# BC3G-US-SMA

## Datasheet


Rev 1.1

10/11/2015

# Table of Contents

# 1. Product revision history

| Revision | Date | Comments |
|---|---|---|
| 0.9 | 2015-08-12 | Preliminary release |
| 1.0 | 2015-09-04 | Initial release |
| 1.1 | 2015-11-10 | Addition of power consumption |

# 2. Product description

The BC3G-US-SMA is the smallest certified and most versatile 2G/3G modem available in the market. Its simple UART serial interface provides access to cellular networks and allows TCP socket opening and Email or SMS sending within few minutes of development.

Based on the Gemalto EHS5-US, this device is compatible with American and Canadian 3G HSPA cellular networks.

# 3. Certification

PTCRB certified
FCC compliant
IC compliant
RoHS compliant

# 4. Features

- Dual-Band UMTS (WCDMA/FDD): 850 and 1900 MHz
- Dual-Band GSM EHS5-US: 850 and 1900 MHz
- HSDPA Cat.8 / HSUPA Cat.6 data rates DL: max. 7.2 Mbps, UL: max. 5.76 Mbps
- EDGE Class 12 data rates DL: max. 237 kbps, UL: max. 237 kbps
- GPRS Class 12 data rates DL: max. 85.6 kbps, UL: max. 85.6 kbps
- High quality voice call support through digital audio interface (I2S)
- SMS
- Email
- Embedded IP stack
- Secure data transmission with HTTPS/SSL
- Internet Services TCP/client, HTTP client
- Integrated FOTA (Firmware update Over The Air)
- Wide input supply voltage (3V to 20V)
- Independent VCC_IO supply for GPIOs and serial interface
- UART serial interface for communication and configuration
- GPIOs
- I2C Master communication Interface
- Micro SIM card
- SMA antenna connector

# 5. Description

The BC3G-US-SMA is a ready to use cellular modem providing flexibility and ease of integration. The following block diagram shows the simplified modem architecture.

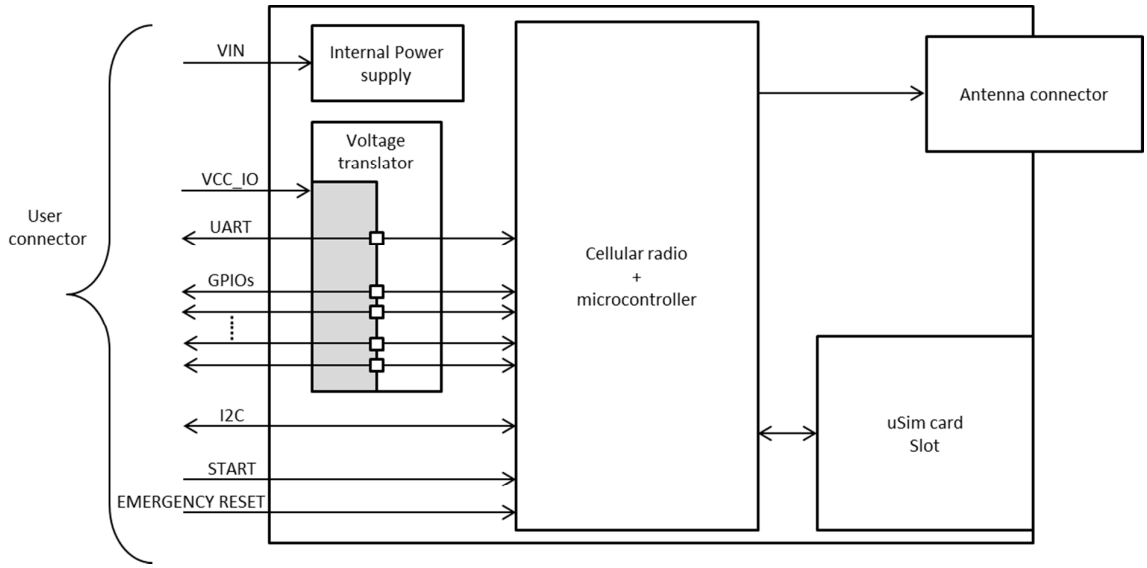



**Figure 1: Block diagram**

## 5.1. VIN

Main power input. The module wide input voltage range (3V to 20V) can accommodate all usual power sources from the single cell Lithium battery to automotive 12V and more. External 100uF decoupling capacitor is required to provide peak current consumption.

