynchronous input for UART A
5	TXA	O	CMOS level asynchronous output for UART A
6	TXB	O	CMOS level asynchronous output for UART B
7	RXB	I	CMOS level asynchronous input for UART B
8*	GPIO3/ ADC_CONV/ NANT_SC	IO	general purpose IO/ output for external A/D converter control/ antenna short circuit sensor input (active low)
9	RF_ON	O	output to indicate whether the RF section is enabled (active high)
10	GND	P	ground
11	GND	P	ground
12	GND	P	ground
13	GND	P	ground
14	GND	P	ground
15	GND	P	ground
16	GND	P	ground
17	RF_IN	I	antenna signal input
18	GND	P	ground
19	V_ANT	P	external power supply for active antenna
20	VCC_RF	O	RF Power (+2.8 V) supply output
21	V_BATT	P	backup battery input
22	RESET	I	master reset (active low)
23	GPIO10/GPS_FIX	IO	general purpose IO or GPS fix indication (active low)
24	GPIO6/SDO	IO	general purpose IO or SPI serial data out
25	GPIO5/SDI	IO	general purpose IO or SPI serial data in
26	GPIO7/SCK	IO	general purpose IO or SPI serial clock
27*	GPIO15/ ANT_OC	IO	general purpose IO/ antenna open circuit sensor input (active high)
28*	GPIO1/ ANT_CTRL	IO	general purpose IO/ antenna DC power control output (ON=high)
29	GPIO9/1PPS	O	general purpose IO or 1 pulse per second output
30	GND	P	ground
** See also Table 4-4 for J20D pad functions*			

Table 4-5: J20/J20S receiver pad functions

5.0 Software interface

The host serial I/O port of the receiver's serial data interface supports full duplex communication between the receiver and the user. The default serial modes are shown in Table 5-1.

Port	J20 (GSW2.3)	J20S (XTrac)	J20D (SiRFDRive 1.0)
Port A	NMEA, 9600	NMEA, 9600	NMEA, 9600
Port B	RTCM, 9600	SiRF binary, 38400	RTCM, 9600

Table 5-1: Jupiter 20 default baud rates

5.1 NMEA output messages

The output NMEA (0183 v2.2) messages and intervals for the receiver are listed in Table 5-2. A complete description of each NMEA message is contained in the Navman NMEA reference manual (MN000315).

NMEA message	J20	J20S	J20D
GGA	1 s	1 s	1 s
GSA	1 s	1 s	1 s
GSV	1 s	1 s	1 s
RMC	1 s	1 s	1 s
VTG	1 s	1 s	1 s
GLL	1 s	1 s	1 s
ZDA	1 s	N/A	N/A
PTTK, DR	N/A	N/A	1 s
N/A=not available			

Table 5-2: Default NMEA messages

5.2 SiRF binary

A complete description of each binary message is contained in the SiRF Binary Protocol reference manual.

5.3 Software functions and capabilities

The Jupiter 20 has additional capabilities to the standard SiRF GPS software:

- GPS fix output – GPIO10 Low for 2D or 3D fix
- GPIO command control via serial commands – for use by customer
- Gyro, wheel-tick and forward reverse inputs (DR only)
- Antenna power monitor messages and power control O/P (non DR only)
- PTTK, DR – DR status messages in NMEA protocol format

Refer to the Jupiter 20 Integrator's manual (LA000508) for further information.

Table 5-3 shows the software features available with the Jupiter 20 configurations.

Feature	Description	J20 GSW2.3	J20S XTrac	J20D SiRFDrive
SBAS capability	Improves position accuracy by using freely available satellite-based correction services called SBAS (Satellite Based Augmentation System)	A		A
DGPS ready	Accepts DGPS corrections in the RTCM SC-104 format	E		E
TricklePower	Improves battery life using this enhanced power management mode	A	A	
Adaptive TricklePower	Intelligently switches between TricklePower and full power depending on the current GPS signal level (when TricklePower is enabled)	E	yes	
Advanced power management	Improves battery life using a software-based power management		A	
Push-to-Fix	Provides an on-demand position fix mode designed to further improve battery life	A	A	
Almanac to Flash	Improves cold start times by storing the most recent almanac to flash memory	yes		yes
Low signal acquisition	Acquires satellites and continues tracking in extremely low signal environments		yes	
Low signal navigation	Continues navigating in extremely low signal environments		yes	
1 PPS	A timing signal generated every second on the second	E		E
yes=*always enabled* ***A***=*available* ***E***=*enabled by default in production units*				

Table 5-3: Jupiter 20 software capability

6.0 Dead Reckoning input specifications

6.1 Gyro input specification

The specifications shown in Table 6-1 apply to the Jupiter 20D only.

