PRELIMINARY OPERATION NOTE

1. OVERVIEW

1.1 OBJECT OF THE DOCUMENT

This document gives an overview of the WGM1898A: Dual-band GSM(PCS)/GPRS Phone.

It describes the main functionalities (GPRS / GSM 900MHz / PCS 1900MHz, interface to a melody chip(Option), LCD interface, SIM interface, vibrator interface, audio interfaces for speaker/microphone or accessories…) of this module as well as the electrical interfaces.

1.2 STANDARDS COMPLIANCE

- GSM 02.60: "Digital cellular telecommunications system (Phase 2+); Stage 1 Service Description of the General Packet Radio Service (GPRS)". Version 6.3.0.
- GSM 03.03: "Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification". Version 6.6.0.
- GSM 03.13: "Digital cellular telecommunications system (Phase 2+); Discontinuous Reception (DRX) in the GSM system". Version 6.0.0.
- GSM 03.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description; Stage 2". Version 6.7.0.
- GSM 03.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS);Overall description of GPRS radio Interface; Stage 2". Version 6.4.0.
- GSM 04.02: "Digital cellular telecommunications system (Phase 2+); GSM Public Land Mobile Network (PLMN) access reference configuration". Version 6.0.0.
- GSM 04.03: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Channel structures and access capabilities". Version 6.0.0.
- GSM 04.04: "Digital cellular telecommunications system (Phase 2+); Layer 1 General requirements". Version 6.0.0.
- GSM 04.05: "Digital cellular telecommunications system (Phase 2+); Data Link (DL) layer General aspects". Version 6.0.1.
- GSM 04.07: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3 General aspects". Version 6.5.1.
- GSM 04.08: "Digital cellular telecommunications system (Phase 2+);Mobile radio interface layer 3 specification". Version 6.11.0.
- GSM 04.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Radio Link Control/Medium Access Control (RLC/MAC) protocol". Version 6.9.0.
- GSM 04.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Logical Link Control (LLC)". Version 6.7.0.
- GSM 04.65: : "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Serving GPRS Support Node (SGSN); Sub network Dependent Convergence Protocol (SNDCP)". Version 6.7.0.
- GSM 05.02: "Digital cellular telecommunications system (Phase 2+); Multiplexing and multiple access on the radio path". Version 6.9.0.

- GSM 05.03: "Digital cellular telecommunications system (Phase 2+); Channel coding". Version 6.2.1.
- GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control". Version 6.8.0.
- GSM 05.10: "Digital cellular telecommunications system (Phase 2+); Radio subsystem synchronisation". Version 6.6.0.
- GCF-CC (V.3.9.1) and GT.01.
- NAPRD.03 (V.2.7.2).

1.4 COMPLIANCE WITH FCC GUIDELINES

Fix-mount and mobile devices incorporating M0130M modules must be designed to maintain a minimum separation distance of 20 cm between the antenna and the end user to satisfy RF exposure requirements for mobile transmitting devices.

For portable devices incorporating MO130 modules, the manufacturer of the final device is responsible to perform SAR measurements.

1.5 TERMS AND ABBREVIATION

ADC	Analog to Digital Converter
ADPCM	Adaptive Delta Pulse Code Modulation
AFC	Application Frequency Correction
ASIC	Application Specific Integrated Circuit
BMP	Bitmap
CODEC	Coder-Decoder
CTS	Clear To Send
DAC	Digital to Analog Converter
DAI	Digital Analog Interface
DCS	Digital
DSP	Data Signal Processor
DSR	Data Set Ready
DTR	Data Terminal Ready
EGSM	Enhanced GSM
EMS	Enhanced Messaging Services
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
GSM	Global Standard for Mobile communication
GPRS	Global Packet Radio Services
IC	Integrated Circuit
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input / Output
IRDA	Infra Red
ISO	International Standards Organisation
ITU	International Telecommunication Union
JPEG	Joint Picture Expert Group
JTAG	Joint Test Action Group
KBPS	Kbit per second
LCD	Liquid Crystal Display
LED	Diode
LNA	Low Noise Amplifier
MBPS	Mbit per second
MIDI	Musical Instrument Digital Interface
MMI	Man Machine interface
PA	Power Amplifier
PBCCH	Packet Broadcast Channel
PCB	Printed Circuit Board

PCS	Personal Communication System
PLL	Phase Locked Loop
PNG	Portable Network Graphics
RAM	Random Access Memory
RF	Radio Frequency
RI	Ring Indication
RMS	Root Mean Square
RTS	Ready To Send
RX	Receive direction
SIM	Subscriber Identification Module
SMS	Short Message Service
SRAM	Static Random Access Memory
TBC	To Be Confirmed
TBD	To Be Defined
TX	Transmit direction
UART	Universal Asynchronous Receiver and Transmitter
USB	Universal Serial Bus
USSD	Unstructured Supplementary Service Data
VCO	Voltage Controlled Oscillator
WAP	Wireless Application Protocol
WBMP	Wide Bitmap

