

MO130 MODULE FOR MOBILE APPLICATION

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SAGEM SA / SCT	F. ROMAO			
	O. HOLIN			
	T. GLASSON			
	F. BULTEAU			
	P. CAILLET			
	F. HADDED			
	R. PATINEC			
	P. RATAJCZYK			
	E. SOUBRANE			
	JC. SURBON			
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CONCLUSION OR SUMMARY :

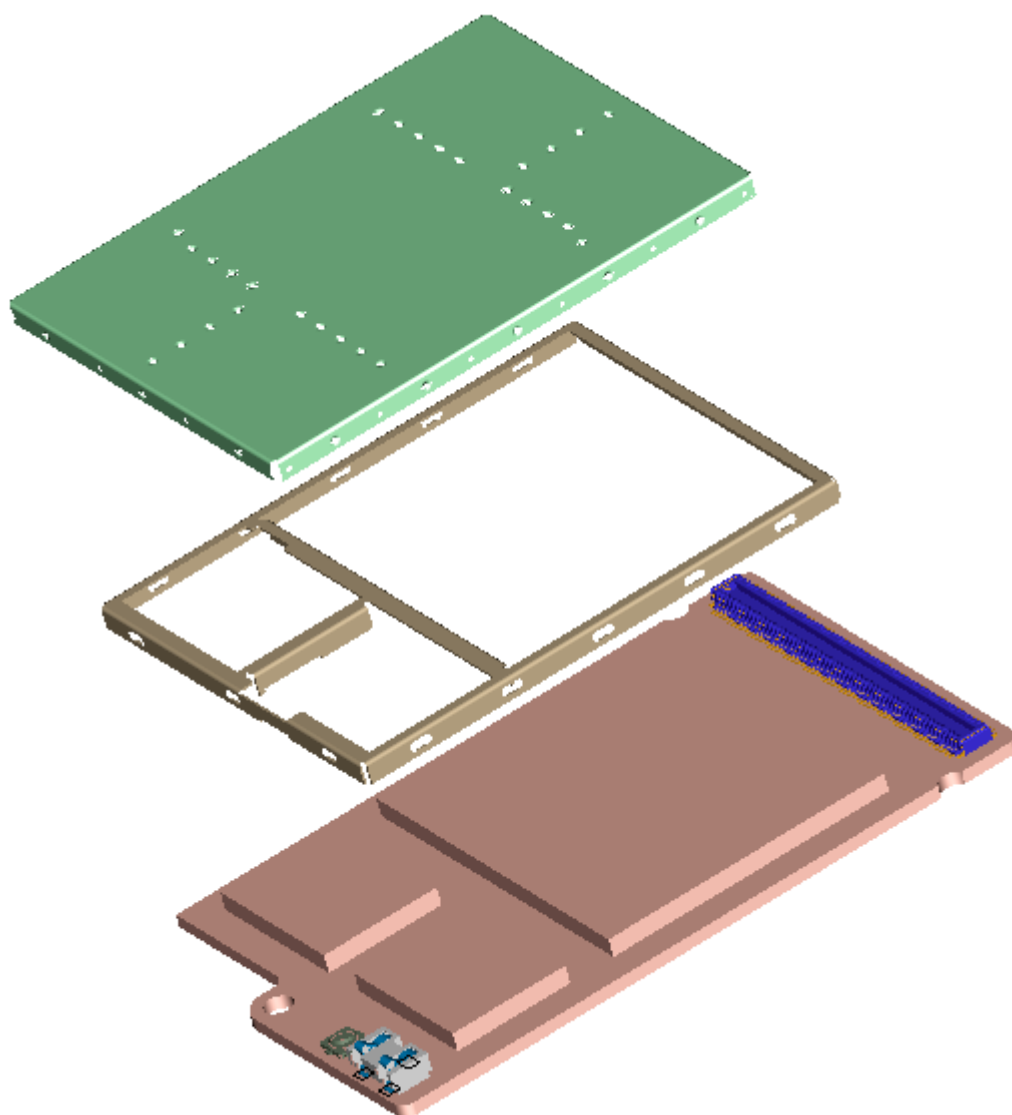
This document gives an overview of the MO130 module: a miniature, single-side board, tri-band GSM/GPRS module, ready for integration in mobile application like vehicle-mounted or vending machines... It describes the main functionalities of this module as well as the electrical interfaces, the mechanical specification (dimension, form...) and the electrical specification of the module.

APPROBATION :

	Writer	Project manager	IPDE
Name :	E. SOUBRANE	T. GLASSON	O. HOLIN
Date :	28/03/03	28/03/03	28/03/03
Signature :			

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MO130 MODULE FOR MOBILE APPLICATION



REVISIONS

Version	Date	Writer	Subject
A	17/01/02	E. Soubrane	Document creation
B	25/02/02	E. Soubrane	Modification: 120 pin connector pinout
C	02/05/02	E. Soubrane	Modification: Battery connector pinout and functioning modes description, consumption
D	11/08/02	E. Soubrane	Pinout modifications, sensitivity, audio.
E	28/06/02	E. Soubrane	V56, sensitivity
F	23/07/02	E. Soubrane	DTR, DSR modification
G	06/09/02	E. Soubrane	LEDs connection precision, mechanical dimension precision, maximum capacitance on parallel bus
H	13/09/02	E. Soubrane	VBACKUP, IO description, SIMCD
I	14/11/02	E. Soubrane	BACKLCD/BACKKEY, Battery connector
J	06/01/03	E. Soubrane / T. Glasson	IO description precision, mechanical scheme update, humidity constraints. Compliance with FCC guidelines, GCF-CC (V.3.5.0)
K	06/02/03	E. Soubrane	Reset input level, V56 voltage in OFF mode
L	11/02/03	T. Glasson	Certification procedure warnings
M	04/03/03	E. Soubrane	VBAT max
N	28/03/03	T. Glasson	Certification clarifications

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1. OVERVIEW

1.1 OBJECT OF THE DOCUMENT

This document gives an overview of the MO130 module: a miniature, single-side board, tri-band GSM/GPRS module, ready for integration in mobile application like vehicle-mounted or vending machines...

It describes the main functionalities (GPRS / GSM 900MHz / DCS 1800MHz / PCS 1900MHz, interface to a melody chip, LCD interface, SIM interface, vibrator interface, audio interfaces for speaker/microphone or accessories, battery interface, battery charging interface...) of this module as well as the electrical interfaces, the mechanical specification (dimension, form...) and the electrical specification of the module.

1.2 REFERENCE DOCUMENTS

SCT U37 MT SPEC 117 C MASV2 module – Target specification
SCT TMO MASV2 SPEC 57 F MO130 module application note

1.3 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 (SNDP)". 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.3.5.0) and GT.01.
- NAPRD.03 (V.2.5.1).

1.4 COMPLIANCE WITH FCC GUIDELINES

Fix-mount and mobile devices incorporating M0130 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.

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

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	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. <u>If a full compliant RS232 (+/-5V) serial interface is needed:</u> 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

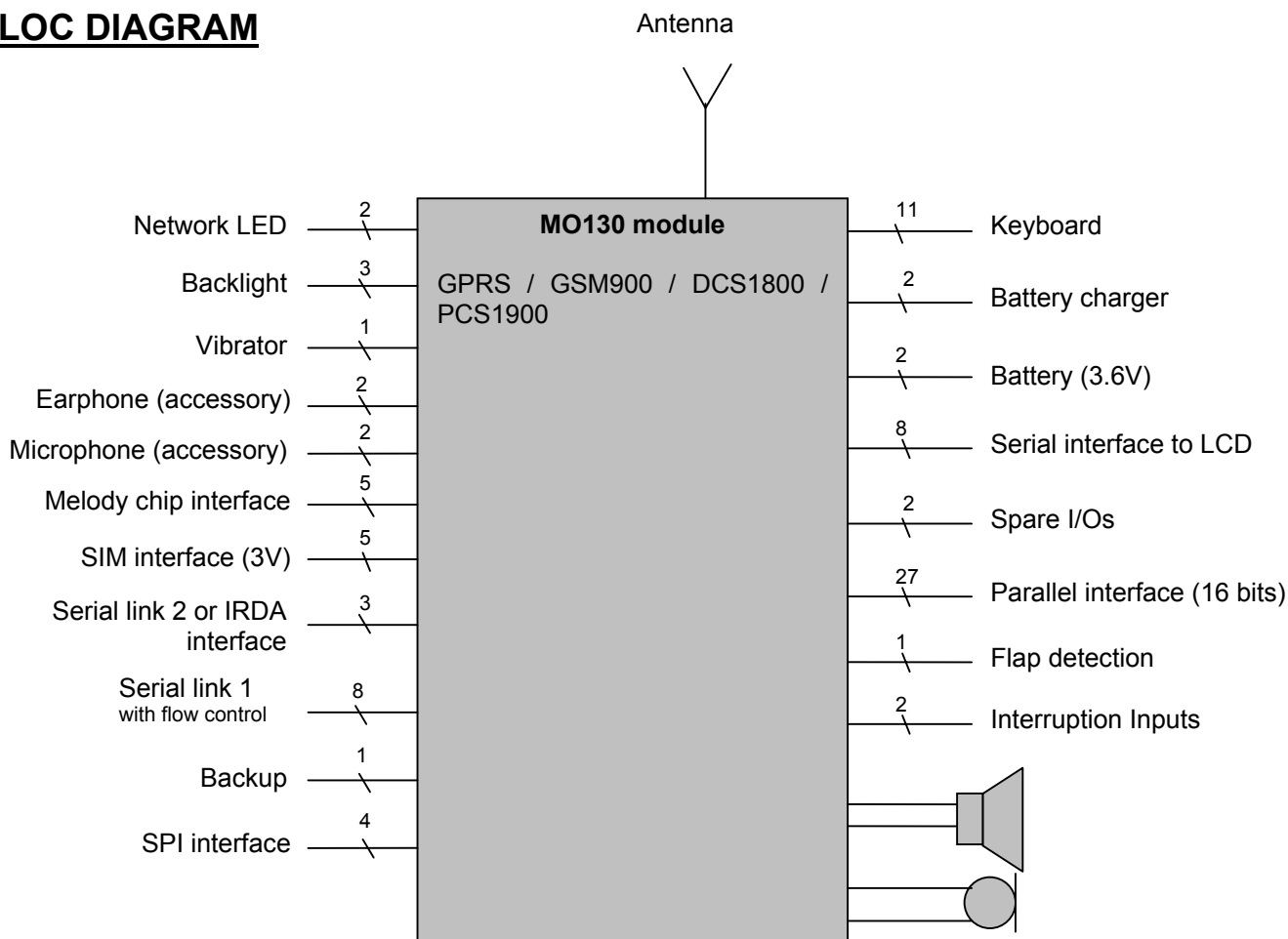


Figure 1
MO130 bloc diagram

See Pinout chapter for more details.

3. FUNCTIONAL DESCRIPTION

3.1 SIM

The SIM Card interface is compatible with the ISO 7816-3 IC card standard on the issues required by the GSM 11.11 Phase 2+ standard. The module also supports Release 99 of the SIM Toolkit recommendation too and supports a Fixed Dialling Number directory.

The SIM Card interface insures the detection (SIMCD), the power on (SIMVCC) of the SIM Card and the communication with it through a data signal (SIMIO), a clock signal (SIMCLK) and a reset signal (SIMRST).

Signal	Pin N°	Description
SIMRST	5	SIM reset, provided by Base-band processor
SIMCLK	4	SIM clock, provided by Base-band processor
SIMIO	7	SIM serial data line, input and output
SIMVCC	6	SIM supply voltage
SIMCD	114	SIM insertion detection

SIM card connection:

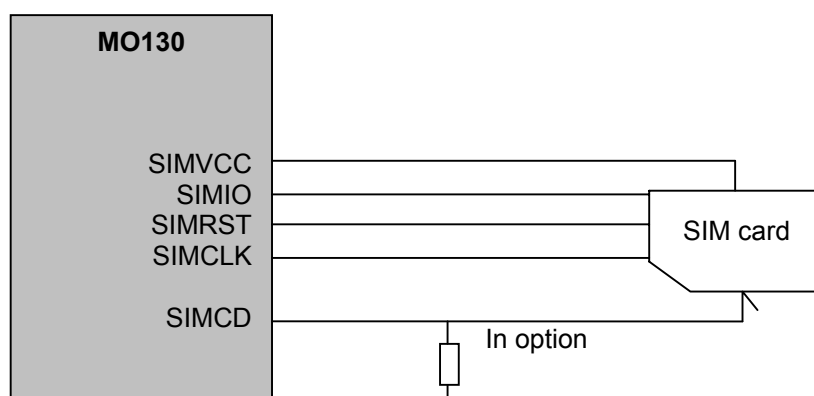


Figure 2
SIM connection

The SIMCD signal should be connected to the SIM card reader in order to get SIMCD at low level (GND) when no card is present and at high level (SIMVCC) when card is present (external pull down needed when SIM card connector with detection is used).

This interface includes main protections.

3.2 AUDIO

The module supports the following voice codecs:

- Half-Rate
- Full-Rate
- Enhanced Full Rate

It manages an external handset microphone (MICP/MICN) and an external handset earphone (HPP/HPN) in differential mode.

