

GPS/GLONASS/GALILEO/COMPASS

RECEIVER

NV08C-CSM

Datasheet

Version 1.0

Revision History

Revision ID	Date	Description
1.0	November 1, 2010	First version for distribution

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1. Overview

1.1. Introduction

The NV08C-CSM is an integrated satellite navigation receiver. The device's key feature is its ability to work with both global navigation satellite systems (GNSS) that have been deployed so far in the world – GPS and GLONASS. The GALILEO and COMPASS as well as SBAS systems are also fully supported.

The NV08C-CSM device was developed for use in various LBS and M2M applications demanding low cost, low power consumption and uncompromised performance such as:

- fleet management
- in-car and handheld personal navigation
- asset and personal tracking
- anti theft systems
- surveillance and security systems
- WiFi, WiMAX, GSM, CDMA base station time synchronization

The NV08C-CSM offers high sensitivity and high performance of GNSS signal acquisition and tracking combined with low power consumption and small size. The assisted GPS/GLONASS/GALILEO and advanced power saving modes are supported.

Separate GPS and GLONASS RF channels provide better noise immunity in urban and industrial environment, railway stations and other places with high interference level. Multiple satellites available from GNSS constellations ensure higher availability of navigation signal in “urban canyons” compared to any single constellation solution.

For system integrator the NV08C-CSM provides a variety of interfaces, flexible power supply options, power supply for active antenna. A very compact and complete GNSS receiver can be integrated on a low cost 2 or 4-layer PCB with a minimal number of external passive parts.

Fig. 1 illustrates a block diagram of the module NV08C-CSM, describing its main internal blocks and interfaces.

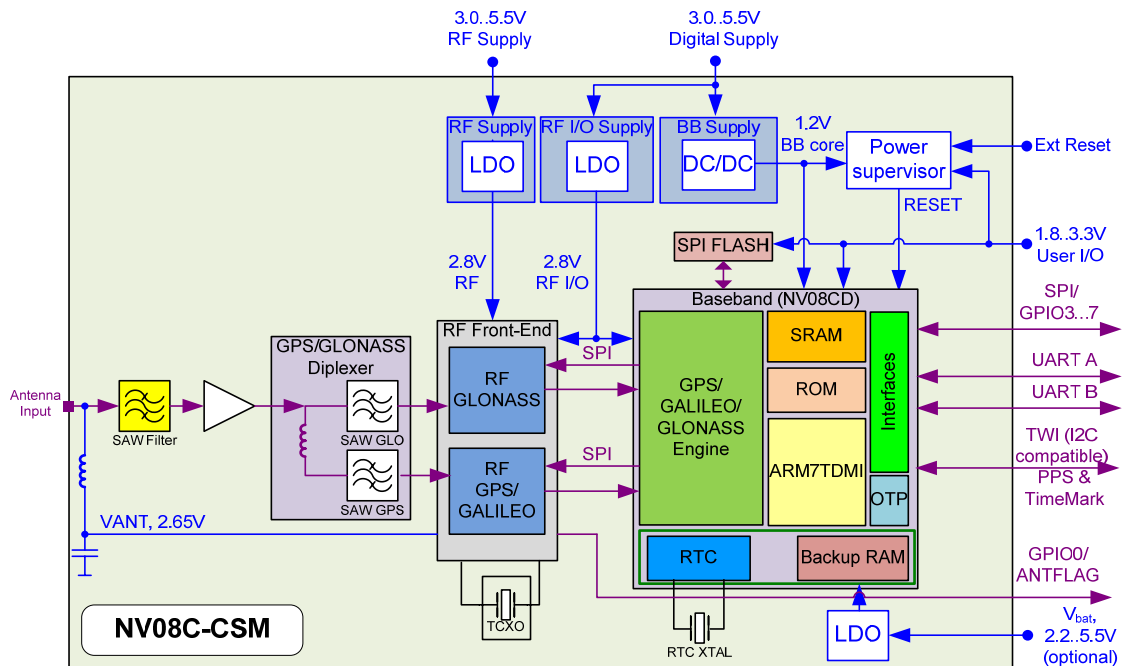


Fig. 1. NV08C-CSM Block Diagram

1.2. Navigation Features

Parameter	Description
Supported GNSS signals	<ul style="list-style-type: none"> ▪ L1 GLONASS CT ▪ L1 GPS/SBAS C/A ▪ L1 GALILEO/COMPASS OS Data+Pilot
Number of channels	32 channels, each is capable to receive any supported signal
Time to first fix	Cold star: 30s(average) Warm start: 30s (average) Hot start 3s (average)
Sensitivity	Cold star: -143dBm With A-GNSS: -160dBm Tracking mode: -160dBm
Accuracy (CEP) ¹	Autonomous mode: 2.5m Differential mode SBAS: 2m Differential mode DGNSS: 1m Height: 3.0m Velocity: 0.05m/s
Assisted GNSS	Supported
1PPS time accuracy	±25 ns
Update rate	Up to 10Hz

Parameter	Description
Limitations	Velocity: less than 500 m/s Acceleration: less than 5 g Height: less than 18,000 m

¹ All SV @ -135 dBm

1.3. RF Functionality

An active antenna is connected to the RF input of NV08C-CSM. The active antenna supply voltage 2.65V is available at the RF input as soon as an active antenna is connected and a current flow is present (if $I_{ANTBIAS} > 1.1\text{mA}$). A short protection circuit automatically blocks the supply voltage provided to the RF input pin if the current exceeds 57 mA.

