CB900 GSM/GPRS Module

Product Technical Specifications

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CONTENTS

1. Introduction

This document describes the hardware interface, including interface specifications, electrical and mechanical details, of the CB900 module that connects to the cellular device application.

1.1. Abbreviations

The following abbreviations are used in this document:

Abbreviation	Description
ACM	Accumulated Call Meter
ADC	Analog Digital Convertor
AMR	Adaptive Multi-rate
AMR- FR	AMR Full-rate
ADN	Abbreviated Dialing Number
APN	Access Point Name
CLIP	Calling Line Identity Presentation
CSD	Circuit Switched Data
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCS	Data Coding Scheme
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
DTR	Data Terminal Ready
EFR	Enhanced Full-rate
FR	Full-rate
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
IP	Internet Protocol
PDP	Packet Data Protocol
PDU	Packet Data Unit
PPP	Point-to-Point Protocol
RF	Radio Frequency
RTS	Ready To Send
SIM	Subscriber Identification Number
SMS	Short Messages Service
TCP	Transmission Control Protocol
UART	Universal Asynchronous Receiver Transmitter
UDP	User Data Protocol
USSD	Unstructured Supplementary Service Data

1.2. Safety Precautions

For your own safety, please follow the safety precautions listed below during all phases of the operation, usage, service or repair of any cellular terminal or mobile incorporating the CB900 Module. All manufacturers of these cellular terminals or mobile devices are advised to include the following safety precautions into all manuals provided with their terminal or mobile device, and pass this information to device users and operating personnel. Failure to comply may be dangerous or illegal.

Road safety

Do not use a mobile device while driving. Park the vehicle first or use a hand free earphone. It is illegal in some countries to use a mobile device while driving.

Switch off in aircraft

Cellular terminal or mobile devices can cause interference to aircraft electronics. Using them on aircraft is both illegal and dangerous.

Switch off when refueling vehicle

Do not use the cellular terminal or mobile device at a refueling station or near fuels or chemicals.

Forbidden Usage

Always switch off your cellular terminal or mobile device where it is forbidden to be used in any areas like a hospital.

Interference

All cellular terminals or mobile devices may be subjected to radio interference, which could affect their performance.

Emergency calls

As the GSM/GPRS module is based on GSM standard for radio signals and cellular networks, this connection cannot be guaranteed at all times under all conditions. It should never be entirely relied upon for essential communications such as an emergency call.

Note on compliance with international rules and regulations

The CB900 module is a fully certified cellular radio engine. The module has been tested and certified for compliance to international safety and GSM standard requirements at the modular level.

Manufacturers of cellular terminal or mobile equipment incorporating the CB900 are required to test their final products to ensure compliance to these EMC tests/requirements:

- ESD
- Radiated Spurious Emissions
- Conducted Emissions, if applicable
- Further tests if applicable

The module was not assessed against the essential requirement 'health'. Manufacturers of the final products are also responsible to ensure that their products are tested for compliance to any other health requirements that might be applicable.

A few other important notes regarding safety in implementation and usage of the module:

- The module shall be supplied by a Limited Power Supply (LPS) according to EN60950:2000.
- No necessary spacing (creepage and clearance distance) shall be reduced by installing the module into the final equipment.
- Provisions shall be made for fastening the module securely in the end product.

Instructions and equipment markings related to safety shall be in a language, which is acceptable in the country in which the equipment is to be installed.

2. Technical Specifications

2.1. General Specifications

Feature	Description
Network Type	Quad-Band GSM/GPRS
Frequency Bands	Quad Band: GSM850 / EGSM900 / DCS1800 / PCS1900
Output Power	GSM 850 / EGSM 900 : Class 4 (2W) DCS1800 / PCS1900: Class 1 (1W)
Physical Dimensions	Dimensions: 27.3 *27.3 *3mm Weight: 5g (including of shielding)
Power Supply	3.5V to 4.6V

Operational	Environmental Description
Normal Operating Temperature	-20 °C to +55 °C
Extended Operating Temperature	-40 °C to +85 °C
Relative humidity	5 – 95%

2.2. GSM/ GPRS Specifications

Feature	Description

GSM Audio	Telephony Emergency call Half Rate, Full Rate and Enhanced Full Rate (HR/FR/EFR) Adaptive Multi-rate (AMR) Hands-Free Operation Echo Cancellation (Enhanced AEC) Noise Reduction DTMF (encoding only)
SMS	Point-to-point (MO/MT) Cell Broadcast Text and PDU mode
GPRS	Class 12/10/8 Mobile Station Class B Coding Schemes MCS1 – MCS4 TCP Stack, UDP Stack HTTP Stack, FTP Stack PPP Stack

2.3. RF Frequencies

RF functionalities comply with the GSM Phase II GSM 850/EGSM 900/DCS 1800/PCS 1900 recommendations.

The frequencies covered are:

Tx GSM850: (824 ~ 849 MHz)	Rx GSM850: (869 ~ 894 MHz)
Tx EGSM900: (880 ~ 915 MHz)	Rx EGSM900: (925 ~ 960 MHz)
Tx DCS1800: (1710 ~ 1785 MHz)	Rx DCS1800: (1805 ~ 1880 MHz)
Tx PCS1900: (1850 ~ 1910 MHz)	Rx PCS1900: (1930 ~ 1990 MHz)

2.4. Baseband Functionalities

The Baseband is composed of an ARM, The digital baseband power supply is 1.2V and the digital IO power supply is 1.8V.

