



# WISMO2C2 Product Specification

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Level : 002  
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| 0.2              | 16/06/99      | Connector Modifications  | JMB                |
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| 0.4              | 02/08/99      | SPK load update  | PJS                |
| 0.5              | 12/08/99      | SIM and connector update   | PBE                |
| 0.6              | 15/09/99      | Battery connection example   | JMB                |
|                  |               | Boot resistor modification   |                    |
|                  |               | SIM max current update   |                    |
| 0.7              | 23/09/99      | General Update   | PBE                |
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|                               | Name / Nom            | Function /<br>Fonction       | Date/<br>Date | Signature/<br>Signature |
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## Cautions

Information furnished herein by Wavecom are accurate and reliable. However no responsibility is assumed for its use. Please read carefully the safety precautions for a terminal based on WISMO2C2.

General information about Wavecom and its range of products is available at the following internet address: <http://www.wavecom.com>

## Trademarks

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## 1 Introduction

### 1.1 Scope

This document defines and specifies the WISMO2C2 module, available under 4 hardware versions (antenna pads [WISMO2C2] or RF connector [WISMO2C2-RFC]):

- WISMO2C2-G900/1800 for dual band E-GSM/GPRS cl2 900 / 1800 MHz
- WISMO2C2-G900/1900 for dual band E-GSM/GPRS cl2 900 / 1900 MHz
- WISMO2C2-RFC-G900/1800 for dual band E-GSM/GPRS cl2 900 / 1800 MHz
- WISMO2C2-RFC-G900/1900 for dual band E-GSM/GPRS cl2 900 / 1900 MHz



Figure 1 : WISMO2C2 and WISMO2C2-RFC (bottom view)



Figure 2 : WISMO2C2 with antenna pads (top view)



Figure 3 : WISMO2C2-RFC with RF connector (top view)

## 2 General description

### 2.1 General information

WISMO2C2 is a self-contained E-GSM/GPRS 900 / 1800 (or E-GSM/GPRS 900 / 1900) dual band module including the following features :

- 58.3 x 32.2 x 6.0 mm
- 2 Watts EGSM radio section running under 3,6 Volts
- 1 Watt GSM1800/GSM1900 radio section running under 3,6 Volts
- Digital section under 2.8 Volts
- 3V SIM interface
- Real Time Clock with calendar
- Battery charger
- Echo Cancellation + noise reduction
- Full GSM or GSM/GPRS software stack
- Complete shielding
- Complete interfacing :
  - Power supply
  - Serial link
  - Audio
  - SIM card
  - Keyboard
  - LCD (not available with AT commands)

WISMO2C2 has two external connections :

- RF connection pads (to the antenna) or RF connector with MMS RF connector (RADIAL) [WISMO2C2-RFC]
- General Purpose Connector (GPC) to Digital, Keyboard, Audio and Supply

WISMO2C2 is designed to fit in very small terminals and only some custom functions have to be added to make a complete Dual Band solution:

- Keypad and LCD module
- Earpiece and Microphone
- Base connector
- Battery
- Antenna switch
- SIM connector



## 2.2 RF functionalities

The RF functionalities comply with the Phase II GSM900/GSM1800 or GSM1900 recommendation. The frequencies are :

- Rx (EGSM 900) : 925 to 960 MHz
- Tx (EGSM 900) : 880 to 915 MHz
  
- Rx (GSM 1800) : 1805 to 1880 MHz
- Tx (GSM 1800) : 1710 to 1785 MHz
  
- Rx (GSM 1900) : 1930 to 1990 MHz
- Tx (GSM 1900) : 1850 to 1910 MHz

The RF part is based on a specific dual band chip including :

- ◇ 2 dedicated down-converters.
- ◇ 1 FI demodulator
- ◇ 1 VCO
- ◇ Transmit loop (modulator, down mixer, phase frequency comparator)
- ◇ 2 power amplifiers

## 2.3 Baseband functionalities

The digital part of the WISMO2C2 is composed of a PHILIPS-VLSI chip (ONE C GSM/GPRS Kernel). This chipset is using a 0,25  $\mu$ m mixed technology CMOS, which allows massive integration as well as low current consumption.

## 2.4 Firmware

WISMO2C2 is designed to be integrated into various types of applications such as handsets or vertical applications (telemetry, multimedia, automotive,...).

For handsets, the firmware is customised by Wavecom. For vertical applications, the firmware offers a set of AT commands to control the module. With this standard software, some interfaces of the module are not available since they are dependent on the peripheral devices connected to the module. They are the LCD interface, the SPI bus, the battery charging interface.

### 3 Interfaces

#### 3.1 Functional description

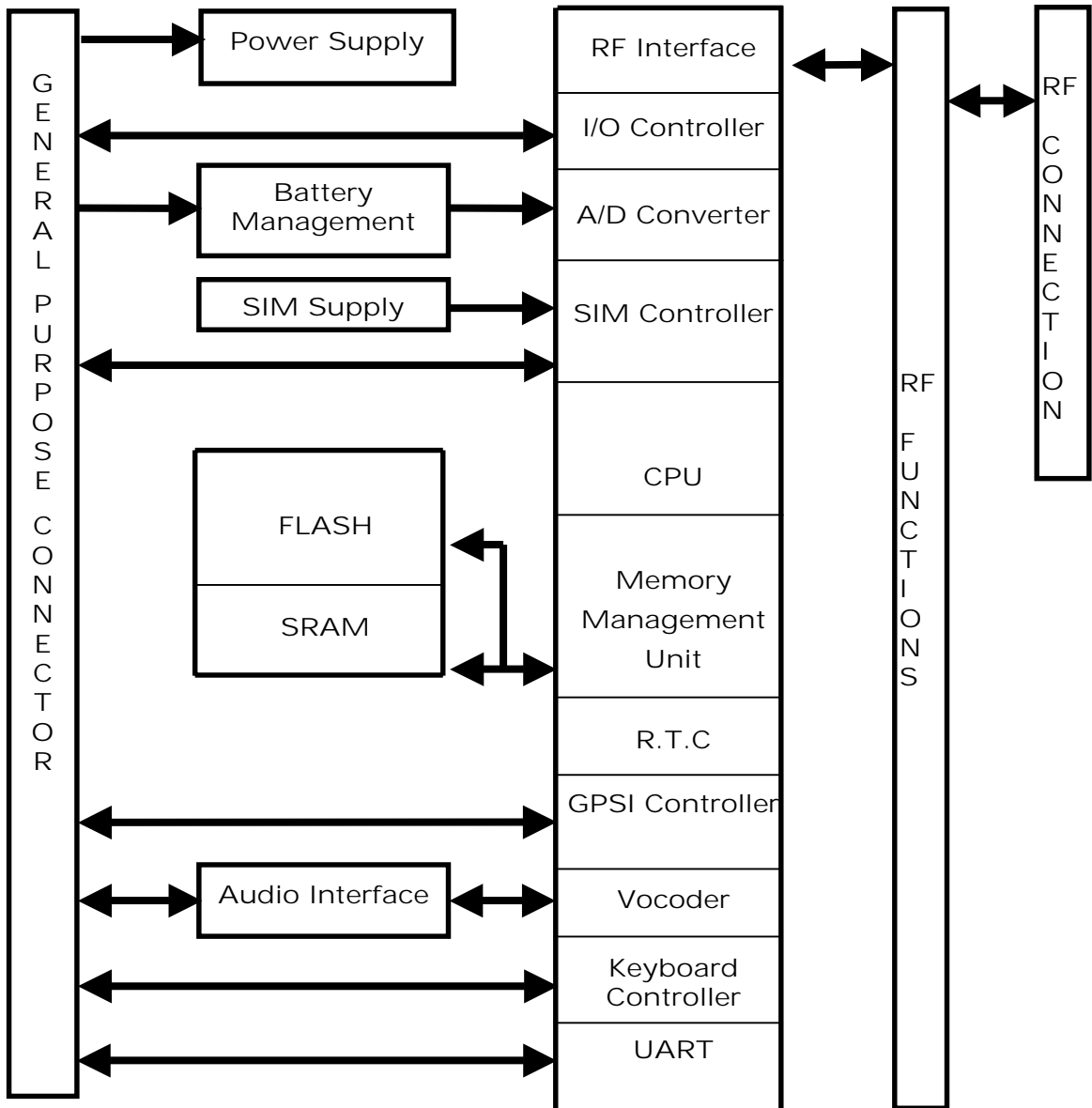



Figure 4 : Functional architecture

### 3.2 General Purpose Connector (GPC)

A 60 pins connector<sup>1</sup> is provided to interface the WISMO2C2 with a board containing either a LCD module, or a keyboard, or a SIM connector, or a battery connection...

The interfaces available on the GPC are described in the next paragraphs.

**Please be aware that some of these interfaces can not be handled when using the WISMO2C2 driven by AT commands : LCD interface, SPI bus.**

The  symbol is used to indicate the interfaces not available with AT commands.

**These functions have then to be managed externally i.e using the main processor of the application.**

#### 3.2.1 Power supply

The power supply is one of the key issue in the design of a GSM terminal. Due to the bursted emission in GSM (or GPRS classe 2), the power supply must be able to deliver high current peaks in a short time. During these peaks the ripple ( $U_{ripp}$ ) and the drop ( $U_{drop}$ ) on the supply voltage must not exceed a certain limit. In communication mode, a GSM terminal emits  $577\mu s$  radio bursts every  $4.615ms$ .

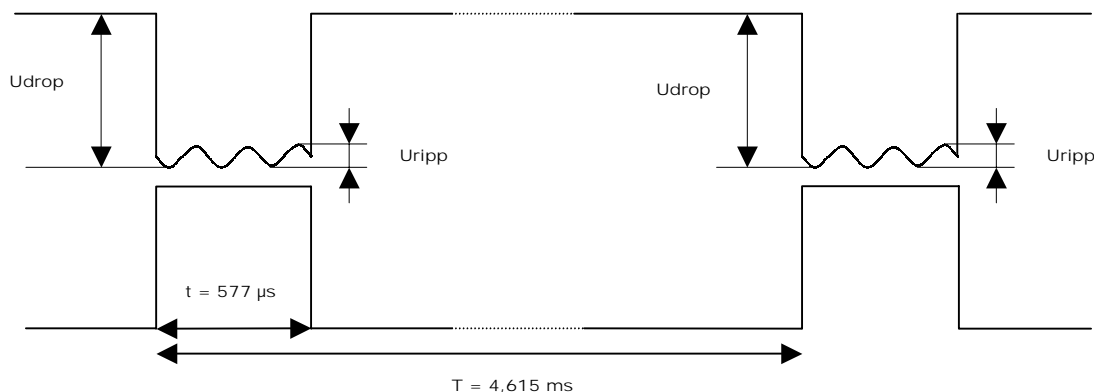


Figure 5 : bursted emission principle

<sup>1</sup> The communication interface connector is a 60 pins connector with 0.5mm pitch from KYOCERA / AVX group with the following reference (see chapter connectors reference for further details):  
**14 5087 060 930 861.**

The matting connector has the following reference :

**24 5087 060 X00 861.**

Two different inputs are provided for the power supply. The first one, VBATT is used to supply the RF part and VDD, the second one is used to supply the baseband part.

Notes :

- It is possible to connect VBATT to VDD.
- In case of separate power supplies, they have to be in the same state i.e both active or inactive at the same time.

VBATT : supplies directly the RF components with 3,6 V. It is essential to minimize the voltage ripple at this connection in order to avoid any phase error. The RF Power Amplifier current (2.0A peak in GSM mode) flows with a ratio of 1/8 of the time (around 577µs every 4.615ms). The rising time is around 10µs.

VDD : supplies the +2.8V ballast regulators of the WISMO2C2. It is essential to keep the voltage over 3.1 volts.

The WISMO2C2 shielding case is the grounding. The ground has to be connected on the mother board through a complete layer on the PCB.

**Power Supply Voltage**

|              | V <sub>MIN</sub> | V <sub>NOM</sub> | V <sub>MAX</sub> | Ripple max  |
|--------------|------------------|------------------|------------------|---|
| <b>VBATT</b> | 3.3 V (*)        | 3.6 V            | 4.5 V (**)       | 50 mVpp for freq<200kHz<br>2 mVpp for freq>200kHz |
| <b>VDD</b>   | 3.1 V            |                  | 4.5 V            | 100 mVpp  |

(\*) : This value has to be guaranteed during the burst (with 2.0A Peak in GSM or GPRS mode)

(\*\*) : max operating Voltage Stationnary Wave Ratio (VSWR) 2:1

When supplying the module with a battery, the characteristics should be :

- Total impedance (battery+protections+PCB)<150 mOhms

**Power consumption in OFF mode  
(module supplied, OFF state, no software running)**

|                     | Conditions | I <sub>NOM</sub> | I <sub>MAX</sub> |
|---------------------|------------|------------------|------------------|
| Overall consumption | Off        | 50 µA            | 100 µA           |

**Power consumption in EGSM/GPRS cl2 mode**

|                     | Conditions  | I <sub>NOM</sub> | I <sub>MAX</sub> |
|---------------------|---|------------------|------------------|
| VBATT               | During TX bursts @ PCL5*  | 1.7 A peak       | 2.0 A peak       |
| VBATT               | During RX bursts  | 75 mA peak       | 80 mA peak       |
| VBATT               | Average<br>1Rx/1Tx@PCL5*  | 270 mA           | 320 mA           |
| VBATT               | Average<br>1Rx/1Tx@PCL8*  | 180 mA           | 200 mA           |
| VBATT               | Average Idle mode   | 100 µA           | 300 µA           |
| VDD                 | Average TCH/FS mode   | 85 mA            | 100 mA           |
| VDD                 | Average Idle mode<br>(module in handset applications)             | 3 mA**           | 6 mA**           |
| VDD                 | Average Idle mode<br>(module driven by AT commands, UART running) | 12 mA            | 16 mA            |
| Overall consumption | Average communication<br>1Rx/1Tx@PCL5*                            | 355 mA           | 420 mA           |
|                     | Average communication<br>GPRS only<br>2Rx/1Tx@PCL5*               | 370 mA<br>[TBD]  | 440 mA<br>[TBD]  |
|                     | Average Idle mode<br>(module in handset applications)             | 3 mA             | 6 mA             |
|                     | Average Idle mode<br>(module driven by AT commands, UART running) | 12 mA            | 16 mA            |

(\*) : PCL : Power Control Level.  
 PCL5 : 2W emission requested (max.power)  
 PCL8 : 0.5W emission requested  
 (\*\*): Informative value

**Power consumption in GSM/GPRS cl2 1800 or 1900 mode**

|                            | Conditions  | I <sub>NOM</sub> | I <sub>MAX</sub> |
|----------------------------|---|------------------|------------------|
| VBATT                      | During TX bursts @ PCL0*  | 1.3 A peak       | 1.7 A peak       |
| VBATT                      | During RX bursts  | 75 mA peak       | 80 mA peak       |
| VBATT                      | Average<br>1Rx/1Tx@PCL0*  | 240 mA           | 270 mA           |
| VBATT                      | Average<br>1Rx/1Tx@PCL3*  | 150 mA           | 180 mA           |
| VBATT                      | Average Idle mode   | 100 µA           | 300 µA           |
| VDD                        | Average TCH/FS mode   | 85 mA            | 100 mA           |
| VDD                        | Average Idle mode<br>(module in handset applications)             | 3 mA**           | 6 mA**           |
| VDD                        | Average Idle mode<br>(module driven by AT commands, UART running) | 12 mA            | 16 mA            |
| VDD                        | Average Idle mode   | 3 mA             | 6 mA             |
| <b>Overall consumption</b> | Average communication<br>1Rx/1Tx@PCL0*                            | 325 mA           | 370 mA           |
|                            | Average communication<br>GPRS only<br>2Rx/1Tx@PCL0*               | 340 mA<br>[TBD]  | 390 mA<br>[TBD]  |
|                            | Average Idle mode<br>(module in handset applications)             | 3 mA             | 6 mA             |
|                            | Average Idle mode<br>(module driven by AT commands, UART running) | 12 mA            | 16 mA            |

(\*) : PCL : Power Control Level.  
 PCL0 : 1W emission requested (max.power)  
 PCL3 : 0.25W emission requested  
 (\*\*): Informative value

**Power Supply Pinout**

| Signal | Pin number        |
|--------|-------------------|
| VBATT  | 55, 57, 58, 59 60 |
| VDD    | 11                |
| GND    | Shielding         |

**The grounding connection is done through the shielding** ⇒ the four legs have to be soldered to the ground plane.

### 3.2.2 Digital I/O

All digital I/O comply with 3Volts CMOS.

#### Operating conditions

| Parameter | I/O type | Min    | Max   | Condition                |
|-----------|----------|--------|-------|--------------------------|
| $V_{IL}$  | CMOS     | -0.5 V | 0.8 V |                          |
| $V_{IH}$  | CMOS     | 2.1 V  | 3.0 V |                          |
| $V_{OL}$  | 1X       |        | 0.2 V | $I_{OL} = -1 \text{ mA}$ |
|           | 2X       |        | 0.2 V | $I_{OL} = -2 \text{ mA}$ |
|           | 3X       |        | 0.2 V | $I_{OL} = -3 \text{ mA}$ |
| $V_{OH}$  | 1X       | 2.6 V  |       | $I_{OH} = 1 \text{ mA}$  |
|           | 2X       | 2.6 V  |       | $I_{OH} = 2 \text{ mA}$  |
|           | 3X       | 2.6 V  |       | $I_{OH} = 3 \text{ mA}$  |

To interface the WISMO2C2 digital signals with other logics :

- 3V logic : some serial resistors (between 2.2K and 4.7Kohms) can be added on the lines
- 3.3V logic : some serial resistors (between 4.7K and 10Kohms) can be added on the lines.
- For higher voltage logics, a resistor bridge or a level shifter IC can be added.



### 3.2.3 LCD interface

The WISMO2C2 can be connected to a LCD module driver through either a SPI bus or a two wires interface.

#### 3.2.3.1 SPI bus

The SPI bus includes a CLK signal, an IO signal and an EN signal complying with SPI bus standard. The maximum speed transfer is 3.25Mb/s.

#### Pin description

| Signal  | Pin number | I/O | I/O type  | Description      |
|---------|------------|-----|-----------|------------------|
| SPI_CLK | 10         | O   | 1X        | SPI Serial Clock |
| SPI_IO  | 8          | I/O | CMOS / 1X | SPI Data         |
| SPI_EN  | 28         | O   | 1X        | SPI Enable       |

### 3.2.3.2 Two wires interface

The two wires interface includes a CLK signal and a DATA signal complying with a standard 96KHz interface. The maximum speed transfer is 400Kb/s.

Pin description

| Signal | Pin number | I/O | I/O type  | Description  |
|--------|------------|-----|-----------|--------------|
| SCL    | 10         | O   | 1X        | Serial Clock |
| SDA    | 8          | I/O | CMOS / 1X | Data         |



### 3.2.4 SPI Auxiliar bus

A second SPI Chip Enable (called SPI\_AUX) has to be used to add a SPI peripheral to the Wismo2C2. The maximum speed transfer is 3.25Mb/s.

Pin description

| Signal  | Pin number | I/O | I/O type  | Description      |
|---------|------------|-----|-----------|------------------|
| SPI_CLK | 10         | O   | 1X        | SPI Serial Clock |
| SPI_IO  | 8          | I/O | CMOS / 1X | SPI Data         |
| SPI_AUX | 26         | O   | 1X        | SPI Aux. Enable  |



### 3.2.5 Keyboard interface

**Warning :**

**This interface is not FULLY available with AT commands :  
An AT command allows to get the input key code (see +CMER command description). This code has then to be processed by the applicatiopn.**

This interface provides 10 connections : 5 rows (R0 to R4) and 5 columns (C0 to C4).

The scanning is a digital one , and the debouncing is done in the WISMO2C2.  
No discrete components like R,C (Resistor, Capacitor) are needed.

**Pin description**

| Signal | Pin number | I/O | I/O type  | Description |
|--------|------------|-----|-----------|-------------|
| ROW0   | 13         | I/O | CMOS / 1X | Row scan    |
| ROW1   | 15         | I/O | CMOS / 1X | Row scan    |
| ROW2   | 17         | I/O | CMOS / 1X | Row scan    |
| ROW3   | 19         | I/O | CMOS / 1X | Row scan    |
| ROW4   | 21         | I/O | CMOS / 1X | Row scan    |
| COL0   | 23         | I/O | CMOS / 1X | Column scan |
| COL1   | 25         | I/O | CMOS / 1X | Column scan |
| COL2   | 27         | I/O | CMOS / 1X | Column scan |
| COL3   | 29         | I/O | CMOS / 1X | Column scan |
| COL4   | 31         | I/O | CMOS / 1X | Column scan |

### 3.2.6 Serial link

A flexible 6 wires serial interface is available complying with V24 protocol signaling but not with V28 (electrical interface) due to a 2.8 Volts interface.

The signals are Tx data (CT103/TX), Rx data (CT104/RX), Request To Send (CT105/RTS), Clear To Send (CT106/CTS), Data Terminal Ready (CT108-2/DTR) and Data Set Ready (CT107/DSR).

The set of RS232 signals can be required for GSM DATA services application and is generated by the general purpose I/O provided by the WISMO2C2. The 2 additional signals are Data Carrier Detect (CT109/DCD) and Ring Indicator (CT125/RI).

**Pin description**

| Signal        | Pin number     | I/O | I/O type  | Description          |
|---------------|----------------|-----|-----------|----------------------|
| CT103 / TX    | 39             | I   | CMOS      | Transmit serial data |
| CT104 / RX    | 32             | O   | 1X        | Receive serial data  |
| CT105 / RTS   | 30             | I   | CMOS      | Ready To Send        |
| CT106 / CTS   | 37             | O   | 1X        | Clear To Send        |
| CT107 / DSR   | 36             | O   | 1X        | Data Set Ready       |
| CT108-2 / DTR | 34             | I   | CMOS      | Data Terminal Ready  |
| CT109 / DCD   | 51             | O   | CMOS / 2X | Data Carrier Detect  |
| CT125 / RI    | 54             | O   | CMOS / 2X | Ring Indicator       |
| CT102/GND     | Shielding legs |     |           | Ground               |

The rising time and the falling times of the serial signals in reception (in particular CT103) have to be less than 200ns.

The minimum width of the reception signals (mainly CT03) have to be more than 2ms

Note :

The WISMO2C2 has been designed to be operated using all the serial signals. In particular, it is necessary to use the RTS/CTS hardware flow control signals in order not to lose data.

### 3.2.7 SIM interface

#### 3.2.7.1 General Description

5 signals exist :

- SIMVCC : SIM power supply.
- SIMRST : reset.
- SIMCLK : clock.
- SIMDATA : I/O port.
- SIMPRES : SIM card detect.

The SIM interface controls a 3V SIMs (and a 5V SIMs through an external SIM driver). This interface is fully compliant with GSM 11.11 recommendations concerning SIM functions.

It is recommended to add Transient Voltage Suppressor diodes on the signal connected to the SIM socket in order to prevent any ElectroStatic Discharge. TVS diodes with low capacitance (less than 10pF) have to be connected on SIMCLK and SIMDATA to avoid any disturbance of the rising and falling edge. These types of diodes are mandatory for the Full Type Approval. They shall be placed as close as possible to the SIM socket.

The following references can be used : DALC208SC6 from ST Microelectronics.

