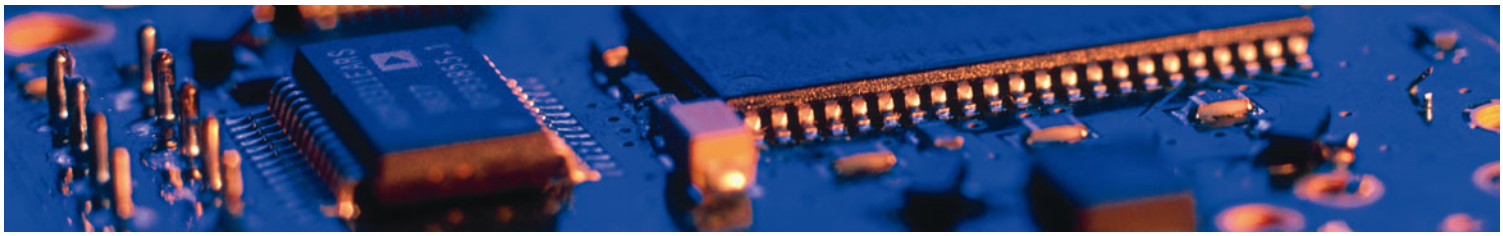

OEM Serial Port Adapter™

2nd Generation

Electrical & Mechanical Datasheet

connectBlue

OEM Serial Port Adapter™ 2nd Generation

Electrical & Mechanical Datasheet

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1 Introduction

1.1 Related Documents

There are some documents related to the Serial Port Adapter (see Figure 1):

- The **Serial Port Adapter User Manual** contains information on how to use the Serial Port Adapter. Study this document before moving on to the others.
- The **Serial Port Adapter AT Commands** document contains a description of the AT commands supported in the Serial Port Adapter. It also contains information on how to use the AT commands to create Bluetooth applications.
- The **OEM Serial Port Adapter Electrical & Mechanical Datasheet** (this document) contains important information about the OEM Serial Port Adapter. Read this document if you are using the OEM Serial Port Adapter.
- The **Bluetooth Enabler Development Kit** is required when using the ECI functionality embedded in the Serial Port Adapter.
    - The **ECI Driver with connectBlue Extensions User Manual** contains a description of the ECI functionality available in the Serial Port Adapter. It also contains information on how to use the ECI Driver to create Bluetooth applications. If you are going to use the ECI protocol in your application, study this document.
    - The **ECI Specification and the ECI Specification with connectBlue Extensions** contain detailed descriptions of the ECI protocol. These documents should be used as a reference when reading the ECI Driver with connectBlue Extensions User Manual.

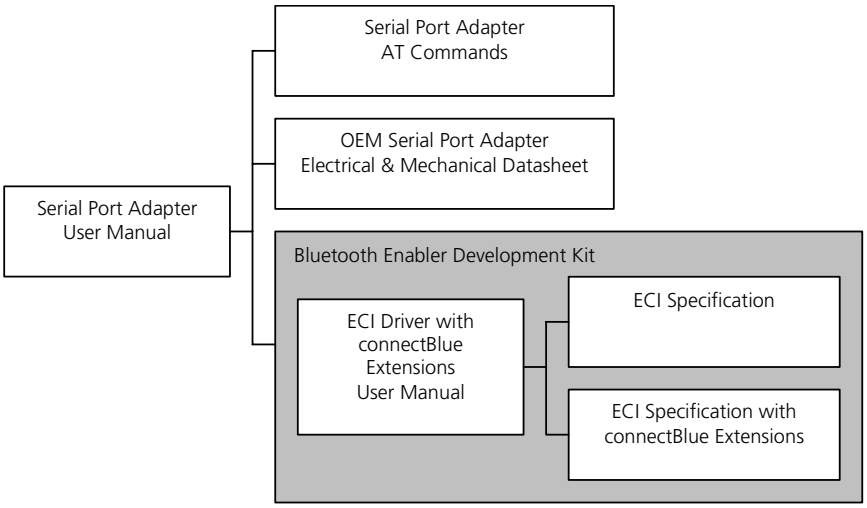


Figure 1: Serial Port Adapter documents

1.2 Product Variants

This Electrical and Mechanical datasheet contains information about the second generation OEM Serial Port Adapter. There are 4 different products (see Picture 1) based on two different hardware modules cB-0701-01 and cB-0702-01. This document makes references to the OEM Module ID, not the Product Name (see Table 1).

Table 1: Product variants

Product Name	OEM Module ID	Type	Description
OEMSPA13i	cB-0701-01	Class 2 / 0 dBm	OEM Serial Port Adapter 13i with internal antenna
OEMSPA13x	cB-0701-01	Class 2 / 0 dBm	OEM Serial Port Adapter 13x with external antenna
OEMSPA33i	cB-0702-01	Class 1 / 20 dBm	OEM Serial Port Adapter 33i with internal antenna
OEMSPA33x	cB-0702-01	Class 1 / 20 dBm	OEM Serial Port Adapter 33x with external antenna

1.2.1 cB-0701-01

cB-0701-01 is a small size Bluetooth module based on the Infineon (former Ericsson Microelectronics) PBM 990 80 baseband controller and the PBA 313 05 (0dBm) radio.

The PBM 990 80 has on chip SRAM and FLASH stacked in the same package.

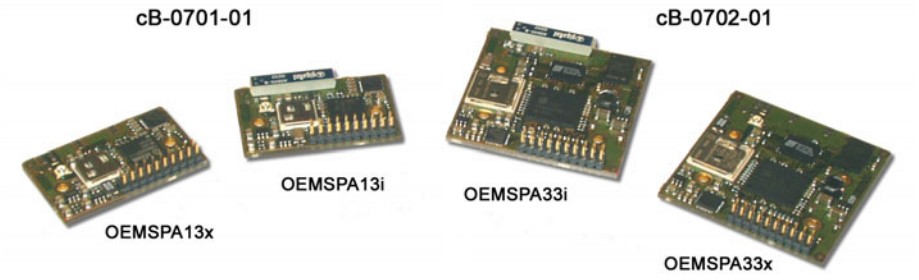
The product name is OEMSPA 13i/x, depending on whether an internal (i) or an external (x) antenna is used.

1.2.2 cB-0702-01

cB-0702-01 is a long-range versatile Bluetooth module based on the Infineon (former Ericsson Microelectronics) PBM 990 90 baseband controller and the PBA 313 02 (20dBm) radio.

The PBM 990 90 has on chip SRAM, the FLASH is located in a separate package. cB-0702-01 also contains external SRAM.

The product name is OEMSPA 33i/x, depending on whether an internal (i) or an external (x) antenna is used.