2.5. Interface Specifications

Feature	Description
68-pin LCC	Power Supply Back-up Battery Keypad 2 Serial Link UART USB 1.1

	1.8V/3V SIM Real time clock GPIOs Analog to Digital Converter Analog Audio Reset Power On Battery Charging Interface I2C master*

*For hardware reference only. These features are not enabled in the standard module firmware as it requires a certain level of firmware customization depending on its intended application. Please contact COBAN for more information

3. Functional Architecture

Figure 1 shows a block diagram of CB900 module and illustrate the major functional components

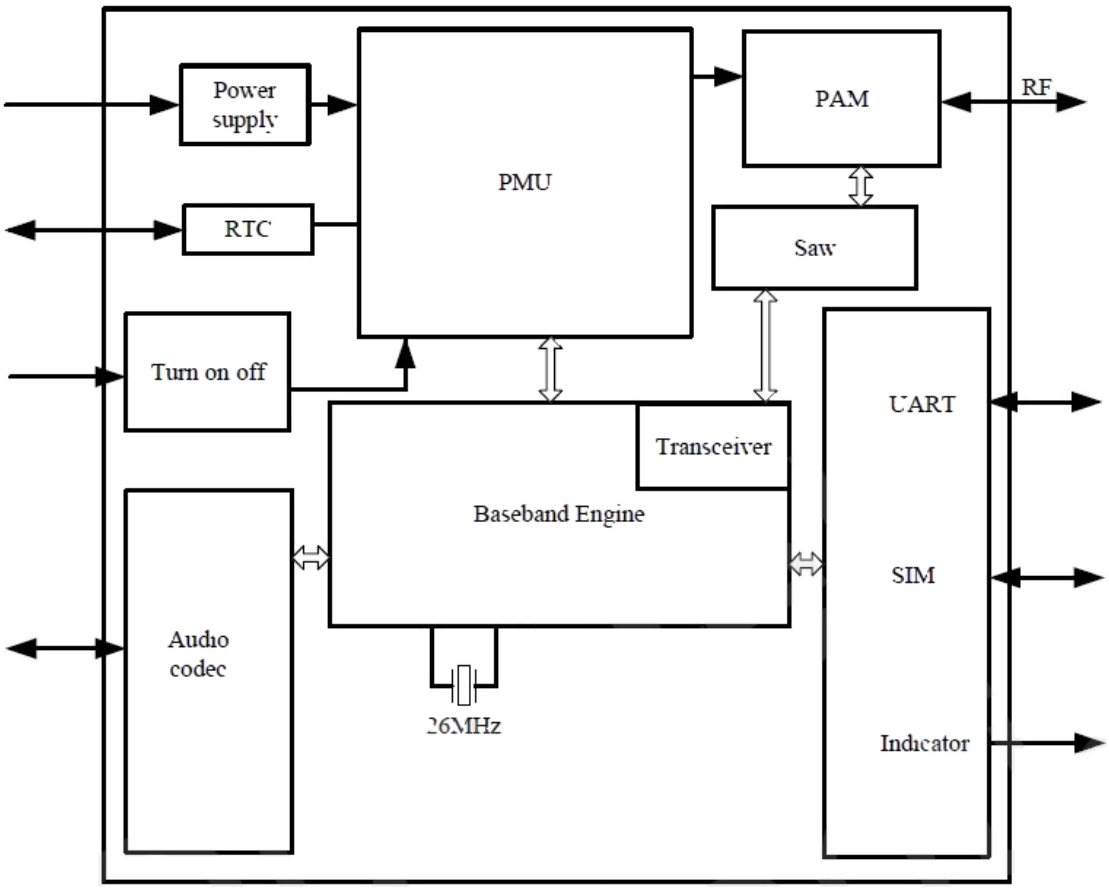

Figure 1: CB900 Functional Architecture Block Diagram

4. INTERFACES

4.1. Pin Assignments

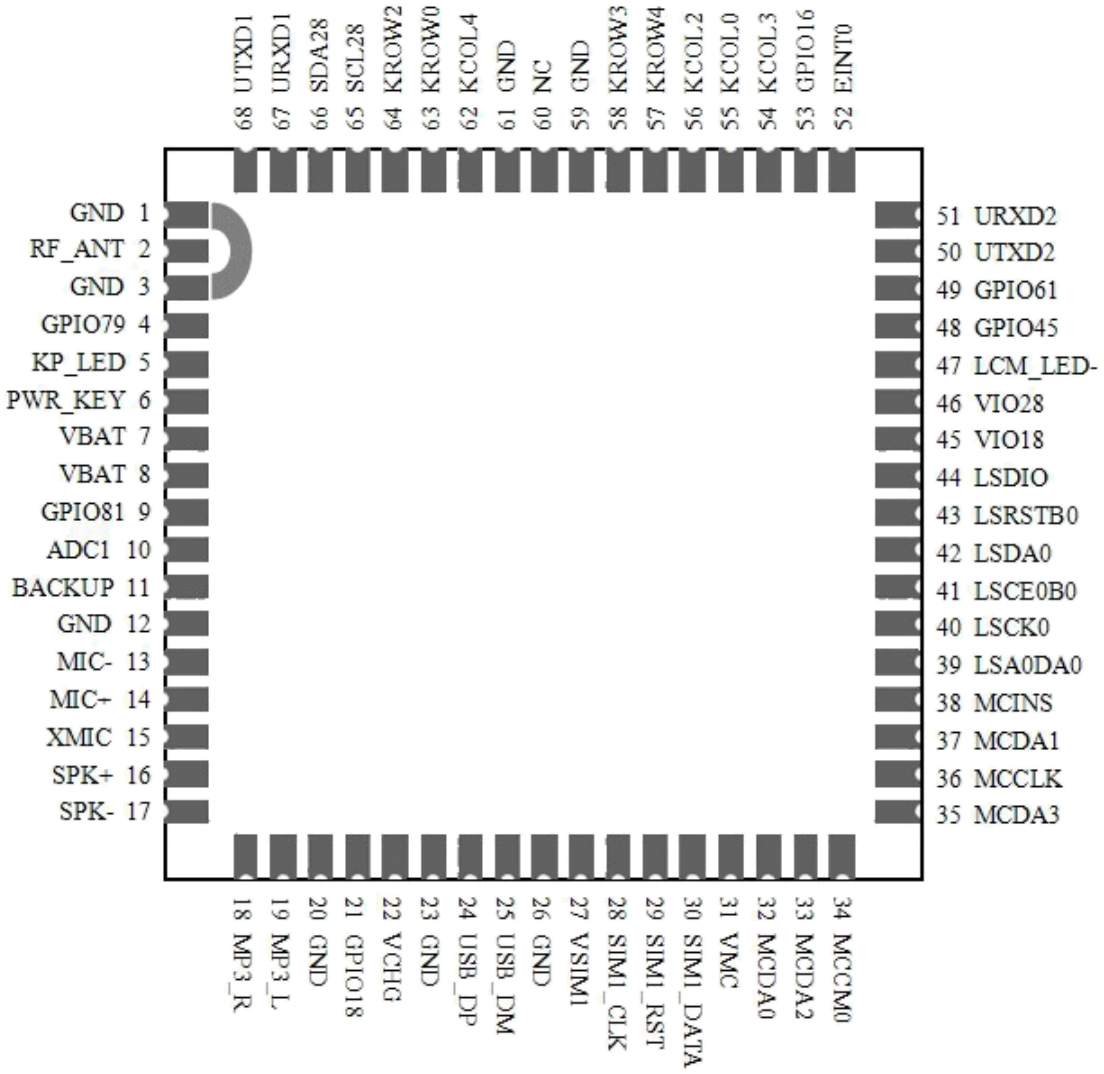

Figure 2: CB900 Pin assignments

Pin	Signal Name	Signal I/O		Pin	Signal Name	Signal I/O
1	GND			35	MCDA3	I/O
2	RF_ANT	I/O		36	MCCLK	I/O
3	GND			37	MCDA1	I/O
4	GPIO79	I/O		38	MCINS	I/O
5	KP_LED	I/O		39	LSA0DA0	I/O
6	PWR_KEY	I		40	LSCK0	I/O
7	VBAT	I		41	LSCE0B0	I/O
8	VBAT	I		42	LSDA0	I/O

9	GPIO81	I/O		43	LSRSTB0	I
10	ADC1	I		44	LSDIO	I/O
11	BACKUP	I/O		45	VIO18	O
12	GND			46	VIO28	O
13	MIC-	I		47	LCM_LED-	O
14	MIC+	I		48	GPIO45	I/O
15	XMIC	I		49	GPIO61	I/O
16	SPK+	O		50	UTXD2	O
17	SPK-	O		51	URXD2	I
18	MP3_R	O		52	EINT0	I
19	MP3_L	O		53	GPIO16	I/O
20	GND			54	KCOL3	I/O
21	GPIO18	I/O		55	KCOL0	I/O
22	VCHG	I		56	KCOL2	I/O
23	GND			57	KROW4	I/O
24	USB_DP	I/O		58	KROW3	I/O
25	USB_DM	I/O		59	GND	
26	GND			60	NC	
27	VSIM1	O		61	GND	
28	SIM1_CLK	O		62	KCOL4	I/O
29	SIM1_RST	O		63	KROW0	I/O
30	SIM1_DATA	I/O		64	KROW2	I/O
31	VMC	O		65	SCL28	I/O
32	MCDA0	I/O		66	SDA28	I/O
33	MCDA2	I/O		67	URXD1	I
34	MCCM0	I/O		68	UTXD1	O

4.2. Pin description

Pin	Signal Name	Signal I/O	Description	Remark
1	GND			
2	RF_ANT	I/O	RF I / O 50 ohm characteristic impedance	
3	GND			
4	GPIO79	I/O	General Purpose IO	Not to float
5	KP_LED	I/O	Keyboard backlight	Not to float
6	PWR_KEY	I	Low PWR_KEY for a specified time period to boot or shutdown	Internally pulled up to 2.8V
7	VBAT	I I	VBAT=3.5V~4.6V	Maximum load current
8	VBAT			

				2A
9	GPIO81	I/O	General Purpose IO	Not to float
10	ADC1	I	Analog to digital conversion	Not to float
11	BACKUP	I/O	Backup battery pin	Not to float
12	GND			
13	MIC-	I	Audio Input channel 1	Not to float
14	MIC+			
15	XMIC	I	Audio Input channel 2	
16	SPK+	O	Audio Output channel 1	
17	SPK-			
18	MP3_R	O	Audio Output channel 2	
19	MP3_L			
20	GND			