**Pin description**

| Signal  | Pin number | I/O | I/O type  | Description      |
|---------|------------|-----|-----------|------------------|
| SIMCLK  | 3          | O   | 2X        | SIM Clock        |
| SIMRST  | 5          | O   | 2X        | SIM Reset        |
| SIMDATA | 7          | I/O | CMOS / 3X | SIM Data         |
| SIMVCC  | 9          | O   |           | SIM Power Supply |
| SIMPRES | 50         | I   | CMOS      | SIM Card Detect  |

**Electrical Characteristics**

| Parameter                             | Conditions                     | Min                 | Typ  | Max                 | Unit    |
|---------------------------------------|--------------------------------|---------------------|------|---------------------|---------|
| SIMDATA $V_{IH}$                      | $I_{IH} = \pm 20\mu A$         | $0.7 \times SIMVCC$ |      |                     | V       |
| SIMDATA $V_{IL}$                      | $I_{IL} = 1mA$                 |                     |      | $0.3 \times SIMVCC$ | V       |
| SIMRST,<br>SIMDATA<br>SIMCLK $V_{OH}$ | Source current =<br>$20\mu A$  | $SIMVCC - 0.1V$     |      |                     | V       |
| SIMRST,<br>SIMDATA<br>SIMCLK $V_{OL}$ | Sink current = -<br>$200\mu A$ |                     |      | 0.1                 | V       |
| SIMVCC*<br>Output<br>Voltage          | $I_{SIMVCC} \leq 6mA$          | 2.70                | 2.80 | 2.85                | V       |
| SIMCLK<br>Rise/Fall Time              | Loaded with 30pF               |                     |      | 50                  | ns      |
| SIMRST,<br>SIMDATA<br>Rise/Fall Time  | Loaded with 30pF               |                     |      | 1                   | $\mu s$ |
| SIMCLK<br>Frequency                   | Loaded with 30pF               |                     |      | 3.25                | MHz     |

(\*) : given for the 3V interface. An external SIM driver is needed to handle 5V SIMs.

**Note :**

When not used **SIMPRES** has to be tied to VCC.

When used, a low to high transition means that the SIM card is inserted and a high to low transition means that the SIM card is removed.

### SIM socket pin description

| Signal | Pin number | Description                           |
|--------|------------|---------------------------------------|
| VCC    | 1          | SIMVCC                                |
| RST    | 2          | SIMRST                                |
| CLK    | 3          | SIMCLK                                |
| CC4    | 4          | VCC module                            |
| GND    | 5          | GROUND                                |
| VPP    | 6          | Not connected                         |
| I/O    | 7          | SIMDATA                               |
| CC8    | 8          | SIMPRES with 100kΩ pull down resistor |

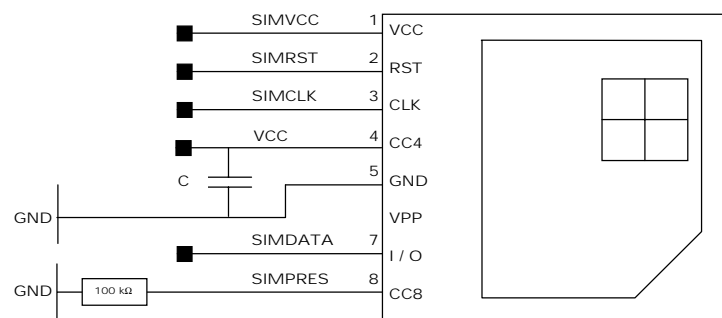


Figure 6 : SIM socket

The capacitor placed on the Sim Vcc must not exceed 470nF.

#### 3.2.7.2 SIM 3/5V management

The WISMO2C2 module is designed to interface with 3V SIMs only<sup>2</sup>. Nevertheless, it is possible to manage 3V and 5V SIMs using an external level shifter (see application notes in appendix). In this case, depending on the type of SIM detected, the module firmware triggers the GPO0 output signal (pin #26) in order to properly set the external SIM driver level (3V or 5V).

<sup>2</sup> Most of the GSM operators have been providing 3V SIMs since 1998.

### 3.2.8 General Purpose Input/Output

The WISMO2C2 provides 6 General Purpose I/O, 3 General Purpose Outputs and 1 General Purpose Input. They are used to control any external device such as a LCD or a Keyboard backlight.

**Pin description**

| Signal | Pin number | I/O | I/O type  | Description         |
|--------|------------|-----|-----------|---------------------|
| GPIO0  | 24         | I/O | CMOS / 2X | General Purpose I/O |
| GPIO4  | 53         | I/O | CMOS / 2X | General Purpose I/O |
| GPIO5  | 35         | I/O | CMOS / 2X | General Purpose I/O |
| GPO1   | 22         | O   | 3X        | General Purpose O   |
| GPO2   | 20         | O   | 1X        | General Purpose O   |
| GPI    | 18         | I   | CMOS      | General Purpose I   |

The following GPIOs are not available (reserved) in case of module running with the AT commands firmware :

| Signal | Pin number | I/O | I/O type  | Description         | Comments     |
|--------|------------|-----|-----------|---------------------|--------------|
| GPIO1  | 52         | I/O | CMOS / 2X | General Purpose I/O | FLASH LED(*) |
| GPIO2  | 54         | I/O | CMOS / 2X | General Purpose I/O | RI           |
| GPIO3  | 51         | I/O | CMOS / 2X | General Purpose I/O | DCD          |
| GPO0   | 26         | O   | 3X        | General Purpose O   | SIM 3V/5V    |

(\*) The FLASH LED signal can be used to drive an LED according to the module activity status.

| LED status | WISMO2C2 status                                   |  |
|------------|---|--|
| OFF        | Module in download mode or module OFF             |  |
| ON         | Permanent   | Module switched ON, not registered on the network                        |
|            | Slow flash<br>LED ON for 200ms,<br>OFF for 2s     | Module switched ON, registered on the network                            |
|            | Quick flash<br>LED ON for 200ms,<br>OFF for 600ms | Module switched ON, registered on the network, communication in progress |

### 3.2.9 Analog to Digital Converter

Analog to Digital converter input is provided by the WISMO2C2. This converter is a 10 bits one, ranging from 0 to 2.8V .

Pin description

| Signal | Pin number | I/O | I/O type | Description   |
|--------|------------|-----|----------|---------------|
| AUXV0  | 33         | I   | Analog   | A/D converter |

Electrical Characteristics

| Parameter              | Min   | Max  | Unit |
|------------------------|-------|------|------|
| Resolution             | 10    |      | bits |
| Sampling rate          | 90.3  |      | Ksps |
| Input signal range     | 0     | 2.8V | V    |
| ADC Reference Accuracy | 0.75  | 2    | %    |
| Integral Accuracy      | +/- 1 |      | LSB  |
| Differential Accuracy  | +/- 1 |      | LSB  |
| Input Impedance ( R )  | 10    |      | MΩ   |
| Input Impedance ( C )  |       | 50   | pF   |

### 3.2.10 Audio

Two different microphone inputs and two different speaker outputs are supported.

The WISMO2C2 also includes an echo cancellation feature which allows handsfree function.

The MIC2 inputs already include the biasing for an electret microphone allowing an easy connection to a handset.

The MIC1 inputs does not include an internal bias. MIC1/SPK1 is then appropriate for a handsfree system or a handset with biasing external to the module.

#### 3.2.10.1 Common microphone inputs characteristics

The connection can be either differential or single-ended but using a differential connection in order to reject common mode noise and TDMA noise is strongly recommended. When using a single-ended connection, be sure to have a very good ground plane, a very good filtering as well as shielding in order to avoid any disturbance on the audio path.

**Internal audio filter characteristics :**

| Frequency   | Gain    |
|-------------|---------|
| 0-150 Hz    | < -22dB |
| 150-180 Hz  | < -11dB |
| 180-200 Hz  | < -3dB  |
| 200-3700 Hz | 0dB     |
| >4000 Hz    | < -60dB |

The gain of MIC inputs is internally adjusted. The gain can be tuned from 30dB to 51dB using an AT command.

**Microphone gain vs Max input voltage**

| Transmit Gain (dB) | Max Vin (mVrms) | AT+VGT(*)  |
|--------------------|-----------------|------------|
| 30                 | 43.80           | 0 to 31    |
| 33                 | 31.01           | 32 to 63   |
| 36                 | 21.95           | 64 to 95   |
| 39                 | 15.54           | 96 to 127  |
| 42                 | 11              | 128 to 159 |
| 45                 | 7.79            | 160 to 191 |
| 48                 | 5.51            | 192 to 223 |
| 51                 | 3.9             | 224 to 255 |

(\*) control of the transmit gain by AT commands (for WISMO2C2 driven by AT commands)



Recommended characteristics for the microphone:

- 2V – 0.5mA
- 2 KOhms
- Sensitivity -40 to -50dB
- SNR > 50dB
- Frequency response compatible with the GSM specifications

For possible references, see chapter *connectors and peripheral devices references*.

### 3.2.10.2 Common speaker outputs characteristics

The connection can be differential or single-ended but using a differential connection to reject common mode noise and TDMA noise is strongly recommended. Moreover in single-ended mode, ½ of the power is lost. When using a single-ended connection, be sure to have a very good ground plane, a very good filtering as well as shielding in order to avoid any disturbance on the audio path.

Speaker outputs SPK2 are push-pull amplifiers and can be loaded down to 150 Ohms and up to 1nF (see details in table *Speaker gain vs Max output voltage*). These outputs are differential and the output power can be adjusted by step of 2dB. The output can be directly connected to a speaker.

#### 3.2.10.2.1 Differential Connection

Impedance of the speaker amplifier output in differential mode :

- $R \leq 1\Omega \pm 10\%$

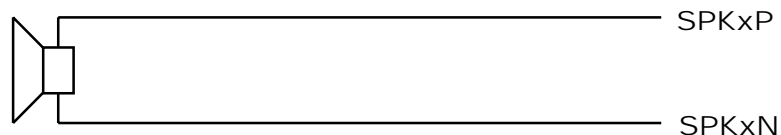
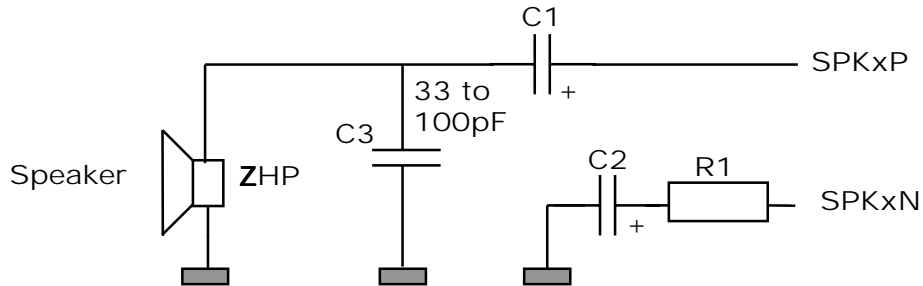


Figure 7 : SPK outputs (differential connection)

3.2.10.2.2 Single-ended Connection

Typical implementation:



**Figure 8 : SPK outputs (single-ended connection)**

C1 = from 4.7 $\mu$ F to 47 $\mu$ F as per the speaker characteristics and the output power.

C1=C2

R1= Speaker Impedance

Using a single-ended connection also includes losing half of the output power compared to a differential connection.

Nevertheless in a 32 Ohms speaker case, you should use a cheaper and smaller solution : R1 = 82 Ohm et C2 = 4.7 $\mu$ F (ceramic)

The gain of SPK outputs is internally adjusted. The gain can be tuned using an AT command.

**Speaker gain vs Max output voltage**

| Receive Gain (dB) (*) | Max output level (Vrms) | AT+VGR (**) | Max.speaker load ( $\Omega$ ) |
|-----------------------|-------------------------|-------------|-------------------------------|
| +2                    | 1.74                    | 0 to 15     | 150                           |
| 0                     | 1.38                    | 16 to 31    | 50                            |
| -2                    | 1.099                   | 32 to 47    | 32                            |
| -4                    | 0.873                   | 48 to 63    | 32                            |
| -6                    | 0.693                   | 64 to 79    | 32                            |
| -8                    | 0.551                   | 80 to 95    | 32                            |
| -10                   | 0.437                   | 96 to 111   | 32                            |
| -12                   | 0.347                   | 112 to 127  | 32                            |
| -14                   | 0.276                   | 128 to 143  | 32                            |
| -16                   | 0.219                   | 144 to 159  | 32                            |
| -18                   | 0.174                   | 160 to 175  | 32                            |
| -20                   | 0.138                   | 176 to 191  | 32                            |
| -22                   | 0.110                   | 192 to 207  | 32                            |
| -24                   | 0.087                   | 208 to 223  | 32                            |
| -26                   | 0.069                   | 224 to 239  | 32                            |
| -26                   | 0.069                   | 240 to 255  | 32                            |

(\*) analog gain : might not be significant

(\*\*) control of the receive gain by AT commands (for WISMO2C2 driven by AT commands)

Recommended characteristics for the speaker:

- 150 Ohms<sup>3</sup>
- 10mW
- 110dB
- Frequency response compatible with the GSM specifications

For possible references, see chapter *connectors and perpiheral devices references*.

<sup>3</sup> 32 Ohms for handsets

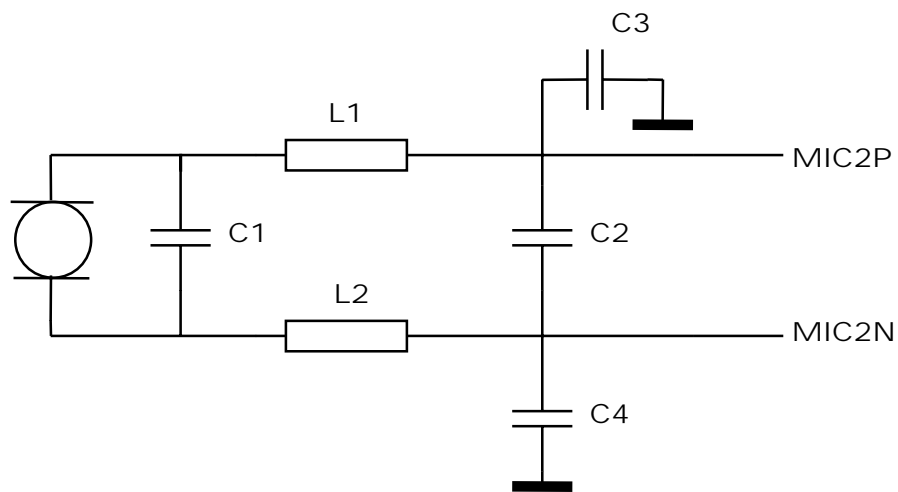
3.2.10.3 Microphone inputs

3.2.10.3.1 Microphone 2 Inputs

The MIC2 inputs are differential ones. They already include the convenient biasing for an electret microphone (0,5 mA and 2 Volts). This electret microphone can be directly connected on these inputs. The impedance of the microphone 2 has to be around 2kΩ. These inputs are the standard ones for an handset design while MIC1 inputs can be connected to an external headset or a handsfree kit.

AC coupling is already embedded in the module.

Typical implementation:



**Figure 9 : MIC2 inputs (differential connection)**

C1 = 10pF to 33pF

C2 = C3 = C4 = 47pF to 100pF

L1 = L2 = 100nH

C1 has to be the nearest possible to the microphone. Microphone manufacturers provide this capacitor directly soldered on the microphone.

C2 has to be very close to the WISMO2C2 connector.

L1, L2, C3 and C4 has to be put near the WISMO2C2 connector and can be removed according to their environment (ground plane, shielding, etc...). The best way is to plan all the components and to remove those which are not necessary to filter out the TDMA noise on the audio path.

**Pin description**

| Signal | Pin # | I/O | I/O type | Description                 |
|--------|-------|-----|----------|-----------------------------|
| MIC2P  | 46    | I   | Analog   | Microphone 2 positive input |
| MIC2N  | 48    | I   | Analog   | Microphone 2 negative input |

3.2.10.3.2 Microphone 1 Inputs

The MIC1 inputs are differential and do not include internal bias. To use these inputs with an electret microphone, bias has to be generated outside the WISMO2C2 module according to the characteristic of this electret microphone. These inputs are the standard ones used for an external headset or a handsfree kit.

AC coupling is already embedded in the module.

3.2.10.3.2.1 Differential connection

Impedance of the microphone input in differential mode :

- Module ON :  $R_{in} = 10K\Omega \pm 10\%$
- Module OFF :  $R_{in} > 1M\Omega \pm 10\%$

Typical implementation:

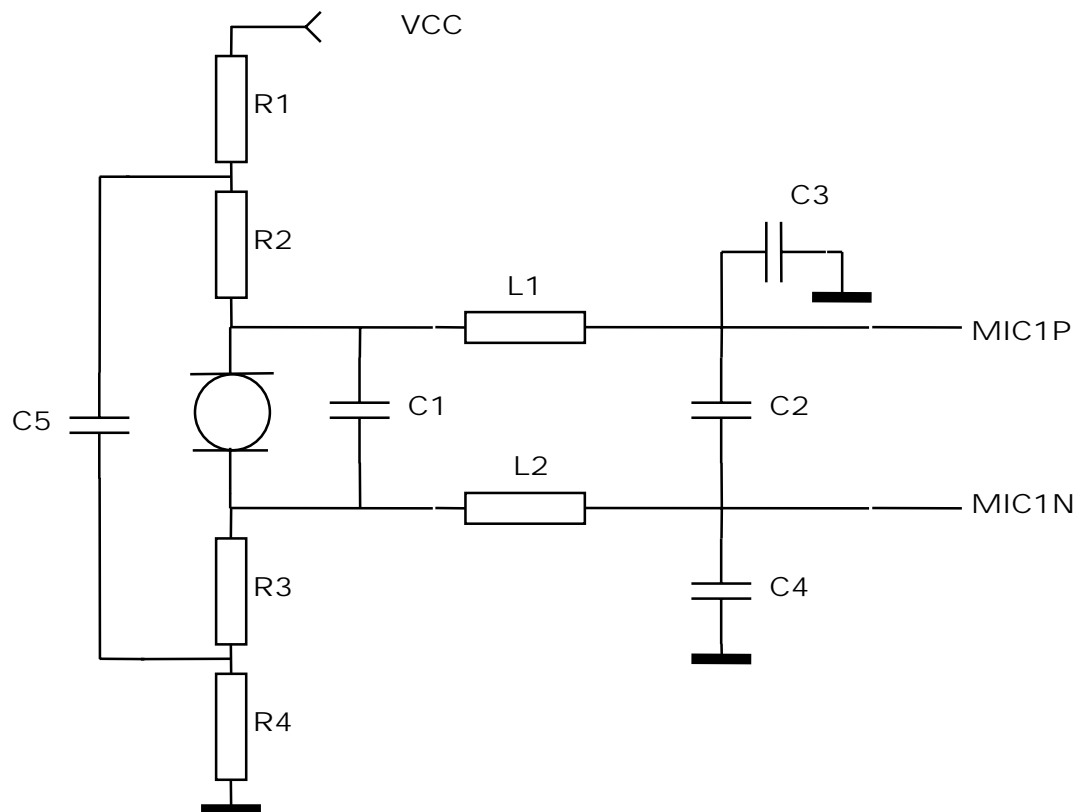


Figure 10 : MIC1 inputs (differential connection)

R1 = R4 = from 100 to 330 $\Omega$

R2 = R3 = usually between 1K $\Omega$  and 3.3K $\Omega$  as per the microphone characteristics

C1 = 10pF to 33pF

C2 = C3 = C4 = 47pF to 100pF

C5 = 47 $\mu$ F

$L1 = L2 = 100\text{nH}$

R1 and R4 are used as a voltage supply filter with C5.

C1 has to be the nearest possible to the microphone. Microphone manufacturers provide this capacitor directly soldered on the microphone.

C2 has to be very close to the WISMO2C2 connector.

L1, L2, C3 and C4 has to be put near the WISMO2C2 connector and can be removed according to their environment (ground plane, shielding ...etc). The best way is to plan all the components and to remove those which are not necessary to filter out the TDMA noise on the audio path.

### 3.2.10.3.2.2 Single-ended connection

Typical implementation:

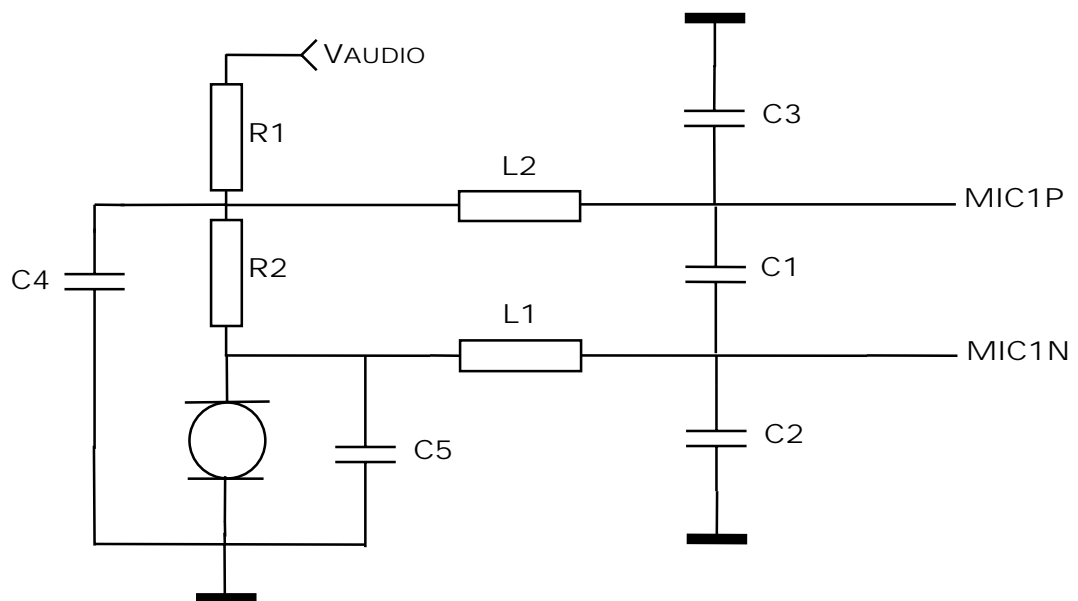


Figure 11 : MIC1 inputs (single-ended connection)

Note : VAUDIO must be very "clean" in single-ended connection (for example, VCC plus filter cell like RC or LC).

R1 = from 100 to 330 $\Omega$

R2 = usually between 1K $\Omega$  and 3.3K $\Omega$  as per the VAUDIO voltage level and the microphone characteristics

C1 = 10pF to 33pF

C2 = C3 = C5 = 47pF to 100pF

C4 = 47 $\mu$ F

L1 = L2 = 100nH

R1 is used as a voltage supply filter with C4.

C5 has to be the nearest possible to the microphone. Microphone manufacturers provide this capacitor directly soldered on the microphone.

C1, C2, C3 have to be very close to the WISMO2C2 connector.

L1, and L2 has to be put near the WISMO2C2 connector and can be removed according to their environment (ground plane, shielding ...etc). The best way is to plan all the components and to remove those which are not necessary to filter out the TDMA noise on the audio path.

**Pin description**

| Signal | Pin # | I/O | I/O type | Description                 |
|--------|-------|-----|----------|-----------------------------|
| MIC1P  | 42    | I   | Analog   | Microphone 1 positive input |
| MIC1N  | 44    | I   | Analog   | Microphone 1 negative input |

**3.2.10.4 Speaker outputs**

## 3.2.10.4.1 Speaker 2 Outputs

**Pin description**

| Signal | Pin # | I/O | I/O type | Description               |
|--------|-------|-----|----------|---------------------------|
| SPK2P  | 45    | O   | Analog   | Speaker 2 positive output |
| SPK2N  | 47    | O   | Analog   | Speaker 2 negative output |

## 3.2.10.4.2 Speaker 1 Outputs

**Pin description**

| Signal | Pin # | I/O | I/O type | Description               |
|--------|-------|-----|----------|---------------------------|
| SPK1P  | 41    | O   | Analog   | Speaker 1 positive output |
| SPK1N  | 43    | O   | Analog   | Speaker 1 negative output |

3.2.10.5 Buzzer Output

The buzzer output is a digital one. A buzzer can be directly connected between this output and VBATT. The maximum current is 80 mA (PEAK). A diode against transient peak voltage must be connected as described below.

