M22

GSM / GPRS Wireless Module

Design Guide
Rev. 0.1
December. 2003

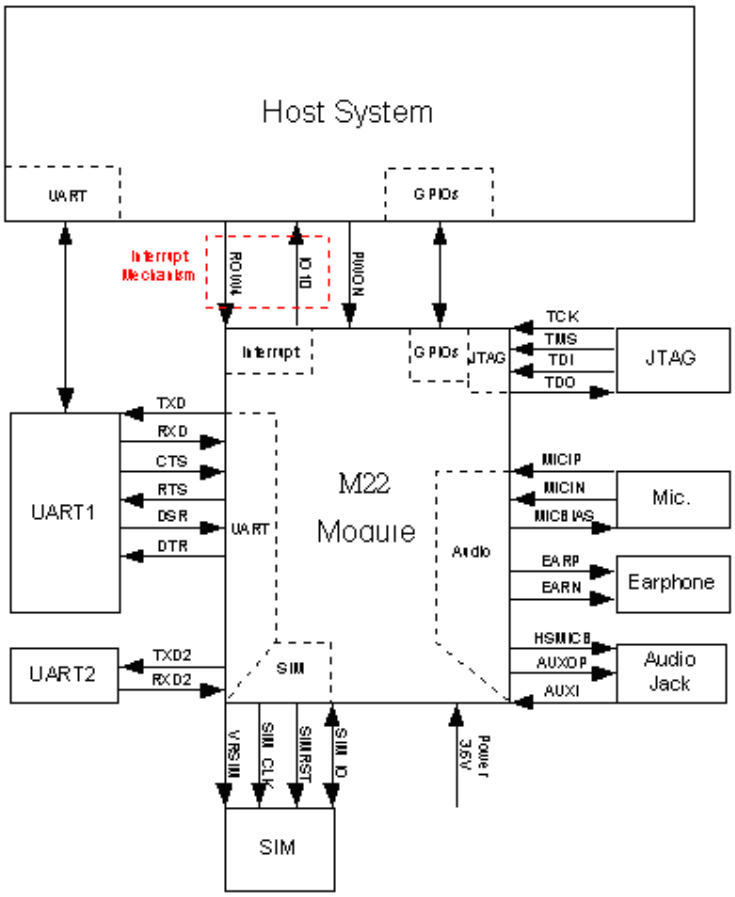
BenQ Corporation

Networking & Communications BG

18 JiHu Road, Nei-Hu, Taipei 114, Taiwan, R.O.C.
Tel: +886-2-2799-8800
Fax: +886-2-2656-6399
http://www.benq.com

1. Overview

This design guide is based mainly on the M22 evaluation board (EVB). The M22 EVB enables you to evaluate the M22 module and peripheral design. In addition, it provides sampling firmware that you can use as a starting point to develop code. To give the user a system concept of the interconnections between the host and M22 module, we first give a block diagram as



The reference schematics for M22 peripherals will be given in details in this design guide. Since the interconnections between the host and M22 vary by application, we tend to give only reference designs of general functions, such as, interrupts,

re-download mechanisms, flow control of RS232, etc.

2. Design Guide Organization

The rest of the manual is organized as follows:

Section 3 Pin out definition of M22 module is given along with the RF antenna placement and trace guidelines. In addition, the recommended power on; and handshaking sequences are shown.

Section 4 Suggested peripheral schematics, i.e., SIM, audio, and paging indicator is given.

Section 5 The IO mapping of the M22 module is explained in details.

Section 6 The UART interface pin description is given.

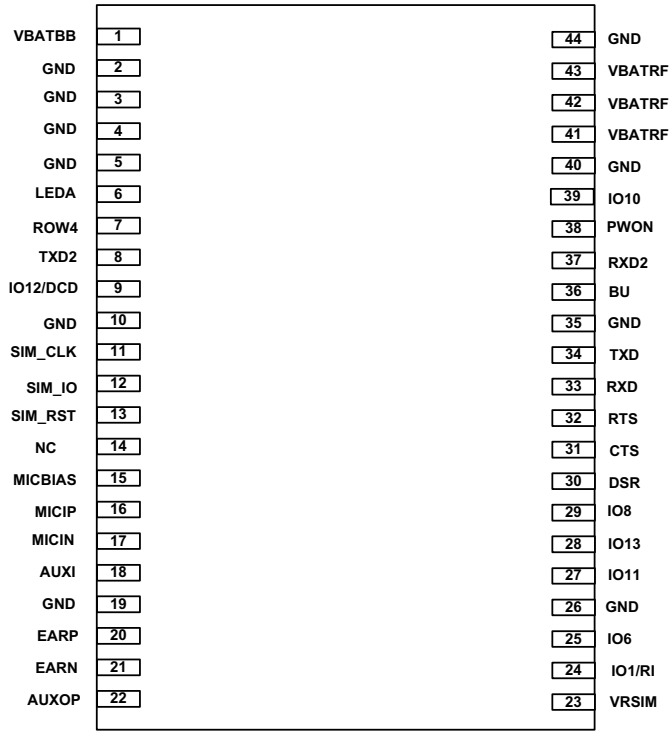
Section 7 The re-download procedure is shown.

Section 8 Hardware flow control of the RS232 is illustrated in details.

Section 9 Some related power on/off concerns are given.

3. Pin Assignment of M22 module

The following is the pin out definition of the M22 module



3.1. M22 Module Placement

In our module, we have one 50ohm antenna port (interfaced by MMCX female connector) for signal transfer, and the Antenna port can be directly connected to antenna though RF coaxial cable. In addition, the RF signal will be impacted by high data rate. We strongly suggest the audio trace and SIM signal trace to be short as possible and as far away as possible from the RF trace and power line to prevent cross coupling.