To insure high immunity to outband interference NV08C-CSM comprises two-stage RF filtering circuit. The front-end wideband GPS+GLONASS RF filter ensures more than 40dB suppression of far-field interferers like GSM, WiFi, WiMAX, Bluetooth etc. The second filtering stage is provided by GPS/GLONASS diplexer separately for each RF channel which insures high channel separation as well as further attenuation of outband interferences.

The parameters of NV08C-CSM for RF input are presented in Table 1.

Table 1. Parameters of NV08C-CSM RF inputs

Active antenna	
1dB Compression Point	+30dBm
Input Return Loss	-15dB
Total Noise Figure of the analog path at the RF_IN input	6 dB

Note – the Table 1 shows estimated values of parameters. The actual values may differ as a result of device qualification.

The signal from the diplexer is further processed by two independent analog ICs that provide two receiver channels:

- GPS/GALILEO/COMPASS/SBAS L1 (1575.42 MHz @ 4 MHz)
- GLONASS L1 (1601.5 MHz @ 8 MHz)

In each channel the satellite signal is down-converted into the IF band around 4...5MHz, gets filtered by polyphase filters having bandwidth 4MHz for GPS and 8MHz for GLONASS and passes a variable gain amplifier combined with automatic gain control. The analog ICs include 2-bit ADC that converts the signal to a digital code for processing in the digital baseband IC.

Normally both channels are enabled and the NV08C-CSM receives all supported navigation signals at the same time. For power saving one of channel may be individually disabled by software (“GPS Only” mode).

In order to decrease the power consumption a Time-to-Time Fix (TTTF) mode is provided. In this periodic mode the power for analog part of the device is only supplied for a short time interval that is just enough to re-capture the signal and evaluate its parameters. Then the power for analog part and active antenna (if present) is turned off, the digital baseband calculates the position data, transfer this data to the external user’s system and enters a power saving mode as well. The period of TTTF mode is programmable by user.

In order to facilitate a fast acquisition of low level signals in poor reception areas the NV08C-CSM contains a 26 MHz generator (TCXO) with high temperature stability (± 0.5 ppm).

1.4. Environmental Data

Operating Temperature from -40°C to $+85^{\circ}\text{C}$.

Maximum relative humidity 98% at $+40^{\circ}\text{C}$.

1.5. Data Interface

Host data interface:

- Two UART (up to 230'400 bit/s)
- One SPI
- One TWI (I²C compatible)
- 1PPS output / external synchronization pulse (input)
- 8 GPIO

Supported protocols:

- IEC1162 (NMEA 0183)
- BINR (proprietary)
- RTCM SC 104

Data exchange rate up to 230'400 bit/s

Data update/output rate: 1, 2, 5, 10 Hz

Data output rate in TTTF mode: $(1-60\text{ s})^{-1}$

1.6. Electrical Parameters

The NV08C-CSM device requires the following power supply voltages:

Digital I/O supply	1.8 ... 3.3 V
Digital and RF supply	3.0 ... 5.5 V
Backup memory and RTC clock	2.2 ... 5.5 V

The power consumption with the dual voltage supply option is as follows:

TTTF Mode (@ 1c):

- GPS only	18 mW*
- GNSS	24 mW*.

Continuous tracking mode:

- GPS only	120 mW*
- GNSS	180 mW*.

Sleep mode:

- 4 μA @ 2.2 ... 5.5 V.

* average value.

The sleep mode is supported by on-chip real-time clock and a static RAM, which are used to keep the time and other information while main power is off. With this information the start time of receiver before getting the first valid navigation data is shorter. In order to use the sleep mode it is necessary to provide an additional backup voltage to the VBAT pin (see the chapters below).

2. Hardware Reference

2.1. Package

NV08C-CSM is a LGA like package. SMD components are mounted on one side of the device PCB and shielded by a metal lid to protect the device against mechanical damage and electromagnetic interference. The other side of the device is equipped with 35 pads for NV08C-CSM SMT assembly on customer's PCB as well as test pads used for device production only.