1.6 PRODUCT FEATURES

Temperature range	Normal range: -10°C to +55°C (full compliant) Extended range: -20°C to –10°C and +55°C to +70°C (functional without any risk for the network) Storage: -40°C to °85°C
Weight (in g)	10.5g
ESD	ESD protected, < 1kv or 2kv (see application note)
Physical dimensions	34x54.4x3 mm (typical)
Connection	120 pins connector + 1 antenna connection + 1 battery connection
Decoupling capacitors	Mainly integrated.
Power supply	3.45V to 5V range, 3.8V nominal.
Power consumption	Off mode: 120uA (typ) Standby mode: 2.5mA (typ) Communication mode: 280mA typ (average in GPRS 4+1 at max power) Communication mode: 1800mA (peak during TX slot)
Power supply connector	Dedicated connector.
Battery charge management and interface	Battery charge management is included. The charger interface is provided on 120 pins connector.
Antenna	No antenna included in the module.
Antenna connector	50 ohms with coaxial connector. The return loss of the external antenna has to be better than –10dB (50Ohms reference) in all the frequency range.
Frequency bands	EGSM900 + DCS1800 + PCS1900
Voice codecs	Half Rate, Full Rate, Enhanced Full Rate
GSM class	Small MS
Transmit power	Class 4 (2W) for EGSM900 Class 1 (1W) for DCS1800 / PCS1900

Supported SIM card	3V SIM cards. To prevent SIM card's damages, the power supply of the module has to be turned off before any manipulation of the SIM card.
SIM slot	Not included on the module. Signals for the management of the SIM card are provided on 120 pins connector.
Vibrator	Not included in the module. Controls are provided on 120 pins connector.
Network LED	Not included in the module. Controls are provided on 120 pins connector.
Keyboard / LCD backlight	Not included in the module. Controls are provided on 120 pins connector.
Audio up-link	2 differential inputs are provided for microphone (accessories and handset)
Audio down-link	2 differential inputs are provided for earphone (accessories and handset)
Flap open/closed detection	Dedicated interrupt input is provided on 120 pins connector for the open/closed detection.
Keyboard interface	5x5 keyboard interface is provided on 120 pins connector.
UART1 interface with flow control	Up to 115.2 Kbaud with autobauding. Full flow control signals (+2.8V) are provided on 120 pins connector. If a full compliant RS232 (+/-5V) serial interface is needed: The drivers (like MAX3232, ST3237CD, …) are not included in the module and have to be added on the main PCB. A proven schematic to build the RS232 interface is provided in application note.
IrDA interface or UART2 interface	Up to 115.2 Kbaud. UART2 and IrDA are not multiplexed but could not be used at the same time.
Data services	GPRS, CSD, Fax
Supplementary services	Line identification, Call Waiting, Call Hold, Call Forwarding, Multiparty, Closed User Group, Call Barring, Advice of Charge, USSD
USB interface	Not integrated in the module. It can be added by means of a dedicated micro-controller with USB capabilities.
Melody chip interface	The melody chip is not integrated in the module but the interface is provided (power supply, clock, audio, serial link) on 120 pins connector.
Serial Interface	A serial interface is provided on 120 pins connector in order to manage an external LCD and a chip melody.
Parallel Interface	A parallel interface (16 bits) is provided on 120 pins connector (7 addresses, 2 chip select and OE, RW signals are available).
Reset pin	Available (reset of all the system including backup)
Power on pin	Available
General purpose I/Os pin	See chapter
GPRS	SMG 31bis, Multi slot class 8 (class 10 in future versions), class B terminal, PBCCH support

WAP	1.2
GSM/DCS certification GCF-CC	V.3.5.0 and GT.01
PCS certification	NAPRD.03 (V.2.5.1)
Multimedia objects download	ringing tones, wallpapers, icons, games, screen savers
Picture / animation formats supported	WBMP, BMP, JPEG, PNG, GIF, SAGEM proprietary formats
Audio formats supported	MIDI, iMelody, PCM, ADPCM, SAGEM proprietary formats
Software customisation	Customisable MMI

