GPS/GLONASS/GALILEO/COMPASS RECEIVER

NV08C-CSM-BRD GNSS card

Datasheet

Version 0.1

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Revision History

Revision ID	Date	Description
0.0	February 21, 2013	Preliminary versions of the specification

Contents

1 General Description

The NV08C-CSM-BRD Card is an easy-to-integrate card, to provide navigation functions to mobile and portable devices. The NV08C-CSM-BRD Card uses standard NMEA protocol and proprietary BINR protocol for communication with the Host System. The NV08C NMEA and BINR Protocol Specifications are available for download at http://www.nvs-gnss.com/support/documentation

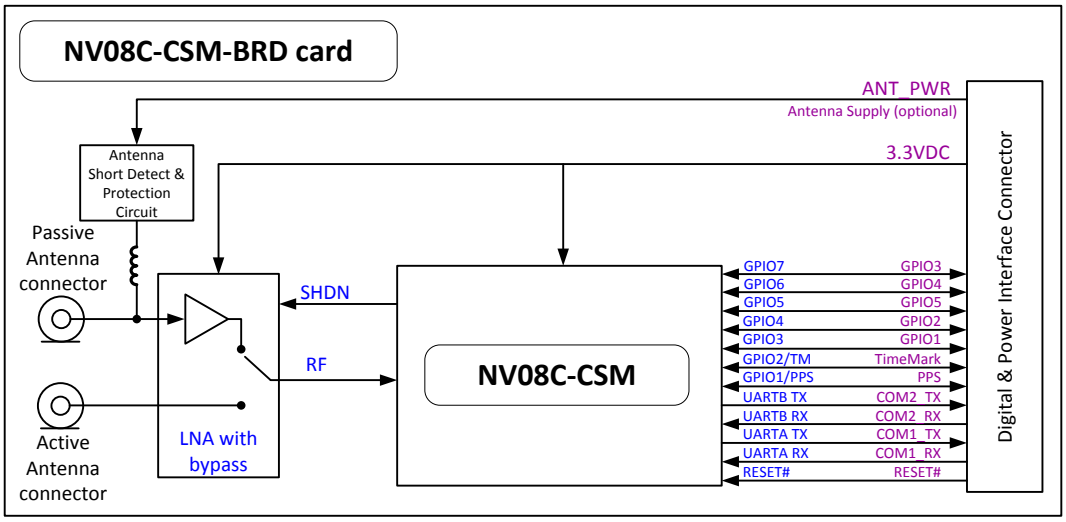

Figure 1. NV08C-CSM-BRD Card System Diagram

The NV08C-CSM-BRD Card is based on NVS Technologies' compact NV08C-CSM high performance Global Navigation Satellite System (GNSS) receiver module. The NV08C-CSM's key feature is its compatibility with existing GNSS systems such as GPS and GLONASS and Satellite Based Augmentation Systems (SBAS), as well as with newly deployed GNSS systems such as GALILEO and COMPASS.

The NV08C-CSM-BRD Card features a highly sensitive receiver to capture and maintain the satellite signals, combined with low power consumption, even when receiving multiple GNSS and SBAS signals. Tracking satellites from multiple GNSS constellations and using Assisted GNSS (A-GNSS) ensures much higher availability of navigation signals, when compared to single constellation alternatives, and provides increased performance, accuracy and reliability for devices used in urban and industrial environments. The NV08C-CSM receiver includes two separate RF paths (GPS and GLONASS) and a 3-stage SAW filtration for enhanced interference immunity.

The NV08C-CSM-BRD Card provides flexible integration options, including active or passive antenna connection with automatic detection, antenna power supply and short circuit protection.

The NV08C-CSM-BRD Card Features:

- Very quick and simple integration
- GPS, GLONASS, GALILEO, QZSS, COMPASS & SBAS L1
- Precise navigation, positioning and timing
- 32 GNSS tracking channels
- 200K correlators - Ensuring fast TTFF and high signal sensitivity
- Raw Data output - Pseudorange, Carrier phase and Doppler
- Individual GLONASS group delay calibration assuring very high accuracy

- Assisted GNSS (A-GNSS) interface
- 64 KB EEPROM for firmware upgrade and data storage
- NMEA 0183 / IEC 61162-1, binary (BINR) and RTCM SC-104 data protocols
- Receiver Autonomous Integrity Monitoring (RAIM)
- Industrial operating temperature range -40 to +85°C

Please visit www.nvs-gnss.com for more information on NVS Technologies' NV08C GNSS Receiver Module Series.