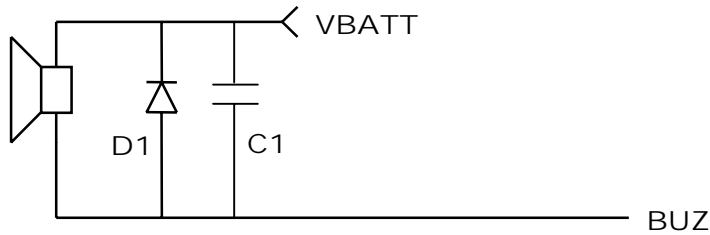


Figure 12 : Buzzer connection

C1 : depends on the buzzer type.

Pin description

| Signal | Pin # | I/O | I/O type | Description   |
|--------|-------|-----|----------|---------------|
| BUZ    | 49    | O   | Analog   | Buzzer output |

Operating conditions

| Parameter     | Condition          | Min | Max | Unit |
|---------------|--------------------|-----|-----|------|
| $V_{OL}$      | $I_{moy} = 40mA$   |     | 0.6 | v    |
| $I_{PEAK}$    | $VBATT = VBATTmax$ |     | 80  | mA   |
| $I_{AVERAGE}$ | $VBATT = VBATTmax$ |     | 40  | mA   |



### 3.2.11 Battery charging interface

The WISMO2C2 module supports one battery charging circuit for Li-Ion batteries. This circuit uses an interface which consists of a current source inputs (CHG\_IN) where the constant current has to flow in order to charge the battery. This current value depends on the battery capacity. It is recommended to provide a current equal to the value of the capacity plus 50mA. For a 550mA battery the current will be 600mA. The maximum current is 800mA.

A specific AT command (WCBM), available from 4.3 level, allows to manage the charge battery (start and stop the charge, enable or disable unsolicited Battery Charge Indications and set the battery charge parameters).

The WISMO2C2 module monitors the battery voltage to detect the end of the charge. WISMO2C2 also monitors the temperature of the battery through the BAT\_TEMP pin which has to be connected to a temperature sensor inside the battery (a NTC resistor for instance).

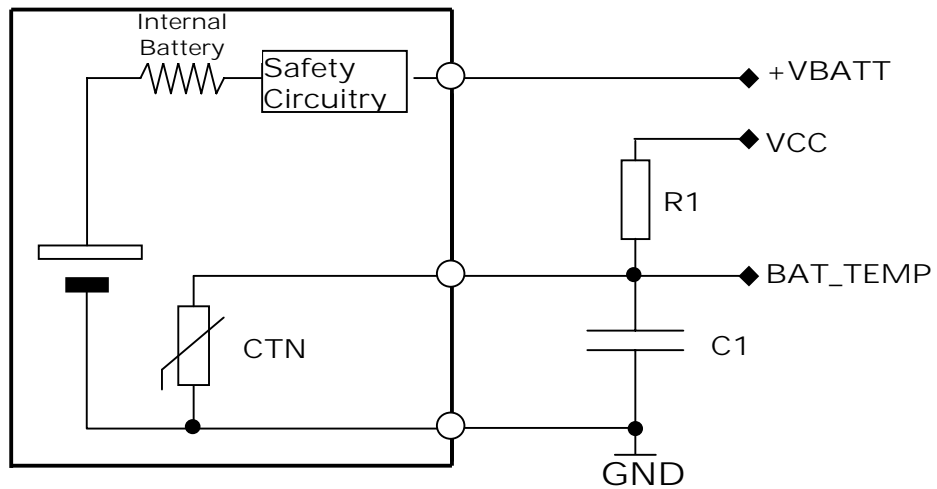
**Pin description**

| Signal   | Pin number | I/O | I/O type | Description          |
|----------|------------|-----|----------|----------------------|
| CHG_IN   | 1, 2, 4    | I   | Analog   | Current source input |
| BAT_TEMP | 38         | I   | Analog   | A/D converter        |

**Electrical Characteristics**

| Parameter                      | Min               | Max  | Typ | Unit   |
|--------------------------------|-------------------|------|-----|--------|
| BAT_TEMP resolution            | 10                |      |     | bits   |
| BAT_TEMP sampling rate         | 90.3              |      |     | Ksps/s |
| BAT_TEMP Input Impedance ( R ) | 4.7               |      |     | kΩ     |
| BAT_TEMP Input Impedance ( C ) |                   | 100  |     | nF     |
| CHG_IN Voltage (for I=Imax)    | +VBATT max + 0.7V | TBD* |     | V      |
| CHG_IN Current                 |                   | 800  |     | mA     |
| BAT_TEMP Input signal range    |                   |      | 2.8 | V      |

\* To be parametrized as per battery manufacturer



**Figure 13 : Connection examples**

### 3.2.11.1 Li-ion charging procedure

A constant current source has to be provided through **CHG\_IN** input in order to charge the Li-ion battery, and **BAT\_TEMP** input has to be connected to a battery temperature sensor. During this procedure the voltage of the battery is accurately monitored.

The Li-ion charging involves two phases. During the first phase, the battery is charged with a constant current until its voltage reaches 4.1V\*. During the second phase the constant current is pulsed by the module. The width and the frequency of the pulse change during this phase in order to ensure a safety charge. The battery is considered as fully charged when, after a pulse, the voltage remains at a 4.1V\* during more than 10s.

The Li-ion battery must have an included safety circuit to avoid any discharge or overcharge. This circuit is delivered by the manufacturer inside the battery pack. The impedance of this safety circuit has to be the lowest possible in order to reduce the drop-out of the voltage. This drop-out is due to the RF Power Amplifier current (up to 2.0A). A maximum of 150mΩ is required.

(\*) : To be parametrized as per battery manufacturer

### 3.2.11.2 How to define R1 and C1

#### How to choose R1:

R1 has to be chosen to have a full range of BAT-TEMP (from 0V to 2.8V) when the CTN value changes from the minimum to the maximum temperature

#### How to choose C1:

C1 has to be chosen to have a RC filter with a time constant lower than 2ms.

#### Calculation examples :

$$CTN(25^{\circ}C) = 47K$$

$$CTN(55^{\circ}C) = 10K$$

$$CTN(-10^{\circ}C) = 300K$$

$$CTN(-10^{\circ}C) \times VCC = ( CTN(-10^{\circ}C) + R1 ) \times BAT-TEMP \text{ (full range)}$$

$$R1 = 47K \Rightarrow BAT-TEMP(-20^{\circ}C) = 2.42V$$

$$BAT-TEMP(55^{\circ}C) = 0.49V$$

$$R(-20^{\circ}C) = R1 // CTN(-10^{\circ}C) = 40K$$

$$R(+55^{\circ}C) = 8K$$

With C = 10nF ::

$$RC(-20^{\circ}C) = 400\mu s$$

$$RC(+55^{\circ}C) = 80\mu s$$

### 3.2.12 ON / ~OFF

This input is used to switch ON or OFF the WISMO2C2 module. A high level signal has to be provided on the pin ON/~OFF to switch ON the module. The level of the voltage of this signal has to be maintained between 2.4V and VDD during a minimum of 500ms. This signal can be left at high level until switch off.

To be able to switch OFF the module, the pin ON/OFF has to be released. Through the firmware, the module can be switched off (using the CPOF command).

#### Pin description

| Signal  | Pin number | I/O | I/O type | Description     |
|---------|------------|-----|----------|-----------------|
| ON/~OFF | 6          | I   | CMOS     | Module Power ON |

#### Electrical Characteristics

| Parameter             | Min | Max | Unit       |
|-----------------------|-----|-----|------------|
| Input Impedance ( R ) | 10  |     | k $\Omega$ |
| Input Impedance ( C ) |     | 50  | pF         |

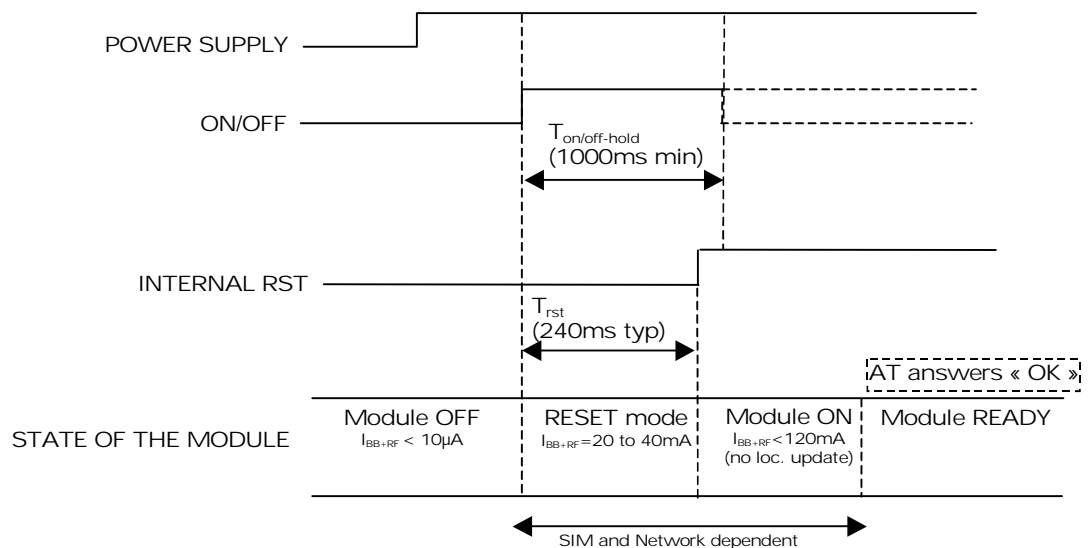
#### Operating conditions

| Parameter       | I/O type | Min   | Max      | Unit |
|-----------------|----------|-------|----------|------|
| V <sub>IL</sub> |          | 0 V   | 0.6 V    | V    |
| V <sub>IH</sub> |          | 2.4 V | VDD+0.5V | V    |

### 3.2.12.1 Operating sequences

#### 3.2.12.1.1 Power ON

Once the module supplied, the application must set the ON/OFF signal to high to start the module power ON sequence. The ON/OFF signal must be hold for 500ms minimum. After this time, an internal mechanism keeps it on hold. During the power ON sequence, an internal reset is automatically performed by the module for 240ms (typical). During this phase, any external reset should be avoided. Once the initialisation is complete (timing is SIM and network dependent) the AT interface answers « OK » to the application<sup>4</sup>. For further details, please check the AT commands manual (+WIND, +WAIP)



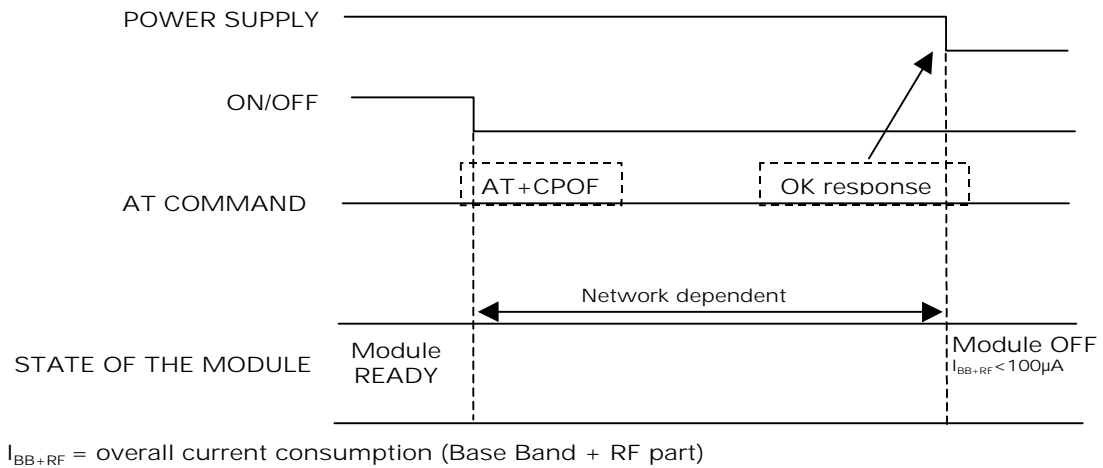
$I_{BB+RF}$  = overall current consumption (Base Band + RF part)

Figure 14 : Power-ON sequence (no PIN code activated)

<sup>4</sup> For this, the application has to send AT. If the application manages hardware flow control, the AT command can be sent during the initialisation phase. Another solution is to use the +WIND command to get an unsolicited status from the module.

3.2.12.1.2 Power OFF

To properly power OFF the module, the application must set the ON/OFF signal to low and then send the AT+CPOF command to de-register from the network and switch off the module. Once the « OK » response is issued by the module, the power supply can be switched off.



**Figure 15 : Power-OFF sequence**

3.2.13 BOOT (optional)

This input can be used to download a software in the Flash ROM of the WISMO2C2 module. For the applications based on AT commands this is a backup download procedure only (see chapter on firmware download for details on the nominal procedure). The internal boot procedure is started when this pin is low during the reset of the module. In normal mode this pin has to be left open. In Internal boot mode, low level has to be set through a 1K $\Omega$  resistor. If used, this input has to be driven by an open collector or an open drain.

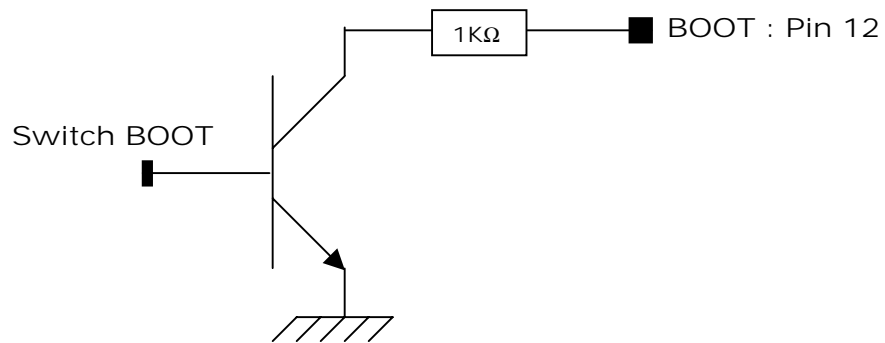


Figure 16 : BOOT pin connection

- If Switch Boot = 1, Boot pin 12 = 0, for download mode
- If Switch Boot = 0, Boot pin 12 = 1, for normal mode

Pin description

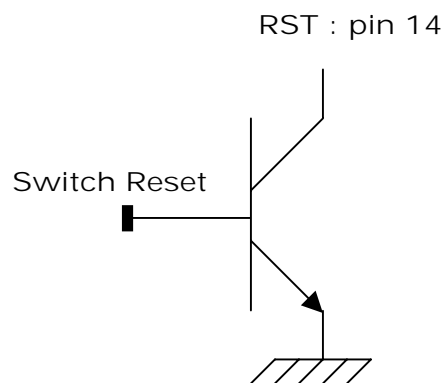
| Signal | Pin number | I/O | I/O type | Description   |
|--------|------------|-----|----------|---------------|
| BOOT   | 12         | I   | CMOS     | Flash Loading |

Nota : The nominal firmware download procedure is using the X-modem protocol (see chapter 6.3)

### 3.2.14 Reset signal (~RST)

This signal is used to force a reset procedure by providing low level during at least 100µs. This signal has to be considered as an emergency reset only. A reset procedure is already driven by an internal hardware during the power-up sequence.

This signal can also be used to provide a reset to an external device. It then behaves as an output. If no external reset is necessary this input can be left open. If used (emergency reset), it has to be driven by an open collector or an open drain.



**Figure 17 : RST pin connection**

- If Switch Reset = 1, Reset pin 14 = 0
- If Switch Reset = 0, Reset pin 14 = 1

#### Pin description

| Signal | Pin number | I/O | I/O type | Description  |
|--------|------------|-----|----------|--------------|
| ~RST   | 14         | I/O |          | Module Reset |

#### Electrical Characteristics

| Parameter             | Min | Max | Unit |
|-----------------------|-----|-----|------|
| Input Impedance ( R ) | 4.7 |     | kΩ   |
| Input Impedance ( C ) |     | 10  | nF   |



Operating conditions

| Parameter        | Min   | Max   | Condition                |
|------------------|-------|-------|--------------------------|
| *V <sub>T-</sub> | 1.1V  | 1.2 V |                          |
| *V <sub>T+</sub> | 1.7V  | 1.9 V |                          |
| V <sub>OL</sub>  |       | 0.4 V | I <sub>OL</sub> = -50 µA |
| V <sub>OH</sub>  | 2.0 V |       | I <sub>OH</sub> = 50 µA  |

\* V<sub>T-</sub>, V<sub>T+</sub>: Hysterisis Level

Additional comments on RESET:

The RESET process is activated either by the external ~RST signal OR by an internal signal (coming from a RESET generator). This automatic reset is activated at Power-up.

The module remains in reset mode as long as the RST signal is held low. This signal should be used only for "emergency" resets.

A software reset will be preferred to a HW reset.

3.2.14.1 Reset sequence

To activate the « emergency » reset sequence, the ~RST signal has to be set to low for 100µs minimum. As soon as the reset is complete, the AT interface answers « OK » to the application<sup>5</sup>.

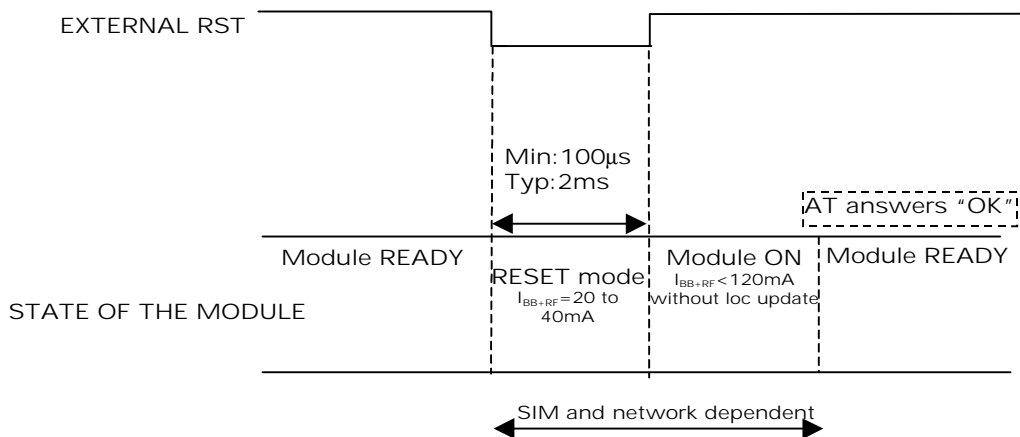


Figure 18 : reset sequence

<sup>5</sup> For this, the application has to send AT.J. If the application manages hardware flow control, the AT command can be sent during the initialisation phase. Another solution is to use the +WIND command to get an unsolicited status from the module.

### 3.2.15 External Interrupt (~INTR)

The WISMO2C2 provides an external interrupt input. This input is very sensitive and an interrupt is activated on high to low edge. If this signal is not used it can be left open. If used this input has to be driven by an open collector or an open drain.

This input is used for instance to power OFF automatically the module.

Pin description

| Signal | Pin number | I/O | I/O type | Description        |
|--------|------------|-----|----------|--------------------|
| ~INTR  | 16         | I   | CMOS     | External Interrupt |

Electrical characteristics

| Parameter | Min   | Max  | Unit |
|-----------|-------|------|------|
| $V_{IL}$  | -0.5V | 0.7V | Volt |
| $V_{IH}$  | 2.2V  | 3.0V | Volt |

### 3.2.16 VCC output

This output can be used to power some external functions. **VCC** has to be used as a digital power supply. This power supply is available when the module is on.

**Pin description**

| Signal | Pin number | I/O | I/O type | Description    |
|--------|------------|-----|----------|----------------|
| VCC    | 40         | O   | Supply   | Digital supply |

**Operating conditions**

| Parameter      | Condition | Min  | Max  | Unit |
|----------------|-----------|------|------|------|
| Output voltage | I = 10mA  | 2.74 | 2.86 | V    |
| Output Current |           |      | 10   | mA   |

### 3.2.17 VCC\_RTC (Real Time Clock)

This pin is used as a back-up power supply for the internal Real Time Clock. The RTC is supported by the module when powered on but a back-up power supply is needed to save date and hour when the module is switched off. If the RTC is not used this pin can be left open.

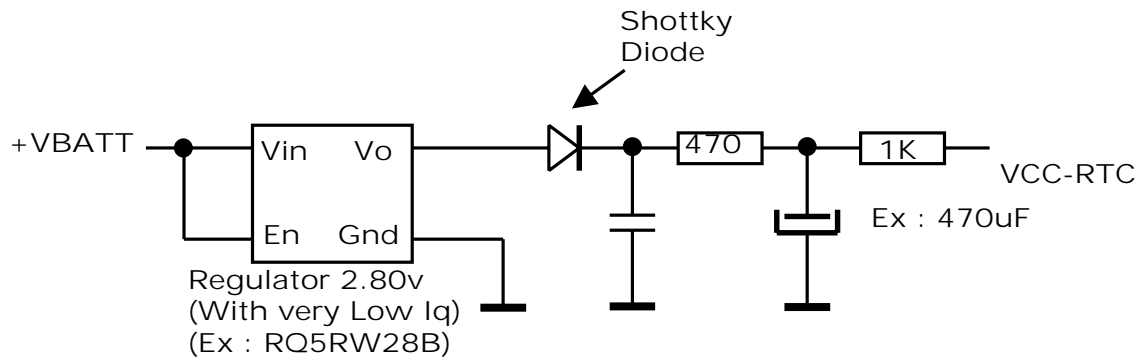
**Pin description**

| Signal  | Pin number | I/O | I/O type | Description        |
|---------|------------|-----|----------|--------------------|
| VCC_RTC | 56         | I/O | Supply   | RTC Back-up supply |

**Operating conditions**

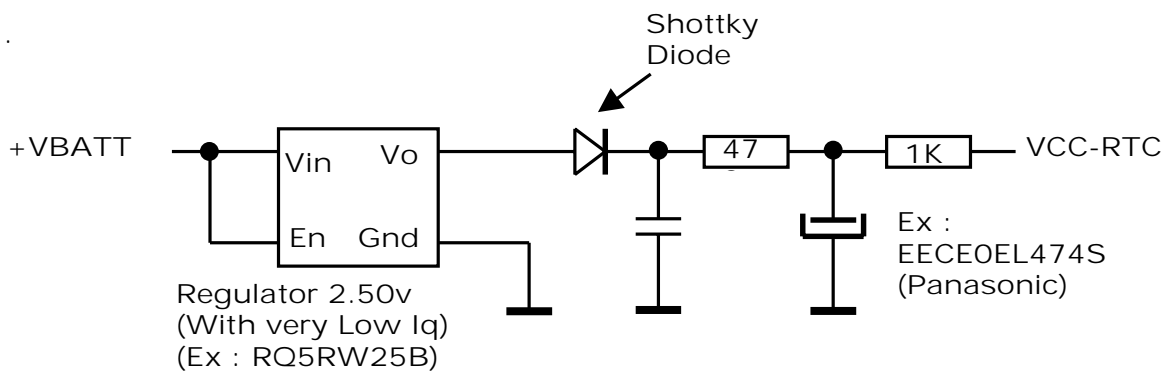
| Parameter      | Condition                               | Min | Max  | Unit |
|----------------|---|-----|------|------|
| Input voltage  |   | 2   | 2.75 | V    |
| Input Current  | VCC=0V; t° = 25°C<br>VCC_RTC=2.5V       |     | 3    | µA   |
| Input Current  | VCC=0V; t°:-20°C / 55°C<br>VCC_RTC=2.5V |     | 10   | µA   |
| Output voltage |   | 2.4 | 2.75 | V    |
| Output current |   |     | 2    | mA   |

Application example



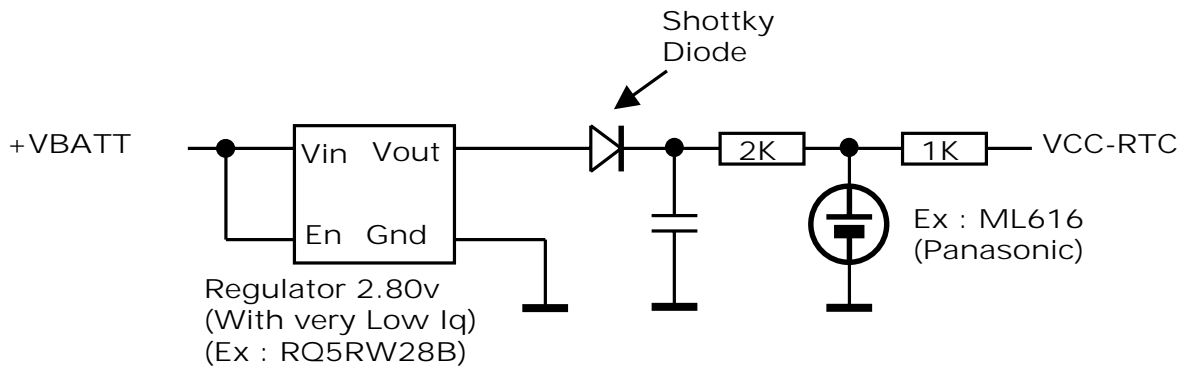
Charge capacity with 470µF Capacitor : 30 seconds min (Estimation)

**Figure 18 : Back-up RTC (capacitor)**



Charge capacity with 0.47 Farad Gold Capacitor : 2 Hours min (Estimation)  
Note: The Gold Capacitor max. voltage is 2.5v.