3.2. Ground Pin

There are 10 ground pins in M22 module, they should be connected together and routed to the common connection of the PCB ground plane (The ground plane in PCB should be as large as possible).

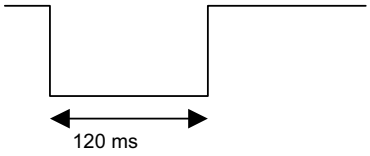
3.3. VBATRF Pin (Pin 41~43) / VBATBB Pin (Pin 1)

The “Power amplifier” is supplied by the VBATRF pins. During transmitting mode, high output power will draw a large amount of current. The width of this power trace that is connected to the VBATRF pins could not be less than **80**mils. In addition, it is better to shunt a **100**uF (low ESR) bypass capacitor on VBATRF pins to prevent voltage drop and to reduce ripple. Furthermore, another chips in

the module are supplied by the VBATBB pin. The width of this trace that connected to this pin should also be wider.

3.4. Power on sequence

The pin POWON is dedicated to powering on the M22 module. The pin is initially HIGH when power is applied to the M22 module. Once the pin is pulled low for more than **120 ms**, M22 will power on.



3.5. Interrupt

There are two pins dedicated to work as an acknowledge function between the system (Host) and module (Client):

The pin IO10 is used for the M22 module (Client) to interrupt the system (Host), whereas the pin Row4 is used for the system (Host) to interrupt the M22 module (Client).

Pin	Name	Function
39	IO10 (active high)	Module (Client) informs system (Host)
7	Row 4 (active low)	System (Host) informs module (Client)

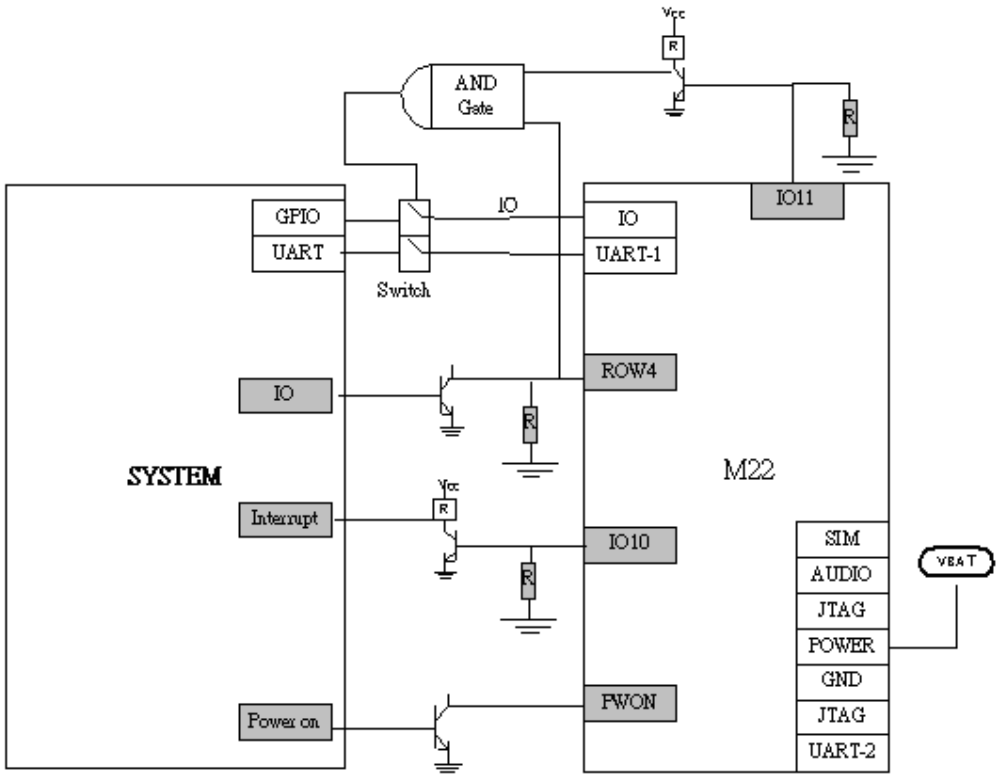
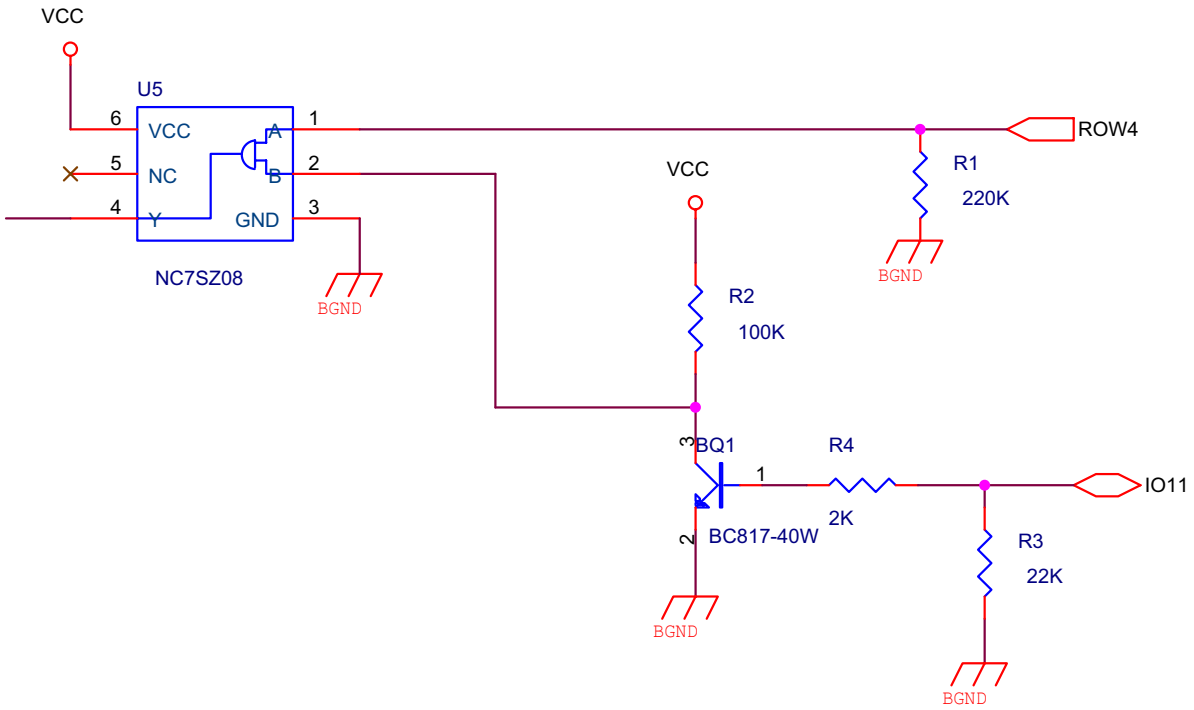


