

OEM Serial Port Adapter™

cB-OEMSPA310, cB-0907-01

Electrical & Mechanical Datasheet

*connect***Blue**

OEM Serial Port Adapter™
cB-0907-01

Electrical & Mechanical Datasheet

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1 Introduction

1.1 Migrating from Bluetooth 1.1 to 2.0 products

A migration from a cB-OEMSPA13 or cB-OEMSPA33 module to a cB-OEMSPA310 module is normally done without any problems. Even so, there are some issues that have to be considered.

- The resistance value of the pull-down resistors needs to be decreased to 1k Ω . It is especially important to be observant on the Mode and Switch-1 signals. This point is not necessary for the cB-OEMSPA333 modules and 10k Ω can still be used. See the LED and Switch Design Examples for more info.
- The High- and Low-signal definitions are slightly changed on the Logic Level signals. Especially consider the Low-level definition on the Switch-0 signal. See the Input/Output signals in the Characteristics section for more info.
- A 5V system using resistor dividers to adapt the 5V TxD output signal of the host to the 3V levels of the OEMSPA RxD input signal should decrease the resistor values to 1.8k Ω and 2.2k Ω . See the Logic Levels Design Examples for more info.

1.2 Related Documents

There are some documents related to the Serial Port Adapter:

- 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.

1.3 Product Variants

This Electrical and Mechanical datasheet contains information about the OEM Serial Port Adapters based on the PCB cB-0907-01.

Table 1: Product variants

Product Name	OEM Module ID / Regulatory ID / FCC ID	Bluetooth Type	Description
cB-OEMSPA310i-04	cB-0113 cB-0907-01 PVH090701S	Class 2 / +3dBm 2mW	OEM Serial Port Adapter 310i with internal antenna,

1.4 cB-0907-01

cB-0907-01 is a small size Bluetooth module based on the Phillips BGB203 system in package (SiP). The BGB203 has on chip SRAM and FLASH stacked in the same package. The module is only available in one configuration with internal antenna and no extra connectors (see Picture 1).



**Picture 1: CB-OEMSPA310i-04 OEM
Serial Port Adapter with internal
antenna**

1.5 Block Diagram cB-0907-01

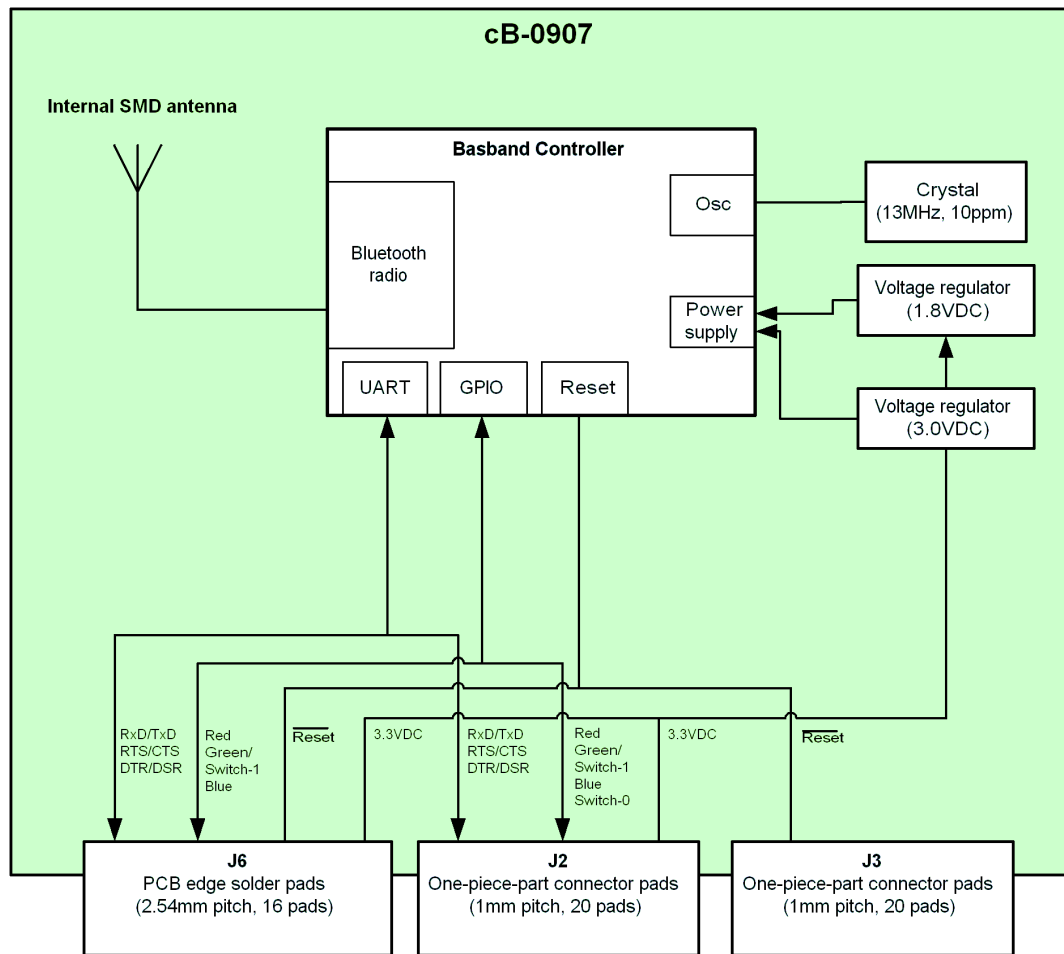


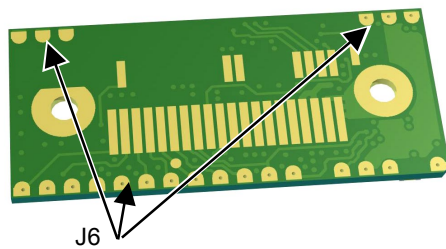
Figure 1: Block diagram of cB-0907-01

2 Electrical Interface and Connectors

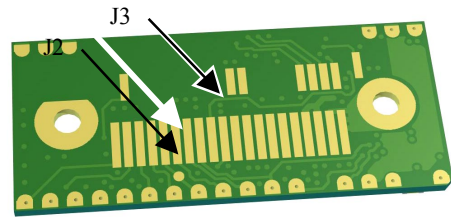
This section describes the signals available on the module interface connectors.

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

- Via the PCB solder pads on the edge of the PCB, J6 (see Picture 2). See Section 5.4 for more information.
- Via the 2x20-pin 1mm pitch board-to-board (one piece part) connectors, J2 through J3. The J2 to J3 connectors on the OEM Serial Port Adapter exist on the module only as a mating PCB-layout pattern (see Picture 3). See Section 5.2 for more information.



Picture 2: J6 are available on the edge of the cB-0907-01.



Picture 3: J2 to J3 are available on cB-0907-01. Some of the not used pads are not visible.

