

**KV103.SMT**

**OEM GNSS MODULE**

**Specification**



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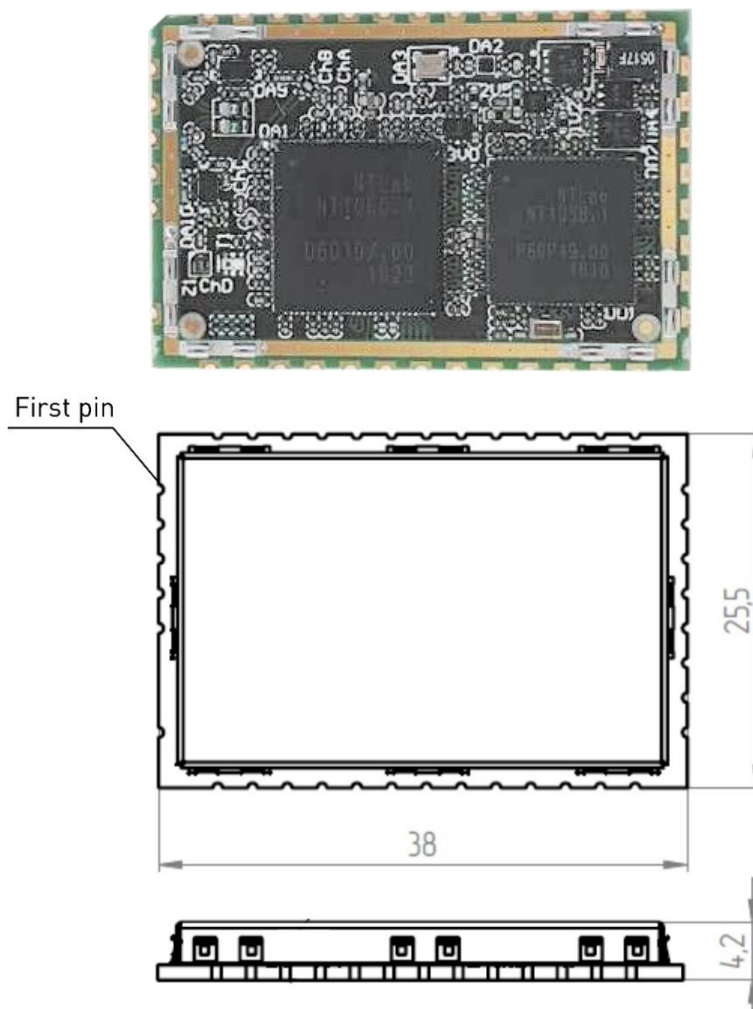
## 1 INTRODUCTION

KV103.SMT OEM module supports multiple frequencies and multiple constellations including GPS, GLONASS, NavIC and SBAS signals to improve the continuity and reliability of positioning.

It can be used for the following purposes:

- as a source of navigational data (Position, Velocity, Time) in autonomous mode (standalone mode, SBAS mode), 1 Hz;
- as a source of raw ranging measurements (include code and phase pseudoranges, Doppler measurements, SNRs), 20 Hz.

The top view of KV103.SMT and its dimensions are shown in *Figure 1.1*.

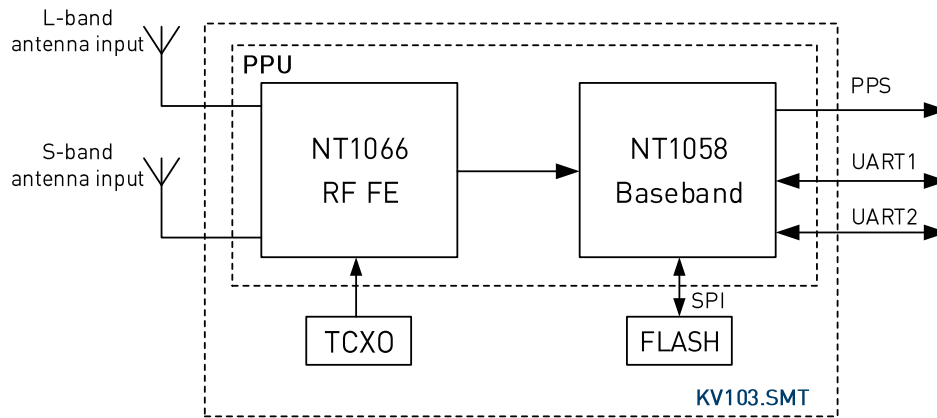


*Figure 1.1* - KV103.SMT OEM module top view and dimensions, mm

Shield is mounted on the module to improve EMC. This done using the contact pads on the PCB. The warranty after shield modification is on the user's own responsibility.