## 5.2. VCC_IO

Serial interface (UART) and GPIOs power input. In order to make the module integration as easy as possible, the serial interface and the GPIOs are powered through a VCC_IO supply pin, totally independent from the VIN main supply. VCC_IO support voltage between 1.2V and 3.6V allowing direct connectivity to you processor in any situations.

## 5.3. Serial interface (UART)

Module communication and configuration interface. The communication with the module is done with a simple API through this serial interface. The settings are:

- Baudrate: 115200bps
- Data: 8bits
- Flow control: Hardware
- Stop bit: 1

The Hardware flow control is mandatory. Those pins are powered by the VCC_IO supply which should be adapted to your processor requirements. See document **BC3G-US-SMA_API_2.0** for detailed description of the communication protocol and commands.

### 5.4. GPIOs

The BC3G-US-SMA has 12 general purposes input/output (GPIO) pins that can be configured as input (GPI), output (GPO), and digital audio interface (DAI). Those pins are divided in 4 groups; please refer to section **6.GPIO & Pinmux** for the detailed configuration modes matrix and limitations. Those pins are powered by the VCC_IO supply which should be adapted to your requirements.

### 5.5. I2C

The I2C BUS provided on the module is a dedicated I2C master interface configurable to 100kbps or 400kbps speed. This interface can be used to communicate with additional devices like temperature sensor, accelerometer or GPS. The required pull-up on both I2C_CLK and I2C_DAT signals **are not** provided in the module and shall be installed on your PCB. This provides you the flexibility to use I2C BUS voltage of your choice (from 1.8V to 5.0V) regardless of VCC_IO.

### 5.6. START

This signal is used to start up the module from the Power-off state. A 10ms positive pulse initiates the power-up sequence. This pin is then ignored for the rest of normal operation. The START pin can be directly connected to VCC_IO for an always-on application. There is no hardware STOP pin on the module. The appropriate API command should be sent through the communication & configuration interface to put the module in Power-off mode. The START pin must be in logic low state when sending the Power-off API command otherwise the module will automatically restart. Please refer to section **10.Start-up & Emergency Reset sequencing** for more details.

### 5.7. EMERGENCY RESET

This signal shall only be used in extreme situations if the module is not responding to serial interface (UART) commands. A positive pulse longer than 10ms will reset then restart the module. The module is kept in reset state for as long as the high level is present on this pin. Once the level is back to a logic low level, the module will restart by itself (no need to pulse the START pin). This pin is not a shutdown. Please refer to section **10.Start-up & Emergency Reset sequencing** for more details.

### 5.8. uSIM card slot

The Micro SIM (3FF or Mini UICC) card slot uses a push-push connector style. If the SIM is removed during operation the SIM interface is shut down immediately to prevent destruction of the SIM.

### 5.9. Antenna connector

The external antenna connection is made through a standard and relatively robust SMA connector. The connexion is electrically matched to 50 ohms transmission line.

### 5.10. User connector

The user connections are made through a 50mils header. The module has the male pins; your board should have the female socket. The part number 20021321-00030T4LF from the company FCI is suggested for your design.

# 6. GPIOs & Pinmux

## 6.1. Pin mux

| Pin group | I/O# | Mode | |
|---|---|---|---|
| | | MODE_0 | MODE_1 |
| A | 0 | DAI_TX | |
| | 1 | DAI_TFS | |
| | 2 | DAI_CLK | |
| | 3 | DAI_RX | |
| | 4 | RING# | |
| | 5 | GPI | |
| B | 6 | GPI | GPO |
| | 7 | GPI | GPO |
| C | 8 | READY | GPO |
| | 9 | GPO | GPO |
| D | 10 | GPI | GPO |
| | 11 | GPI | GPO |

**Table 1: Pin mux**

The 12 GPIOs are separated in 4 groups that can be configured individually in one of the available modes. Table 1 shows the selection matrix. Group-A is dedicated to the Digital audio interface. The module boots with all groups in mode_0 to avoid electrical contention on GPIO pins. See section **10.Start-up & Emergency Reset sequencing** for reset state and boot behavior.

## 6.2. GPI

When configured as GPI, the pin is an input for the module and can be read with the API commands.

## 6.3. GPO

When configured as GPO, the pin is an output for the module and can be controlled with the API commands. All GPOs applies a logic low state after boot until you change it through the API commands.