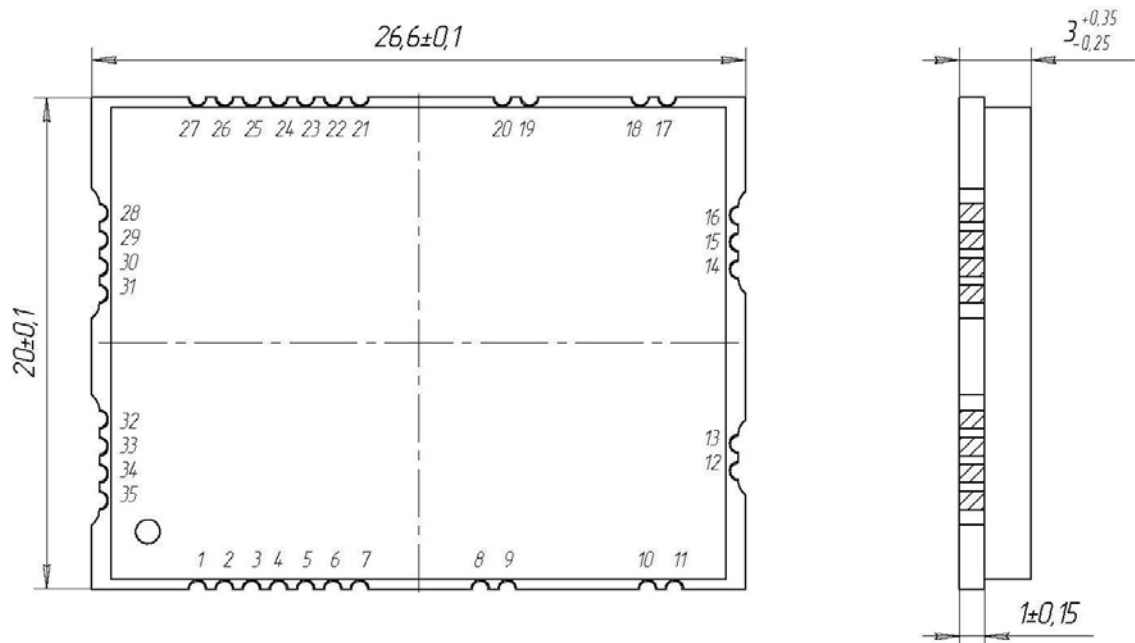


Fig. 2. Drawing and dimensions of the module (dimensions in mm)

The detailed package drawing is shown in Appendix 1.

Note – Test pads located on the bottom side of the module must remain unconnected on customer's PCB.

2.2. Signals Specification

The Table 2 below lists all the pins types of the NV08C-CSM device. For each pin, the signal name, pin number, pin type, and a description are given. The Table 3 defines different pin types.

Table 2. Signal Type Definitions

Pin Type	Definition
I	Input Only
O	Output Only
I/O	Input or Output
AN	Analog
PWR	Power
GND	Ground

Table 3. Pin list

Pin Number	Pin Name	Pin Type	Description
Programmable I/O signals			
1	GPIO2	I/O	TimeMark, TWI clock
2	GPIO1	I/O	PPS, TWI data
4	GPIO5	I/O	SPI A data MOSI, output in master mode, input in slave mode
5	GPIO7	I/O	SPI A Clock
6	GPIO3	I/O	SPI A CS1
7	GPIO4	I/O	SPI A data MISO, output in master mode, input in slave mode
20	GPIO0	I/O	ANT FLAG
35	GPIO6	I/O	SPI A CS0
Interface pins			
30	RX2	I	Input UART B
31	TX2	O	Output UART B
32	TX1	O	Output UART A
33	RX1	I	Input UART A
Power Supply and GND pins			
8	VIN_A	PWR I	Input supply for LDO A
21	RF_SHDN	O	Low power consumption signal. Active level is High for normal device operation. Active level is Low for Low power consumption mode. NOTE: Engineering samples (marked as v 2.0 on the device shield) the RF_SHDN pad must not be connected.
23	VBAT	PWR I	BB battery supply
26	VIN_D	PWR I	Input supply voltage for LDO D
28	VCCIO	PWR I	BB IO supply
Reset signal			
25	#RES	I	Reset input. Active level is low.
RF input signals			
15	RF	AN I	Antenna input
GND pins			
3, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 22, 24, 27, 29, 34	GND	GND	Ground

Note – All GPIO pads can be reallocated by FW Patch (see 3.4).

2.3. Electrical Specification

2.3.1. Absolute Maximum Ratings

The

Table 4 lists the absolute maximum ratings of the NV08C-CSM. Operation at or beyond these maximum ratings may cause permanent damage to the device. These are stress ratings only.

Table 4. Absolute Maximum Ratings

Symbol	Parameter	Minimum	Maximum	Unit
T _s	Storage Ambient Temperature	-55	125	°C
VIN_A	Supply Voltage for LDO A	-0.3	6	V
VIN_D	Supply Voltage for LDO D	-0.3	6	V
VCCIO	BB IO Supply Voltage	-0.5	4.6	V
VBAT	BB Battery Supply Voltage	-0.3	6	V
PRF	RF_IN Power		10	dBm
VIO	P7 – P0, #RES	-0.5	VCCIO +0.5 (<4.6)	V

2.3.2. Recommended Operating Conditions

Recommended operating conditions are values that guarantee correct device operation. As long as the device is used within the ranges, electrical DC and AC characteristics are guaranteed.