2. BLOC DIAGRAM

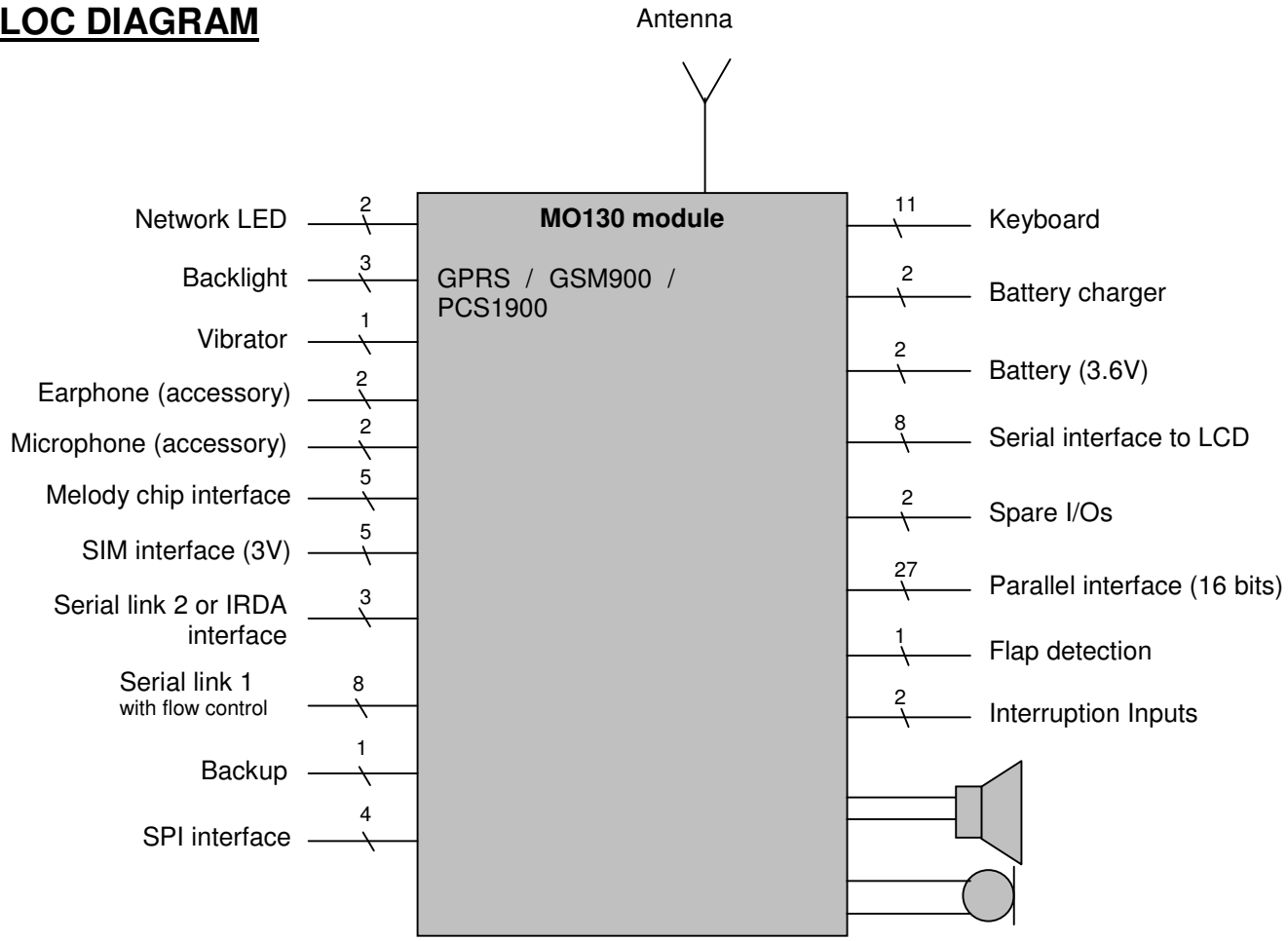
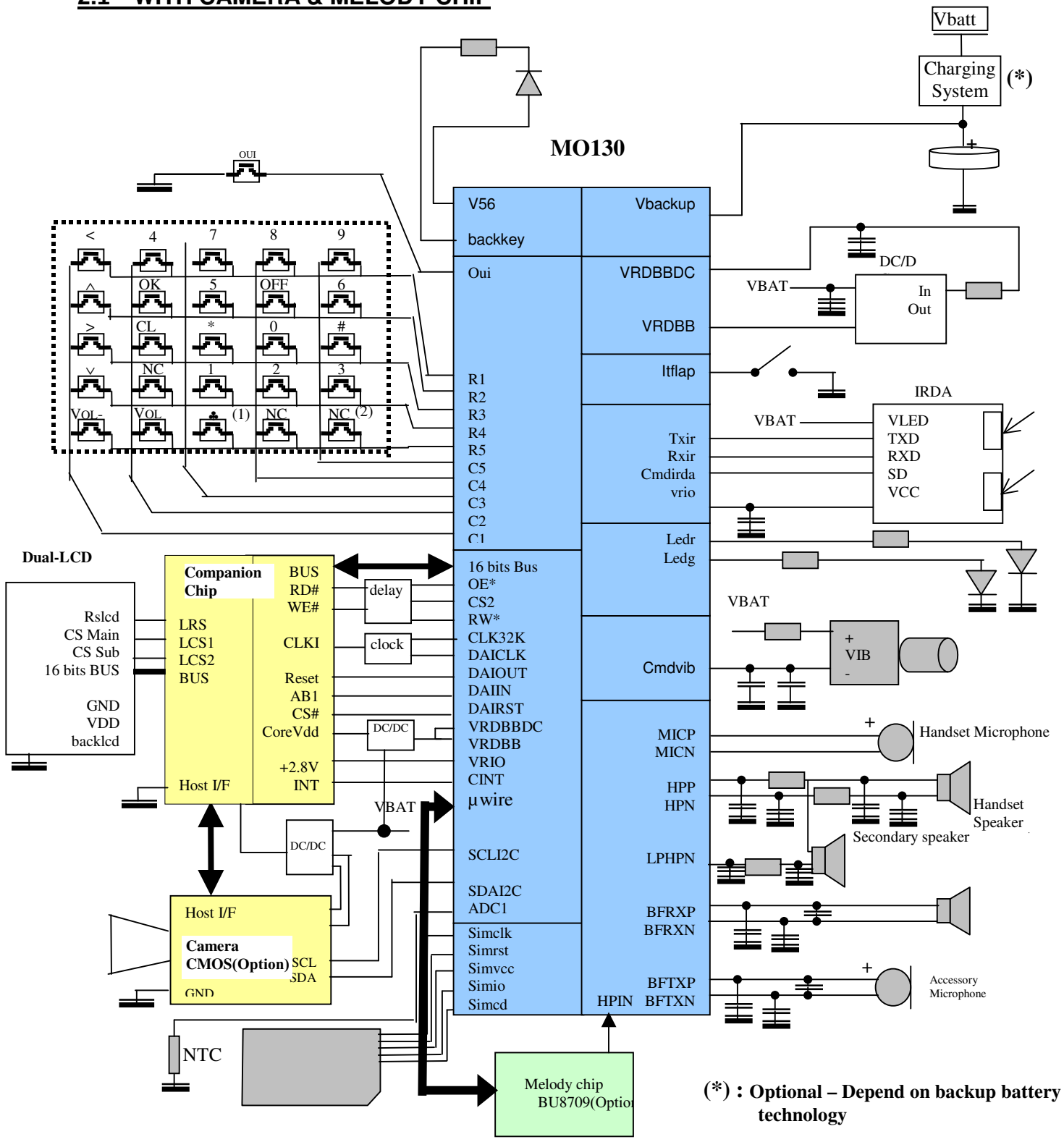