2.1 Pin Numbering

2.1.1 J2, J3 and J6 Connectors

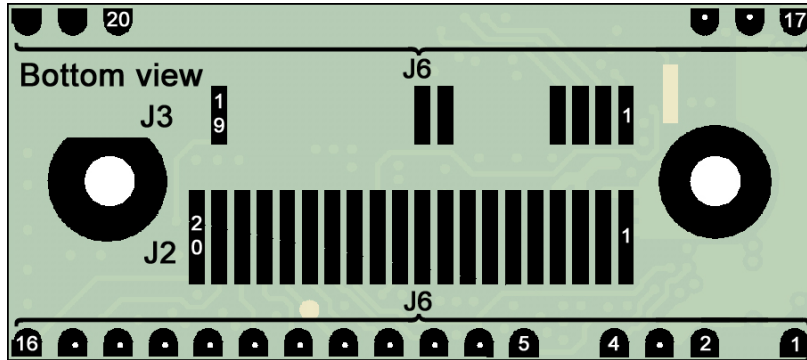


Figure 2: Bottom view of the PCB with the pinning of the J2, J3 and the J6 connector.

2.2 Pin Description

2.2.1 J2 Connector

Table 2: Signals on J2.

J2 Pin Nr	Pin Name	Signal Name	Signal Level	Type	Description
1-2	VSS	Ground	Ground		GND
3-4	VCC_3V3	Power	3.3V		3.0 – 6.0 VDC power supply
5-10		Reserved			Reserved, do not connect.
11	RED/Mode	Red LED output	CMOS	Out	RED: Logic Red LED Signal (see Chapter 3, Table 9). Active low. Mode: Not used on cB-0907-01. This pin is also used to select Logic level mode (instead of RS232) for connectBlue products with internal RS232 driver. To be compatible with these products check the datasheet for these products about this signal.
12	Switch-0	Function switch	CMOS	In	Used for the “Connect on external signal” function, see the Serial Port Adapter AT command Specification for more information on the Function switch. Active low. Note! The maximum input voltage level on this signal is 2V. See section A.2.3.4 for design examples.

J2 Pin Nr	Pin Name	Signal Name	Signal Level	Type	Description
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 9). Not valid until 500ms after startup. Active low. Switch-1: If the level on this pin is pulled-down with 1kΩ** the units goes back to default serial settings. The module will restore all factory settings if both the Switch-1 and Switch-0 signals are low during start up. The "Restore Default" input is only active during the first 500ms after startup. See the Serial Port Adapter AT command Specification for more information on the Restore switch. See section A.2.3.2 for design examples.
14	BLUE	Blue LED output	CMOS	Out	Logic Blue LED Signal (see Chapter 3, Table 9). Active low. Note: Signal will flicker at data transmission. See section A.2.3.1 for design examples.
15	UART-CTS*	Clear To Send	CMOS	In	Hardware flow control. Active low.
16	UART-TxD*	Transmit Data	CMOS	Out	"0" : Low, "1" : High
17	UART-RTS*	Request To Send	CMOS	Out	Hardware flow control. Active low.
18	UART-RxD*	Receive Data	CMOS	In	"0" : Low, "1" : High
19	UART-DTR*	Data Terminal Ready	CMOS	Out	Active low.
20	UART-DSR*	Data Set Ready	CMOS	In	Active low.

* All signals are logic level UART signals (typically 0 - 3VDC)

** Use 1k Ω as pull-down which is different to previous product generations from connectBlue

2.2.2 J3 Connector

Table 3: Signals on J3

J3 Pin Nr	Pin Name	Signal Name	Signal Level	Type	Description
1-18					Reserved, do not connect.
19	RESET	Hardware reset	CMOS	In	Active low. Must be open drain collector. See section 2.4 for design examples.
20					Reserved, do not connect.

2.2.3 J6 Connector (Solder pads)

Table 4: Signals on J6

J6 Pin Nr	Pin Name	Signal Name	Signal Level	Type	Description
1	RESET	Hardware reset	CMOS	In	Active low. Must be open drain collector. See section 2.4 for design examples.
2	VSS	Ground	Ground		GND
3	VCC_3V3	Power	3.3V		3.0 – 6.0 VDC voltage supply
4	UART-DTR*	Data Terminal Ready	CMOS	Out	Active low.
5	RED/Mode	Red LED output	CMOS	Out	RED: Logic Red LED Signal (see Chapter 3, Table 9). Active low. Mode: Not used on cB-0907-01. This pin is also used to select Logic level mode (instead of RS232) for connectBlue product with internal RS232 driver. To be compatible with these products check the datasheet for these products about this signal.

J6 Pin Nr	Pin Name	Signal Name	Signal Level	Type	Description
6	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 9). Not valid until 500ms after startup. Active low. Switch-1: If the level on this pin is pulled-down with 1kΩ** the units goes back to default serial settings. The module will restore all factory settings if both the Switch-1 and Switch-0 signals are low during start up. The "Restore Default" input is only active during the first 500ms after startup. See the Serial Port Adapter AT command Specification for more information on the Restore switch. See section A.2.3.2 for design examples.
7	BLUE	Blue LED output	CMOS	Out	Logic Blue LED Signal (see Chapter 3, Table 9). Active low. Note: Signal will flicker at data transmission. See section A.2.3.1 for design examples.
8	UART-CTS*	Clear To Send	CMOS	In	Hardware flow control. Active low.
9	UART-TxD*	Transmit Data	CMOS	Out	"0" : Low, "1" : High
10	UART-RTS*	Request To Send	CMOS	Out	Hardware flow control. Active low.
11	UART-RxD*	Receive Data	CMOS	In	"0" : Low, "1" : High
12-15					Reserved, do not connect.
16	UART-DSR*	Data Set Ready	CMOS	In	Active low.
17-22		Attachment pads			Reserved, do not connect.

* All signals are logic level UART signals (typically 0 - 3VDC)

** Use 1k Ω as pull-down which is different to previous product generations from connectBlue

2.3 Characteristics

The cB-0907-01 module has a linear power supply, which means that the current is constant if the voltage supply is changed (see Table 6).

2.3.1 Power supply

NOTE: Read the safety notes in chapter 8 before using the modules.

Table 5: Power supply

Symbol	Parameter		Value	Unit
VCC_3V3	Power supply (Unregulated*)	Min	3.0	VDC
		Max	6.0	VDC

* The module is equipped with an internal linear voltage regulator.

Table 6: Current consumption

Symbol	Mode			Value	Unit
I_{cc} @ VCC_3V3 = 3.3V	Not connected		Average	7.9	mA
			Peak	48	mA
	Connected	Idle or Receiving	Average	17	mA
			Peak	55	mA
		Transmitting @115.2kbit/s	Average	22	mA
			Peak	58	mA
	Inquiry		Average	39	mA
			Peak	70	mA

2.3.2 Input/Output signals

Table 7: Input/output signals

Symbol	Parameter		Value	Unit
V_{IN} Low	Logic LOW level input voltage	Min	-0.40	V
		Max	0.80	V
	Logic LOW level input voltage Switch-0	Min	-0.40	V
		Max	0.50	V
V_{IN} High	Logic HIGH level input voltage on all logic input pins except Switch-0	Min	2.05	V
		Max	3.35	V
	Logic HIGH level input voltage Switch-0	Min	1.30	V
		Max	2.10	V
V_{OUT} Low	Logic LOW level output voltage	Max	0.40	V
V_{OUT} High	Logic HIGH level output voltage	Min	2.42	V
I_{GPIO}	Sink and source current	Max	4	mA

2.3.3 Environmental

Table 8: Temperatures characteristics

Parameter		Value	Unit
Storage temperature	Min	-40	°C
	Max	+125	°C
Maximum operating temperature	Min	-30	°C
	Max	+85	°C

2.4 Hardware Reset

A hardware $\overline{\text{RESET}}$ input is available on the J3 and J6 connectors (see section 2.1). An external reset source must be open drain collector, see section A.2.4 for design examples. The $\overline{\text{RESET}}$ pin is internally pulled-up with 120k Ω .

