KOSMINIS VYTIS

KV102.SMT

OEM GNSS MODULE

with low power consumption

Specification

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CONTENTS

1 INTRODUCTION

The **KV102.SMT OEM** module supports the GPS L1, L5, NavIC L5, S and SBAS L1 signals to improve the continuity and reliability of positioning.

The **KV102.SMT** can be used for the following purposes:

- as a source of navigational data (Position, Velocity, Time – PVT) in autonomous mode, 1 Hz;
- as a source of raw GNSS measurements (include code and phase pseudoranges, Doppler measurements, SNRs), Base Mode, 20 Hz.

The view of the **KV102.SMT** is presented in *Figure 1.1*. Dimensions of the module are shown in the *Figure 1.2*.

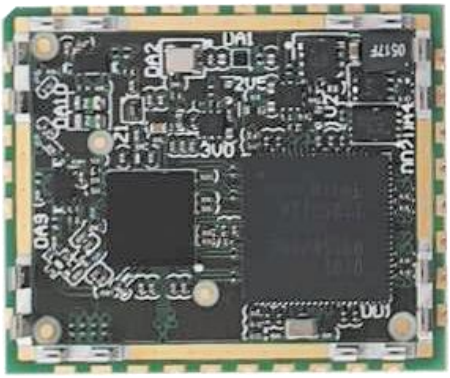

Figure 1.1 – **KV102.SMT OEM** module view

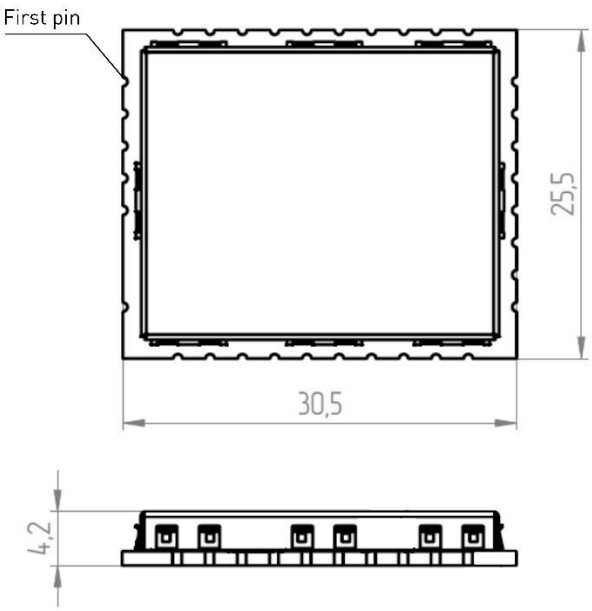

Figure 1.2 – **KV102.SMT OEM** module dimensions, mm

2 BLOCK DIAGRAM

The general block diagram of the KV102.SMT is shown in the *Figure 2.1*.

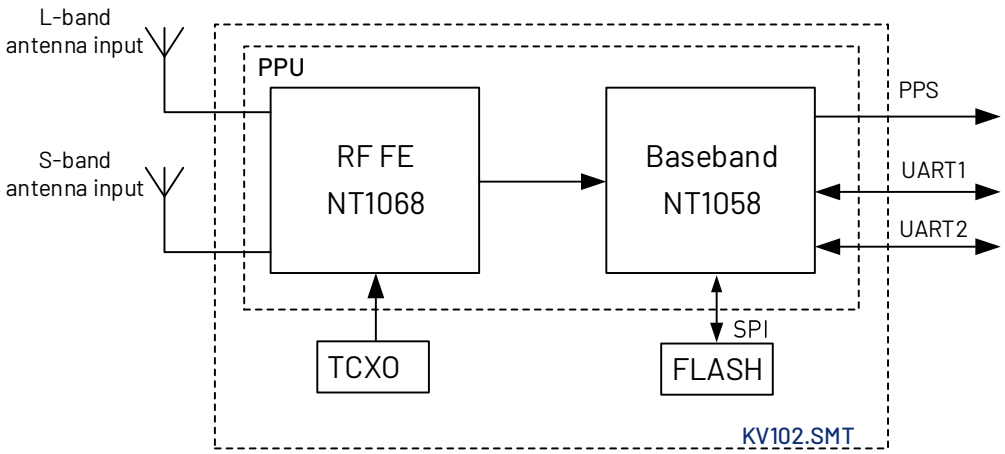

Figure 2.1– The block diagram of the KV102.SMT

Primary Processing Unit (PPU) is a basic functional block of KV102.SMT module. It is the source of standard accuracy navigation data (meter-level position accuracy) and raw GNSS measurements. Refer to the «GNSS-PPU-SETUP-GUIDE-AA-BB-CC.pdf» for details.