2 Mechanical Specification

The NV08C-CSM-BRD Card's Outline Drawing is specified in Figure 2.

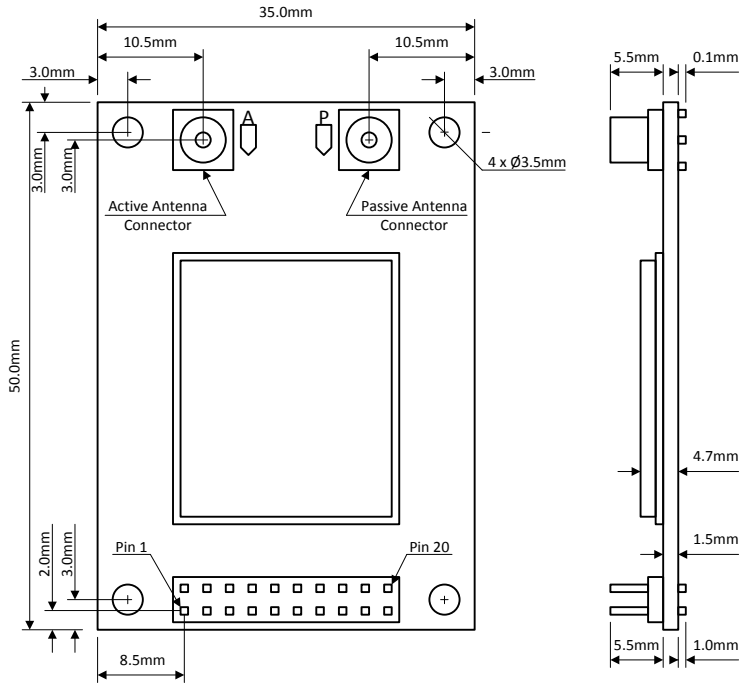

Figure 2. NV08C-CSM-BRD Card Outline Drawing

3 GNSS Antenna Interface

The NV08C-CSM-BRD Card has two RF-connectors for active or passive antenna connection respectively. Both RF-connectors are compact Jack MCX Straight 50 Ohm PCB Connector.