Picture 1: The OEM Serial Port Adapter product family

1.3 Block Diagram cB-0701-01

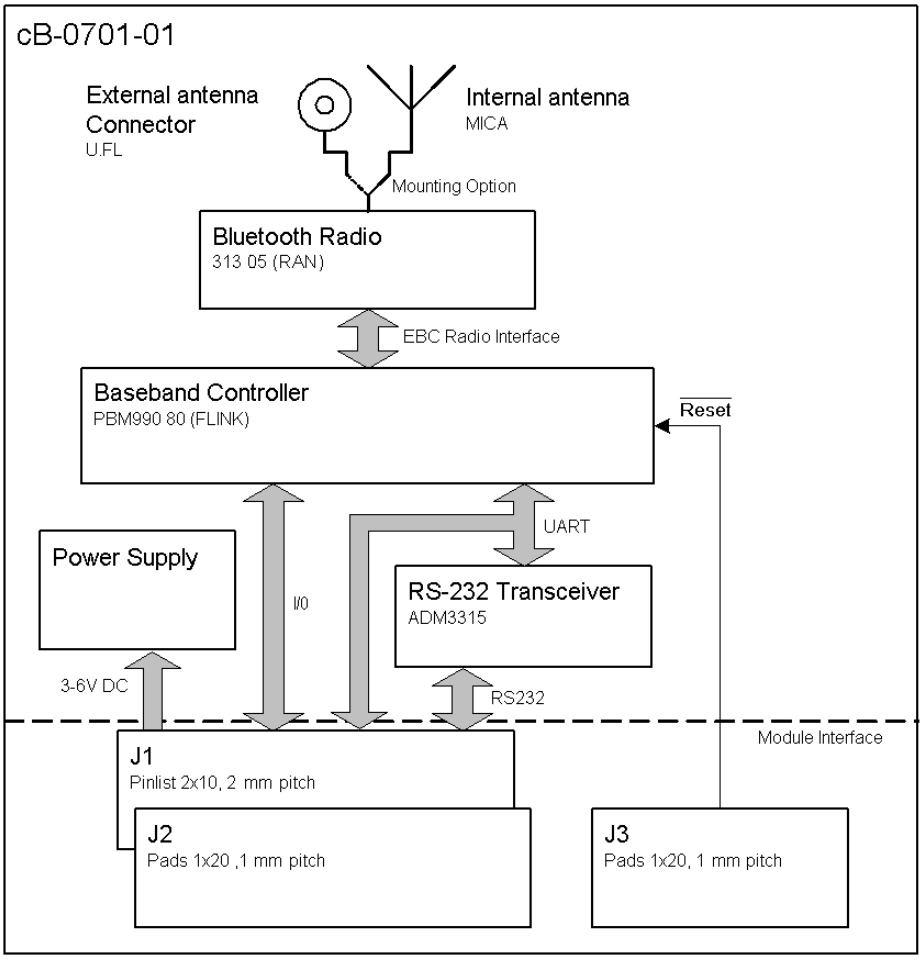


Figure 2: Block diagram of cB-0701-01

1.4 Block Diagram cB-0702-01

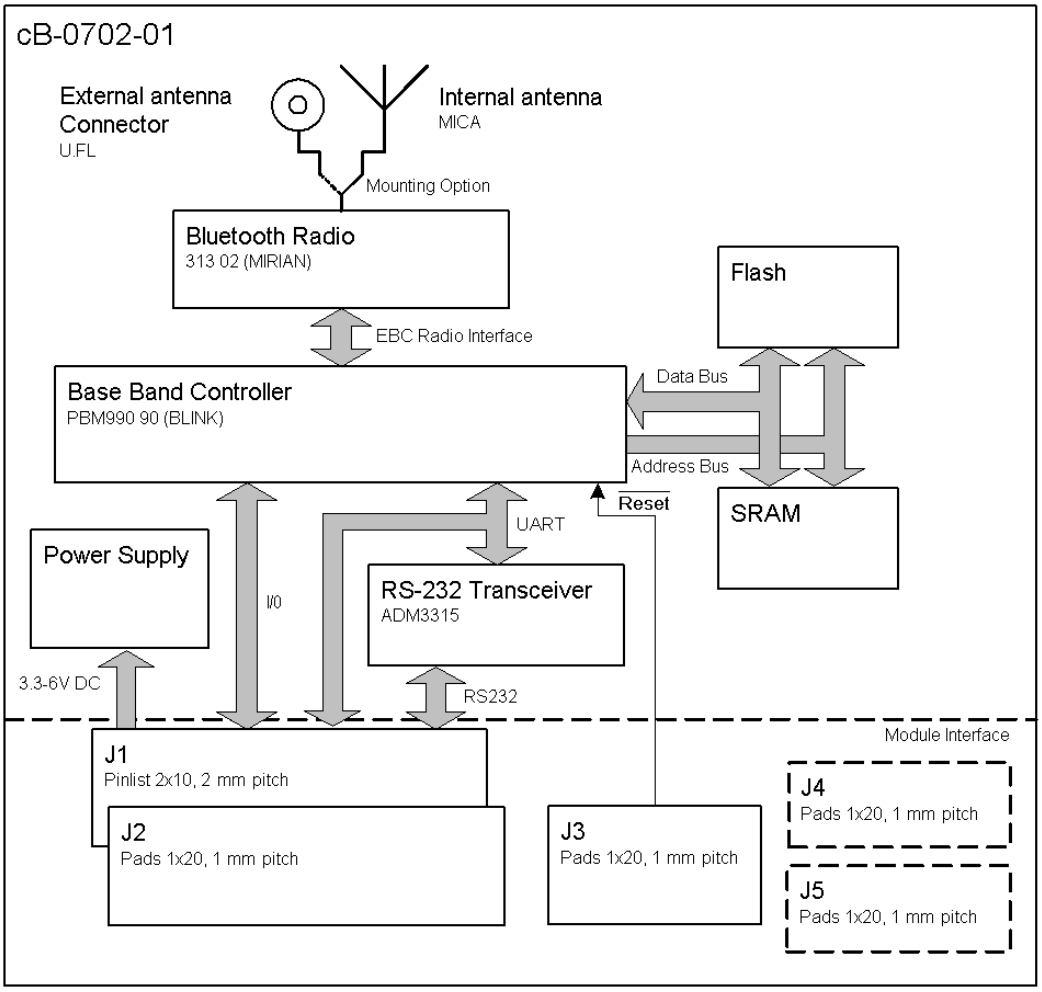


Figure 3: Block diagram of cB-0702-01

2 Electrical Interface and Connectors

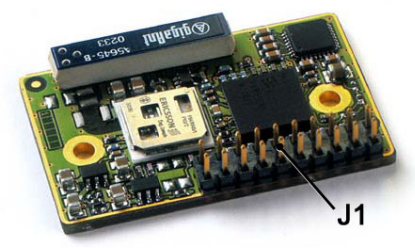
This section describes the signals available on the module interface connectors.

There are two ways to connect to the OEM Serial Port Adapter:

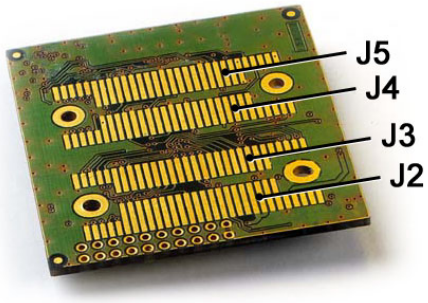
- Via the J1 connector, a 2x10-pin 2mm pitch pin header.
- Via the 1x20-pin 1mm pitch board-to-board (one piece part) connectors, J2 through J5.

NOTE! J4 and J5 are only available on cB-0702-01

The J2 to J5 connectors on the OEM Serial Port Adapter exist on the module only as a mating PCB-layout pattern (see Picture 3).



Picture 2: J1 on the topside of cB-0701-01. The same connector is available on cB-0702-01.



Picture 3: J2 to J5 pads of cB-0702-01, only J2 to J3 are available on cB-0701-01.

NOTE! Connectors J3 to J5 are for future use only and will not be covered in detail in this document.

2.1 Pin Numbering

2.1.1 J1 Connector

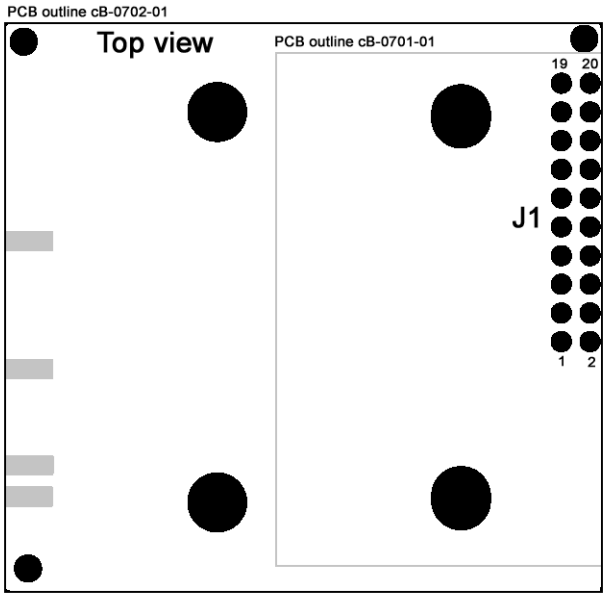


Figure 4: Top view of the two PCBs with the pin numbering of the J1 connector.

2.1.2 J2 and J3 Connector

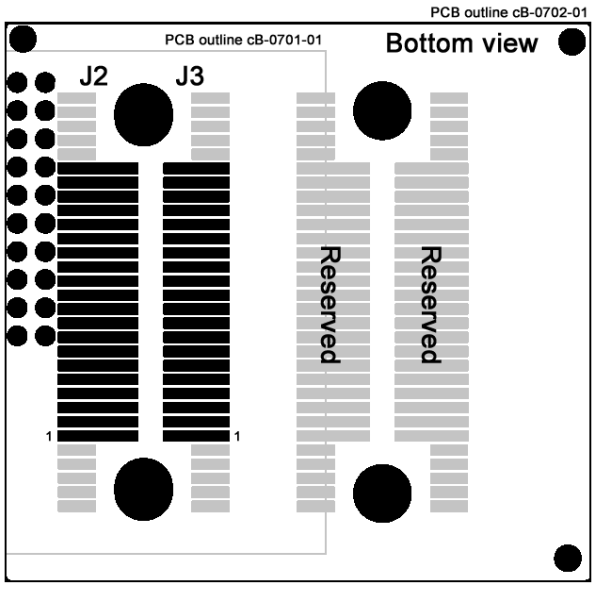


Figure 5: Bottom view of the two PCBs with the pinning of the J2 and the J3 connector.

2.2 Pin Description

2.2.1 J1 and J2 Connector

The J1 and the J2 connector has the same signal set-up and are internally connected, see Table 2.

Table 2: Signals on J1 and J2

J1&J2 Pin Nr	Pin Name	Signal Name	Signal Level	Type	Description
1, 2	VSS	Ground	Ground		Pins internally connected.
3, 4	VCC_5V	Power	3.3V–6V		Pins internally connected. If only cB-0701-01 is used the range 3.0V – 6.0V is allowed
5	RS232-CTS	Clear To Send	RS232	Input	Hardware flow control
6	RS232-TxD	Transmit Data	RS232	Output	
7	RS232-RTS	Request To Send	RS232	Output	Hardware flow control
8	RS232-RxD	Receive Data	RS232	Input	
9	RS232-DTR	Data Terminal Ready	RS232	Output	
10	RS232-DSR	Data Set Ready	RS232	Input	Also used to control the power saving mode "stop mode". See chapter 0 for more information.
11	RED/Mode	Red LED output and serial interface mode select input	CMOS	In/Out	This signal is multiplexed: **RED:** Logic Red LED Signal (see Chapter 3, Table 8). Not valid until 500ms after startup. **Mode:** The level on this pin during power up selects RS232 (High) or logic (Low) level UART-communication. The Mode pin is only valid during the first 500ms after startup and cannot be changed during operation. The Mode pin is internally pulled up i.e. RS232 mode is the default setting. Recommended value of the pull-down resistor is 10 kΩ. See Section A.2.3.2 for design examples.

J1&J2 Pin Nr	Pin Name	Signal Name	Signal Level	Type	Description
12	Switch-0	Function switch	CMOS	In	Used for the "Connect on external signal" function, see the Serial Port Adapter User Manual for more information on the Function switch. See Section A.2.3.4 for design examples.
13	GREEN/ Switch-1	Green LED output and Restore switch	CMOS	In/Out	This signal is multiplexed: **GREEN:** Logic Green LED Signal (see Chapter 3, Table 8). Not valid until 500ms after startup. **Switch-1:** If the level on this pin is set to Low the units goes back to default serial settings. The "Restore Default" input is only active during the first 500ms after startup. See the Serial Port Adapter User Manual for more information on the Restore switch. See Section A.2.3.3 for design examples.
14	BLUE	Blue LED output	CMOS	Output	Logic Blue LED Signal (see Chapter 3, Table 8). See Section A.2.3.1 for design examples.
15	UART1-CTS[1]	Clear To Send	CMOS	Input	Hardware flow control. See Note 1 below.
16	UART1-TxD	Transmit Data	CMOS	Output	
17	UART1-RTS	Request To Send	CMOS	Output	Hardware flow control.
18	UART1-RxD[1]	Receive Data	CMOS	Input	See Note 1 below.
19	UART1-DTR	Data Terminal Ready	CMOS	Output	
20	UART1-DSR	Data Set Ready	CMOS	Input	Also used to control "stop down mode". See Section 0 for more information.

[1] Must be pulled-up (82kΩ) if not used in UART mode on cB-0701-01.

2.2.2 J3 Connector

The only pin available for use on the J3 connector is the $\overline{\text{RESET}}$ pin.

Table 3: Signals on J3

J3 Pin Nr	Pin Name	Signal Name	Signal Level	Type	Description
1-18, 20					Reserved, do not connect.
19	$\overline{\text{RESET}}$	Hardware reset	CMOS	Input	Active low. Must be open drain collector. See Section A.2.4 for design examples.

2.2.3 J4 and J5 Connectors

These connectors are for future use and are not covered by this document.

2.3 Characteristics

The cB-0701-01 and cB-0702-01 boards are designed to be fully interchangeable. This is possible if the host product has made space for the cB-0702-01 board. This makes it possible to choose freely between a class 1 or class 2 device without any change of the host product.

There is only a small electrical different between the modules. The cB-0702-01 module has a step-down switch mode power supply (SMTP) and the current consumption will decrease when the supply voltage increases (constant power). The cB-0701-01 module has a linear power supply, which means that the current is constant if the voltage supply is changed. This means that the current will increase for the cB-0702-01 when the voltage supply decreases to 3.3V compared to Table 5.