21	GPIO18	I/O	General Purpose IO	Not to float
22	VCHG	I	Charging Pin	Not to float
23	GND			
24	USB_DP	I/O	USB data cable positive signal	Not to float
25	USB_DM	I/O	USB data cable negative signal	Not to float
26	GND			
27	VSIM1	O	SIM card supply voltage	SIM card into the module line should not exceed 20cm
28	SIM1_CLK	O	SIM card clock line	
29	SIM1_RST	O	SIM card reset line	
30	SIM1_DATA	I/O	SIM card data cable	
31	VMC	O	SD card power cable	Not to float
32	MCDA0	I/O	SD card data cable	Not to float
33	MCDA2	I/O	SD card data cable	Not to float
34	MCCM0	I/O	SD card command line	Not to float
35	MCDA3	I/O	SD card data cable	Not to float
36	MCCLK	I/O	SD card clock line	Not to float
37	MCDA1	I/O	SD card data cable	Not to float
38	MCINS	I/O	SD card insertion detection line	Not to float
39	LSA0DA0	I/O	LCD address line	Not to float
40	LSCK0	I/O	LCD clock line	Not to float
41	LSCE0B0	I/O	LCD chip select line	Not to float
42	LSDA0	I/O	LCD data address line	Not to float
43	LSRSTB0	I	LCD reset line	Not to float
44	LSDIO	I/O	LCD data cable	Not to float
45	VIO18	O	LCD power	Not to float
46	VIO28	O		
47	LCM_LED-	O	LCD backlight	Not to float
48	GPIO45	I/O	General Purpose IO	Not to float

49	GPIO61	I/O	General Purpose IO	Not to float
50	UTXD2	O	Serial data transmit	Not to float
51	URXD2	I	Serial data receive	Not to float
52	EINT0	I	External interrupt input	Not to float
53	GPIO16	I/O	General Purpose IO	Not to float
54	KCOL3	I	Keyboard input	Not to float
55	KCOL0	I	Keyboard input	Not to float
56	KCOL2	I	Keyboard input	Not to float
57	KROW4	I	Keyboard input	Not to float
58	KROW3	I	Keyboard input	Not to float
59	GND			
60	NC			
61	GND			
62	KCOL4	I	Keyboard input	Not to float
63	KROW0	I	Keyboard input	Not to float
64	KROW2	I	Keyboard input	Not to float
65	SCL28	I/O	I2C clock line	Not to float
66	SDA28	I/O	I2C data cable	Not to float
67	URXD1	I	Serial data receive	Not to float
68	UTXD1	O	Serial data transmit	Not to float

4.3. Power Supply and Ground

The power supply design is one of the key design areas for a GSM terminal due to the burst characteristics of GSM transmission. The supply must be able to deliver very high current peaks in a very short time during a GSM transmit burst, typically up to 2A. During these bursts, it is recommended that the voltage drop does not exceed 400mV. The voltage ripple should not exceed 50mV at frequencies up to 200 kHz and 2mV at frequencies above 200 kHz. This might cause the module to reset.