2.3.2.1. Ambient Temperature

Table 5. Operating Ambient Temperature

Symbol	Parameter	Minimum	Maximum	Unit
T _A	Operating Ambient Temperature	-40	85	°C

2.3.2.2. Power Supply Voltage

Table 6. Power Supply Voltage

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VIN_A	Supply Voltage for LDO A	3.0		5.5	V
VIN_D	Supply Voltage for LDO D	3.0		5.5	V
VCCIO	BB IO Supply Voltage	1.65	1.8/2.5/3.3	3.6	V
VBAT	BB Battery Supply Voltage	2.2		5.5	V

Table 7. Antenna power supply

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V _{RF}	Voltage active antenna	2.5	2.65	2.8	V
I _{ANT}	Current consumption of active antenna	1.1 ¹		57	mA

¹ Minimum current for the built-in active antenna detector.

2.3.2.3. Input Voltage

Table 8. Input Voltage for P7 – P0

Symbol	Parameter	IO Power Supply Voltage VCC_BBIO	Minimum	Maximum	Unit
V _{IH}	High Level Input Voltage	3.3V	2.0	VCCIO + 0.3	V
		2.5V	1.7	VCCIO + 0.3	V
		1.8V	0.65 x VCC_BBIO	VCCIO + 0.3	V
V _{IL}	Low Level Input Voltage	3.3V	-0.3	0.8	V
		2.5V	-0.3	0.7	V

Symbol	Parameter	IO Power Supply Voltage VCC_BBIO	Minimum	Maximum	Unit
		1.8V	-0.3	0.35 x VCCIO	V

Table 9. Input Voltage for #RES

Symbol	Parameter	IO Power Supply Voltage VCC_BBIO	Minimum	Maximum	Unit
V _{IH}	High Level Input Voltage	3.3V	2.1	VCCIO + 0.3	V
		2.5V	1.7	VCCIO + 0.3	
		1.8V	0.7 x VCCIO	VCCIO + 0.3	
		1.2V	0.7 x VCCIO	VCCIO + 0.3	
V _{IL}	Low Level Input Voltage	3.3V	-0.3	0.7	V
		2.5V	-0.3	0.7	
		1.8V	-0.3	0.3 x VCCIO	
		1.2V	-0.3	0.3 x VCCIO	

2.3.3. DC Characteristics

Table 10. DC Characteristics

Symbol	Parameter	IO Power Supply Voltage VCC_BBIO	Conditions	Minimum	Maximum	Unit
V _{OH}	High Level Output Voltage	3.3V	IOH = -100uA	VCCIO - 0.2	-	V
			IOH = -4mA	VCCIO - 0.4	-	
		2.5V	IOH = -100uA	VCCIO - 0.2	-	
			IOH = -4mA	VCCIO - 0.45	-	
		1.8V	IOH = -100uA	VCCIO - 0.2	-	
			IOH = -3mA	VCCIO - 0.45	-	
V _{OL}	Low Level Output Voltage	3.3V	IOL = 100uA	-	0.2	V
			IOL = 4mA	-	0.35	
		2.5V	IOL = 100uA	-	0.2	
			IOL = 4mA	-	0.4	
		1.8V	IOL = 100uA	-	0.2	
			IOL = 3mA	-	0.45	
I _L	Input Leak		-	-	±4	uA

2.3.4. Power Consumption

Table 11. Current Consumptions

Symbol	Parameter	Minimum	Typical	Maximum	Unit
IVIN_A	Total supply current through pin VIN_A ¹		20	30	mA
IVIN_D	BB Core Supply Current VIN_D		25	40	mA
IVBAT	BB Battery Supply Current ²			0.1	mA
IVBAT_STBY	BB Battery Supply Standby		4		uA

Symbol	Parameter	Minimum	Typical	Maximum	Unit
	Current				
IV_IO	BB IO Supply Current ³			40	mA
IV_IO_STBY	BB IO Supply Standby Current ⁴		20		uA

Notes:

1. Without active antenna current.
2. BRAM access rate less than 1M/s.
3. Depends on the load. Max current for each of digital IO is 4mA.
4. RF part switched off, the module is in power saving mode.