Table 4: Power supply

Symbol	Parameter		cB-0701-01	cB-0702-01	Unit
VCC_5V	Power supply	Min	3.0	3.3	V
		Max	6.0	6.0	V

Current consumption depends on operating status, communication speed and load on RS232 pins etc (see Table 5).

An example:
Product used: OEMSPA13i (cB-0701-01)
Operating status of interest: Connected and transmitting data
Serial settings: RS232, 19.2kBits/s, no hardware flow control (only RxD and TxD connected)
Other end Transceiver: Receiver load = 3kΩ, Voltage levels: ±9V

Current consumption: $50_{I\_Average} + 7_{I\_TxD} + 9 / 20_{I\_RxD} = 57.45mA$

Table 5: Current consumption

Symbol	Mode			cB-0701-01		cB-0702-01		Unit
Baud rate[1]				≤57.6	>57.6	≤57.6	>57.6	kBits/s
I_{CC}[2]	Not connected		Average	25	60	18	40	mA
			Peak	85	120	65	90	mA
	Not connected, stop mode enabled	Not connectable	Average	0.6	0.7	0.5	0.5	mA
		Connectable	Average	1.1	1.5	0.6	1.0	mA
		Connectable, discoverable	Average	2.3	2.5	1	1.2	mA
	Connected	Idle	Average	35	70	27	49	mA
			Peak	100	150	170	210	mA
		Transmitting	Average	50	85	35	78	mA
			Peak	100	150	170	210	mA
$I_{RS232\ Output}$[3]	RS232		Average	7	7	7	7	mA
$R_{RS232\ load}$[4]	RS232		Typ	20	20	20	20	kΩ

[1] The internal clock frequency increases when the baud rate is higher than 57.6kBits/s
[2] @ VCC_5V = 5V
[3] RS232 output signals TxD RTS, DTR loaded with 3kΩ. Not included in I_{CC}, very dependent on the load.
[4] Internal load on each RS232 input pin.

Table 6: Input/output signals

Symbol	Parameter		cB-0701-01	cB-0702-01	Unit
V_{IN} Low	Logic LOW level input voltage	Min	-0.3	-0.3	V
		Max	0.8	0.95	V
V_{IN} High	Logic HIGH level input voltage	Min	2.05	2.25	V
		Max	3.2	3.5	V
V_{OUT} Low	Logic LOW level output voltage	Max	0.1	0.1	V
V_{OUT} High	Logic HIGH level output voltage	Min	2.8	2.8	V
I_{GPIO}	Sink and source current	Max	4	4	mA
C_{GPIO}	Input capacitance	Typ	30	30	pF
C_{RESET}	Reset input capacitance	Typ	20	20	nF
$V_{T\_OUT\_RS232}$	RS232 Transmit output voltage	Typ	±6	±6	V
$V_{R\_IN\_RS232}$ HIGH	RS232 HIGH level receive input voltage (logic LOW)	Min	3	3	V
		Typ	6	6	V
		Max	25	25	V
$V_{R\_IN\_RS232}$ LOW	RS232 LOW level receive input voltage (logic HIGH)	Max	-3	-3	V
		Typ	-6	-6	V
		Min	-25	-25	V

Table 7: Temperatures characteristics

Parameter		cB-0701-01	cB-0702-01	Unit
Storage temperature	Min	-40	-40	°C
	Max	+85	+85	°C
Recommended operating temperature	Min	-20	-30	°C
	Max	+75	+55	°C
Maximum operating temperature	Min	-30	-30	°C
	Max	+75	+75	°C

2.4 Hardware Reset

A hardware $\overline{\text{RESET}}$ input is available on the J3 connector (see Section 2.2.2). An external reset source must be open drain collector, see Section A.2.4 for design examples. The $\overline{\text{RESET}}$ pin is pulled-up with 82kΩ.

2.5 Logic Pins

All logic input pins have protecting diodes to V_{SS} and V_{CC} (2.9V), see Figure 6 and Figure 7.

The UART-RxD and UART-CTS pins do not have internal pull-up resistors. When UART mode is used, they must be defined, either by the host system UART or pulled-up (see Figure 8 for a 5V system). If In RS232 mode is used, they can be left undefined.

The supply voltage must be powered on prior to or simultaneously to the logic pin voltages.

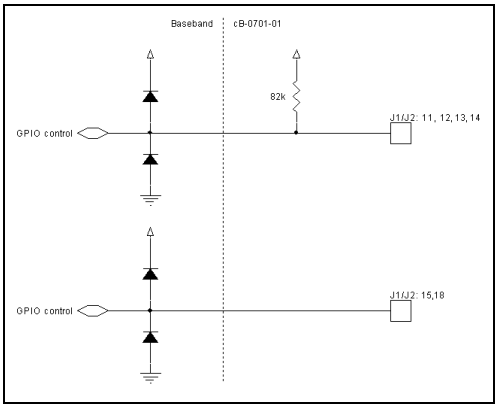


Figure 6: Logic pin design on cB-0701-01.

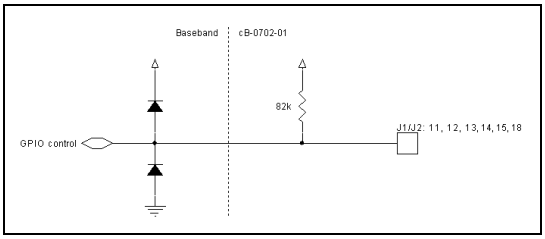


Figure 7: Logic pin design on cB-0702-01.

Use a resistive divider in a 5V system to set logic input pin to a HIGH state instead of a pull-up resistor (see Figure 8).

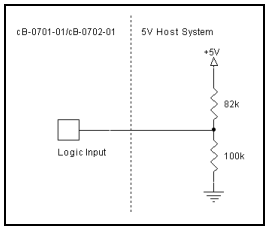


Figure 8: Use a resistive divider instead of Pull-up in a 5V system.

2.6 Power Control

The DSR signal on the UART and the RS232 interfaces may be used to control "stop mode". "Stop mode" is the most efficient power saving mode.

For more information about "stop mode", see the Serial Port Adapter User Manual.

3 Operating Status

The module can be in different modes (see the Serial Port Adapter User Manual for more information about the modes) and the RED, GREEN and BLUE signals can be used to detect or indicating the status, see Table 8. The LED signals are active LOW.

Table 8: Signal states in different module modes

Serial Port Adapter Mode	Status	RGB LED Color	GREEN GPIO	BLUE GPIO	RED GPIO
Data mode	IDLE	Green	LOW	HIGH	HIGH
AT mode, ECI mode	IDLE	Orange	LOW	HIGH	LOW
Data mode, AT mode, ECI mode	CONNECTING[1]	Purple	HIGH	LOW	LOW
Data mode, AT mode, ECI mode	CONNECTED[1]	Blue	HIGH	LOW	HIGH

[1] On data activity the active LEDs flashes and will be HIGH for 50-100ms. For information on how to suppress the flashes see Section A.2.3.1.

4 Antennas

There are 2 different antenna options available:

- An internal surface mounted (SMD) antenna.
- An "antenna on a cable" may be connected to a U.FL connector. Three different "antennas on a cable" are available.

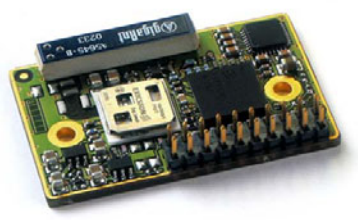
See Section 5.1 for more information on antenna placement.

This chapter gives an overview of the qualities of the different antenna options.

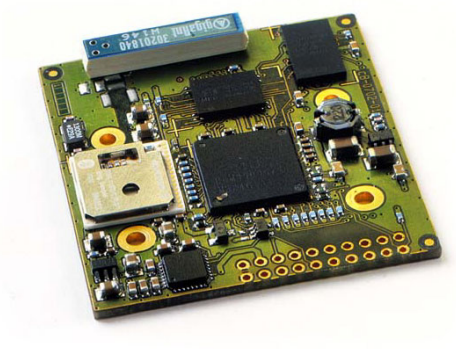
4.1 Surface Mounted Antenna (internal)

The unit cannot be mounted in a metal-shielded enclosure with this antenna.

Part Number	**OEMSPA 13i**
Antenna name	Mica 2.4 GHz
Manufacture	gigaAnt
Antenna type	Patch antenna
Polarization	Linear
Gain	+2.7dBi
Size (LxWxH)	20.5x3.6x3.35 mm
Connector	Surface mounted
Comment	See Section 5.1 for mounting the module considering the antenna.



Part Number	**OEMSPA 33i**
Antenna name	Mica 2.4 GHz
Manufacture	gigaAnt
Antenna type	Patch antenna
Polarization	Linear
Gain	+2.7dBi
Size (LxWxH)	20.5x3.6x3.35 mm
Connector	Surface mounted
Comment	See Section 5.1 for mounting the module considering the antenna.

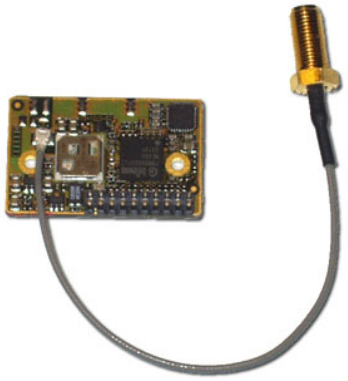


4.2 Antennas on a Cable (external antennas)

The external antennas are connected to the board through a U.FL connector. Some of the antennas are connected directly to the U.FL connector of the board and some are connected using an SMA connected through a short U.FL to SMA adapter cable.

4.2.1 Antenna Accessories

Part Number	**cB-ACC-18**
Name	U.FL to SMA adapter cable
Connector	U.FL and SMA female
Cable length	120 mm



Comment	The SMA connector may be mounted in a panel.

4.2.2 Antennas

Part Number	cB-ACC-16
Name	WCR-2400-SMA
Manufacture	Centurion
Type	½ wave dipole
Polarization	Vertical
Gain	+2.5dBi
Size	100 mm
Connector	SMA male

Comment	To be mounted on the U.FL to SMA adapter cable.

Part Number	cB-ACC-17
Name	Reel planTec Bluetooth m70
Manufacture	Reel
Size (∅xH)	75x20 mm
Gain	+1dBi
Mounting	M16x13.6 mm
Cable length	3 m
Connector	SMA male
Other info	Waterproof (IP67)

Comment	To be mounted on the U.FL to SMA adapter cable.