The bias voltage of the microphone is provided directly on MICP/MICN pins.

There are three options for the earphone:

- One multi-mode 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 far from the microphone.
- one 32 Ohms earphone as earpiece.

The Module can also manage accessories (earphone and microphone) through dedicated lines (BFRXP/BFRXN for earphone and BFTXP/BFTXN for microphone). The typical impedance for the earphone is 150ohms.

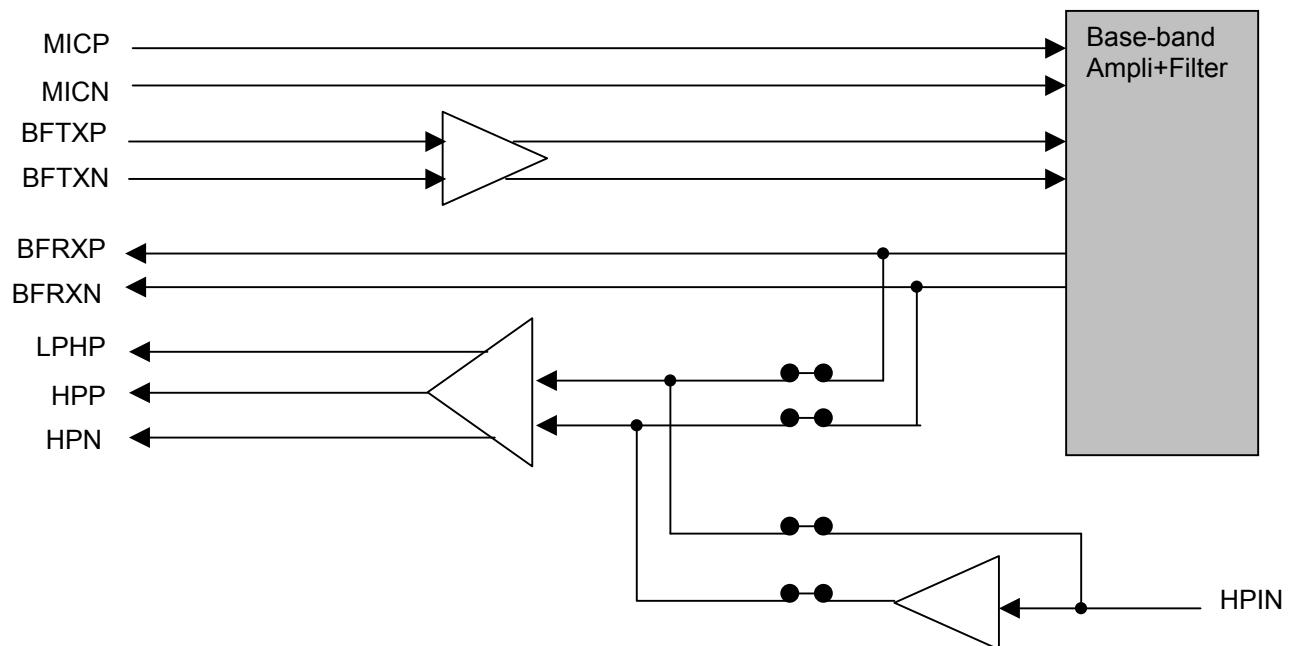


Figure 3
Audio

This interface includes main protections.

To ensure proper operation of such sensitive signals, there have to be isolated from the other by ground on mother board layout.

NB: To avoid destruction of module components, the HP inductance has to be 47nH +/- 5% @ 200MHz

3.3 DISPLAY

A serial interface is provided on the module to manage an external LCD (256 colour) through data input signal (DIMIW), data output signal (DOMIW), clock (CKMIW), reset (RESETLCD*), register select (RSLCD) and two chip selects (CSMIW1 and CSMIW2), one dedicated to the LCD, the other to the chip melody. Power supply of the LCD (ALIMLCD) is also provided through this interface.

This interface could be used to manage two LCDs. In this case, the module can't manage a chip melody through this serial link.

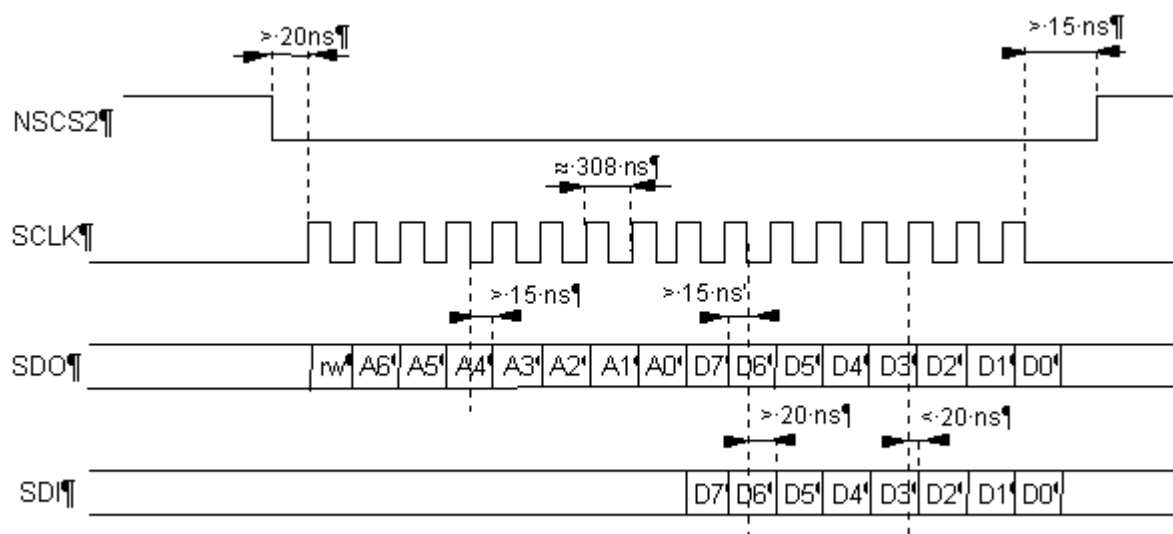


Figure 4
Serial link timing

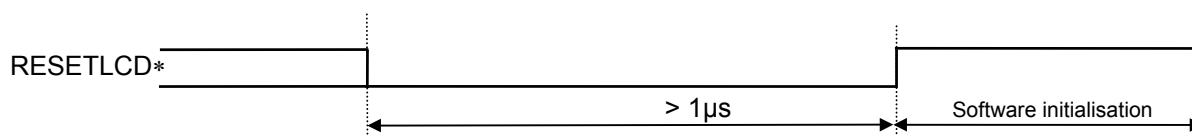


Figure 5
Reset serial link timing

This interface includes main protections.

If another LCD driver is used, the software would be provided by SAGEM, or at least the specific drivers will be integrated by SAGEM. In that case a specific quotation is required.

3.4 PARALLEL INTERFACE

A parallel interface is provided on the 120 pins connector. This interface include 16 bits data lines (D<0..15>), 7 address lines (A<0>,A<1>, A<2>, A<3>, A<4>, A<5>,A<6>), Write control signal RW* (active low), Output Enable signal OE* (active low) and two chip selects CS2 and CS3 (active low).

NB: The maximum capacitance acceptable on each signal of the parallel interface is 25pF (including copper line capacitance, connectors capacitance...).

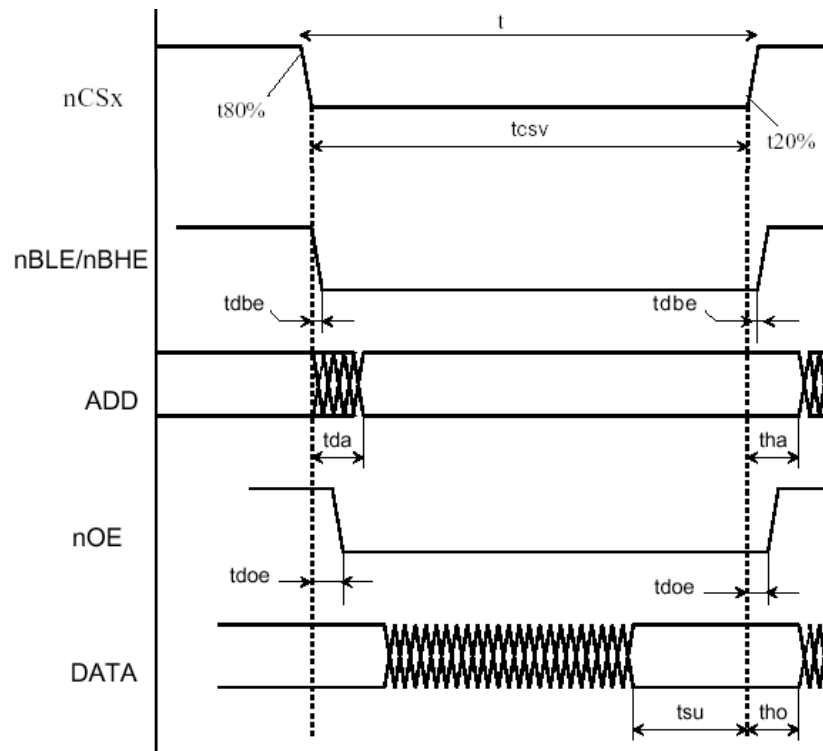


Figure 6
Parallel link read timing

Timing	Description	Min (ns)	Max (ns)
t_{cvc}	CPU frequency	-	$1/F_{cpu}$
t_{csv}	Chip Select Valid	t_{cyc}	$(N+1)t_{cyc}$
t_{da}	NCS to Address valid	-	3.9
t_{ha}	Address hold from nCS	0	-
t_{dbe}	NBHE, nBLE to nCS	-	-0.2
t_{doe}	NOE to nCS	-	4.5
t_{su}	Input data setup to nCS	7.9	-
t_{ho}	Input data hold from nCS	0	-
t_{srw}	NCS to RnW	$T_{cyc}/2 - t_{drw}$	-
t_{drw}	RnW to nCS	1.3	2.2
t_{dso}	NCS to output data valid	-	$T_{srw} + 14$
t_{hd}	Output data hold from RnW	1.1	-

N= Wait State number

Note: all timings computed for an external capacitance load of 10pF

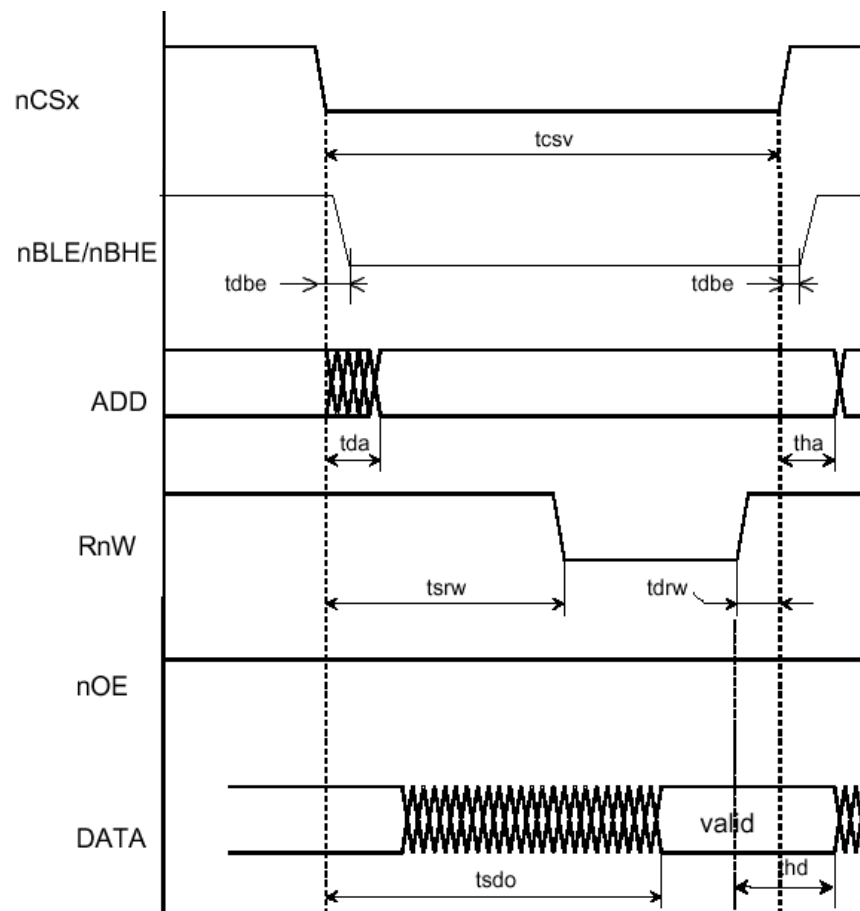


Figure 7
Parallel link write timing

NB: if needed, additional Wait State could be added by SAGEM.

Be careful: the maximum capacitance (components, lines, connectors,...) acceptable on each signal of the parallel bus is 25pF.

3.5 SPI INTERFACE

A SPI interface is provided on the 120 pins connector. This interface include Input/output data lines (DOSPI, DISPI), clock (CLKSPI) and enable (ENSPI1).