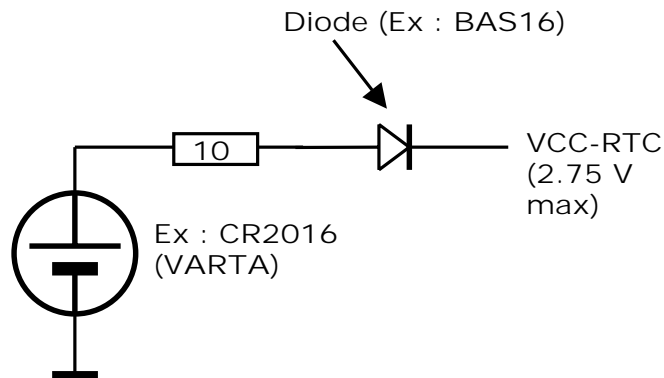
**Figure 19 : Back-up RTC (super capacitor)**



Charge capacity with 2mAH Rechargeable Battery : 3 Days (Estimation)

**Figure 20 : Back-up RTC (Rechargeable Battery)**

The following solution is less recommended.



Charge capacity with 85mAH Capacitor : 4000 Hours min (Estimation)  
Note: The "non rechargeable battery" is always in active mode except when the module is ON.

**Figure 21 : Back-up RTC (non Rechargeable Battery)**

### 3.3 RF interface

The impedance is 50 Ohms nominal and the DC impedance is 0 Ohm.

#### 3.3.1 RF connection

Two land patterns set on the PCB support the RF connection which can be used by the application through spring contacts or a soldered RF cable.

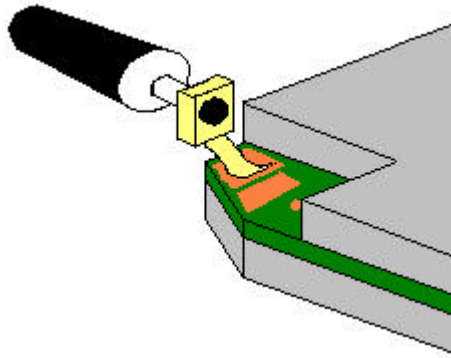
Since no standard spring contact is available for WISMO2C2, this solution requires a specific part to be developed.

The soldered solution will preferably be based on a RG178 coaxial cable with the following stripping and mounting guidelines :

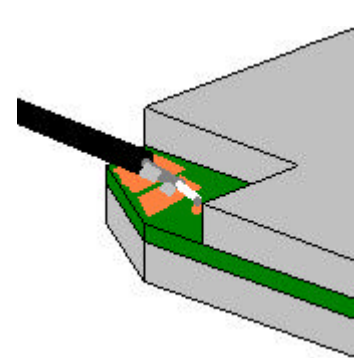
## Introduction

TWO-WAY ARE POSSIBLE TO CONNECT AN ANTENNA TO THE MODULE:

- The antenna can directly be connected to the module on the "Antenna PAD" by using a spring contact (case A).
- The antenna can be connected to the module through a coaxial wire. The coaxial wire is connected to both the "Round PAD" and the "Ground PAD" (case B).



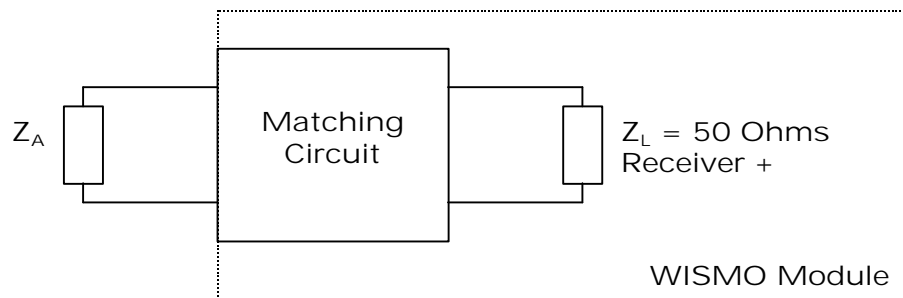
Antenna connection by spring contact



Coaxial cable connection

## Antenna directly connected to the module: matching circuit

The goal of the matching circuit is to link the antenna (impedance  $Z_A$ ) to the Receiver and transmitter access of the module (impedance  $Z_L = 50$  ohm real).



The matching circuit is composed by four elements implemented (see figure 1 and 2) on the module connecting the "antenna PAD" to the "Round PAD" (access to the receiver and the transmitter).

The four elements of the matching circuit are not yet fixed (defined), and depend on each antenna and mechanical integration. The matching circuit must be verified in both frequency bandwidths: 900 MHz (880 to 960 MHz and 1800 MHz (1710 to 1880 MHz).



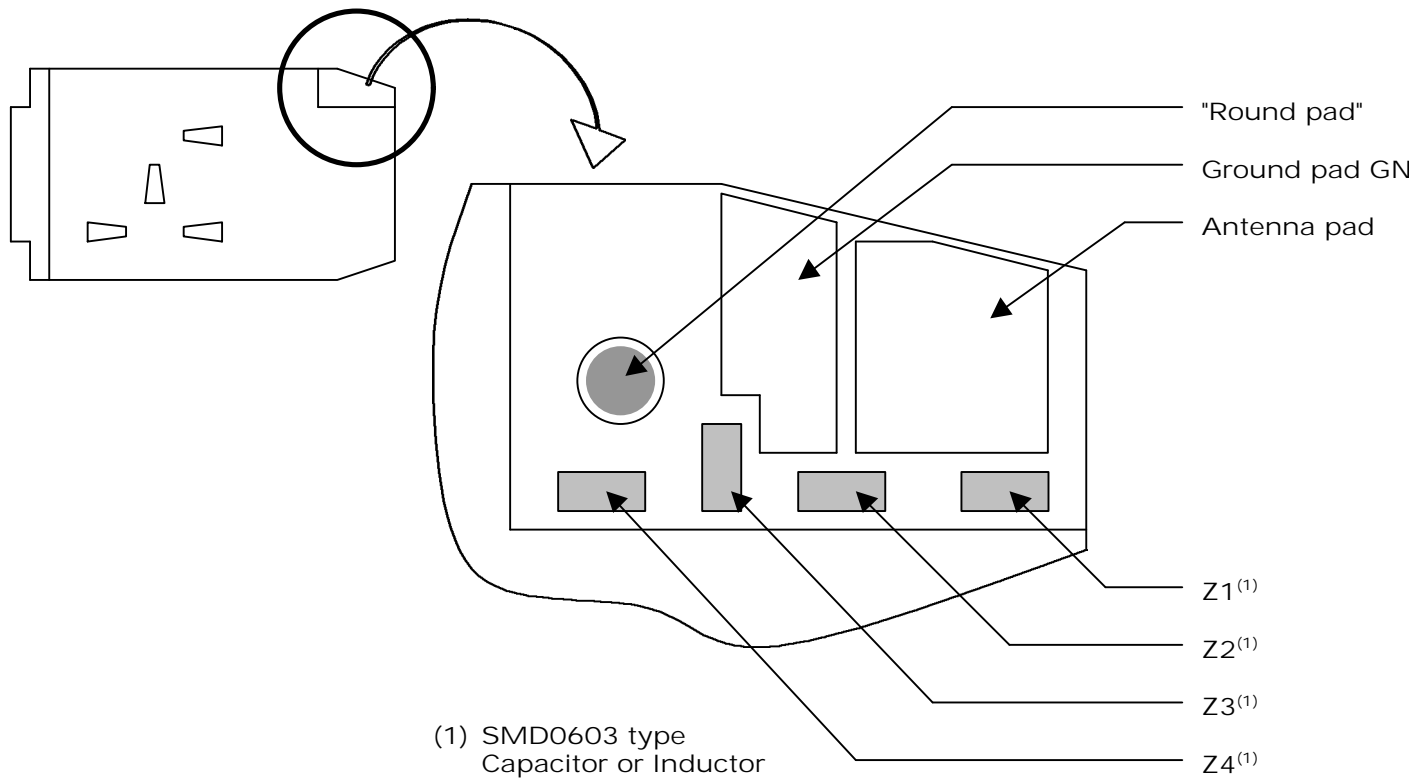


Figure 1: WM2C-G900/G1800 antenna matching circuit

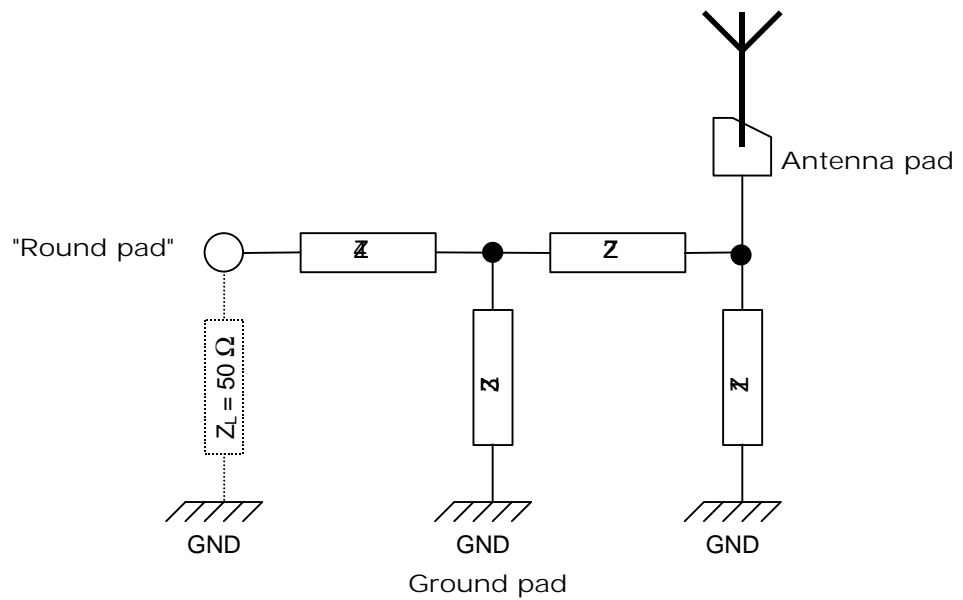
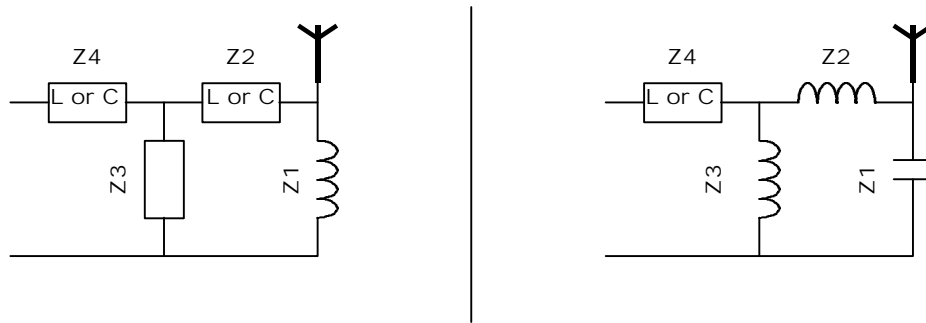


Figure 2: Equivalent schematic, the components must be defined

Recommendation:

For ESD (Electrostatic Discharge) compatibility, the antenna must be "DC" connected to the ground, in using an inductor or an association of inductors. Two topologies are proposed

Application schematics:



## Antenna connected through a coaxial cable:

The matching circuit is not equipped. The 50 ohm coaxial cable must be connected as shown on the following drawing.

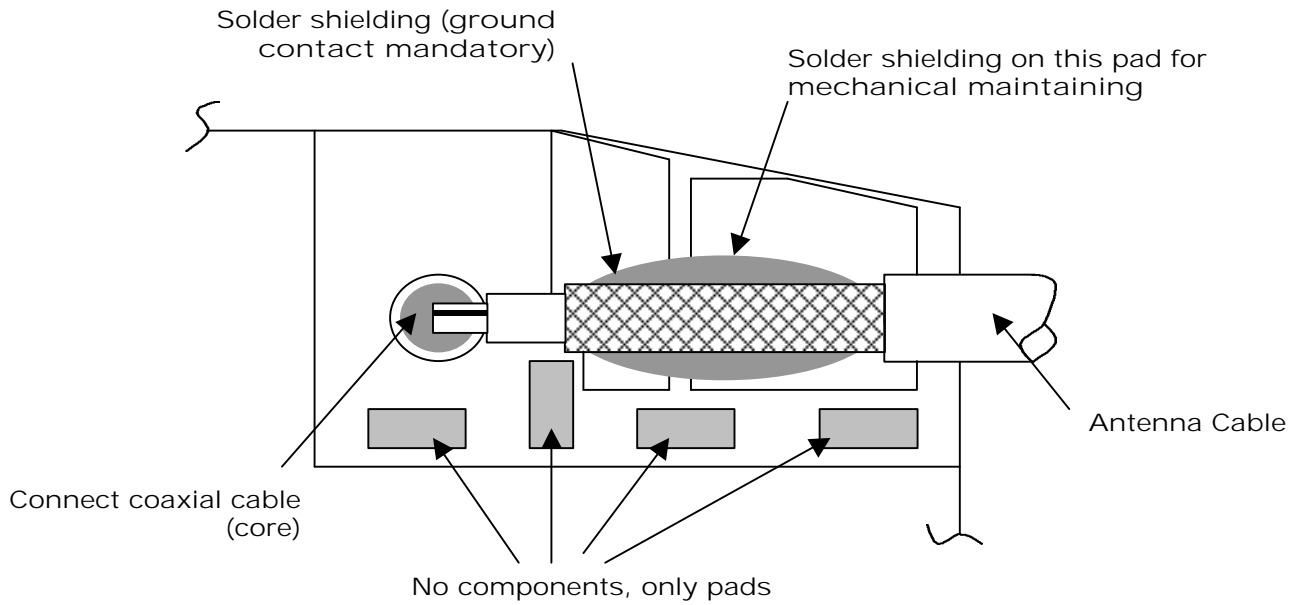


Figure 3: WM2C-G900/G1800 coaxial cable connection

Notes :

- The WISMO2C2 does not support an antenna switch for a car kit but this function can be implemented externally and it can be driven using a GPIO.
- The antenna cable and connector should be chosen in order to minimise losses in the frequency bands used for GSM900 (900 MHz) and GSM1800/GSM1900 (1.8GHz/1.9GHz).
- 0.5dB can be considered as a maximum value for loss between the module and an external connector.

### 3.3.2 RF connector (WISMO2C2-RFC)

The RF connection between the WISMO2C2-RFC module and the customer application is made by the RADIALL coaxial connector type MMS. The MMS connector stands on three pliable legs. This design guarantees the receptacle stability after the placement. The MMS snap-on mating system ensures a correct positive connection each time. Multi-sourcing cable assemblies are available. (see chapter 5.2)

### 3.3.3 RF performances

RF performances are compliant with the ETSI recommendation 05.05 and 11.10 (Normal MS requirements)

The main parameters are :

- Receiver:
  - EGSM Sensitivity : < -104 dBm Static & TUNHigh
  - GSM1800/GSM1900 Sensitivity : < -104 dBm Static & TUNHigh
  - Selectivity @ 200 kHz : > +9 dBc
  - Selectivity @ 400 kHz : > +41 dBc
  - Dynamic range : 63 dB
  - Co-channel rejection : >= 9 dBc
  
- Transmitter :
  - Maximum output power (EGSM): 33 dBm +/- 2 dB at ambient temperature
  - Maximum output power (GSM1800/GSM1900) : 30 dBm +/- 2 dB at ambient temperature
  - Minimum output power (EGSM) : 5 dBm +/- 5 dB at ambient temperature
  - Minimum output power (GSM1800/GSM1900) : 0 dBm +/- 5 dB at ambient temperature
  - H2 level : < -30 dBm
  - H3 level : < -30 dBm
  - Noise in 925 - 935 MHz : < -67 dBm
  - Noise in 935 - 960 MHz : < -79 dBm
  - Noise in 1805 - 1880 MHz (GSM1800 band) : < -71 dBm
  - Noise in 1930 - 1990 MHz (GSM1900 band) : < -71 dBm
  - Phase error at peak power : < 5 ° RMS
  - Frequency error : +/- 0.1 ppm max

### 3.3.4 Antenna specifications

The antenna must fullfill the following requirements :

- Frequency bands : dual band E-GSM 900 MHz – GSM 1800 MHz / GSM 1900 MHz

|                     | <b>EGSM 900</b> | <b>GSM 1800</b>  | <b>GSM 1900</b>  |
|---------------------|-----------------|------------------|------------------|
| <b>Frequency RX</b> | 925 to 960 MHz  | 1805 to 1880 MHz | 1930 to 1990 MHz |
| <b>Frequency TX</b> | 880 to 915 MHz  | 1710 to 1785 MHz | 1850 to 1910 MHz |

- Impedance : 50Ω
- VSWR Tx max 2 :1 / Rx max 2 :1
- Typical radiated gain : 0dBi

## 4 Technical specifications

### 4.1 Interfaces

| Pin # | Name        | I/O | I/O type  | Description                 | Comment                                    |
|-------|-------------|-----|-----------|-----------------------------|--|
| 1     | CHG_IN      | I   | Supply    | Supply for battery charging | High current                               |
| 2     | CHG_IN      | I   | Supply    | Supply for battery charging | High current                               |
| 3     | SIMCLK      | O   | 2 X       | Clock for SIM interface     |  |
| 4     | CHG_IN      | I   | Supply    | Supply for battery charging | High current                               |
| 5     | SIMRST      | O   | 2 X       | Reset for SIM interface     |  |
| 6     | ON/~OFF     | I   | CMOS      | Power ON/OFF control        |  |
| 7     | SIMDATA     | I/O | CMOS / 3X | I/O for SIM interface       |  |
| 8     | SDA/SPI_IO  | I/O | CMOS/1X   | Wire interface or SPI Data  |  |
| 9     | SIMVCC      | O   | Supply    | SIM card supply             | 6mA max                                    |
| 10    | SCL/SPI_CLK | O   | 1X        | Wire interface or SPI clock |  |
| 11    | VDD         | I   | Supply    | Low power supply            | 3.1V minimum or connected to VBATT         |
| 12    | BOOT        | I   | CMOS      | BOOT                        | Pull down through 1K for Flash downloading |
| 13    | ROW0        | I/O | CMOS/1X   | Keyboard Row                |  |
| 14    | ~RST        | I/O | SCHMITT   | Module Reset                | Active low                                 |
| 15    | ROW1        | I/O | CMOS/1X   | Keyboard Row                |  |
| 16    | ~INTR       | I   | CMOS      | External interrupt          | Active low. 100K Pull-up inside            |
| 17    | ROW2        | I/O | CMOS/1X   | Keyboard Row                |  |
| 18    | GPI         | I   | CMOS      | General Purpose Input       | 100K Pull-down inside                      |
| 19    | ROW3        | I/O | CMOS/1X   | Keyboard Row                |  |
| 20    | GPO2        | O   | 1X        | General Purpose Output      |  |
| 21    | ROW4        | I/O | CMOS/1X   | Keyboard Row                |  |
| 22    | GPO1        | I/O | 3X        | General Purpose Output      |  |
| 23    | COL0        | I/O | CMOS/1X   | Keyboard Column             |  |
| 24    | GPIO0       | I/O | CMOS/2X   | General Purpose I/O         |  |
| 25    | COL1        | I/O | CMOS/1X   | Keyboard Column             |  |

|    |                      |          |           |   |  |
|----|----------------------|----------|-----------|---|--|
| 26 | GPO0 or SPI_AUX      | O        | 3X        | General Purpose Output or SPI Aux enable<br>SIM 3V / 5V |  |
| 27 | COL2                 | I/O      | CMOS/1X   | Keyboard Column   |  |
| 28 | SPI_EN               | O        | 1X        | SPI enable  |  |
| 29 | COL3                 | I/O      | CMOS/1X   | Keyboard Column   |  |
| 30 | CT105/RTS            | I        | CMOS      | RS232 interface Request To Send                         | Pull up to VCC with 100K $\Omega$ when not used  |
| 31 | COL4                 | I/O      | CMOS/1X   | Keyboard Column   |  |
| 32 | CT104/RX             | O        | 1X        | RS232 interface - Receive                               |  |
| 33 | AUXV0                | I        | Analog    | Auxiliar ADC input 0                                    | Can be tied to GND if not used                   |
| 34 | CT108-2/DTR          | I        | CMOS      | RS232 interface Data Terminal Ready                     | Pull up to VCC with 100K $\Omega$ when not used  |
| 35 | GPIO5                | I/O      | CMOS / 2X | General Purpose I/O                                     |  |
| 36 | CT107/DSR            | O        | 1X        | RS232 interface Data Set Ready                          |  |
| 37 | CT106/CTS            | O        | 1X        | RS232 interface Clear To Send                           |  |
| 38 | BAT_TEMP             | I        | Analog    | ADC input for battery temperature measurement           | Can be tied to GND if not used                   |
| 39 | CT103/TX             | I        | CMOS      | RS232 interface - Transmit                              | Pull up to VCC with 100 K $\Omega$ when not used |
| 40 | VCC                  | O        | Supply    | 2.8V digital supply output                              | 10mA max.  |
| 41 | SPK1P                | O        | Analog    | Speaker 1 positive output                               |  |
| 42 | MIC1P                | I        | Analog    | Microphone 1 positive input                             |  |
| 43 | SPK1N                | O        | Analog    | Speaker 1 negative output                               |  |
| 44 | MIC1N                | I        | Analog    | Microphone 1negative input                              |  |
| 45 | SPK2P                | O        | Analog    | Speaker 2 positive output                               |  |
| 46 | MIC2P                | I        | Analog    | Microphone 2 positive input                             |  |
| 47 | SPK2N                | O        | Analog    | Speaker 2 negative output                               |  |
| 48 | MIC2N                | I        | Analog    | Microphone 2 negative input                             |  |
| 49 | BUZ                  | O        | Analog    | Buzzer output   | 80mA max   |
| 50 | SIMPRES              | I        | CMOS      | SIM Card Detect   | Tied to VCC when not used                        |
| 51 | GPIO3 or CT109 / DCD | I/O<br>O | CMOS/2X   | General Purpose I/O<br>RS232 - Data Carrier             |  |



|    |                        |          |         | Detect   |              |
|----|------------------------|----------|---------|--|--------------|
| 52 | GPIO1<br>FLASH LED     | I/O      | CMOS/2X | General Purpose I/O<br>Module State              |              |
| 53 | GPIO4                  | I/O      | CMOS/2X | General Purpose I/O                              |              |
| 54 | GPIO2 or<br>CT125 / RI | I/O<br>O | CMOS/2X | General Purpose I/O<br>RS232 - Ring<br>Indicator |              |
| 55 | +VBATT                 |          | Supply  | Battery Input                                    | High current |
| 56 | VCC_RTC                | I/O      | Supply  | RTC back-up supply                               |              |
| 57 | +VBATT                 |          | Supply  | Battery Input                                    | High current |
| 58 | +VBATT                 |          | Supply  | Battery Input                                    | High current |
| 59 | +VBATT                 |          | Supply  | Battery Input                                    | High current |
| 60 | +VBATT                 |          | Supply  | Battery Input                                    | High current |