Characteristics	Value	Unit
input max voltage range	max +5, min 0	VDC
input resistance nominal	18.2	kΩ
nominal bias at zero angular velocity	2.5	VDC
nominal scale factor	22.2	mV per degrees/s
linearity	±0.5 max	%
angular resolution	0.055	degrees/s
max gyro angular rate	±80	degrees/s
Note that clockwise rotation should cause the input to rise		

Table 6-1: Gyro input specifications

At the time of publication, recommended manufacturers of gyros are as follows:

Murata ENV series

Panasonic EWTS series

(Navman takes no responsibility for the use of these gyros in an application.)

6.2 Wheel tick rate

The wheel tick rate is 4 kHz maximum, 1 Hz minimum.

6.3 Fwd/Rev input sense

The fwd/rev input sense is: LOW=forward, HIGH=reverse. External pull down is required if this input is not used.

7.0 Jupiter 20 development kit

The Jupiter 20 Development kit series assists in the integration of the Jupiter 20 module in custom applications. The Development kit contains all of the necessary hardware and software to carry out a thorough evaluation of the Jupiter 20 module. Refer to the Jupiter Series Development kit guide (LA000645) for further details.

The following development kits are available for Jupiter 20 products:

- TU10-D057-400 Jupiter 20 Development kit RoHS
- TU10-D057-401 Jupiter 20 S Development kit RoHS
- TU10-D057-402 Jupiter 20 DR Development kit RoHS

8.0 Jupiter 20 mechanical drawing

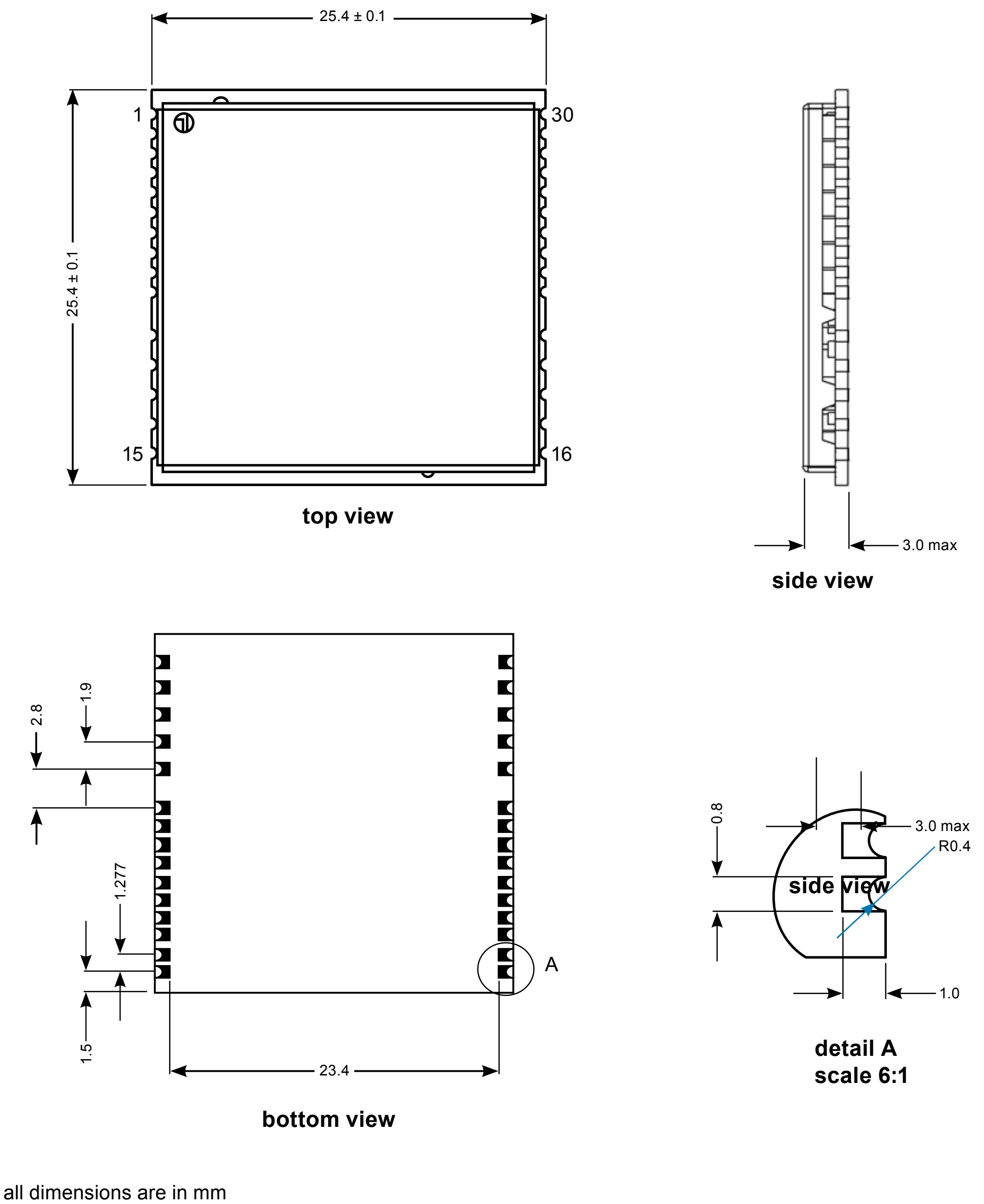


Figure 8-1: Jupiter 20 mechanical layout

9.0 Product handling

9.1 Packaging and delivery

Jupiter 20 modules are shipped in Tape and Reel form. The reeled modules are shipped with 250 units per 300 x 44 mm (D x W) reel with a pitch of 32 mm. Each reel is ‘dry’ packaged and vacuum sealed in an MMB (Moisture Barrier Bag) with two silica gel packs and placed in a carton.