2.3.5. Digital IO AC Characteristics

2.3.5.1. SPI Interface

Table 12. AC parameters of P7 – P3 interface signals when PIO is programmed as SPI interface

Symbol	Parameter	Minimum	Maximum	Unit
F	Frequency of P7 – P3		20	MHz
Td_mst	SPI Clock to Data Valid in SPI Master mode: SPI_CK to SPI_MO Valid.		15	ns
Td_slv	SPI Clock to Data Valid in SPI Slave mode: SPI_CK to SPI_SO Valid.		15	ns
Tsu_mst	SPI Data to SPI Clock setup in SPI Master mode: SPI_MI to SPI_CK setup.	15		ns
Tsu_slv	SPI Data to SPI Clock setup in SPI Slave mode: SPI_SI to SPI_CK setup	15		ns
Th_mst	SPI Data after SPI Clock hold in SPI Master mode: SPI_MI after SPI_CK hold.	1		ns
Th_slv	SPI Data after SPI Clock hold in SPI Slave mode: SPI_SI after SPI_CK hold.	1		ns

2.4. Hardware Integration Guide

2.4.1. Power supply

2.4.1.1. Wiring the module to the external power supply

Ошибка! Источник ссылки не найден.. shows the power connection diagramm of NV08C-CSM.

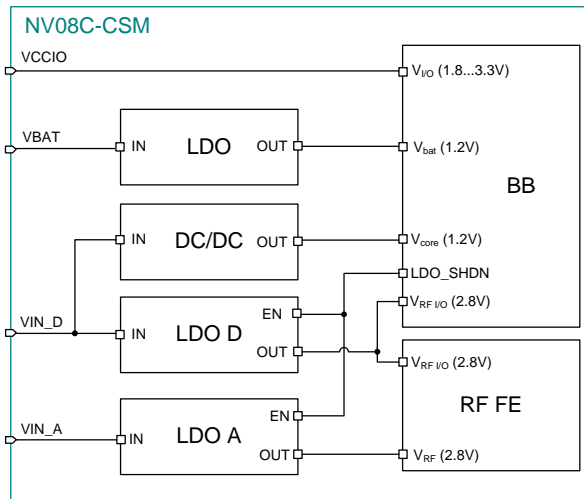


Fig. 3. The scheme of module power connection

For maximum flexibility in system integration the module has four supply inputs:

- | | | |
|--|---------------|-------------|
| 1. RF-core power supply (LDO A) | VIN_A, | 3.0...5.5 V |
| 2. Digital core power supply (LDO D) | VIN_D, | 3.0...5.5 V |
| 3. Backup power supply | VBAT, | 2.2...5.5 V |
| 4. I/O power supply | VCCIO, | 1.8...3.3 V |

Note – Shown above are the nominal values of supply voltages. Please refer to the Table 6 for actual allowable ranges.

Power for the RF front-end part is provided by integrated linear regulators LDOA and LDOD. The LDOA provides clean analog supply voltage for RF while the LDOD is a voltage regulator for digital circuits. Input power supply for LDOA and LDOD (VIN_A and VIN_D) may have voltage anywhere in the range 3.0 – 5.5V. The digital baseband (BB) requires 1.2V as the core voltage (supplied by integrated DC/DC converter), IO voltage in range 1.8...3.3V (VCCIO) and a back-up supply 1.2V (VBAT) for a real-time clock and backup RAM. Backup power VBAT is optional and required if “hot” and “warm” starts of the receiver are desired. Otherwise the VBAT may be connected to VIN_D.

In the user’s systems the power to NV08C-CSM may be provided in a number of different ways depending on its specifics and availability of voltage supplies. Some of the most common cases are described in the following sections.

2.4.1.2. Single voltage power supply

The external power supply V_IN has to be connected to the pins VIN_A, VIN_D, VCCIO and VBAT.

Table 13. Voltage of external power supply

Power Supply	Voltage (V)	
	Min	Max
V_IN	3.0	3.6

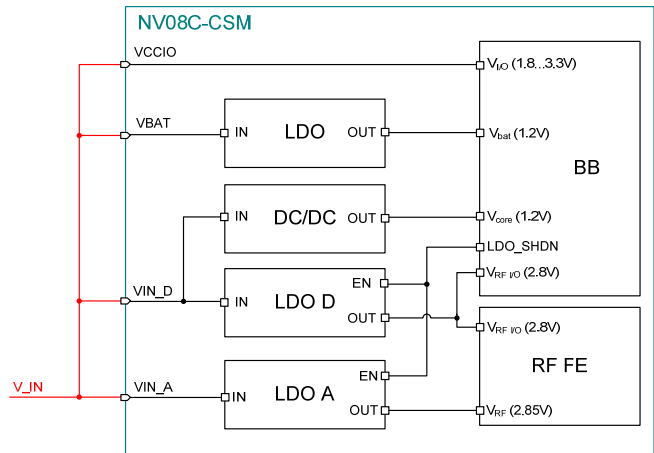


Fig. 4. Power connections with single voltage power supply

2.4.1.3. External power supply for digital I/O

Often the voltage of digital IO signals in the user's system is different than V_IN. It's convenient to have the same digital IO voltage levels in NV08C-CSM as in the rest of the user's system. In this case the IO voltage supply from the user's system shall be connected to VCCIO instead of V_IN.

