WISMO Quik Q2500 series

WISMO Quik Q2501
Product Specification

Reference: **WM_PRJ_Q2501_PTS_001**
Revision: **002**
Date: **February 2004**

Document Information

Revision	Date	History of the evolution	
001	Nov 03	First Edition	
002	Feb 04	Deletion of GPS external interruption (GPS_EXTINT1). Addition of GSM baseband activation indicator (GSM_BBEN) § 3.6.9 Addition of a dedicated GPIO for SIM 3V/1V8 or 3V/5V selection. Addition of electrical characteristics § 3.9 & 4.2 Renaming of GSM_TXBURST as GSM_PAC_EN Modification of Figures 6, 7, 19, 23. Update of § 1.1, 2.4, 3.4, 3.5.2.2.1, 3.5.3, 3.5.4.1, 3.6.3.2, 3.6.5, 3.6.6, 3.6.7, 3.7.1, 3.7.5, 4.3.1, 4.3.2	

Overview

This document describes the WISMO Quik Q2501 module. This module is an E-GSM/DCS - GPRS 900/1800 MHz dual band transceiver plus a 16-channel GPS receiver.

The WISMO Quik Q2501 memory configuration is:

- GSM/GPRS part: 32 Mbits of Flash memory and 4 Mbits of SRAM,

- GPS part 8 Mbits of Flash memory.

This module is dedicated to automotive applications, driven by AT commands.

This document:

- Describes the architecture of the WISMO Quik Q2501 and interworking between GSM/GPRS and GPS functionalities,

- Presents all the interfaces available on the WISMO Quik Q2501,

- Gives the electrical and mechanical characteristics of the WISMO Quik Q2501.

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Caution

Information furnished herein by WAVECOM are accurate and reliable. However no responsibility is assumed for its use. Please read carefully the safety precautions for an application based on WISMO Quik Q2501 module.

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1 References

1.1 Reference Documents

[1] Automotive Environmental Control Plan for WISMO Quik Q2501
Ref. WM_PJQ_Q2501_DCP_001

[2] WISMO Quik Q2501 Customer Design Guidelines
Ref. WM_PRJ_Q2501_PTS_002

[3] WISMO Quik Q2501 Process Customer Guideline
Ref. WM_PRJ_Q2501_PTS_003

[4] AT Commands Interface Guide for revision X50
Ref. WM_ASW_OAT_UGD_016

[5] Specific AT commands for GPS management
Ref. WM_RNASW_Q2501_UGD_001

1.2 Glossary

Term	Definition
Performing a FIX	Means the GPS receiver is able to compute a position
Dead reckoning	GPS Feature that allows navigation with poor/no satellites view by the aid of external sensors that provide course (odometer) and heading (gyroscope).
Single Coax	WAVECOM concept that allows the user to use only one single coaxial cable for both GSM and GPS RF signal to connect the WISMO Quik Q2501 module to the antennas. The antennas are most of the time physically distinct but connected to the WISMO Quik Q2501 module by a single coaxial cable through an antenna switch system, saving a second coaxial cable.
Cold Start	Powering up a unit after it has been turned off for an extended period of time and no longer contains current ephemeris data. In Cold Start Scenario, the receiver has no knowledge on last position, approximate time or satellite constellation. The receiver starts to search for signals blindly. This is normal behavior, if no backup battery is connected. Cold Start time is the longest startup time for GPS receivers and can be several minutes.

Term	Definition
Hot Start	Start mode of the GPS receiver when current position, clock offset, approximate GPS time and current ephemeris data are all available. In Hot Start Scenario, the receiver was off for less than 2 hours. It uses its last Ephemeris data to calculate a position fix.
Warm Start	Start mode of a GPS receiver when current position, clock offset and approximate GPS time are known. Almanac data is retained, but the ephemeris data is cleared. In Warm Start Scenario, the receiver knows - due to a backup battery or by other techniques – his last position, approximate time and almanac. Thanks to this, it can quickly acquire satellites and get a position fix faster than in cold start mode.
Coarse Acquisition Code (C/A Code)	The standard positioning signal the GPS satellite transmits to the civilian user. It contains the information the GPS receiver uses to fix its position and time. Accurate to 24 meter. This code is a sequence of 1023 pseudorandom binary biphase modulations on the GPS carrier (L1) at a chipping rate of 1.023 MHz, thus having a code repetition period of 1 millisecond. The code was selected to provide good acquisition properties. Also known as the "civilian code.".

1.3 Abbreviations

Abbreviation	Definition
AC	Alternative Current
ADC	Analog to Digital Converter
A/D	Analog to Digital conversion
AGC	Automatic Gain Control
AT	ATtention (prefix for modem commands)
AUX	AUXiliary
C/A	Coarse Acquisition code (C/A Code)
CB	Cell Broadcast
CBS	Cell Broadcast Service
CEP	Circular Error Probable
CLK	ClocK
C/N	Carrier to Noise ratio
CMOS	Complementary Metal Oxide Semiconductor
COCOM	COordinating COMmittee for Multilateral Export Controls
CPU	Central Processing Unit
CS	Coding Scheme
CTS	Clear To Send
DAC	Digital to Analog Converter
dB	Decibel
dBc	Decibel relative to the Carrier power
dBi	Decibel relative to an Isotropic radiator
dBm	Decibel relative to one milliwatt
DC	Direct Current
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCS	Digital Cellular System
DR	Dead Reckoning
DSP	Digital Signal Processing
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
DTX	Discontinuous Transmission

Abbreviation	Definition
EFR	Enhanced Full Rate
E-GSM	Extended GSM
EN	Enable
ESD	ElectroStatic Discharges
ETSI	European Telecommunications Standards Institute
FR	Full Rate
GCF	GSM Certification Forum
GND	GrouND
GPI	General Purpose Input
GPIO	General Purpose Input Output
GPO	General Purpose Output
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
HR	Half Rate
IF	Intermediate Frequency
I	Input
I/O	Input / Output
I2C	Inter-Integrated Circuit
KSPS	Kilo Samples Per Second
LDO	Low Drop Out regulator
LED	Light Emitting Diode
LNA	Low Noise Amplifier
LSB	Less Significant Bit
MAX	MAXimum
MIC	MICrophone
MIN	MINimum
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
NMEA	National Marine Electronics Association
O	Output
PA	Power Amplifier
PBCCH	Packet Broadcast Control CHannel
PCB	Printed Circuit Board

Abbreviation	Definition
PCL	Power Control Level
PIO	Peripheral Input Output
PLL	Phase Lock Loop
PWM	Pulse Width Modulation
RAM	Random Access Memory
RF	Radio Frequency
RHCP	Right Hand Circular Polarization
RI	Ring Indicator
ROM	Read Only Memory
RMS	Root Mean Square
RST	ReSeT
RTC	Real Time Clock
RTCM	Radio Technical Commission for Maritime services
RTS	Request To Send
RX	Receive
SBAS	Satellite Based Augmentation System
SEP	Spherical Error Probability
SIM	Subscriber Identification Module
SMS	Short Message Service
SPI	Serial Peripheral Interface
SPL	Sound Pressure Level
SPK	SpeaKer
SRAM	Static RAM
TCH	Traffic CHannel
TDMA	Time Division Multiple Access
TU	Typical Urban fading profile
TUHigh	Typical Urban, High speed fading profile
TX	Transmit
TYP	TYPical
UART	Universal Asynchronous Receiver-Transmitter
VSWR	Voltage Stationary Wave Ratio
WAA	Wide Area Augmentation System
3GPP	3rd Generation Partnership Project

General presentation

1.4 Features

WISMO Quik Q2501 is a self-contained E-GSM/DCS-GPRS 900/1800 dual-band module with 16 channels GPS receiver.

Following table presents the WISMO Quik Q2501 features:

Feature	Information
Physical characteristics	Size: 58.4 x 32.2 x 6.3 mm Weight: 11 g Complete shielding
Module control	Full set of AT commands for GSM/GPRS including GSM 07.07 and 07.05 AT command sets. Specific AT commands for GPS management on same link as GSM/GPRS AT commands Direct reception of GPS data through serial link Status indication for GSM and for GPS functions
GSM/DCS	Frequency bands: • Rx (E-GSM 900): 925 to 960 MHz. • Rx (DCS 1800): 1805 to 1880 MHz. • Tx (E-GSM 900): 880 to 915 MHz. • Tx (DCS 1800): 1710 to 1785 MHz. Transmit power: • Class 4 (2 W) at E-GSM • Class 1 (1 W) at DCS
GPRS	GPRS multislot class 10 Multislot class 2 supported PBCCH support Coding schemes: CS1 to CS4
Voice Features	GSM Voice Features with Emergency calls 112 Full Rate (FR)/ Enhanced Full Rate (EFR) / Half Rate (HR) Echo cancellation and noise reduction Full duplex Hands free
SMS	SMS MT, MO and SMS CB SMS storage into SIM card

Feature	Information
GSM Supplementary Services	Call Forwarding, Call Barring Multiparty Call Waiting, Call Hold USSD
Data / Fax	Data circuit asynchronous, transparent, and non-transparent up to 14400 bits/s. Fax Group 3 compatible
SIM interface	3 V only SIM interface 1.8 & 5 V SIM interfaces are available with external adaptation SIM Tool Kit Release 99.
GPS	GPS L1 civil frequency 1575.42 MHz 16 channels GPS receiver Accuracy: • 2.5 m CEP • GPS 2 m CEP (depending on accuracy of correction data); SBAS/WAAS supported. Start-up times: • Hot start: < 3.5 sec • Warm start: 33 sec • Cold start: 34 sec Signal reacquisition < 1 s Protocols: • NMEA-0183 input/output • UBX binary input/output • RTCM in Interface available for Dead Reckoning
Real Time Clock	Real Time Clock with calendar and alarm RTC update with GPS information
Temperature sensor	Internal sensor for module temperature monitoring via AT commands or embedded OpenAT application.
Advanced antennas management	Single Coax connectivity GPS active antenna management (3 V / 5 V compatible) with internal protection circuit Possible use of an auto-powered GPS active antenna.

1.5 Architecture

1.5.1 Functional architecture
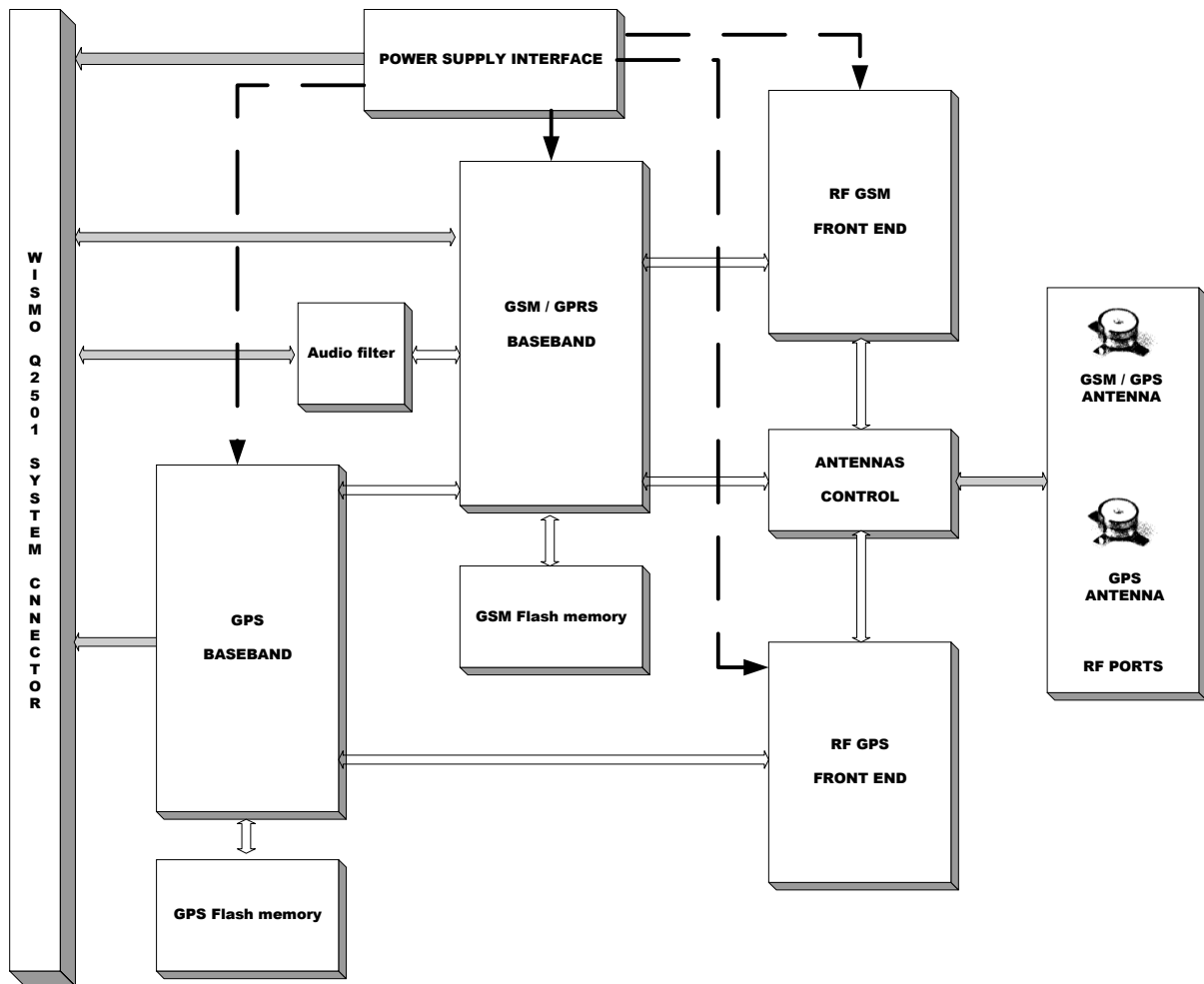
Figure1: Functional architecture

1.5.2 RF architecture

The RF part of WISMO Quik Q2501 have separate RF front-ends for GSM/GPRS and GPS.

1.5.2.1 GSM RF architecture
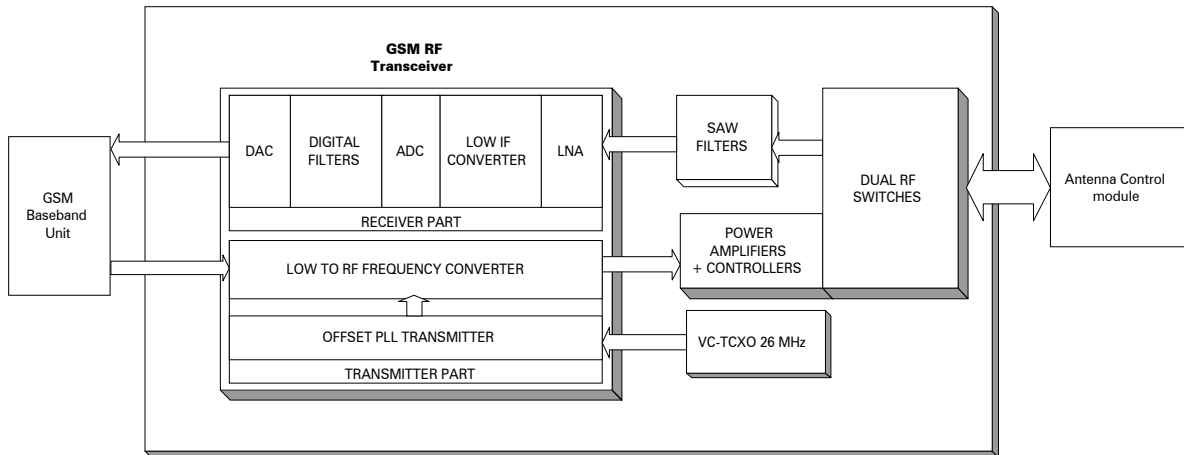
Figure 2: GSM/DCS RF front-end

The GSM/DCS Radio Frequency part is based on two specific dual band chips including:

<u>GSM Transceiver</u>:

- Low-IF Receiver,
- Dual RF (Radio Frequency) synthesizer,
- Digital IF to Baseband Converter,
- Offset PLL (Phase Lock Loop) transmitter.

<u>Power Amplifier:</u>

- Dual band Power Amplifier with controller and integrated antenna switch.

1.5.2.2 GPS RF architecture
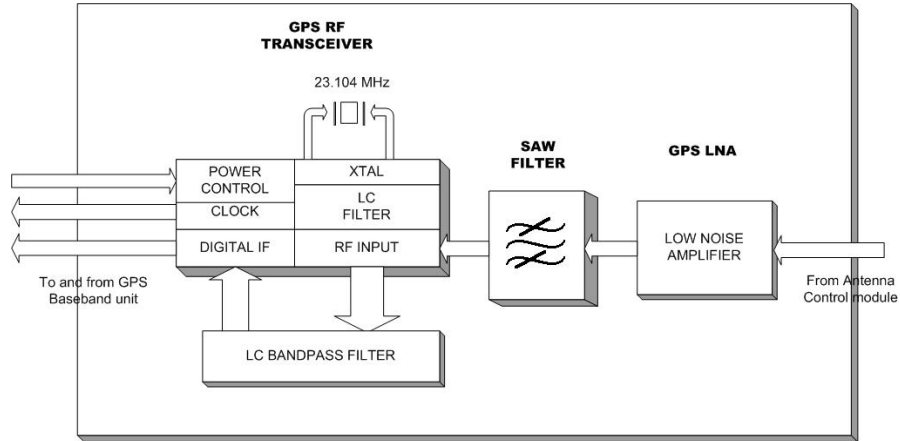
Figure 3: GPS RF front-end

The GPS Radio Frequency part is based on two specific GPS chips:

- **GPS LNA**: Low Noise Amplifier,
- **GPS RF transceiver** including :
  - RF frequency Down-converter,
  - Low frequency LC filter,
  - AGC loop circuit,
  - Analog to digital converter.