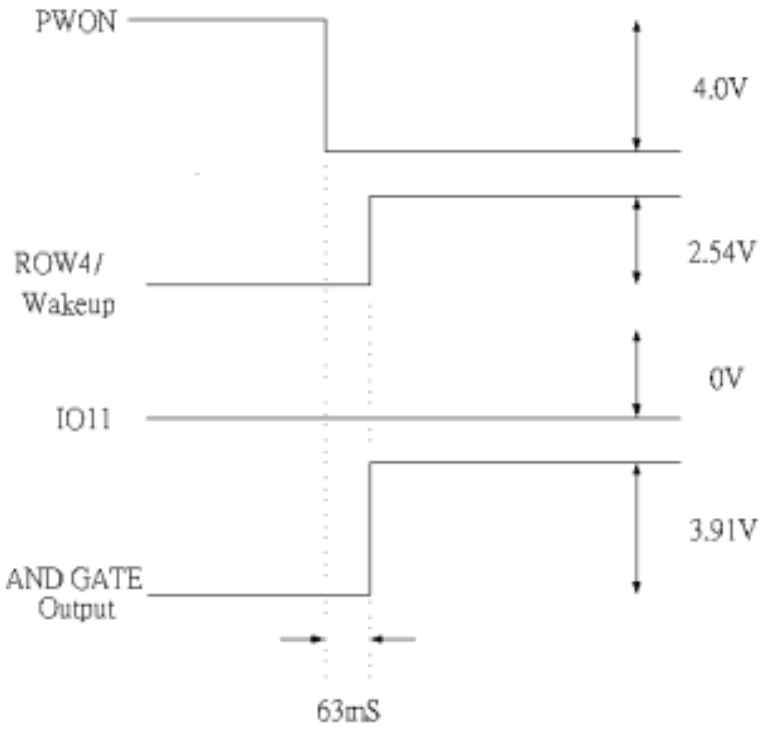
Figure 1 Application Connection Diagram

Note: Vcc comes from system.

Note: The scenario in Figure 1 is to be used when the Module is required to control the switches connecting the UARTs and GPIOs of the host and module. This is done when the module power off. The *AND* gate in the above diagram can be implemented by the following schematics.

AND GATE OUTPUT, PWON, ROW4, IO11 Sequence





VCC=4V; M22 VBAT=4V

IO11： reset status is input

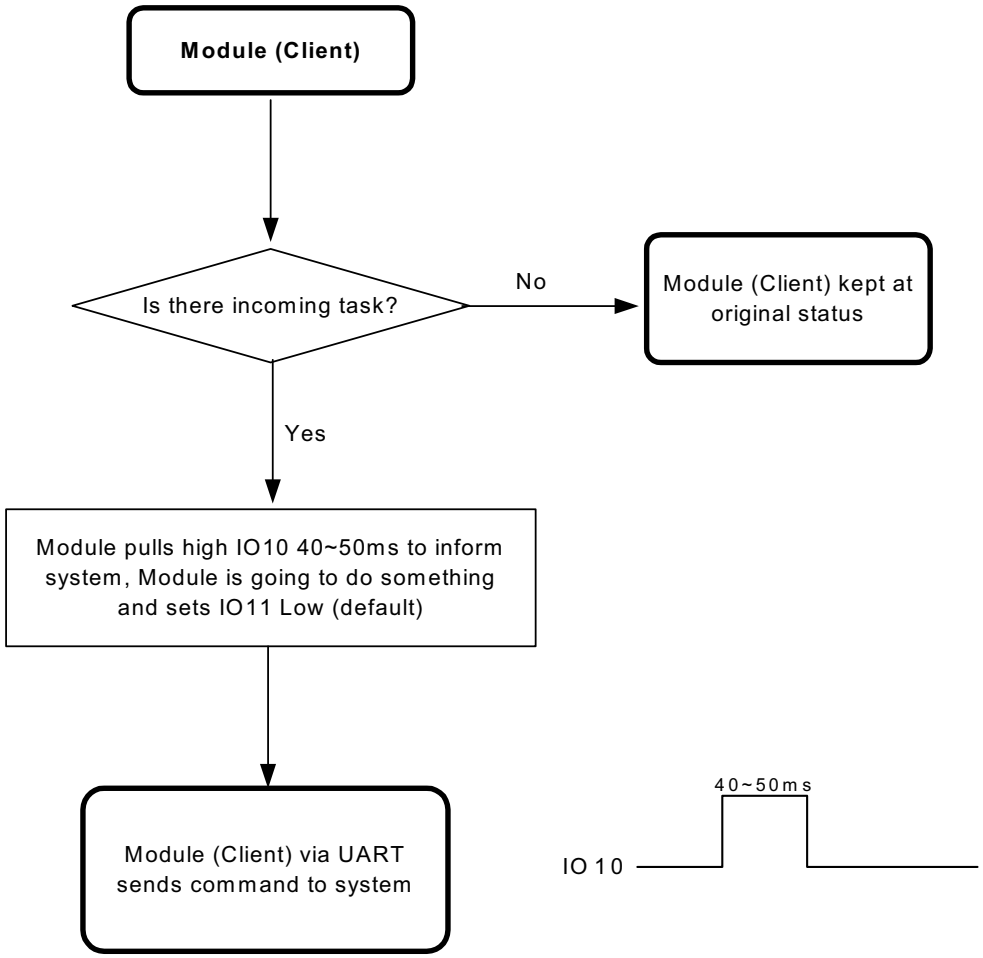
ROW4/wakeup：input pin pull high after trigger