Part Number	cB-ACC-19
Name	CAP24235 Microblue
Manufacture	Centurion
Type	Microstrip
Polarization	Linear
Gain	+1.5dBi
Size	21x60 mm
Cable length	200 mm
Connector	U.FL
Comment	Connected directly to the U.FL connector on OEM board.

Part Number	cB-ACC-20
Name	CAF94146 Microsphere
Manufacture	Centurion
Type	Microstrip
Polarization	Linear
Gain	+2.7dBi
Size (LxWxH)	46x30x2.5 mm
Cable length	200 mm
Connector	U.FL or SMA
Comment	Connected directly to the U.FL connector on OEM board. Delivered with a mounting kit.

5 Mounting Information

5.1 Board Outlines

5.1.1 cB-0701-01

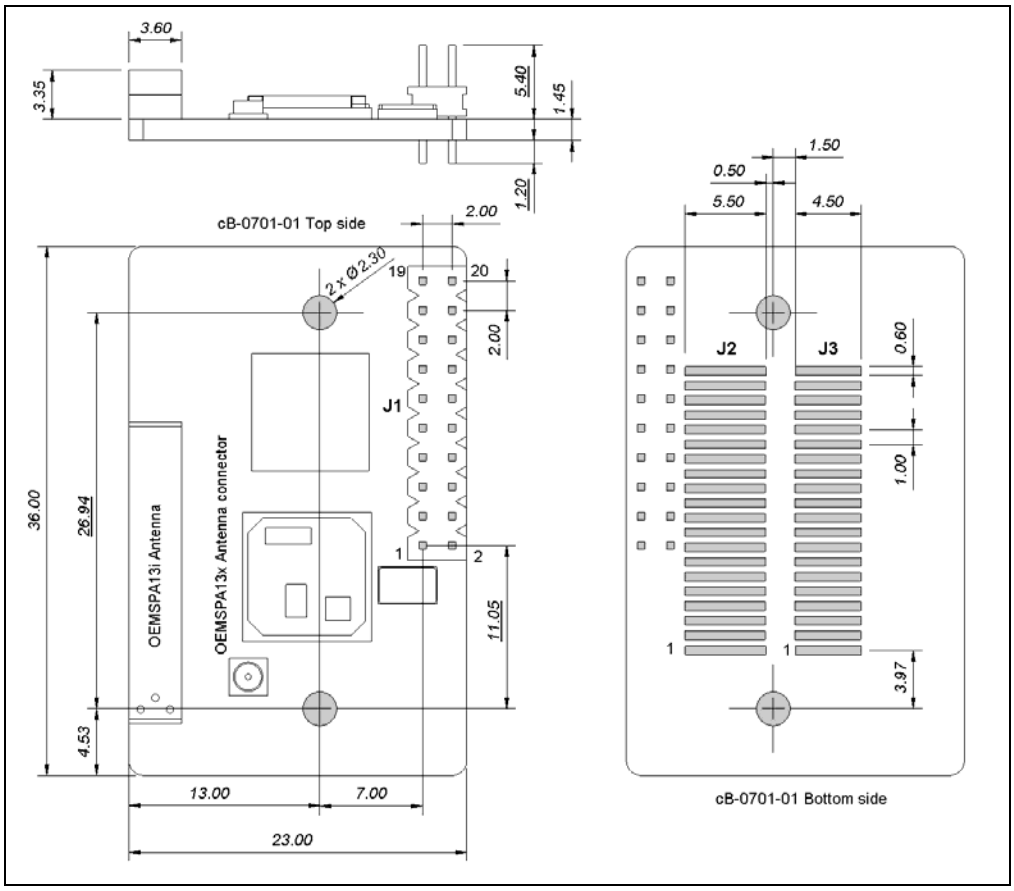


Figure 9: cB-0701-01 dimensions [mm]. The J2 pads are longer to fit both the SEI and FSI connector (see Section 5.4).

5.1.2 cB-0702-01

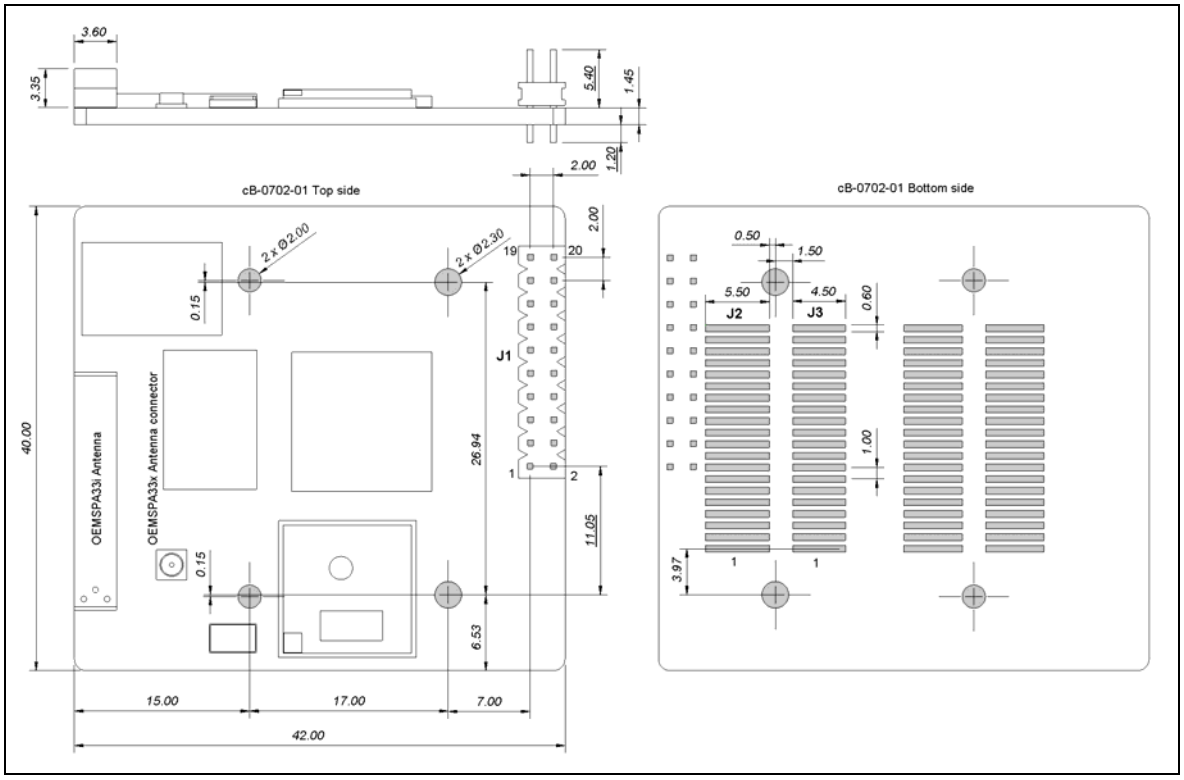


Figure 10: cB-0702-01 dimensions [mm]. The J2 pads are longer to fit both the SEI and FSI connector (see Section 5.4).

5.1.3 Mounting Holes

There are 2 x 2.3mm mounting holes on cB-0701-01 and 2 x 2.3mm, 2 x 2.0mm mounting holes on cB-0702-01. The reasons for the 2.3mm holes are that the threaded M2 holes on the FSI and the SEI connectors (see Section 5.4.1) are not aligned. The outer tangents of the 2.3mm holes align the module if the FSI connector is used and the inner if SEI connector is used (see Figure 11). The 2mm holes on cB-0702-01 are aligned with the FSI connector (see Figure 10).

Choose the outer tangent (CC distance 27.24mm) if the module is aligned and mounted with some other technique based on M2 screws (e.g. press-fit nuts), see Figure 12 and Figure 13.

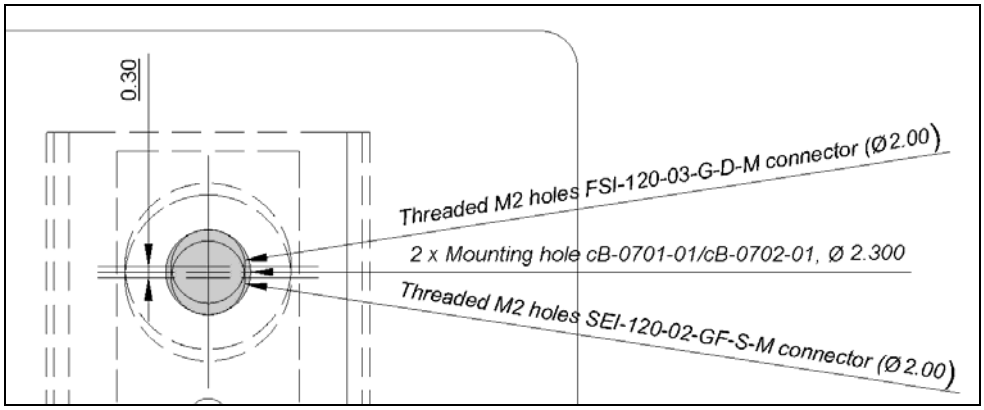


Figure 11: The 2.3mm mounting holes [mm]

5.2 Traces and Component Keep Out Area

The 20-pin 2 mm pitch pin connector (J1) sticks out 1.2 mm below the bottom side of the OEM Serial Port Adapter boards.

It is recommended to keep traces and components out of this area on the motherboard or keep a safe distance between the motherboard and the OEM Serial Port Adapter board (> 1.6 mm).

See Section 5.1 for detailed measurements and positions for the J1 connector.

5.3 Using the J1 Pin Connector

If you mount the boards on a motherboard using the mounting holes, distances higher or equal to 1.6 mm must be used (due to the pins of the J1 connector, see Section 5.2).

Chapter 2 contains more information about the connector and the electrical interface.

5.3.1 Suitable Header Connectors

5.3.1.1 TCSD-10-D-XXX-01-F-N Flat Cable Connector from Samtec

The TCSD family is a 2mm pitch flat cable connector (including flat cable). The cable is available with different connector options. See www.samtec.com for more information and your local distributor.

Another manufacturer is AMP, www.amp.com.

5.4 Using the J2/J3 Board-to-Board Connectors

The board-to-board connector should be a 1mm pitch one-piece part connector. The recommended manufacture is Samtec with many connector options available; see Section 5.4.1.1 and 5.4.1.2.

Chapter 2 contains more information about the connector and the electrical interface.

A tip is to make place for the J1 pin connector as indicated in Section 5.2. This allows you to use a standard connectBlue OEM Serial Port Adapter even if you are not using a board-to-board connector. Contact connectBlue if there is a requirement to use this reserved area for components.