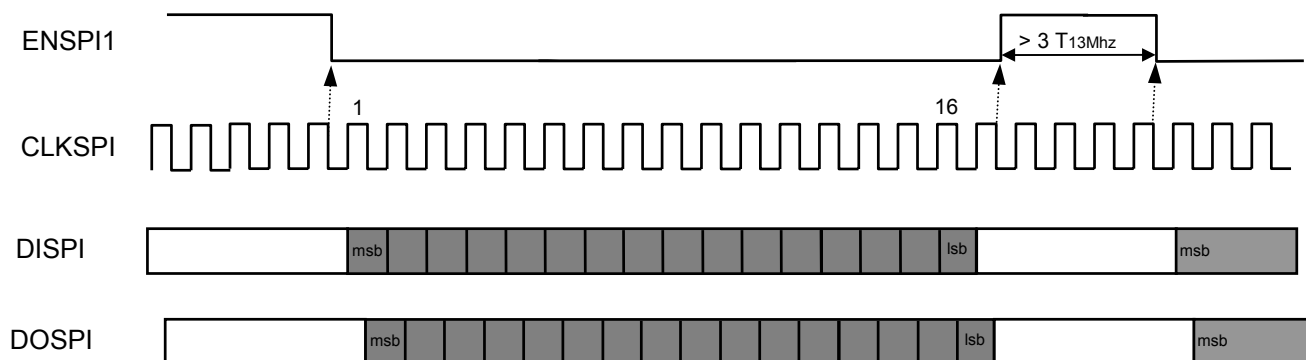


Figure 8
SPI interface timing

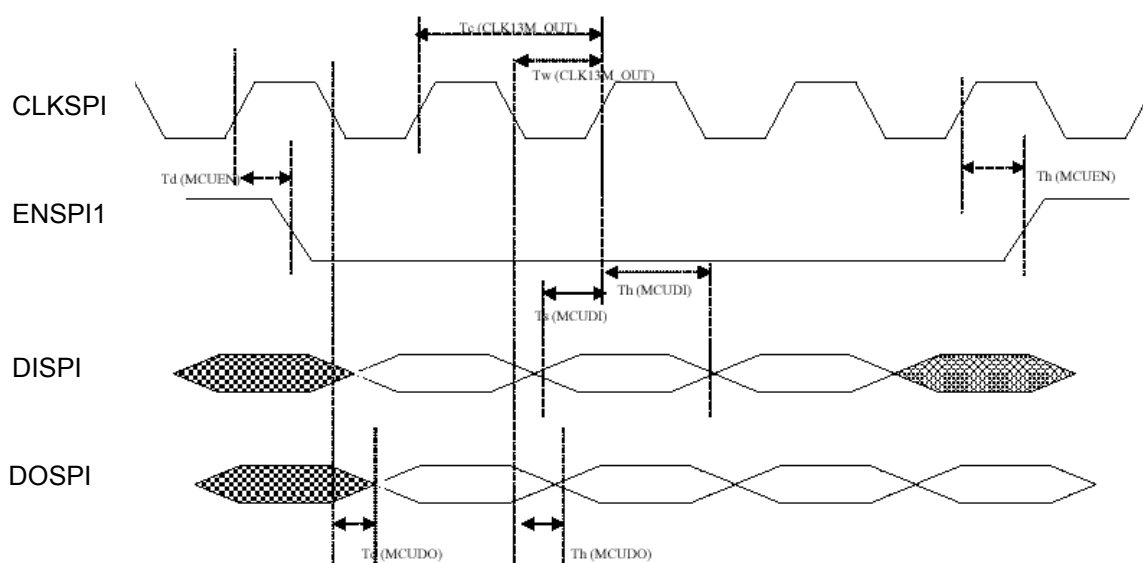


Figure 9
SPI interface timing (second)

Timing	Description	Min (ns)	Max (ns)
$T_{w(CLK13M_OUT)}$	Pulse duration	30ns	-
$T_{c(CLK13M_OUT)}$	Cycle time	77ns	-
$T_{d(MCUDO)}$	Delay time DOSPI	-	8.2ns
$T_{h(MCUDO)}$	Hold time DOSPI	0	-
$T_{d(MCUEN)}$	Delay time ENSPI1	-	7.5ns
$T_{h(MCUEN)}$	Hold time ENSPI1	0	-
$T_{s(MCUDI)}$	Setup DISPI	7.5ns	-
$T_{h(MCUDI)}$	Hold time DISPI	2.5ns	-

3.6 DATA

3.6.1 Data services

The module supports the following services:

- GPRS
- CSD: transparent and non-transparent up to 9600 BPS
- fax: class 1

Data sessions may be established over the main serial link or using the IrDA port (see below).

3.6.2 IrDA

This UART interface is compatible with 16C750 compliant devices. It includes the slow infra-red protocol in order to be connected with an infra-red transmitter to any external data peripherals with an IrDA compliant data interface.

This IrDA interface (TXIR, RXIR and CMDIRDA) provided by the module is compliant with the IrDA 1.0 SIR up to 115.2 Kbaud.

This interface includes main protections.

3.6.3 UART 2

It is strongly recommended to let this interface externally accessible for Debug.

3.6.4 V24

A V24 interface is provided on external pins of the module with the following signals:

- RTS/CTS
- RX/TX
- DSR
- DTR
- DCD
- RI

It supports speeds up to 115.2 KBPS and may be used in autobauding mode.

This interface includes main protections.

3.7 MULTIMEDIA

The MO130 module offers various multimedia and downloading features:

- WAP 1.2 browser
- Download Fun services for customisation of screensavers, wallpapers, ringtones and call groups icons
- EMS V5
- Downloadable games using Infusio's ExEN platform (Optional through specific development)

The supported picture formats are:

- WBMP
- BMP
- JPEG

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- PNG
- GIF
- SAGEM proprietary B/W format

The supported screensavers formats are:

- Animated GIF
- SAGEM proprietary formats

The supported ringtones formats are:

- MIDI
- iMelody
- PCM (mono, 8kHz)
- SAGEM proprietary formats

3.8 MELODIES GENERATION

The module is hardware compatible with three solutions :

1. First solution

For MIDI files melodies the current available characteristics of the rendering is: 8 tones / 15 instruments / 4kHz bandwidth (available later 16 tones / 8 instruments / 4kHz bandwidth).

2. Second solution:

For rich rendering PCM (4 kHz bandwidth) is used, this format can also be used for over the air downloading.

3. Third solution: external chip melody

The characteristics of this solution are: 16 tones, 16 instruments, wide audio bandwidth.

In this case, some interfaces of the module could be used to manage a chip melody:

- 13MHz digital clock is available on external pins of the module for this application.
- HPIN audio digital signal is available on external pins of the module for this application.
- A serial link (DIMIW, DOMIW, CKMIW) could be used for the communication between the module and the chip melody.
- VRIO +2.8V regulator output could be used to supply the chip melody.

Be careful, the serial link used for the melody chip is the same as the one used for the LCD (but 2 different chip selects).

Most of this interface includes main protection.

The melody chip driver would be done by SAGEM if needed (specific development).

3.9 ANTENNA

Two accesses for the antenna connection are provided.

- one by mean of a 50ohms connector
- one by mean of a simple copper area

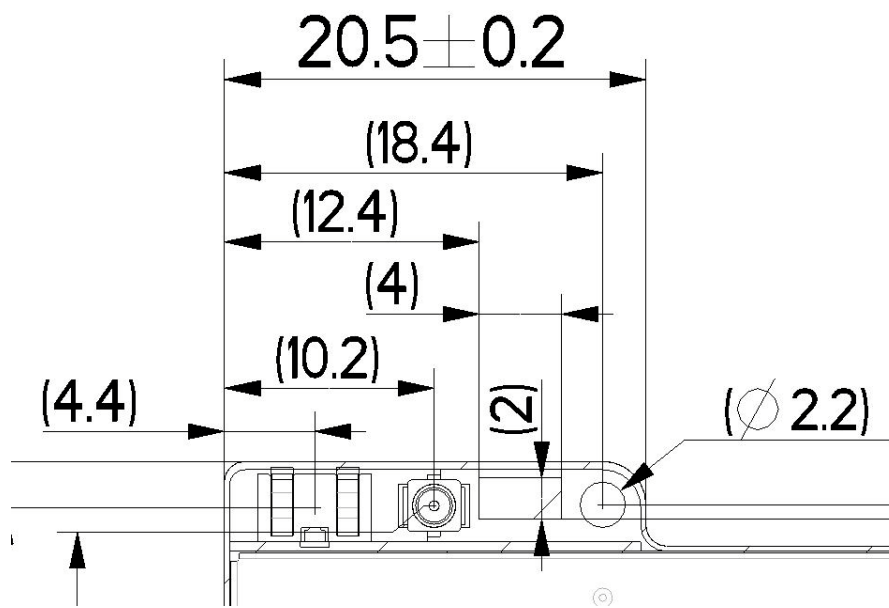


Figure 10
Antenna area on the MO130

See into application note for more details.

NB:

- No ground in the neighbourhood of the pad for the antenna connection.
- 50ohms guaranteed only in conducted mode
- Functioning of the module in radiated mode depends on the respect of the radio rules.

3.10 KEYPAD

A 5X5 keyboard could be managed by the module through the R1/R2/R3/R4/R5 row signals and C1/C2/C3/C4/C5 column signals.

OUI signal performs the ON function. OFF signals performs OFF function.

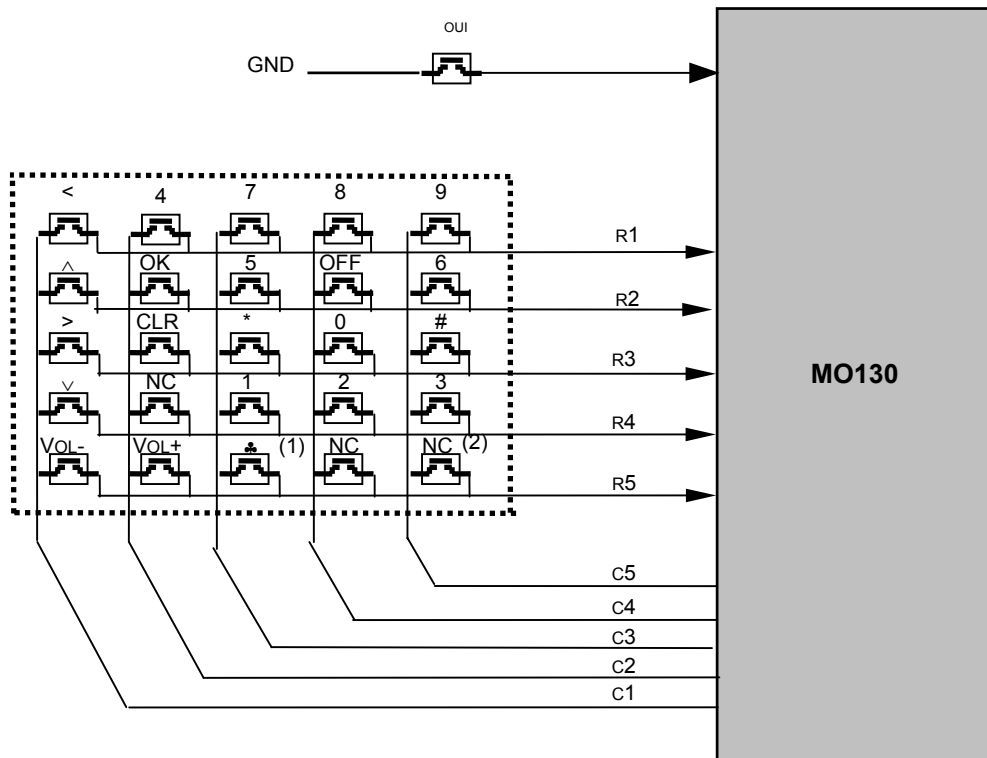


Figure 11
Keyboard connection

(1) tbd (for example: refusal of an incoming call when the flap is closed)

(2) could be used for a particular function if required.

NC = these keys are connected internally in the MO130 module but are not managed.

The module uses the Tegic T9™ predictive input system.

3.11 DAI

A DAI interface is provided on the module for type approval tests.

3.12 CLOCKS

A 32KHz frequency clock and a 13MHz frequency digital clock are provided on external pins of the module. The 13MHz clock could be used for the chip melody interface (see §3.6-Chip melody).

To ensure proper operation of such sensitive signals, there have to be isolated from the other by ground on mother board layout.

3.13 POWER MANAGEMENT AND CHARGE

3.13.1 Battery

The power supply signal VBAT is 3.45V to 5V range and 3.8V nominal.

It has to be more than 3V, even during transients in order to avoid unwanted resets. The power supply dropout has to be limited to 450mV, when the current consumption goes from minimum to maximum (0.1 to 1.8A). The noise level of the power supply has to be limited to 50mV RMS in the 100MHz – 1MHz frequency range

A battery level measurement algorithm is turning the module OFF when average VBAT < 3.45V for more than a few minutes.

For Li-ion battery, SAGEM advises to use Sanyo or LG battery. If other battery is used, SAGEM agreement is needed (slight qualification tests).

This interface includes main protections.

3.13.2 VRDBB

+1.8V output is available on external pin of the module and could supply +1.8V external components (current capability 10mA in active mode).

This interface includes main protections.

3.13.3 VRDBBDC

+1.8V input is available on external pin of the module. An external +1.8V DC-DC converter could eventually be connected on this pin to supply the +1.8V to all the module. If no external DC-DC is added, this pin has to be connected to the VRDBB output.