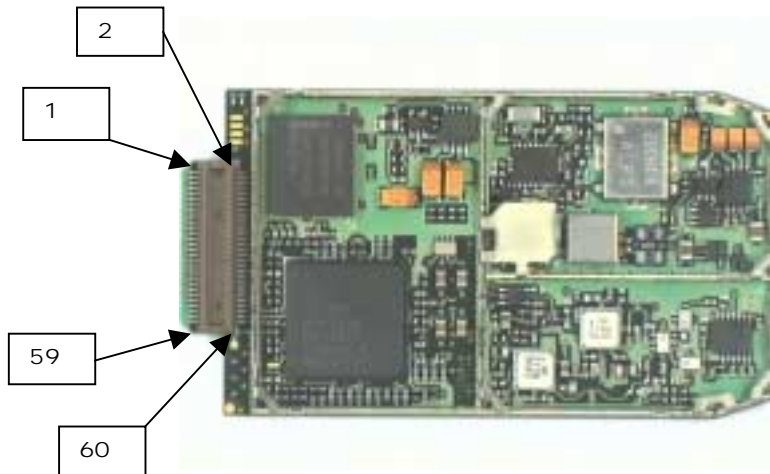


Figure 23 : WISMO2C2 pin position (bottom view)

## 4.2 Climatic and mechanical environments

| Conditions                                    | Temperature range |
|---|-------------------|
| Operating / Full GSM specifications compliant | -20°C to +55°C    |
| Storage                                       | -30°C to +85°C    |

| WISMO2C2                      |                           | ENVIRONNEMENTAL CLASSES  |  |  |
|-------------------------------|---------------------------|--|--|--|
| TYPE OF TEST                  | STANDARDS                 | STORAGE<br>Class 1.2   | TRANSPORTATION<br>Class 2.3  | OPERATING (PORT USE)<br>Class 7.3  |
| Cold                          | IEC 68-2.1<br>Ab test     | -25° C            72 h   | -40° C            72 h   | -20° C (GSM900)    16 h<br>-10° C (GSM1800/1900) 16h   |
| Dry heat                      | IEC 68-2.2<br>Bb test     | +70° C            72 h   | +70° C            72 h   | +55° C            16 h   |
| Change of temperature         | IEC 68-2.14<br>Na/Nb test |  | -40° / +30° C    5 cycles<br>t1 = 3 h  | -20° / +30° C (GSM900) 3 cycles<br>-10° / +30° C (GSM1800/1900):<br>3 cycles                    t1 = 3 h |
| Damp heat<br>cyclic           | IEC 68-2.30<br>Db test    | +30° C            2 cycles<br>90% - 100% RH<br>variant 1                             | +40° C            2 cycles<br>90% - 100% RH<br>variant 1                             | +40° C            2 cycles<br>90% - 100% RH<br>variant 1   |
| Damp heat                     | IEC 68-2.56<br>Cb test    | +30° C            4 days   | +40° C            4 days   | +40° C            4 days   |
| Sinusoidal vibration          | IEC 68-2.6<br>Fc test     | 5 - 62 Hz    :        5 mm / s<br>62 - 200Hz :        2 m / s2<br>3 x 5 sweep cycles |  |  |
| Random vibration<br>wide band | IEC 68-3.36<br>Fdb test   |  | 5 - 20 Hz    :        0.96 m2 / s3<br>20 - 500Hz :        - 3 dB / oct<br>3 x 10 min | 10 - 12 Hz    :        0.96 m2 / s3<br>12 - 150Hz :        - 3 dB / oct<br>3 x 30 min                    |

## 4.3 Mechanical specifications

### 4.3.1 Physical characteristics

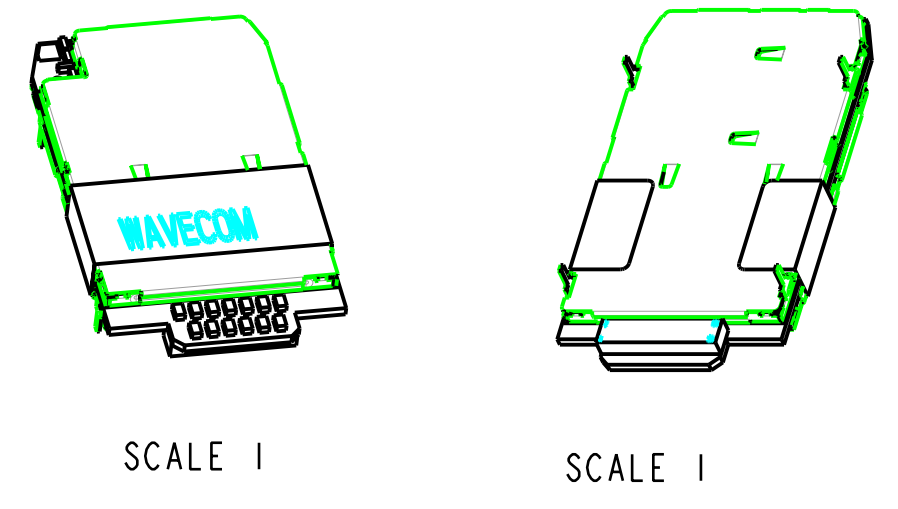
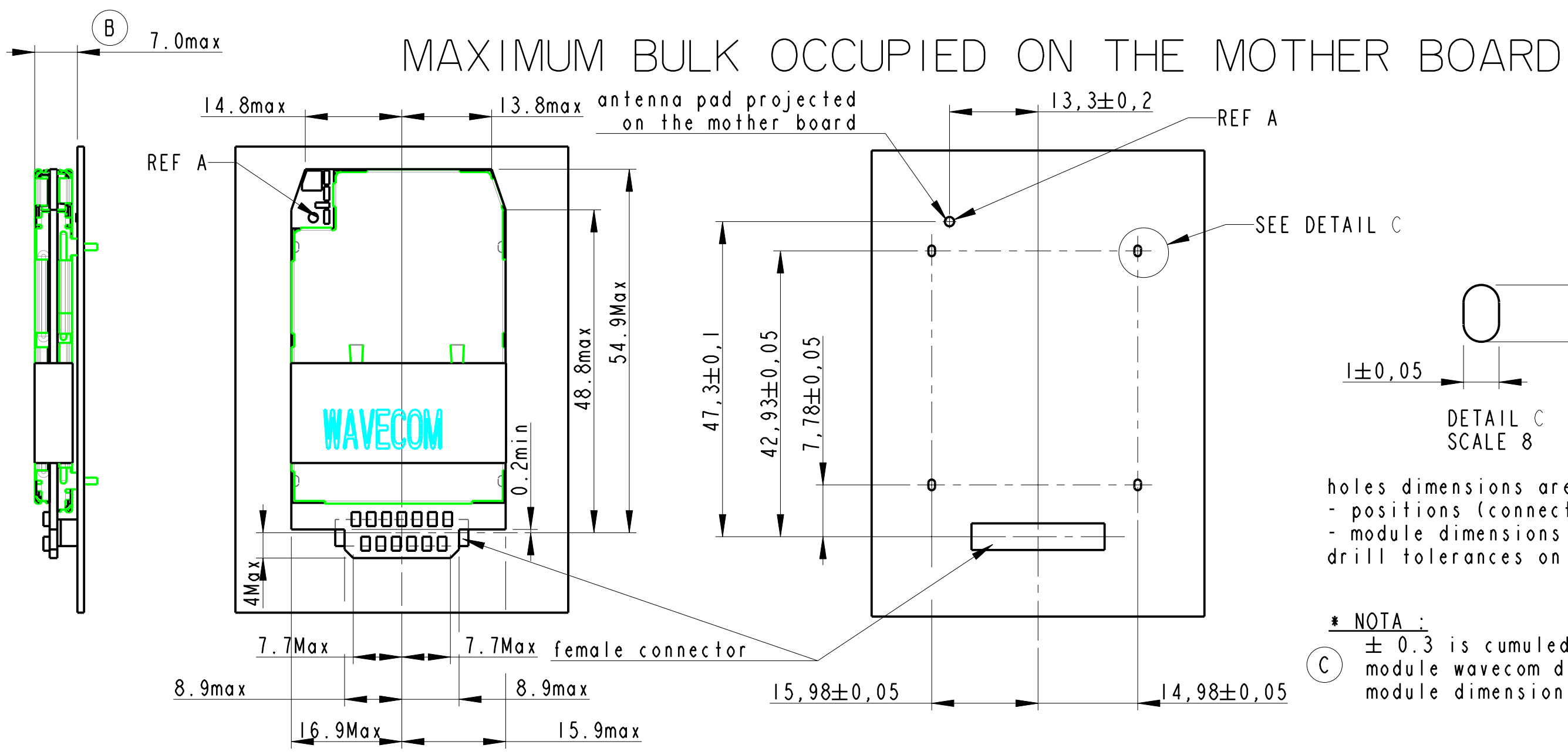
The WISMO2C2 module has a complete self-contained shield.

Dimensions : 58.3 x 32.2 x 6.0 mm

Weight : 20 g

### 4.3.2 Mechanical drawings

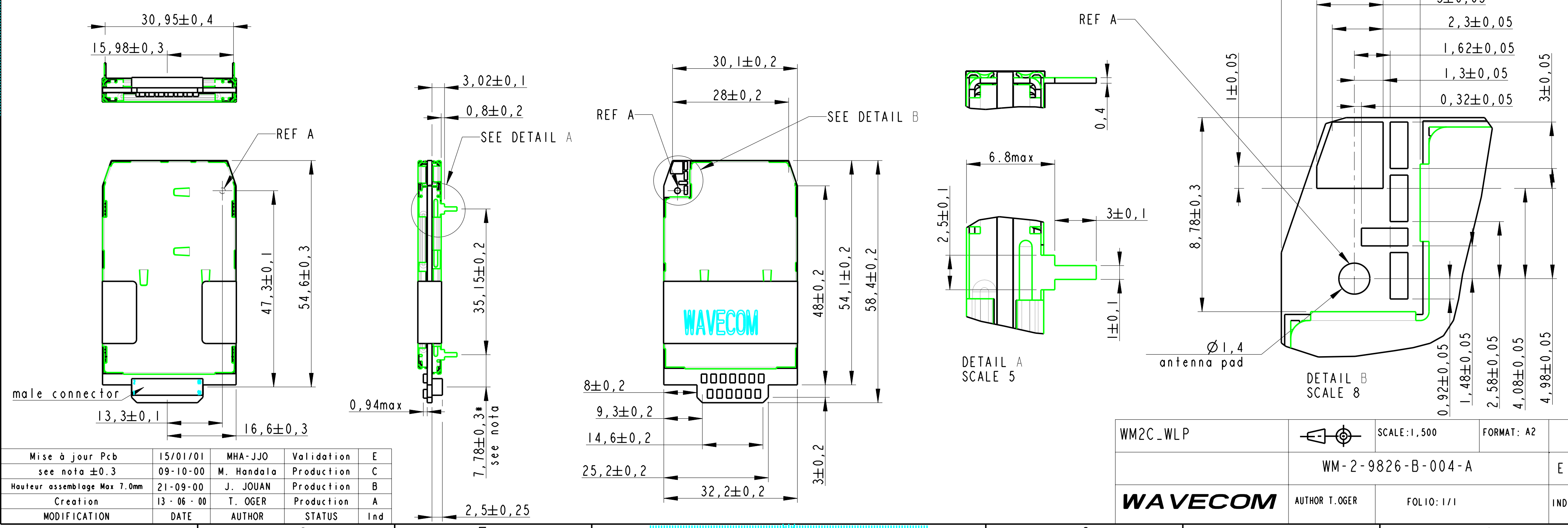
The two next pages give the mechanical specifications of WISMO2C2 and WISMO2C2-RFC.



holes dimensions are assuming tolerances of  
 - positions (connectors and module)  
 - module dimensions  
 drill tolerances on the mother board have to be added

\* **NOTA :**  
 ± 0.3 is cumuled tolerances of:  
 (C) module wavecom dimensions + module position  
 module dimensions + module position (linear & angular): +/-0.3mm

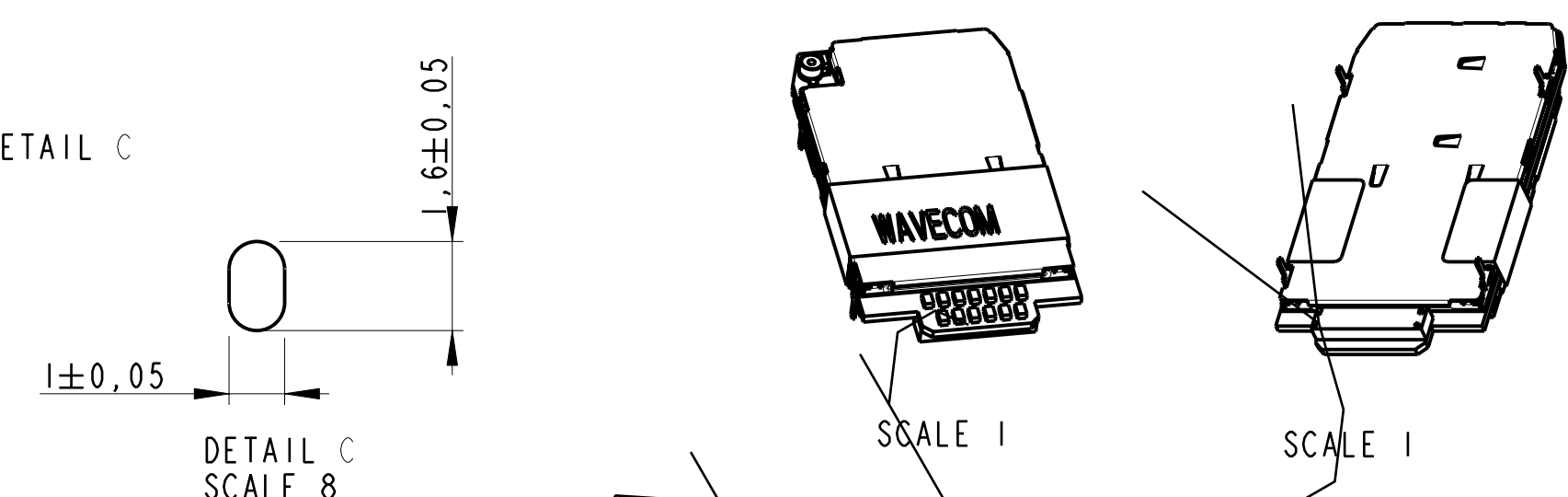
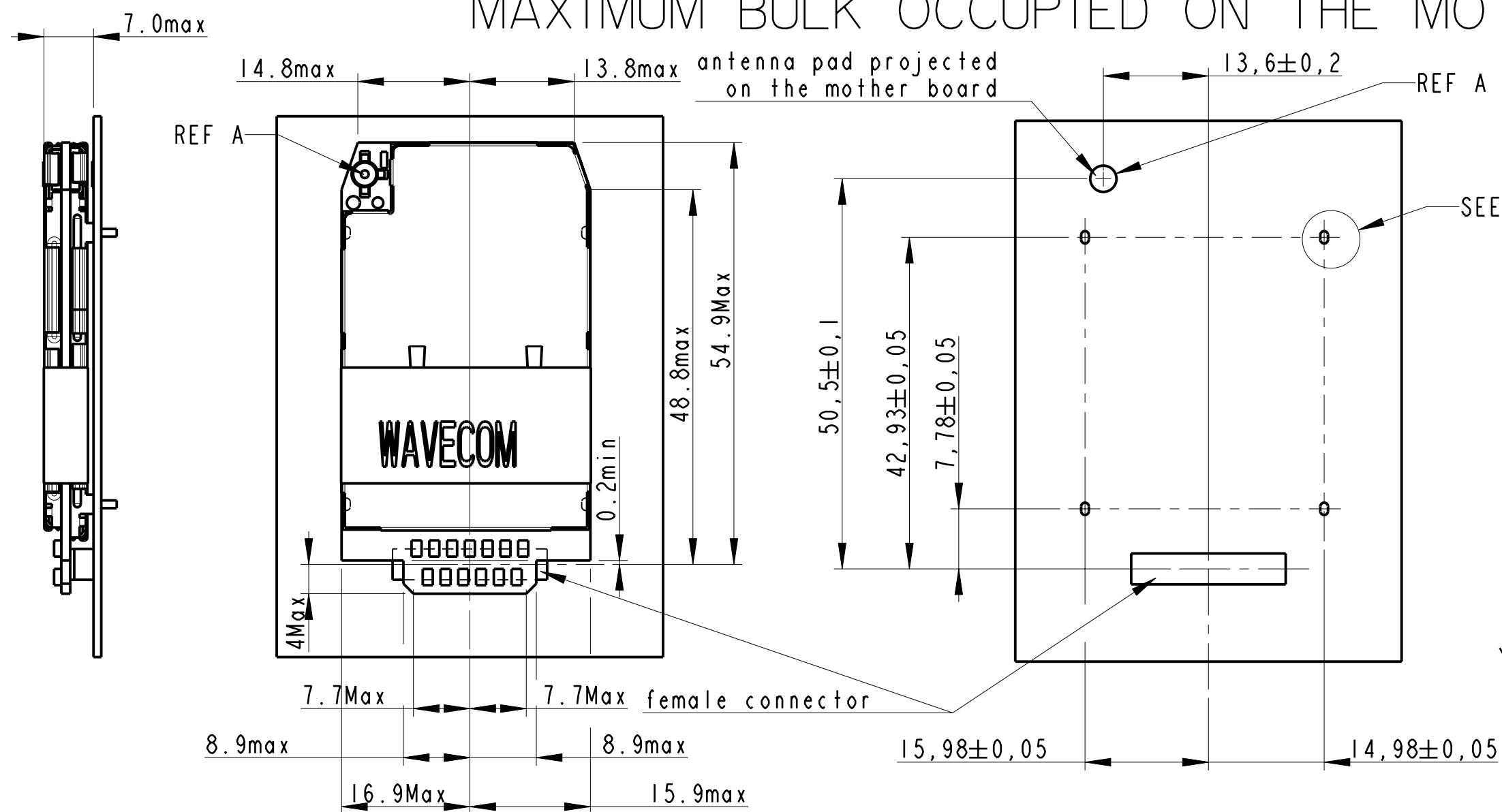
### MODULE DIMENSIONS



|                              |          |            |            |     |
|------------------------------|----------|------------|------------|-----|
| Mise à jour Pcb              | 15/01/01 | MHA-JJO    | Validation | E   |
| see nota ±0.3                | 09-10-00 | M. Handala | Production | C   |
| Hauteur assemblage Max 7.0mm | 21-09-00 | J. JOUAN   | Production | B   |
| Creation                     | 13-06-00 | T. OGER    | Production | A   |
| MODIFICATION                 | DATE     | AUTHOR     | STATUS     | Ind |

|                   |                |             |            |
|-------------------|----------------|-------------|------------|
| WM2C_WLP          |                | SCALE:1.500 | FORMAT: A2 |
| WM-2-9826-B-004-A |                |             | E          |
| <b>WAVECOM</b>    | AUTHOR T. OGER | FOLIO: 1/1  | IND.       |