Figure 1
MO130 bloc diagram

See Pinout chapter for more details.

2.1 WITH CAMERA & MELODY CHIP



(*) : Optional – Depend on backup battery technology

Figure 2
MO130 with camera & Melody chip- Bloc diagram

3 FUNCTIONAL INTEGRATION

3.1 SIM

A SIM card connector must be connected to the MO130 module.

The SIM card connection could be done in two ways:
- Connector 6 points without SIM card detection
- Connector 8 points with SIM card connection

In both case, decoupling capacities of 15pF have to be added on SIMCLK, SIMRST, SIMVCC and SIMIO signals near the SIM card connector.

3.1.1 Without SIM card detection

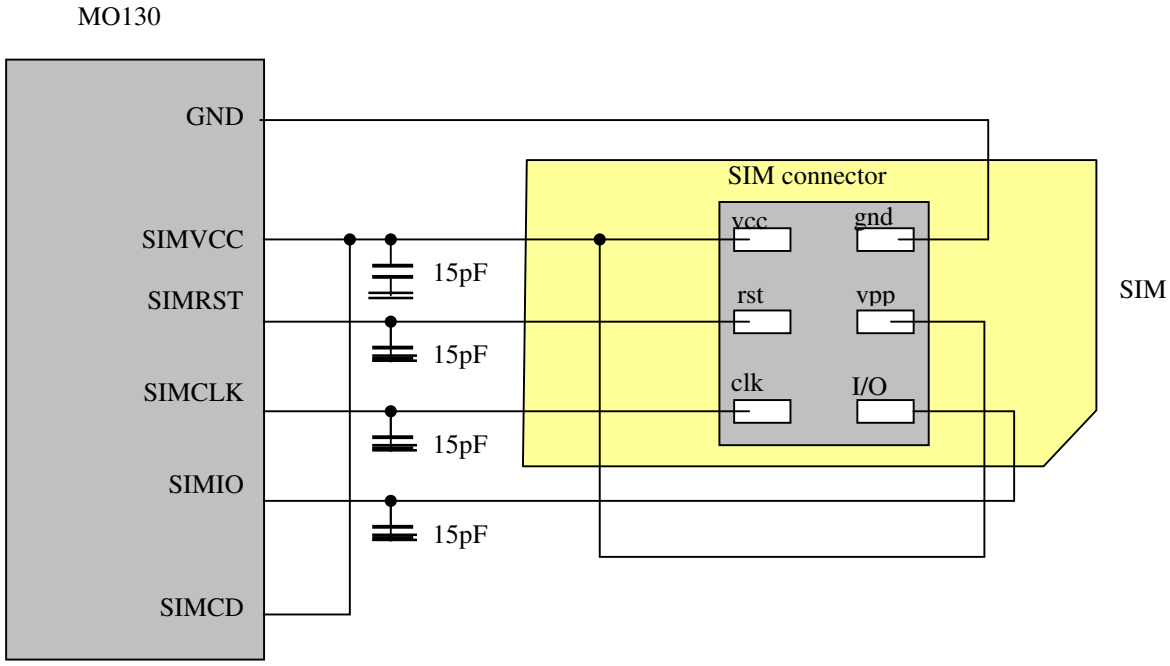


Figure 5
SIM card connection without detection

In this configuration, the SIMCD signal is always high when SIMVCC is ON. There is no SIM card detection, the SIM card is considering as always present.