3 Operating Status

The module can be in different modes (see the Serial Port Adapter AT command Specification for more information about the modes) and the RED, GREEN and BLUE signals can be used to detect or indicating the status, see Table 9. The LED signals are active LOW.

Table 9: 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	IDLE	Orange	LOW	HIGH	LOW
Data mode, AT mode	CONNECTING*	Purple	HIGH	LOW	LOW
Data mode, AT mode	CONNECTED*	Blue	HIGH	LOW	HIGH

* 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.

DTR signal can be set to indicate an active Bluetooth link. For more information see Serial Port Adapter AT command Specification.

4 Antennas

4.1 Surface Mounted Antenna (Internal)

Part Number	OEMSPA 310i
Antenna name	FR05-S1-N-0-104
Manufacture	Fractus
Gain	0 dBi
Antenna size (LxWxH)	7.0 x 3.0 x 1.0 mm
Comment	The antenna gain is very dependent of the mounting of the module. See section 5.4 for mounting the module considering the antenna.



5.1.2 Mounting Holes

There are 2 x 2.3mm mounting holes on cB-0907-01. The reasons for the 2.3mm holes are that the threaded M2 holes on the single and double row connectors (see section 5.2.1) are not aligned. The outer tangents of the 2.3mm holes align the module if the single row connectors are used and the inner if double row connectors are used (see Figure 4).

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 5 and Figure 6.

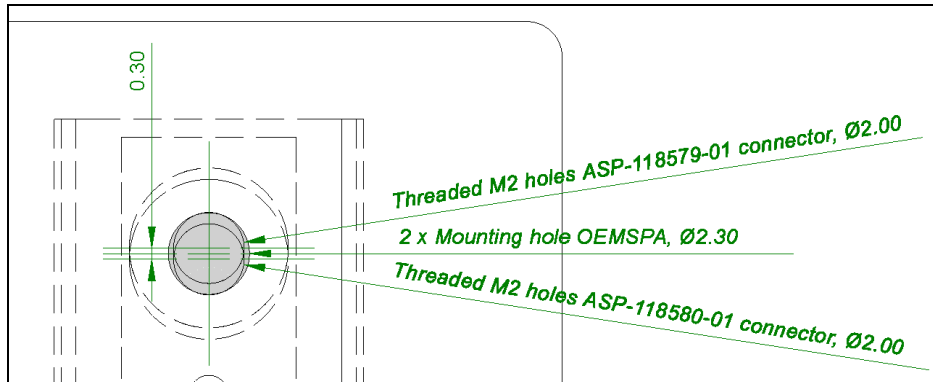


Figure 4: The 2.3mm mounting holes [mm]

5.2 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 5.2.1.1 and 5.2.1.2.

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

5.2.1 Suitable One-Piece Part Connectors

5.2.1.1 Single row connectors

These connectors are a single row connector and can be used if only J2 is needed.

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.

There are alignment pins on the bottom side of the connector.

The connector is available with M2 threaded inserts that fit the mounting holes on the board (see section 5.1.2). 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, see section 5.3 for more information about press-fit nuts.

Table 10: Single row connectors from Samtec.

Samtec order number	Quote number	Equivalent part	Package	Remark
ASP-118645-01	55392	SEI-120-02-GF-S-AB	Tube	Align pin on bottom side only
ASP-118645-02	55392	SEI-120-02-GF-S-AB-TR	Tape-n-Reel	Align pin on bottom side only
ASP-118579-01	55392	SEI-120-02-GF-S-M-AB	Tube	With M2 threaded inserts and align pin on bottom side only
ASP-118579-02	55392	SEI-120-02-GF-S-M-AB-TR	Tape-n-Reel	With M2 threaded inserts and align pin on bottom side only

NOTE:

When ordering connectors from Samtec or an official Samtec distributor, please use the ASP order number and refer to the connectBlue global quote number for best price. For technical questions regarding the Samtec connectors please contact connectBlue or Samtec at (Scandinavia@samtec.com).

See Figure 5 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 5.1.2).

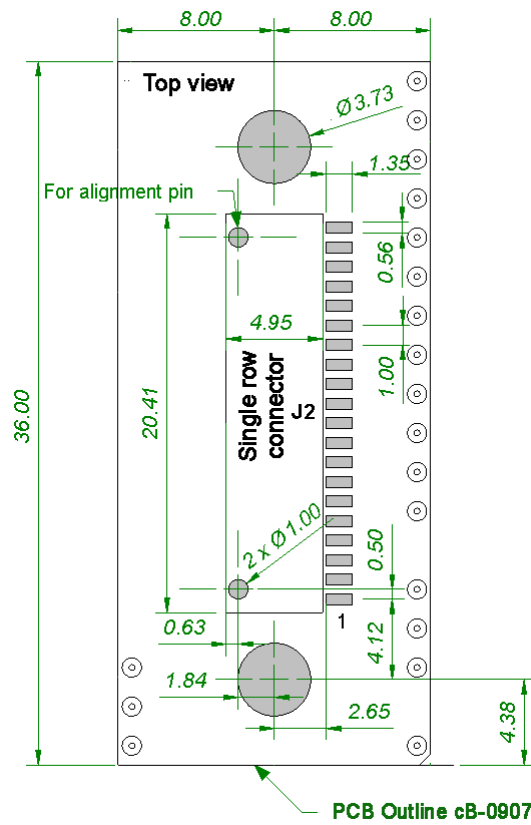


Figure 5: Host PCB layout [mm] for single row connector.

5.2.1.2 Double row connectors

This connector is a double row connector and can be used if both J2 and J3 are needed.

This connector has a height of 3.0mm 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 (The FSI-120 serie from Samtec).

There are alignment pins on the bottom side of the connector.

The connector is available with M2 threaded inserts that fit the mounting holes on the board (see section 5.1.2). 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, see section 5.3 for more information about press-fit nuts.

Table 11: Double row connectors from Samtec.

Samtec order number	Quote number	Equivalent part	Package	Remark
REF-120021-01	55392	FSI-120-03-G-D-AB	Tube	Align pin on bottom side only
REF-120021-02	55392	FSI-120-03-G-D-AB-K-TR	Tape-n-Reel	Align pin on bottom side only
REF-120018-01	55392	FSI-120-03-G-D-M-AB	Tube	With M2 threaded inserts and align pin on bottom side only
REF-120018-02	55392	FSI-120-03-G-D-M-AB-K-TR	Tape-n-Reel	With M2 threaded inserts and align pin on bottom side only

NOTE:

When ordering connectors from Samtec or an official Samtec distributor, please use the REF order number and refer to the connectBlue global quote number for best price. For technical questions regarding the Samtec connectors please contact connectBlue or Samtec at (Scandinavia@samtec.com).

See Figure 6 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 5.1.2).