Note: The mechanism shows that after the PWON pin is pulled low, ROW4 becomes HIGH after 63ms. At the same time interval IO11 remains input status, since the resistor R3 pulls IO11 to low within the reset period, therefore BQ1 is kept open and pin 3 of BQ1 is kept high. Meanwhile Row4 is high, so the output of the AND gate (U5) is high and the switch is closed. If the switch needs to be opened, the IO11 can be controlled to be high and BQ1 will close. This in turn will make pin 2 of U5 Low. The output of the AND gate will therefore be low and the switch will be opened. During power off of the module, the pull Low resistor R1 will keep the pin 1 of U5 to low and therefore the output of the AND gate will be Low also. Thus opening the switch in Figure 1.

3.7 The handshaking mechanism between System (Host) and Module (Client)

Note: The UART function of the handshaking mechanism is defined to be hardware flow control type.

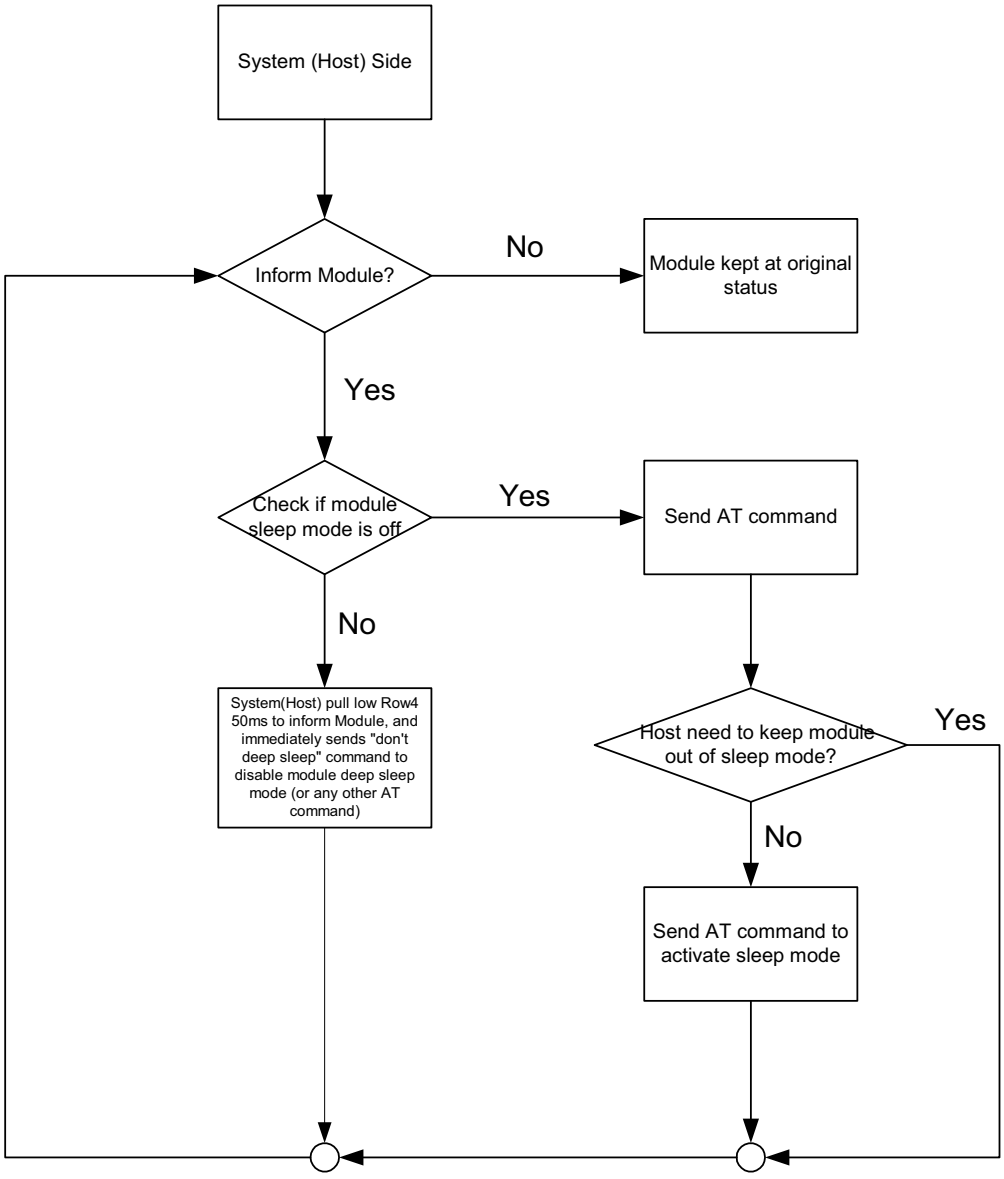
- **Module (Client) needs to inform system (Host) of tasks**