Table 14. Voltage of external power supply

Power Supply	Voltage (V)	
	Min	Max
V_IN	3.0	5.5
V_IO	1.65	3.6

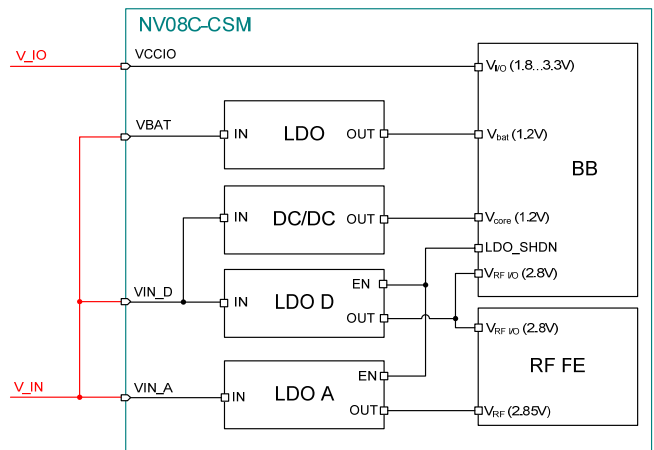


Fig. 5. Power connections with external power supply for digital I/O

2.4.1.4. Backup power supply

The baseband contains a backup power island that is powered via the pin VBAT. The power island contains a real-time counter and backup RAM. If a backup power supply is implemented in the user system, then the power for VBAT shall be provided from the backup supply. In this case when main power supply goes off, the RTC and backup RAM remain powered providing necessary data for faster start of receiver on power on.

The Fig. 6 shows the power connections for the case when the supply voltages for baseband core, backup and IO are provided by user's system.

Table 15. Voltage of external power supply

Power Supply	Voltage (V)	
	Min	Max
V_IN ¹	3.0	3.6
V_IN ²	3.0	5.5
V_IO ²	1.65	3.6
V_BU	2.2	5.5

Notes:

¹ For case when VCCIO connected to V_IN.

² For case when VCCIO connected to V_IO.

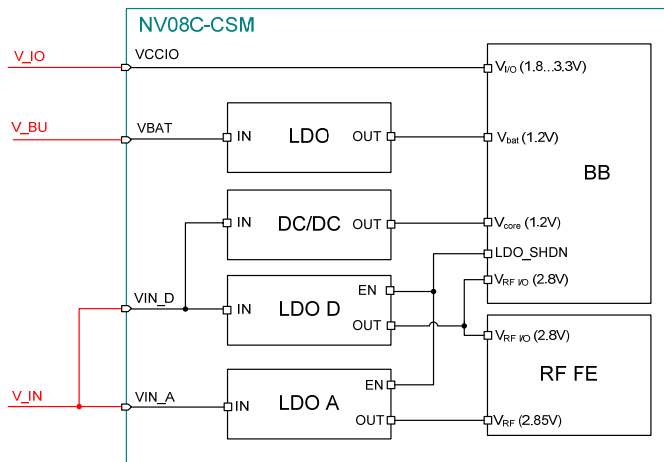


Fig. 6. Power connections with external power supplies for baseband core, IO and backup

2.4.1.5. Decoupling capacitors

All the necessary decoupling capacitors are integrated in the module. Nevertheless, in order to minimize the effect of power supply noise on reception of signals is recommended to:

- separate power supplies VIN_A and VIN_D either by means of separate power sources or using an inductive isolation
- provide an additional capacitor 22pF (0201, NPO or X7R) as close to the pin VIN_A as possible

As an option power supply inputs may be equipped with capacitors shown in the Table 16.

Table 16. Power supply optional capacitors

Pin	Recommended Capacitors	Note
VIN_A	1 uF ceramic	optional
VIN_D	1 uF ceramic	optional
VCCIO	1 uF ceramic	optional
VBAT	1 uF ceramic	optional

2.4.1.6. Typical power consumption

The Table 17 shows the average consumption of the module in continues tracking and Time-to-Time-Fix modes. The power consumption via VCCIO is typically small compared to the consumption of RF FE and baseband core.

Table 17. The average consumption of the module in a mode Time-to-Time-Fix

Mode	Power supply options
Time-to-Time Fix @1c, GPS only	18 mW
Time-to-Time Fix @1c, GNSS	24 mW
Tracking&navigation, GPS only	< 120 mW
Tracking&navigation, GNSS	< 180 mW

2.4.2. Reset

Input signal # Res (RESET, pin # 25) in NV08C-CSM may be driven by user system to force reset of the digital part of the device. To reset the device user system should provide the #Res input pad with a pulse as specified below:

- voltage level – less than $0.3 \times V_{CCIO}$
- the pulse length – not less than 1 microsecond

After this signal is applied (signal level goes from low to high) the integrated power supervisor holds the device in reset mode for at least 140 ms.

2.4.3. Recommended Antennas

The NV08C-CSM requires an external active antenna. Power supply (2.65 V) for the active antenna is provided to RF input. A short protection circuit automatically blocks the supply voltage provided to RF input if the current exceeds 57 mA.