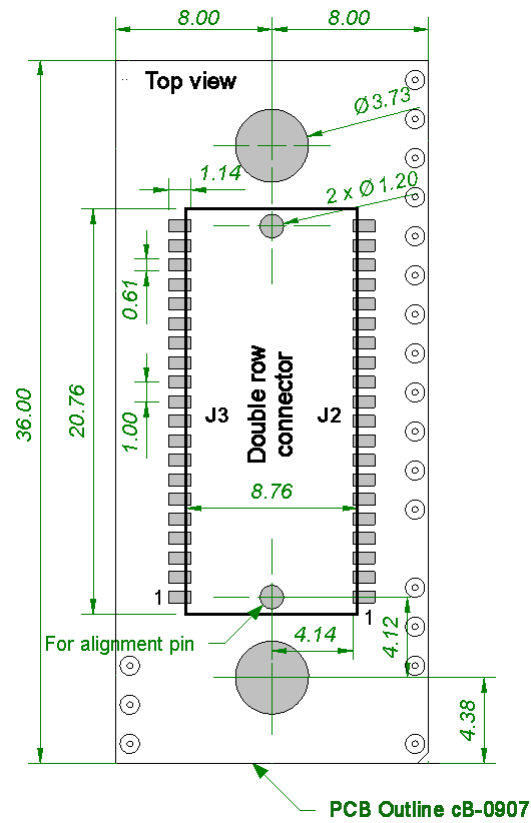


Figure 6: Host PCB layout [mm] for double row connector.

5.3 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 5 and Figure 6) and are manufactured by PEM Fastening Systems (www.pemnet.com), part no KFS2-M2 (see Figure 7). Be careful with the distance between the nuts regarding alignment, see section 5.1.2.

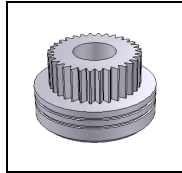


Figure 7: KFS2-M2 press-fit nut.

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

5.4 Using the J6 PCB solder pads

5.4.1 Host PCB

The host PCB footprint should not contain any traces or vias under the module except the pads interfacing the J6 pads to avoid contact with traces/vias on the module. The host pads which are soldered to the J6 pads should reach 0.5-1.0mm under the PCB and some mm outside the module. No other pads than the J6 should be soldered to the host PCB. See section 2.1.1 for more info about the J6 pads.

5.4.2 Mounting process

- We strongly recommend the modules not being soldered more than 1 time after shipping from connectBlue and that the modules are mounted just before the host product is being soldered the last time. Although, connectBlue devices will withstand up to two reflows to an absolute maximum temperature of 250°C.
- The PCB in our modules is made of FR4-type with Chemical Gold Pads.
- The modules are produced in a lead-free process with a lead-free soldering paste.
- It is recommended that the customers make their own electrical, climate, stress and vibration tests on the final assembled product to secure that the manufacturing process hasn't damaged or affected the Bluetooth module in any way.
- The modules can be delivered on trays or individually packed in ESD bags with label on each module. The label will not withstand the heat of soldering and should be removed before processed. The modules delivered in trays will not have individual label (only batch labels on the tray).
- Modules delivered on trays are classed with MSL-Class 3.
- The device recommended maximum reflow temperature is 245°C for 10 sec.
- The device absolute maximum reflow temperature is 250°C for 3 sec.

5.5 Antenna Issues

The unit cannot be mounted arbitrary, because of the radio communication. The unit cannot be mounted in a metal enclosure, see Figure 8.

No metal casing or plastics using metal flakes should be used, avoid also metallic based paint or lacquer. Keep a minimum clearance of 3 mm between the antenna and the casing. Keep minimum 6 mm free space from metal around the antenna including under and above.

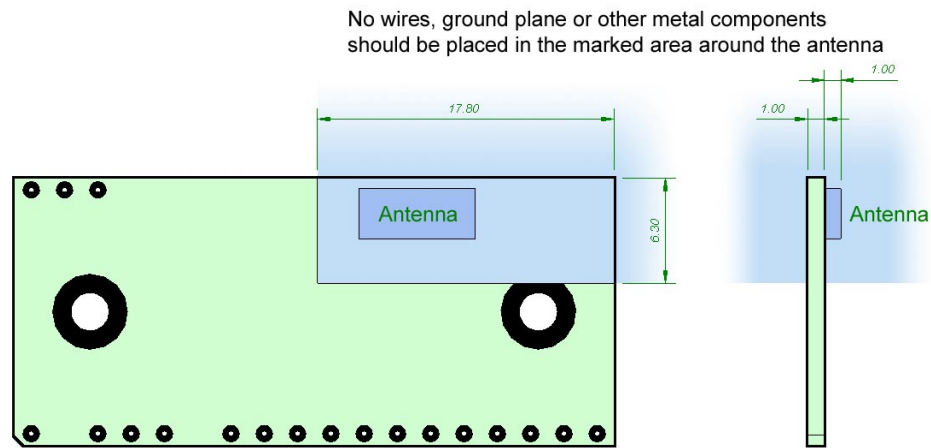


Figure 8: SMD Antenna restrictions.

6 Bluetooth Information

6.1 General information

In the tables below you can find information about Bluetooth properties. The output power of the cB-OEMSPA310i device is max +3dBm (2mW).

Table 12: Bluetooth information cB-OEMSPA310i

Parameter	Data
Bluetooth radio	NXP BGB203
Bluetooth base band controller	NXP BGB203
RF output power	Class 2, max 3dBm (2mW)
Receive sensitive level	-90dBm
Receive input level (max)	+15dBm
Output frequency	2.402 –2.480 GHz, ISM band.
Bluetooth stack	Embedded host stack
Bluetooth qualification	2.0

6.2 Bluetooth Qualification information



All products based on the PCB cB-0907-01 have been qualified according to the Bluetooth specification 2.0.

Table 13 - Bluetooth Qualification information

Module	Bluetooth specification	QD ID	List date
cB-OEMSPA310i	2.0	B012220	2007-01-23

The following Bluetooth profiles are supported (covered functionality):

- Generic Access Profile (GAP)
- Serial Port Profile (SPP)
- Dial-up Networking Profile (DUN GW, DUN DT)

When creating end products based on the Serial Port Adapter the following applies:

- The end product does not have to be re-qualified.
- A free of charge *Bluetooth* End Product Listing (EPL) **must** be completed at the Bluetooth SIG website www.bluetooth.org. This applies for all products implementing *Bluetooth* technology. The EPL requires no testing (online listing only) and is good marketing since the product is published at the *Bluetooth* web site www.bluetooth.com. When creating the EPL you shall refer to the Qualified Design ID (QDID) of the connectBlue module. Easy-to-follow EPL guides are available at www.bluetooth.org to assist you with the EPL. A free of charge "Bluetooth SIG Adopter membership" is required.
- The *Bluetooth* trademark may be placed on the end product and/or used in material related to the end product. This requires a free of charge "Bluetooth SIG Adopter membership". For more information see www.bluetooth.org.

For more information please contact connectBlue.

7 Regulatory Information

7.1 Declaration of Conformity



We, **connectBlue AB**, of
Norra Vallgatan 64 3V
SE-211 22 Malmö, Sweden

declare under our sole responsibility that our products:

cB-OEMSPA310i (cB-0113),
OEM Module Adapter III (cB-0068).

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

R&TTE Directive 1999/5/EC:

Effective use of frequency spectrum:

EN 300 328 V1.7.1 (2006-05)

EMC:

EN 301 489-1 V1.8.1 (2008-04)

EN 301 489-17 V1.3.2 (2008-04)

EN 61000-6-2 (2005)

Health and safety:

EN 50371:2002

EN 60950-1:2006 and/or IEC 60950-1:2005 (2nd Edition)

Medical Electrical Equipment

IEC 60601-1-2 (2001)

2009-12-08 Malmö, Sweden

Mats Andersson

CTO of connectBlue AB

If a cB-OEMSPA310i is used within EU 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 Safety Compliance

In order to fulfill the safety standard EN 60950-1 the unit must be supplied by a limited power source.