This interface includes main protections.

3.13.4 VRIO

+2.8V output is available on external pin of the module and could supply +2.8V external components (current capability 10mA in active mode).

This interface includes main protections.

3.13.5 V56

+5.6V un-regulated power supply is available for Blue or White LEDs power supply on external pin of the module with the following characteristics:

- 27mA capability in ON mode
- 5.5V to 5.7V in ON mode

This interface includes main protections.

3.13.6 Vbackup

External Backup could be supply through the VBACKUP input (from 2.2V to 3.2V).

If No external Backup is supplied, VBACKUP input has to be connected to VBAT signal.

3.13.7 Charge

This interface manages the charge of the mobile, when a charger is connected, even in the following conditions: deeply discharged battery, short-circuited battery and unconnected battery.
No additional components are needed.

Three types of charger can be managed by this interface:

Parameter	Type 1	Type 2	Type 3
Unloaded max output voltage (V)	7	11	16
Max voltage for max current (V)	6.5	10.5	-
Current limitation (mA)	450	650	-
Voltage period (ms)	-	-	10
Equivalent output resistor (ohms)	-	-	8+/-10%

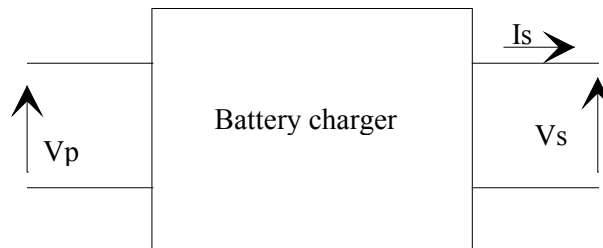
This interface includes main protections.

3.13.8 AC/DC switching charger

3.13.8.1 Operating temperature

0°C to +55°C.

3.13.8.2 Electrical ratings



Class II equipment (EN 60950 § 1-2-4-2)

1 - Primary input voltage

$98V < V_p < 254V$; $F = 50/60Hz$.

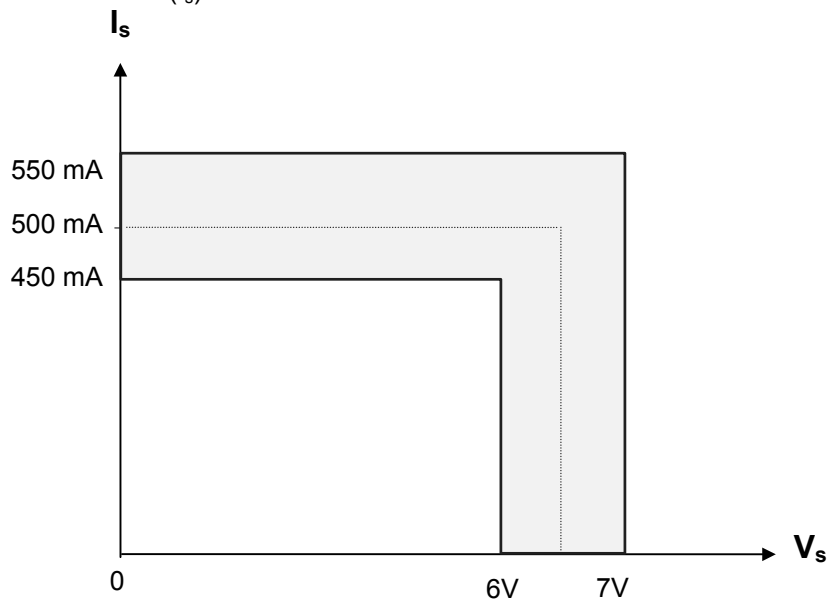
2 - Primary/secondary insulation

Security transformer class E (EN 60950 § 5-1)

Electric strength : reinforced insulation (EN 60950 § 5-3-2)

3 - Static output template

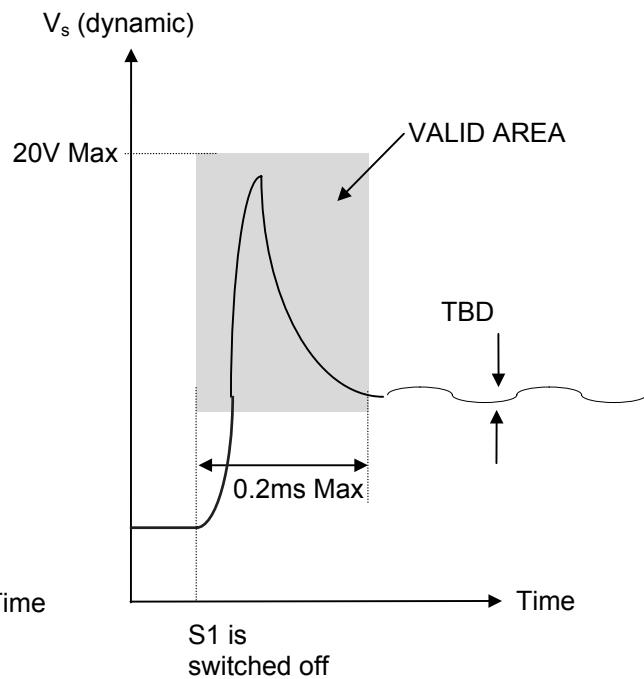
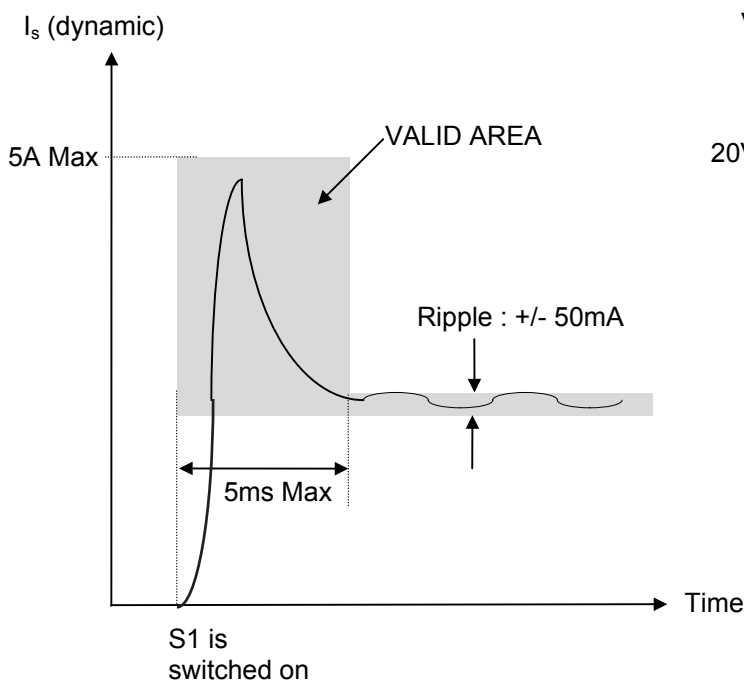
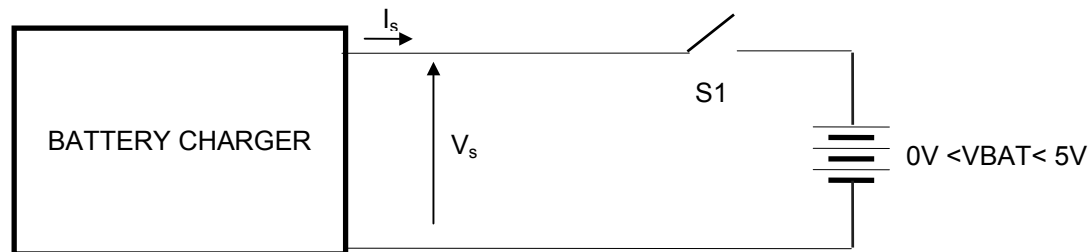
This template shows the $V_s = f(I_s)$ function.



4 - Dynamic output template

An external device is controlling the battery charge by means of a switch S1, which can be switched on and off.

Following templates shows the output current and voltage during transients, this feature is very important to enable the charging control by controlling S1 (PWM).



5 - Reverse current (main off)

Main off or unplug, the current flowing from the battery to the charger have to stay smaller than « I_r » in order to prevent discharge !

$I_r < 100\mu A$ for $V_{BAT} \leq 5V$

3.13.8.3 Thermal ratings

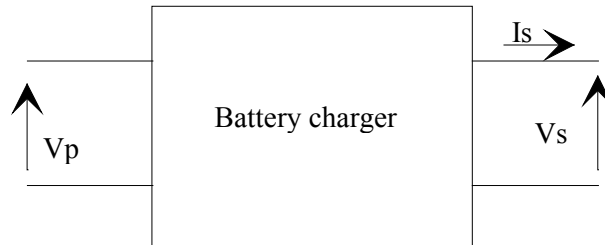
The heating of the enclosure will comply with EN 60950 § 5-1
Tab. 16 - part 2.

3.13.9 Simple battery charger

3.13.9.1 Operating temperature

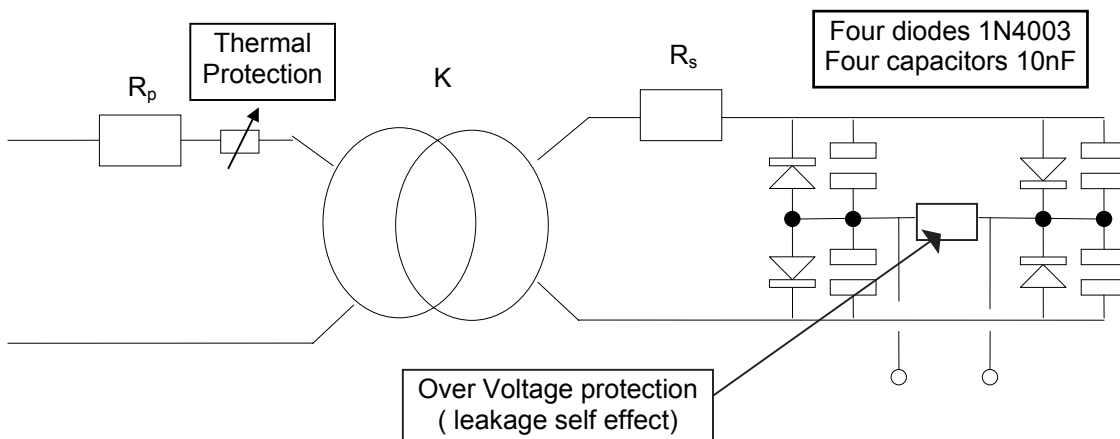
0°C to +55°C.

3.13.9.2 Electrical ratings



Class II equipment (EN 60950 § 1-2-4-2)

1 - Bloc definition



Equivalent resistance : $R_{eq} = K^2 R_p + R_s = 8,3\Omega \pm 10\%$ (for 20°C Ambient)

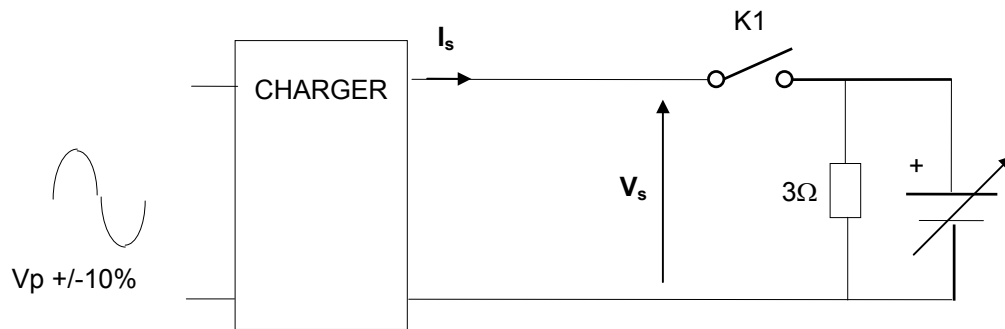
Transformation Ratio : $K = 0,038$

NOTA : R_s can be realise by coil resistor and if necessary by external resistor

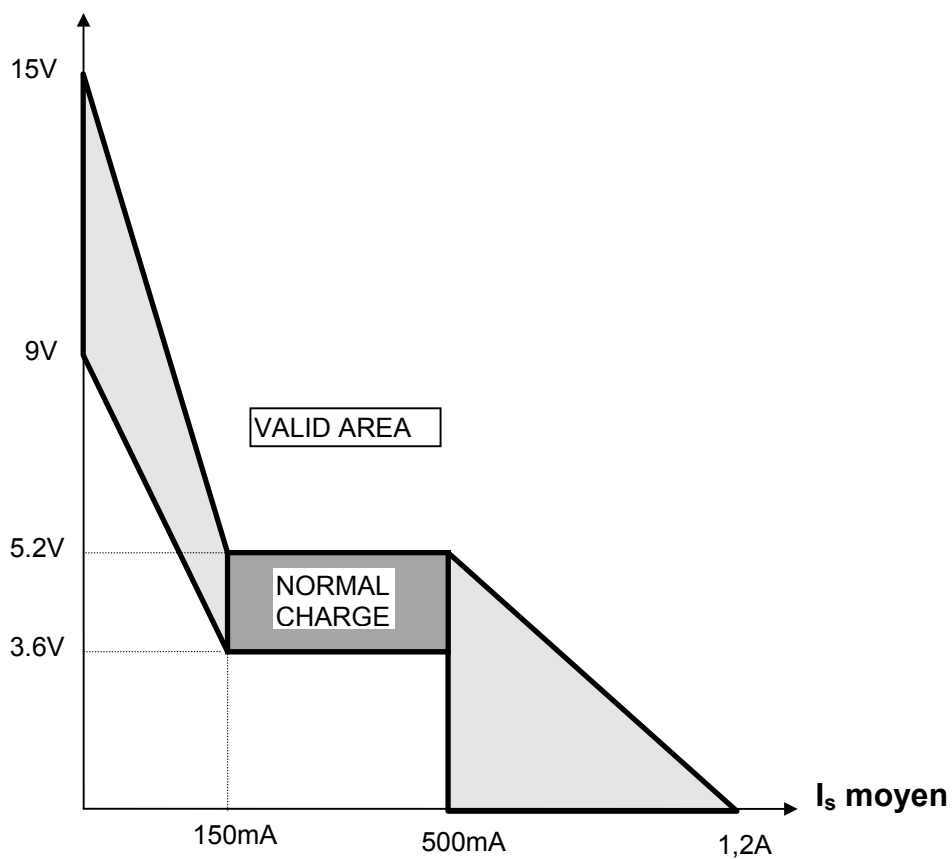
NOTA2 : Without output capacitor to avoid current over load through GSM switch