All four legs of the shield must be soldered onto the target PCB. The ground connection of the target PCB has to go through a full ground plane on the PCB.

Power Supply Voltage

The power supply voltage for VBATT is given below:

Power Supply	Parameters	Conditions	Min	Type	Max	Unit
VBAT	Supply Voltages	Voltage measured at the VBAT pin. If voltage drops below 3.5V, the module will automatically power off.	3.5*	4.2	4.6	V
	Voltage Drop	Normal condition with max transmitter output			400	mV

	Voltage Ripple	Normal condition with max transmitter output			50	mV

Note: * must be guaranteed to ensure compliance with the GSM certification requirements.

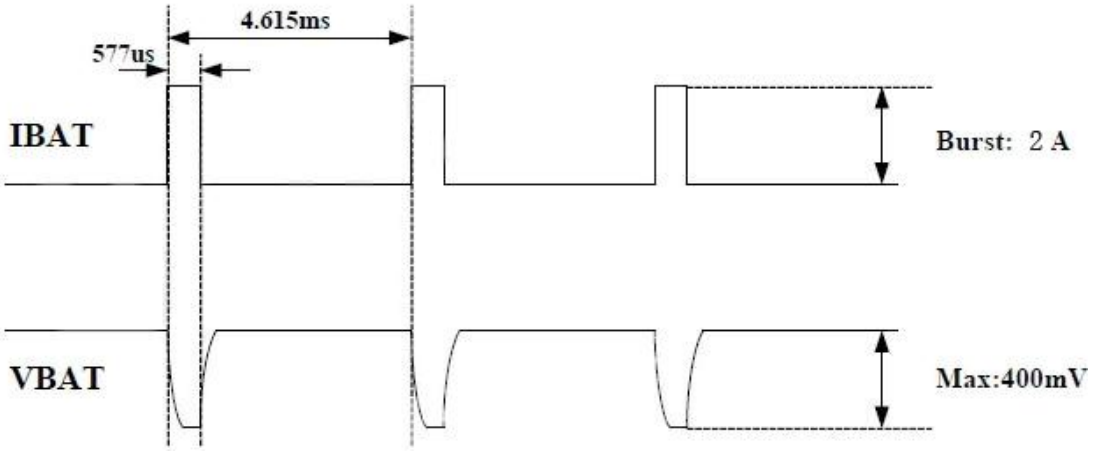

Figure 3: voltage and current waveform of the modules at launch

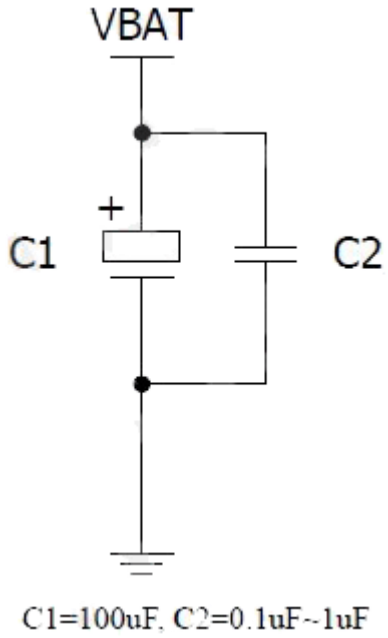

Figure 4: VBAT input reference circuit

4.4. Operating Modes

Operation Type	Mode	Description
Normal Operation	GSM IDLE	The module is registered to the network. Power consumption depends on the interval of the network paging.
	GSM CONNECTED	The module has established a call connection with the network. Power consumption depends on the network settings and coverage

	GPRS IDLE	The module is attached to the GPRS network. Power consumption depends on the network settings.
	GPRS DATA	The module sends and receives data from the network. Power consumption depends on the network settings and GPRS configurations.
Reduced operation	GSM SLEEP	In order to extend the battery life of hand held devices, the module can enter into a sleep mode with software command. The module will wake up from the sleep mode if there are any activities.
	AIRPLANE	The module disconnect from the network just like SLEEP but keep the SIM active so that activity like accessing the phone book in SIM is still possible.
Battery Charging	CHARGE	The module performs battery charging in parallel with other operation

4.5. Analog to Digital Converter (ADC)

Electrical Characteristics

Parameters	Conditions	Min	Type	Max	Unit
Resolution	-	-	10	-	Bits
Reference voltage	-	-	2.8	-	V
Differential non-linearity	-	-2	-	2	LSB
Integral non-linearity	Best Fitting	-2	-	2	LSB
Input Range	-	0		2.8	V
Input Resistance	-	1		100	KΩ

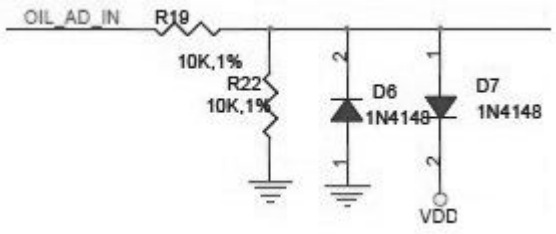

Figure 5: ADC input reference circuit

4.6. Power ON Control

This input pin is used to switch the module ON. A switch-ON interruption is triggered in the module at the detection of a falling edge of this signal pin over a period of 250ms.