7.3 FCC and IC Compliance

See Table 1 for information about the different product variants.

7.3.1 Compliance for cB-0907-01

7.3.1.1 FCC Statement for cB-0907-01

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

7.3.1.2 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.

7.3.1.3 IC Compliance

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,

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website www.hc-sc.gc.ca/rpb

7.3.1.4 Labeling Requirements for End Product

For an end product using the product cB-0907-01 there must be a label containing, at least, the following information:

This device contains FCC ID: PVH090701S IC: 5325A-090701S

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 accordance with 47 CFR § 15.19 the end product shall bear the following statement in a conspicuous location on the device:

“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.”

When the device is so small or for such use that it is not practicable to place the statement above on it, the information shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC ID label must be displayed on the device.

In case, where the final product will be installed in locations where the end-user is not able to see the FCC ID and/or this statement, the FCC ID and the statement shall also be included in the end-product manual.

7.4 UL listing information

If a customer intends to UL list a product including any of the Bluetooth modules based on the PCB cB-0907-01 this information is useful:

The printed circuit board is produced according to the following specification:

- UL recognized ZPMV2 min. 105 °C flame class V-0 or better.

7.5 Compliance with RoHS directive



All products based on the PCB cB-0907-01 are produced according to the RoHS (Restriction of the use of certain Hazardous substances in electrical and electronic equipment) directive and complies with the directive.

8 Guidelines for Efficient and Safe Use

8.1 General

Read this information before using your OEM Serial Port Adapter.

For any exceptions, due to national requirements or limitations, when using your OEM Serial Port Adapter, please visit www.bluetooth.org.

Note: Changes or modifications to the product not expressly approved by connectBlue AB will void the user's authority to operate the equipment.

8.2 Product Care

- Do not expose your product to liquid or moisture.
- Do not expose your product to extreme hot or cold temperature (see Section 2.3.3 for further information).
- Do not expose your product to lit candles, cigarettes, cigars, open flames, etc.
- Do not drop, throw or try to bend your product since rough treatment could damage your product.
- Do not attempt to disassemble your product. Doing so will void warranty. The product does not contain consumer serviceable or replaceable components. Service should only be performed by connectBlue AB.
- Do not paint your product as the paint could prevent normal use.
- If you will not be using your product for a while, store it in a place that is dry, free from damp, dust and extreme heat and cold.
- The clearance and creepage distances required by the end product must be withheld when the module is installed.
- The cooling of the end product shall not negatively be influenced by the installation of the module when the module is installed.

8.3 Radio Frequency Exposure

The OEM Serial Port Adapter contains a small radio transmitter and receiver. During communication with other Bluetooth products the OEM Serial Port Adapter receives and transmits radio frequency (RF) electromagnetic fields (microwaves) in the frequency range 2400 to 2500 MHz. The output power of the radio transmitter is less than 4mW.

When using the OEM Serial Port Adapter, you will be exposed to some of the transmitted RF energy. This exposure is well below the prescribed limits in all national and international RF safety standards and regulations.

8.4 Electronic Equipment

Most modern electronic equipment, for example, in hospitals and cars, is shielded from RF energy. However, certain electronic equipment is not. Therefore:

Note: This equipment emits RF energy in the ISM (Industrial, Scientific, Medical) band. Please insure that all medical devices used in proximity to this device meet appropriate susceptibility specifications for this type of RF energy.

8.5 Potentially Explosive Atmospheres

Turn off your electronic device before entering an area with potentially explosive atmosphere. It is rare, but your electronic device could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fuelling areas, such as petrol station, below deck on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles, such as grain, dust, or metal powders.

8.6 Power Supply

The OEM Serial Port Adapter must be supplied by a limited power source according to EN 60950-1.

- Connect your power supply only to designated power-sources as marked on the product.
- Make sure all cords and cable are positioned so that they will not be stepped on, tripped over or otherwise subject to damage or stress.
- To reduce risk of electric shock, unplug the unit from any power source before attempting to clean it.

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

Question	Yes	No
Are you going to integrate the OEM Serial Port Adapter in a metal enclosure?	The module cannot be mounted in a metal enclosure. Choose one of the OEM Serial Ports Adapters with antenna connector for external antenna.	Go on to next point.
Do you wish to use logic level when communicating with the OEM Serial Port Adapter?	See section A.2.2.1 for electrical design.	See section A.2.2.2 - A.2.2.3 for electrical design.
Do you want to use RS232 as the physical serial interface?	See section A.2.2.2 for electrical design.	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 9 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.2.3.2 for electrical design.	Go on to next point.
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 0 for electrical design. Use a double row connector. See section 5.2.1.2.	

A.2 Design Examples

This section contains design examples for all interfaces on J2, J3, and J6. The connector type that suits a specific application depends on the needed signal and the preferred interface type (board-to-board or SMD).

A.2.1 Logic Levels

A 3.0/3.3V host system can be connected directly to the logic level pins (BLUE, UART-TxD / UART-RxD etc). A serial 100Ω resistor shall be used (see Figure 9) for protection, see Table 7 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 ($1.8k\Omega/2.2k\Omega$) to adjust the levels. This is applicable for speeds up to 115.2kBits/s. The divider can be improved by adding a logic buffer (74HCT08) for higher speeds (see Figure 10). The host system input pins could require a buffer (see Figure 10) depending on the logic level requirements (see Table 7).

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

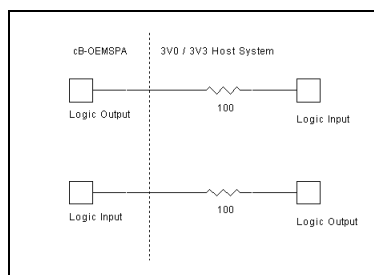


Figure 9: Logic levels interface to a 3/3.3V system. A protective 100Ω resistor is used.

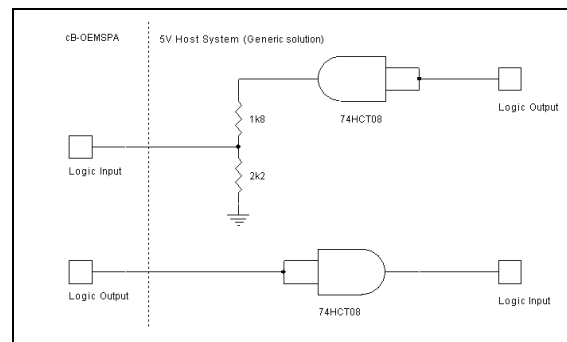


Figure 10: Interface example with logic levels to a 5V system.

A 5V system with open collector outputs is designed in Figure 11.

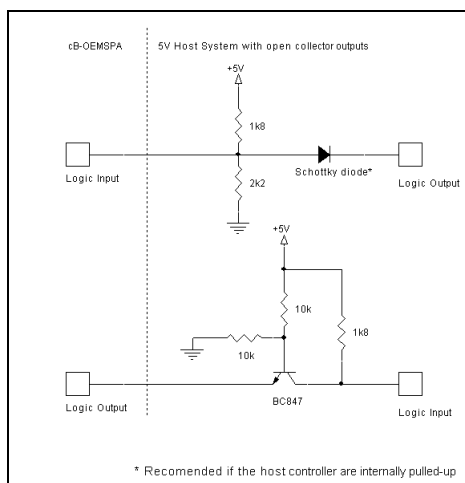


Figure 11: Open collector outputs.