5.4.1 Suitable One-Piece Part Connectors

5.4.1.1 SEI-120-02-GF-S-M-AB Connector from Samtec

This connector is a single row connector and can be used if only J2 is needed ($\overline{\text{RESET}}$ will not be available, the double row FSI connector is a better choice if $\overline{\text{RESET}}$ is required).

This connector has a profile height of 1.65 mm and this has to be considered if components are to be mounted on the motherboard under the OEM Serial Port Adapter board.

The –AB option is for alignment pin on the bottom side of the connector.

The connector is available with M2 threaded inserts (–M option in part no) that fit the mounting holes on the board (see Section 5.1.3). You may screw the OEM Serial Port Adapter board directly into these inserts. If you want to have a tighter and more secure mounting, you may use longer screws and secure it using a nut on the backside of the motherboard.

Another way to mount the module is to use press-fit nuts on the motherboard and skip the M2 threads on the connector (skip the -M option), see Section 5.5 for more information about press-fit nuts.

See Figure 12 for more information about the connector and necessary measurements on the motherboard. The large mounting holes on the motherboard are designed for press-fit nuts and could be smaller if press-fit nuts are not used. The mounting holes are aligned with the outer tangent of the 2.3mm mounting holes of the module (see Section 5.1.3).

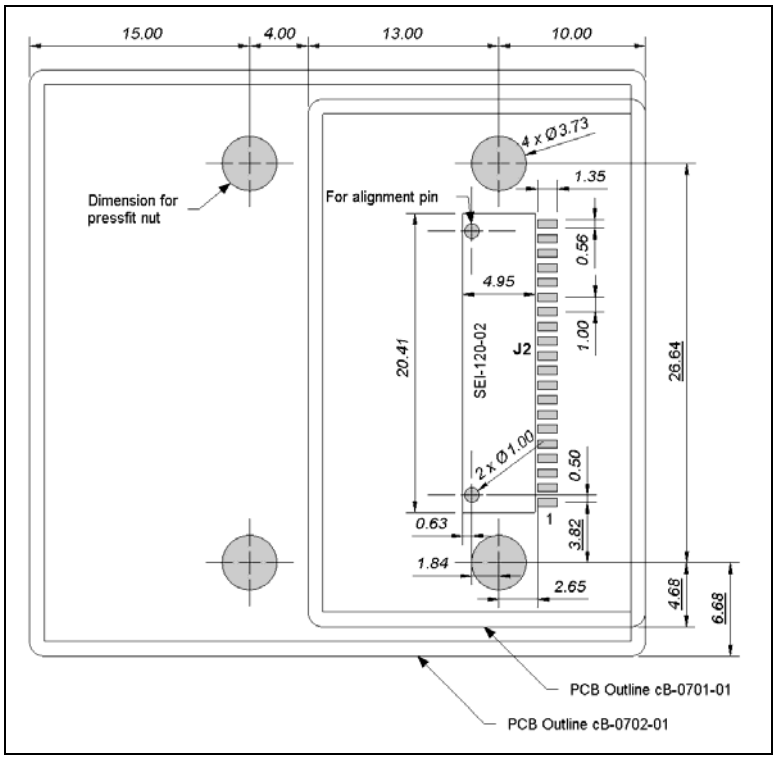


Figure 12: Host PCB layout [mm] for SEI-120-02-GF-S.

5.4.1.2 FSI-120-03-G-D-M-AB Connector from Samtec

This connector is a double row connector and can be used if both J2 and J3 are needed ($\overline{\text{RESET}}$ is only available on J3).

This connector has a height of 3.0mm (-03 option) and this has to be considered if components are to be mounted on the motherboard under the OEM Serial Port Adapter board. The connector is also available with a height of 6.0mm and 10.0mm (-06 and –10 option).

The –AB option is for alignment pin on the bottom side of the connector.

The connector is available with M2 threaded inserts (–M option in part no) that fit the mounting holes on the board (see Section 5.1.3). You may screw the OEM Serial Port Adapter board directly into these inserts. If you want to have a tighter and more secure mounting you may use longer screws and secure it using a nut on the backside of the motherboard.

Another way to mount the module is to use press-fit nuts on the motherboard and skip the M2 threads on the connector (skip the -M option), see Section 5.5 for more information about press-fit nuts.

See Figure 13 for more information about the connector and necessary measurements on the motherboard. The large mounting holes on the motherboard are designed for press-fit nuts and could be smaller if press-fit nuts are not used (see Section 5.1.3).

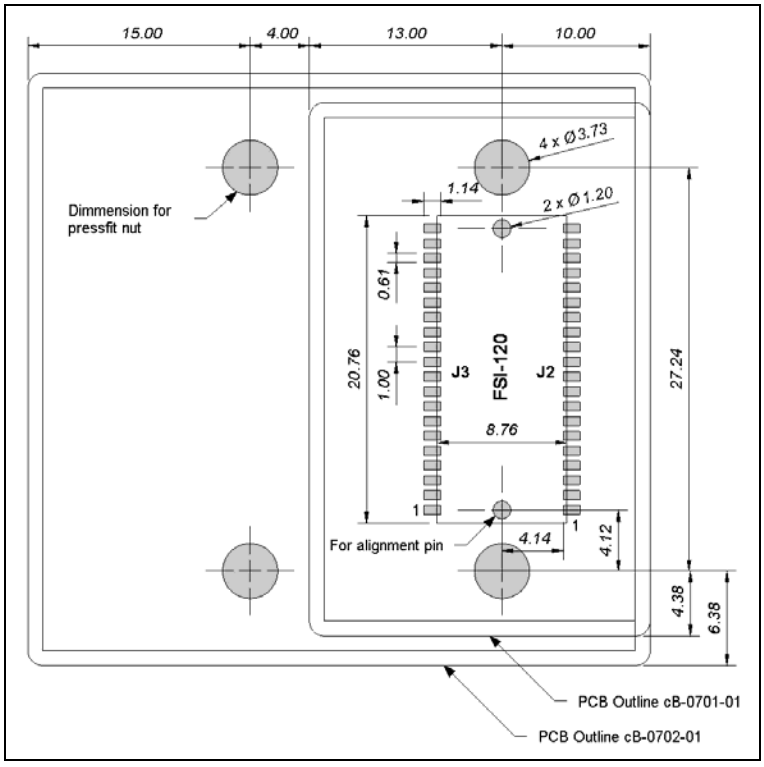


Figure 13: Host PCB layout [mm] for FSI-120-XX-GF-S.

5.5 Using Press-Fit Nuts for Mounting the Module

A press-fit nut is pressed into the PCB from the bottom side with a special press tool. M2 sized press-fit nuts are suitable for the modules (see Figure 12 and Figure 13) and are manufactured by PEM Fastening Systems (www.pemnet.com), part no KFS2-M2 (see Figure 14). Be careful with the distance between the nuts regarding alignment, see Section 5.1.3.

Figure 14: KFS2-M2 press-fit nut.

Spacer-pipes are recommended to use between the PCBs when press-fit nuts are used.

Press-fit nuts are used on the OEM Module Adapter (included in the connectBlue complete kits).

5.6 Antenna Issues

The unit cannot be mounted arbitrary, because of the radio communication. The unit with an internal surface mounted antenna (OEMSPA13i and OEMSPA33i) cannot be mounted in a metal enclosure.

If a metal enclosure is required, one of the external antenna options has to be used. See Section 4.2 for more information on the antenna options available.

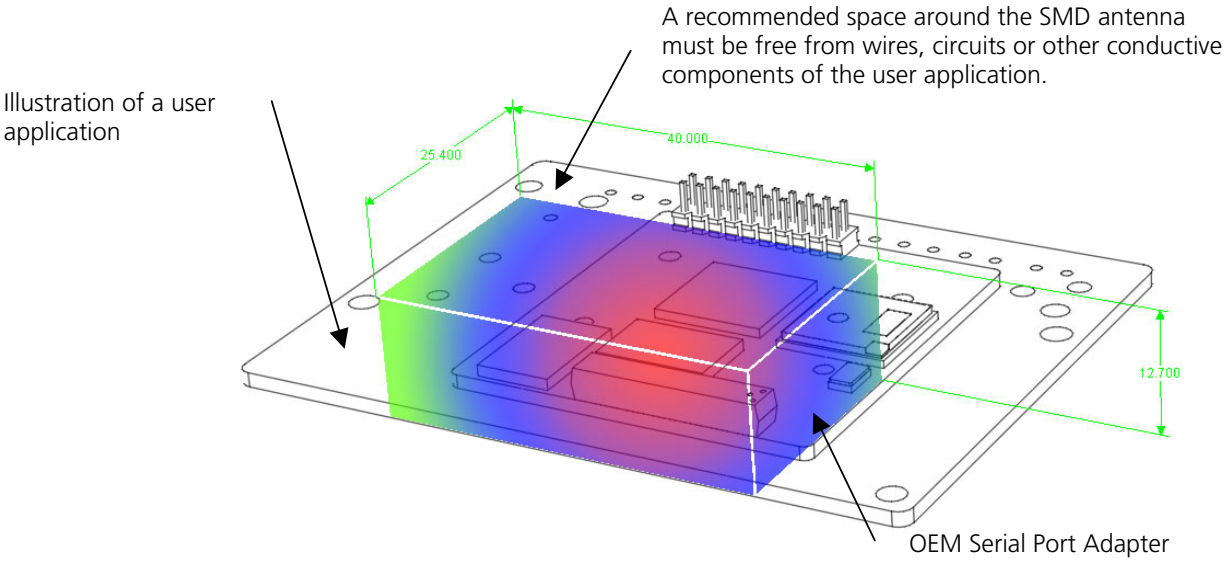


Figure 15: Internal antenna mounting instruction [mm].

6 Bluetooth Information

In the tables below you can find information about Bluetooth properties.