1.5.3 Baseband architecture

The baseband part of WISMO Quik Q2501 includes separate baseband units for GSM-GPRS and for GPS.

1.5.3.1 GSM-GPRS baseband architecture
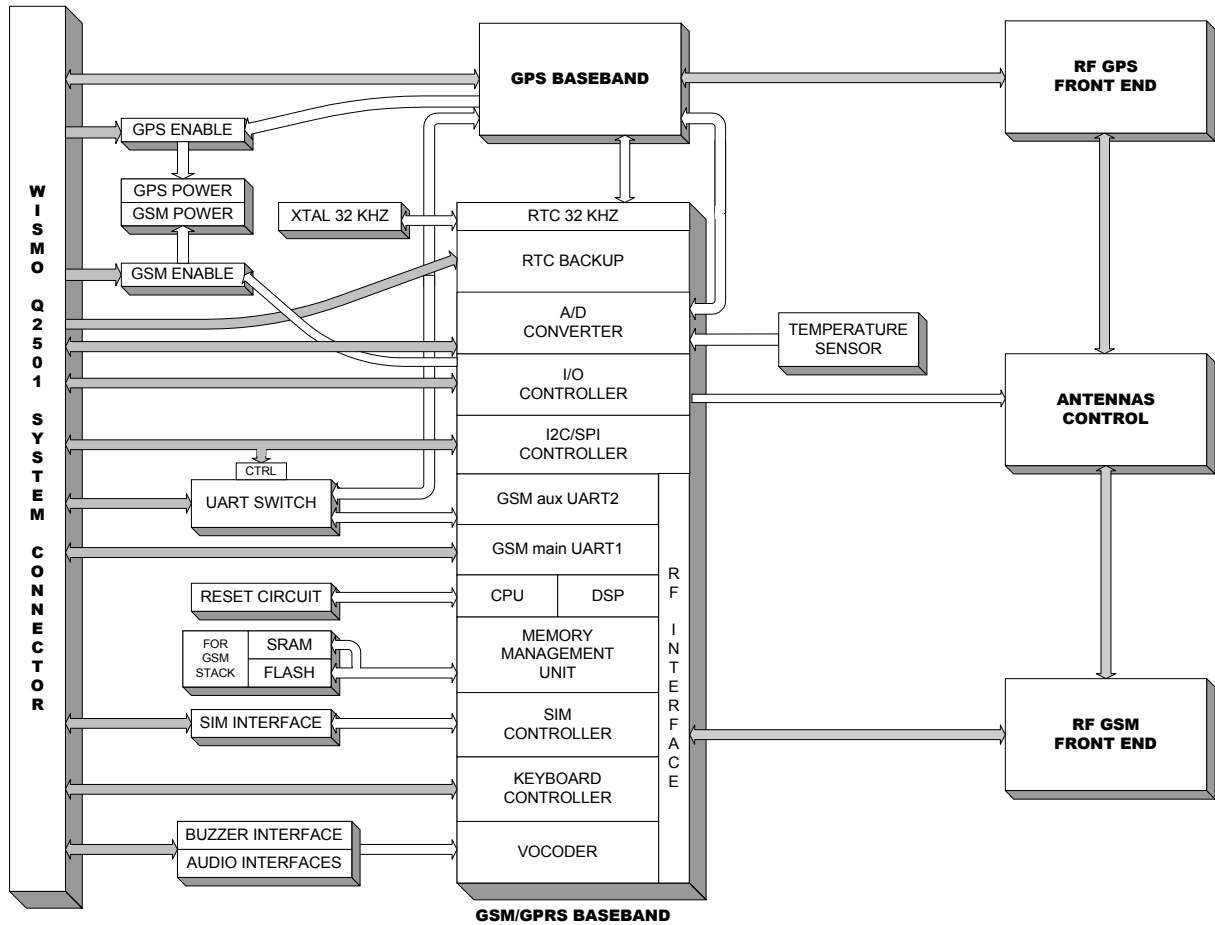
Figure 4: GSM/GPRS baseband architecture

This GSM/GPRS baseband chipset of WISMO Quik Q2501 is based on a 0.25 μm mixed CMOS technology, which allows massive integration as well as low current consumption.

1.5.3.2 GPS baseband architecture
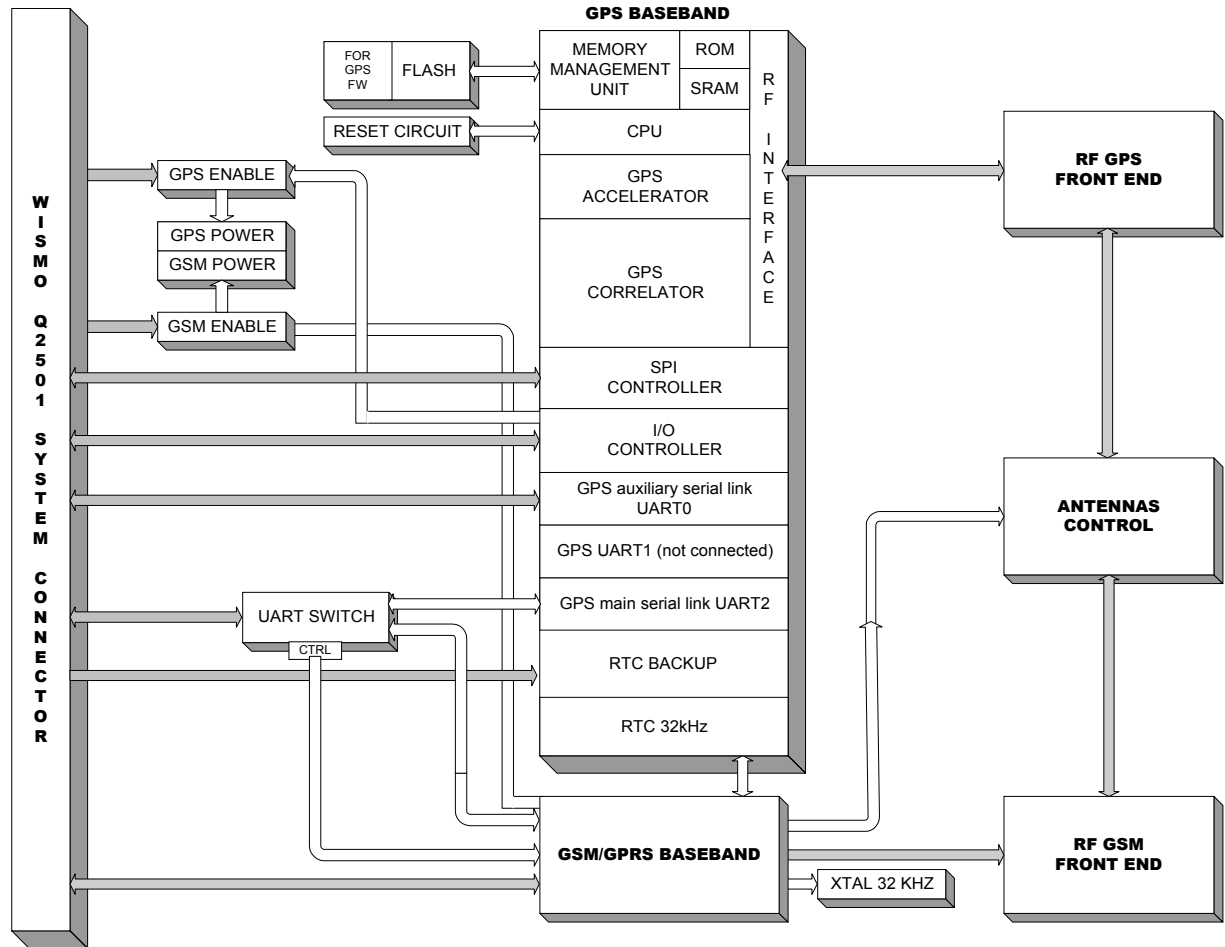
Figure 5: GPS baseband architecture

The GPS baseband chipset of WISMO Quik Q2501 is based on an ARM7TDMI processor core and uses a 0.18 μm CMOS technology. The embedded GPS processor includes a 16-channel GPS correlator.

1.6 Firmwares

The GSM & GPS firmwares run independently from each other on two different processors.

1.6.1 GSM/GPRS Firmware

WISMO Quik Q2501 module includes a complete GSM/GPRS firmware offering a set of AT commands to control the module.

Some specific customers applications can be developed with Open AT environment.

For detailed information about GSM/GPRS AT commands, refer to document [4].

1.6.2 GPS Firmware

WISMO Quik Q2501 offers a full GPS firmware, which performs the basic GPS operations, including tracking, acquisition, navigation and position data output.

The GPS output data are compliant with NMEA 0183 protocol.

A specific AT commands set has been developed within the GSM/GPRS firmware in order to control the GPS firmware.

For detailed information about AT commands specific to GPS operations, refer to document [5].
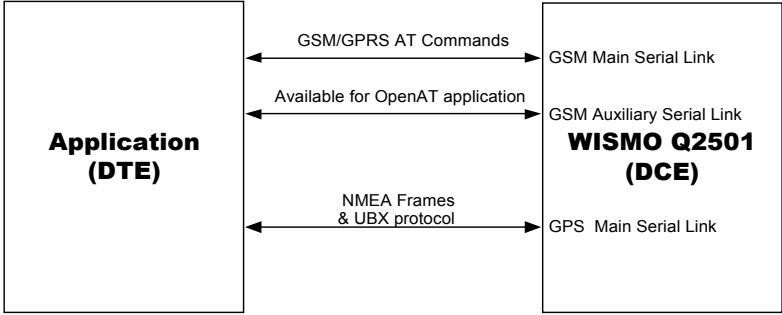
1.7 Operating modes
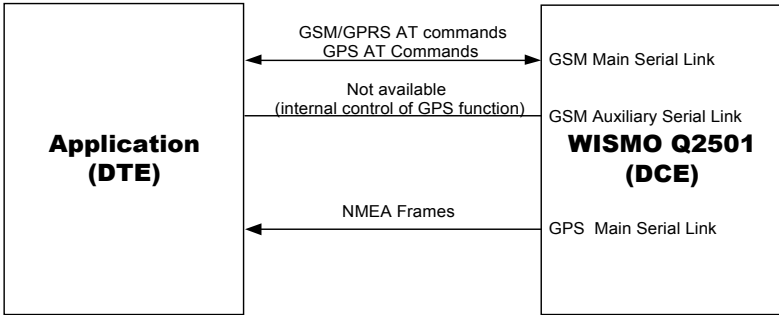
1.7.1 System modes

Modes	Functions
GSM/GPRS and GPS ON *Default Configuration*	Both GSM/GPRS and GPS features are available. This is the default configuration at module power on.
GSM/GPRS only	Only the GSM/GPRS feature is available. The GPS feature is OFF.
GPS only	Only the GPS feature is available. The GSM/GPRS feature is OFF. (in fact, the GSM µP is in idle state. Since the GPS is managed by the GSM µP, it can be totally switched off)

The choice between these three possible system modes is available by software or hardware. See Specific AT commands for GPS management document [5] for details.

1.7.2 Serial links configuration

Modes	Functions
External mode *Default configuration*	GPS is controlled only by the customer application using UBX protocol and NMEA frames are retrieved on the GPS main serial link only. There is no other way to retrieve GPS information. GPS Auxiliary serial link is used for UBX protocol only. GSM/GPRS is controlled by AT Commands on the GSM main serial link. The GSM auxiliary serial link is available for use by application software (with Open AT for example) **Application (DTE)** ←→ GSM/GPRS AT Commands → GSM Main Serial Link ←→ Available for OpenAT application → GSM Auxiliary Serial Link **WISMO Q2501 (DCE)** ←→ NMEA Frames & UBX protocol → GPS Main Serial Link

Modes	Functions
Internal mode	GPS is controlled by the customer application using specific AT commands through the GSM main serial link. GPS information can be retrieved either by specific AT commands on GSM main serial link or directly on the GPS main serial link (NMEA frames). The GSM main serial link is used for AT commands to control both GSM/GPRS and GPS. The GSM auxiliary serial link is not available because used internally for GSM – GPS communication.
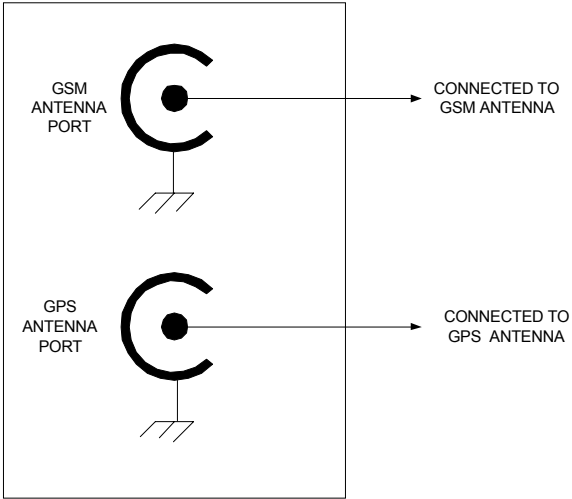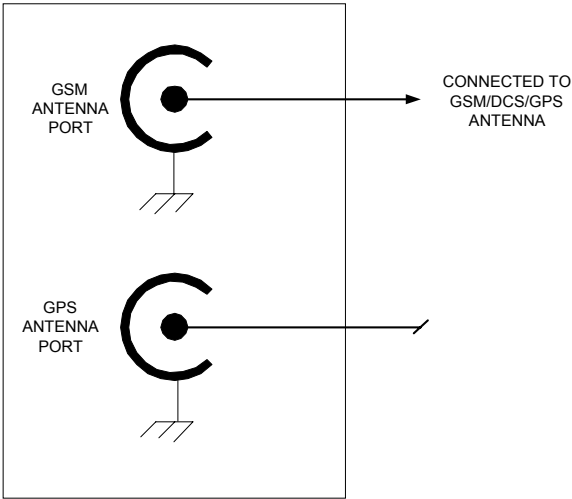
The choice between these modes is available by software. See Specific AT commands for GPS management document [5] for details.

The WISMO Quik Q2501 module is a DCE (Data Communication Equipment).

The names of the WISMO Quik Q2501 module serial link signals are given view from the application DTE (Data Terminal Equipment).

Example: GSM_TXD2 means GSM Main Serial Link transmit line of the application DTE what fits with the receive line (RX) of the WISMO Q2501 module.

1.7.3 RF connectors configuration

Modes	Functions
Default configuration	Dedicated GSM and GPS antennas are connected by TWO separate RF connectors. GSM ANTENNA PORT — CONNECTED TO GSM ANTENNA GPS ANTENNA PORT — CONNECTED TO GPS ANTENNA
Single Coax configuration	GSM/DCS/GPS antennas are connected to "GSM RF connector" by a SINGLE coaxial cable. "GPS RF connector" is left unconnected. GSM ANTENNA PORT — CONNECTED TO GSM/DCS/GPS ANTENNA GPS ANTENNA PORT — Note: See 3.3.2 for intrinsic limitations of Single Coax configuration

The choice between these two possible configurations for antenna connection is available by software. See Specific AT commands for GPS management document [5] for details.

1.8 GPS active antenna management

Wismo Quik Q2501 module can manage a GPS active antenna in both default RF connection and Single Coax mode. This function can be useful to protect the module power supply.

Active antenna management is in charge of the GSM baseband and is based on a current consumption monitoring:

- Connected: current consumption is within the limits

- Short circuit: antenna current consumption over the upper limit; the antenna is automatically disconnected to protect power supply.

- Open circuit: the antenna current consumption is below the lower limit. This information is not available in Single Coax configuration.

Specific AT commands are available in both internal and external for this function (see [5] for details).

2 System connector interface

2.1 System connector description

The system connector is an 80-pin connector, with 0.5 mm pitch, which is available to interface the WISMO Quik Q2501 with the customer application.

This connector is made by Molex with the following reference: MX53748-0808 The matting connector for customer application has the following reference: MX52991-0808.

For further details, refer to paragraph 6.3, System Connector data sheet.

2.2 Functional interfaces

Common Interface	
Main Power Supply(*)	Activity Status Indication
Module Activation(*)	Real Time Clock Power Supply
Download mode control	
Reset(*)	

GSM Interface	
GSM main Serial link(*)	SIM Interface(*)
GSM aux serial link	Keyboard
GSM SPI / I2C	Audio interfaces
GSM Burst Emission Indication	Buzzer
GSM External Interrupt	Analogue to Digital Converter
GSM GPIO	Digital to Analogue Converter
GSM GPO	3V power supply for peripherals
GSM GPI	

GPS Interface	
GPS activation(*)	GPS Active antenna management
GPS Main Serial Link(*)	GPS SPI Bus for Dead Reckoning
GPS Auxiliary Selrial Link	1.8V power supply for peripherals
GPS External Interrupt	

GROUND Connection(*) through solder joint of shielding legs
(see mechanical drawing for details)

Legend: (*) = minimum interfaces required for the customer application.

Figure 6: System connector functional description

2.2.1 Important notes

1. Some of the WISMO interface signals are multiplexed in order to limit number of pins but this architecture implies some limitation.

2. All external signals must be inactive when the WISMO module is OFF to avoid any damage when starting and allow WISMO module to start correctly.

3. The WISMO Quik Q2501 shielding case is the grounding.

2.2.2 Minimum requirements for application

To be able to drive correctly the WISMO Quik Q2501 module, the use of some interfaces is mandatory on the customer application. These interfaces are given in Figure 6 (displayed in bold characters).