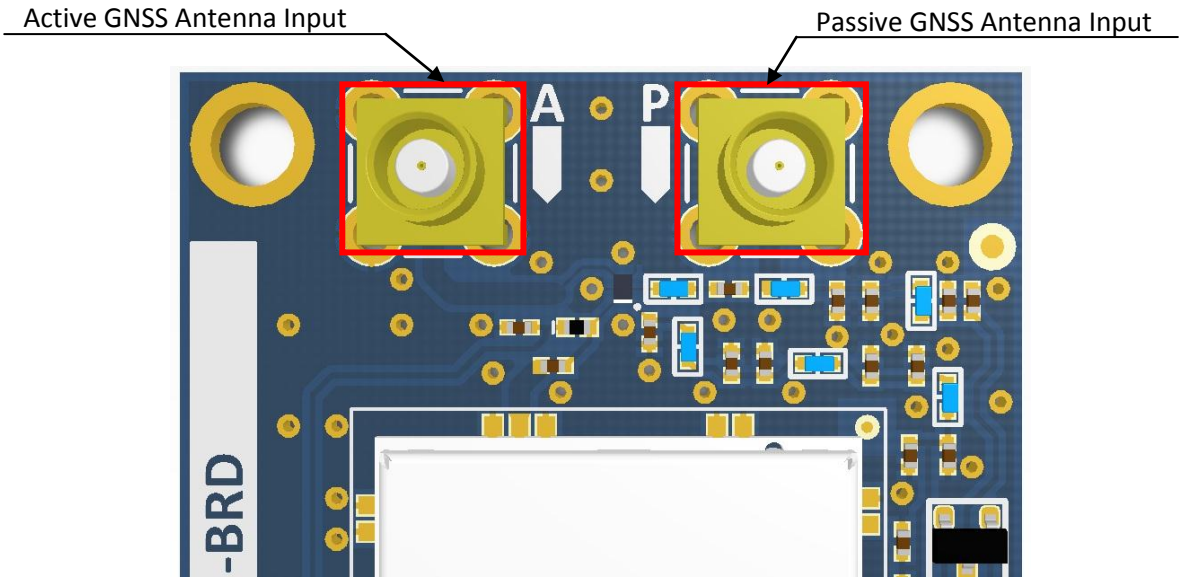

Figure 3. Location of the Active and Passive GNSS Antenna Inputs

4 Data and Program Interfaces

4.1 Data interface

The NV08C-CSM-BRD Card uses two UART primary data interfaces for communication with a Host System. Supported baud rate for communication with NV08C-CSM-BRD Card is 4800 to 230400 bps.

4.2 Data Protocol

The NV08C-Mini PCI-E's supported protocols are as follows:

- NMEA 0183 v2.3 (IEC61162-1)
- BINR (proprietary binary protocol)
- RTCM SC 104 (messages: #1, #9, #31, #34)

4.3 Default Device Configuration

By default, the NV08C-CSM-BRDis pre-configured to working with NMEA, 115200 bps:

messages/rates: GGA/1, RMC/1, GSV/1, GSA/1, RZD/1, GBS/10 (refer to NV08C Receivers Protocol Specification for further details)

Other NV08C-CSM-BRDdefault settings:

- Navigation mode: GPS and GLONASS
- RTCM data: accounted automatically
- SBAS data: on demand ($PONAV NMEA command)
- RAIM: automatic
- Assisted data: accounted automatically
- Navigation data update rate: 1 Hz
- NMEA messages: see the Protocol Specification document

5 Electrical Specification

5.1 Absolute Maximum Ratings

Table 1 provides the NV08C-CSM-BRD Card's absolute maximum (stress) ratings. Operation at or beyond these maximum ratings might cause permanent damage to the device.

Table 1. Absolute Maximum Ratings

Parameter	Minimum	Maximum	Unit
Storage Temperature Range	-55	+125	°C
Operating Temperature Range	-40	+85	°C
Relative humidity @ 40°C		98	%
Supply Voltage	-0.3	+3.9	V
RF Input Power		5	dBm

5.2 DC Electrical Characteristics

Table 2. DC Electrical Characteristics

Parameter	Minimum	Typical	Maximum	Unit
Supply Voltage	3.0	3.3	3.6	V
Supply current[1]		60[1]	90	mA
Supply current in Sleep Mode		0.2	0.3	mA
Active Antenna DC Bias				
Voltage	2.9	3.3	3.6	V
Current	0.85[2]	-	45[3]	mA
Power Consumption				
GPS only		150		mW
GNSS		200		mW

[1] Excluding active antenna current consumption
[2] Minimum threshold of active antenna current detector
[3] Maximum supplied active antenna current

5.3 AC Electrical Characteristics

Table 3. AC Electrical Characteristics

Parameter	Minimum	Typical	Maximum	Unit
RF Chains				
L1 GPS/GALILEO/SBAS Centre Frequency		1575.42		MHz
L1 GPS/GALILEO/SBAS Bandwidth		4		MHz
L1 GLONASS Centre Frequency		1601.5		MHz
L1 GLONASS Bandwidth		8		MHz
Active antenna input				
Input P1dB		+5		dBm
Noise Figure		8		dB
Impedance		50		Ω
Return Loss		-15		dB
Passive antenna input				
Input P1dB		-7		dBm
Noise Figure		1.5		dB
Impedance		50		Ω
Return Loss		-15		dB