## 6.4. READY

When configured as READY, the pin indicates that the module is ready to accept commands through the serial interface. A logic level high indicates that the module is ready; this pin may be used to drive a LED indicator but care must be taken to not violate the specified maximum current.

## 6.5. DAI (Digital Audio Interface)

Those pins allow the use of an external codec or audio devices capable of pulse code modulation (PCM). The DAI interface supports a 256kHz, long frame synchronization master mode with the following features:

- 16 Bit linear
- 8kHz sample rate
- The most significant bit MSB is transferred first
- 125µs frame duration
- Common frame sync signal for transmit and receive

## 6.6. RING#

The RING# signal indicates an incoming call to your processor. This is an active low signal.

# 7. Pinout

| Group | # | Function | Description | Type |
|---|---|---|---|---|
| Power | 28 | VIN | | PWR |
| | 30 | VIN | | PWR |
| | 11 | GND | | GND |
| | 14 | GND | | GND |
| | 19 | GND | | GND |
| | 25 | GND | | GND |
| | 26 | GND | | GND |
| | 1 | VCC_VIO | | PWR |
| UART | 2 | UART_CTS | Serial interface, UART clear to send signal | I |
| | 3 | UART_RTS | Serial interface, UART request to send | O |
| | 4 | UART_RX | Serial interface, UART receive data | I |
| | 6 | UART_TX | Serial interface, UART transmit data | O |
| Group A | 5 | RING# | Ring indicator, active low:<br>0 = Incoming call<br>1 = No incoming call<br>(Note 1) | O |
| | 7 | DAI_TFS | Frame synchronization signal to external codec: Long frame @ 256kHz (Note 1) | O |
| | 8 | DAI_CLK | Bit clock to external codec: 256kHz (Note 1) | O |
| | 9 | DAI_TX | PCM data to external codec (Note 1) | O |
| | 17 | DAI_RX | PCM data from external codec (Note 1) | I |
| | 20 | GPI5 | General purpose input (Note 1) | I |
| Group B | 15 | GPIO6 | General purpose input or output (Note 1) | I/O |
| | 18 | GPIO7 | General purpose input or output (Note 1) | I/O |
| Group C | 21 | READY | Ready goes HIGH when the module is ready (Note 1) | O |
| | | GPO8 | General purpose output (Note 1) | O |
| | 22 | GPO9 | General purpose output (Note 1) | O |
| Group D | 23 | GPIO10 | General purpose input or output (Note 1) | I/O |
| | 24 | GPIO11 | General purpose input or output (Note 1) | I/O |
| I2C | 13 | I2C_DAT | I2C data signal (Note 2) | I/O |
| | 16 | I2C_CLK | I2C clock signal (Note 2) | O |
| Control | 10 | START | This signal switches the module ON. A rising edge will turn ON the module. (Note 3) | I |
| | 12 | EMERG_RST | The signal must be driven HIGH for at least 10ms to reset the module. (Note 3) | I |
| RFU | 27 | RFU_0 | (Note 4) | |
| | 29 | RFU_1 | (Note 4) | |

**Table 2: Pinout**

| | |
|---|---|
| Note 1 | Refer to pinmux table |
| Note 2 | Require external pull-up resistor |
| Note 3 | Internal 100k pulldown |
| Note 4 | Reserved for future uses |

| | |
|---|---|
| PWR | Power |
| GND | Ground |
| I | Input |
| O | Output |
| I/O | Input or Output |

# 8. Electrical specifications

## 8.1. Absolute maximum voltage ratings

| Pin number | Min | Max |
|---|---|---|
| 28, 30 | 0V | +25V |
| 1-9, 15, 17-18, 20-24 | -0.5V | +4.6V |
| 13, 16 | -0.5V | +5.5V |
| 10, 12 | -12V | +12V |