The MOQ (Minimum Order Quantity) for shipping is 250 units.

All packaging is ESD protective lined. Please follow the MSD and ESD handling instructions on the labels of the MMB and exterior carton (refer to sections 9.2 and 9.3).

9.2 Moisture sensitivity

The Jupiter 20 GPS receiver is an MSD (Moisture Sensitive Device). Precautionary measures are required in handling, storing and using such devices to avoid damage from moisture absorption. If localised heating is required to rework or repair the device, precautionary methods are required to avoid exposure to solder reflow temperatures that can result in performance degradation.

Further information can be obtained from the IPC/JEDEC standard J-STD-033: Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices.

9.3 ESD sensitivity

The Jupiter 20 GPS receiver contains class 1 devices and is ESDS (ElectroStatic Discharge Sensitive). Navman recommends the two basic principles of protecting ESDS devices from damage:

- Only handle sensitive components in an ESD Protected Area (EPA) under protected and controlled conditions
- Protect sensitive devices outside the EPA using ESD protective packaging

All personnel handling ESDS devices have the responsibility to be aware of the ESD threat to reliability of electronic products.

Further information can be obtained from the IEC Technical Report IEC61340-5-1 & 2: Protection of electronic devices from electrostatic phenomena.

9.4 Safety

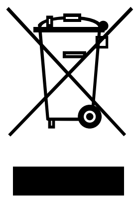
Improper handling and use of the Jupiter GPS receiver can cause permanent damage to the receiver and may even result in personal injury.

9.5 RoHS compliance

This product complies with Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

9.6 Disposal

We recommend that this product should not be treated as household waste. For more detailed information about recycling of this product, please contact your local waste management authority or the reseller from who you purchased the product.



10.0 Ordering information

The part numbers of the Jupiter 20 variants are shown in Table 10-1.

Part Number	Description
TU20-D411-001	Jupiter 20 (standard)
TU20-D411-101	Jupiter 20S (with XTrac)
TU20-D421-201	Jupiter 20D (with Dead Reckoning)
TU20-D101-001	Jupiter 20 std adapter
TU10-D007-400	Jupiter 20 std development kit
TU10-D007-401	Jupiter 20S development kit
TU10-D007-402	Jupiter 20D development kit

Table 10-1: Jupiter 20 ordering information

11.0 Glossary and acronyms

2dRMS: twice distance Root Mean Square

ADC: Analogue to Digital Converter

Almanac: A set of orbital parameters that allows calculation of approximate GPS satellite positions and velocities. The almanac is used by a GPS receiver to determine satellite visibility and as an aid during acquisition of GPS satellite signals. The almanac is a subset of satellite ephemeris data and is updated weekly by GPS Control.

C/A code: Coarse Acquisition code
A spread spectrum direct sequence code that is used primarily by commercial GPS receivers to determine the range to the transmitting GPS satellite.

DGPS: Differential GPS
A technique to improve GPS accuracy that uses pseudo-range errors recorded at a known location to improve the measurements made by other GPS receivers within the same general geographic area.

GDOP: Geometric Dilution of Precision
A factor used to describe the effect of the satellite geometry on the position and time accuracy of the GPS receiver solution. The lower the value of the GDOP parameter, the less the error in the position solution. Related indicators include PDOP, HDOP, TDOP and VDOP.

EGNOS: European Geostationary Navigation Overlay Service
The system of geostationary satellites and ground stations developed in Europe to improve the position and time calculation performed by the GPS receiver.

Ephemeris
A set of satellite orbital parameters that is used by a GPS receiver to calculate precise GPS satellite positions and velocities. The ephemeris is used to determine the navigation solution and is updated frequently to maintain the accuracy of GPS receivers.

GPS: Global Positioning System
A space-based radio positioning system that provides accurate position, velocity, and time data.

OEM: Original Equipment Manufacturer

Re-acquisition
The time taken for a position to be obtained after all satellites have been made invisible to the receiver.

SBAS: Satellite Based Augmentation System
Any system using a network of geostationary satellites and ground stations to improve the performance of a Global Navigation Satellite System (GNSS), e.g. EGNOS and WAAS.

SRAM: Static Random Access Memory

WAAS: Wide Area Augmentation System
System of satellites and ground stations developed by the FAA (Federal Aviation Administration) providing GPS signal corrections. (Currently available for North America only.)

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