The above block diagram shows how the module informs the host system that a task requiring interaction will be carried out. When the tasking is coming, the module pulls HIGH IO10 for at least 40~50 ms to inform host that a task will be carried out.

Note: Based on Figure 1, assume the interrupt pin in system (Host) is low active, therefore if module needs to inform system via IO10, the module have to pull high IO10 a time interval to achieve this requirement,

- **System (Host) informs Module (Client) of tasks**

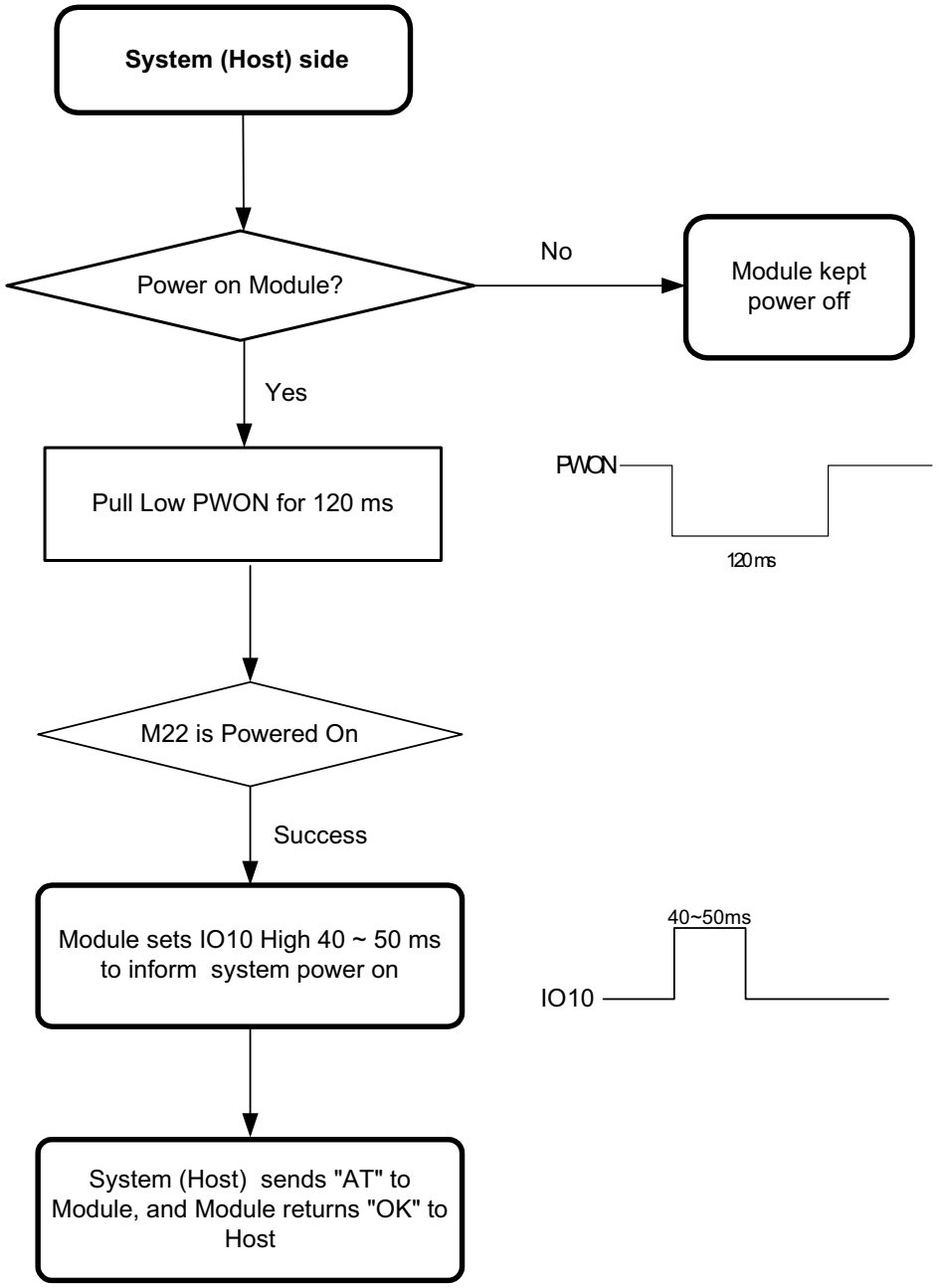


The above block diagram shows how the host system informs the module that a task requiring interaction will be carried out.

Note: The above procedure is exclusively used in hardware flow control configuration.