It's very important to choose a proper antenna. An active antenna with high gain and wide passband may reduce the quality of the signal reception due to interference with in-band and out of band noise. A low gain active antenna (or high attenuation in antenna cable) may decrease the sensitivity.

The recommended parameters of active antenna are the following:

- GPS/GLONASS L1, bandwidth 35 MHz @ $f_c = 1590$ MHz
- Gain including the attenuation in the cables 20 ± 2 dB
- Antenna noise factor < 2 dB
- Suppression of out-of-band signals: at least 35dB @ $f_c \pm 70$ MHz.

If the active antenna requires a voltage other than 2.65 V, the antenna power supply may be applied as shown in **Ошибка! Источник ссылки не найден..**

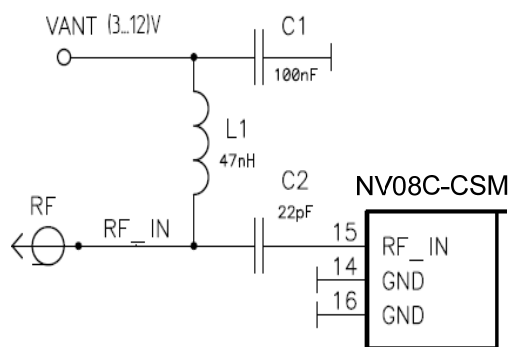


Fig. 7. Option to connect an external active antenna with an external power source

Note – If you use this option connect, the built-in detector of circuit and short circuit protection will not work.

2.4.4. Digital IO Interfaces

The NV08C-CSM provides two UART interfaces, one SPI interfaces, two-wire interface (I²C compatible) and GPIO interface.

IO interfaces in NV08C-CSM are connected to external devices via 8 pins P7 – P0. Use of P7 – P0 is programmable (see the protocol description).

Table 18. Default configuration for pins P7 – P0

Pin	Status after RESET	Description
GPIO7	GPIO7	Configuration pads (See Table 19)
GPIO6	GPIO6	
GPIO5	GPIO5	
GPIO4	GPIO4	
GPIO3	GPIO3	
GPIO2	TimeMark	External time synchronization input
GPIO1	PPS	1 PPS output
GPIO0	ANTFLAG	Active antenna current trigger: "1" - Active antenna connected (current > 1.1mA) "0" - no load.

Notes:

1. The pads which are not used by the user's system as UART, PPS and TimeMark can be programmed as GPIO.
2. Pads GPIO1, GPIO2 can be used as a two-wire interface (I²C compatible). In this case, the pads will be configured as shown in the table below:

GPIO2	PU	TW_SCL. Two-wire interface, the synchronization
GPIO1	PU	TW_SDA. Two-wire interface, data

Table 19. Configuration settings

GPIO	Function	PIO value	Description
GPIO7	Settings saving in BRAM	GPIO7 = 1 (default)	Save settings
		GPIO7 = 0	Do not save settings
GPIO6	FW Patch download via SPI A	GPIO6 = 1 (default)	GPIO7, GPIO5, GPIO4, GPIO3 used only for configuration purpose
		GPIO6 = 0	GPIO7, GPIO5, GPIO4, GPIO3 are configured as SPI and will be used for FW Patch download from external SPI-FLASH
GPIO5 GPIO4 GPIO3	UART port configuration	GPIO5 = 0 (default) GPIO4 = 0 (default) GPIO3 = 0 (default)	UART A – 115200 NMEA UART B – 115200 BINR
		GPIO5 = 0 GPIO4 = 0 GPIO3 = 1	UART A – 4800 NMEA UART B – 19200 BINR
		GPIO5 = 0 GPIO4 = 1 GPIO3 = 0	UART A – 9600 NMEA UART B – 19200 BINR
		GPIO5 = 0 GPIO4 = 1 GPIO3 = 1	UART A – 19200 NMEA UART B – 57600 BINR
		GPIO5 = 1 GPIO4 = 0 GPIO3 = 0	UART A – 38400 NMEA UART B – 38400 BINR
		GPIO5 = 1 GPIO4 = 0 GPIO3 = 1	UART A – 38400 NMEA UART B – 4800 RTCM NMEA_time_sym = 2
		GPIO5 = 1 GPIO4 = 1 GPIO3 = 0	UART A – 4800 NMEA UART B – 4800 RTCM NMEA_time_sym = 2
		GPIO5 = 1 GPIO4 = 1 GPIO3 = 1	UART A – 57600 NMEA UART B – 57600 BINR

3. Software and Protocols Reference

3.1. Data protocol and configuration

The module supports the exchange with an external Host-processor through the following protocols:

- BINR (own binary protocol)
- NMEA 0183 v2.3, v3.0
- RTCM 104 v2.3

By default, the module is configured to exchange:

- UART A: Protocol NMEA, 115'200 bps
- UART B: Protocol BINR, 115'200 bps

Note – Any port may be configured for receiving differential corrections data in RTCM format. In this case it is still possible to control the module by adding of NMEA-commands to RTCM stream since the module SW is able to sort out these data types.