2.3 System Connector pin-out
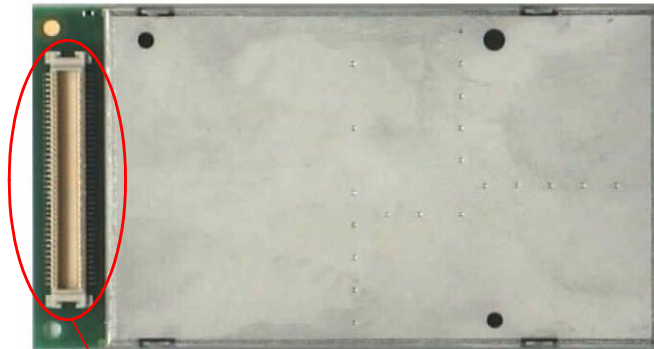
2	GPS_TXD2	GPS_RXD2	1
4	GPS_TXD0	GPS_RXD0	3
6	GSM_BBEN	GPS_SCK	5
8	GPS_MOSI	GPS_REVERSE	7
10	RESERVED	GPS_EXTINT0	9
12	RESERVED	GPS_MISO	11
14	RESERVED	GPS_PCS0_N	13
16	RESERVED	GPS_PCS1_N	15
18	GPS_VANT	GPS_TIMEPULSE	17
20	GSM_PAC_EN	GPS_VCORE	19
22	GPIO1	GPS_EN	21
24	GPIO2	SIM_CLK	23
26	ON/~OFF	SIM_RST	25
28	SDA/SPI_IO	SIM_DATA	27
30	SCL/SPI_CLK	SIM_VCC	29
32	BOOT	AUXDAC	31
34	~RST	ROW0	33
36	~INTR	ROW1	35
38	GPI	ROW2	37
40	GPO2	ROW3	39
42	GPO1	ROW4	41
44	GPIO0	COL0	43
46	GPO0	COL1	45
48	GPO3	COL2	47
50	GSM_RTS1	COL3	49
52	GSM_RXD1	COL4	51
54	GSM_DTR1	GPIO3	53
56	GSM_DSR1	GPIO5	55
58	AUXADC	GSM_CTS1	57
60	VCC	GSM_TXD1	59
62	MIC1P	SPK1P	61
64	MIC1N	SPK1N	63
66	MIC2P	SPK2P	65
68	MIC2N	SPK2N	67
70	SIM_PRES	BUZ	69
72	FLASH_LED	GSM_DCD1	71
74	GSM_RI1	GPIO4	73
76	VCC_RTC	VBATT	75
78	VBATT	VBATT	77
80	VBATT	VBATT	79

Ground Connection through solder joint of shielding legs
(see mechanical drawing for details)

Figure 7: System connector pin-out

2.4 System connector multiplexing

Pin #	Multiplex 1	Multiplex 2	Reset State	Comments
1	GPS_RXD2		PIO controlled after Reset	
2	GPS_TXD2		PIO controlled after Reset	
3	GPS_RXD0		PIO controlled after Reset	
4	GPS_TXD0		PIO controlled after Reset	
5	GPS_SCK		PIO controlled after Reset	Driven low
6	GSM_BBEN		Ouput	
7	GPS_REVERSE		Input	Driven low
8	GPS_MOSI		PIO controlled after Reset	Driven low
9	GPS_EXTINT0		Input	Pull up external resistor to GPS_VCORE
10	RESERVED			
11	GPS_MISO		PIO controlled after Reset	Driven low
12	RESERVED			
13	GPS_PCS0_N		PIO controlled after Reset	Pull up external resistor to GPS_VCORE
14	RESERVED			
15	GPS_PCS1_N		PIO controlled after Reset	Driven high
16	RESERVED			
17	GPS_TIMEPULSE		Input	
18	GPS_VANT		Input	
19	GPS_VCORE		Output	
20	GSM_PAC_EN		Output Low	
21	GPS_EN		Input	
22	GPIO1		Input	
23	SIM_CLK		Output Low	
24	GPIO2		Input	
25	SIM_RST		Output Low	
26	ON/~OFF		Input	
27	SIM_DATA		Output Low	
28	SDA	SPI_IO	Input	If used pull-up an external resistor to VCC
29	SIM_VCC		Output	
30	SCL	SPI_CLK	Input	If used pull-up an external

Pin #	Multiplex 1	Multiplex 2	Reset State	Comments
				resistor to VCC
31	AUXDAC		Tri-state	
32	BOOT		Input	
33	ROW0		Output	
34	~RST		Input/output	
35	ROW1		Output	
36	~INTR		Input	
37	ROW2		Output	
38	GPI	GSM_TXD2	Input	Not available in Internal mode
39	ROW3		Output	
40	GPO2	GSM_RXD2	Output High	Not available in Internal mode
41	ROW4		Output	
42	GPO1		Output Low	Multiplexed with 1.8 V and 5 V SIM card management signal
43	COL0		Input	
44	GPIO0	GSM_CTS2	Input	Not available in Internal mode
45	COL1		Input	
46	GPO0	SPI_AUX	Output High	
47	COL2		Input	
48	GPO3	SPI_EN	Output High	
49	COL3		Input	
50	GSM_RTS1		Input	
51	COL4		Input	
52	GSM_RXD1		Output High	
53	GPIO3		Input	
54	GSM_DTR1		Input	
55	GPIO5	GSM_RTS2	Input	Not available in Internal mode
56	GSM_DSR1		Output High	
57	GSM_CTS1		Output High	
58	AUXADC		Input	
59	GSM_TXD1		Input	
60	VCC		Output	
61	SPK1P		Tri-state	
62	MIC1P		Input	
63	SPK1N		Tri-state	
64	MIC1N		Input	
65	SPK2P		Tri-state	
66	MIC2P		Input	
67	SPK2N		Tri-state	
68	MIC2N		Input	

Pin #	Multiplex 1	Multiplex 2	Reset State	Comments
69	BUZ		Open collector	
70	SIM_PRES		Input	
71	GSM_DCD1		Input	
72	FLASH_LED		Input	
73	GPIO4		Input	
74	GSM_RI1		Input	
75	VBATT		Input	
76	VCC_RTC		Input	
77	VBATT		Input	
78	VBATT		Input	
79	VBATT		Input	
80	VBATT		Input	

2.5 Common GSM/GPS interface

2.5.1 Power supply

2.5.1.1 Main power supply

WISMO Quik Q2501 is powered by a single power supply signal VBATT, for both GSM and GPS functions.

Pin description

Signal	Pin #	I/O	I/O type	Description
VBATT	75 77 78 79 80	I	Supply	Main power supply

The power supply constraints for GPS are not critical compared to GSM/GPRS.

Actually, the power supply is one of the key issues in the design of a GSM/GPRS application. Due to the bursted nature transmission, the power supply must be able to deliver high current peaks in a short time.

The GSM RF Power Amplifier current flows with a ratio of:

- Max current 1/8 of the time (around $577\,\mu$s every 4.615 ms for GSM/GPRS class 2 – 2 RX / 1 TX),

- Max current 2/8 of the time (around $1154\,\mu$s every 4.615 ms for GSM/GPRS class 10 – 3 RX / 2 TX).

Because **VBATT** supplies directly the GSM RF power amplifier component, it is essential to keep a minimum voltage ripple at this connection in order to avoid any phase error or spectrum modulation degradation. See paragraph 2.9 Electrical characteristics for detailed information.

Refer to document [2] for further information about power supply design.
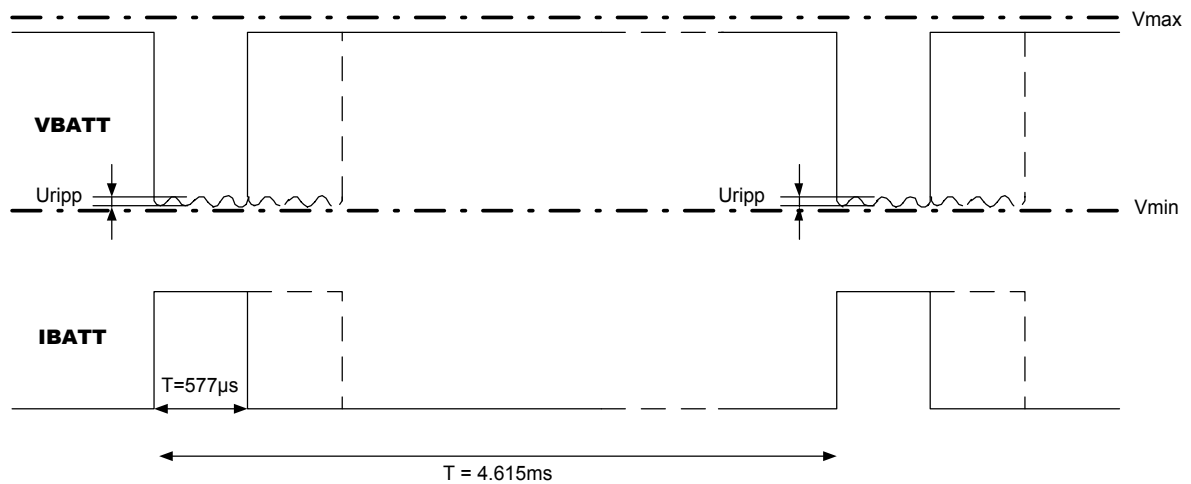
Legend:

——— In GSM or GPRS class 2 modes

— – In GPRS class 10 mode

Figure 8: Typical power supply voltage in GSM/GPRS mode

2.5.1.2 RTC back-up power supply

If using the WISMO Quik Q2501 internal Real Time Clock (RTC), it is necessary to provide a back-up power supply because:

- When the WISMO Quik Q2501 module is powered on, the RTC power supply is provided by the module.

When the WISMO Quik Q2501 module is powered off, a back-up power supply is needed to save RTC date and time information for GSM part and to save Backup RAM with RTC data, valid almanac and ephemeredes to perform a Hot start or a War mstart for GPS part (The GPS will perform a FIX faster).

Nevertheless, since it is possible to retrieve GPS time and date information, it is not necessary to use this backup power supply interface.

If the RTC is not used, this pin can be left open.

<u>Note</u>: Only after GPS have been supplied, the RTC section and the back-up battery switch will be initialized properly. If only VCC_RTC is applied first, the current consumption of the RTC and back up SRAM is undetermined.

Pin description

Signal	Pin #	I/O	I/O type	Description
VCC_RTC	76	I/O	Supply	RTC back-up power supply

2.5.2 Module activation

2.5.2.1 General description

This input is used to switch ON or OFF the WISMO Quik Q2501 module.

A high logic level has to be provided on the ON/~OFF pin to switch the module on. This signal can be left at high level until switching the module off.

To be able to switch the module off, the ON/~OFF pin has to be released before using AT+CPOF command through the firmware.

Pin description

Signal	Pin #	I/O	I/O type	Description
ON/~OFF	26	I	Internal 100 kΩ pull down	Module Activation

2.5.2.2 Operating sequences

2.5.2.2.1 Power ON

Once the module is supplied by the power source, the application must set the ON/~OFF signal to high to start the module power ON sequence.

The ON/~OFF signal must be held for 1 s 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 240 ms (typical) 560 ms (max).

During this phase, any external reset should be avoided.(External Reset is an emergency Reset).

Once the initialization is complete (timing is SIM and network dependent) the AT interface answers « OK » to the application. For this, the application has to send AT↵.

If the application manages hardware flow control, the AT command can be sent during the initialization phase. Another solution is to use the AT+WIND command to get an unsolicited status from the module.

For further details, please refer to the AT commands documentation (AT+WIND, AT+WAIP).
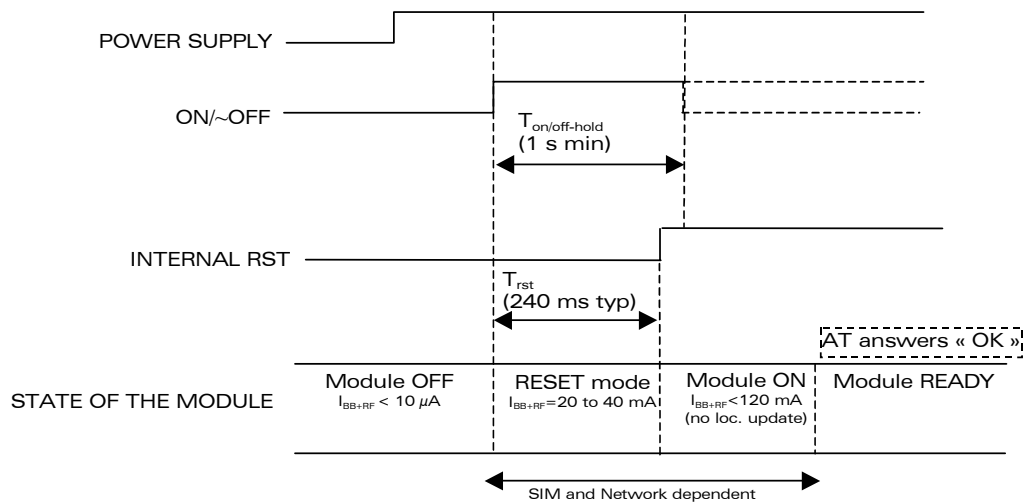
I_{BB+RF} = overall current consumption (Base Band + RF part)

Figure 9: Power-ON sequence diagram (no PIN code activated)

2.5.2.2.2 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.
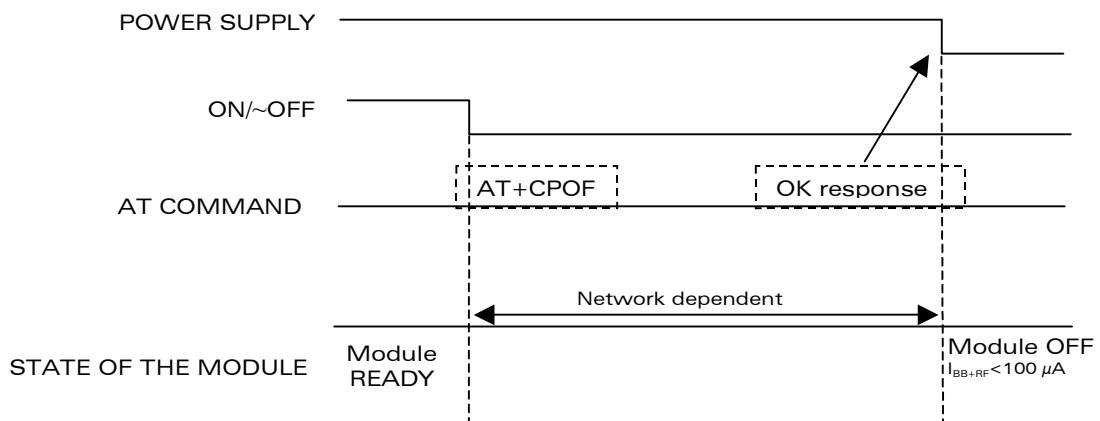
I_{BB+RF} = overall current consumption (Base Band + RF part)

Figure 10: Power-OFF sequence diagram

2.5.3 Alternative download control

If the standard X-modem download procedure does not work correctly, an alternative download procedure can be selected with the BOOT pin. This alternative procedure requires a specific downloading software tool.

The Alternative Download procedure can be used for both the GSM & GPS sections.

The alternative download procedure is started when this input is low during the power ON of the modem.

In normal mode, this pin has to be left open.

If used, this input has to be driven by an open collector or an open drain:

- If Boot pin= 1, module is in normal mode
- If Boot pin= 0, module is in alternative download mode

Pin description

Signal	Pin #	I/O	I/O type	Description
BOOT	32	I	CMOS	Alternative download control

2.5.4 Reset signal

2.5.4.1   General description

The ~RST signal is used as an input to force a reset procedure by providing low level. This reset procedure has to be considered as an emergency reset or for alternative download procedure described above.

This signal can also be used as an output to provide a reset to an external device. If no external reset is necessary this pin can be left open.

Pin description

Signal	Pin #	I/O	I/O type	Description
~RST	34	I/O	4.7k pull-up	Reset

Additional comments on reset process:

The reset process is activated <u>EITHER</u> by the external ~RST signal <u>OR</u> by an internal signal (coming from a reset generator). This automatic reset is activated at Power-up.

The module remains in RESET state mode as long as the ~RST signal is held low.

<u>Warning</u>: A software reset is always preferred to a hardware reset. This signal should be used only for "emergency" resets.

2.5.4.2   Reset sequence

To activate the « emergency » reset sequence, the ~RST signal has to be set to low for 500 μs minimum.

As soon as the reset is complete, the AT interface answers « OK » to the application. For this, the application has to send AT↵. If the application manages hardware flow control, the AT command can be sent during the initialization phase. Another solution is to use the AT+WIND command to get an unsolicited status from the module.

For further details, refer to AT commands documentation [4].
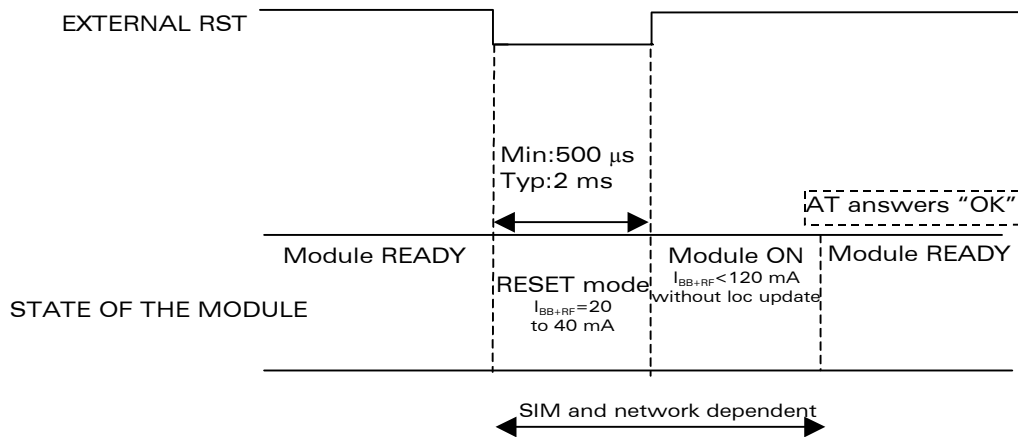
Figure 11: Reset sequence diagram

2.5.5 Activity status indication

The GSM and GPS activity status indication signals can be used to drive two LEDs through an open-collector transistor according to the module activity status.