Table 9: Bluetooth information cB-0701-01

Parameter	Data
Bluetooth radio	Infineon/Ericsson PBD 313 05 (RAN)
Bluetooth base band controller	Infineon/Ericsson PBM 990 80 (FLINK)
RF output power	Class 2, typ 1.5dBm
Receive sensitive level	-80dBm (0.1% BER)
Receive input level (max)	Max +14 dBm
Output frequency	2.402 –2.480 GHz, ISM band.
Point to multi-point operation	Yes
Bluetooth stack	Embedded host stack
Bluetooth qualification	1.1

Table 10: Bluetooth information cB-0702-01

Parameter	Data
Bluetooth radio	Infineon/Ericsson PBD 313 02 (MIRIAN)
Bluetooth base band controller	Infineon/Ericsson PBM 990 90 (BLINK)
RF output power	Class 1, min –28dBm, max +16dBm
Receive sensitive level	-80dBm (0.1% BER)
Receive input level (max)	Max +15 dBm
Output frequency	2.402 –2.480 GHz, ISM band.
Point to multi-point operation	Yes
Bluetooth stack	Embedded host stack
Bluetooth qualification	1.1

7 Regulatory Information

7.1 Declaration of Conformity

We, **connectBlue AB**, of
Stora Varvsgatan 11 N:1
SE-211 19 Malmö, Sweden

declare under our sole responsibility that our products:

OEM Serial Port Adapter 13i, cB-0032-01, OEM Serial Port Adapter 13x, cB-0033-01
OEM Serial Port Adapter 33i, cB-0034-01, OEM Serial Port Adapter 33x, cB-0035-01
Serial Port Adapter 12i, cB-0036-01, Serial Port Adapter 32i, cB-0037-01
Serial Port Adapter 33i, cB-0041-01, Serial Port Adapter 33c, cB-0038-01
Rugged Serial Port Adapter 32s, cB-0039-01, OEM Module Adapter 2, cB-0040-01

to which this declaration relates, conforms to the following product specifications:

R&TTE Directive 1999/5/EC

EN 300 328-2 V1.1.1 (2000-07)

EMC Directive: 89/336/EEC

EN 301 489-1 V1.3.1 (2001-09)

EN 301 489-17 V1.1.1 (2000-09)

EN 61000-6-2 (1999)

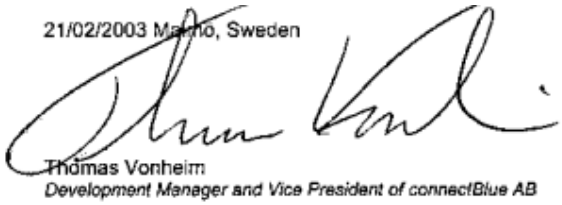
Low Voltage Directive: 73/23/EEC

EN 61131-2

Medical Electrical Equipment

IEC 60601-1-2

21/02/2003 Malmö, Sweden



Thomas Vonheim
Development Manager and Vice President of connectBlue AB

A notification must be made to each of the national authorities responsible for radio spectrum management of the intention to place radio equipment that uses frequency bands whose use is not harmonized throughout the EU, on its national market.

More information at: *http://europa.eu.int/comm/enterprise/rtte/gener.htm*

7.2 FCC Compliance

7.2.1 FCC Statement for cB-0701-01

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

7.2.1.1 Labeling Requirements for End Product

For an end product using the OEM Serial Port Adapter or the OEM Bluetooth Enabler there must be a label containing, at least, the following information:

> This device contains
> FCC ID: PVH070101

The label must be affixed on an exterior surface of the end product such that it will be visible upon inspection in compliance with the modular approval guidelines developed by the FCC.

In addition, the user manual for the end product must contain the following information:

"This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation."

7.2.1.2 Antenna

When using the module equipped with the external antennas as described previously the antenna is fixed and cannot be removed or replaced by the end user.

7.2.1.3 Caution

Any changes or modifications NOT explicitly APPROVED by connectBlue AB could cause the module to cease to comply with FCC rules part 15, and thus void the user's authority to operate the equipment.

7.2.2 FCC Statement for cB-0702-01

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

7.2.2.1 Labeling Requirements for End Product

For an end product using the OEM Serial Port Adapter or the OEM Bluetooth Enabler there must be a label containing, at least, the following information:

This device contains FCC ID: PVH070201

The label must be affixed on an exterior surface of the end product such that it will be visible upon inspection in compliance with the modular approval guidelines developed by the FCC.

In addition, the user manual for the end product must contain the following information:

"This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation."

7.2.2.2 RF-exposure Statement for cB-0702-01

This portable modular transmitter MUST have a separation distance of at least 2.5cm between the antenna and the body of the user or nearby persons, excluding hands, wrists, feet, and ankles.

If the radio module is installed in a laptop display, transmission MUST be prevented if the lid is closed to ensure that the minimum distance of 2.5cm between the user and the transmitting antenna is maintained.

Any notification to the end user of installation or removal instructions about the integrated radio module is NOT allowed.

7.2.2.3 Antenna

When using the module equipped with the external antennas as described previously the antenna MUST be fixed, not to be able to be removed or replaced by the end user.

On modules equipped with SMA-connector, the connector-antenna thread MUST be locked with LOCTITE ® Product 270.

LOCTITE ® Product 270 is a single component anaerobic glue. The product cures when confined in the absence of air between close fitting metal surfaces.

7.2.2.4 Caution

Any changes or modifications NOT explicitly APPROVED by connectBlue AB could cause the module to cease to comply with FCC rules part 15, and thus void the user's authority to operate the equipment.

Appendix A - Application Notes

Usually only a subset of the available functionality is of interest to the designer. In addition, depending on the host system, the electrical interface can be designed in many ways. The designer can use the step-by-step guide in this chapter as an aid in the design process.

A.1 Step-by-Step Guide

Table 11: Step-by-step guide with Yes and No answers.

Question	Yes	No
Do you wish to make your design compatible with both the cB-0701-01 and the cB-0702-01 module?	The PCB outlines are larger on the cB-0702-01 module, which have to be considered if high components are placed near the module (see Chapter 5). There is a little variation in the Voltage power supply and logic levels between the modules and the cB-0702-01 has higher peak current consumption because of higher output power (see Section 2.3).	Go on to next point.
Are you going to integrate the OEM Serial Port Adapter in a metal enclosure?	The internal antenna models cannot be used. Use the OEMSPA13x or OEMSPA33x.	You are free to choose between the products. The internal antenna models are lower cost and are easier to design-in. However, an external antenna could give better range.
Do you wish to use logic level (UART mode) when communicating with the OEM Serial Port Adapter?	See Section A.2.1.2 for electrical design.	See Section A.2.1.1 for electrical design.
Are you using a 5V host system?	See Section A.2.2, Figure 20 for electrical design.	See Section A.2.2, Figure 19 for electrical design.
Is low power consumption important?	The power consumption can be reduced by enabling the stop mode, see Table 5. The stop mode is controlled with the DSR pin, see Section 0.	Go on to next point.
Do you wish to connect LEDs to the OEM Serial Port Adapter?	See Section A.2.3 for design examples for connecting the LEDs.	Go on to next point.
Do you want to detect the status of the module with a controller?	See Chapter 3, Table 8 for status detection and Section A.2.3 for electrical design.	Go on to next point.
Do you wish to utilize the restore switch?	See Section A.2.3.3 for electrical design.	Go on to next point.

Question	Yes	No
Do you wish to utilize the Function switch (“Connect on external signal”)?	See Section A.2.3.4 for electrical design.	Go on to next point.
Do you want to manually reset the module?	See Section A.2.4 for electrical design. Use the FSI connector, see Section 5.4.1.2.	Go on to next point.

A.2 Design Examples

This section contains design examples for all interfaces on J1, J2 and J3. J1 and J2 have the same pin set-up and are internally connected. You can use J1 or J2 depending on which connector (see Section 5.1) you are using.

A.2.1 Serial Interface UART/RS232

The serial interface can operate in RS232 or UART mode, see Section A.2.3.2.

CTS (Clear To Send) and RTS (Request To Send) are used for hardware flow control.

DSR (Data Set Ready) is used to control power saving functions, see Section 2.6.

DTR (Data Terminal Ready) can be used to detect if the module is up and running and ready to receive data.

Note! The module must be configured to flow control none if hardware flow control is not used, see the Serial Port Adapter User Manual.

A.2.1.1 RS232 Mode

The modules are fully compatible with the EIA-232 standard and can be connected to all RS232 transceivers. Speed and current consumption depends on the host system RS232 transceiver. See Figure 16 for a complete example. Not used functionality can be left unconnected; see Section A.2.1.

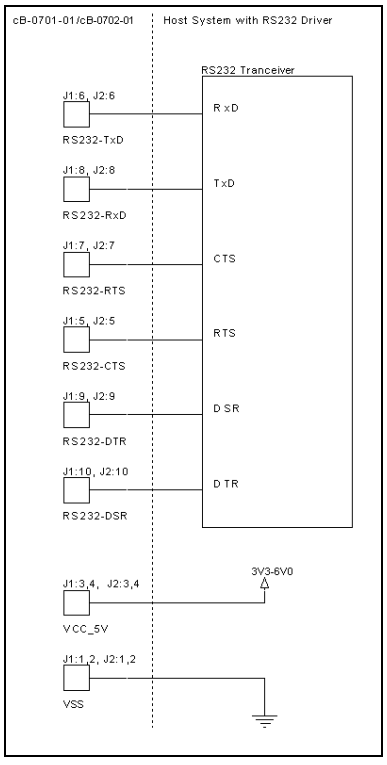


Figure 16: A complete RS232 interface.

A.2.1.2 UART Mode

Logic levels (see Table 6) are used in UART mode; see Section A.2.3.2 for information on how to select UART mode.

Note! It is very important to set the module in UART mode properly when interfacing with logic levels; collision with the internal RS232 transceiver could damage the module.

UART mode can be used in a host controller application with a UART interface. The design of the interface depends on the power supply voltage of the host system; see Figure 17 for a 3.0/3.3V host system and Figure 18 for a 5V host system. CTS and RxD must be pulled-up (82kΩ) if not used, other signals not used can be left unconnected; see Section A.2.1.

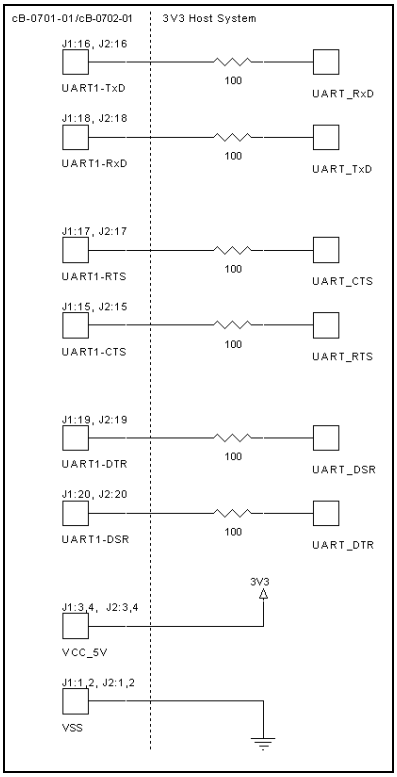


Figure 17: A complete UART interface with a 3.0/3.3V host system.