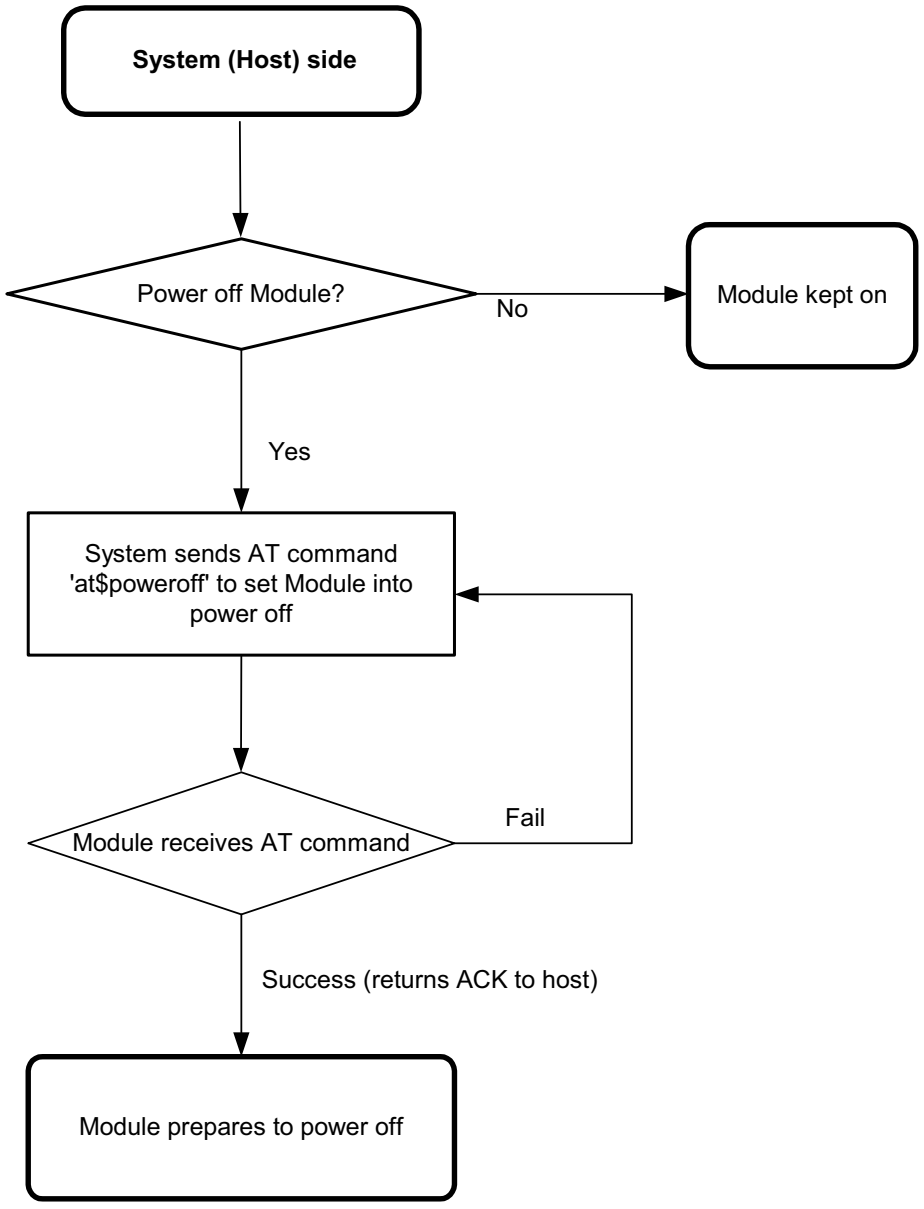
3.8 Power on/off sequence between System (Host) and Module (Client)

■ **Power on sequence**



The above block diagram shows the power on sequence. First the host powers on and pulls Low PWON of the module for at least 120 ms. When the module is powered on, it sets IO10 will High 40 ~ 50 ms .

■ **Power off sequence**



The above block diagram shows the power off sequence. The host sends an AT command 'at$poweroff' to set module into power off. Module powers off once AT command is received. Please note that if the host system is left powered on, switches are suggested to protect from current leakage.

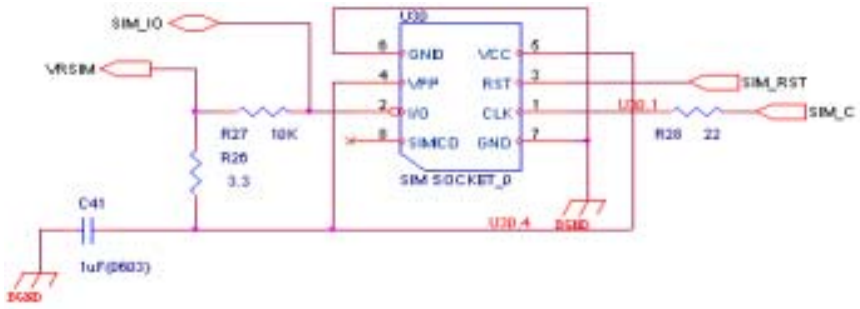
Note : User can not try to power on module within 2000 ms after sending at$poweroff command to module

4 Peripherals

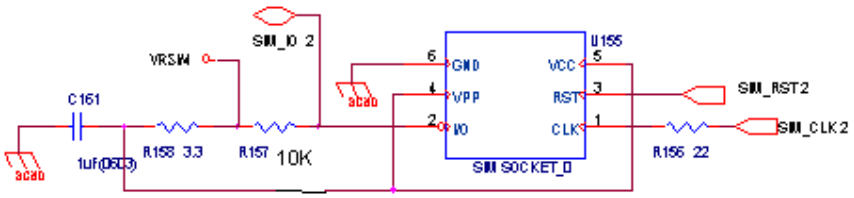
4.1 SIM

The SIM Card digital interface in the M22 ensures the translation of logic levels between M22 and the SIM Card, for the transmission of 3 different signals: SIM_CLK; a reset signal from M22 to the SIM Card (SIM_RST); and serial data from M22 to the SIM Card (SIM_IO). The SIM card interface can be programmed to drive a 3V SIM Card.