3.2 AUDIO

There are three options for the earphone:

- One multi-mode 8 ohms earphone as earpiece, hands free loudspeaker and melody/ring.
- Two earphones, one 32 Ohms as earpiece and one 8 Ohms as Ring/melody and as hands-free loudspeaker if it is located far from the microphone.
- One 32 Ohms earphone as earpiece.

Note: In case of only one speaker is used a 15 ohms resistor must be connected between LPHPN and HPN as following. (HPP to LPHPN thru 15 ohms = Normal path, HPP straight to HPN = Hands free path).

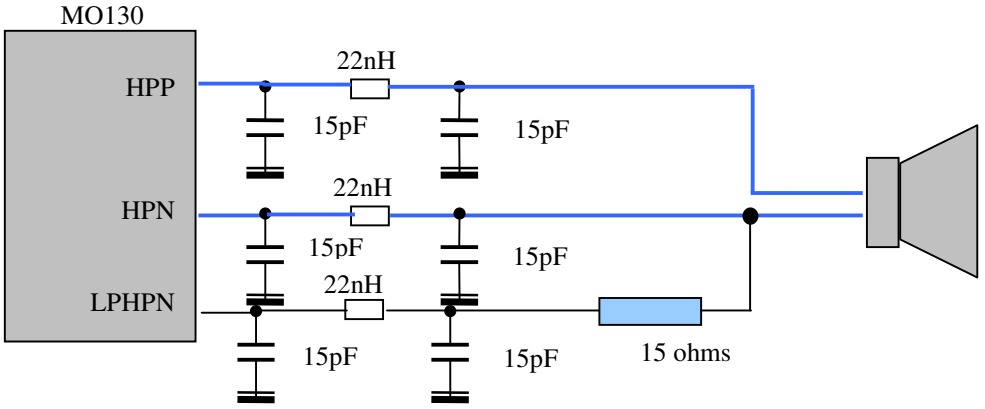


Figure 7
Audio handset with a single speaker.

Note: The maximum voltage on HPP/HPN is Vbat-0.4V.

3.2.1 Handset

Two earphones and one Microphone could be connected to the module with the following characteristics (see SAGEM references):

- 8 ohms to 150ohms earphones
- microphone accepting the polarisation described below.

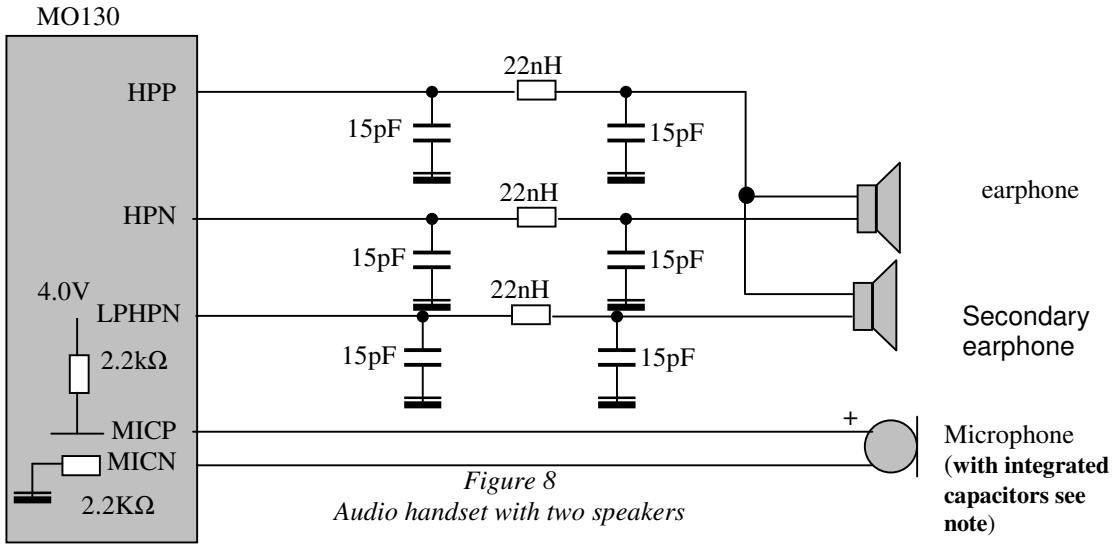


Figure 8
Audio handset with two speakers

Note: Ask the microphone suppliers to add inside the microphone two capacitors in parallel. One for GSM (33pF) and one for DCS (10pF) TDMA burst noise suppression.