5.4 NV08C-CSM-BRD Connector Pin Configuration

Table 4. Digital & Power Connector Pinout

Pin#	Name	Description
1	ANT_PWR	Power Supply for external antenna
2	VIN	3.3 VDC Power Supply
3	GPIO1	General Purpose I/O Pin (CSM's GPIO3)
4	GPIO2	General Purpose I/O Pin (CSM's GPIO4)
5	RESET	Active low reset input
6	GPIO3	General Purpose I/O Pin (CSM's GPIO7)
7	VBAT	Для сохранения конфигурации. Либо доработка FW для записи их во FLASH
8	*NC*	*Not Connected*
9	TimeMark	General Purpose I/O Pin (CSM's GPIO1, TimeMark/Event on demand)
10	GND	Digital Ground
11	COM1_TX	Transmitted Data for CSM's UART A output
12	COM1_RX	Received Data for CSM's UART A input
13	GND	Digital Ground
14	COM2_TX	Transmitted Data for CSM's UART B output
15	COM2_RX	Received Data for CSM's UART B input
16	GND	Digital Ground
17	GPIO4	General Purpose I/O Pin (CSM's GPIO6)
18	GND	Digital Ground
19	PPS	Pulse output synchronized to UTC/GPS/GLONASS time (CSM's GPIO2)
20	GPIO5	General Purpose I/O Pin (CSM's GPIO5)

5.5 Digital Signals Specification

5.5.1 RESET# Signal

The RESET**#** signal can be used for NV08C-CSM device reset.

NV08C-CSM device has Power Supervisor inside. Therefore Host System does not need to specially control this signal during the NV08C-CSM-BRD Card power up. NV08C-CSM is in active mode when RESET# signal is de-asserted.

To provide forced reset of NV08C-CSM the Host System should provide a pulse to the RESET# input as specified below:

- Voltage level – less than 0.7 V
- The pulse length – no less than 1 ms

After the signal is applied (RESET# signal level goes from low to high) the integrated power supervisor holds the NV08C-CSM device in reset mode for at least 140 ms.

Table 5. RESET# signal level requirements

Parameter	Minimum	Typical	Maximum	Unit
High Level Input Voltage	2.1	3.3	3.6	V
Low Level Input Voltage	-0.3	0	0.7	V

6 Functional Description

6.1 Functional overview

The NV08C-CSM-BRD Card with a connected external antenna provides automatic acquisition, tracking and positioning of GNSS signals. Navigation data is provided to the Host System by means of NMEA (default for UART A) or BINR (default for UART B) protocols.

Either active or passive antenna connection is supported. Refer to the following section for additional information.

6.2 GNSS Antenna Connection

The NV08C-CSM-BRD Card features two separate RF coaxial connectors, to connect either an active or a passive antenna. The 3.3V supply voltage is provided to the active antenna connector. The active GNSS antenna input includes an auto-detection feature with short-circuit protection. The selection of the RF input is automatically activated when an active antenna's current is detected. When no current is drawn, the passive GNSS antenna input is selected. The NV08C-CSM-BRD Card automatically switches to the active GNSS antenna input when an external active antenna is connected (when I_{ANT} > 0.2mA). The supply current is limited to 30 mA typ. (45 mA max.) in case of short-circuit on the active antenna connector.

It is very important to select a proper antenna to achieve optimum performance.

If an active antenna is employed, excessive LNA gain and bandwidth may reduce the quality of signal reception, due to potential in-band and out-of-band interferences. As well, an active antenna with insufficient gain or bandwidth, or high cable loss may decrease the receiver's sensitivity.

Recommended active antenna parameters are as follows:

- GPS/GLONASS L1, bandwidth 35 MHz @ fc = 1590 MHz
- Gain including LNA and cable losses 20 to 30 dB
- Built-in LNA noise figure <2 dB
- RF Output Impedance 50 Ω
- Return Loss <-10 dB
- Out-of-band signal Rejection: at least 35dB @ fc ± 70 MHz.

If a passive antenna is used it is essential to select an antenna with good RF output impedance matching to prevent the NV08C-NV08C-BRD's LNA from self-oscillating, and also to keep cable loss as low as possible, as it directly impacts the RF path's noise figure and decreases the receiver's sensitivity.

Recommended passive antenna parameters are as follows:

- GPS/GLONASS L1, bandwidth 35 MHz @ fc = 1590 MHz
- Average Gain: > -1 dBic
- RHCP polarization
- Axial ratio: < 3 dB
- Output impedance 50 Ohm
- Return loss < -10 dBm
- Cable Losses as low as possible.