A.2.2 Serial Interface

The serial interface of the module is Logic Level logic levels and the module can be connected to an external CPU (see section A.2.2.1).

An external driver is needed if the module should be on another physical interface like RS232 (see section A.2.2.2 - A.2.2.3).

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

DSR (Data Set Ready) can be used to make a connect attempt. See the Serial Port Adapter AT commands specification.

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 AT Commands specification.

A.2.2.1 Logic level Mode

The serial UART interface 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 12 for a 3.0/3.3V host system and Figure 13 for a 5V host system.

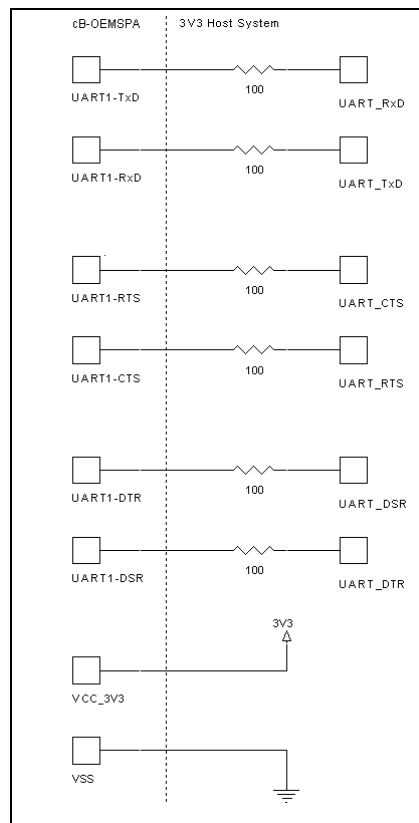


Figure 12: A complete UART interface with a 3.0/3.3V host system.

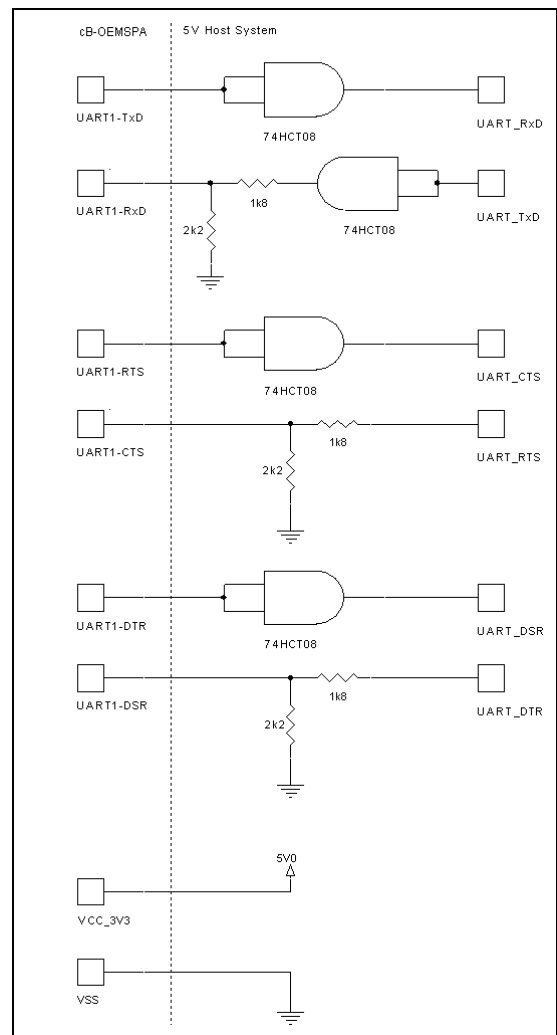


Figure 13: A complete UART interface with a 5V host system.

A.2.2.2 External RS232 driver

An external RS232 driver is needed if the module should have a RS232 serial interface. See Figure 14 for a complete design example that could be connected to the serial port of standard PC. Not used functionality can be left unconnected; see section A.2.2.

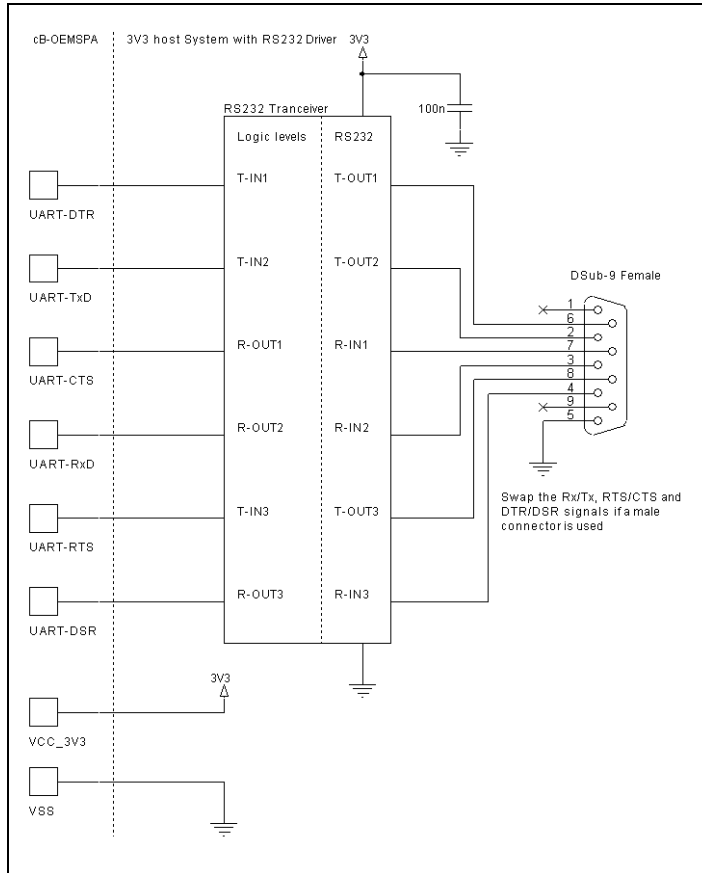


Figure 14: A complete RS232 interface.

A.2.2.3 External RS422 driver

An external RS422 driver could be used in a point-to-point (full duplex) application (see Figure 15).

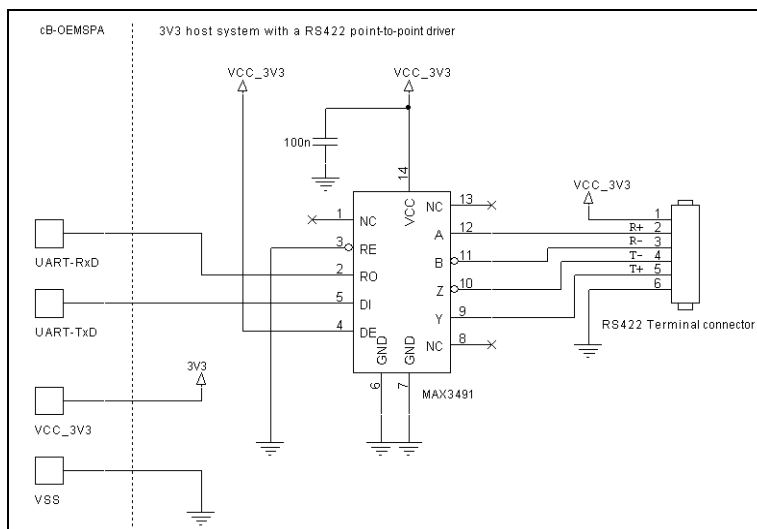


Figure 15: A complete RS422 interface.