3.2.2 Headset

This accessory is mainly connected to the bottom connector of the mobile but can also be connected to the mobile by an audio jack plug.
Thus, an external microphone and earphone (150 ohms) could be connected on the MO130 module for accessories (see SAGEM references)

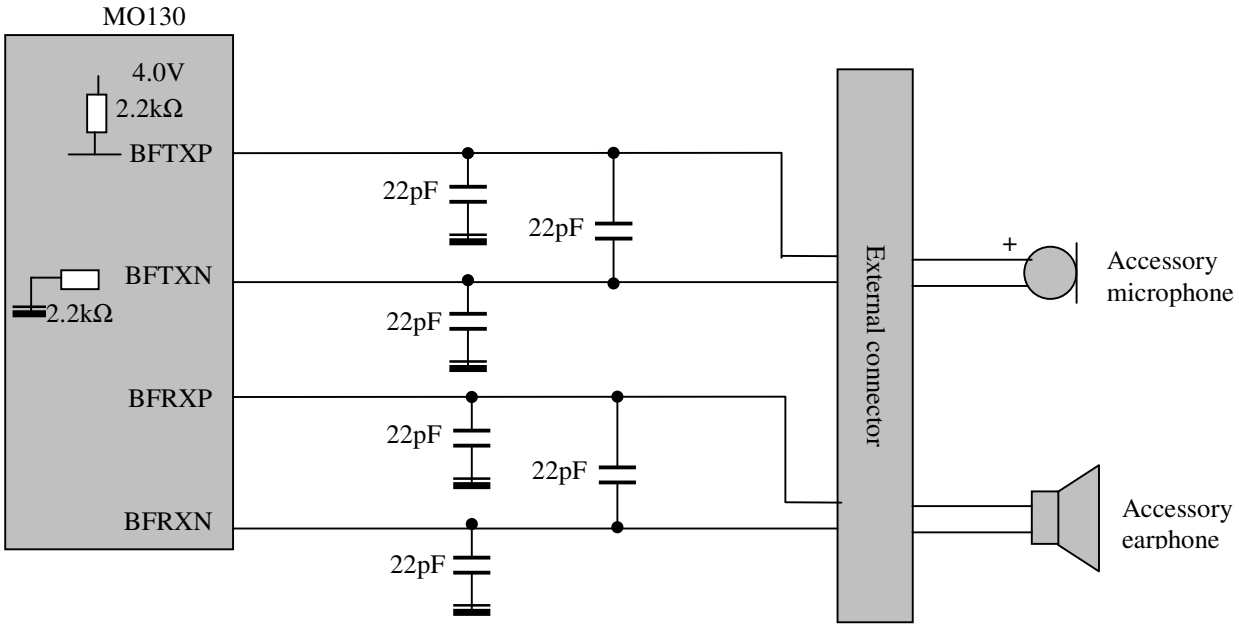


Figure 9
Audio accessories

Note: The capacitors have to be near the external connector.
This audio path can also be used to connect a Car Kit device, but some precautions should be taken (see next).

Warning:

Even if it may be possible to connect simultaneously a Headset (if connected into an audio jack plug) and a car kit on the same audio path, Sagem does not recommended to do that. Instead, add analog switches (controlled by GPIO's) to separated and create two different paths, or connect only one device (audio jack or car kit)

The issues in case of both connection (without any analog switch) are the following:

- The downlink audio path: The two devices will work at the same time but, the audio filters and amplifiers gains won't be adapted to one of these speakers.

- The uplink audio path: The two microphones will work at the same time but, the audio filters and amplifiers gains won't be adapted to one of these microphones. Moreover, a pseudo-stereo signal with possible echoes will be created due to:
    - The merge of the two microphones signals.
    - The lag of the car kit microphone's audio path.

3.3 Example of multi-LCD's connection:

3.3.1 Schematic

If this configuration is used (Main colour LCD and sub monochrome or colour LCD), Sagem recommend to connect them in this way(both LCD' s on the parallel bus).

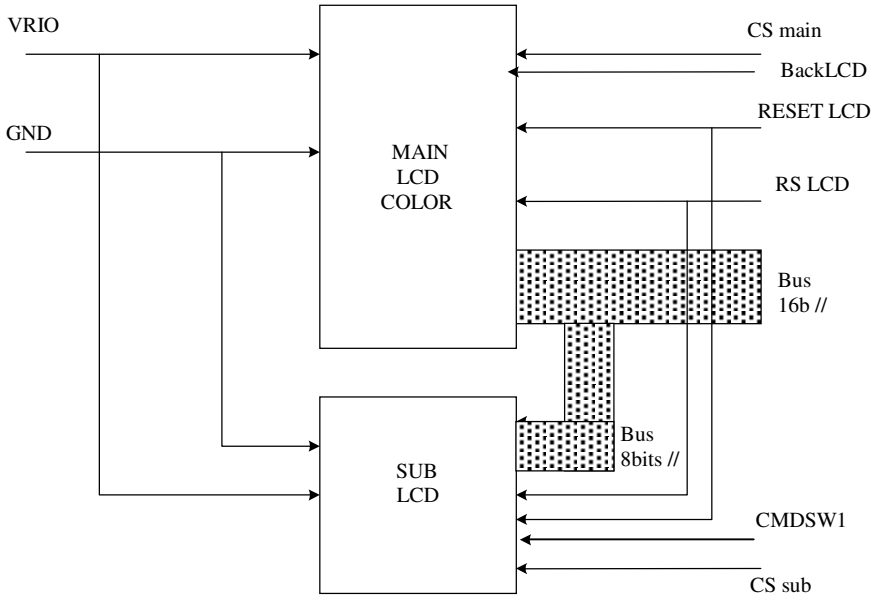


Figure 37
Example of multi-LCD's connection.