Note: The module should be properly switched OFF before all power supplies are removed. This is to avoid any unforeseen corruption of internal data.

Pin Description

Electrical Characteristics

Parameters	Min	Type	Max	Unit
High level input voltage, VIH	2	-	-	V
Low level input voltage, VIL	-	-	-0.805	V

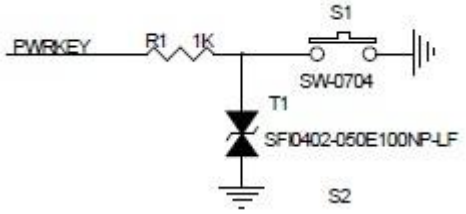

Figure 6: KEY Power ON reference circuit

Boot timing diagram is as following:

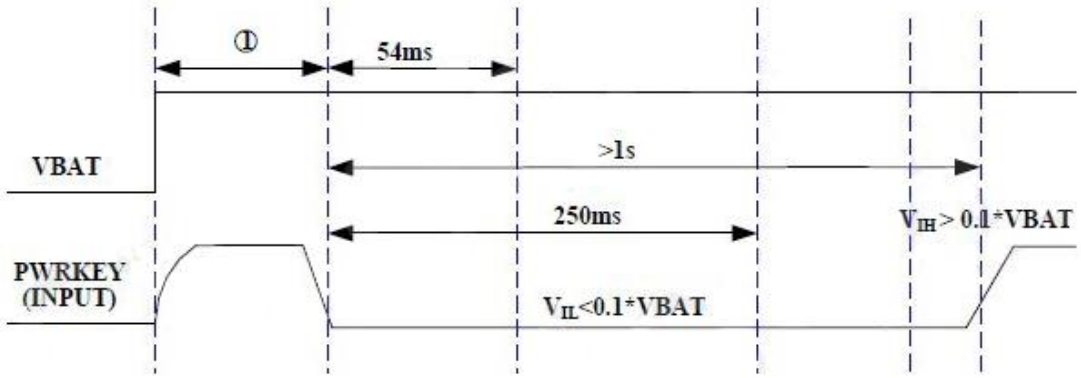

Figure 7: Boot timing diagram

4.7. Subscriber Identity Module (SIM) Interface

The SIM card interface is composed of an internally dedicated voltage regulator and I/O level shifters. It is able to support both 1.8V and 3V SIM cards. It is recommended that the routing traces of the SIM interface lines be kept as short as possible. ESD diodes can be added to the signals connected to the SIM socket to prevent any ESD-related issues. The diodes shall be placed as close to the SIM socket as possible. Also, a decoupling capacitor of about 100nF should be added on the VSIM1 line near the SIM socket. At any point of time, only one SIM card is to be connected as the same pins of both (SIM holder placed on top of the module, external SIM holder) are shorted.

Pin Description

Pin	Signal Name	Signal I/O	Description
27	VSIM1	O	SIM card supply voltage, the module

			automatically selects 1.8v or 3.0v
28	SIM1_CLK	O	SIM card clock line
29	SIM1_RST	O	SIM card reset line
30	SIM1_DATA	I/O	SIM card data cable

Electrical Characteristics

Parameters	Conditions	Min	Type	Max	Unit
VSIM1	SIM 3V	2.7	2.85	2.95	V
	SIM 1.8V	1.65	1.8	1.95	V

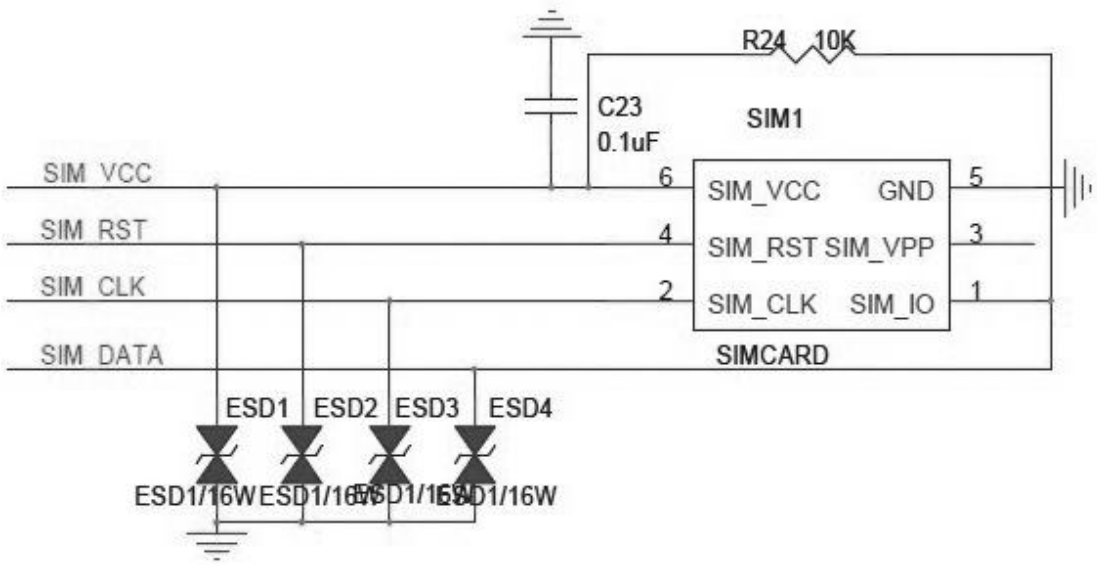

Figure 8: Example of a SIM socket implementation

4.8. Serial Link (UART) Interfaces

The module has two UART. Baud rate from 300 bits/s up to 115200 bits/s feature.
Note: Default factory setting baudrate is set at 115200, unless other specified.

Pin	Signal Name	Signal I/O	Description
50	UTXD2	O	DCE Data Transmit
51	URXD2	I	DCE Data Receive
67	URXD1	I	DCE Debug serial Data Receive
68	UTXD1	O	DCE Debug serial Data Transmit

Application

The block diagram below shows the possible UART connection.