# MAXIMUM BULK OCCUPIED ON THE MOTHER BOARD

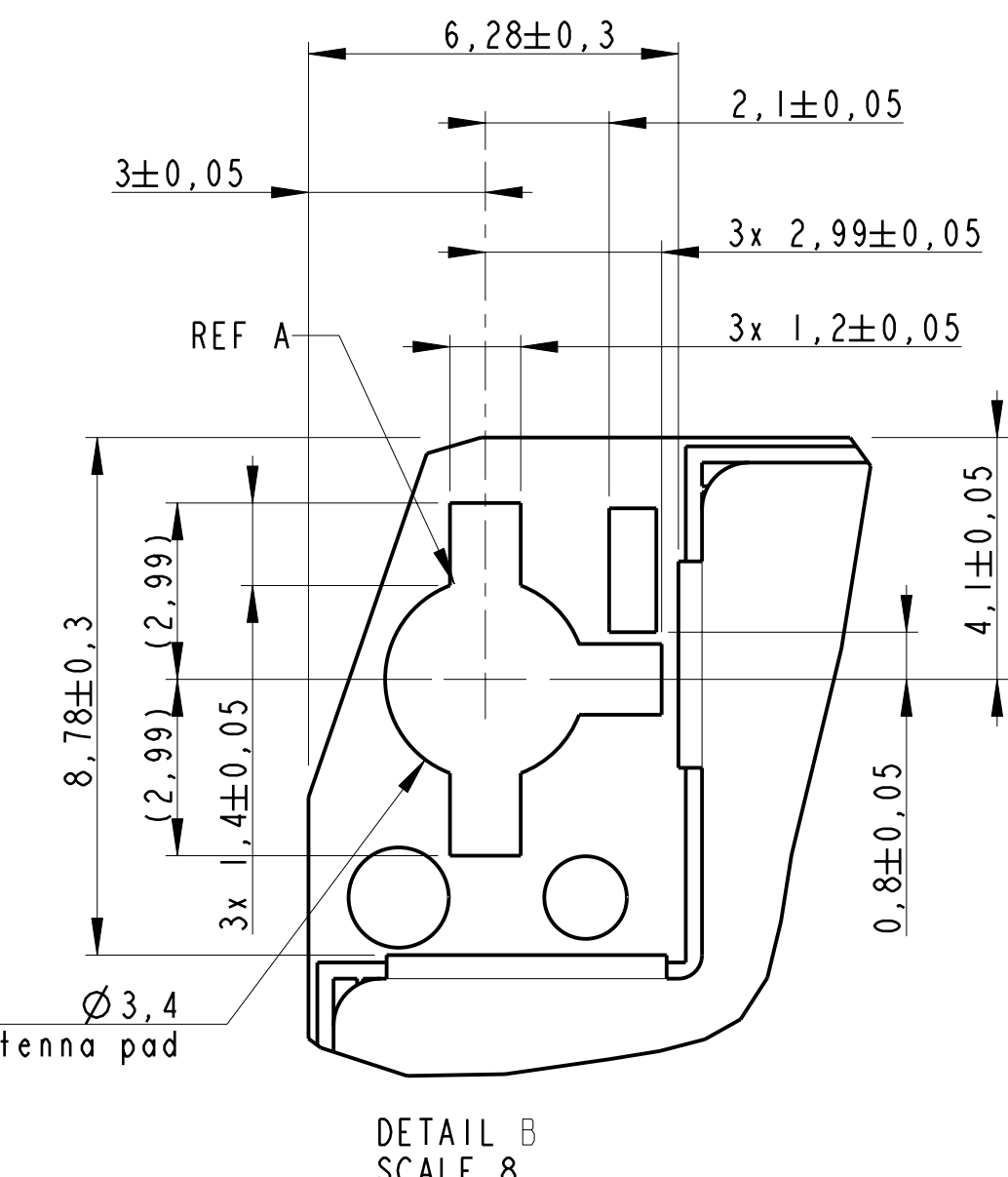
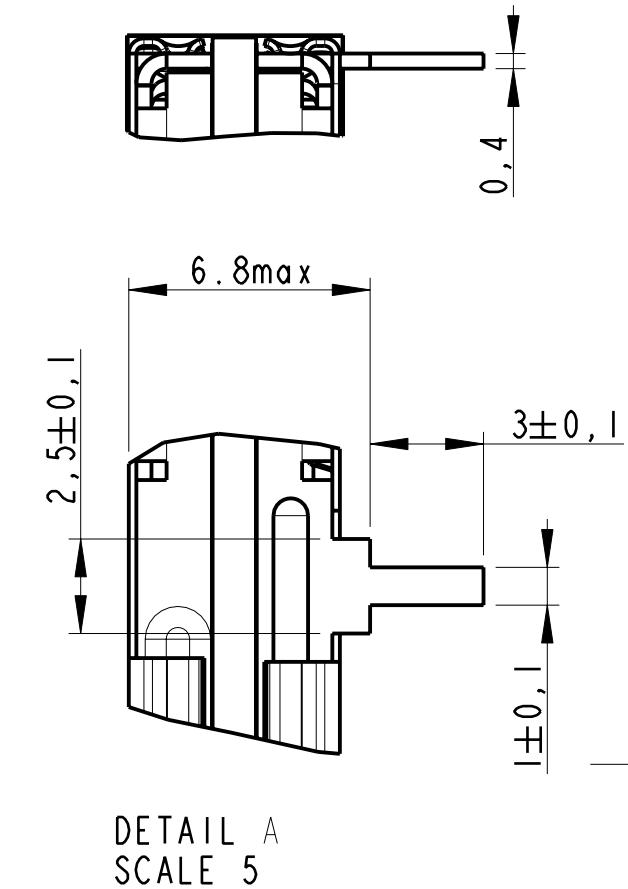
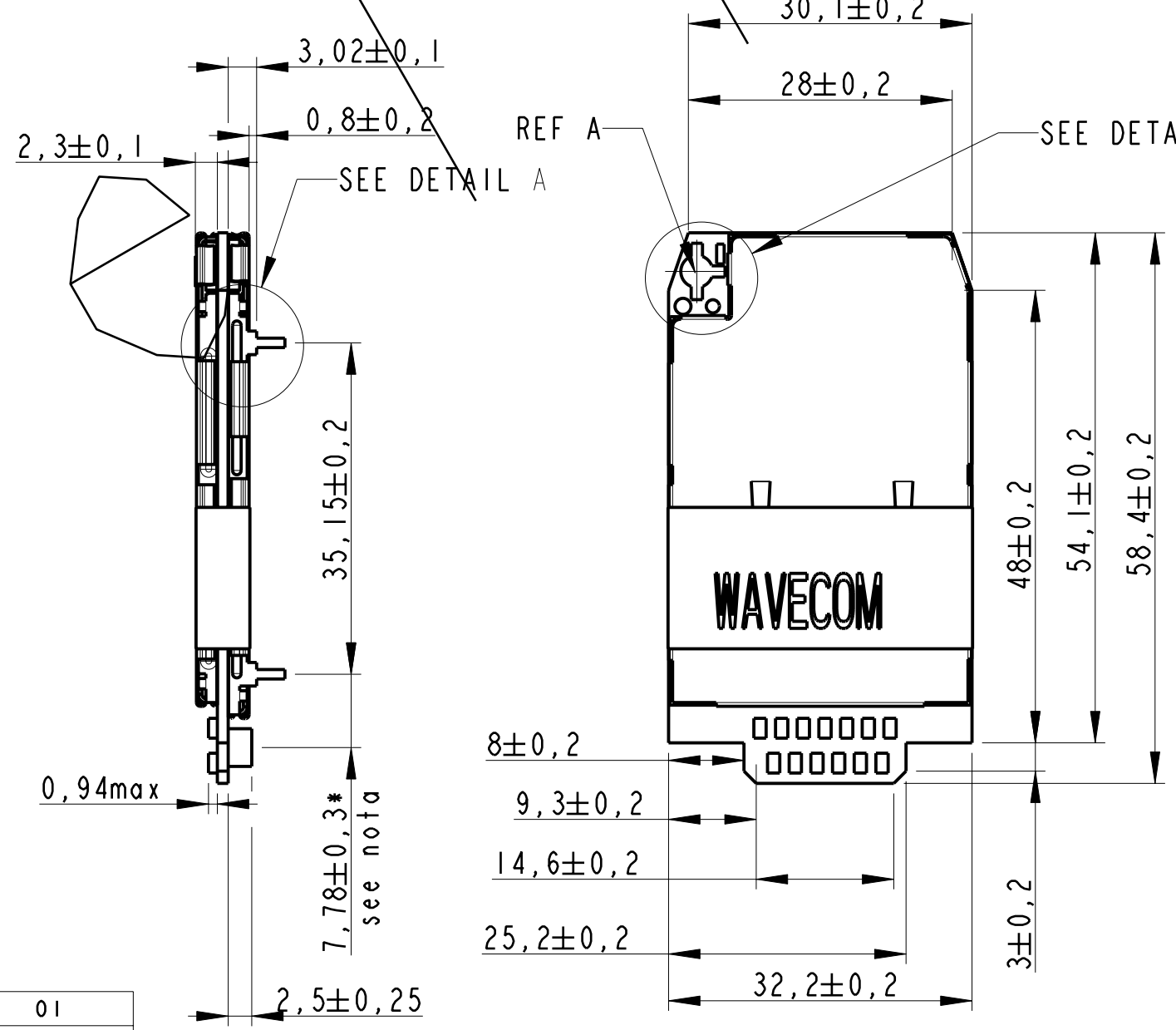
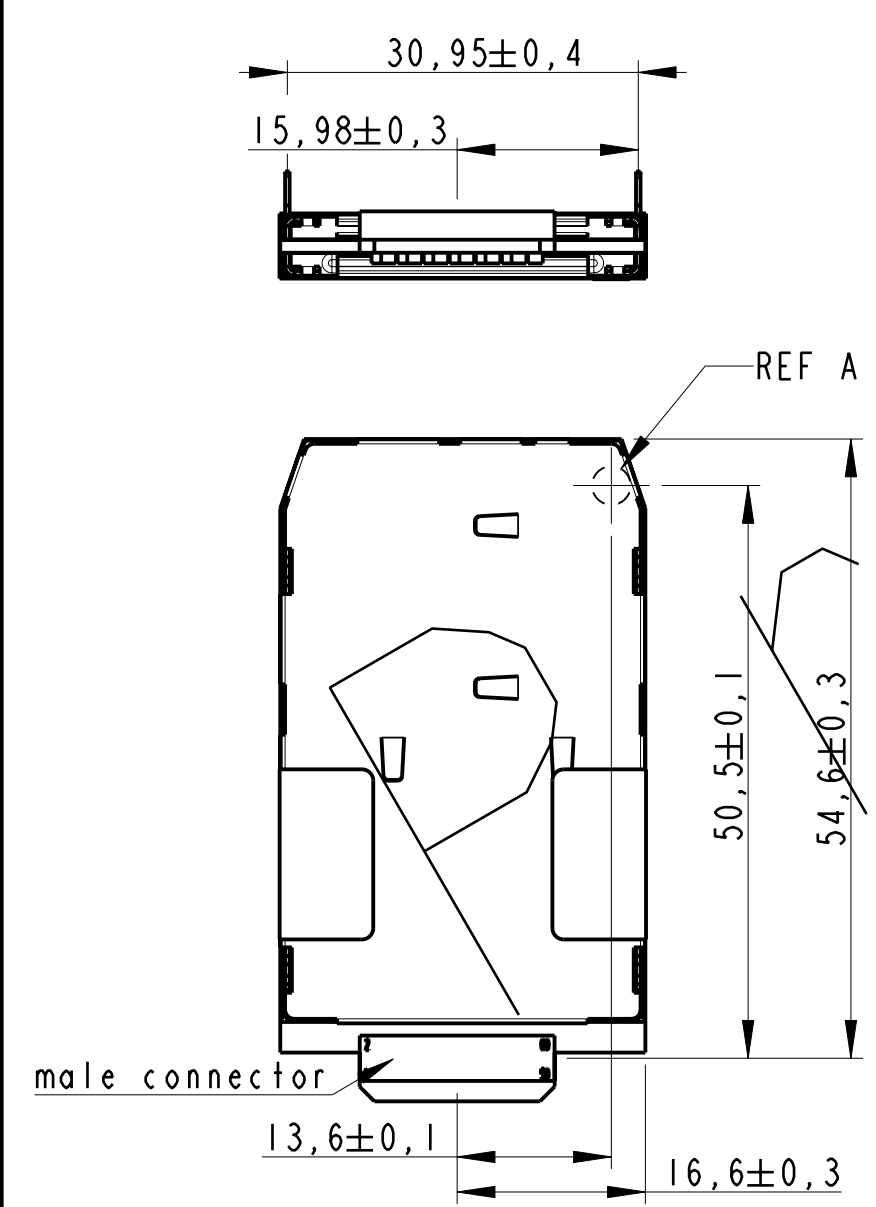


holes dimensions are assuming tolerances of  
 - positions (connectors and module)  
 - module dimensions  
 drill tolerances on the mother board have to be added

\* **NOTA :**  
 ± 0.3 is cumuled tolerances of:  
 module wavecom dimensions + module position  
 module dimensions + module position (linear & angular): +/-0.3mm

REF A : Antenna pad

# MODULE DIMENSIONS



|              |          |        |       |             |     |
|--------------|----------|--------|-------|-------------|-----|
| Creation     | 19/09/01 | JPM    | JJO   | Preliminary | 01  |
| MODIFICATION | DATE     | AUTHOR | RESP. | STATUS      | IND |

|                   |            |             |            |
|-------------------|------------|-------------|------------|
| WM2C2-RFC         |            | SCALE:1.500 | FORMAT: A2 |
| WM-2-9929-V-002-A |            |             | 01         |
| <b>WAVECOM</b>    | AUTHOR JPM | FOLIO: 1/1  | IND.       |

## 5 Connectors and peripheral devices references

### 5.1 General Purpose Connector

The GPC is a 60 pins connector with 0.5mm pitch from KYOCERA / AVX group with the following reference :

**14 5087 060 930 861.**

The matting connector has the following reference :

**24 5087 060 X00 861<sup>6</sup>.**

The stacking height is 3.0 mm.

For further details see GPC data sheets in appendix. More information is also available from <http://www.avxcorp.com>

### 5.2 RF connector (WISMO2C2-RFC)

The RF connector is a microminiature coaxial connector MMS series from RADIALL with the following reference :

**R 209 408 012.**

The characteristics of this RF connector and the standard cable assemblies are in appendix.

---

<sup>6</sup> X=2 or 9

### 5.3 SIM Card Reader

- ITT CANNON CCM03 series (see <http://www.ittcannon.com> )
- AMPHENOL C707 series (see <http://www.amphenol.com> )
- JAE (see <http://www.jae.com> )

Drawer type :

- MOLEX 99228-0002 (connector) / MOLEX 91236-0002 (holder) (see <http://www.molex.com> )

### 5.4 Microphone

Possible references :

- HOSIDEN KUF3323
- HOSIDEN KUF4323
- PANASONIC WM64

### 5.5 Speaker

Possible references :

- SANYO M15X0080
- PHILIPS
- PRIMO

### 5.6 Antenna Cable

The following cable reference has been qualified for being mounted on WISMO2C2 :

- RG178

### 5.7 GSM antenna

GSM antennas and support for antenna adaptation can be obtained from manufacturers such as:

- ALLGON (<http://www.allgon.com> )
- MOTECO (<http://www.moteco.com> )
- AMPHENOL (<http://www.amphenol.com> )
- GALTRONICS (<http://www.galtronics.com> )
- RADIALL / LARSEN (<http://www.larsenantennas.com/>)
- RANGESTAR (<http://www.rangestar.com/>)

### 5.8 RF connector

RF connector and accessories can be obtained from RADIALL:

- RADIALL (<http://www.radiall.com/>)

## 6 Design Guidelines

The following paragraphs gives general design guidelines.

### 6.1 HARDWARE and RF

#### 6.1.1 EMC

The EMC tests have to be performed as soon as possible on the application to detect any possible problem.

When designing, special attention should be paid to:

- Possible spurious emission radiated by the application to the RF receiver in the receiver band
- ESD protection on SIM (if accessible from outside), serial link,...
- EMC protection on audio input/output (filters against 900MHz emissions)
- Bias of the Microphone inputs
- Length of the SIM interface lines (preferably <10cm)
- Ground plane : WAVECOM recommends to have a common ground plane for analog / digital / RF grounds.
- Metallic case or plastic casing with conductive paint are recommended

Note :

The module does not include any protection against overvoltage.

#### 6.1.2 Power Supply

The power supply is one of the key issues in the design of a GSM terminal.

A weak power supply design could affect in particular :

- EMC performances
- the emissions spectrum
- the phase error and frequency error

**Warning:**

**Careful attention should be paid to :**

- **Quality of the power supply : low ripple, PFM or PSM systems should be avoided (PWM converter preferred).**
- **Capacity to deliver high current peaks in a short time (pulsed radio emission).**

#### 6.1.3 Layout requirement

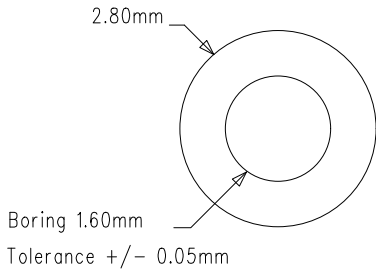


# CHIPS & BORING DIAMETER

of the WISMO MODULES mechanical insertion pins

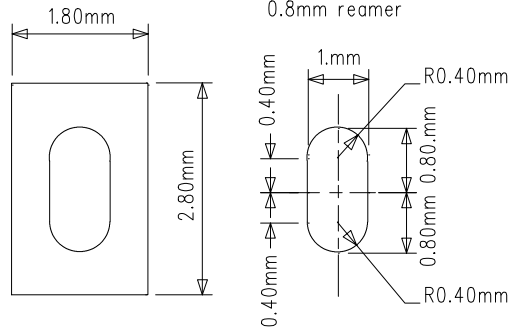
## CASE N 1

To be used in priority



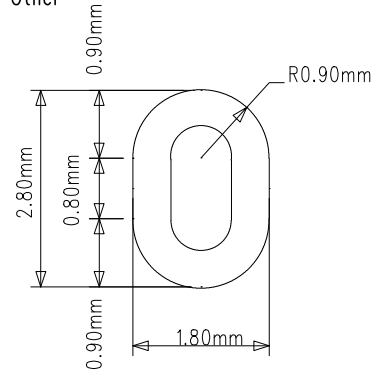
## CASE N 2

on specific request



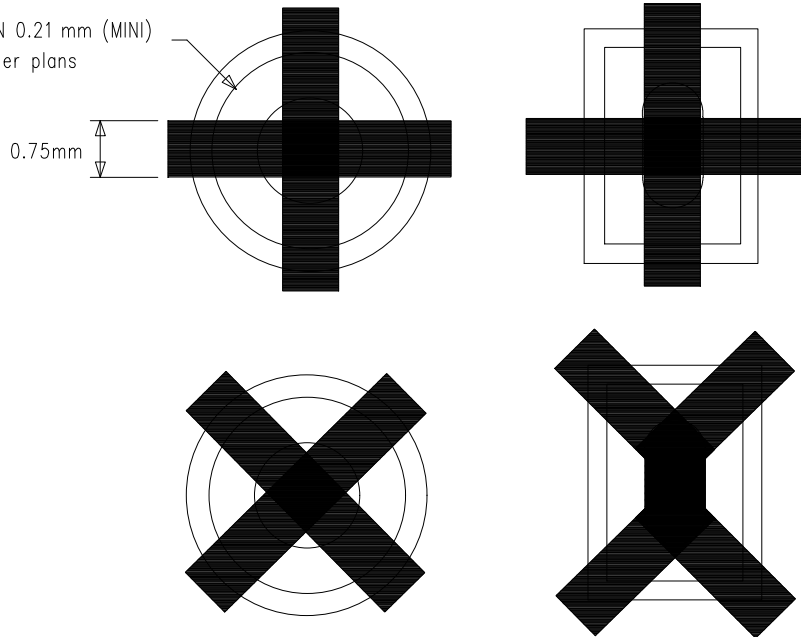
## CASE N 3

Other



## THERMAL BRAKES DEFINITION

ISOLATION 0.21 mm (MINI)  
with copper plans



NORMALISATION INDUSTRIELLE

ETABLI : HER

DATE : 02/07/00

APPROUVE :

SECTION : 1545

# WAVECOM

CHIPS & BORING DIAMETER  
OF THE WISMO  
MECHANICAL INSERTION PINS

#### 6.1.4 Antenna

Antenna sub-system and integration in the application is a major issue.

Attention should be paid to :

- Choice of the antenna cable (type, length, performances, thermal resistance, etc)
- Antenna connector (type + losses)
- ◆ These elements could affect GSM performances such as sensitivity and emitted power
- The antenna should be isolated as much as possible from the digital circuitry (including the interface signals) ◆ it is strongly recommended to shield the terminal.

◆ On terminals including the antenna, a poor shielding could dramatically affect the sensitivity of the terminal.

Moreover, the power emitted through the antenna could affect the application.

**Warning:**

**Wavecom strongly recommends to work with an antenna manufacturer either to develop an antenna adapted to the application or to adapt an existing solution to the application. The antenna adaptation (mechanical and electrical adaptation) is one of the key issues in the design of a GSM terminal.**

#### 6.2 Mechanical integration

Attention should be paid to :

- Antenna cable integration (bending, length, position, etc)
- Legs of the module to be soldered on the Ground plane

## 6.3 Firmware upgrade

The WISMO2C2 firmware is stored in flash memory and it can easily be upgraded.

**In order to follow the regular evolutions of the GPRS standard and to offer state of the art software, Wavecom recommends that the application designed around a WISMO (or WISMO based product) allows easy firmware upgrades on the module via the standard Xmodem protocol. Therefore, the application shall either allow a direct access to the WISMO serial link through an external connector or implement any mechanism allowing the WISMO firmware to be downloaded via Xmodem.**

Two upgrade procedures are available:

### 6.3.1 Nominal upgrade procedure

The firmware file can be downloaded into the modem using the Xmodem protocol.

To enter this mode, the AT+WDWL command (see description in the AT command manual) has to be sent.

The necessary serial signals to proceed with the Xmodem downloading are: Rx, Tx, RTS, CTS and GND.

### 6.3.2 Backup procedure

In case the nominal upgrade mode is not possible (due to critical corruption on the flash memory), a backup procedure is also available. It requires a WAVECOM specific software to download the firmware file into the modem.

This tool has to run on a PC connected to the serial bus of the modem.

The necessary signals to proceed with the downloading are: Rx, Tx, RTS, CTS and GND.

Prior to running the WAVECOM downloader, the modem has to be set in download mode.

For this, the BOOT signal has to be set to low while powering ON (or resetting) the modem.

**Advise :** To reduce the time of the download, it's possible to change the speed of the serial link at 115200 bits/s. for that, you have to execute the AT command herebelow:

- 1) AT+IPR=115200
- 2) AT+WDWL
- 3) file transfer
- 4) AT+CFUN=1 (reset of the module)

Make attention that after the last command, the serial link will be by default at 9600 bits/s.

## 7 Appendix

### 7.1 Wavecom acceptance test

These tests are Wavecom internal qualification tests. They are performed on a Wavecom evaluation platform (module on test board).

| Test                          | Applied standard   | Acceptance criteria   |
|-------------------------------|--|---|
| Performance Test              | ETSI recommendation for GSM900/GSM1800 (and GSM900/GSM1900) communication. | Full conformity to the recommendation regarding the main RF parameters.   |
| Cooking Test                  | -  | The test continues even after the Cooking Test milestone has been reached   |
| Stress Test                   | Therma shocks IEC 68-2-14.   | Full conformity to the recommendation regarding the main parameters.  |
| Vibration Test                | Sinusoidal vibration IEC 68-2-6.   | No performance degradation or mechanical degradation is allowed after test.   |
| Vibration Test                | Random vibration IEC 68-2-36.  | No performance degradation or mechanical degradation is allowed after test.   |
| Shock Test                    | IEC 68-2-27.   | No performance degradation or mechanical degradation is allowed after test.   |
| Bump Test                     | IEC 68-2-29.   | No performance degradation or mechanical degradation is allowed after test.   |
| Humidity Test                 | Corrosion test IEC 68-2-3.   | No visible degradation of the product, both visual and fonctionnal.<br>The unit is tested at room temperature and must be fully operative for the main RF parameters.     |
| Warehouse Tet                 | Low temperance IEC 68-2-1.   | Under normal condition (room temperature) after the test, the unit must behave in full conformity with the main RF parameters specification.                              |
| Warehouse Test                | High temperature IEC 68-2-2.   | Under normal condition (room temperature) after the test, the unit must behave in full conformity with the main RF parameters specification.                              |
| Dust Test1                    | MIL-STD-810D, method 510-3.  | No visible dust in the visible areas. No more than 50 dust particules in the cabinet of the product. The unit, tested at room temperature must be fully operative.        |
| Light Test1                   | UV radiation and temperature EDF HN60E03.                                  | Visual inspection on the discoloration and other degradation effects such as cracks in the material of the unit after the test.   |
| Fall Test1                    | IEC 68-2-32.   | Only minor casing degradation is allowed, with a maximum dimension change of 1mm. The unit must remain fully operative and full specification for the main RF parameters. |
| Electro Static Discharge Test | IEC 1000-4-2.  | No performance degradation allowed after the test.  |
| Salt Mist Test                | IEC 68-2-11  | After the test, visual inspection on the unit.  |
| Atmosphere Test               | Flowing mixed gas corrosion. IEC 68-2-60                                   | After the test, visual inspection on the unit and inside.   |
| Marking Test                  | EN 60 950  | After the test, visual inspection on the unit. No degradation is allowed on the marking.  |

## 7.2 Label marking

Under Construction

## 7.3 Reference documents

GSM ETSI recommendations for Phase I and Phase II.

| Specification Reference    | Title  |
|----------------------------|--|
| GSM900/1800/1900 ph2 Radio | ETSI GSM 05.05 v7.1.0 release 1998   |
| GSM ph2 Link-Management    | ETSI GSM 03.06, 04.08, 05.05, 05.08, 05.10, 07.01 and GT 01 v4.2.1   |
| GSM ph2 Link-Management    | ETSI GSM 03.06, 04.08, 05.05, 05.08, 05.10, 07.01 and GT 01 v4.2.1   |
| GSM ph2 Layer 2            | ETSI GSM 04.06 and GT 01 v4.2.1  |
| GSM900 ph2 Layer 3         | ETSI GSM 04.08 and GT 01 v4.2.1  |
| GSM1800 ph2 Layer 3        | ETSI GSM 04.08 and GT 01 v4.2.1  |
| GSM900/GSM1800 Multiband   | ETSI GSM 02.07, 03.22, 04.08, 04.13, 05.05, 05.08 and GT 01 v4.2.1   |
| GSM ph2 SIM                | ETSI GSM 11.11 and GT 01 v4.2.1  |
| GSM ph2 Teleservices       | ETSI GSM 03.50 and GT 01 v4.2.1  |
| GSM ph2 Miscellaneous      | ETSI GSM 02.07, 03.40, 03.41, 04.08, 04.10, 04.11, 06.10, 06.11, 06.12, 06.31, 06.32, 07.01, 09.07 and GT 01 v4.2.1            |
| GSM1800 ph2 Miscellaneous  | ETSI GSM 02.07, 03.40, 03.41, 04.08, 04.10, 04.11, 06.10, 06.11, 06.12, 06.31, 06.32, 07.01, 09.07 and GT 01 v4.2.1            |
| GSM1900 ph2+               | EN 300 919 V7.1.0 (1999-07) European standard (Telecommunications series) Digital cellular telecommunications system (phase2+) |

## 7.4 Safety recommendations (for information only)

**IMPORTANT  
FOR THE EFFICIENT AND SAFE OPERATION OF  
YOUR GSM APPLICATION BASED ON WISMO2C  
PLEASE READ THIS INFORMATION CAREFULLY**

### 7.4.1 RF safety

#### 7.4.1.1 General

Your GSM terminal<sup>7</sup> is based on the GSM standard for cellular technology. The GSM standard is spread all over the world. It covers Europe, Asia and some parts of America and Africa. This is the most used telecommunication standard.

Your GSM terminal is actually a low power radio transmitter and receiver. It sends out and receives radio frequency energy. When you use your GSM application, the cellular system which handles your calls controls both the radio frequency and the power level of your cellular modem.