2 - Test circuit

This design show the test circuit



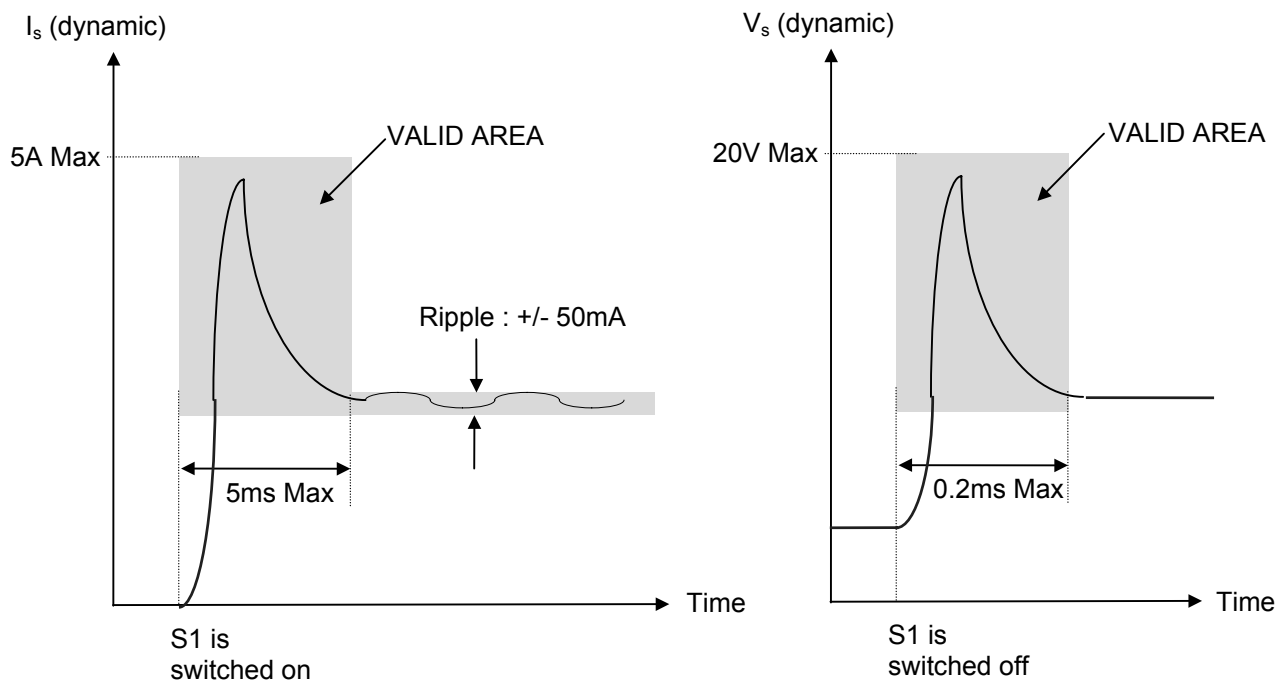
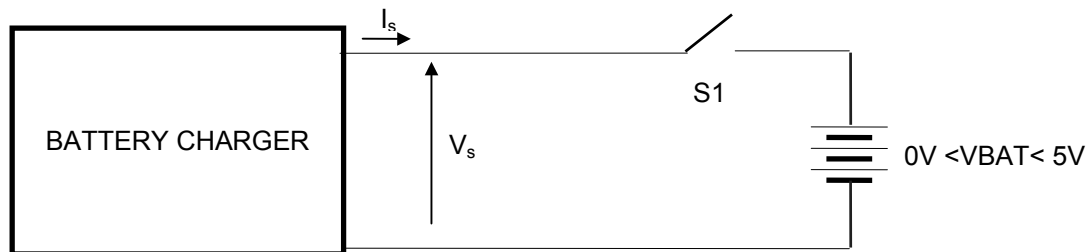
$$V_s \cong V_{BAT} + 0.6V$$



3 - Dynamic output template

An external device is controlling the battery charge by means of a switch S1, which can be switched on and off.

Following templates shows the output current and voltage during transients, this feature is very important to enable the charging control by controlling S1 (PWM).



4 - Reverse current (main off)

Main off or unplug, the current flowing from the battery to the charger have to stay smaller than « Ir » in order to prevent discharge !

$I_r < 100\mu A$ for $V_{BAT} \leq 5V$

3.13.9.3 Thermal ratings

The heating of the enclosure will comply with EN 60950 § 5-1

Tab. 16 - part 2.

Thermal tests will be done with 230V +10%, the duration of the tests will be at least 3 hours stabilisation , the test circuit will be conform to paragraph 4.4 with K1 closed .

Bobbin temperature elevation have to be lower than 75°C in all cases , to insure a final temperature lower than 115°C for 40°C ambient temperature .

Primary resistance increase with temperature and $\Delta\theta = \Delta R_p / (R_p \cdot 4,2 \cdot 10^{-3})$

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Verify : $\Delta R_p / R_p (20^\circ\text{C}) < 0.315$

Report have to be made by the supplier stipulating the bobbin and the enclosure temperature elevation .

3.14 ACCESSORIES

Accessories connection has to be defined more precisely.

With the MO130 module, the following accessories could be connected :

- a pedestrian stereo or non stereo hand-free kit
- a battery charger
- an automotive hand-free kit

These interfaces includes main protections.

3.15 MANUFACTURER MMI CUSTOMIZATION

The MO130 module already includes built-in MMI. This MMI can be customised by customer with SAGEM help.

Options for customisation include :

- custom bitmaps and animations (with pre-determined sizes): start animation, menus animations, icons...
- custom fonts (with pre-determined sizes)
- custom messages (provided they fit in the MMI design)
- custom screen-savers
- enabling or disabling some features

If more customisation is required, this has to be discussed with SAGEM.

As explained in other chapters, if a specific LCD or keyboard configuration is needed, SAGEM will take the responsibility to develop the required software drivers. In case of already available drivers, SAGEM will take the responsibility to integrate them in the software.

All these options are submitted to specific software development on SAGEM side. Therefore, MMI options require separate, dedicated quotation.

3.16 OTHER FUNCTIONS

3.16.1 Flap

An interrupt pin is available on external pin of the module for the Open/closed detection of a clam mobile.

3.16.2 Buzzer

This interface is not provided at this time but could be included if requested.

3.16.3 Backlight

3.16.3.1 Red or Green LEDs

A current generator (BACKKEY) is dedicated to backlight of the LCD or the keyboard with the following characteristics:

- Output voltage V_{on} from 1.7V to 3.7V, 2.5V typ.

- Output current I_{on} from up to 150mA typ.
- Output voltage V_{off} from 3.0V to 5.5V, 3.8V typ.
- Output current I_{off} 200nA max.
- Analog output, programmable current NMOS type.

An other current generator (BACKLCD) is dedicated to backlight of the LCD or the keyboard with the following characteristics:

- Output voltage V_{on} from 1.7V to 3.7V, 2.5V typ.
- Output current I_{on} up to 80mA typ.
- Output voltage V_{off} from 3.0V to 5.5V, 3.8V typ.
- Output current I_{off} 100nA max
- Analog, programmable NMOS type, or Digital output

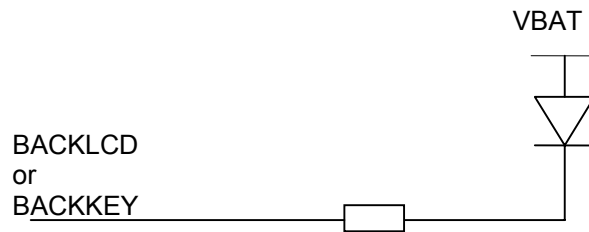


Figure 12
LED (baklight) connection

This interface includes main protections.

3.16.3.2 Blue and White LEDs

V56 power supply could be used to supply maximum 3 blue or white LEDs ($I_{V56} = 27mA$ max). To connect more blue or White LEDs; an external driver has to be added.

3.16.3.3 Multicolour LEDs and EL film

An external driver has to be added to manage the multicolour LEDs or White LEDs.

3.16.4 Network LED

Two external pin of the module (LEDR and LEDG) are dedicated to network LED.

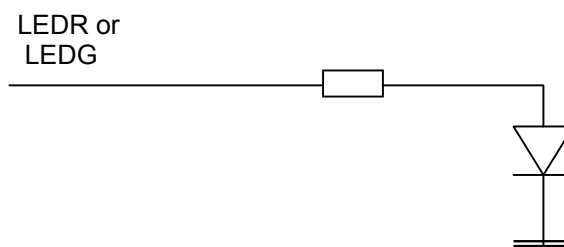


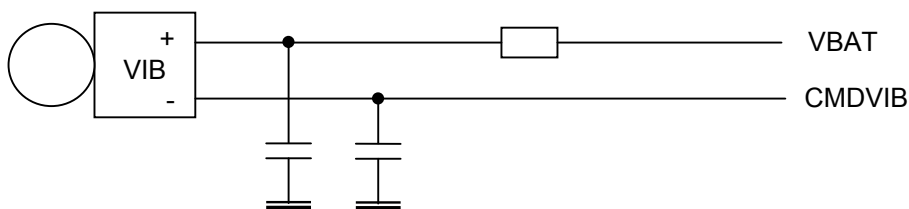
Figure 13
Network LED connection

This interface includes main protections.

3.16.5 Vibrator

An external pin of the module provides vibrator command (CMDVIB) to drive a vibrator with the following characteristics:

- R_s series resistance from 10 ohms to 50 ohms.
- Z_l series inductance from 50uH to 100uH.
- C_l load capacitance from 0 to 1nF.
- I_{off} quiescent current 100nA max.



*Figure 14
Vibrator connection*

This interface includes main protections.

4. OPERATING MODES

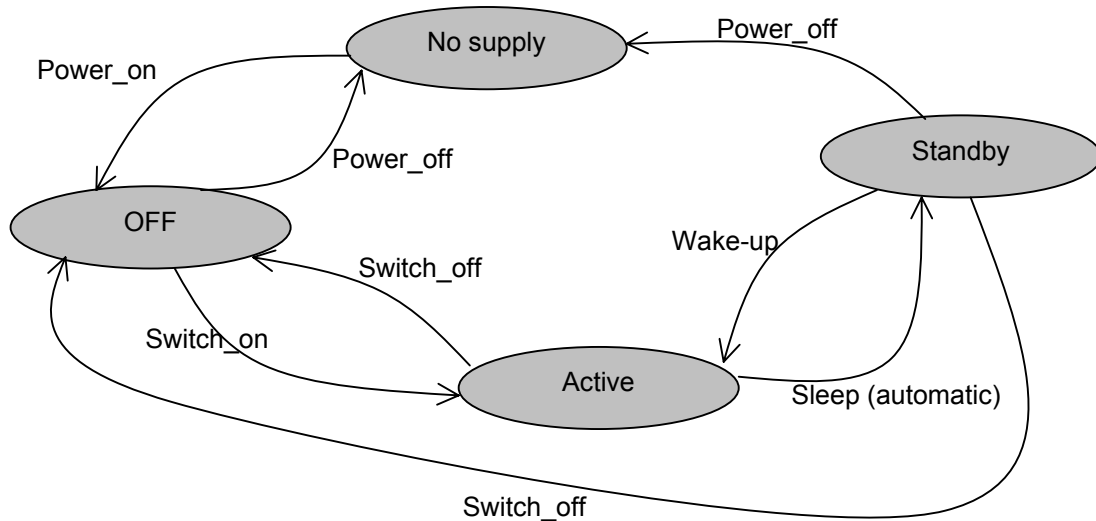


Figure 15
Operating modes state diagram

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

5. PINOUT

The following list of signals could change.