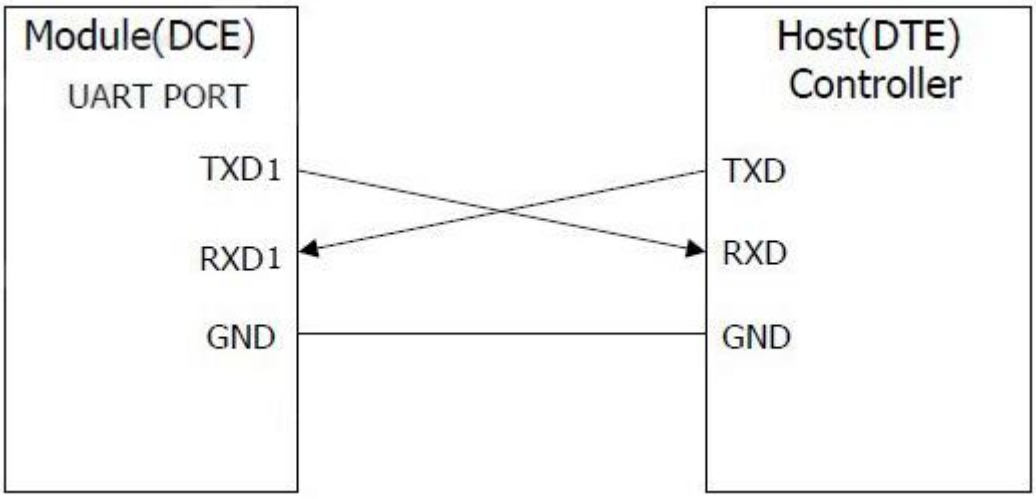

Figure 9: Interfacing with UART

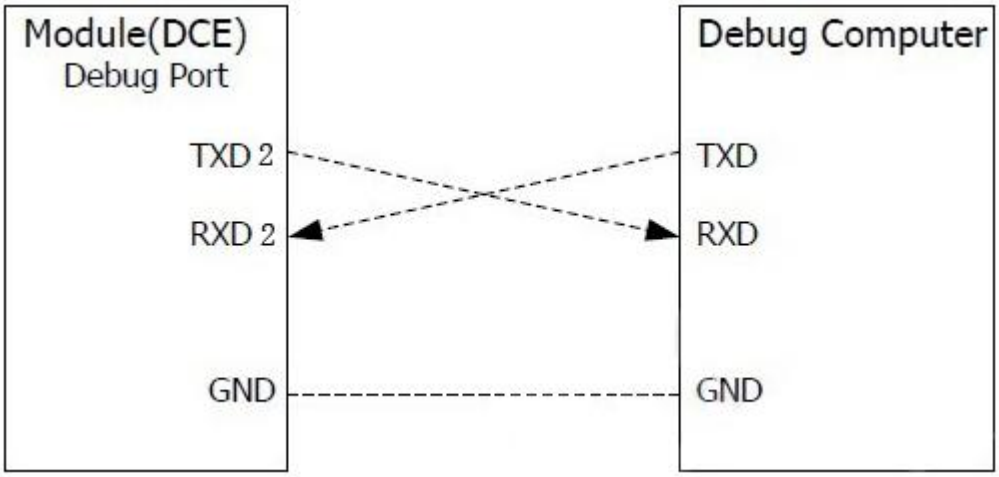

Figure 10: Interfacing with UART

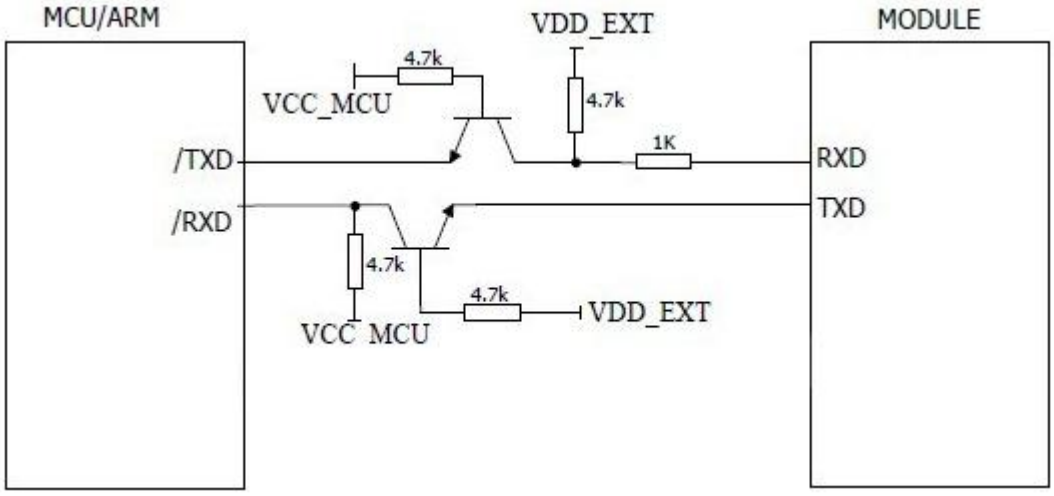

Figure 11: Level-shifter connection to 5V level

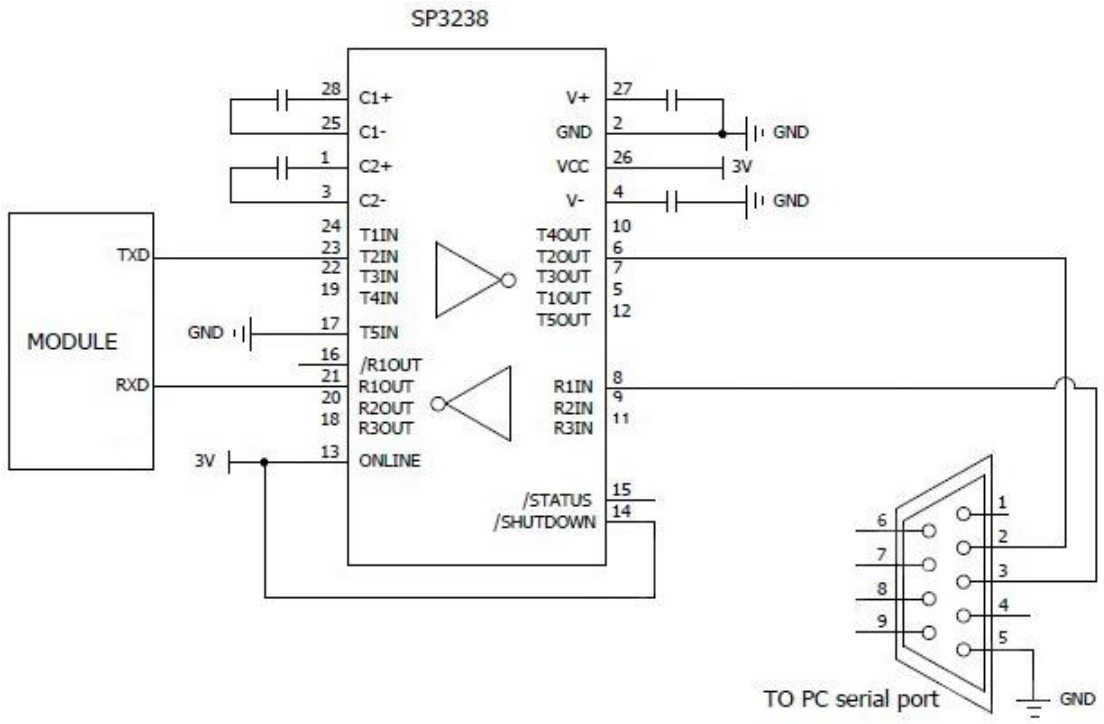

Figure 12: Level-shifter connection to RS232

4.9. USB Interface

The USB interface supports a USB 1.1. It is primarily intended for flashing of firmware and for use as command and data interface.

Application

Note: Connection of a 4.7F Capacitor externally at VBUS for filtering is required.

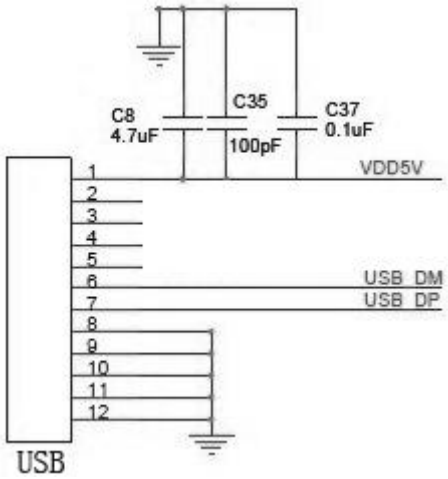

Figure 13: Example of USB implementation

4.10. Analog Audio Interfaces

4.10.1. Microphone input

The handset differential inputs MICIP and MICIN can be amplified by the differential handset microphone amplifier. The microphone reference voltage is at 2V.

Pin Description

Pin	Signal Name	Signal I/O	Description
13	MIC-	I	Microphone amplifier input (-ve)
14	MIC+		Microphone amplifier input (+ve)

Electrical Characteristics

Parameters	Conditions	Min	Type	Max	Unit
Maximum differential input range (MIC+ – MIC-)	Input 3 dBm0	-	-	0.8	Vpp
Nominal reference level (MIC+ – MIC-)	-	-	-10	-	dBm
Differential input resistance (MIC+ – MIC-)	-	-	50	-	KΩ
Amplifier gain for (MICIP-MICIN) input	Differential MIC	-	-	39	dB
Recommended MIC Impedance		-	2k	-	Ohms
Recommended MIC Sensitivity		40	-	50	dB/PA
Recommended MIC SNR		-	-	50	dB

MIC Application