PPU is implemented on chips set which are designed by NTLab company:

- NT1068 is a 4-channel L1, L2, L5, S multi-bands Radio-Frequency Front-End (RF FE) integrated circuit for GNSS signals receiving and their processing: for amplification, filtering and down converting of the received signals to a fixed intermediate frequency (IF);
- NT1058 is microcontroller which includes digital baseband processor and 64 dual channels hardware correlator for GNSS signals tracking and primary processing of digital signals.

The KV102.SMT has two physical UART ports (UART1 and UART2) which can be used to transmit navigation information in the autonomous mode, to output raw ranging measurements, to monitor status information and configure the module. Each of the serial ports consist of RX and TX line. The baud rates can be set individually for each serial port. Refer to Chapter 6 for information about default UART settings.

The KV102.SMT contains on-module SPI serial flash memory to store two configurations. Firmware upgrade is possible through any of UART channels.

The *PPS* is a time synchronization output signal from NT1058 with 1 second period (corresponds to the frequency of navigation solution). The PPS adjusts to the GPS system time with an accuracy of +/-20 ns. It is possible to additionally shift the PPS edge along the time axis to the left/right (perform calibration). The PPS adjusts can be performed for the system time of any GNSS that the receiver supports (not only GPS).

Voltage logic level is 2.5 V, pulse width is 1 ms. PPS is triggered by the leading edge. Polarity cannot be reversed.

3 POWER SUPPLY

KV102.SMT host-device must provide DC voltage for the module and antenna:

- 3.3 V...5.5 V DC module power supply is provided from Pin 26;
- 5 V DC antenna power supply is provided from Pin 35.

GNSS external active antenna requirements:

- antenna voltage supply 5 V;
- maximum current 100 mA;
- LNA gain range (minus signal loss) 20 dB ...35 dB.

The external GNSS antenna(s) must have a clear line of sight to the sky during operation. Roofs free from other structures or geographic overhead elements, with a direct view of the horizon, usually make good places to install. This clear view allows antenna to track the maximum number of satellites during the day.

Don't install GNSS antenna near the window of the building or indoors. When installing the GNSS antenna, choose a location where the antenna will not be covered by drifting snow or accumulated snow. It must not be covered with leaves or placed in a position where it could be blocked.

Avoid placing the GNSS antenna in close proximity to broadcast antennas, metal surfaces or powerful transmitters.

Optimal performance will not be available in narrow streets or if the antenna is obstructed by objects.

Poor visibility may result in a position shift or an increase in Time To First Fix (TTFF).

Therefore, good visibility of the sky is an important condition. Incorrect antenna placement can influence on navigation solution.

4 PIN DEFINITION

The pinout of the KV102.SMT module is shown in the *Figure 4.1*.

Pins assignment is presented in the *Table 4.1*.

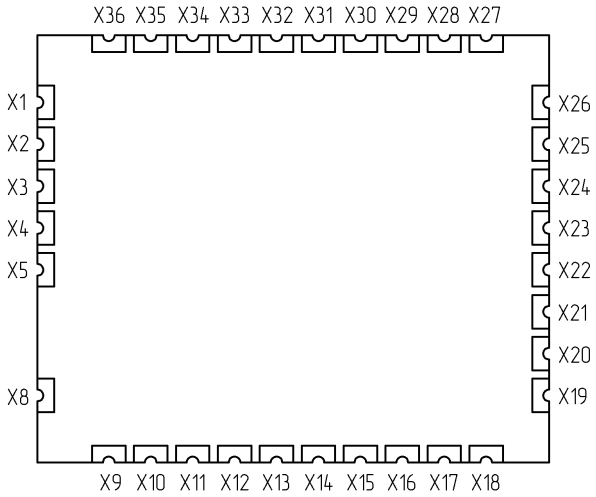

Figure 4.1– Pinout of the KV102.SMT module

Table 4.1– Pins assignment of the KV102.SMT module

Pin number	Name	Type	Description
X1, X3, X5, X8, X25, X27, X34, X36	GND	Power	Signal and Power Ground
X2	RF_IN_L	Input	L-band antenna input
X4	RF_IN_S	Input	S-band antenna input
X9	68_SCK	Input	SPI NT1068[1]
X10	68_MOSI	Input	SPI NT1068[1]
X11	68_MISO	Output	SPI NT1068[1]
X12	68_CS	Input	SPI NT1068[1]
X13	LED	Output	NT1058 Ready signal
X14	Vbat	Power	Battery power input[2]
X15	PPS	Output	PPS time mark
X16	UART2_TX	Output	UART2 transmit data

[1] Used for service purposes

[2] Reserved for connecting a backup battery. At the moment, this option is not available.