Other basic settings of the module:

- navigation mode: GLONASS / GPS
- SBAS data: accounted automatically
- RAIM: automatic
- Assisted data: accounted automatically
- issuing navigation data rate: 1 Hz
- NMEA messages: GSA, RMC, GGA, GSV, GBS

The basic settings may be changed by any of the following means:

- choosing one of the preset configurations by a certain code on GPIO inputs (refer to Table 19)
- protocol commands via ports
- downloading a software patch (see 3.4) via SPI or UART (the patch shall be developed by the product support services)
 - at the hardware level: by programming a one-time programmable during the module production (only available when ordering large quantities of modules).

3.2. Low power battery mode

The module has a sophisticated system to reduce the power consumption. Some of supported energy saving methods are the following:

- automatic clock gating of currently unused subsystems (such as the fast search unit, unused correlation channels, the interface blocks)
- possibility to completely turn off the power for one of the analog channels
- the Time-to-Time Fix cyclical mode providing an automatic transition to a very low power sleep mode (300 – 400 uA) once the navigation solution is obtained and automatic "wake up" at user-defined time period
- the Push-to-Fix mode, which provides an automatic "fall asleep" once the navigation solution is obtained with a "wake up" by a signal from the user system

WARNING! Time-to-Time Fix and Push-to-Fix modes require the external supply on pin VBAT for supply backup and crystal 32,768 Hz.

3.3. Assisted GNSS

The module supports the use of external assisted data for quick navigation solutions on power up. Such data can be extracted by the user system from GSM, CDMA or the Internet and loaded into the module via the BINR or NMEA protocols. The assisted data in a compact form (as a ready binary data file) is available for download on the support site.

3.4. Extension of the basic functionality, Patch technology

It is possible to extend the basic functionality of the module by downloading new codes (Patch codes) from an external device into nonvolatile memory (FLASH, EEPROM) integrated in the NV08C-CSM via UART and SPI interfaces.

The Patch Code may be downloaded through the following external devices:

- SPI Flash Memory connected via SPI A interfaces.
- Host-system sending the Patch Code via UART or SPI (emulation of SPI Flash).

To download the Patch Code via UART interface (see **Ошибка! Источник ссылки не найден.**) the following command should be sent to the device:

- for NMEA protocol: \$POPRL,B*3F\r\n

- for BINR protocol: 0x10 0x01 0x52 0x45 0x4C 0x4F 0x41 0x44 0x5F 0x42 0x10 0x03

By receiving this command the module turns to the programming mode and starts output of character 0x43 (in ASCII – character "C") to UART TX. In response to it the user's system must download a new Patch Code in the form of sequence of bytes (provided as a binary file) by means of Xmodem protocol. As soon as the binary file is completely downloaded the module stores the Patch Code in nonvolatile memory and restarts.

A Patch Code download software is available from technical support.

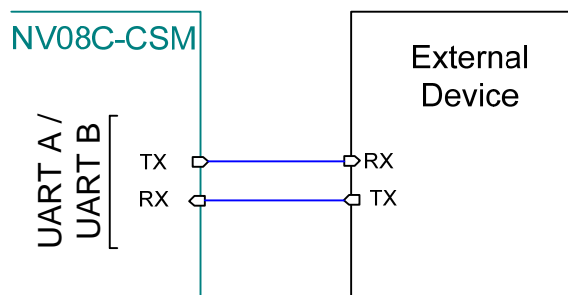


Fig. 8. Connecting the module to an external device to download Patch Code

The **Ошибка! Источник ссылки не найден.** shows how the SPI Flash (Serial EEPROM) memory shall be connected to the module for the Patch Code download.

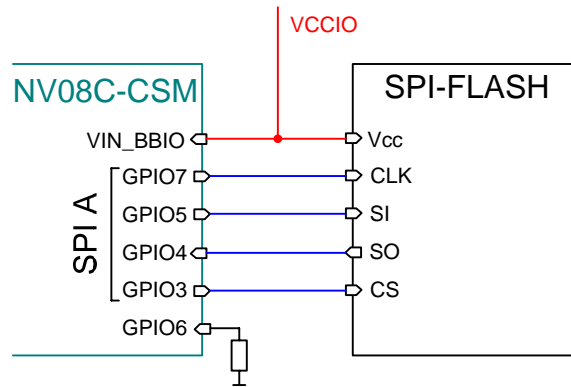


Fig. 9. Connecting the module to the SPI-FLASH (serial EEPROM)

The users cannot develop the Path Code by themselves. Please contact the technical support if there is a need to expand the base functionality of the module due to requirements of specific applications.

3.5. Dead reckoning

The module supports the Dead Reckoning mode by extending the basic functionality by using the Patch technology. Please contact technical support for more information.

APPENDIX 1