This section describes the two common approaches to microphone connection. Since this feature is exposed to the environment, provision for ESD protection is recommended. Typical characteristics of a microphone device which can be used: Impedance: ~2 kohm, sensitivity ~ 40-50 dB/PA and SNR >50 dB.

Differential Ended

Differential ended connection is the recommended implementation. The following diagram shows a proposed implementation. The capacitance values chosen may need to be optimized based on application, for GSM related EMI, this can be from 10 pF to 47 pF for an 0402 size. If not needed, these components may be unplaced.

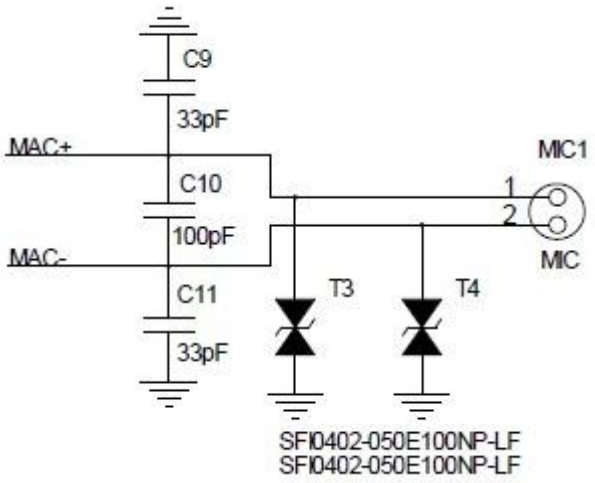

Figure 14: Example of Microphone implementation

4.10.2. Speaker

The class D amplifier is capable of driving 700 mWrms into an 8 ohms load. Default switching frequency is 600 kHz.

Pin Description

Pin	Signal Name	Signal I/O	Description
16	SPK+	O	Speaker signal (+ve)
17	SPK-		Speaker signal (-ve)

Electrical Characteristics

Parameters	Min	Type	Max	Unit
Output Load Resistance	-	8	-	Ω

Application

The connections to the speaker should run in parallel to the transducer and provisions for shunt capacitors are recommended for filtering RF and Digital Noise. Suggested values are 33 pF for EMI. Ensure that the voltage rating of the selected components can withstand operation at the maximum swing voltages in both directions, 16 volt parts should be sufficient. Since this feature is exposed to the environment, provision for ESD protection is recommended.