Pin description

Signal	Pin #	I/O	I/O type	Description
FLASH_LED	72	I/O	CMOS/2x	GSM Status
GPS_TIMEPULSE	17	I/O	1V8_CMOS	GPS Status

FLASH_LED	GSM status	
OFF	Module in download mode or module OFF	
ON	Permanent	Module switched ON, not registered on the network
	Slow flash LED ON for 200 ms, OFF for 2 s	Module switched ON, registered on the network, no communication in progress.

FLASH_LED	GSM status	
	Quick flash LED ON for 200 ms, OFF for 600 ms	Module switched ON, registered on the network, communication in progress

GPS_TIMEPULSE	GPS status	
OFF	GPS part OFF or not enough satellites in view	
ON	LED ON for 100 ms, OFF for 900 ms (default duty cycle, can be modified by software)	GPS part performs a positioning (FIX).

2.6 GSM interface

2.6.1 Serial links

WISMO Quik Q2501 provides 2 serial links connected to the GSM baseband unit:

- GSM Main serial link: GSM_UART1,
- GSM Auxiliary serial link: GSM_UART2.
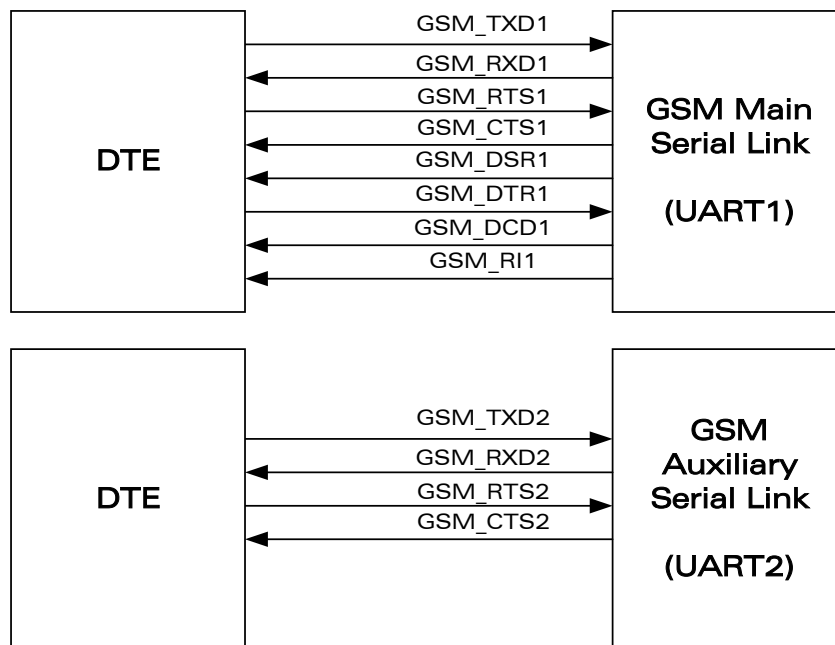
Figure 12: GSM interface - Serial LinksGSM Main Serial Link

A flexible 8-wire serial interface is available complying with V24 technical specifications.

This serial link is used for AT commands communication, for GSM function only (external mode) or for both GSM and GPS functions (internal mode).

Pin description

Signal	Pin #	I/O	I/O type	Description
GSM_TXD1	59	I	CMOS	CT103 – Transmit Serial Data
GSM_RXD1	52	O	3X	CT104 – Receive Serial Data
GSM_RTS1	50	I	CMOS	CT105 – Request To Send
GSM_CTS1	57	O	3X	CT106 – Clear To Send
GSM_DSR1	56	O	3X	CT107 – Data Set Ready
GSM_DTR1	54	I	CMOS	CT108-2 – Data Terminal Ready
GSM_DCD1	71	O	CMOS/2X	CT109 – Data Carrier Detect
GSM_RI1	74	O	CMOS/2X	CT125 – Ring Indicator
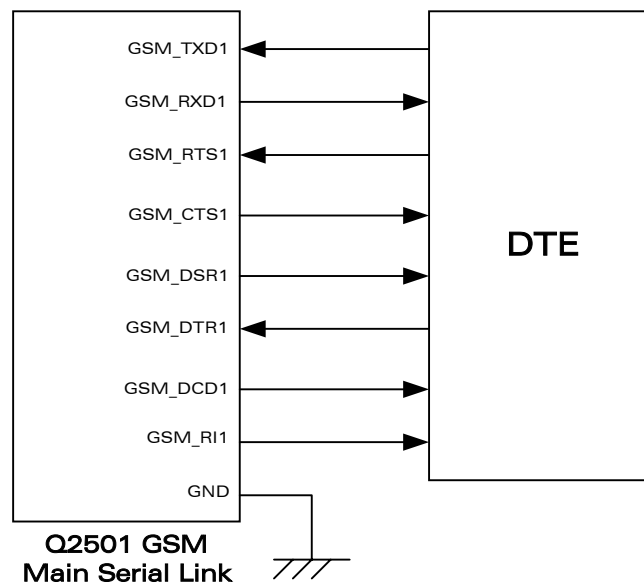
Figure 13: Main GSM serial link signals

The WISMO Quik Q2501 has been designed to allow a certain flexibility in the use of the serial interface signals.

However, the use of GSM_CTS1 and GSM_RTS1 signals for hardware flow control in order to avoid data corruption during transmission is mandatory.

This is not the case for GSM_DTR1 and GSM_DSR1 signals which can be left disconnected if not used.

2.6.1.2 GSM Auxiliary Serial Link

A flexible 4-wire serial interface is available complying with V24 technical specifications.

In external mode, this serial link is available for application operations (OpenAT data exchanges for example).

In internal mode, this serial is not available because used within the WISMO module for GPS control operations.

Pin description

Signal	Pin #	I/O	I/O type	Description
GSM_TXD2	38	I	CMOS	CT103 – Transmit Serial Data Multiplexed with GPI
GSM_RXD2	40	O	3X	CT104 – Receive Serial Data Multiplexed with GPO2
GSM_RTS2	55	I	CMOS	CT105 – Request To Send Multiplexed with GPIO5
GSM_CTS2	44	O	3X	CT106 – Clear To Send Multiplexed with GPIO0
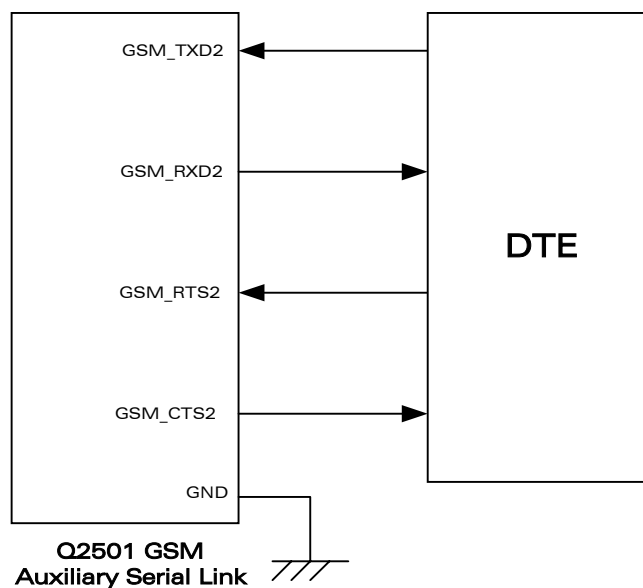
Figure 14: Auxiliary GSM serial link signals

2.6.2 General Purpose I/O

The WISMO Quik Q2501 provides:

- up to 6 GSM General Purpose I/O,
- up to 4 GSM General Purpose Output,
- up to 1 GSM General Purpose Input

They can be used to control any external devices.

Pin description

Signal	Pin #	I/O	I/O type	Description
GPIO0	44	I/O	CMOS/3X	Multiplexed with GSM_CTS2
GPIO1	22	I/O	CMOS/2X	
GPIO2	24	I/O	CMOS/2X	
GPIO3	53	I/O	CMOS/2X	
GPIO4	73	I/O	CMOS/2X	
GPIO5	55	I/O	CMOS/3X	Multiplexed with GSM_RTS2
GPO0	46	O	3X	Multiplexed with SPI_AUX
GPO1	42	O	3X	Multiplexed with 1.8 V or 5 V SIM card management signal
GPO2	40	O	3X	Multiplexed with GSM_RXD2
GPO3	48	O	3X	Multiplexed with SPI_EN
GPI	38	I	CMOS	Multiplexed with GSM_TXD2

When using internal mode as described in § 1.7.2, all the signals multiplexed with GSM_UART2 are not available (GPIO0, GPIO2, GPIO5 and GPI).

2.6.3 Peripheral Bus

One peripheral bus is available on the WISMO Quik Q2501 System Connector. It can be used to drive SPI peripherals (3-wire interface) or standard 2-wire peripherals.

The choice between these two types of peripherals is exclusive due to signal multiplexing.

2.6.3.1 SPI bus

The SPI bus includes clock (SPI_CLK), I/O (SPI_IO) and enable signals (SPI_EN, SPI_AUX) complying with SPI bus standard. The maximum speed transfer is 13 Mb/s.

Pin description

Signal	Pin #	I/O	I/O type	Description
SDA/SPI_IO	28	I/O	CMOS/3X	SPI data signal
SCL/SPI_CLK	30	O	3X	SPI clock
SPI_EN	48	O	3X	Main SPI enable signal Multiplexed with GPO3
SPI_AUX	46	O	3X	Auxiliary SPI enable signal Multiplexed with GPO0
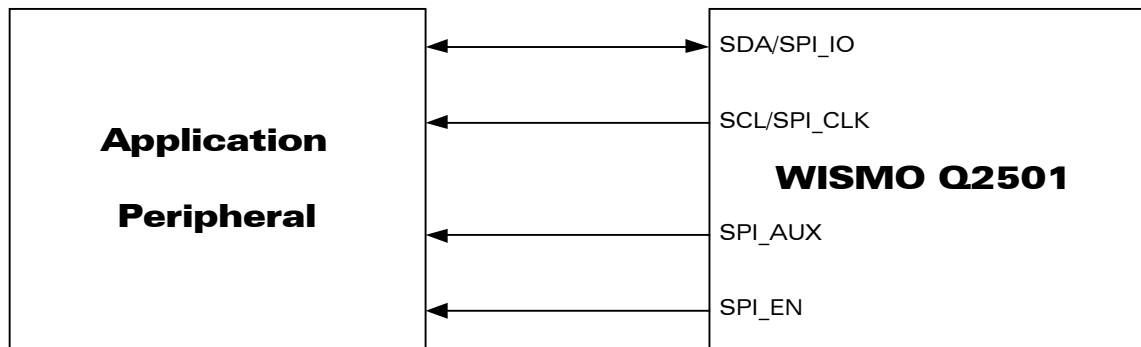
Figure 15: SPI Bus

2.6.3.2   2-wire interface

The 2-wire serial interface includes clock and data signals complying with a standard speed clock of 96 kbit/s. The maximum speed clock is 400 kbits/s.

Pin description

Signal	Pin #	I/O	I/O type	Description
SCL/SPI_CLK	30	O	3X	Serial Clock
SDA/SPI_IO	28	I/O	CMOS/3X	Serial Data
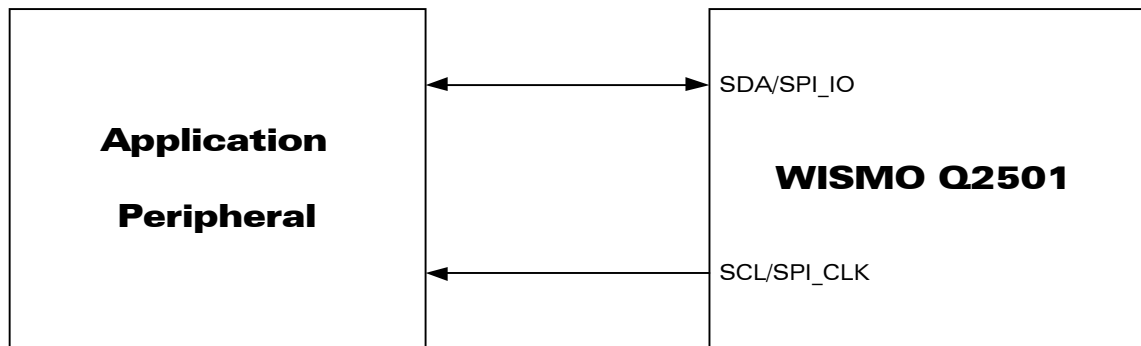
Figure 16: 2-wire interface bus

2.6.4 SIM interface

The WISMO Quik Q2501 module is designed to interface with 3V SIM cards only, in compliance with ETS 300 641 and 3GPP TS 51.011 V5.0.0 recommendations (refer to § 6.1.1).

Nevertheless, it is possible to manage 1.8V/3V or 3V/5V SIM cards using an external voltage level shifter controlled by the GPO1 output signal (refer to § 2.6.2 and to document [2]: Customer Design Guidelines).

Pin description

Signal	Pin #	I/O	I/O type	Description
SIM_CLK	23	O	2X	SIM Clock
SIM_RST	25	O	2X	SIM Reset
SIM_DATA	27	I/O	CMOS / 3X	SIM Data
SIM_VCC	29	O	-	SIM Power Supply
SIM_PRES	70	I	CMOS	SIM Card Detect

Note for SIM_PRES connection:

- When not used SIM_PRES 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.

2.6.5 Keyboard interface

This interface provides 10 connections:

- 5 rows (ROW0 to ROW4),

- 5 columns (COL0 to COL4).

The scanning is a digital one, and the debouncing is done in the WISMO module. No discrete components like resistors or capacitors are needed.

The keyboard scanner is equipped with internal pull-down resistors for the rows and pull-up resistors for the columns. Current only flows from the column pins to the row pins.

Pin description

Signal	Pin #	I/O	I/O type	Description
ROW0	33	I/O	CMOS / 1X	Row scan
ROW1	35	I/O	CMOS / 1X	Row scan
ROW2	37	I/O	CMOS / 1X	Row scan
ROW3	39	I/O	CMOS / 1X	Row scan
ROW4	41	I/O	CMOS / 1X	Row scan
COL0	43	I/O	CMOS / 1X	Column scan
COL1	45	I/O	CMOS / 1X	Column scan

Signal	Pin #	I/O	I/O type	Description
COL2	47	I/O	CMOS / 1X	Column scan
COL3	49	I/O	CMOS / 1X	Column scan
COL4	51	I/O	CMOS / 1X	Column scan

2.6.6 Audio interface

Two different microphone inputs (MIC1 and MIC2) and two different speaker outputs (SPK1 and SPK2) are supported.

Main audio interface is made up of MIC2 inputs (microphone) and SPK2 outputs (speaker).

Auxiliary audio interface is made up of MIC1 inputs (microphone) and SPK1 outputs (SPK1). Auxiliary audio interface is appropriate for a hands-free system or a handset with biasing external to the module.

The WISMO Quik Q2501 module also includes echo cancellation and noise reduction features improving quality of hands-free function.

In some cases, ESD protection must be added on the audio interface lines.

2.6.6.1   Microphone inputs

2.6.6.1.1 General description

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

The auxiliary microphone inputs (MIC1) do not include an internal bias.

For both microphone paths 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.

The use of a single-ended connection requires a very good ground plane, a very good filtering as well as shielding in order to avoid any disturbance on the audio path.

2.6.6.1.2 Main Microphone Inputs (MIC2)

MIC2 inputs include an internal convenient biasing for an electret microphone. This electret microphone can be directly connected on these inputs, either in differential or single-ended mode.

The gain is internally adjusted through AT commands.

AC coupling is already embedded in the module.

Pin description

Signal	Pin #	I/O	I/O type	Description
MIC2P	66	I	Analog	Microphone 2 positive input
MIC2N	68	I	Analog	Microphone 2 negative input

2.6.6.1.3 Auxiliary Microphone Inputs (MIC1)

MIC1 inputs do not include internal bias, making these inputs the standard ones for an external headset or a hands-free kit, connected either in differential or single-ended mode.

Note: to get a good TDMA noise filtering for the biasing of MIC1, a recommended solution is the use of an external supply instead of using VCC (pin 60) provided by the WISMO Quik Q2501 module.

To use these inputs with an electret microphone, bias has to be generated outside the WISMO Quik Q2501 module according to the characteristics of this electret microphone.

AC coupling is already embedded in the module.

Pin description

Signal	Pin #	I/O	I/O type	Description
MIC1P	62	I	Analog	Microphone 1 positive input
MIC1N	64	I	Analog	Microphone 1 negative input

2.6.6.2 Speaker outputs

2.6.6.2.1 General description

These outputs are differential and the output power can be adjusted by step of 2 dB.

Outputs can be directly connected to a speaker.

The gain of the speaker outputs is internally adjusted and can be tuned using an AT command (refer to AT commands documentation [4]).