6.3 Navigation Parameters

Table 6. Navigation Parameters

Parameter	**Description**	
Supported GNSS signals	L1 GPS/SBAS C/A L1 GLONASS CT L1 GALILEO/COMPASS OS Data+Pilot	
Number of channels	32 channels each capable receiving any supported signals	
Time to first fix	Cold star: Warm start: Hot start:	25 s (average) 25 s (average) 3 s (average)
Sensitivity	Cold star: With A-GNSS: Tracking mode:	– 143 dBm – 160 dBm – 160 dBm
Accuracy [1]	Autonomous mode: Differential mode SBAS: Differential mode DGNSS: Height: Velocity:	<1.5 m <1 m <1 m <2 m 0.05 m/s
PPS Accuracy	15 ns (1 Sigma), 38.5ns granularity	
Assisted GNSS	Supported	
Update rates	1 / 2 / 5 / 10 Hz	
Limitations	Velocity: Acceleration: Height:	less than 500 m/s less than 5 g less than 50,000 m

[1] RMS, 24hr static, SV @ –135 dBm

6.4 Sleep Mode

When the navigation function is not required the NV08C-CSM-BRD Card can be switched to Sleep mode, to consume minimum power from the Host System. The NV08C-CSM device and input LNA are switched to IDLE mode when NV08C-CSM-BRD Card in sleep mode.

The NV08C-CSM-BRD Card is switched to Sleep mode by sending the $POPWR,1111*66<CR><LF> NMEA command.

Note: The time interval to switch the NV08C-CSM device to IDLE mode depends on the communication baud rate. The NV08C-CSM device needs to receive and decode NMEA commands. After decoding a command, a minimum of 10 ms is required to safely switch the device to IDLE mode.

The NV08C-CSM-BRD Card wakes up when the Host System sends any command via the UART.

Note: The NV08C-CSM device is sensitive to the falling edge of UART RX signals. A minimum of 10 ms after detecting a falling edge is required to switch the device from IDLE to normal operation mode, otherwise the first command cannot be properly decoded. Therefore the Host System must wait until the NV08C-CSM device has started normal operation prior to sending the next control command.

6.5 Assisted GNSS

The NV08C-CSM-BRD Card supports Assisted (AGNSS). The AGNSS function uses external data to enable faster navigation when powering-up. Assisted data can be downloaded from an Assisted-server by the Host System then loaded to the NV08C-CSM-BRD Card using the BINR protocol.

6.6 Firmware Update

The NV08C-CSM-BRD Card's Firmware can be updated. The PatchWriter (a software tool to download Firmware) and the latest revision of the Firmware Patch (FW) are available at www.nvs-gnss.com.

The Host System can also download new FW to the NV08C-CSM-BRD Card without using the PatchWriter. The following command is sent to the device to upload new FW:

- for NMEA protocol: $POPRL,R*2F\r\n
- for BINR protocol: 0x10 0x01 0x52 0x45 0x4C 0x4F 0x41 0x44 0x5F 0x52 0x10 0x03

When receiving the command the NV08C-CSM-BRDCard shifts into programming mode and starts the output of character 0x43 (in ASCII – character "C"). In response the Host System downloads new FW as a sequence of bytes (from FW binary file) with using the X-modem-CRC protocol. Once the binary file has been completely downloaded, the NV08C-CSM stores the new FW load into its non-volatile memory and then restarts the receiver.

NVS Technologies can support application specific requirements. Contact NVS' Technical Support Department for customization of standard functionalities.

***Caution** – The process of storing the Patch to FLASH memory will only begin when transmission of the Patch to the module has been fully completed. (This will require a few seconds depending on the data transferring baud rate). During this process the NV08C-CSM-BRD Card must not be powered-off and RESET signal must not be applied. Turning off or resetting the device while downloading a Patch might lead to a malfunction of the NV08C-CSM-BRD Card and recovery can only be done by the factory. The minimum baud rate for updating a FW is 57600 bps.*