3.3.2 Supplies in case of multiple LCDs.

If multiple LCDs are used, then it should be wise to add a separate supply for the extra LCD.
This could be simply done by connecting a transistor between Vbatt and the LED' s which would be commanded for example by a GPIO.

3.4 VIBRATOR

A vibrator could be connected to the WGM1893C, with the following characteristics:

- R_s serial resistance from 10 ohms to 50 ohms.
- Z_I serial inductance from 50µH to 100µH.
- C_l load capacitance from 0 to 1nF
- I_{off} quiescent current up to 100nA

External components have to be added near the vibrator: two capacities and one resistor.

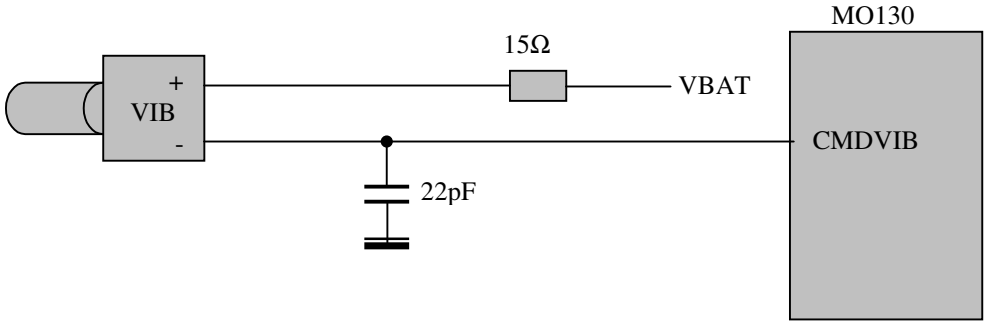


Figure 38
Vibrator

Characteristics of the vibrator used by WONU:

- 3 phases
- 2 poles
- Rated voltage 3V DC
- Rated speed 6000 to 10000rpm
- Maximum current 75mA

Equivalent impedance 25 to 50 ohms

3.5 NETWORK LEDS

3.5.1 Network LED connection

A network LED could be connected to the WGM1898A (red LED connected to LEDR and green LED to LEDG)

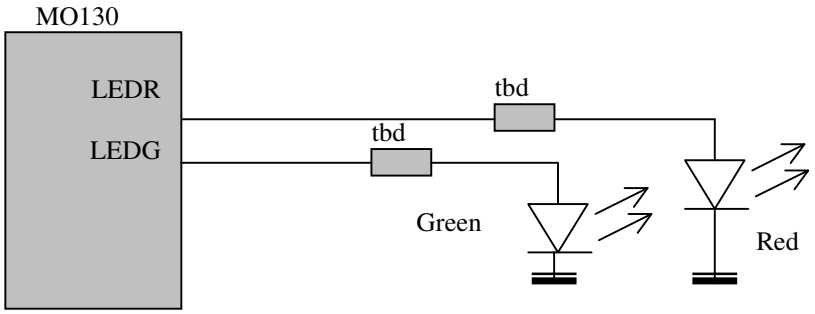
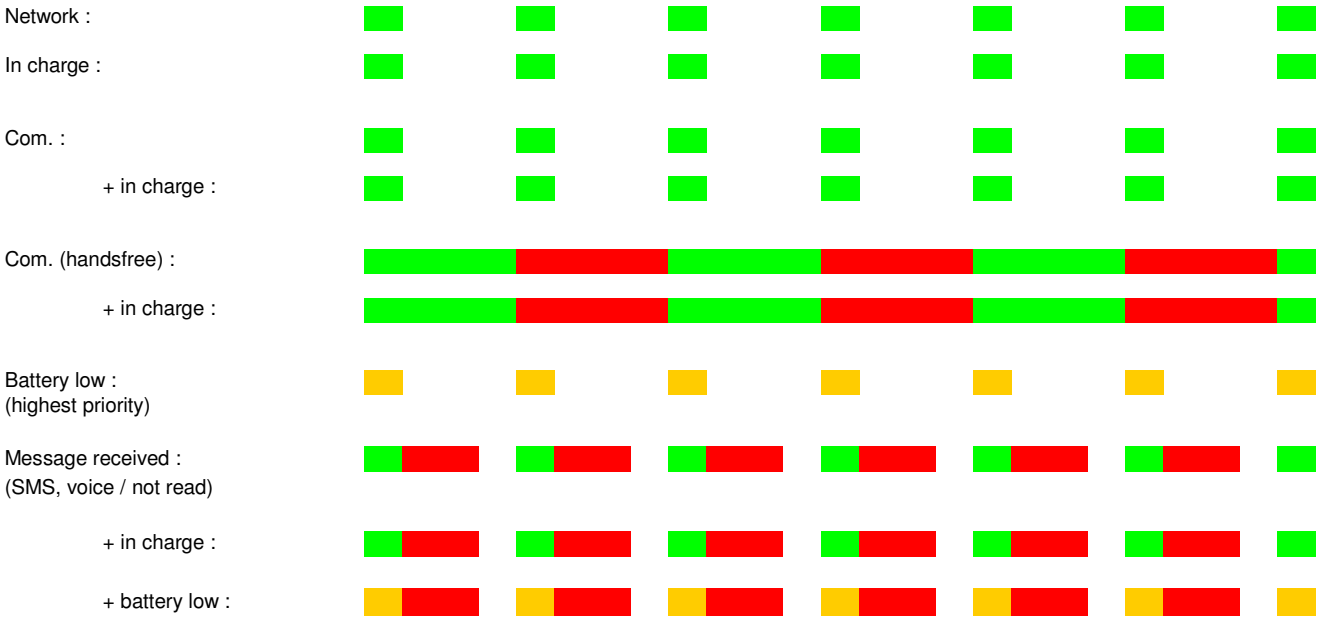