Signal name	IO type	Function	Description	Pin N°
DAIRST	Input	DAI interface	DAI reset	116
DAIOUT	Output		DAI output data	115
DAIIN	Input		DAI input data	117
DAICLK	Input		DAI clock	118
SWANTANT	Output	Antenna switch command		112
ITFLAP	Input	Flap interrupt	Flap detection interruption	80
BACKLCD	Output	LED control	Backlight LED control	72
BACKKEY	Output		Backlight LED control	71
LEDR_BUZ	Output		Alarm LED control / buzzer control on demand	91
LEDG	Output		Network LED control	90
RSLCD	Output	Serial interface to connect LCD or chip melody (2 chip selects)	LCD driver register select	89
RESETLCD*	Output		LCD driver reset	88
ALIMLCD	Output		LCD driver power supply	75
DIMIW	Input		LCD driver input data of the serial link	86
DOMIW	Output		LCD driver output data of the serial link	84
CKMIW	Output		LCD driver clock of the serial link	85
CSMIW1	Output		LCD1 driver chip select of the serial link	98
CSMIW2	Output		LCD2 driver chip select of the serial link	97
R1	Input	Keyboard interface	Keyboard row 1	22
R2	Input		Keyboard row 2	21
R3	Input		Keyboard row 3	20
R4	Input		Keyboard row 4	19
R5	Input		Keyboard row 5	18
C5	Output		Keyboard column 5	23
C4	Output		Keyboard column 4	24
C3	Output		Keyboard column 3	25
C2	Output		Keyboard column 2	26
C1	Output		Keyboard column 1	27
OUI*	Input	ON key	Keyboard ON key	113
SIMVCC	Output	SIM interface	SIM power supply	6
SIMRST	Output		SIM reset	5
SIMCLK	Output		SIM clock	4
SIMIO	In/output		SIM data	7
SIMCD	Input		SIM insertion detection	114
BFTXP	Input	To external microphone (accessory)	Differential input from microphone	52
BFTXN	Input		Differential input from microphone	53
BFRXP	Output	To external HP (accessory)	Differential output to earphone	49
BFRXN	Output		Differential output to earphone	50
MICP	Input	Microphone interface	Differential input to handset microphone	63

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MICN	Input		Differential input to handset microphone	62
HPP	Output	Earphone interface	Differential output to 32ohms or 8ohms earphone	56
HPN	Output		Differential output to 8ohms earphone	57
LPHP	Output		Differential output to 32ohms earphone	55
HPIN	Input	Melody chip interface	HP in for melody chip interface	59
CMDVIB	Output	Vibrator interface	Vibrator command	79
RI	Output	V24 interface with flow control	Ring Indicator	109
DSR	Output		Data Send Ready	94
DCD	Output		Data Carrier Detect	110
DTR	Input		Data Terminal Ready	95
CTS	Output		Clear To Send	82
RTS	Input		Request To Send	83
TXD1	Output		UART transmit 1	101
RXD1	Input		UART receive 1	105
TXD2	Output		UART transmit 2	103
RXD2	Input		UART receive 2	104
TXIR	Output	IRDA interface	IRDA transmit	100
RXIR	Input		IRDA receive	99
CMDIRDA	Output		IRDA command	96
INT	Input	Internal use		92
SCL	Output			14
SDA	In/out			93
CHARGEUR	Input	Load interface	Charge	69,70
ON*	Output		Accessories control	73
TESTRESETZ	Input	Reset	Reset system signal	81
ITDATA	Input	Accessories detection	Interrupt signal	76
CMDSW1	In/output	Spare IO	I/O	107
CMDSW2	In/output		I/O	106
CINT	Input	Interrupt	Interruption	111
D<0>	In/output	Parallel interface	Data bus	33
D<1>	In/output		Data bus	34
D<2>	In/output		Data bus	35
D<3>	In/output		Data bus	36
D<4>	In/output		Data bus	37
D<5>	In/output		Data bus	38
D<6>	In/output		Data bus	39
D<7>	In/output		Data bus	40
D<8>	In/output		Data bus	41
D<9>	In/output		Data bus	42
D<10>	In/output		Data bus	43
D<11>	In/output		Data bus	44
D<12>	In/output		Data bus	45
D<13>	In/output		Data bus	46
D<14>	In/output		Data bus	47
D<15>	In/output		Data bus	87
A<0>	In/output		Address bus	32
A<1>	In/output		Address bus	78
A<2>	In/output		Address bus	77

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A<3>	In/output		Address bus	68
A<4>	In/output		Address bus	67
A<5>	In/output		Address bus	66
A<6>	In/output		Address bus	65
OE*	Output		Output Enable	30
RW*	Output		Read / Write	29
CS2	Output		Chip select 2	31
CS3	Output		Chip select 3	28
CLK13M	Output	Clocks	13MHz clock digital output	16
CLK32K	Output		32KHz clock digital output	9
ADC1	Input	ADC/DAC	Battery type detection	11
DAC	Output		Digital to analog converter	13
DISPI	Input	SPI bus	Data input	120
DOSPI	Output		Data output	102
CLKSPI	Output		Clock SPI	108
ENSPI1	Output		SPI enable	119
VBAT	Input	Power supply	+3.6V battery power supply	Bat. Conn. 1
V56	Output		+5.6V output power supply	74
VRDBB	Output		+1.8V output power supply	3
VRDBBDC	Input		+1.8V DCDC output	1
VRIO	Output		+2.8V output power supply	2
VBACKUP	Input		Backup input	12
GND	Ground	Ground		8,10,15,17,48 ,51,54,58,60, 61,64 Bat. Conn 2
OUT_ANT	Output	Antenna output		Ant. conn.
TCLK	Input	JTAG interface	JTAG	Test point
TMS	Input		JTAG	Test point
TDI	Input		JTAG	Test point
TDODIGIT	Output		JTAG	Test point
TDI ANALOG	Input		JTAG	Test point
TDO ANALOG	Output		JTAG	Test point
NBSCAN	Input	Boundary scan	JTAG	Test point
NEMU0	Output		For debug	Test point
NEMU1	Output		For debug	Test point

6. ELECTRICAL SPECIFICATION

V_{OH}	High level output voltage
V_{OL}	Low level output voltage
V_{IH}	High level input voltage
V_{IL}	Low level input voltage

6.1 VBAT

The module is supplied through the VBAT signal with the following characteristics:

Parameter	Name	Min	Typ	Max
VBAT period (ms)	VbatTe (*)	4.614	4.615	DC
VBAT low duration (us)	VbatTi (*)	550	-	VBAT period
VBAT rise time (us)	VbatTr (*)	0	-	-
VBAT fall time (us)	VbatTf (*)	0	-	-
VBAT maximum voltage (V)	VbatMax (*)	-	-	5
VBAT minimum voltage (V)	VbatMin (*)	3.45	-	-
VBAT drop voltage (mV)	DeltaVbat (*)	-	-	450 (**)
Transient voltage (V)		3	-	-
Noise level (Vrms) @100MHz-1MHz		-	-	50mV

(*): cf figure 16.

(**): for a new battery. Of course for old battery, this value will be higher and will create a reset (without MMI message) of the mobile phone when the battery begins to be discharge.

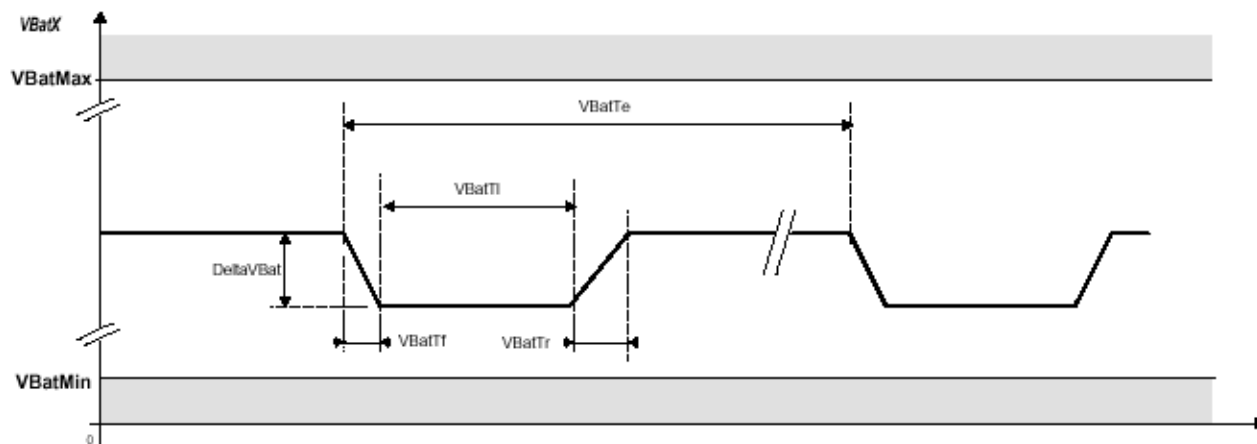


Figure 16
VBAT voltage waveform

NB: a battery level measurement algorithm is turning the module OFF when VBAT < 3.45V for more than a few minutes.

6.2 POWER SUPPLIES

6.2.1 VRDBB (120 pin connector, pin 3)

Signal	Min	Typ	Max	Remarks
Voltage level	1.65V	1.80V	1.95V	Protection
Current capability Active mode	-	-	10mA	
Current capability Sleep mode	-	-	1mA	
Quiescent current Active mode	-	150μA	-	
Quiescent current Sleep mode	-	20μA	-	
Quiescent current Disable	-	1μA	-	
Rise time	-	10μs	-	

6.2.2 VRIO (120 pin connector, pin 2)

Signal	Min	Typ	Max	Remarks
Voltage level	2.70V	2.80V	2.90V	Protection
Current capability Active mode	-	-	10mA	
Current capability Sleep mode	-	-	1mA	
Quiescent current Active mode	-	150μA	-	
Quiescent current Sleep mode	-	20μA	-	
Quiescent current Disable	-	1μA	-	
Rise time	-	10μs	-	

6.2.3 V56 (120 pin connector, pin 74)

Signal	Min	Max	Remarks
Voltage level	5.5V	5.7V	Protection Un-regulated
Current capability	-	27mA	
Rise time	-	2ms	

NB: in OFF mode, this power supply is in low power configuration (V56 = 4.5V and I_{V56} = 1mA max).

6.2.4 ALIMLCD (120 pin connector, pin 75)

Signal	Min	Max	Remarks
Voltage level	2.75V	2.85V	Protection
Current capability	-	10mA	

6.3 DAI INTERFACE

DAIRST, DAIIN, DAICLK and DAIOU have the following characteristics:

Signal	V _L (V)		V _H (V)		Remarks
	Min	Max	Min	Max	
DAIRST (in)	-0.5	+0.8	+2.0	+3.2	Protection
DAICLK (in)	-0.5	+0.8	+2.0	+3.2	Pull down Protection
DAIIN (in)	-0.5	+0.8	+2.0	+3.2	Pull down Protection
DAIOU (out)	-	+0.6	+2.4	-	Protection

6.4 NETWORK LED

LEDR and LEDG have the following characteristics:

Signal	V _L (V)		V _H (V)		Remarks
	Min	Max	Min	Max	
LEDR, LEDG (out)	-	+0.6	+2.4	-	Protection

I_{out} max = 4mA

6.5 BACKLIGHT

BACKLCD and BACKKEY have the following characteristics:

Parameter	Signal	Min	Typ	Max	Remarks
V _{on}	BACKLCD, BACKKEY	1.7V	2.5V	3.7V	Protections BACKLCD: analog or digital
I _{on}	BACKKEY	120mA	150mA	180mA	
	BACKLCD	50mA	80mA	90mA	BACKKEY: analog
V _{off}	BACKLCD, BACKKEY	3.0V	3.8V	5.5V	
I _{off}	BACKKEY			200nA	
	BACKLCD			100nA	

6.6 SERIAL INTERFACE FOR LCD

RESETLCD*, RSLCD, DIMIW, DOMIW, CKMIW, CSMIW1, CSMIW2 have the following characteristics:

Signal	V _L (V)		V _H (V)		Remarks
	Min	Max	Min	Max	
DIMIW (in)	-0.5	+0.8	+2.0	+3.2	Protection
RESETLCD* (out)	-	+0.6	+2.4	-	Pull down Protection
Output (out)	-	+0.6	+2.4	-	Protection

6.7 KEYBOARD INTERFACE

R1, R2, R3, R4, R5, C1, C2, C3, C4 and C5 have the following characteristics:

Signal	V _L (V)		V _H (V)	
	Min	Max	Min	Max
Input (R1/2/3/4/5)	-0.5	+0.8	+2.0	+3.2
Output (C1/2/3/4/5)	-	+0.6	+2.4	-

OUI*:

Signal	Min	Max
Ton (ms)	65	-

6.8 VIBRATOR CONTROL

CMDVIB has the following characteristics:

Parameter	Min	Typ	Max
V _{on}	1.2V	1.8V	3V
I _{on}	70mA	80mA	92mA
V _{off}	3.0V	3.8V	5.5V
I _{off}	-	-	100nA

6.9 V24

CTS, RTS, DCD, DSR, DTR and RI have the following characteristics:

Signal	V _L (V)		V _H (V)		Remarks
	Min	Max	Min	Max	
RTS (in)	-0.5	+0.8	+2.0	+3.2	Pull-up
RI (out)	-	+0.6	+2.4	-	Pull up
DCD, DSR, CTS (out)	-	+0.6	+2.4	-	Pull-up on DCD
DTR (in)	-0.5	+0.8	+2.0	+3.2	Pull up on DTR

6.10 IRDA

RXIR, TXIR and CMDIRDA have the following characteristics:

Signal	V _L (V)		V _H (V)		Remarks
	Min	Max	Min	Max	
RXIR (in)	-0.5	+0.8	+2.0	+3.2	Protections
TXIR, CMDIRDA (out)	-	+0.6	+2.4	-	

6.11 CHARGER

Charger has the following characteristics:

Parameter	Description	Min	Max
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e Centre de Saint Christophe - URD 37	S TELEPHONIE MOBILE MOBILE PHONES	Ref. : SCT TMO MASV2 SPEC 14 M Date : 04/03/03
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VCHARGEUR	Charger voltage	0V	16V
Tchstart	Charge start up timer	8s	16s

6.12 RESET

TESTRESETZ has the following characteristics:

Signal	Min	Max	Remarks
V _L (V)	-0.5	+0.495	Pull up Protection
V _H (V)	+1.365	+2.15	
Treset (ms)	65	-	

NB: The reset signal resets all the system including backup.