A.2.3 LED and Switch Design

A.2.3.1 BLUE Signal

The BLUE logic LED signal is not multiplexed with any other functionality, which makes the design more straightforward (for more information see Figure 16). 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 9). See Figure 17 for an example on how to suppress the flashes.

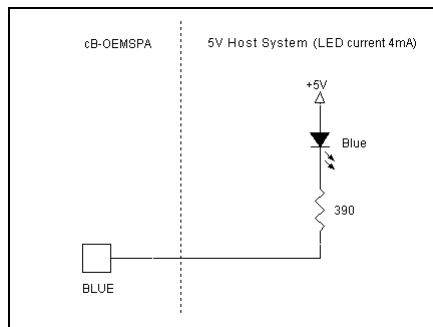


Figure 16: A blue LED can be connected directly to the module if the LED current is below 4mA. A high state (active low) makes the voltage drop over the LED to 2.2V. This is not enough to light the LED.

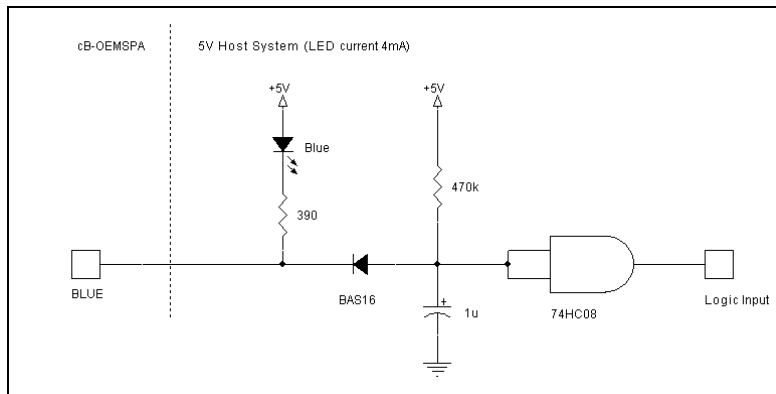


Figure 17: A Low pass filter and a 74HC08 suppress the flashes when the module is sending and receiving data. The Blue LED can be removed if not required. The values are not suited in all applications and need to be verified in a specific application.

A.2.3.2 RED/Mode Signal

The RED logic LED signal is not multiplexed with any other functionality. See Figure 18 for a 3.3V design.

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 19).

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

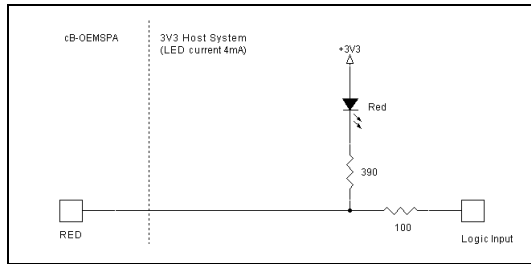


Figure 18: A red LED in a 3.3V host system. The status of the signal can also be used as input to a host controller.

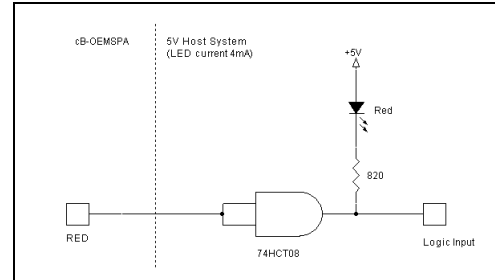


Figure 19: A red LED in a 5V host system. The status of the signal can also be used as input to a host controller.

The RED signal pin is also used to select Logic Level mode (instead of RS232) for connectBlue product with internal RS232 driver e.g. cB-OEMSPA312. The mode functionality is not applicable on cB-0907-01 because there is no internal RS232 driver available. To be compatible with these products check this signal in their Electrical and Mechanical datasheet.

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 9). 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 AT Commands specification for more details). The module will restore all factory settings if both the Switch-1 and Switch-0 signals are low during start up. The input signal must be stable for the first 500ms after startup (after reset/power on reset).

The signal is internally pulled-up ($16k\Omega$) to 3.0V for NOT restoring settings to default.

Note! The internal $16k\Omega$ pull-up is smaller than on previous product generations from connectBlue. This requires a smaller pull-down resistor ($1k\Omega$) for a low state.

If a LED is used and a switch is required to be able to restore the settings, a high impedance 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 20) and a 74HCT08 logic gate in a 5V system (see Figure 21).

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 $16k\Omega$). A design that prevents this can be found in Figure 25.

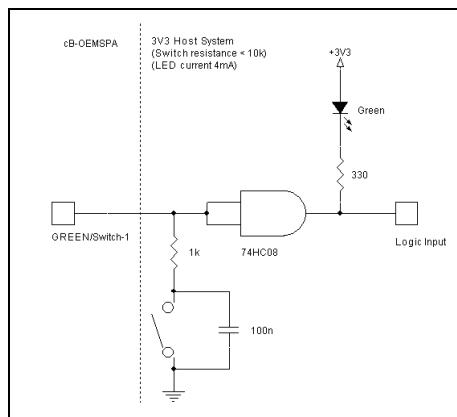


Figure 20: Switch-1 used together with a green LED in a 3.3V host system. The status of the signal can also be used as input to a host controller. Notice the $1k\Omega$ serial resistor.

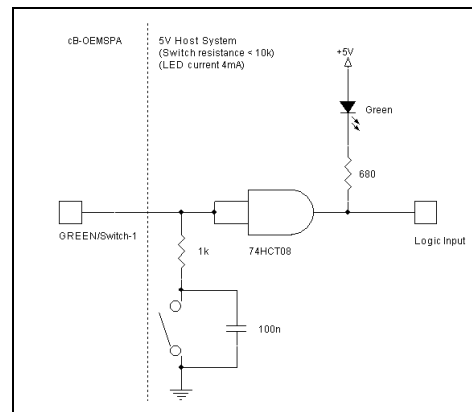


Figure 21: Switch-1 used together with a green LED in a 5V host system. The status of the signal can also be used as input to a host controller. Notice the $1k\Omega$ serial resistor.

The buffer can be removed in a 3.3V system if no restore switch is required (see Figure 22).

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 23).

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

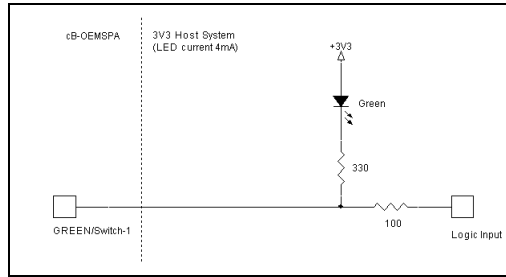


Figure 22: No restore switch used but a green LED in a 3.3V host system. The status of the signal can also be used as input to a host controller.

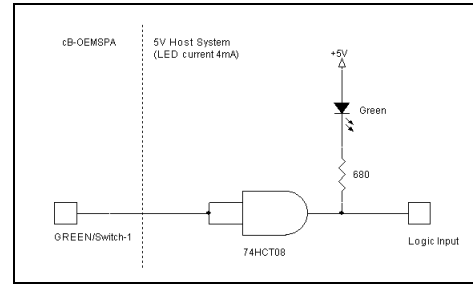


Figure 23: No restore switch used but a green LED in a 5V host system. The status of the signal can also be used as input to a host controller.