Table continuation 4.1– Pins assignment of the KV102.SMT module

Pin number	Name	Type	Description
X17	UART2_RX	Input	UART2 receive data
X18	DBGCLK	I/O	NT1058 debug interface[3]
X19	DBGIO	I/O	NT1058 debug interface[3]
X20	nPOR	Input	NT1058 debug interface[3]
X21	UART1_TX	Output	UART1 transmit data
X22	UART1_RX	Input	UART1 receive data
X23	BOOT	Input	Boot mode selection
X24	DEF	I/O	–
X26	Vin	Power	KV102.SMT power supply input
X28	58_CS	Output	SPI NT1058[3]
X29	58_MISO	Input	SPI NT1058[3]
X30	58_MOSI	Output	SPI NT1058[3]
X31	58_CLK	Output	SPI NT1058[3]
X32	TCXO_EN	Input	Internal TCXO enabled[4]
X33	TCXO_EXT	Input	TCXO External input
X35	ANT_Vcc	Power	Antenna power supply input

[3] Used for service purposes
[4] By default, high level. Set low level when is used TCXO External.

5 SPECIFICATION

Table 5.1 – Specification of the **KV102.SMT**

SUPPORTED GNSS CONSTELLATIONS		
GPS L1, L5; NavIC L5, S; SBAS L1		
TECHNICAL SPECIFICATION		
Parameter	**Value**	**Note**
Channels	128	
Measurement Precision (RMS): – C/A pseudoranges, cm – L1, L2 carrier phase, mm	 20 0.8	 smoothed pseudoranges
Standalone mode Accuracy (RMS): – position Horizontal/Vertical, m	2.1 / 3.5	- for static and dynamic mode; - depends on atmospheric conditions, satellite visibility and geometry, multipath conditions, GNSS antenna
SBAS mode Accuracy (RMS): – position Horizontal/Vertical, m	0.8 / 1.1	GPS+SBAS (static mode)
Velocity Accuracy (RMS): - velocity Horizontal/Vertical, m/s:	0.02 / 0.03	
Time to First Fix (TTFF): - «Cold» Start, sec	< 90	- for static mode; - depends on atmospheric conditions, satellite visibility and geometry, multipath conditions, GNSS antenna;
– signal Re-acquisition, sec	< 5	- for static mode; - when the GNSS signal is interrupted for less than 10 sec and then restored
Data update rates: – position, velocity, time Hz – raw GNSS measurement, Hz	 1 20	 no options; 1,2,5,10 Hz available
Timing Accuracy	+/- 20 ns	
Maximum operating limits: – velocity, m/s – altitude, m – acceleration, g	 515 18000 Up to 8	
Interfaces	2xUART 1PPSout	for 1PPSout: voltage logic level is 2.5 V, pulse width is 1 ms
Data Output Format	NMEA 2.3, NMEA 4.11, NTL Binary, RTCM 3.3	RTCM 3.3 :MSM + Legacy messages
Electrical parameters: – supply voltage, V – power consumption, W	 3.3...5.5 < 0.75	
Environmental characteristics: – operating temperature, °C – storage temperature, °C	 -40 °C to +71 °C -55 °C to +85 °C	
Weight and size: – dimensions (L x W x H), mm; – weight, g	 30.5 x 25.5 x 4.2 < 15	
Note: All specifications are at an ambient temperature of 25 °C. Extreme operating temperatures can significantly impact specification values. The product is not protected against overvoltage or reversed voltages		

6 COMMUNICATION INTERFACES

The following external interfaces are available: 2xUART, 1xPPS out (CMOS 2.5).

There are several interface protocols: RTCM3.3 (MSM + Legacy messages), NovAtel OEM (only messages for transmitting range measurements and ephemeris), NMEA 2.3, NMEA 4.11, NTL Binary.

Table 6.1 – Interface setting

Interface	Description
UART1 Tx/Rx (Pin 21/22)	Available data transmission formats: • NMEA-0183 for nav. data transmission; • NTL Binary for nav. data transmission and control; • RTCM3.3 or Novatel OEMv7 for raw ranging data transmission. Available baud rate range: 9600 to 460800. Default settings: 115200 Baud, 8 bits, no parity bit, 1 stop bit, NMEA.
UART2 Tx/Rx (Pin 16/17)	Available data transmission formats: • NMEA-0183 for nav. data transmission; • NTL Binary for nav. data transmission and control; • RTCM3.3 or Novatel OEMv7 for raw ranging data transmission. Available baud rate range: 9600 to 460800. Default settings: 115200 Baud, 8 bits, no parity bit, 1 stop bit, no data.

Refer to «GNSS-DCP-BUILD-AA-BB-CC.pdf» document to get more information about interface performance details.

CONTACTS

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