**Table 3: Absolute maximum working voltage**

## 8.2. Recommended operating conditions

| Parameter | | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Main power | | | | | | |
| VIN | | | 3 | | 20 | V |
| Group: UART, A, B, C & D | | | | | | |
| VCC_IO | | | 1.2 | | 3.6 | V |
| $V_{IH}$ | High level input voltage (Note 5) | VCC_IO: 1.2V to 1.95V | VCC_IO x 0.65 | | | V |
| | | VCC_IO: 1.95V to 2.7V | 1.6 | | | V |
| | | VCC_IO: 2.7V to 3.6V | 2 | | | V |
| $V_{IL}$ | Low level input voltage (Note 5) | VCC_IO: 1.2V to 1.95V | | | VCC_IO x 0.35 | V |
| | | VCC_IO: 1.95V to 2.7V | | | 0.7 | V |
| | | VCC_IO: 2.7V to 3.6V | | | 0.8 | V |
| $I_{OH}$ | High level output current (Note 5) | VCC_IO: 1.2V | | | -3 | mA |
| | | VCC_IO: 1.4V to 1.6V | | | -6 | mA |
| | | VCC_IO: 1.65V to 1.95V | | | -8 | mA |
| | | VCC_IO: 2.3V to 2.7V | | | -9 | mA |
| | | VCC_IO: 3V to 3.6V | | | -12 | mA |
| $I_{OL}$ | Low level output current (Note 5) | VCC_IO: 1.1V to 1.2V | | | 3 | mA |
| | | VCC_IO: 1.4V to 1.6V | | | 6 | mA |
| | | VCC_IO: 1.65V to 1.95V | | | 8 | mA |
| | | VCC_IO: 2.3V to 2.7V | | | 9 | mA |
| | | VCC_IO: 3V to 3.6V | | | 12 | mA |
| | Rise/Fall time (Note 5) | | | | 5 | ns/V |
| $V_{OH}$ | High level output voltage (Note 5) | VCC_IO: 1.2V to 3.6V & $I_{OH}$ = -100uA | VCC_IO - 0.2 | | | V |
| | | VCC_IO: 1.2V & $I_{OH}$ = -3mA | | 0.95 | | V |
| | | VCC_IO: 1.4V & $I_{OH}$ = -6mA | 1.05 | | | V |
| | | VCC_IO: 1.65V & $I_{OH}$ = -8mA | 1.2 | | | V |
| | | VCC_IO: 2.3V & $I_{OH}$ = -9mA | 1.75 | | | V |
| | | VCC_IO: 3V & $I_{OH}$ = -12mA | 2.3 | | | V |
| $V_{OL}$ | Low level output voltage (Note 5) | VCC_IO: 1.2V to 3.6V & $I_{OL}$ = 100uA | | | 0.2 | V |
| | | VCC_IO: 1.2V & $I_{OL}$ = 3mA | | 0.25 | | V |
| | | VCC_IO: 1.4V & $I_{OL}$ = 6mA | | | 0.35 | V |
| | | VCC_IO: 1.65V & $I_{OL}$ = 8mA | | | 0.45 | V |
| | | VCC_IO: 2.3V & $I_{OL}$ = 9mA | | | 0.55 | V |
| | | VCC_IO: 3V & $I_{OL}$ = 12mA | | | 0.7 | V |
| Group: I2C | | | | | | |
| Pull-up resistors value | | | | 2.21 | | kΩ |
| Pull-up voltage range | | Pull-up = 2.21kΩ | 1.75 | | 5.2 | V |
| $V_{IH}$ | High level input voltage | Pull-up = 2.21kΩ | 1.3 | | Pull-up voltage | V |
| $V_{IL}$ | Low level input voltage | Pull-up = 2.21kΩ | 0 | | 0.35 | V |
| $V_{OL}$ | Low level output voltage | Pull-up = 2.21kΩ | | | 0.35 | V |
| Group: Control | | | | | | |
| $V_{IH}$ | High level input voltage | | 0.9 | | 10 | V |
| $V_{IL}$ | Low level input voltage | | 0 | | 0.5 | V |
| Temperature | | | | | | |
| Operating temperature | | | -30 | | 55 | C |

**Table 4: Recommended operating conditions**

# 9. Power consumption

## 9.1. Power-off

| VIN (V) | Average (A) |
|---|---|
| 3.0 | 0.0045 |
| 5.0 | 0.0030 |
| 9.0 | 0.0033 |
| 12.0 | 0.0033 |
| 20.0 | 0.0033 |

## 9.2. Processor ON with radio OFF

| VIN (V) | Average (A) |
|---|---|
| 3.0 | 0.085 |
| 5.0 | 0.051 |
| 9.0 | 0.029 |
| 12.0 | 0.022 |
| 20.0 | 0.013 |