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 24).

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 16k Ω). A design that prevents this can be found in Figure 25.

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

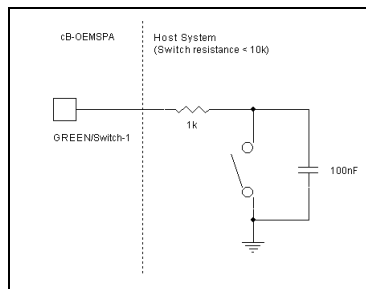


Figure 24: A low resistance restore switch used. Notice the 1k Ω serial resistor.

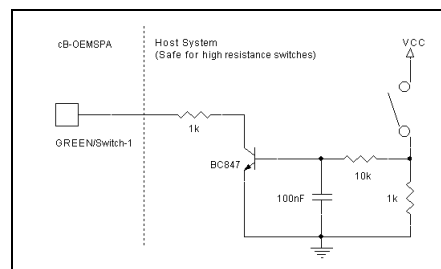


Figure 25: If the resistance in the switch is not guaranteed to be low enough, a safer design can be used. Notice the 1k Ω serial resistor.

A.2.3.4 Switch-0 Signal

Switch-0 is not multiplexed with other functionality and a switch is easily implemented (see Figure 26).

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 16k Ω). A design that prevents this can be found in Figure 27.

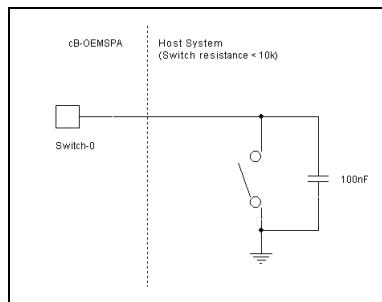


Figure 26: A low resistance function switch used.

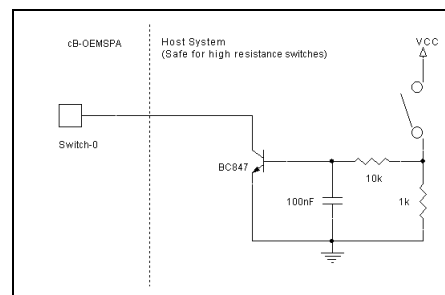


Figure 27: If the resistance in the switch is not guaranteed to be low enough, a safer design can be used.

The maximum input level on Switch-0 is 2.05V (see section 2.3.2), which results in that the Switch-0 signal should not be connected to a host with a driving high state > 1.8V. The solution is to use an open collector design between the host and the OEMSPA (see Figure 28). Notice that the logic input should be active high.

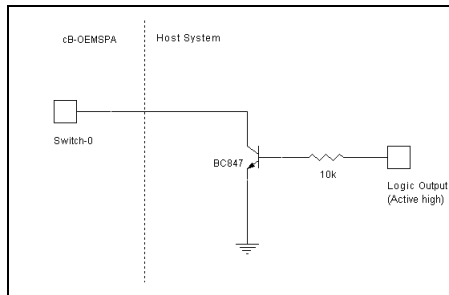


Figure 28: Open collector input to Switch-0. Notice that the logic input is active high.

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

A.2.4 Reset

The RESET pin can be connected to an external reset source, see Figure 29 for a switch example.

If the reset signal is connected to an output signal it must be an open drain collector, see Figure 30. Notice the capacitive load on the RESET pin in section 2.3.

The RESET pin can be left unconnected if not used.

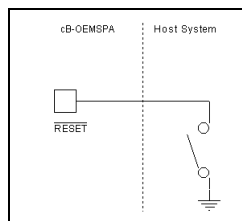


Figure 29: A reset switch.

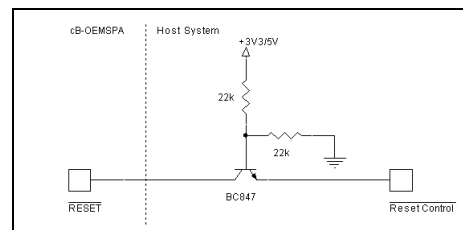


Figure 30: Design of an open collector reset from an active high output.

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.2.2 for information). The design is based on the LM339 Quad OP-amp instead of logic gates.

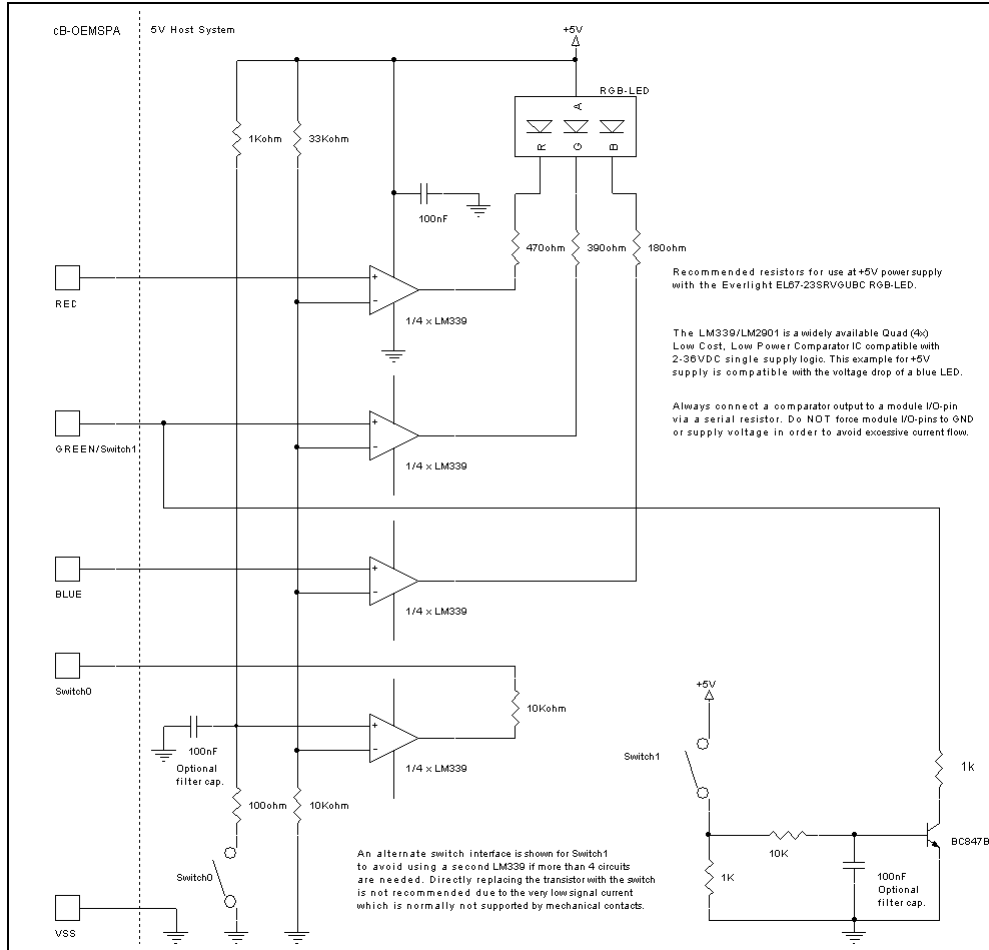


Figure 31: A complete 5V host interface with operational amplifier