#### 7.4.1.2 Exposure to RF energy

There has been some public concern about possible health effects of using GSM terminals. Although research on health effects from RF energy has focused on the current RF technology for many years, scientists have begun research regarding newer radio technologies, such as GSM. After existing research had been reviewed, and after compliance to all applicable safety standards had been tested, it has been concluded that the product was fitted for use.

If you are concerned about exposure to RF energy there are things you can do to minimize exposure. Obviously, limiting the duration of your calls will reduce your exposure to RF energy. In addition, you can reduce RF exposure by operating your cellular terminal efficiently by following the below guidelines.

#### 7.4.1.3 Efficient terminal operation

For your GSM terminal to operate at the lowest power level, consistent with satisfactory call quality :

If your terminal has an extendible antenna, extend it fully. Some models allow you to place a call with the antenna retracted. However your GSM terminal operates more efficiently with the antenna fully extended.

Do not hold the antenna when the terminal is « IN USE ». Holding the antenna affects call quality and may cause the modem to operate at a higher power level than needed.

---

<sup>7</sup> based on WISMO2C2

#### 7.4.1.4 Antenna care and replacement

Do not use the GSM terminal with a damaged antenna. If a damaged antenna comes into contact with the skin, a minor burn may result. Replace a damaged antenna immediately. Consult your manual to see if you may change the antenna yourself. If so, use only a manufacturer-approved antenna. Otherwise, have your antenna repaired by a qualified technician.

Use only the supplied or approved antenna. Unauthorized antennas, modifications or attachments could damage the terminal and may contravene local RF emission regulations or invalidate type approval.

#### 7.4.2 General safety

##### 7.4.2.1 Driving

Check the laws and the regulations regarding the use of cellular devices in the area where you have to drive as you always have to comply with them. When using your GSM terminal while driving, please :

- give full attention to driving,
- pull off the road and park before making or answering a call if driving conditions so require.

##### 7.4.2.2 Electronic devices

Most electronic equipment, for example in hospitals and motor vehicles is shielded from RF energy. However RF energy may affect some improperly shielded electronic equipment.

##### 7.4.2.3 Vehicle electronic equipment

Check your vehicle manufacturer representative to determine if any on-board electronic equipment is adequately shielded from RF energy.

##### 7.4.2.4 Medical electronic equipment

Consult the manufacturer of any personal medical devices (such as pacemakers, hearing aids, etc...) to determine if they are adequately shielded from external RF energy.

Turn your terminal **OFF** in health care facilities when any regulations posted in the area instruct you to do so. Hospitals or health care facilities may be using RF monitoring equipment.

#### 7.4.2.5 Aircraft

Turn your terminal OFF before boarding any aircraft.

- Use it on the ground only with crew permission.
- Do not use it in the air.

To prevent possible interference with aircraft systems, Federal Aviation Administration (FAA) regulations require you to have permission from a crew member to use your terminal while the aircraft is on the ground. To prevent interference with cellular systems, local RF regulations prohibit using your modem while airborne.

#### 7.4.2.6 Children

Do not allow children to play with your GSM terminal. It is not a toy. Children could hurt themselves or others (by poking themselves or others in the eye with the antenna, for example). Children could damage the modem, or make calls that increase your modem bills.

#### 7.4.2.7 Blasting areas

To avoid interfering with blasting operations, turn your unit **OFF** when in a « blasting area » or in areas posted : « turn off two-way radio ». Construction crew often use remote control RF devices to set off explosives.

#### 7.4.2.8 Potentially explosive atmospheres

Turn your terminal **OFF** when in any area with a potentially explosive atmosphere. It is rare, but your modem or its accessories could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injuries or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fueling areas such as petrol stations ; below decks 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.

Do not transport or store flammable gas, liquid, or explosives, in the compartment of your vehicle which contains your terminal or accessories.

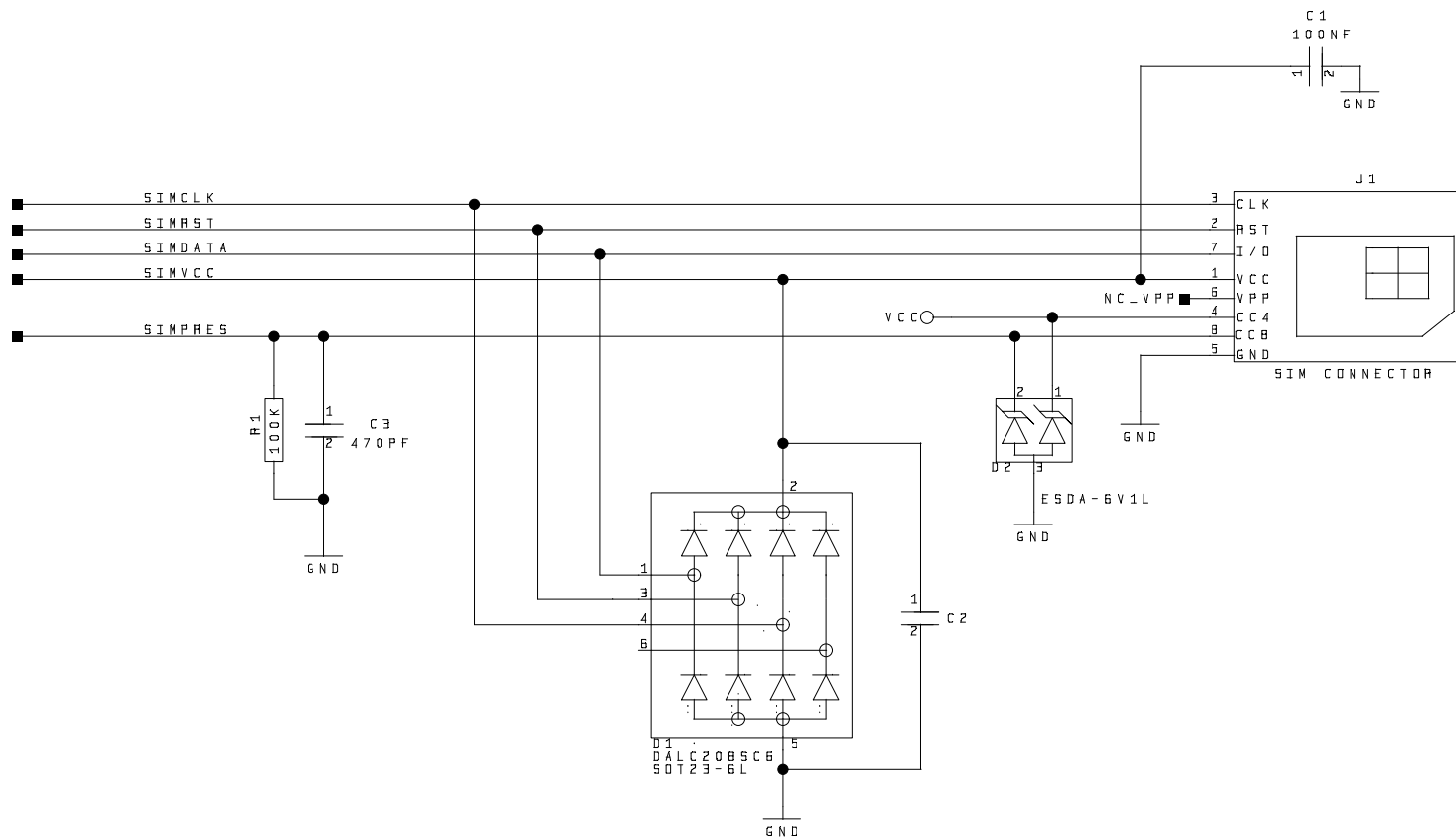
Before using your terminal in a vehicle powered by liquefied petroleum gas (such as propane or butane) ensure that the vehicle complies with the relevant fire and safety regulations of the country in which the vehicle is to be used.



## 7.5 Application notes for the SIM interface

The next 2 pages are application notes to interface the module with SIM cards:

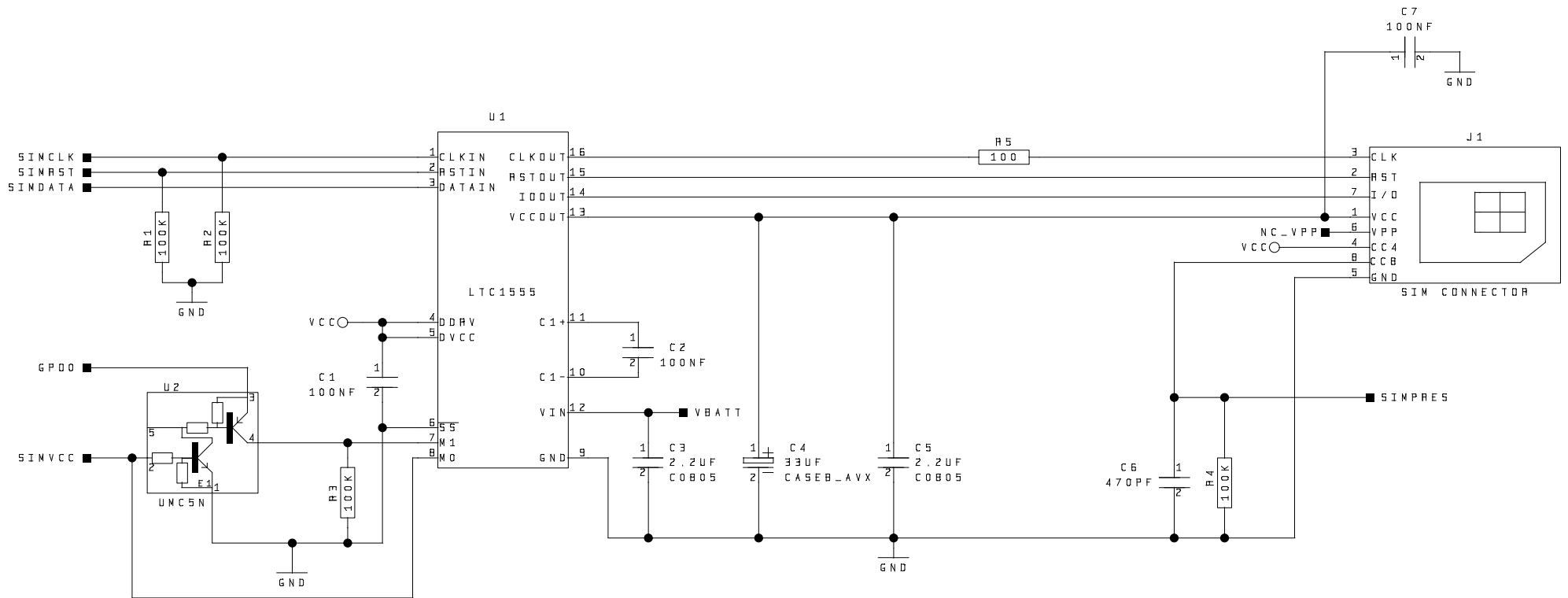
- application note #1: interface with 3V SIMs
- application note #2: interface with 3V/5V SIMs




- C1 HAS TO BE CLOSE J1
- ESD PROTECTION CAPACITANCE IS LESS THAN 10PF FOR SIMDATA AND SIMCLK
- ESD PROTECTION HAS TO BE CLOSE J1
- 470nF Max for C2

The shock wave in the wireless world

|   |  |
|---|--|
| PROJECT: APPLICATION NOTE   | Sheet: 1/1                                   |
| SCHEMATIC: SIM 3V ONLY (WISMD2C-2)  |  |
| WAVECOM<br>39 Rue du Gouverneur Eboe<br>92130 ISSY LES MOULINEAUX<br>FRANCE | Date: 31/08/2001<br>Version: 3.00<br>Eng:FDL |



- C4 HAS TO BE CLOSE (13) & (9) OF U1
- C4 IS A LOW ESR TANTALUM CAPACITOR
- C7 HAS TO BE CLOSE J1



# WAVECOM

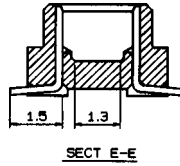
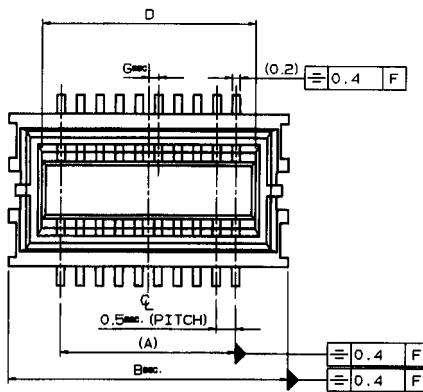
The shock wave in the wireless world

|   |  |
|---|--|
| PROJECT: APPLICATION NOTE   | Sheet: 1/1                                   |
| SCHEMATIC: SIM 3V-5V (WIS02C2)  |  |
| WAVECOM<br>39 Rue du Gouverneur Eboe<br>92130 ISSY LES MOULINEAUX<br>FRANCE | Date: 04/09/2001<br>Version: 2.00<br>Eng:FDL |

## 7.6 General Purpose Connector data sheet

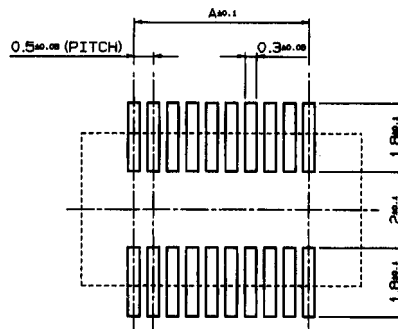
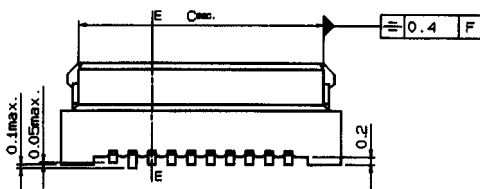
The next pages are the KYOCERA/ELCO data sheets for the GPC (also available from <http://www.avxcorp.com> .

## Surface Mount Vertical Plug

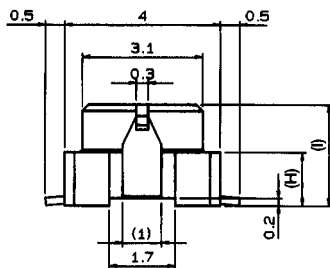


### Specifications:

- 1000 per Tape and Reel
- Voltage - 50 V
- Current Rating - 0.4 A
- Dielectric Withstanding Voltage - 500 V
- Operating Temperature - (-25°C ~ +85°C)
- Contact Material - phosphor bronze
- Insulator Material - PPS (UL 94 V-0)



MOUNTING LAYOUT



| No. of Pos. | P/N                 | A         | B         | C         | D         | G          |
|-------------|---------------------|-----------|-----------|-----------|-----------|------------|
| 20          | 10 5087 020 XX0 861 | 4.5/.177  | 7.2/.283  | 6.2/.244  | 5.5/.217  | 0.25/.0098 |
| 30          | 10 5087 030 XX0 861 | 7.0/.276  | 9.7/.382  | 8.7/.343  | 8.0/.315  | 0.50/.0196 |
| 36          | 10 5087 036 XX0 861 | 8.5/.335  | 11.2/.441 | 10.2/.402 | 9.5/.374  | 0.25/.0098 |
| 40          | 10 5087 040 XX0 861 | 9.5/.374  | 12.2/.480 | 11.2/.441 | 10.5/.414 | 0.25/.0098 |
| 50          | 10 5087 050 XX0 861 | 12.0/.472 | 14.7/.579 | 13.7/.539 | 13.0/.512 | 0.50/.0196 |
| 60          | 10 5087 060 XX0 861 | 14.5/.571 | 17.2/.677 | 16.2/.638 | 15.5/.610 | 0.25/.0098 |

Dimensions millimeters/inches

### ORDERING CODE

Typical Example

**14** **5087** **0XX** **2XX** **861**

**14: PLUG - Tape and Reel**

**NUMBER OF CONTACTS:**

40, 60 : 3.0mm Stack

36, 40, 50 : 3.5mm Stack

20, 30, 36,

50, 60 : 4.0mm Stack

**2:** Without Adhesive Tape

**9:** Adhesive Cover Tape

**VARIATION CODE:**

30 H I  
.9 2.15

35 1.4 2.7

40 1.9 3.2

**PLATING VARIATION:**

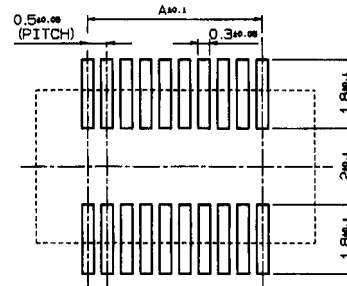
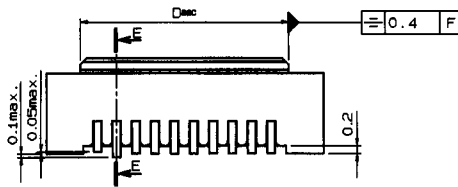
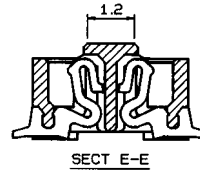
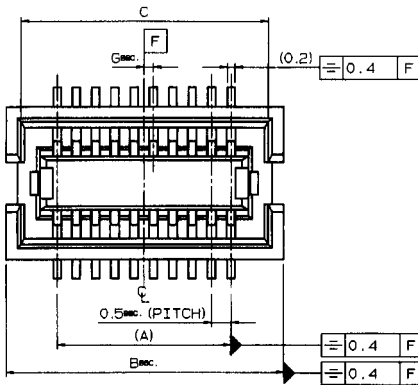
**861:** 15 microinches of gold with gold flash tails

Consult factory for other sizes

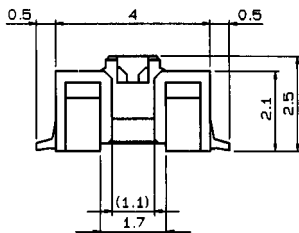
## Surface Mount Vertical Receptacle

### Specifications:

- 1000 per Tape and Reel
- Voltage - 50 V
- Current Rating - 0.4 A
- Dielectric Withstanding Voltage - 500 V
- Operating Temperature - (-25°C ~ +85°C)
- Contact Material - phosphor bronze
- Insulator Material - PPS (UL 94 V-0)



MOUNTING LAYOUT



| No. of Pos. | P/N                 | A         | B         | C         | D         | G          |
|-------------|---------------------|-----------|-----------|-----------|-----------|------------|
| 20          | 20 5087 020 x00 861 | 4.5/.177  | 7.2/.283  | 6.4/.252  | 5.4/.213  | 0.25/.0098 |
| 30          | 20 5087 030 x00 861 | 7.0/.276  | 9.7/.382  | 8.9/.350  | 7.9/.311  | 0.50/.0196 |
| 36          | 20 5087 036 x00 861 | 8.5/.335  | 11.2/.441 | 10.4/.409 | 9.4/.370  | 0.25/.0098 |
| 40          | 20 5087 040 x00 861 | 9.5/.374  | 12.2/.480 | 11.4/.449 | 10.4/.409 | 0.25/.0098 |
| 50          | 20 5087 050 x00 861 | 12.0/.472 | 14.7/.579 | 13.9/.547 | 12.9/.508 | 0.50/.0196 |
| 60          | 20 5087 060 x00 861 | 14.5/.570 | 17.2/.677 | 16.4/.646 | 15.4/.606 | 0.25/.0098 |

Dimensions millimeters/inches

### ORDERING CODE

Typical Example

24

5087

0XX

200

861

24: Receptacle - Tape and Reel

NUMBER OF CONTACTS:

20, 30, 36, 40, 50, 60

2: Without Adhesive Tape

9: Adhesive Cover Tape

PLATING VARIATION:

861: 15 microinches of gold with gold flash tails

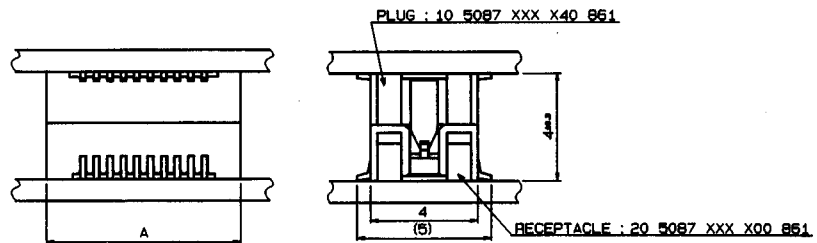
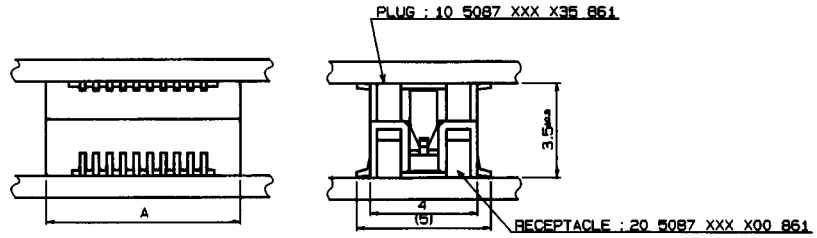
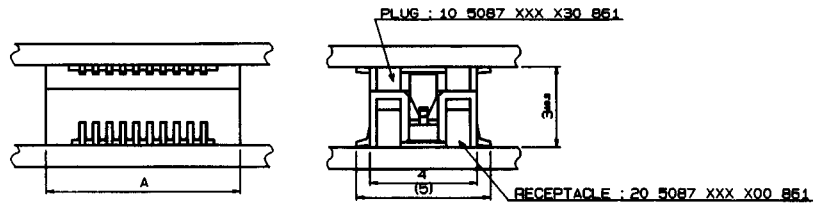
Consult factory for other sizes

# 0,5 mm Spacing

# Applications

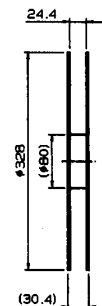
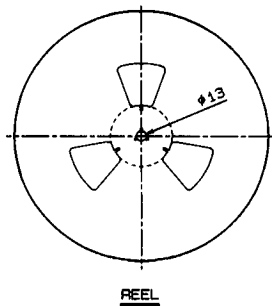
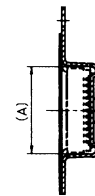
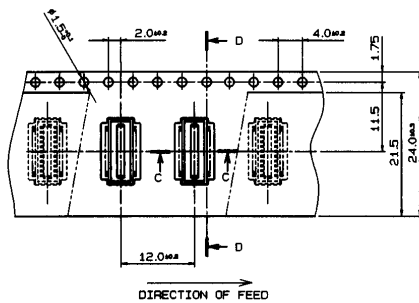
|       | P/N                 | Stacking Height |
|-------|---------------------|-----------------|
| PLUG  | 10 5087 xxx x30 861 | 3.0             |
| RECE. | 20 5087 xxx x00 861 |                 |
| PLUG  | 10 5087 xxx x35 861 | 3.5             |
| RECE. | 20 5087 xxx x00 861 |                 |
| PLUG  | 10 5087 xxx x40 861 | 4.0             |
| RECE. | 20 5087 xxx x00 861 |                 |

| No. of Pos. | A        |
|-------------|----------|
| 20          | 7.2/283  |
| 30          | 9.7/382  |
| 36          | 11.2/441 |
| 40          | 12.2/480 |
| 50          | 14.7/579 |
| 60          | 17.2/677 |



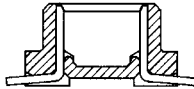
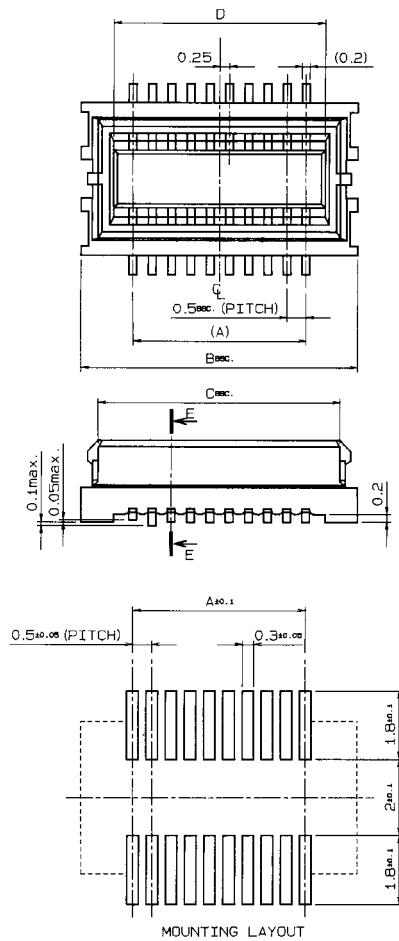
# 0,5 mm Spacing