2.6.6.2.2 Main Speaker Outputs (SPK2)
Pin description

Signal	Pin #	I/O	I/O type	Description
SPK2P	65	O	Analog	Speaker 2 positive output
SPK2N	67	O	Analog	Speaker 2 negative output

2.6.6.2.3 Auxiliary Speaker Outputs (SPK1)
Pin description

Signal	Pin #	I/O	I/O type	Description
SPK1P	61	O	Analog	Speaker 1 positive output
SPK1N	63	O	Analog	Speaker 1 negative output

2.6.7 Buzzer interface

The buzzer output (BUZ) is an open collector output driven by a PWM which allows a direct connection to a buzzer supplied with VBATT.
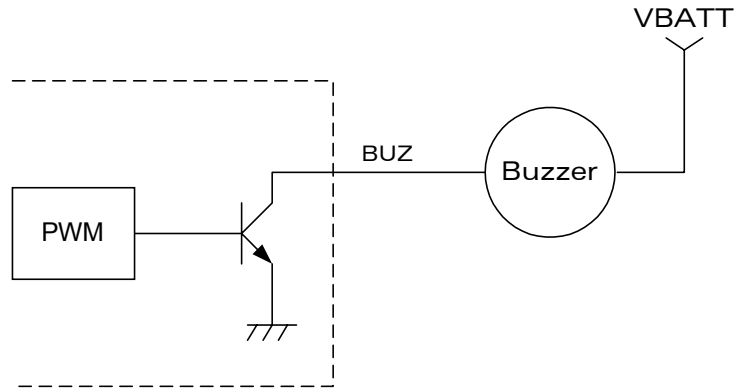
Figure 17: Buzzer output

Pin description

Signal	Pin #	I/O	I/O type	Description
BUZ	69	O	Open collector	Buzzer output

2.6.8 Output signals

2.6.8.1 Power supply for external devices

This output can be used to power some external functions. VCC has to be used as a 2.8 V digital power supply. This power supply is available when the module is on.

Pin description

Signal	Pin #	I/O	I/O type	Description
VCC	60	O	Supply	2.8 V Power supply for external digital devices

2.6.8.2 GSM transmission activity status

WISMO Quik Q2501 provides a status indication about the GSM RF transmission activity (GSM_PAC_EN).

This output can be used for example as a power supply synchronization in order to guarantee a correct current supply during transmission bursts.

Pin description

Signal	Pin #	I/O	I/O type	Description
GSM_PAC_EN	20	O	Digital	GSM transmission activity status

This signal indicates following status:

- GSM_PAC_EN=0: no operation

- GSM_PAC_EN=1: indicates increased power consumption during transmission

2.6.9 GSM Baseband activation indicator

The GSM Baseband activation indicator (GSM_BBEN) is available on system connector. This output signal is driving and supplying by RTC part and can be used as an external information allowing the main power supply (VBATT) to be externally switched OFF.

Pin description

Signal	Pin #	I/O	I/O type	Description
GSM_BBEN	6	O	CMOS VCC_RTC / 1X	Indicator of GSM Baseband activation

2.6.10 External interruption

The WISMO module provides an external interrupt input (~INTR) which is activated on high to low edge.

This input can be used for instance to automatically power off the module by an external event.

Pin description

Signal	Pin #	I/O	I/O type	Description
~INTR	36	I	CMOS	External Interrupt

2.6.11 Auxiliary analog signals

2.6.11.1 Analog to Digital Converter

WISMO Quik Q2501 provides an analog to digital converter.

This input can be used for example to monitor external temperature, useful for safety power-off in case of application over heating.

Pin description

Signal	Pin #	I/O	I/O type	Description
AUXADC	58	I	Analog	A/D converter

2.6.11.2 Digital to Analog Converter

WISMO Quik Q2501 provides a digital to analog converter.

This output voltage level varies according to a programmable value. It can be used as a programmable voltage generator.

Pin description

Signal	Pin #	I/O	I/O type	Description
AUXDAC	31	O	Analog	D/A converter

2.7 GPS interface

2.7.1 GPS activation

The GPS function can be activated/deactivated either by software or by hardware command through the GPS_EN signal available on the system connector and acting as:

- An input when GPS activation is hardware controlled,

- An output when GPS activation is software controlled; in that case, GPS_EN output is externally used as a GPS activation indicator.

The choice between hardware or software control is performed by AT command (see AT+WGPSM command in document [5]).

In case of conflict between hardware control and software control, the latest one has priority.

<u>Hardware Activation:</u>

Hardware activation pin for GPS function is available on the system connector (GPS_EN):

- high logic level: enable the GPS section.
  The voltage level of this signal has to be maintained between 2.4 V and VBATT.

- low logic level: disable the GPS section.

<u>Software Activation</u>:

GPS function activation/deactivation is controlled by AT commands (see AT WGPSM command in document [5]).

When software control is selected, any action on GPS_EN input is without effect.

Pin description

Signal	Pin #	I/O	I/O type	Description
GPS_EN	21	I/O	1V8_CMOS	Activation of the GPS function

2.7.2 GPS serials links

WISMO Quik Q2501 provides 2 serial links connected to the GPS baseband unit:

- GPS Main serial link: GPS_UART2
- GPS Auxiliary serial link: GPS_UART0
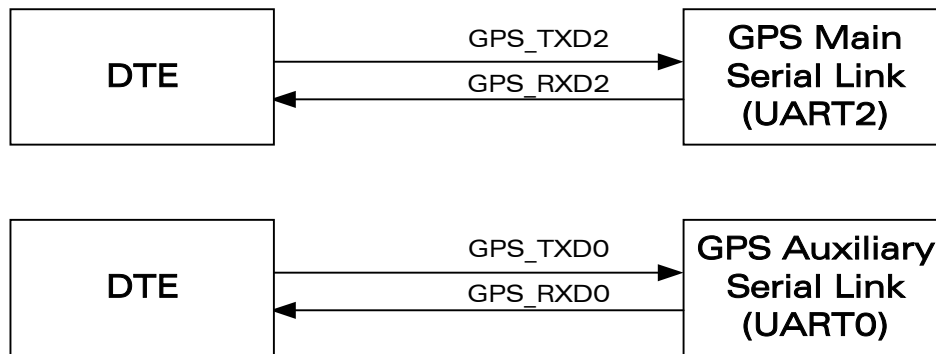
Figure 18: GPS interface - Serial LinksGPS Main Serial Link

This 2-wire serial interface is a 3 V interface complying with V24 technical specifications.

In default configuration, this interface makes GPS NMEA frames available (see § 1.7 for further details).

Pin description

Signal	Pin #	I/O	I/O type	Description
GPS_RXD2	1	O	Open Collector with internal 10 kΩ Pull-up resistor	CT104 - Receive serial data
GPS_TXD2	2	I	2V8 CMOS	CT103 - Transmit serial data
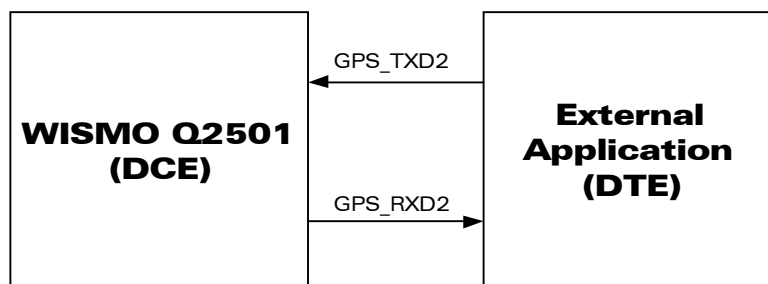
Figure 19: Main GPS serial link

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February 2004

2.7.2.2   GPS Auxiliary Serial Link

This 2-wire serial interface is a 1.8 V interface complying with V24 technical specifications.

Default protocol is RTCM, and NMEA protocol is available by software configuration via GPS baseband.

Pin description

Signal	Pin #	I/O	I/O type	Description
GPS_RXD0	3	O	1V8_CMOS_1X	CT104 – Receive serial data
GPS_TXD0	4	I	1V8_CMOS	CT103 – Transmit serial data
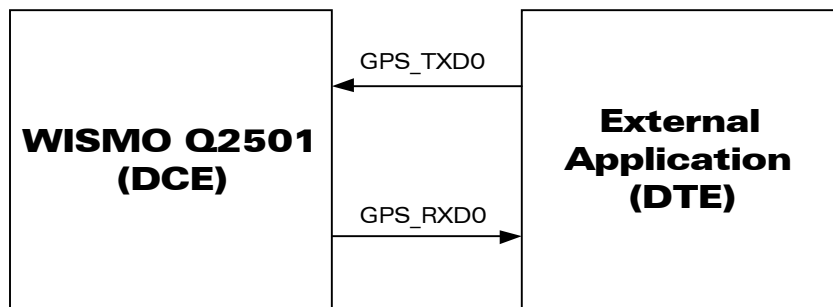
Figure 20: Auxiliary GPS serial link

2.7.3 Dead reckoning interface

WISMO Quik Q2501 module provides a full-digital interface for dead reckoning function: SPI bus (GPS_SCK, GPS_MOSI and GPS MISO) with 2 different chip select (GPS_PCS0_N and GPS_PCS1_N), and 2 GPI (GPS_REVERSE and GPS_EXTINT0).

The SPI bus is used to drive an ADC for temperature monitoring (GPS_PCS0_N) and for gyroscope (GPS_PCS1_N).

The distance information is given by the odometer and optionally by the reverse indicator.

Pin description

| Signal	Pin #	I/O	I/O type	Description
GPS_SCK	5	I	1V8_CMOS	SPI clock for dead reckoning
GPS_MOSI	8	I/O	1V8_CMOS/ 1X	SPI data (Master Output Slave In) - Not used for dead reckoning
GPS_MISO	11	I/O	1V8_CMOS/ 1X	SPI data (Master Input Slave Out) for dead reckoning
GPS_PCS0_N	13	O	1V8_CMOS 1X	Temperature sensor for dead reckoning
GPS_PCS1_N	15	O	1V8_CMOS 1X	Gyroscope connection for dead reckoning
GPS_REVERSE	7	I	1V8_CMOS	Reverse indicator input for dead reckoning
GPS_EXTINT0	9	I	1V8_CMOS	Odometer input for dead reckoning

2.7.4 Output signal

2.7.4.1   1.8 V external power supply

A 1.8 V power supply output is available on the System Connector for external digital devices.

Pin description

Signal	Pin #	I/O	I/O type	Description
GPS_VCORE	19	O	Supply	1.8 V supply for external digital devices

This supply is available when the GPS part is activated.

2.7.5 GPS antenna power supply

A voltage input is available on the System Connector in order to supply a GPS active antenna connected to the WISMO Quik Q2501 module.

This power supply DOES NOT need to be protected, since the protection is already embedded in the module.

Pin description

Signal	Pin #	I/O	I/O type	Description
GPS_VANT	18	I	Supply	GPS antenna external supply

- If 5V Antennas are used, it is necessary to provide 5V on this pin.
- If 3V antennas are used:
    - If the current sinked by the antenna does not exceed 10 mA, the antenna can be powered by the internal 3 V Supply. Connect GPS_VANT to VBATT.
    - if the current exceeds 10 mA, it is necessary to provide 3 V on this pin
- If Single Coax option is used, it is mandatory to provide a 5 V supply on this pin.

2.8 Operating mode configuration

Operating mode	ON/~OFF (input signal)	GPS_EN (input signal)	GSM_BBEN (output signal)
Module OFF	Low	Low	Low
GSM/GPRS only	High	Low	High
GPS only	High	High	High (see Note)
GSM/GPRS/GPS	High	High	High

<u>Note</u>: in GPS only mode, the GSM function of the WISMO module keeps on to be supplied (GSM_BBEN=1) in order to control:

- the GPS antenna supply,
- the GPS reset,
- etc.

2.9 Electrical characteristics
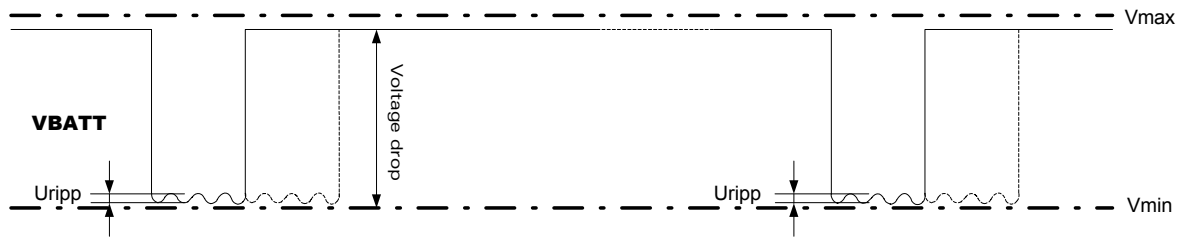
2.9.1 Power Supply

2.9.1.1 Introduction

The table below sums up the power supply inputs / outputs available on the WISMO Q2501 module:

Power suply	Pin #	I/O	Description
VBATT	75, 77, 78, 79, 80	I	Main power supply for both GPS and GSM functions
GPS_VANT	18	I	GPS antenna supply
VCC	60	O	2.8 V Power supply for external digital devices
GPS_VCORE	19	O	1.8 V Power supply for external digital devices
VCC_RTC	76	I/O	RTC back-up power supply

2.9.1.2 Main power supply (VBATT)

Parameter	Condition		Min	Typ	Max	Unit
VBATT voltage	Maximum output power 2.0 A peak		3.4	3.8	4.5	V
	Rising time			10		μs
Ripple voltage (U_{ripp}) before RF parameters are damaged	At T=25 °C And V=3.8 V	f*≤100 kHz			10	mVpp
		100 kHz <f*<400 kHz			3	mVpp
		f*=400 kHz			3	mVpp
		f*=600/800/1000 kHz			0.5	mVpp
		f*=500/700/900 kHz			1	mVpp
		f*=1100 kHz			1	mVpp
		f*=1200 kHz			1	mVpp
		f*=1300 kHz			2	mVpp
		f*=1400/1600 kHz			1	mVpp
		f*=1500/1700 kHz			3	mVpp
		f*=1800 kHz			3	mVpp
Drop Voltage	Maximum output power / V=3.8 V				300	mV

f*=ripple frequency measured in the burst.

VBATT with capacitive effect on power supply
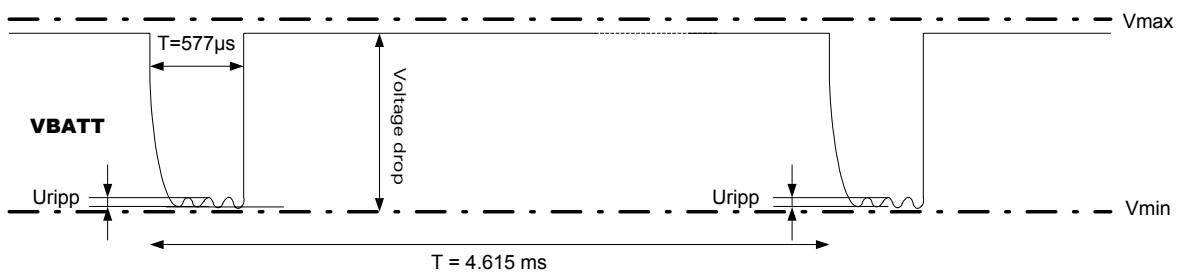
Legend:

——————— In GSM or GPRS class 2 modes

----------------------- In GPRS class 10 mode

When supplying the module with a battery, the total DC impedance (battery + protections + PCB traces) should be <150 mOhms.

2.9.1.3   GPS antenna external supply (GPS_VANT)

Parameter	Condition	Min	Typ	Max	Unit
Input voltage		2.8	3.3 or 5	5.5	V
Input Current	GPS_VANT=3.3 or 5 V		30	50	mA

2.9.1.4   2.8 V Power supply for external digital devices (VCC)

Parameter	Condition	Min	Typ	Max	Unit
Ouput voltage	I=10 mA	2.74	2.8	2,85	V
Output Current				10	mA

2.9.1.5 1.8 V Power supply for external digital devices (GPS_VCORE)

Parameter	Condition	Min	Typ	Max	Unit
Output voltage	I = 1 mA	1.65	1.8	1.95	V
Output Current				1	mA

2.9.1.6 RTC backup supply (VCC_RTC)

Conditions taken into account for the measurements mentioned in the table hereafter are:GSM_BBEN (pin 6) not used.

Parameter	Condition	Min	Typ	Max	Unit
Input voltage		2.25		2.75	V
Input Current	VCC=0 V; T° = 25°C VCC_RTC=2.5 V		20	33	µA
Input Current	VCC=0V; T°:-20°C / 55°C VCC_RTC=2.5V		25	38	µA
Output voltage	T°:-40°C/+85°C	2.25		2.58	V
Output current	VCC_RTC= 2.35 V			200	µA

2.9.1.7 Power consumption

2.9.1.7.1 Power consumption in OFF mode

Parameter	Condition	Min	Nom	Max	Unit
I_{VBATT}	Module supplied Module in OFF state No software running		8	13	μA

Note: information mentioned above are given assuming a 50 Ω RF output for GSM.