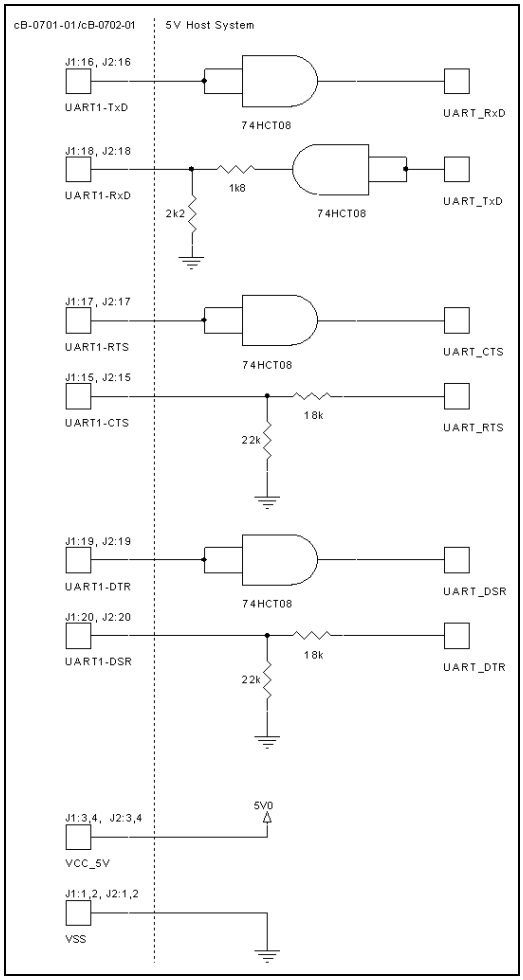


Figure 18: A complete UART interface with a 5V host system.

A.2.2 Logic Levels

A 3.0/3.3V host system can be connected directly to the logic level pins (BLUE, UART1-TxD / UART1-RxD etc). A serial 100Ω resistor shall be used (see Figure 19) for protection, see Table 6 for logic levels characteristics.

A 5V host system can easily be adjusted to the logic levels. A host system output signal can use a resistive divider (18k/22k) to adjust the levels. This is applicable for speeds up to 115.2kBits/s. The divider can be adjusted to 1.8k/2.2k and a logic buffer (74HCT08) for higher speeds (see Figure 20). The host system input pins could require a buffer (see Figure 20) depending on the logic level requirements (see Table 6).

The 74HCT08 gate is also available in a single gate package (74AHCT1G08).

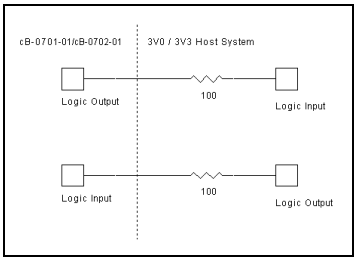


Figure 19: Logic levels interface to a 3/3.3V system. A protective 100Ω resistor is used.

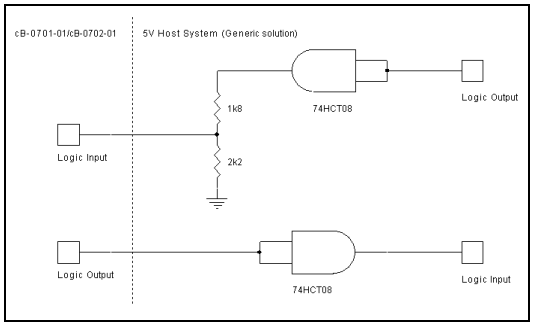


Figure 20: Interface example with logic levels to a 5V system.

A 5V system with open collector outputs is designed in Figure 21.

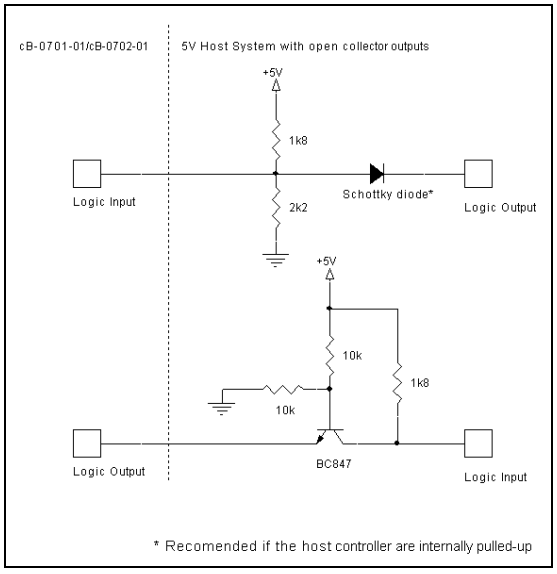


Figure 21: Open collector outputs.

A.2.3 LED and Switch Design

A.2.3.1 BLUE Signal

The BLUE signal is not multiplexed with any other functionality, which makes the design more straightforward (for more information see Figure 22). There are two important notes:

- A blue LED requires about 3.5V forward voltage drop (cannot be used in a 3.3V system).
- The BLUE signal can be used to detect if the module is connected or not. The BLUE signal flashes when the module is sending and receiving data (see Chapter 3, Table 8). See Figure 23 for an example on how to suppress the flashes.

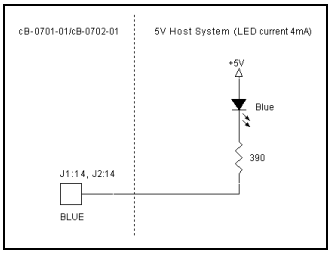


Figure 22: A blue LED can be connected directly to the module if the LED current is below 4mA. A high state (active low) makes the voltage drop over the LED to 2.2V. This is not enough to light the LED.

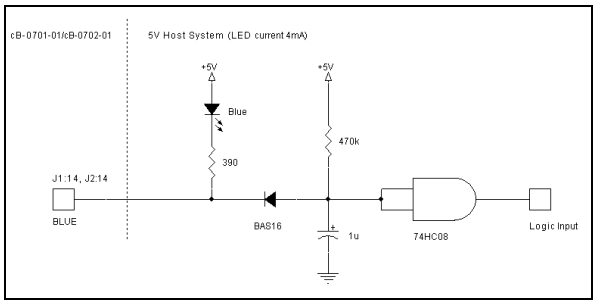


Figure 23: A Low pass filter and a 74HC08 suppress the flashes when the module is sending and receiving data. The Blue LED can be removed if not required.

A.2.3.2 RED/Mode Signal

The RED/Mode signal is a multiplexed signal:

- **RED** - Logic red LED signal (see Chapter 3, Table 8). Becomes valid 500ms after start up.
- **Mode -** The module reads the status of the signal during startup to decide if the serial interface shall be RS232 (HIGH) or logic UART (LOW) levels. The input signal must be stable for the first 500ms after startup (after reset/power on reset).

The signal is internally pulled-up (82kΩ) to 2.8V for RS232 as default.

If a LED is used in UART mode a high impendence buffer is required to prevent the signal from being pulled-up via the LED. A 74HC08 logic gate can be used in a 3/3.3V system (see Figure 24) and a 74HCT08 logic gate in a 5V system (see Figure 25). Both gates are available in a single gate package (74AHC1G08/74AHCT1G08).

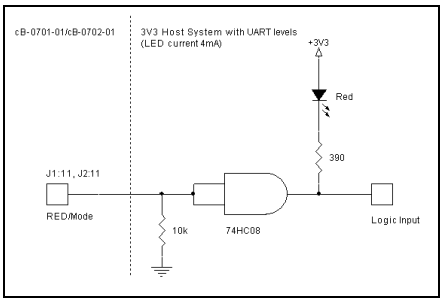


Figure 24: UART mode selected together with a red LED in a 3.3V host system. The status of the signal can also be used as input to a host controller.

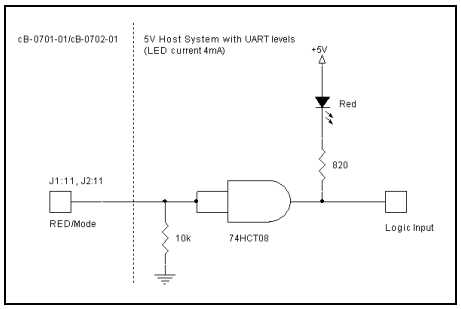


Figure 25: UART mode selected together with a red LED in a 5V host system. The status of the signal can also be used as input to a host controller.

The buffer can be removed in a 3.3V system if RS232 mode is used (see Figure 26).

In a 5V system the high state output (2.8V) from the module is not enough to turn off the LED so a 74HCT08 buffer can be used to raise the high level to 5V (see Figure 27).

The 74HCT08 gate is available in a single gate package (74AHCT1G08).

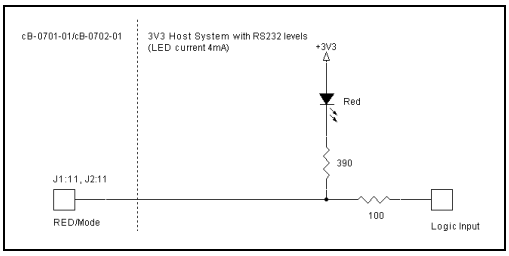


Figure 26: RS232 mode selected (default) together with a red LED in a 3.3V host system. The status of the signal can also be used as input to a host controller.

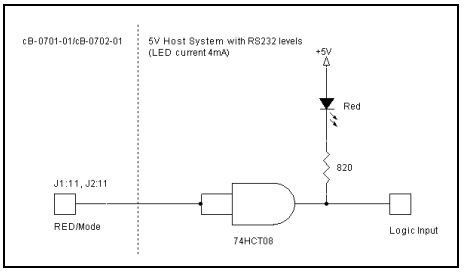


Figure 27: RS232 mode selected (default) together with a red LED in a 5V host system. The status of the signal can also be used as input to a host controller.

Only a pull-down on the RED/Mode pin is needed if UART mode is used but no red LED is required (see Figure 28). The RED/Mode pin can be left unconnected if RS232 (default) is used and no red LED required.

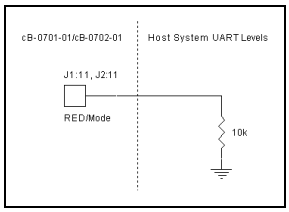


Figure 28: The mode pin is pulled-down (10kΩ) in UART mode.

A.2.3.3 GREEN/Switch-1 signal

The GREEN/Switch-1 signal is a multiplexed signal:

- **GREEN** - Logic green LED signal (see Chapter 3, Table 8). Becomes valid 500ms after start up.
- **Switch-1 -** The module reads the status of the signal at startup to decide if the serial interface settings shall be restored (LOW) (see the Serial Port Adapter User Manual for more details). The input signal must be stable for the first 500ms after startup (after reset/power on reset).

The signal is internally pulled-up (82kΩ) to 2.8V for NOT restoring settings to default.

If a LED is used and a switch is required to be able to restore the settings, a high impendence buffer need to prevent the signal from being pulled-up via the LED. A 74HC08 logic gate can be used in a 3/3.3V system (see Figure 29) and a 74HCT08 logic gate in a 5V system (see Figure 30).