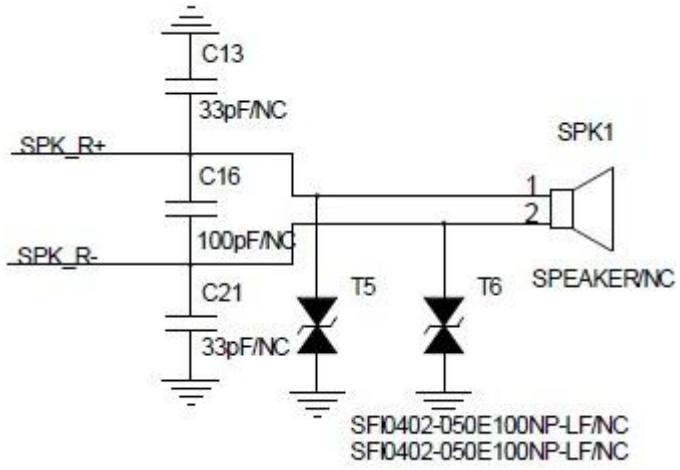

Figure 15: Example of speaker implementation

4.10.3. Earphone

The earphone amplifier provides a full differential signal on the MP3_R and MP3_L terminals. The amplifier is capable of driving 100 mWrms into a 16 ohm load.

Pin Description

Pin	Signal Name	Signal I/O	Description
15	XMIC	I	Earphone input
18	MP3_R	O	Earphone amplifier output (+ve)
19	MP3_L		Earphone amplifier output (-ve)

Electrical Characteristics

Parameters	Conditions	Min	Type	Max	Unit
Power supply rejection	Mono Modes(GSM Voice)	90	100	-	dB
Maximum Output Swing at EARP-EARN	Load = OPEN	-	-	4.1	Vpp

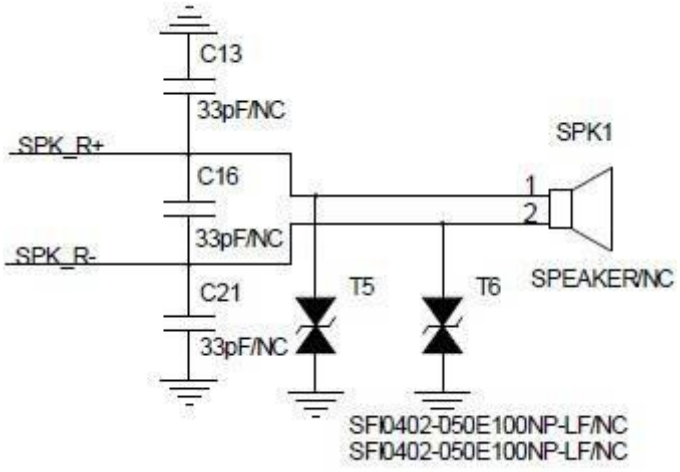

Figure 15: Example of earphone implementation

4.11. General Purposes Input / Output ports

Pin Description and Electrical Characteristics

Pin	Signal Name	Parameters	Min	Type	Max	Unit
4 9 21 48 49 53	GPIO79 GPIO81 GPIO18 GPIO45 GPIO61 GPIO16	High level input voltage, VIH	2.5		3	V
		Low level input voltage, VIL	0		0.3	V
		High level output voltage, VOH	2.6	2.8	2.85	V
		Low level output voltage, VOL	-	-	0.45	V

4.12. Keyboard Interface

The 10-pin keyboard interface includes 4 row inputs and 4 column outputs. The 8 lines can be used as general purpose inputs and outputs. Please contact COBAN directly for more information on the extended customization to this interface.

Pin Description and Electrical Characteristics

Pin	Signal Name	Parameters	Min	Type	Max	Unit
54 55 56	KCOL3 KCOL0 KCOL2	High level input voltage, VIH	2.5		3	V
		Low level input voltage, VIL	0		0.3	V

57 58 62 63 64	KROW4 KROW3 KCOL4 KROW0 KROW2	High level output voltage, VOH	2.6	2.8	2.85	V
		Low level output voltage, VOL	-	-	0.45	V

4.13. 2-Wire Serial Interface

This is a half-duplex serial port using 2-line for data transmission consisting of SDA data signal and SDL clock signal. It can transfer at speeds up to 400Kbits/s (fast-mode).
Note: Supports 1.8V I2C compliant devices.

Pin Description and Electrical Characteristics

Pin	Signal Name	Parameters	Min	Type	Max	Unit
65 66	SCL28 SDA28	High level input voltage (SDA and SCL), VIH	-	-	2.8	V
		Low level input voltage(SDA and SCL), VIL	0	-	-	V

This feature is not enabled in the standard module firmware as it requires a certain level of firmware customization depending on its intended application. Please contact COBAN for more information.

4.14. RF interface

CB900 RF interface has a characteristic impedance of 50. The matching networks for an external antenna connection are not included in the module and should be placed on the application board.

4.14.1. RF Performance

Frequency Bands	RF Sensitivity (dBm) (Nominal)
GSM 850/EGSM 900	-106dBm
DCS1800/ PCS1900	-104dBm

4.14.2. Recommendations

The antenna must fulfill the following requirements below:

Frequency Bands	EGSM 900	DCS 1800	GSM 850	PCS 1900

TX Frequency	880 - 915 MHz	1710 - 1785 MHz	824 - 849 MHz	1850 - 1910 MHz
RX Frequency	925 - 960 MHz	1805 - 1880 MHz	869 - 894 MHz	1930 - 1990 MHz
Impedance	50 ohm			
VSWR Rx max	1.5 : 1			
VSWR Tx max	1.5 : 1			
Typical radiated gain	0 dBi in one direction at least			

The optimum operating frequency depends on the application. A dual-band or a quad band antenna must operate in the above frequency bands.

FCC Caution.

§ 15.19 Labelling requirements.

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

§ 15.21 Changes or modification warning

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

§ 15.105 Information to the user.

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

-Reorient or relocate the receiving antenna.

-Increase the separation between theequipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help.

*** RF warning for Portable device:**

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

The GSM module is designed to comply with the FCCstatement. FCC ID is 2AA64CB900. The host system using GSM module, should have label indicated FCC ID :2AA64CB900