## 2 BLOCK DIAGRAM

The general block diagram of KV103.SMT is shown in *Figure 2.1*.



*Figure 2.1*- The block diagram of KV103.SMT

*PPU implements following functions:*

- computation of Position and Time in standalone and SBAS modes;
- computation of precise Time and generation of Pulse Per Second (PPS) strobes;
- generation of raw ranging measurements based on code and carrier phase measurements.

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

- NT1066 is a 4-channel L1, L2, L5, S multi-bands Radio-Frequency Front-End (RF FE) integrated circuit for GNSS signals receiving and their primary processing;
- NT1058 is microcontroller which includes digital baseband processor and 64 dual channels hardware correlator for GNSS signals tracking and primary processing of digital signals.

KV103.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 1ms. PPS is triggered by the leading edge. Polarity cannot be reversed. Duty cycle can be reversed (up to 1sec).

KV103.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.

### 3 POWER SUPPLY

KV103.SMT host-device must provide DC voltage for module and antenna power supply:

- 3.3 V...5.5 V DC module power supply is provided from Pin 29;
- 5 V DC antenna power supply is provided from Pin 41.

*External active GNSS antenna(s) requirements:*

- antenna voltage supply 5 V;
- maximum current 100 mA;
- LNA gain range (minus signal loss) 20 dB ...3 dB.

The external GNSS antenna(s) must have a clear line of sight to the sky during operation. Roofs free from other 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.

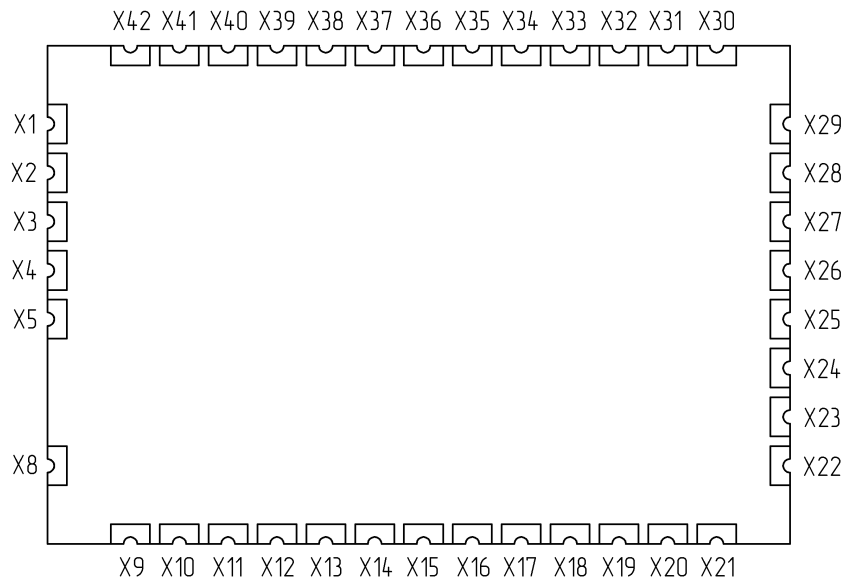
Poor visibility may result in a position shift or an increase in Time To First Fix (TTFF).

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

#### 4 PIN DEFINITION

The pinout of KV103.SMT module is shown in *Figure 4.1*.

Pins assignment is presented in the *Table 4.1*.



*Figure 4.1*– Pinout of KV103.SMT module

*Table 4.1*– KV103.SMT module pins assignment

Pin number	Name	Type	Description
X1, X3, X5, X8, X28, X30, X35, X37, X39, X40, X42	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	66_SCK	Input	NT1066 <sup>1</sup> SPI
X10	66_MOSI	Input	NT1066 <sup>1</sup> SPI
X11	66_MISO	Output	NT1066 <sup>1</sup> SPI
X12	66_CS	Input	NT1066 <sup>1</sup> SPI
X13	Ready	I/O	General Purpose I/O
X14	LED_PC5	Output	NT1058 Ready signal