(1) Type I (8 Pin SIM Socket)



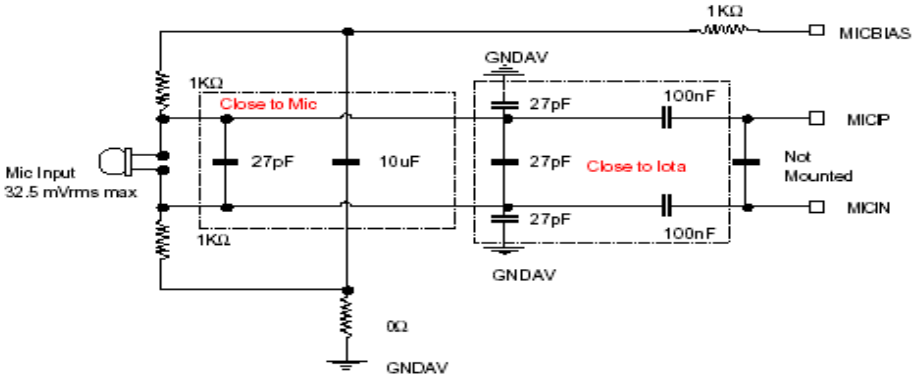
(2) Type II (6 Pin SIM Socket)



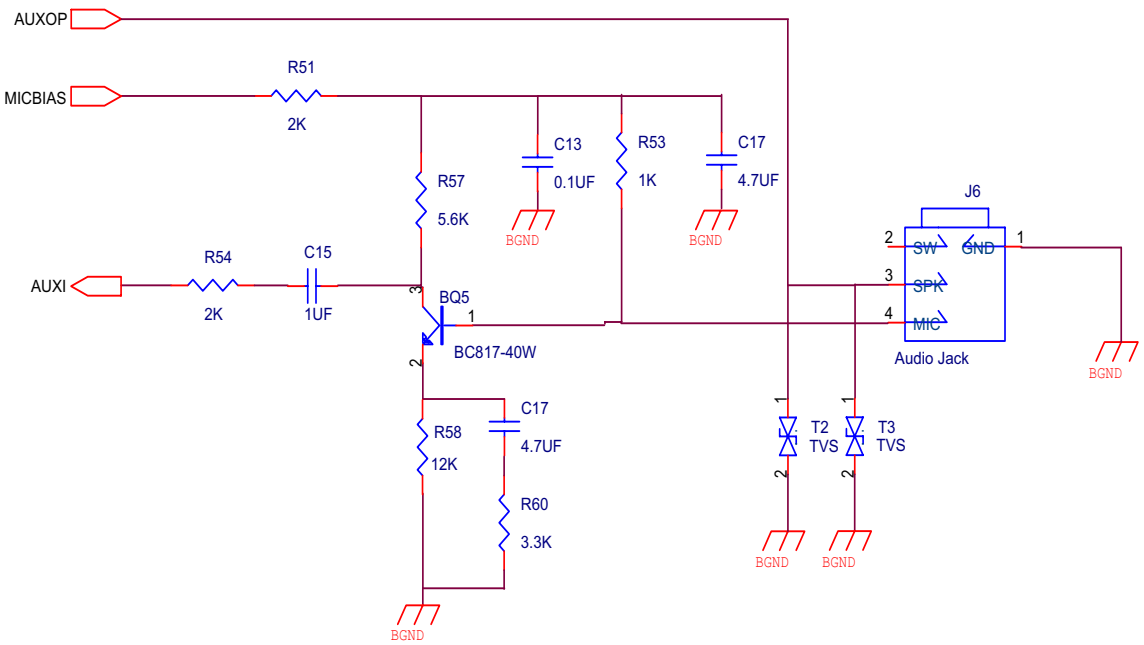
4.2 Audio

There are 2 embedded audio drivers built in the BenQ M22 module. The 2 drivers can drive different kinds of audio load (such as receiver, microphone, or hands free).

➢ ***Microphone***

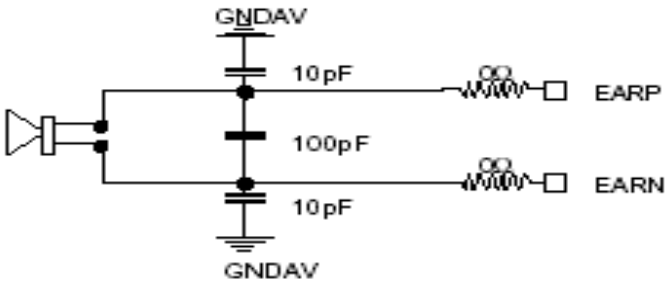


➢ ***Auxiliary Input/output***



Voltage Gain = 2 with R60=3.3K

➢ ***Ear output***



Audio Path Selection AT Commands

The M22 module provides the switching of audio paths using AT commands (In connection status):

Default value: case (2)

(1) at$aupath=3,0 (EARN, EARP, MICIN, MICIP, MICBIAS path OFF)

(2) at$aupath=3,1 (EARN, EARP, MICIN, MICIP, MICBIAS path ON)