# Tape and Reel



# Super Micro Connectors 0.5mm Pitch

## Series 5087 Plug



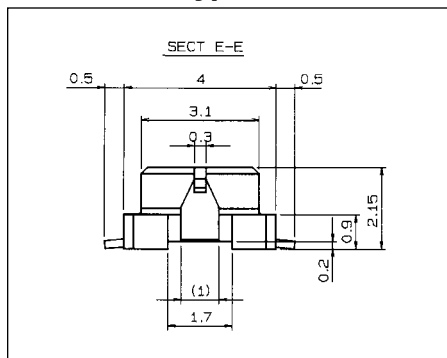
### ORDERING CODE

14 5087 0XX X XX 8XX

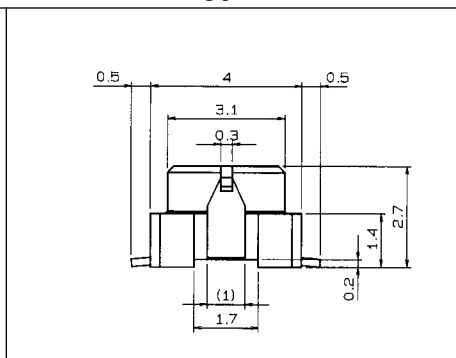
- FINISH
  - 861 = Ni Under Coated  
1.25µm min.  
Gold-Mating Area  
Au 0.38µm min.
  - 829 = Ni Under Coated  
1.25µm min.  
Gold-Mating Area  
Au 0.1µm min.
- VARIATION
  - 30 : H = 3.0mm
  - 35 : H = 3.5mm
  - 40 : H = 4.0mm
- TYPE
  - 0 = without Boss with Retention Clip
  - 2 = without Boss, Retention Clip
  - 9 = without Boss, Retention Clip, with Adhesive Tape
- NUMBER OF POSITIONS (20, 30, 32, 36, 40, 50, 60)
- SERIES
- TAPE AND REEL  
14 = Plug

A = 0.5 (± -1)  
 B = 0.5 (± -1)+2.7  
 C = 0.5 (± -1)+1.7  
 D = 0.5 (± -1)+1.0

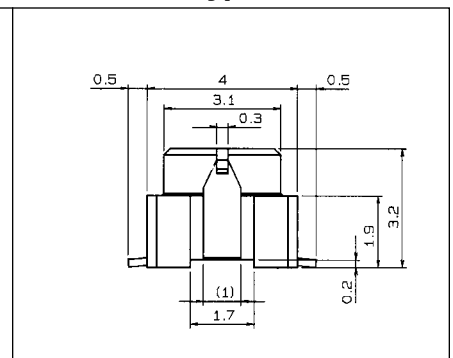
### H = 3.0mm Type



### H = 3.5mm Type



### H = 4.0mm Type

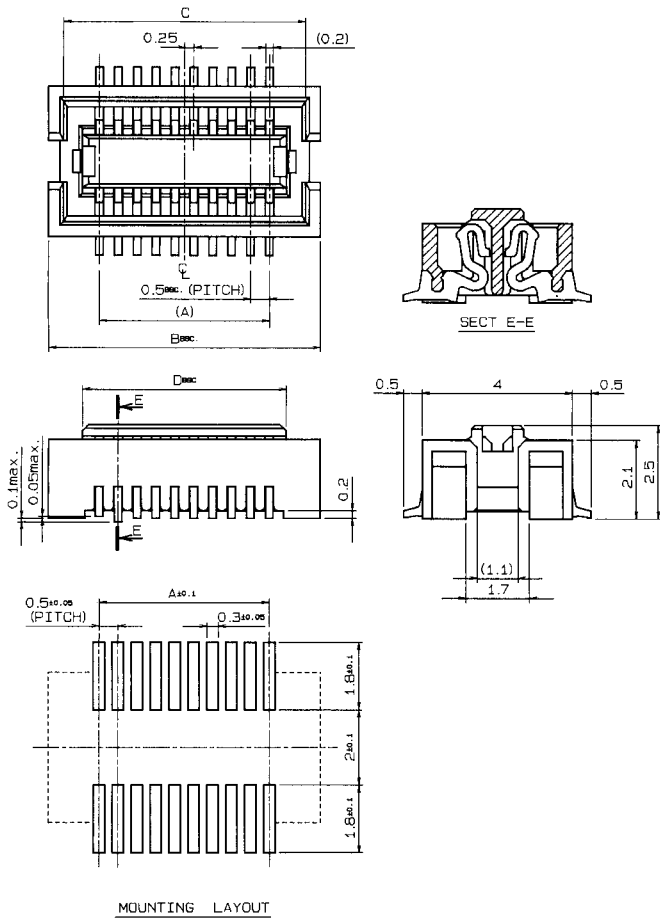


Additional information on this product is available from AVX's catalog or AVX's FAX Service. Call 1-800-879-1613 and request document #269. Visit our website <http://www.avxcorp.com>

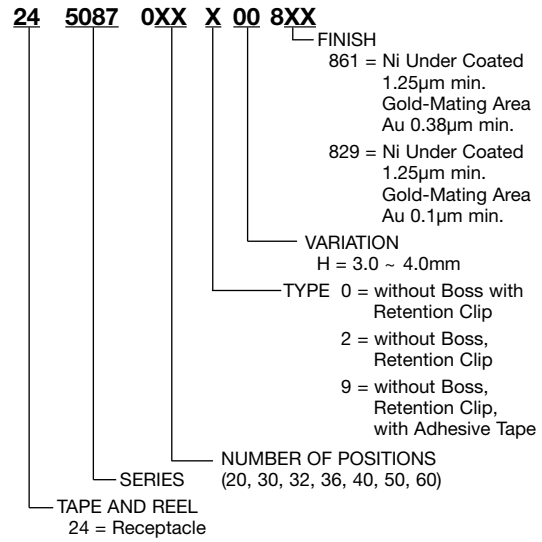


# Super Micro Connectors 0.5mm Pitch

## Series 5087 Receptacle H = 3.0 ~ 4.0mm Type



### ORDERING CODE

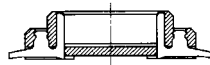
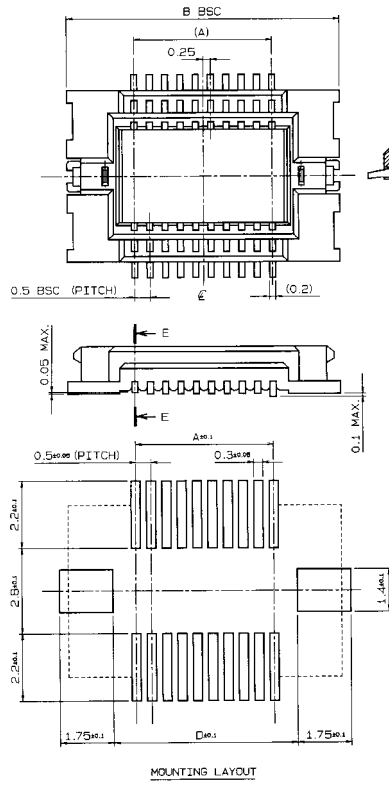


|              |
|--------------|
| A = 0.5 (±1) |
| B = A + 2.7  |
| C = A + 1.9  |
| D = A + 0.9  |

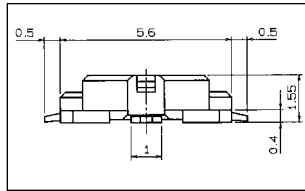
Additional information on this product is available from AVX's catalog or AVX's FAX Service. Call 1-800-879-1613 and request document #270. Visit our website <http://www.avxcorp.com>

# Super Micro Connectors 0.5mm Pitch

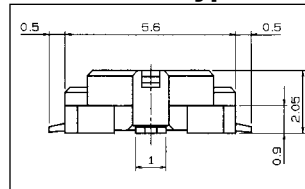
## Series 5087 Plug



**H = 2.0mm Type**



**H = 2.5mm Type**



### ORDERING CODE

14 5087 0XX X XX 8XX

FINISH  
 861 = Ni Under Coated  
 1.25µm min.  
 Gold-Mating Area  
 Au 0.38µm min.  
 829 = Ni Under Coated  
 1.25µm min.  
 Gold-Mating Area  
 Au 0.1µm min.

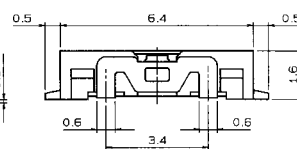
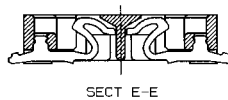
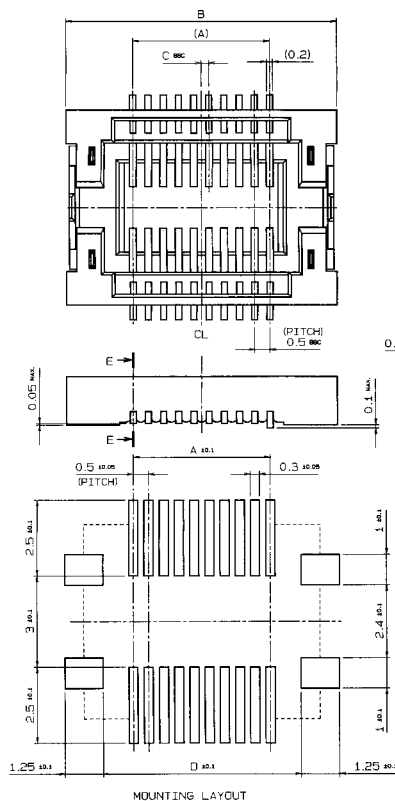
VARIATION  
 20 : H = 2.0mm  
 25 : H = 2.5mm

TYPE 0 = without Boss with Retention Clip  
 2 = without Boss, Retention Clip  
 9 = without Boss, Retention Clip, with Adhesive Tape

NUMBER OF POSITIONS  
 (10\*, 20, 30, 40, 50, 60) \*2.0mm H only

SERIES  
 TAPE AND REEL  
 14 = Plug

## Series 5087 Receptacle H = 2.0 ~ 2.5mm Type



### ORDERING CODE

24 5087 0XX X 01 8XX

FINISH  
 861 = Ni Under Coated  
 1.25µm min.  
 Gold-Mating Area  
 Au 0.38µm min.  
 829 = Ni Under Coated  
 1.25µm min.  
 Gold-Mating Area  
 Au 0.1µm min.

VARIATION  
 H = 2.0 ~ 2.5mm

TYPE 0 = without Boss with Retention Clip  
 2 = without Boss, Retention Clip  
 9 = without Boss, Retention Clip, with Adhesive Tape

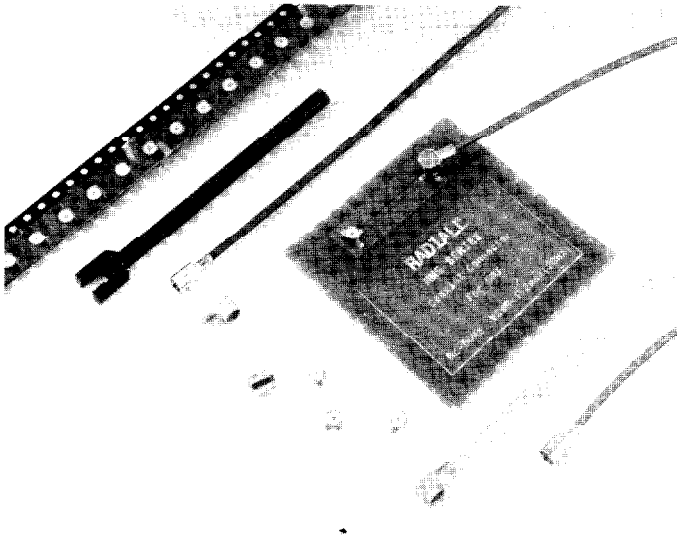
NUMBER OF POSITIONS  
 (10, 20, 30, 40, 50, 60)

SERIES  
 TAPE AND REEL  
 24 = Receptacle

Additional information on this product is available from AVX's catalog or AVX's FAX Service. Call 1-800-879-1613 and request document #271. Visit our website <http://www.avxcorp.com>

## 7.7 MMS Connector data sheet

The next pages are the RADIALL data sheets for the MMS connector (also available from <http://www.radiall.com/>).



|             |            |
|-------------|------------|
| 50 $\Omega$ | DC - 6 GHz |
| 75 $\Omega$ | DC - 1 GHz |

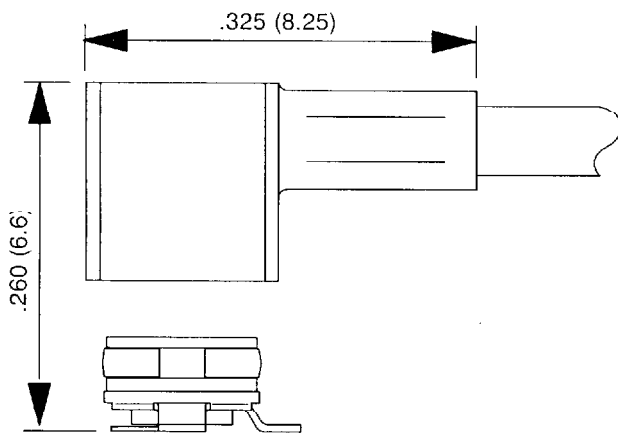
### GENERAL

- Low profile coaxial connectors
- Surface-mount receptacle (SMT)
- Fully compatible with automated pick and place machines
- Snap-on mating
- High RF performance :
  - VSWR : 1.05 at 1 GHz / 1.15 at 2.5 GHz
  - RF leakage : -40 dB at 2 GHz
- Competitive pricing

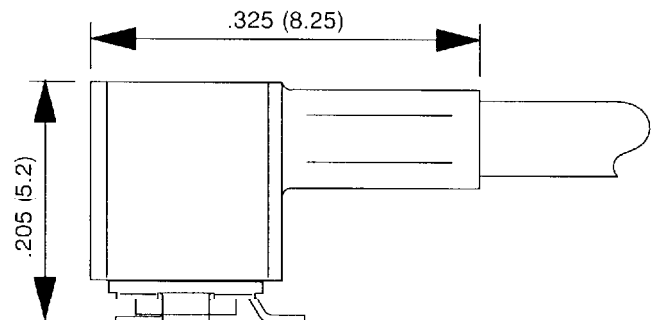
### APPLICATIONS

- Base stations and hand-sets for :
  - cellular telephones
  - cordless telephones
- Satellite reception terminals (GPS, . . .)
- Instrumentation
- Wireless datacom networks
- Automated payment systems
- Videocommunications
- Other general electronics

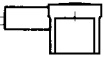
### PROFILE



Unmated



Mated



|  | TEST STANDARD | RESULTS |
|--|---------------|---------|
|--|---------------|---------|

### ELECTRICAL CHARACTERISTICS

| Impedance                 | Frequency range             | 50 Ω  | 75 Ω     |
|---------------------------|-----------------------------|---|----------|
|                           |                             | DC-6 GHz  |          |
| V.S.W.R. (mated pair)     | IEC 1169-1                  | 1.05 at 1 GHz<br>1.15 at 2.5 GHz<br>1.35 at 6 GHz       | DC-1 GHz |
| Insertion loss            | IEC 1169-1                  | 0.2 dB at 2 GHz   |          |
| RF leakage (mated pair)   | MIL STD 1344 method 3008    | -50 dB at 500 MHz<br>-45 dB at 1 GHz<br>-40 dB at 2 GHz |          |
| Outer contact resistance  | NF-C 93050 (I = 40 mA peak) | 5m Ω max  |          |
| Center contact resistance | NF-C 93050 (I = 40 mA peak) | 15m Ω max   |          |
| Insulation resistance     | IEC 1169-1                  | 500 MΩ min (under 250 V RMS)                            |          |
| Working voltage           |                             | 50 V RMS  |          |
| Testing voltage (V RMS)   | IEC 1169-1                  | Ø 1 mm : 250 ; Ø 2 mm : 500                             |          |
| Maximum admissible power  |                             | 40 W at 1 GHz / 20°C / V.S.W.R. = 1                     |          |

### MECHANICAL CHARACTERISTICS

|                           |                      |  |
|---------------------------|----------------------|--|
| Durability                | IEC 1169-1           | 50 matings                                     |
| Force to engage           | IEC 1169-1           | 7 N avg  |
| Force to disengage        | IEC 1169-1           | 5.5 N avg                                      |
| Shocks (drop test)        | IEC 68-2-27          | 50 g/11 ms ; 3 shocks/axis/way                 |
| Random vibrations         | Général Motors spec. | Sine waves 5 to 1000 Hz<br>3 to 30g - 1 H/axis |
| Bumps (mechanical shocks) | IEC 68-2-29          | 25 g/6 ms 1000 bumps/axis/way                  |
| Cable retention force     | IEC 1169-1           | Ø 1 mm : 20 N ; Ø 2 mm : 35 N                  |
| Solderability             | IEC 68-2-54          | Passed   |

### ENVIRONMENTAL CHARACTERISTICS

|                   |          |  |
|-------------------|----------|--|
| Temperature range |          | -40°C / +90°C                                  |
| Climatic cycles   | GAM I 13 | 48 H at 70°C - 24 H at 40°C/93% -36 H at -25°C |

### MATERIALS

|                                   |                       |
|-----------------------------------|-----------------------|
| Bodies plugs / in series adapters | Die cast zinc / brass |
| Bodies receptacles                | Phosphor bronze       |
| Center contact male               | Brass                 |
| Center contact female             | Beryllium copper      |
| Insulator                         | PTFE                  |

### PLATING

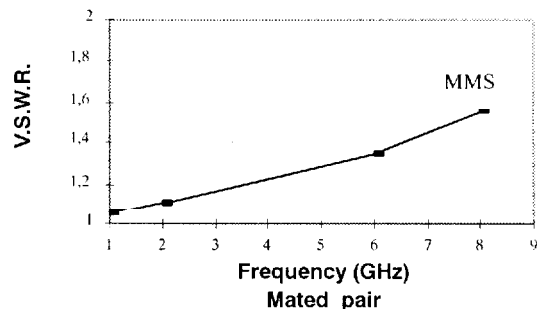
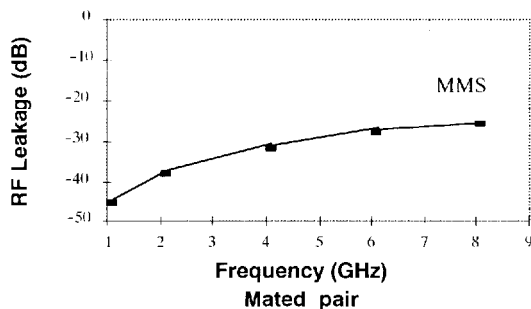
|                                  |        |
|----------------------------------|--------|
| Bodies plugs, in series adapters | Nickel |
| Bodies receptacles               | Gold   |
| Center contact male              | Nickel |
| Center contact female            | Gold   |

### POWER RATING

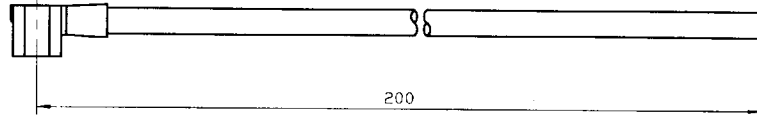
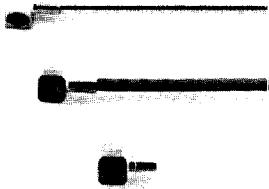
All dimensions are given in mm.

Example : P = 23 W at F= 1.8 GHz, T = 40°C, V.S.W.R. = 1.1

For any further information about the power handled, please see our power application guide (**D1 033 DE**).

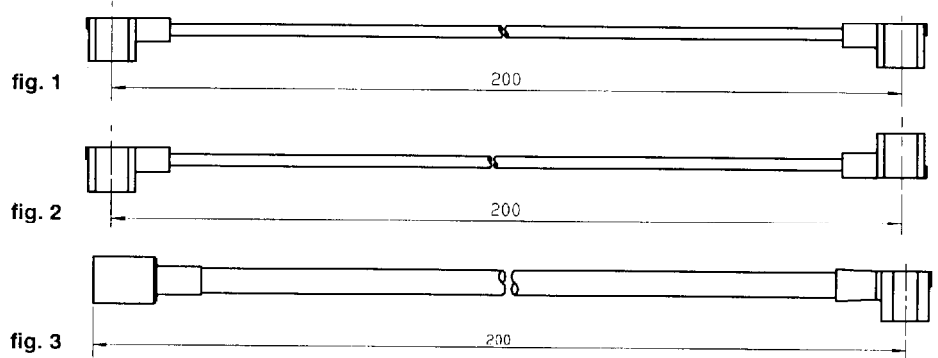


### MMS PIGTAILS



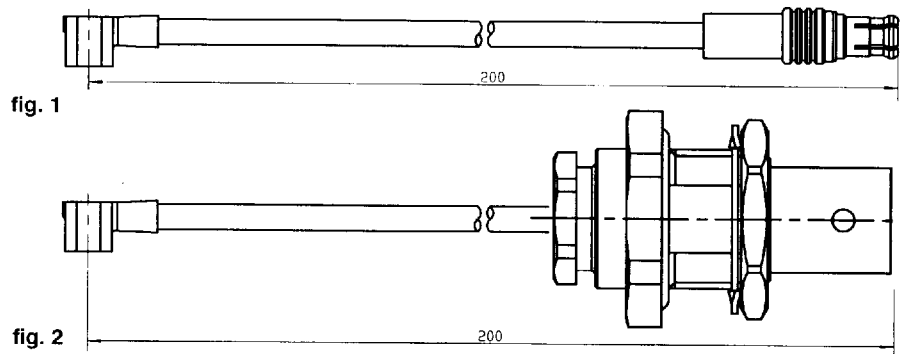
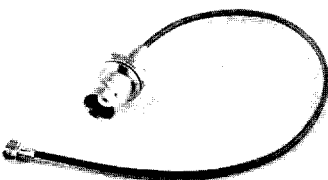
| cable group | part number  | composition                 |
|-------------|--------------|-----------------------------|
| 1 /50/ S    | R285 001 001 | R209 351 020 + C291 050 066 |
| 2 /50/ S    | R285 001 021 | R209 353 000 + C291 145 060 |
| 2 /50/ D    | R285 001 031 | R209 355 000+ C291 146 087  |
| 2 /75/ S    | R285 001 041 | R209 353 000 + C291 305 000 |

### MMS CABLE ASSEMBLIES



| cable group | part number  | fig. | composition                                |
|-------------|--------------|------|--|
| 1 /50/ S    | R285 004 001 | 1    | R209 351 020 + C291 050 066 + R209 351 020 |
| 1 /50/ S    | R285 005 001 | 2    | R209 351 020 + C291 050 066 + R209 351 020 |
| 2 /50/ S    | R285 004 221 | 1    | R209 353 000 + C291 145 060 + R209 353 000 |
| 2 /50/ S    | R285 005 221 | 2    | R209 353 000 + C291 145 060 + R209 353 000 |
| 2 /50/ S    | R285 003 221 | 3    | R209 080 000 + C291 145 060 + R209 353 000 |

### BETWEEN SERIES CABLE ASSEMBLIES



| cable group | part number  | fig. | composition                                | series  |
|-------------|--------------|------|--|---------|
| 2 /50/ S    | R285 017 221 | 1    | R209 353 000 + C291 145 060 + R113 081 020 | MMS/MCX |
| 2 /50/ S    | R285 031 221 | 2    | R209 353 000 + C291 145 060 + R141 323 000 | MMS/BNC |