## 9.3. 2G communication

| VIN (V) | Average (A) | Peak (A) |
|---|---|---|
| 3.0 | 0.668 | 2.88 |
| 5.0 | 0.466 | 1.70 |
| 9.0 | 0.661 | 1.43 |
| 12.0 | 0.519 | 1.13 |
| 20.0 | 0.321 | 0.81 |

## 9.4. 3G communication

| VIN (V) | Average (A) | Peak (A) |
|---|---|---|
| 3.0 | 0.310 | 0.490 |
| 5.0 | 0.139 | 0.350 |
| 9.0 | 0.182 | 0.360 |
| 12.0 | 0.216 | 0.470 |
| 20.0 | 0.251 | 0.620 |

# 10. Start-up & Emergency Reset sequencing

## 10.1. Start-up sequencing

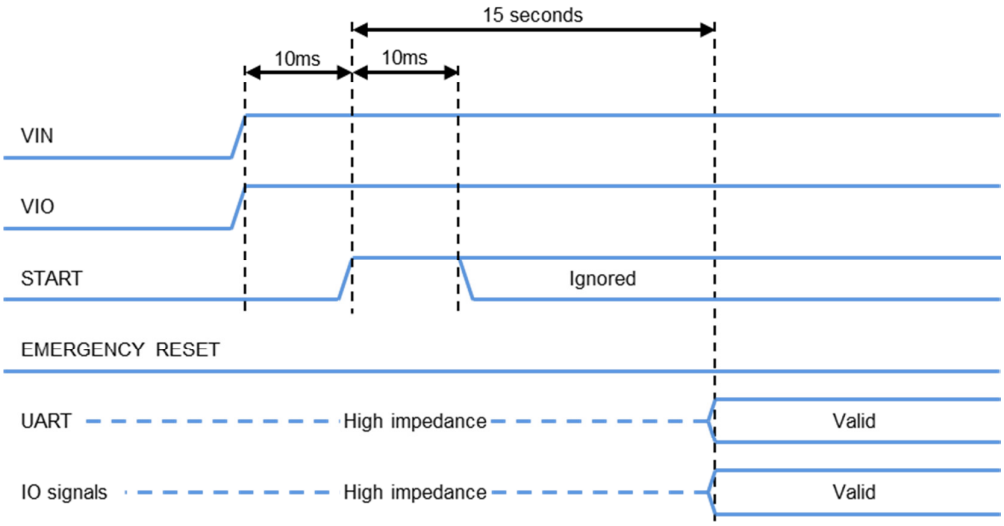



**Figure 2: Start-up sequencing**

There is no particular sequence between VIO and VIN. Both rails should be stable before toggling START signal (here 10ms illustrated).