2.9.1.7.2 Power consumption in GSM/GPRS mode only

Power consumption in E-GSM/GPRS 900 MHz mode only (GPS OFF)

Parameter	Condition	Min	Nom	Max	Unit
I_{VBATT}	Average Idle mode		13.7	16.5	mA
I_{VBATT}	Average Idle synchronised 32K mode paging 0.5 s		6.8	8.1	mA
I_{VBATT}	Average E-GSM (1Rx/1Tx) @PCL5		225	239	mA
I_{VBATT}	Average E-GSM (1Rx/1Tx) @PCL8		159	169	mA
I_{VBATT}	Average GPRS Cl 2 (2Rx/1Tx) @ PCL5		230	245	mA
I_{VBATT}	Average GPRS Cl 2 (2Rx/1Tx) @ PCL8		160	172	mA
I_{VBATT}	Average GPRS Cl 10 (3Rx/2Tx) @ PCL5		400	425	mA
I_{VBATT}	Average GPRS Cl 10 (3Rx/2Tx) @ PCL8		270	285	mA
I_{VBATT}	During RX bursts		85	98	mA peak
I_{VBATT}	During TX bursts @PCL5		1.50	1.80	A peak
I_{VBATT}	During TX bursts @PCL8		775	785	mA peak

Power Control Level: PCL5=2 W typ.; PCL8=0.5 W typ; no DTX

Power consumption in DCS/GPRS 1800 MHz mode only (GPS OFF)

Parameter	Condition	Min	Nom	Max	Unit
I_{VBATT}	Average Idle mode		13.7	16.5	mA
I_{VBATT}	Average Idle synchronised 32K mode paging 0.5 s		6.8	8.1	mA
I_{VBATT}	Average DCS (1Rx/1Tx) @PCL0		164	175	mA
I_{VBATT}	Average DCS (1Rx/1Tx) @PCL3		122	130	mA
I_{VBATT}	Average GPRS Cl 2 (2Rx/1Tx) @ PCL0		166	178	mA
I_{VBATT}	Average GPRS Cl 2 (2Rx/1Tx) @ PCL3		122	131	mA
I_{VBATT}	Average GPRS Cl 10 (3Rx/2Tx) @ PCL0		285	300	mA
I_{VBATT}	Average GPRS Cl 10 (3Rx/2Tx) @ PCL3		198	206	mA
I_{VBATT}	During RX bursts		85	100	mA peak
I_{VBATT}	During TX bursts @PCL0		0.85	1	A peak
I_{VBATT}	During TX bursts @PCL3		0.520	0.535	A peak

Power Control Level: PCL0=1 W typ.; PCL3=0.25 W typ; no DTX

2.9.1.7.3 Power consumption in GPS mode only

Values mentioned below include the GSM part consumption relating to the control of the antenna switching (dual and single coax), the reset of GPS, the ON/OFF command of GPS and the management of AT commands.

Parameter	Condition	Min	Nom	Max	Unit
I_{VBATT}	GPS antenna internally supplied (internal LDO used 10 mA)		81.8	101.1	mA
I_{VBATT}	GPS antenna externally supplied (GPS_VANT input used)		71.8	91.1	mA
I_{GPS_VANT}	GPS_VANT= 5V or 3V3		30	50	mA

2.9.1.7.4 Power consumption in GSM/GPRS/GPS mode

GSM/GPRS/GPS consumption is the addition of both GSM/GPRS and GPS consumptions.

GPS antenna supplied through the GPS_VANT pin is independent of VBATT consumption. However, when using the GPS_VANT input for supplying the GPS antenna, it can be considered that if the GPS antenna consumption is 10 mA, this value can be added to VBATT consumption. That rule is also valid when using the internal power source (LDO) for supplying the GPS antenna.

Power consumption in E-GSM/GPRS 900 MHz/GPS mode

Parameter	Condition	Min	Nom	Max	Unit
I_{VBATT}	Average Idle mode		78.7	99.5	mA
I_{VBATT}	Average Idle synchronised 32K mode paging 0.5 s		71.8	91.1	mA
I_{VBATT}	Average E-GSM (1Rx/1Tx) @PCL5		290	322	mA
I_{VBATT}	Average E-GSM (1Rx/1Tx) @PCL8		224	252	mA
I_{VBATT}	Average GPRS Cl 2 (2Rx/1Tx) @ PCL5		295	328	mA
I_{VBATT}	Average GPRS Cl 2 (2Rx/1Tx) @ PCL8		225	255	mA
I_{VBATT}	Average GPRS Cl 10 (3Rx/2Tx) @ PCL5		465	508	mA
I_{VBATT}	Average GPRS Cl 10 (3Rx/2Tx) @ PCL8		335	368	mA
I_{VBATT}	During RX bursts		150	181	mA peak
I_{VBATT}	During TX bursts @PCL5		1.565	1.883	A peak
I_{VBATT}	During TX bursts @PCL8		0.840	0.868	A peak

Power Control Level: PCL5=2 W typ.; PCL8=0.5 W typ

Power consumption in DCS/GPRS 1800 MHz/GPS mode

Parameter	Condition	Min	Nom	Max	Unit
I_{VBATT}	Average Idle mode		78.7	99.5	mA
I_{VBATT}	Average Idle synchronised 32K mode paging 0.5 s		71.8	91.1	mA
I_{VBATT}	Average DCS (1Rx/1Tx) @PCL0		229	258	mA

Parameter	Condition	Min	Nom	Max	Unit
I$_{VBATT}$	Average DCS (1Rx/1Tx) @PCL3		187	213	mA
I$_{VBATT}$	Average GPRS Cl 2 (2Rx/1Tx) @ PCL0		231	261	mA
I$_{VBATT}$	Average GPRS Cl 2 (2Rx/1Tx) @ PCL3		187	214	mA
I$_{VBATT}$	Average GPRS Cl 10 (3Rx/2Tx) @ PCL0		350	383	mA
I$_{VBATT}$	Average GPRS Cl 10 (3Rx/2Tx) @ PCL3		263	289	mA
I$_{VBATT}$	During RX bursts		150	183	mA peak
I$_{VBATT}$	During TX bursts @PCL0		0.915	1.083	A peak
I$_{VBATT}$	During TX bursts @PCL3		0.585	0.618	A peak

Power Control Level: PCL0=1 W typ.; PCL3=0.25 W typ

2.9.1.8 Thermal dissipation

At VBATT=3.8 V

Operating mode	Condition	Min	Nom	Max	Unit
Module OFF mode			30		μW
E-GSM 900 (GPS OFF)	@PCL5		0.63		W
	@PCL8		0.55		W
DCS1800 (GPS OFF)	@PCL0		0.51		W
	@PCL3		0.44		W
E-GSM 900 GPRS class 2 (GPS OFF)	@PCL5		0.65		W
	@PCL8		0.55		W
E-GSM 900 GPRS class 10 (GPS OFF)	@PCL5		1.08		W
	@PCL8		0.91		W
DCS 1800 GPRS class 2 (GPS OFF)	@PCL0		0.52		W
	@PCL3		0.44		W
DCS 1800 GPRS class 10 (GPS OFF)	@PCL0		0.86		W
	@PCL3		0.70		W
E-GSM 900 GPRS class 2 GPS	@PCL5		0.90		W
	@PCL8		0.80		W
E-GSM 900 GPRS class 10 GPS	@PCL5		1.33		W
	@PCL8		1.16		W
DCS 1800 GPRS class 2 GPS	@PCL0		0.77		W
	@PCL3		0.69		W
DCS 1800 GPRS class 10 GPS	@PCL0		1.11		W
	@PCL3		0.95		W

Power Control Level: PCL5=2 W typ, PCL0=1 W typ, PCL8=0.5 W typ, PCL3=0.25 W typ.

2.9.2 Digital I/O

2.9.2.1   General characteristics

Two types of digital I/O are available inside the WISMO Q2501 module:

- CMOS 1.8 V,
- CMOS 2.8 V (comply with 3 Volts CMOS).

Operating conditions

Parameter	I/O type	Min	Max	Condition
V_{IL}	CMOS		0.3 x VCC*	
V_{IH}	CMOS	0.7 x VCC*		
V_{OL}	1X		0.1 V	I_{OL} = -1 mA
	2X		0.1 V	I_{OL} = -2 mA
	3X		0.1 V	I_{OL} = -3 mA
V_{OH}	1X	1.7 V or 2.7 V**		I_{OH} = 1 mA
	2X	1.7 V or 2.7 V**		I_{OH} = 2 mA
	3X	1.7 V or 2.7 V**		I_{OH} = 3 mA

* with VCC= 1.8 V or 2.8 V according to the type of CMOS voltage

**1.7 V for CMOS 1.8 V or 2.7 V for CMOS 2.8 V

2.9.2.2   General purpose input output

Signal	Pin	I/O	Type		Comment
			Input	Output	
GPIO0	44	I/O	CMOS 2V8	CMOS 2V8/3X	
GPIO1	22	I/O	CMOS 2V8	CMOS 2V8/2X	
GPIO2	24	I/O	CMOS 2V8	CMOS 2V8/2X	
GPIO3	53	I/O	CMOS 2V8	CMOS 2V8/2X	
GPIO4	73	I/O	CMOS 2V8	CMOS 2V8/2X	
GPIO5	55	I/O	CMOS 2V8	CMOS 2V8/3X	
GPO0	46	O	-	CMOS 2V8/3X/tri-state	
GPO1	42	O	-	CMOS 2V8/3X/tri-state	
GPO2	40	O	-	CMOS 2V8/3X/tri-state	
GPO3	48	O	-	CMOS 2V8/3X/tri-state	
GPI	38	I	CMOS 2V8	-	

2.9.2.3 Serial links

Signal	Pin	I/O	I/O type	Level	Comment
GPS Auxiliary Serial Link					
GPS_TXD0	4	I	CMOS 1.8 V	VIL ≤ 0.3 x VCC VIH ≥ 0.7 x VCC	
GPS_RXD0	3	O	CMOS 1.8 V	VOL ≤ 0.1V VOH ≥ 1.6V	
GPS Main Serial Link					
GPS_TXD2	2	I	CMOS 2.8 V	VIL ≤ 0.3 x VCC VIH ≥ 0.7 x VCC	
GPS_RXD2	1	O	CMOS 2.8 V	VOL ≤ 0.1V VOH ≥ 2.7 V	
GSM Auxiliary Serial Link					
GSM_TXD2	38	I	CMOS 2.8 V	VIL ≤ 0.3 x VCC VIH ≥ 0.7 x VCC	Multiplexed with GPI
GSM_RXD2	40	O	CMOS 2.8 V / 3X tri-state	VOL ≤ 0.1V VOH ≥ 2.7 V	Multiplexed with GPO5
GSM_CTS2	44	O	CMOS 2.8 V / 3X	VOL ≤ 0.1V VOH ≥ 2.7 V	Multiplexed with GPIO0
GSM_RTS2	55	I	CMOS 2.8 V	VIL ≤ 0.3 x VCC VIH ≥ 0.7 x VCC	Multiplexed with GPIO5
GSM Main Serial Link					
GSM_TXD1	59	I	CMOS 2.8 V	VIL ≤ 0.3 x VCC VIH ≥ 0.7 x VCC	
GSM_RXD1	52	O	CMOS 2.8 V / 3X	VOL ≤ 0.1V VOH ≥ 2.7 V	
GSM_CTS1	57	O	CMOS 2.8 V / 3X	VOL ≤ 0.1V VOH ≥ 2.7 V	
GSM_RTS1	50	I	CMOS 2.8 V	VIL ≤ 0.3 x VCC VIH ≥ 0.7 x VCC	
GSM_DSR1	56	O	CMOS 2.8 V / 3X	VOL ≤ 0.1V VOH ≥ 2.7 V	
GSM_DTR1	54	I	CMOS 2.8 V	VIL ≤ 0.3 x VCC VIH ≥ 0.7 x VCC	
GSM_DCD1	71	O	CMOS 2.8 V / 2X	VOL ≤ 0.1V VOH ≥ 2.7 V	
GSM_RI1	74	O	CMOS 2.8 V / 2X	VOL ≤ 0.1V VOH ≥ 2.7 V	

* with VCC= 1.8 V or 2.8 V according to the type of CMOS voltage

**1.7 V for CMOS 1.8 V; 2.7 V for CMOS 2.8 V.

The rising time and falling time of the reception signals (mainly GSM_RTS1) have to be less than 200 ns.

2.9.2.4 Keyboard

Row/Column scanning frequency = 200 Hz.

Signal	Pin	I/O	I/O type	Level	Comment
ROW0	33	I/O	CMOS 2.8 V/1X		Internal pull-down resistor
ROW1	35	I/O	CMOS 2.8 V/1X		Internal pull-down resistor
ROW2	37	I/O	CMOS 2.8 V/1X		Internal pull-down resistor
ROW3	39	I/O	CMOS 2.8 V/1X	$VIL \leq 0.3 \times VCC^*$	Internal pull-down resistor
ROW4	41	I/O	CMOS 2.8 V/1X	$VIH \geq 0.7 \times VCC^*$	Internal pull-down resistor
COL0	43	I/O	CMOS 2.8 V/1X	$VOL \leq 0.1V$	Internal pull-up resistor
COL1	45	I/O	CMOS 2.8 V/1X	$VOH \geq 2.7\ V$	Internal pull-up resistor
COL2	47	I/O	CMOS 2.8 V/1X		Internal pull-up resistor
COL3	49	I/O	CMOS 2.8 V/1X		Internal pull-up resistor
COL4	51	I/O	CMOS 2.8 V/1X		Internal pull-up resistor

*VCC = 2.8 V

2.9.2.5 Boot signal

Signal	Pin	I/O	I/O type	Level	Comment
BOOT	32	I	CMOS 2.8 V	$VIL \leq 0.3 \times VCC^*$ $VIH \geq 0.7 \times VCC^*$	Internal 100 kΩ pull-up resistor

*VCC = 2.8 V

2.9.2.6 Status indicators

Signal	Pin	I/O	I/O type	Level	Comment
FLASH_LED	72	O	CMOS 2.8 V/2X	$VOL \leq 0.1V$ $VOH \geq 2.7\ V$	
GPS_TIMEPULSE	17	O	CMOS 1.8 V	$VOL \leq 0.1V$ $VOH \geq 1.7\ V$	
GSM_BBEN	6	O	CMOS 2.8 V / 1X	$VOL \leq 0.1V$ $VOH \geq 2.7\ V$	

2.9.2.7 SPI Bus

Signal	Pin	I/O	I/O type	Level	Comment
SPI_IO	28	I/O	CMOS 2.8 V / 3X	$VIL \leq 0.3 VCC*$ $VIH \geq 0.7 VCC*$ $VOL \leq 0.1V$ $VOH \geq 2.7 V$	Multiplexed with SDA
SPI_CLK	30	O	CMOS 2.8 V / 3X	$VOL \leq 0.1V$ $VOH \geq 2.7 V$	Duty cycle=50 % External pull-up resistor required. Multiplexed with SCL
SPI_EN	48	O	CMOS 2.8 V / 3X	$VOL \leq 0.1V$ $VOH \geq 2.7 V$	Multiplexed with GPO3
SPI_AUX	46	O	CMOS 2.8 V / 3X	$VOL \leq 0.1V$ $VOH \geq 2.7 V$	Multiplexed with GPO0

*VCC = 2.8 V

2.9.2.8 2-wire Bus

Signal	Pin	I/O	I/O type	Level	Comment
SDA	28	I/O	CMOS 2.8 V / 3X	$VIL \leq 0.3 VCC*$ $VIH \geq 0.7 VCC*$ $VOL \leq 0.1V$ $VOH \geq 2.7 V$	Multiplexed with SPI_IO
SCL	30	O	CMOS 2.8 V / 3X	$VOL \leq 0.1V$ $VOH \geq 2.7 V$	Duty cycle=50 % External pull-up resistor required. Multiplexed with SPI_CLK

*VCC = 2.8 V

2.9.3 ON/~OFF signal

Electrical Characteristics

Parameter	Min	Max	Unit
Input Impedance (R)	10		kΩ
Input Impedance (C)		50	pF

Operating conditions

Parameter	Min	Max	Unit
V_{IL}	0	0.2 x VBATT	V
V_{IH}	0.8 x VBATT		V

2.9.4 ~RST signal

Electrical Characteristics

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

Operating conditions

Parameter	Min	Max	Condition
*V_{T-}	1.1V	1.2 V	
*V_{T+}	1.7V	1.9 V	
V_{OL}		0.4 V	$I_{OL} = -50\ \mu A$
V_{OH}	2.0 V		$I_{OH} = 50\ \mu A$

* $V_{T-},\ V_{T+\ :}$ Hysteresis Level

2.9.5 SIM interface

Parameter	Conditions	Min	Typ	Max	Unit
SIM_DATA V_{IH}	$I_{IH} = \pm 20\,\mu A$	0.7xSIM_VCC			V
SIM_DATA V_{IL}	$I_{IL} = 1$ mA			0.3 x SIM_VCC	V
SIM_RST, SIM_DATA SIM_CLK V_{OH}	Source current = 20 μA	SIM_VCC – 0.1 V			V
SIM_RST, SIM_DATA SIM_CLK V_{OL}	Sink current = -200 μA			0.10	V
SIM_VCC* Output Voltage	$I_{SIM\_VCC} <= 6$ mA	2.70	2.80	3.00	V
SIM_CLK Rise/Fall Time	Loaded with 30 pF			50	ns
SIM_RST, SIM_DATA Rise/Fall Time	Loaded with 30 pF			1	μs
SIM_CLK Frequency	Loaded with 30 pF			3.25	MHz
SIM_PRES V_{OH}		2.70	2.80	3.00	V
SIM_PRES V_{OL}				0.10	V

(*): given for the 3 V interface. An external voltage level shifter is needed to handle 1.8 V or 5 V SIM cards.

2.9.6 Audio interface

2.9.6.1 Microphone inputs

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 and can be tuned from 30 dB to 51 dB using an AT command.

Input Gain Range dynamic is splitted into 2 subranges:

- Controller 1 (subrange from 30 to 51 dB)

- Controller 2 (subrange from –6 to 10 & 30 to 51)

Tables hereafter give the microphone gain versus maximum input voltage for each input gain subrange.