Both gates are available in a single gate package (74AHC1G08/74AHCT1G08).

Sometimes, over time, switch contacts can get an oxide layer. This may cause the closed switch resistance to become too high to sink the signal to logic LOW (the signal is internally pulled-up to 82kΩ). A design that prevents this can be found in Figure 34.

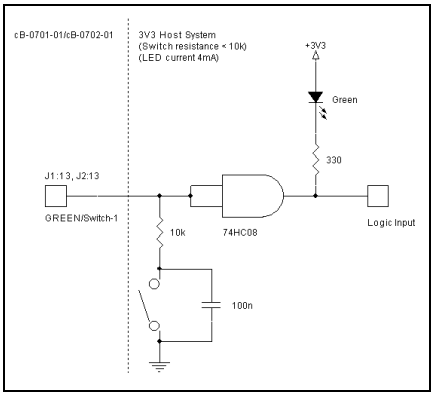


Figure 29: Switch-1 used together with a green LED in a 3.3V host system. The status of the signal can also be used as input to a host controller. Notice the 10kΩ serial resistor.

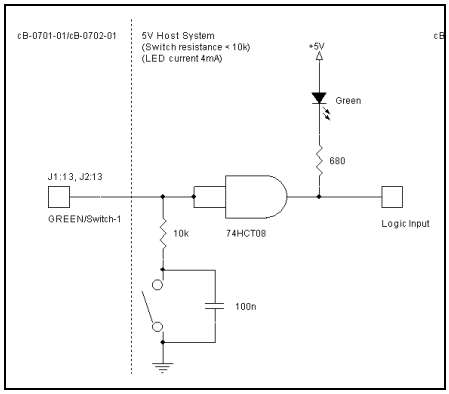


Figure 30: Switch-1 used together with a green LED in a 5V host system. The status of the signal can also be used as input to a host controller. Notice the 10kΩ serial resistor.

The buffer can be removed in a 3.3V system if no restore switch is required (see Figure 31).

In a 5V system the high state output (2.8V) from the module is not enough to turn off the LED, so a 74HCT08 buffer can be used to raise the high level to 5V (see Figure 32).

The 74HCT08 gate is also available in a single gate package (74AHCT1G08).

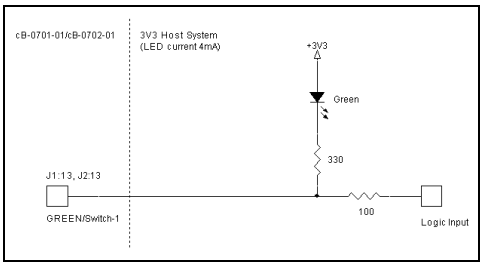


Figure 31: No restore switch used but a green LED in a 3.3V host system. The status of the signal can also be used as input to a host controller.

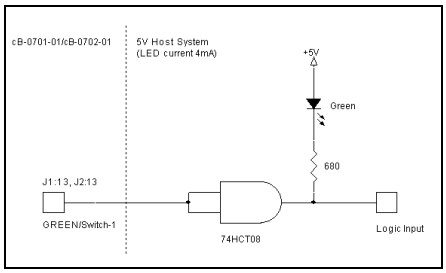


Figure 32: No restore switch used but a green LED in a 5V host system. The status of the signal can also be used as input to a host controller.

A serial resistor to the restore switch must be used to prevent a short circuit when the GREEN/Switch-1 pin is in output HIGH state and the switch is pressed (see Figure 33).

Sometimes, over time, switch contacts can get an oxide layer. This may cause the closed switch resistance to become too high to sink the signal to logic LOW (the signal is internally pulled-up to 82kΩ). A design that prevents this can be found in Figure 34.

The GREEN/Switch-1 pin can be left unconnected if none of its functionality is required.

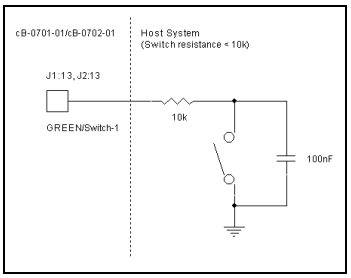


Figure 33: A low resistance restore switch used. Notice the 10kΩ serial resistor.

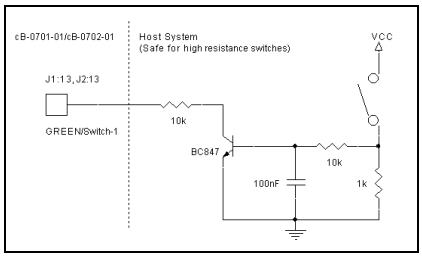


Figure 34: If the resistance in the switch is not guaranteed to be low enough, a safer design can be used. Notice the 10kΩ serial resistor.

A.2.3.4 Switch-0 Signal

Switch-0 is not multiplexed with other functionality and a switch is easily implemented (see Figure 35). Sometimes, over time, switch contacts can get an oxide layer. This may cause the closed switch resistance to become too high to sink the signal to logic LOW (the signal is internally pulled-up to 82kΩ). A design that prevents this can be found in Figure 36.

The Switch-0 pin can be left unconnected if its functionality is not used.

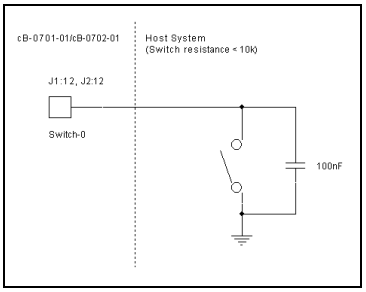


Figure 35: A low resistance function switch used.

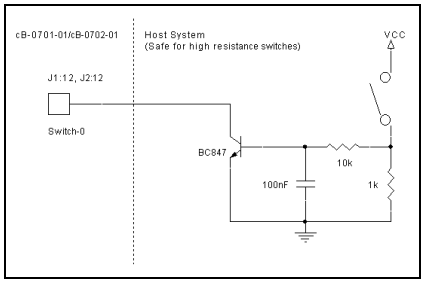


Figure 36: If the resistance in the switch is not guaranteed to be low enough, a safer design can be used.

A.2.4 Reset

The $\overline{\text{RESET}}$ pin can be connected to an external reset source, see Figure 37 for a switch example.

If the reset signal is connected to an output signal it must be a open drain collector, see Figure 38. Notice the capacitive load on the $\overline{\text{RESET}}$ pin in Table 6, Section 2.3.

The $\overline{\text{RESET}}$ pin can be left unconnected if not used.

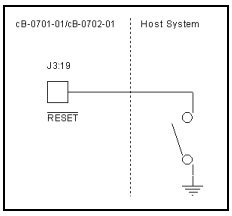


Figure 37: A reset switch.

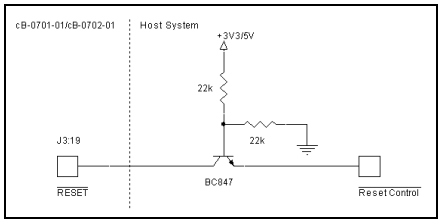


Figure 38: Design of an open collector reset from an active high output.

A.2.5 A Complete 5V Host System Interface

This is a complete 5V host system interface example with an RGB LED and two switches (except the serial interface, see Section A.2.1 for information). The design is based on the LM339 Quad OP-amp instead of logic gates.

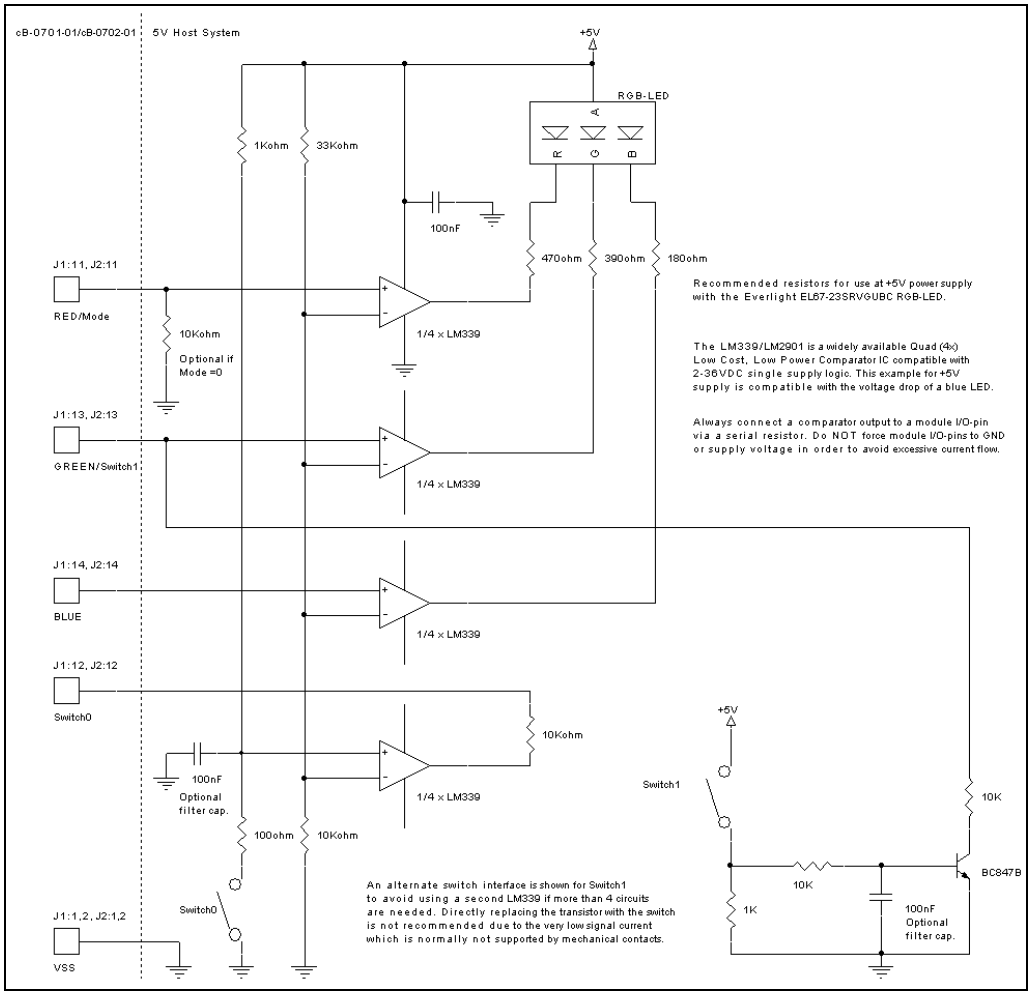


Figure 39: A complete 5V host interface with operational amplifier