Figure 39
Network LED

Signal	VL (V)		VH (V)	
	Min	Max	Min	Max
LEDR, LEDG (out)	-	+0.6	+2.4	-

3.5.2 Network LEDs behaviour.



4. OPERATING MODES

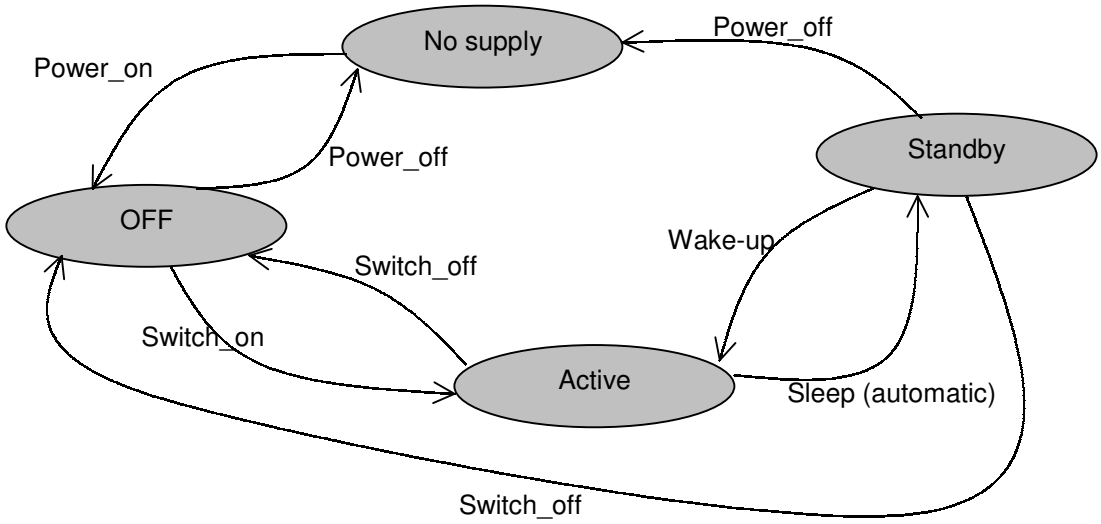


Figure 15
Operating modes state diagram

4.1 MODES DESCRIPTION

4.1.1 No supply

VBAT < 3.2V and VBACKUP < 2.2V.
All functions and power supplies are OFF: VRDBB, VRIO, V56 = 0.

4.1.2 OFF

VBAT > 3.2V or external Backup VBACKUP > 2.2V.
The RTC only is running (32kHz). For internal reasons, V56 is in low power configuration (V56 = 4.5V and I_{v56} = 1mA max). All other functions and power supplies are OFF: VRDBB, VRIO = 0.

4.1.3 Active

The module is active: all the functions are running and all the power supplies are ON and in full power mode (full consumption).
VRDBB = +1.8V
VRIO = +2.8V
V56 = +5.6V

4.1.4 Standby

The module is in standby mode: the power supplies are ON and in low power mode.
This mode is typically use when the module is connected to the network and checking periodically if there is an incoming call.

4.2 TRANSITIONS DESCRIPTION

4.2.1 Power on

A battery is connected to the module with VBAT > 3.2V (and/or VBACKUP is switched ON).

4.2.2 Power off

The battery is removed from the module (and/or VBACKUP is switched OFF).

4.2.3 Switch on

The battery is already connected. The module starts when ON key is pressed or a charger is connected or when wake up occurs.

4.2.4 Switch off

The battery is connected. The software is turning off of the module when OFF key is pressed and VBAT > 3.2V.

4.2.5 Wake up

The actions to go from standby mode to active mode are:
- Charger connection
- Key pressed
- Incoming call
- Data cable connection
- V24 activity