Microphone gain vs Max input voltage (using controller 1)

Transmit Gain (dB)	Max Vin (mVrms)
30	43.80
33	31.01
36	21.95
39	15.54
42	11
45	7.79
48	5.51
51	3.9

Microphone gain vs Max input voltage (using controller 2)

Transmit Gain (dB)	Max Vin (mVpp)
- 6.5	3031
-6.0	2861
...	...
0.0	1434
...	...
+9.5	480
+10.0	454
+ 30.3	43.80
+ 30.8	41.36
...	...
+ 50.8	4.14
+ 51.3	3.90

Recommended characteristics for the microphone:

Type	electret 2 V – 0.5 mA
Impedance	2 kΩ
Sensitivity	-40 to –50 dB
SNR	> 50 dB in a frequency bandwidth between 300 and 3400 Hz
Frequency response	compatible with the GSM specifications.

2.9.6.2 Speaker outputs

Speaker gain vs Max output voltage

Receive Gain (dB) (*)	Max output level (Vrms)	Max.speaker load (Ω)
+2	1.74	150
0	1.38	50
-2	1.099	32
-4	0.873	32
-6	0.693	32
-8	0.551	32
-10	0.437	32
-12	0.347	32
-14	0.276	32
-16	0.219	32
-18	0.174	32
-20	0.138	32
-22	0.110	32
-24	0.087	32
-26	0.069	32
-26	0.069	32

(*) analog gain: might not be significant

The control of the receive gain is done by AT commands.

Recommended characteristics for the speaker:

Type	10 mW, electro-magnetic
Impedance	32 to 150 Ω
Sensitivity	110 dB SPL min. (0 dB = 20 μPa)
Frequency response	compatible with the GSM specifications

2.9.7 Auxiliary signals

2.9.7.1 Analog to Digital Converter (AUXADC)

Parameter	Min	Max	Unit
Resolution	10		bits
Sampling rate	17 for each channel or 68 on specific channel		Ksp/s
Input signal range	0	2.8V	V
Offset error	+/- 90		mV
Full scale error	+/- 25		mV
Integral linearity error	+/- 2		LSB
Differential linearity error	+/- 1		LSB
Input Impedance (R)	100 (typ)		MΩ
Input Impedance (C)	4 (typ)		pF
Current consumption in active state	600		µA
Current consumption in power down state	1		µA

2.9.7.2 Digital to Analog Converter (AUXDAC)

Parameter	Min	Max	Unit
Resolution	8		bits
Output voltage	0.16	2.64	V
Offset error	+/- 50		mV
Full scale error	+/- 50		mV
Integral linearity error	+/- 2		LSB
Differential linearity error	+/- 0.5		LSB
Output load (R)	1		kΩ
Output load (C)		200	pF
Current consumption in active state	560		µA
Current consumption in power down state	1		µA
Setting time	5		µs

2.9.7.3   Buzzer output

Operating conditions

Parameter	Condition	Min	Max	Unit
V_{OL}	$I_{AVERAGE}$= 40 mA		0.6	V
I_{PEAK}	VBATT = VBATT max		80	mA
$I_{AVERAGE}$	VBATT = VBATT max		40	mA

Recommended characteristics for the buzzer:

Type	electro-magnetic.
Impedance	7 to 30 Ω
Sensitivity	90 dB SPL min @ 10 cm

2.9.7.4   External interrupt (~INTR)

Electrical characteristics

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

2.9.8 Dead reckoning interface

Signal	Pin	I/O	I/O type	Level	Comment
GPS_SCK	5	I	CMOS 1.8 V / 1X		
GPS_MOSI	8	I/O	CMOS 1.8 V / 1X		
GPS_MISO	11	I/O	CMOS 1.8 V / 1X		
GPS_PCS0_N	13	O	CMOS 1.8 V / 1X		
GPS_PCS1_N	15	O	CMOS 1.8 V / 1X		
GPS_REVERSE	7	I	CMOS 1.8 V		
GPS_EXTINT0	9	I	CMOS 1.8 V		

2.9.9 GPS activation

Signal	Pin	I/O	I/O type	Level	Comment
GPS_EN	21	I/O	CMOS 2.8 V / 2X	$VIL \leq 0.3\ VCC*$ $VIH \geq 0.7\ VCC*$ $VOL \leq 0.1V$ $VOH \geq 2.7\ V$	Output: 100 kΩ impedance

*VCC = 2.8 V

2.9.10 GSM transmission activity status

Signal	Pin	I/O	I/O type	Level	Comment
GSM_PAC_EN	20	O	CMOS 2.8 V / 3X Tri-state	$VOL \leq 0.1V$ $VOH \geq 2.7\ V$	This signal is also used internally. Misuse can degrade GSM performances.

3 RF interface

3.1 RF connectors

The RF connections between the WISMO Quik Q2501 module and the customer application is made by two MMS type coaxial connectors, manufactured by Radiall.

Both RF connectors are available on the top side of the module, named:

- GSM/DCS RF connector
- GPS RF connector

The MMS connector stands on three pliable legs in order to guarantee the receptacle stability after the placement. A snap-on mating system ensures a correct positive connection each time.

Detailed information about MMS connector is available in this document, paragraph RF Connector data sheet, 6.4.

According to RF interface configuration described in § 1.7.3, these connectors are used differently:

- Default configuration: GSM/DCS antenna connected to GSM/DCS RF connector and GPS antenna connected to GPS RF connector.
- Single Coax configuration: only one coaxial cable connected to GSM/DCS RF connector to drive GSM/DCS and GPS antenna.
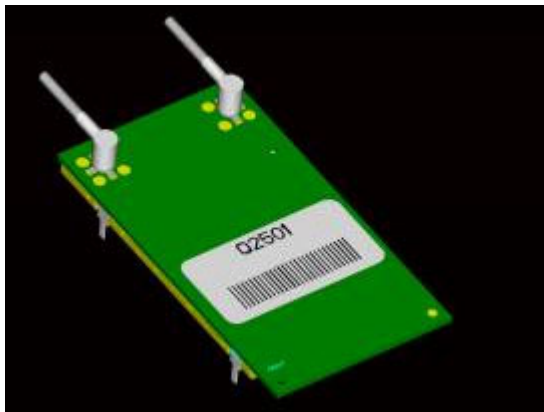
Figure 21: Default configuration
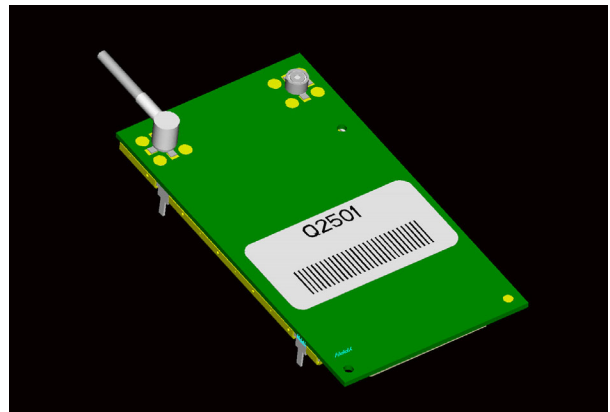
Figure 22: Single Coax configuration

Note:

WAVECOM strongly recommends not to use IMS plug equivalent connectors, because it does not mate correctly with the Radiall receptacle.

3.2 Electrical characteristics

Both RF connections impedance is 50 Ω nominal.

▪ The DC impedance of the GPS interface is < 5 Ω

▪ The DC impedance of the GSM interface is:

o floating if the Single Coax option is not used,

o < 5 Ω if the Single Coax option is used.

3.3 RF performances

3.3.1 GSM RF performances

GSM RF performances are compliant with the ETSI recommendation GSM 05.05.

The main parameters for Receiver are:

- E-GSM900 Reference Sensitivity = -104 dBm Static & TUHigh

- DCS1800 Reference Sensitivity = -104 dBm Static & TUHigh

- Selectivity @ 200 kHz: > +9 dBc

- Selectivity @ 400 kHz: > +41 dBc

- Linear dynamic range: 63 dB

- Co-channel rejection: >= 9 dBc

And for Transmitter:

- Maximum output power (E-GSM900): 33 dBm +/- 2 dB at ambient temperature.

- Maximum output power (DCS1800): 30 dBm +/- 2 dB at ambient temperature.

- Minimum output power (E-GSM900): 5 dBm +/- 5 dB at ambient temperature.

- Minimum output power (DCS1800): 0 dBm +/- 5 dB at ambient temperature.

3.3.2 GPS RF performances

The main parameters for receiver are:

Parameter	Specification		
Receiver type	L1 frequency (1575.42 MHz) C/A code 16-channels 8192 search bins		
Max. Update Rate	4 Hz		
Accuracy_ (Selective Availability off)	Position:		2.5m CEP[2] / 5.0m SEP[3]
	Position DGPS or SBAS[1]:		2.0m CEP / 3.0m SEP
Acquisition		Fast acquisition mode	Normal mode	High sensitivity mode
	Cold start[4]	34 s	36 s	41 s
	Warm start	33 s		
	Hot start	< 3.5 s		
Signal Reacquisition	< 1 s		
Sensitivity[6]		Fast acquisition mode	Normal mode	High sensitivity mode
	Acquisition	-134 dBm	-138 dBm	-140 dBm
	Tracking	-143 dBm	-146 dBm	-149 dBm
Timepulse Accuracy	RMS 99 % Granularity	50 ns <100 ns 43 ns		
Dynamics	≤ 4 g		
Operational Limits	COCOM restrictions		

[1] Depends on accuracy of correction data of DGPS or SBAS service

[2] CEP=Circular Error Probability: The radius of a horizontal circle, centered at the antenna's true position, containing 50 % of the fixes.

[3] SEP=Spherical Error Probability: The radius of the sphere, centered at the true position, containing 50 % of the fixes.

[4] Measured with good visibility and –125 dBm signal strength

[5] Demonstrated with active antenna

In Single Coax configuration:

- when the module is in idle mode (GSM or GPRS), loss is < 0.1 dB in C/N,

- when the module is in GSM TCH/FS or TCH/data mode, loss is roughly 4 dB in C/N.

Because of high number of GSM slots allocated in packet data transmission (GPRS), the use of single coax configuration is not recommended with GPRS.

3.4 Antenna specifications

3.4.1 GSM.DCS Antenna

A GSM/DCS dual-band antenna shall work in these frequency bands and have the following characteristics:

Characteristics		E-GSM 900	DCS 1800
Frequency TX		880 to 915 MHz	1710 to 1785 MHz
Frequency RX		925 to 960 MHz	1805 to 1880 MHz
Impedance		50 Ohms	
VSWR	Rx max	1.5 : 1	
	Tx max	1.5 : 1	
Polarization		Linear	
Typical radiated gain		0 dBi in one direction at least	

Note: WAVECOM recommends a VSWR max. of 1.5:1 for the Rx and the Tx. All aspects of this specification will be fulfilled even with a VSWR max. of 2:1 for the Rx and the Tx.

3.4.2 GPS antenna

The GPS antenna must fulfill the following requirements:

Characteristics	GPS
Frequency RX	1575.42 MHz +/-1.023 MHz
Impedance	50 Ohms
VSWR Rx max	1.5 : 1
Polarization	RHCP
Antenna gain	15 dB typ. 45 dB max.
Typical radiated gain	5 dBi in one direction at least
Supply voltage	3 V or 5 V
Supply current	10 mA max. for internal supply (internal LDO) 50 mA max. for external supply (GPS_VANT input)

Note:

- If a classical patch antenna is followed by an LNA, care must be taken when placing the antennas: the DCS1800 transmission can saturate the GPS thus decreasing the GPS performances.

- if combined antennas are used, isolation of GSM/DCS & GPS is a key parameter.

4 Mechanical specifications

4.1 Physical characteristics

The WISMO Quik Q2501 module has a complete self-contained shield.

- Dimensions: 58.4 x 32.2 x 6.3 mm external dimensions (except shielding legs)
- Weight: 11 g

4.2 Mechanical drawings

The next page gives the mechanical specifications of WISMO Quik Q2501.

SCALE 1,000

SCALE 1,000

30,8±0,2

2,3

2,3
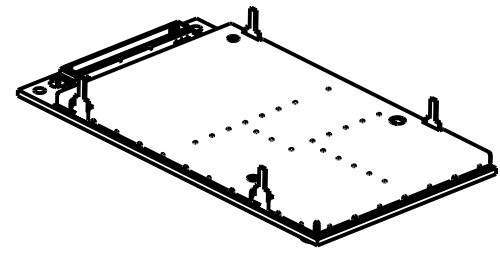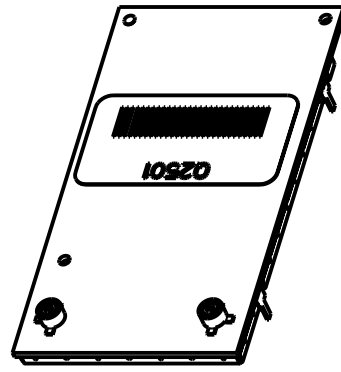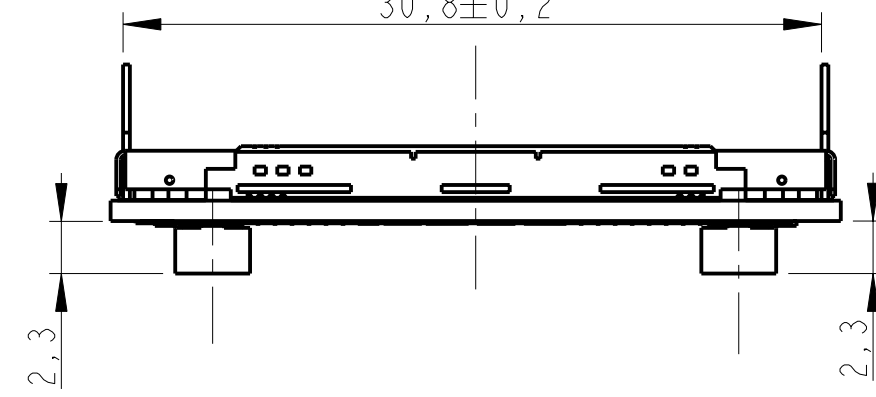
SCALE 3,000

$4^{+0,35}_{-0,20}$ (TBC)

3,2±0,4

SEE DETAIL B

4,5±0,3

4,5±0,3

0,3

5,6±0,3

DETAIL B
SCALE 10,000

54,6±0,4

58,4±0,4

35,15±0,05

Sticker

Q2501

3±0,1

3±0,1

(3,8)

16,1±0,1

0,9±0,1

7,88±0,3

32,2±0,2

Male connector

5 Environmental Specifications

5.1 Operational conditions of functioning

3 different operating classes have been defined:

Class A: The module shall have full function during and after an external influence. The performances meet the minimum requirements.

Class B: The module is fully functional (phone calls sending and receiving, SMS, GPRS) but GSM/DCS performances can be out of ETSI minimum requirements. All functions will return to normal after the external influence has been removed.

Class C: The functional requirements will not be fulfilled during external influence, but will return to full function automatically after that the external influence has been removed.

Following table gives the temperature ranges corresponding to these classes for GSM/DCS function and for GPS function.

GSM/DCS	GPS	Temperature range
A		-20 °C to +55 °C for GSM 900 -10 °C to +55 °C for GSM 1800
B	A	-35 °C to +85 °C
C	C	-40 °C to +85 °C
Storage	Storage	-50 °C to +90 °C

5.2 Environmental qualification

Test Designation	Standards	Definition / Severities
Resistance to Heat	IEC 60068-2-2	Temperature: +85°C Duration: 504 h
Resistance to cold test	IEC 60068-2-30 Db	Storage temperature: -40 ±2 °C Storage time: 72 h
Cooking Test	-	Temperature: +70 ±2°C Duration: 100 days
Damp heat test	IEC 60068-2-3	Storage temperature: +40 ±2°C Storage humidity: HR 95 ±3% Storage time: 21 days
Damp heat cycle test	IEC 60068-2-30 Db	Upper temperature: +55 ±2°C Storage humidity: HR 95 ±3% Number of cycles: 10
Temperature change	IEC 60068-2-14 Nb	Low temperature: -40°±2°C High temperature: +85 ±2°C Total duration: 11 days
Thermal Shock	IEC 60068-2-14	Low temperature: -40°±2°C High temperature: +85 ±2°C Total duration: 200 hours
Resistance to sinusoidal vibration	IEC 60068-2-6 Fc	[10 Hz to 16 Hz]: ±5 mm (peak) [16 Hz to 62 Hz]: 5 g (peak) [62 Hz to 200Hz]: 3 g (peak) [200 Hz to 1000 Hz] 1g (peak) Test duration: 20 cycles Sweep directions: X / Y / Z
Resistance to random vibration	IEC 60068-2-64	Frequency range: 10 Hz - 2000 Hz Spectrum level: • 0.1 g^2/Hz at 10 Hz • 0.01 g^2/Hz at 250 Hz • 0.0005 g^2/Hz at 1000 Hz • 0.0005 g^2/Hz at 2000 Hz Duration: 16 h Vibration axis: X / Y / Z
Resistance to mechanical shock	IEC 68-2-27	Peak acceleration: 30 g / 100 g / 200 g Direction: ±X, ±Y, ±Z
ESD Test	IEC 1000-4-2	1 kV contact discharge on 80-pin connector 2 kV contact discharge on RF connector

For more details refer to Automotive Environmental Control Plan ([1]).

6 Appendix

6.1 Standard and Recommendations

6.1.1 GSM/GPRS mode

The WISMO Quik Q2501 is compliant with the following GSM ETSI, 3GPP and GCF recommendations for GSM/GPRS Phase II.