<sup>1</sup> Used for service purposes

Table continuation 4.1- KV103.SMT module pins assignment

Pin number	Name	Type	Description
X15	AOK	Output	NT1066 Ready signal ("All OK")
X16	Vbat	Power	Battery power input
X17	PPS1	Output	PPS time mark
X18	PPS_0	Input	External sync input
X19	UART2_TX	Output	UART transmit data
X20	UART2_RX	Input	UART receive data
X21	DBGCLK	I/O	NT1058 <sup>2</sup> programming and debugging
X22	DBGIO	I/O	NT1058 <sup>2</sup> programming and debugging
X23	nPOR	Input	NT1058 <sup>2</sup> programming and debugging
X24	UART1_TX	Output	UART transmit data
X25	UART1_RX	Input	UART receive data
X26	BOOT	Input	Boot mode selection
X27	DEF	I/O	General Purpose I/O
X29	Vin	Power	OEM module supply voltage
X31	58_CS	Output	NT1058 <sup>2</sup> SPI
X32	58_MISO	Input	NT1058 <sup>2</sup> SPI
X33	58_MOSI	Output	NT1058 <sup>2</sup> SPI
X34	58_CLK	Output	NT1058 <sup>2</sup> SPI
X36	TCX0_EN	Input	Internal TCX0 enabled
X38	TCX0_EXT	Input	External input of the TCX0
X41	ANT_Vcc	Power	Antenna power input

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<sup>2</sup> Used for service purposes only

## 5 SPECIFICATION

Table 5.1– Specification of KV103.SMT

SUPPORTED GNSS CONSTELLATIONS		
GPS L1,L2, GLONASS L1,L2, NavIC L5,S-band and SBAS L1		
TECHNICAL SPECIFICATION		
Parameter	Value	Note
<b>Channels</b>	128	
<b>Measurement Precision (one sigma):</b> - C/A pseudoranges, cm - L1, L2 carrier phase, mm	20 0.8	smoothed pseudoranges
<b>Standalone mode Accuracy (RMS):</b> - position Horizontal/Vertical, m	2.1/ 3.5	- for Static mode; - depends on atmospheric conditions, satellite visibility and geometry, multipath conditions, GNSS antenna
<b>SBAS mode Accuracy (RMS):</b> - position horizontal/vertical, m	0.8/1.1	GPS+SBAS (static mode)
<b>Velocity Accuracy (RMS):</b> - velocity horizontal/vertical, m/s:	0.02/0.03	
<b>Time to First Fix (TTFF):</b> - «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
<b>Data update rates:</b> - position, velocity, time, Hz - raw data, Hz	1 20	no options 1,2,5,10 Hz available
<b>Timing Accuracy</b>	+/- 20 ns	
<b>Maximum operating limits:</b> - velocity - altitude - acceleration	515 m/s 18000 m Up to 8 g	
<b>Interfaces</b>	2xUART 1PPSout	for 1PPSout: voltage logic level is 2.5 V, pulse width is 1 ms
<b>Data Output Format</b>	NMEA 2.3, NMEA 4.11, NTL Binary, RTCM 3.3	RTCM 3.3 :MSM + Legacy messages
<b>Electrical parameters:</b> - supply voltage - power consumption	3.3 V...5.5 V < 0.9 W	
<b>Environmental characteristics:</b> - operating temperature - storage temperature	-40 °C to +71 °C -55 °C to +85 °C	
<b>Weight and size:</b> - dimensions (L × W × H) - weight (without package)	38 mm × 25.5 mm × 4.2 mm < 15 g	
<b>Note:</b> 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 settings

Interface	Description
UART1 Tx/Rx	<p><i>Available data transmission formats:</i></p> <ul style="list-style-type: none"> <li>• NMEA-0183 for nav. data transmission;</li> <li>• NTL Binary for nav. data transmission and control;</li> <li>• RTCM 3.3 or Novatel OEMv7 for raw ranging data transmission.</li> </ul> <p><i>Available baud rate range:</i> 9600 to 460800.</p> <p><i>Default settings:</i> 115200 Baud, 8 bits, no parity bit, 1 stop bit, NMEA.</p>
UART2 Tx/Rx	<p><i>Available data transmission formats:</i></p> <ul style="list-style-type: none"> <li>• NMEA-0183 for nav. data transmission;</li> <li>• NTL Binary for nav. data transmission and control;</li> <li>• RTCM 3.3 or Novatel OEMv7 for raw ranging data transmission.</li> </ul> <p><i>Available baud rate range:</i> 9600 to 460800.</p> <p><i>Default settings:</i> 115200 Baud, 8 bits, no parity bit, 1 stop bit, no data.</p>

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

**CONTACTS**

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