6.13 SPARE IO

CMDSW1/2 have the following characteristics:

Signal	V _L (V)		V _H (V)		Remarks
	Min	Max	Min	Max	
Input	-0.5	+0.8	+2.0	+3.2	Protections
Output	-	+0.6	+2.4	-	

I_{out} max = 4mA

6.14 CLOCKS

CLK13M and CLK32K have the following characteristics:

Signal	V _L (V)		V _H (V)		Remarks
	Min	Max	Min	Max	
CLK13M (out)	-	+0.6	+2.4	-	
CLK32K (out)	-	+0.4	+1.6	-	

6.15 PARALLEL INTERFACE

D<0..15>, A<0..6>, OE*, RW*, CS2, CS3 have the following characteristics:

Signal	V _L (V)		V _H (V)		Remarks
	Min	Max	Min	Max	
Input D<0..15>	-0.5	+0.8	+2.0	+3.2	
Output D<0..15>, A<0..6>, RW*, OE*, CS2, CS3	-	+0.6	+2.4	-	

NB: The maximum capacitance acceptable on each signal of the parallel interface is 25pF (including copper line capacitance, connectors capacitance...).

6.16 JTAG INTERFACE

TCLK, TMS, TDI, TDODIGIT, TDIANALOG, NBSCAN, NEMU0, NEMU1 have the following characteristics:

Signal	V _L (V)		V _H (V)		Remarks
	Min	Max	Min	Max	
Input TCLK, TMS, TDI, TDIANALOG, NBSCAN	-0.5	+0.8	+2.0	+3.2	
Output TDODIGIT, TDOANALOG, NEMU0, NEMU1	-	+0.6	+2.4	-	

6.17 DAC

Recommended load on pin DAC : 30pF max // 10Kohms min

Parameter	Min	Typ	Max
Resolution	-	10 bits	-
Output voltage with code max	2.0V	2.2V	2.4V
Output voltage with code min	0.18V	0.24V	0.3V

6.18 ADC

Parameter	Min	Typ	Max
Resolution	-	10 bits	-
Input range	0	-	1.75V
Input resistance	-	5.7Kohms	-

6.19 INTERRUPTS

ITFLAP, ITDATA and CINT have the following characteristics :

Signal	V _L (V)		V _H (V)		Remarks
	Min	Max	Min	Max	
ITFLAP	-0.5	+0.8	+2.0	+3.2	Pull up Digital port
ITDATA	-0.5	+0.8	+2.0	+3.2	Pull up Digital port
CINT	-0.5	+0.8	+2.0	+3.2	Pull down Digital port

6.20 VBACKUP

Signal	Min	Max	Remarks
VBACKUP	+2.2V	+3.2V	Protection

If no external backup is supplied, VBACKUP has to be connected to VBAT.

With external BACKUP:

- if VBAT < VBACKUP, internal RTC is supplied by VBACKUP.
- if VBAT > VBACKUP, internal RTC is supplied by VBAT.

Without external VBACKUP (VBACKUP input connected to VBAT)

- if VBAT > 2.2V, internal RTC is supplied by VBAT.
- if VBAT < 2.2V, internal RTC is not supplied.

7. ENVIRONMENTAL SPECIFICATION

7.1 OPERATING CONDITIONS

Parameter	Min	Max
Ambient temperature	-10°C	+55°C
Supply voltage VBAT	+3.45V	+5V

7.2 CLIMATIC CONDITIONS

Parameter	Min	Max
Ambient temperature Normal range	-10°C	+55°C
Ambient temperature Extended range	-20°C	+70°C
Storage temperature	-40°C	+85°C
Long damp heat Operating conditions	Tested at +60°C, 95% RH during 504 hours	
Short damp heat Storage and transportation conditions	Tested at +40°C, 95% RH during 96 hours	