Specification Reference	Title
3GPP TS 45.005 v5.5.0 (2002-08) Release 5	Technical Specification Group GSM/EDGE. Radio Access Network; Radio transmission and reception
GSM 02.07 V8.0.0 (1999-07)	Digital cellular telecommunications system (Phase 2+); Mobile Stations (MS) features (GSM 02.07 version 8.0.0 Release 1999)
GSM 02.60 V8.1.0 (1999-07)	Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description, Stage 1 (GSM 02.60 version 8.1.0 Release 1999)
GSM 03.60 V7.9.0 (2002-09)	Technical Specification Group Services and System Aspects; Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description; Stage 2 (Release 1998)
3GPP TS 43.064 V5.0.0 (2002-04)	Technical Specification Group GERAN; Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2 (Release 5)
3GPP TS 03.22 V8.7.0 (2002-08)	Technical Specification Group GSM/EDGE. Radio Access Network; Functions related to Mobile Station (MS) in idle mode and group receive mode; (Release 1999)
3GPP TS 03.40 V7.5.0 (2001-12)	Technical Specification Group Terminals; Technical realization of the Short Message Service (SMS) (Release 1998)
3GPP TS 03.41 V7.4.0 (2000-09)	Technical Specification Group Terminals; Technical realization of Cell Broadcast Service (CBS) (Release 1998)

Specification Reference	Title
ETSI EN 300 903 V8.1.1 (2000-11)	Digital cellular telecommunications system (Phase 2+); Transmission planning aspects of the speech service in the GSM Public Land Mobile Network (PLMN) system (GSM 03.50 version 8.1.1 Release 1999)
3GPP TS 04.06 V8.2.1 (2002-05)	Technical Specification Group GSM/EDGE Radio Access Network; Mobile Station - Base Station System (MS - BSS) interface; Data Link (DL) layer specification (Release 1999)
3GPP TS 04.08 V7.18.0 (2002-09)	Technical Specification Group Core Network; Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification (Release 1998)
3GPP TS 04.10 V7.1.0 (2001-12)	Technical Specification Group Core Networks; Mobile radio interface layer 3 Supplementary services specification; General aspects (Release 1998)
3GPP TS 04.11 V7.1.0 (2000-09)	Technical Specification Group Core Network; Digital cellular telecommunications system (Phase 2+); Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface (Release 1998)
3GPP TS 45.005 v5.5.0 (2002-08)	Technical Specification Group GSM/EDGE. Radio Access Network; Radio transmission and reception (Release 5)
3GPP TS 45.008 V5.8.0 (2002-08)	Technical Specification Group GSM/EDGE Radio Access Network; Radio subsystem link control (Release 5)
3GPP TS 45.010 V5.1.0 (2002-08)	Technical Specification Group GSM/EDGE Radio Access Network; Radio subsystem synchronization (Release 5)
3GPP TS 46.010 V5.0.0 (2002-06)	Technical Specification Group Services and System Aspects; Full rate speech; Transcoding (Release 5)
3GPP TS 46.011 V5.0.0 (2002-06)	Technical Specification Group Services and System Aspects; Full rate speech; Substitution and muting of lost frames for full rate speech channels (Release 5)
3GPP TS 46.012 V5.0.0 (2002-06)	Technical Specification Group Services and System Aspects; Full rate speech; Comfort noise aspect for full rate speech traffic channels (Release 5)

Specification Reference	Title
3GPP TS 46.031 V5.0.0 (2002-06)	Technical Specification Group Services and System Aspects; Full rate speech; Discontinuous Transmission (DTX) for full rate speech traffic channels (Release 5)
3GPP TS 46.032 V5.0.0 (2002-06)	Technical Specification Group Services and System Aspects; Full rate speech; Voice Activity Detector (VAD) for full rate speech traffic channels (Release 5)
TS 100 913V8.0.0 (1999-08)	Digital cellular telecommunications system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS) (GSM 07.01 version 8.0.0 Release 1999)
GSM 09.07 V8.0.0 (1999-08)	Digital cellular telecommunications system (Phase 2+); General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN) (GSM 09.07 version 8.0.0 Release 1999)
3GPP TS 51.010-1 v5.5.0 (2003-09)	Technical Specification Group GSM/EDGE ; Radio Access Network ;Digital cellular telecommunications system (Phase 2+);Mobile Station (MS) conformance specification; Part 1: Conformance specification (Release 5)
3GPP TS 51.011 V5.0.0 (2001-12)	Technical Specification Group Terminals; Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface (Release 5)
ETS 300 641 (1998-03)	Digital cellular telecommunications system (Phase 2); Specification of the 3 Volt Subscriber Identity Module - Mobile Equipment (SIM-ME) interface (GSM 11.12 version 4.3.1)
GCF-CC V3.13 (2004-03)	Global Certification Forum – Certification criteria

6.1.2 GPS mode

The Wismo Quik Q2501 is compliant with:

- NMEA 0183,
- EN 61162-1 (Ed. 2000)
- EN 61162-2 (Ed. 1998).

6.2 Safety recommendations (for information only)

<div style="border:1px solid black">

IMPORTANT

FOR THE EFFICIENT AND SAFE OPERATION OF

YOUR GSM APPLICATION BASED ON WISMO Quik Q2501

PLEASE READ THIS INFORMATION CAREFULLY

</div>

6.2.1 RF safety

6.2.1.1   General

Your application using the WISMO Quik Q2501 module 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.

6.2.1.2   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.

6.2.1.3   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.

6.2.1.4 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.

6.2.2 General safety

6.2.2.1 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.

6.2.2.2 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.

6.2.2.3 Vehicle electronic equipment

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

6.2.2.4 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.

6.2.2.5 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.

6.2.2.6 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.

6.2.2.7 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.

6.2.2.8 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 fuelling 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.

6.3 System Connector data sheet

Following next page summarizes the MOLEX MX53748-0808 connector datasheet (also available from http://www.molex.com/).

FEATURES AND SPECIFICATIONS

Features and Benefits
- Stacking height: 3.0mm
- Sizes 20 to 80 circuits
- Locking feature provides secure mating
- High temperature housing
- Durable blade on beam contact interface
- Anti-flux design

Reference Information
Packaging: Embossed tape
Mates With: 52991
Designed In: Millimeters

Mating Dimensions
53748 • 52991
H=3.0mm W=5.4mm

Electrical
Voltage: 50V
Current: 0.5A
Contact Resistance: 50mΩ max.
Dielectric Withstanding Voltage: 500V AC
Insulation Resistance: 100 MΩ min.

Physical
Housing: White glass-filled LCP plastic, UL 94V-0
Contact: Brass
Plating: Gold over Nickel
Operating Temperature: -40 to +105°C

molex®

0.50mm (.020") Pitch Board-to-Board Plug

53748
SMT, Dual Row Vertical Stacking
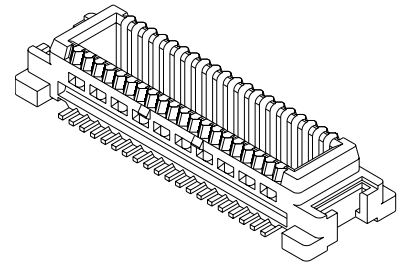
0.40 to 1.60mm (.016 to .063") Pitch

CATALOG DRAWING (FOR REFERENCE ONLY)
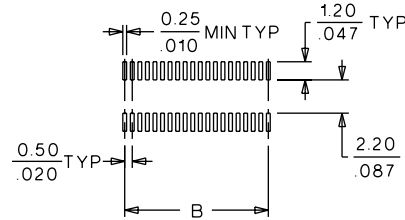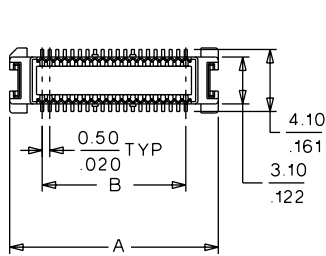
PCB LAYOUT: COMPONENT SIDE
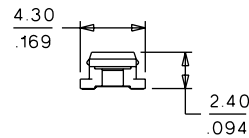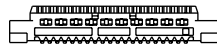
ORDERING INFORMATION AND DIMENSIONS

Circuits	Order No.		Dimension		Carrier Tape Width
	With Vacuum Pick-up Tape	Without Vacuum Pick-up Tape	A	B	
20	53748-0204	53748-0208	8.80 (.346)	4.50 (.177)	16.00 (.630)
30	53748-0304	53748-0308	11.30 (.170)	7.00 (.275)	24.00 (.945)
40	53748-0404	53748-0408	13.80 (.444)	9.50 (.374)	24.00 (.945)
50	53748-0504	53748-0508	16.30 (.641)	12.00 (.472)	32.00 (1.260)
60	53748-0604	53748-0608	18.80 (.740)	14.50 (.570)	32.00 (1.260)
70	53748-0704	53748-0708	21.30 (.838)	17.00 (.669)	44.00 (1.732)
80		53748-0808	23.80 (.937)	19.50 (.767)	44.00 (1.732)

Note: Contact Molex for embossed tape specifications

Note: Use only one connector per daughterboard in order to insure proper mating alignment

6.4 RF Connector data sheet

The 3 next pages are the RADIALL data sheets for the MMS connector (also available from http://www.radiall.com/).

MMS
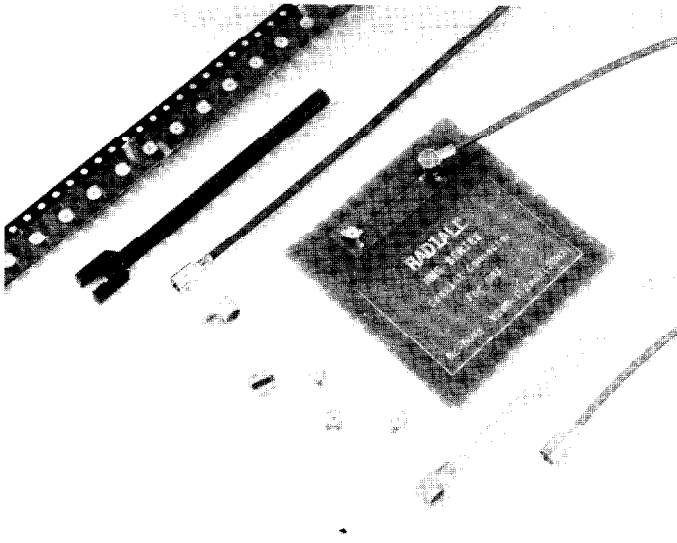
GENERAL

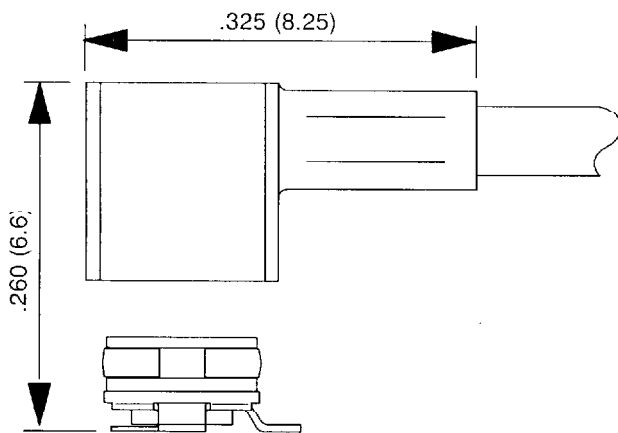| **50 Ω**	**DC - 6 GHz**
75 Ω	**DC - 1 GHz**

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
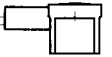- Other general electronics

---

PROFILE

.325 (8.25)

.260 (6.6)

Unmated

.325 (8.25)

.205 (5.2)
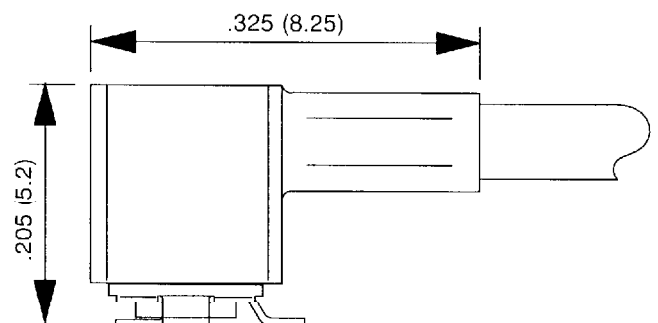
Mated

CHARACTERISTICS

	TEST STANDARD	RESULTS	

ELECTRICAL CHARACTERISTICS

		50 Ω	75 Ω
Impedance		50 Ω	75 Ω
Frequency range		DC-6 GHz	DC-1 GHz
V.S.W.R. (mated pair)	IEC 1169-1	1.05 at 1 GHz 1.15 at 2.5 GHz 1.35 at 6 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 –45 dB at 1 GHz –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 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 T 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 female	Brass Beryllium copper	
Insulator	PTFE	

PLATING

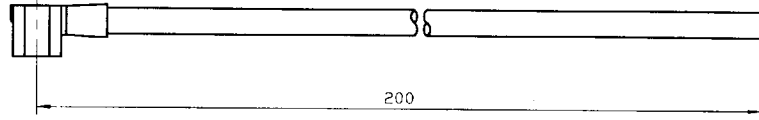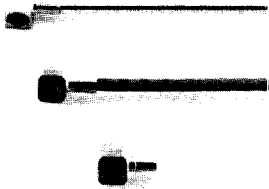|		
Bodies plugs, in series adapters	Nickel	
Bodies receptacles	Gold	
Center contact male female	Nickel Gold	

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)*.


RF Leakage (dB) vs Frequency (GHz) — Mated pair — MMS

V.S.W.R. vs Frequency (GHz) — Mated pair — MMS

MMS

STANDARD CABLE ASSEMBLIES
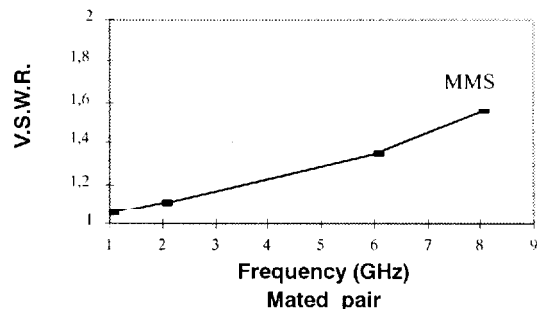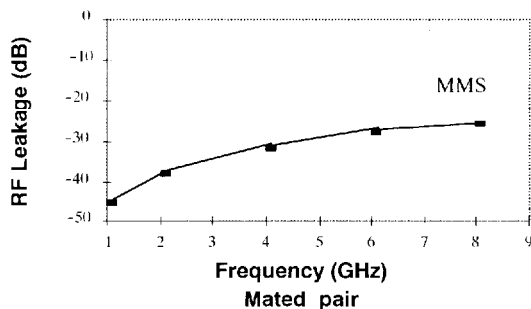
MMS PIGTAILS

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

fig. 1

fig. 2

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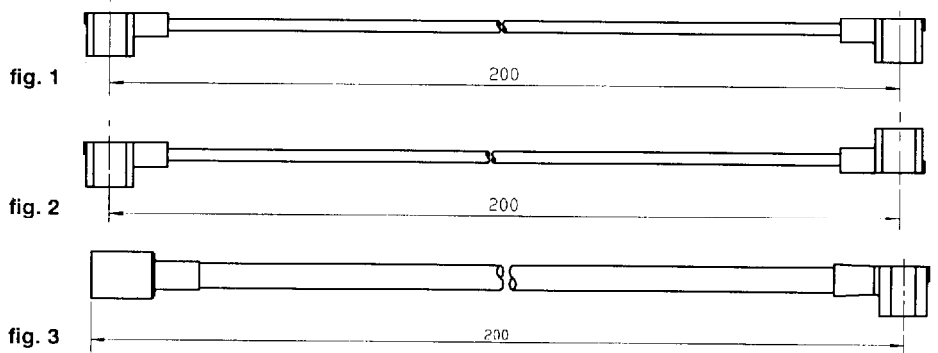
cable group	part number	fig.	composition
1 /50/ S	**R285 004 001**	1	R209 351 020 + C291 050 066 + R209 351 020
1 /50/ S	**R285 005 001**	2	R209 351 020 + C291 050 066 + R209 351 020
2 /50/ S	**R285 004 221**	1	R209 353 000 + C291 145 060 + R209 353 000
2 /50/ S	**R285 005 221**	2	R209 353 000 + C291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

fig. 1

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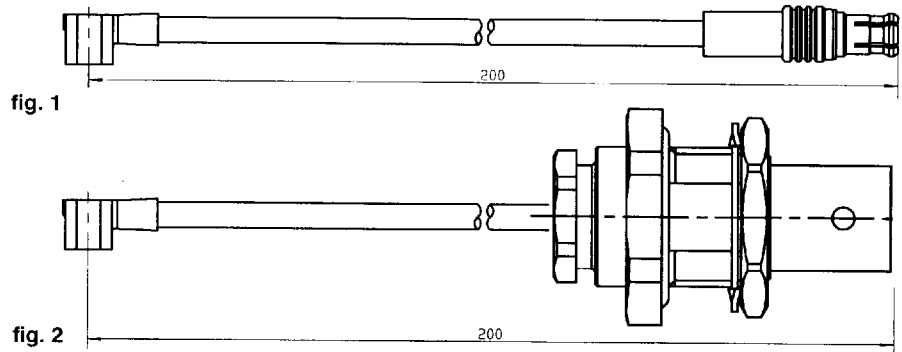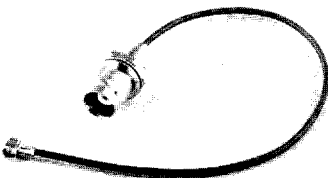
cable group	part number	fig.	composition	series
2 /50/ S	**R285 017 221**	1	R209 353 000 + C291 145 060 + R113 081 020	MMS/MCX
2 /50/ S	**R285 031 221**	2	R209 353 000 + C291 145 060 + R141 323 000	MMS/BNC