## 10.2. Emergency Reset sequencing

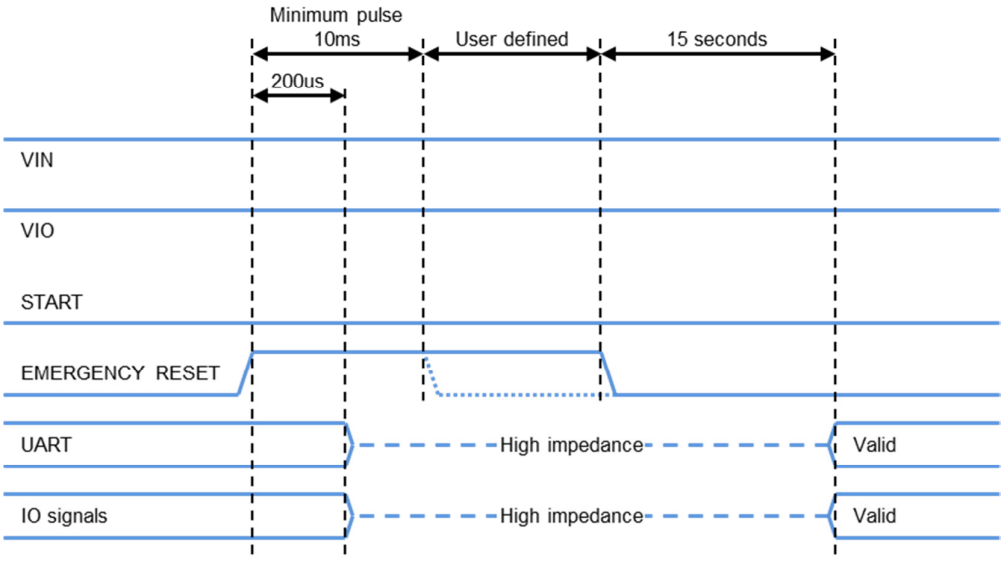
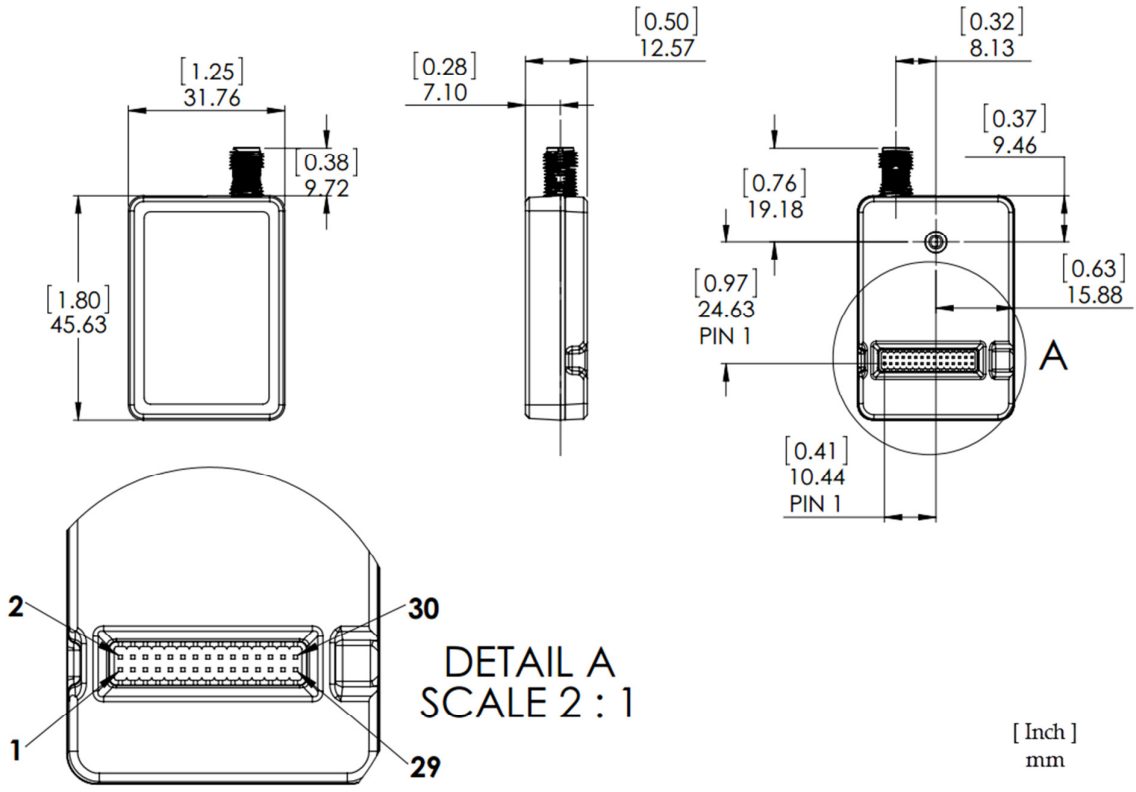



**Figure 3: Emergency Reset sequencing**

# 11. Mechanical

## 11.1. Physical dimensions




## 11.2. Fastening

The BC3G-US-SMA has been designed to be mechanically fixed to the host PCB with a 4-40 screw. The maximum insertion depth in the module is 0.200in (5.1mm). The following screw is suggested for a 63mils (1.6mm) PCB thickness: Keystone Electronics P/N = 9900 (digikey PN = 36-9900-ND).

# 12. API

The complete communication & configuration API description is available online in the document **BC3G-US-SMA_API_2.0.** Please visit the product support Downloads section for the latest version.

http://briowireless.com/product/bc3g-us-sma

# 13. Support

The latest documentation and design files are available online at the following location (under Downloads tab):

http://briowireless.com/product/bc3g-us-sma

You will find the latest version of:

- This Datasheet
- Module Serial Interface Stack Source code
- Module API documentation
- Altium Schematic Symbol
- Altium Layout Footprint
- 3D Step and Solidworks files
- Dev-Kit Userguide
- Dev-Kit PC Software
- Dev-Kit Altium Shematics and Layout files
- Dev-Kit BOM
- Dev-Kit Gerbers files

For more informations, please send your questions at support@briowireless.com