8. MECHANICAL SPECIFICATION WITH CONNECTOR

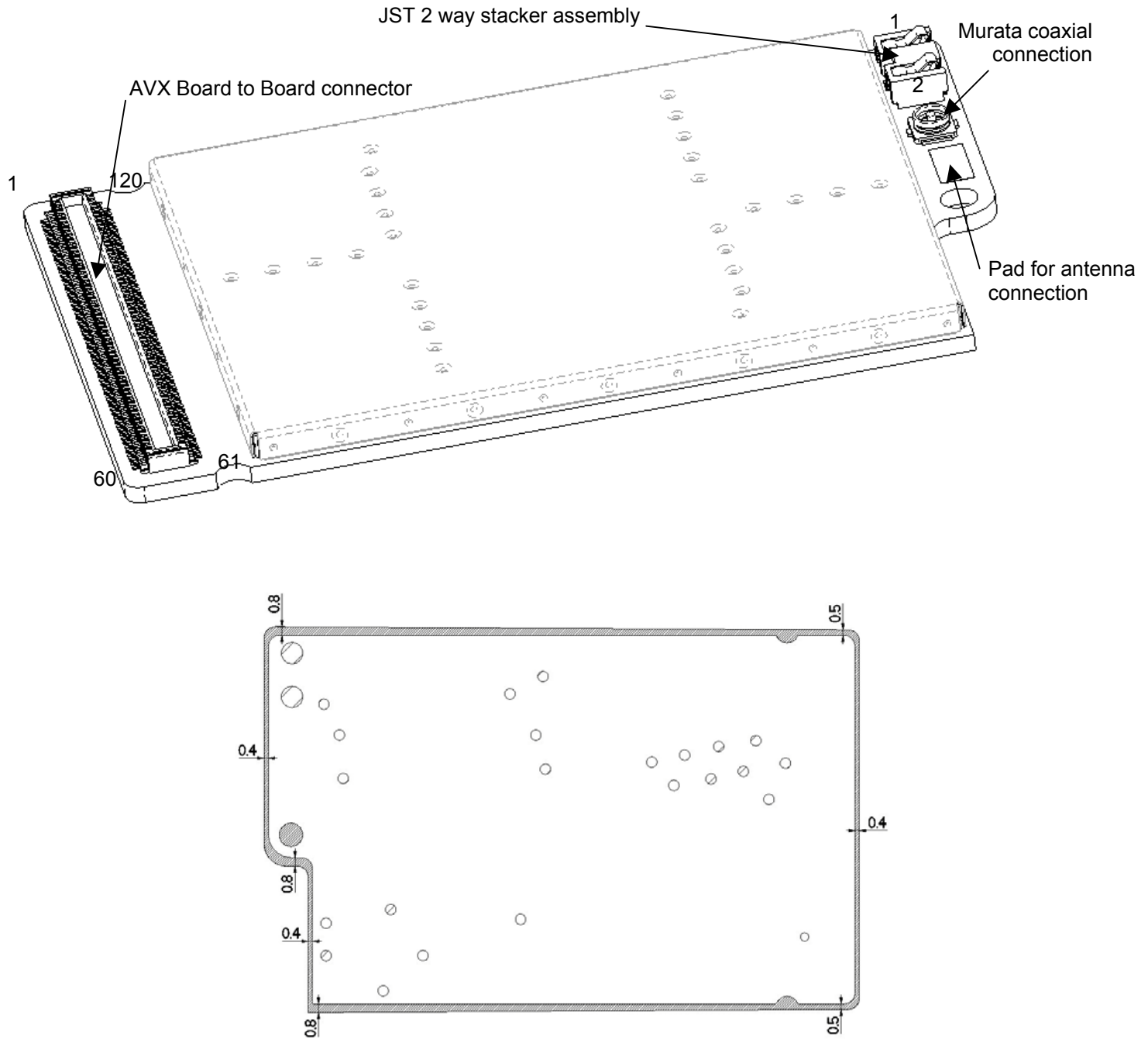


Figure 17
MO130

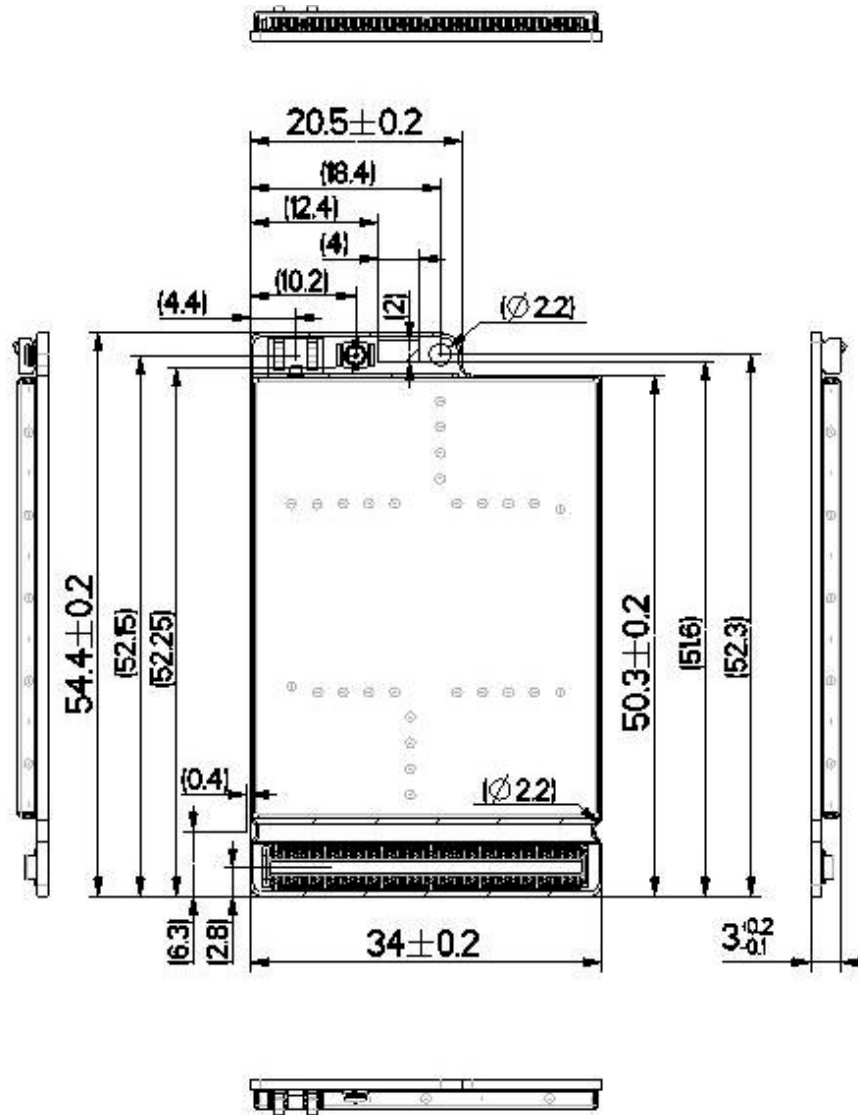


Figure 18
MO130 dimensions

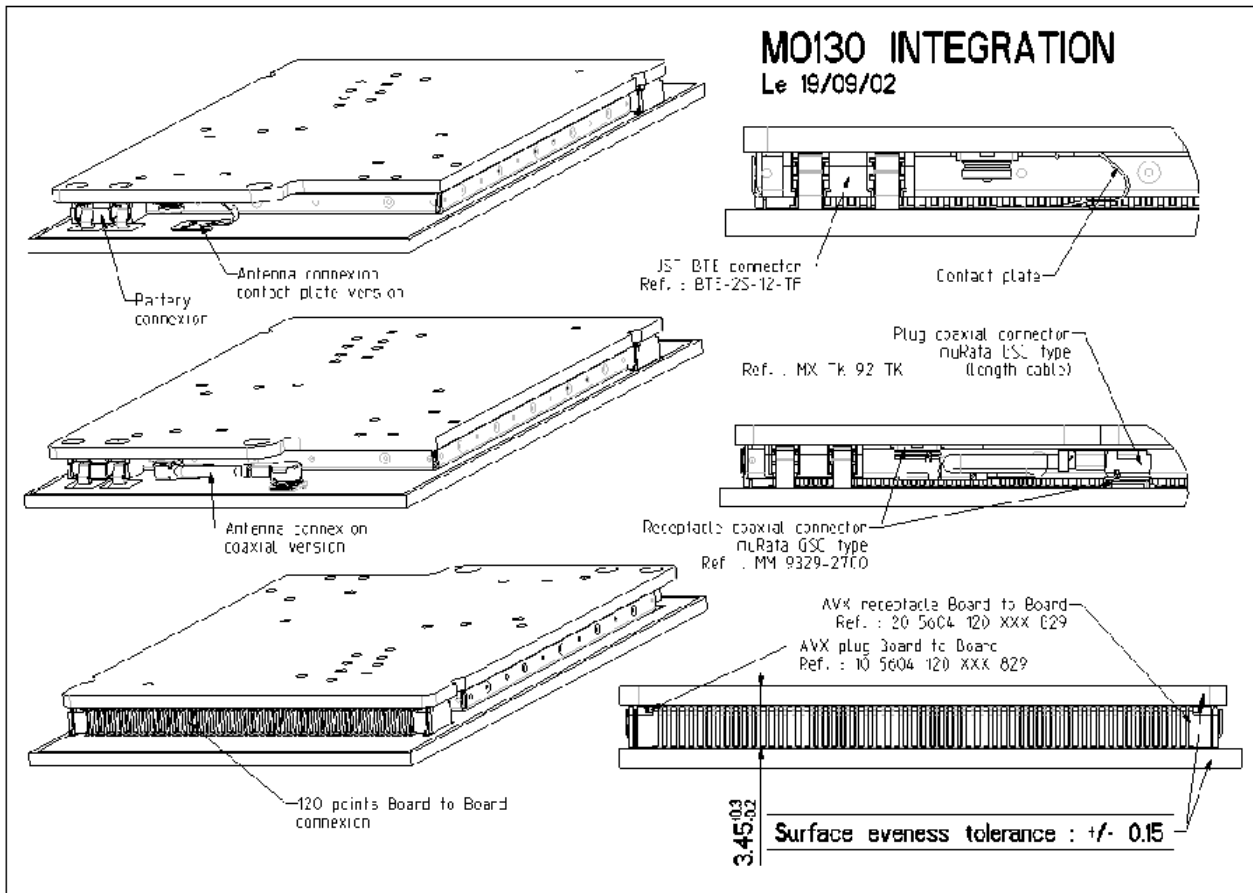
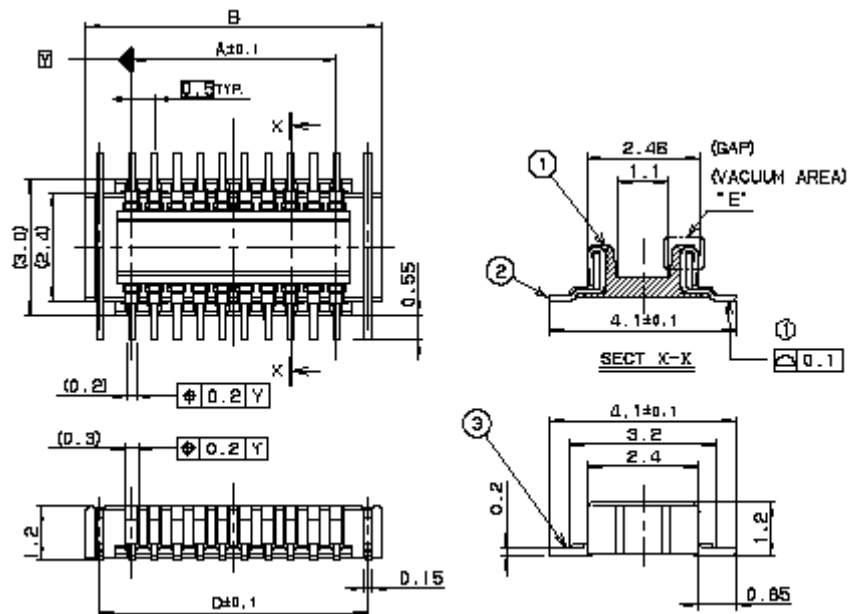


Figure 19
MO130 connection to a mother board

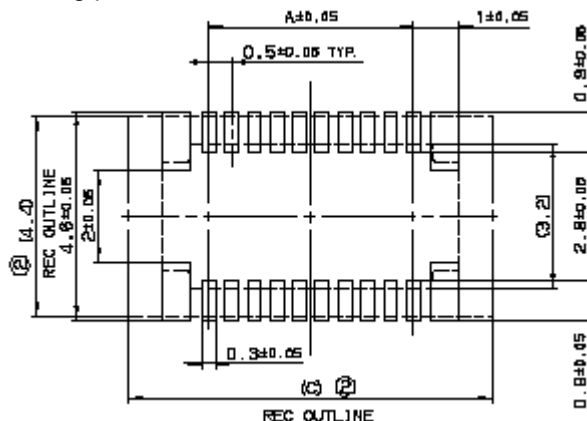
9. INTEGRATION

9.1 120 PINS CONNECTOR

9.1.1 MO130 connector



Recommended PC Board Mounting pattern:



Dimensions and references:

Pin Number	Reference
120	AVX 10 5604 120 212 829

[illegible]

ANNEXE 1 : Reference sensitivity level

The min reference guaranteed sensitivity is:

The sensitivity level is defined as the input level for which class II bits RBER/FER don't exceed 2.4%

This minimum sensitivity shall be :

GSM 900 MS: -105 dBm max

DCS 1800 MS: -105 dBm max

Notes :

This min sensitivity value is guaranteed at 25°C and under static conditions.

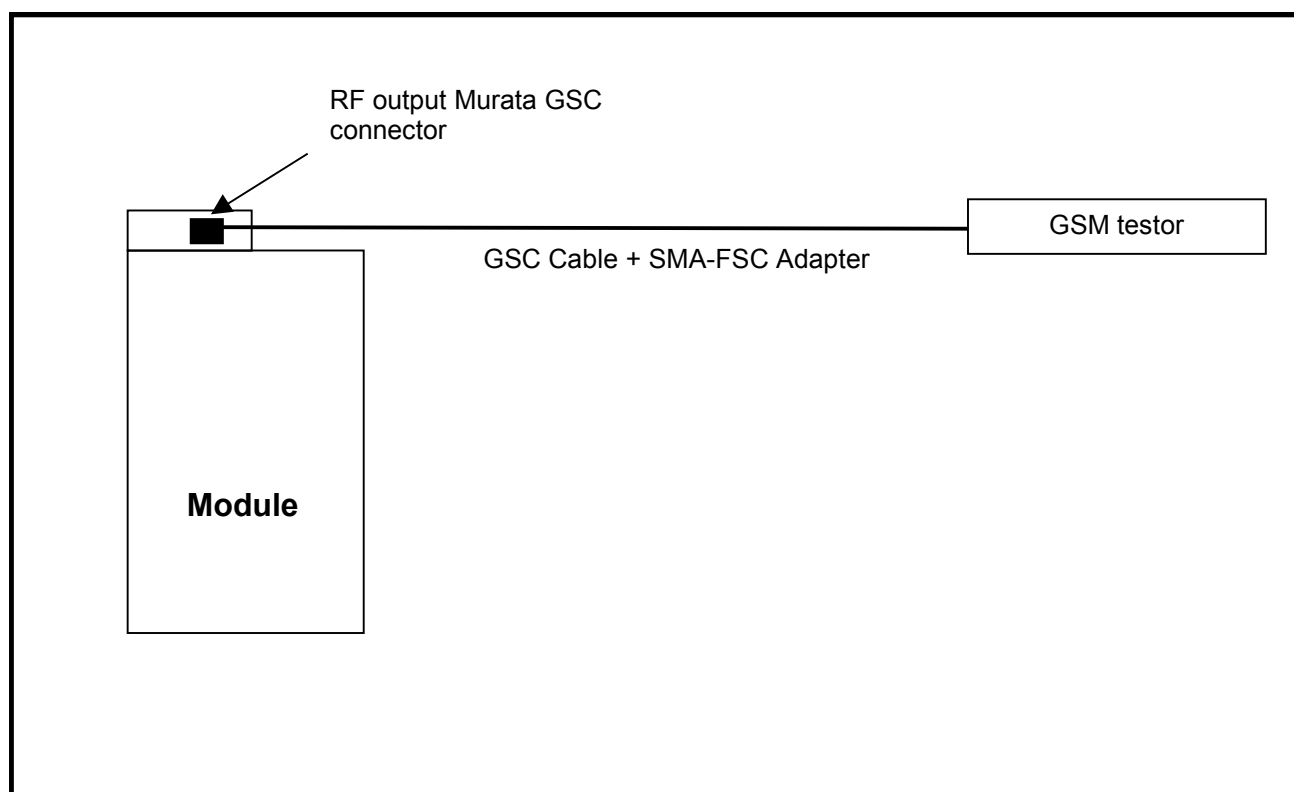
Test Conditions :

Measurement is performed with :

A flexible coaxial cable equipped with a GSC connector.

A SMA-FSC adapter

A GSM tester



Faraday Chamber

Notes: Insertion loss of the cable is removed.

ANNEXE 2 : IO description

IO name	Type
DAIRST	Digital bi directional buffer (IDI041/OUK431)
DAIOUT	Digital bi directional buffer (IDI041/OUK431)
DAIIN	Digital bi directional buffer (IDI041/OUK431). Pull-down
DAICLK	Digital bi directional buffer (IDI041/OUI431). Pull-down
SWANTANT	Digital output buffer (OUO231)
CMDSW1	Digital bi directional buffer (IDI041/OUO431)
CMDSW2	Digital bi directional buffer (IDI041/OUO431)
ITFLAP	Digital bi directional IO with interrupt capability. Pull up
ITDATA	Digital bi-directional IO with interrupt capability. Pull up
CINT	Pull down
BACKKEY	Power open drain
BACKLCD	Power open drain or Digital bi directional IO
LEDR_BUZ	Digital output buffer (OUK831)
LEDG	Digital output buffer (OUK431)
RSLCD	Digital bi directional buffer (IDI041/OUO431)
RESETLCD*	Digital bi directional buffer (IDI041/OUO431). Pull-down
ALIMLCD	Power supply output
DIMIW	Digital bi directional buffer (IDI041/OUO431)
DOMIW	Digital output buffer (OUK431)
CKMIW	Digital output buffer (OUI431)
R1	Digital bi directional buffer (IDI041/OUO231)
R2	Digital bi directional buffer (IDI041/OUO231)
R3	Digital bi directional buffer (IDI041/OUO231)
R4	Digital bi directional buffer (IDI041/OUO231)
R5	Digital bi directional buffer (IDI041/OUO231)
C1	Digital bi directional buffer (IDI041/OUO431)
C2	Digital bi directional buffer (IDI041/OUO431)
C3	Digital bi directional buffer (IDI041/OUO431)
C4	Digital bi directional buffer (IDI041/OUO431)
C5	Digital bi directional buffer (IDI041/OUO431)
SIMVCC	Power supply output
SIMRST	Digital output
SIMCLK	Digital output
SIMIO	Digital bi directional buffer
SIMCD	Digital bi directional buffer (IDI091/OUO431). Pull-down
BFTXP	Analog audio input
BFTXN	Analog audio input
BFRXP	power audio output
BFRXN	power audio output
HPP	High/Mean power audio output
HPN	High power audio output
LPHP	Mean power audio output
HPIN	Analog audio input
MICP	Analog audio input
MICN	Analog audio input

CMDVIB	Power open drain
DISPI	Digital input buffer (IDI041). Pull-down.
DOSPI	Digital output buffer (OUK431)
ENSPI1	Digital bi directional buffer (IDI041/OUK431)
CLKSPI	Digital output buffer (OUO231)
DCD	Digital bi directional buffer (IDI041/OUK431). Pull-up
DTR	Digital bi directional buffer (IDI091/OUK831). Pull-up
RI	Open drain. Pull up
DSR	Digital bi directional buffer (IDI041/OUK431)
RTS	Digital bi directional buffer (IDI091/OUO231). Pull-up
CTS	Digital output buffer (OUK831)
TXD2	Digital bi directional buffer (IDI041/OUK831)
RXD2	Digital input buffer (IDI091). Pull-up
TXD1	Digital output buffer (OUK831)
RXD1	Digital bi directional buffer (IDI091/OUO231). Pull-up
TXIR	Digital bi directional buffer (IDI041/OUK831)
RXIR	Digital bi directional buffer (IDI091/OUK431). Pull-up
CMDIRDA	Digital output buffer (OUK431)
CHARGEUR	Analog input
ON*	Analog open drain
TESTRESETZ	Digital input. Pull-up
CLK13M	Digital output
CLK32K	Digital output buffer (OUK431)
ADC1	
DAC	Analog output
D<0..15>	Digital bi directional buffer (IDI041/OUI831)
A<0..6>	Digital output buffer (OUI831)
CS2*	Digital output buffer (OUI831)
CS3*	Digital bi directional buffer (IDI041/OUI831)
RW*	Digital bi directional buffer (IDI041/OUI831)
OE*	Digital output buffer (OUI831)
VBACKUP	Power supply input
VRIO	Power supply output
VRDBB	Power supply output
VRDBBDC	Power supply input
V56	Power supply output

NB:

OUO231 -> Level shifter type 1 (Iol = 1mA max)

OUI431, OUK431, OUO431 -> Level shifter type 2 (Iol = 2mA max)

OUI831, OUK831 -> Level shifter type 3 (Iol = 4mA max)

END OF DOCUMENT