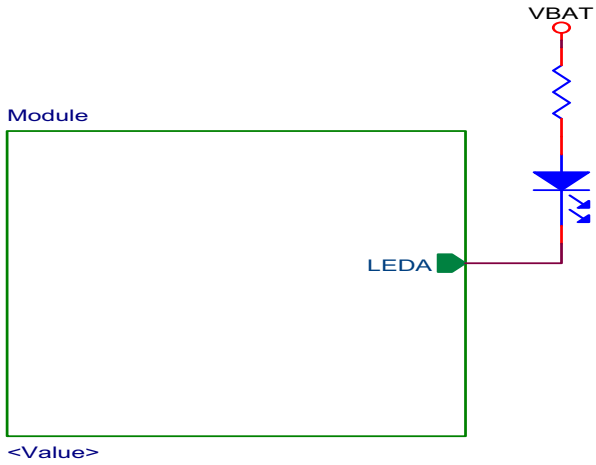
(3) at$aupath=2,0 (AUXI,AUXOP,MICBIAS path OFF)

(4) at$aupath=2,1 (AUXI,AUXOP,MICBIAS path ON)

4.3 Paging Indicator

LEDA is dedicated for paging indication. The application circuit is shows as below. The diagram below illustrates the application schematic for LED driver inputs LEDA. In each case the current limiter resistor R has to be selected in order to be compliant with maximum current drive capability of each input.

Pin	Name	Max drive current	High level voltage	Low level voltage	supply	Function
6	LEDA	10mA	VBATBB	0.4	VBATBB	paging indicator



LEDA is controlled through software program using a dedicated bit, which is built in the M22 module already.

The LEDA pin status :

a. When there is no voltage input, the LEDA is in high status. It means that the LED won't be illuminated.

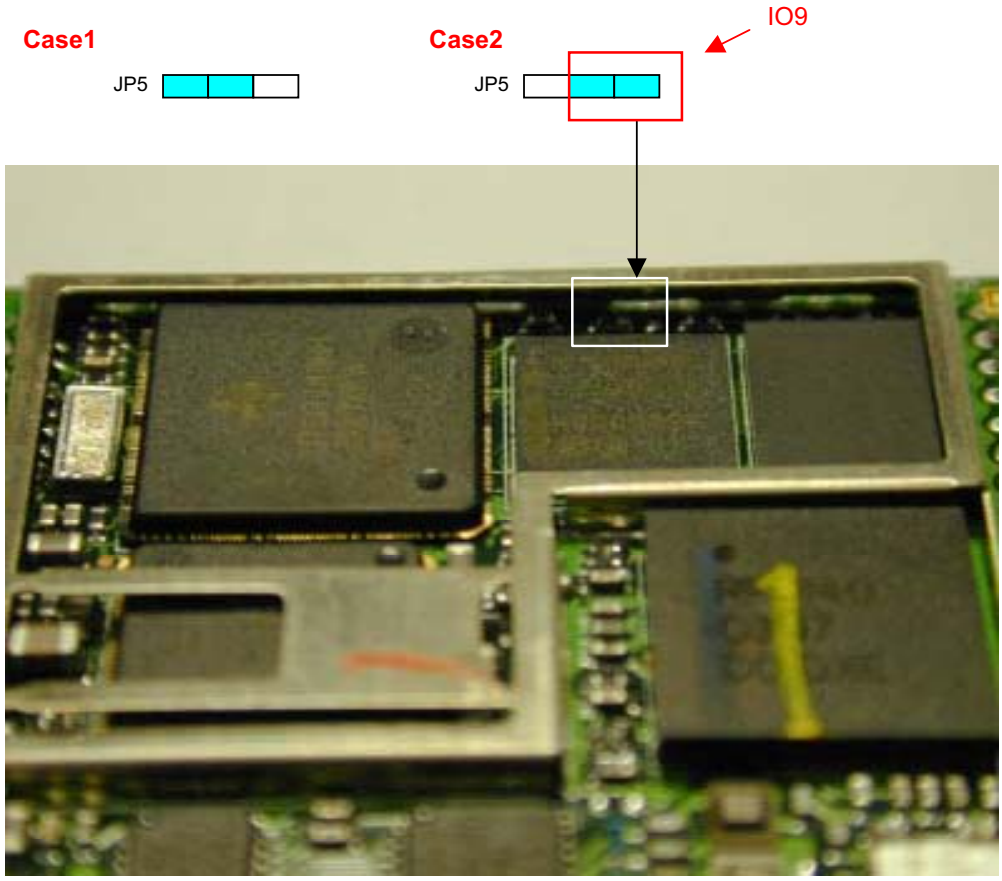
b. When the module is powered on and not making phone calls, LEDA will pull low **500 ms** and pull high **500 ms**, alternately.

c. When incoming phone call, the LEDA will pull low **125 ms** and return to high status **125ms** after hanging up the phone

4.4 Acoustic test (DAI interface)

Pin Name	Pin Out	Pull	Reset	Config	Description
MCSI_TXD/IO 9	28*		0	0	Transmit serial data
MCSI_RXD/IO10	4		Input	Input	Receive serial data
MCSI_CLK/IO 11	30		Input	Input	Bit synchronization clock
MCSI_FSYNCH/IO 12	10		Input	Input	Frame synchronization clock or SS reset

*Pin 28 is multipurpose function pin (switch by config JP5). In normal operation mode, it pin is function as GPIO1 (JP5 is setting as Case 1). In acoustic test mode, it pin is function as DAI interface (JP5 should be setting as Case 2)



5 IO mapping

There have 6 IO pins available for M22 module. The function for these IO pins is List below.

No.	Pin	Description	I/O	PU	Reset	Config
39	IO 10	M22 (Client) wake up System (Host)	O		Input	Output / 0
28	IO 13	GPIO13	I		Output/1	Input
25	IO 6	Re-download Data path and audio path switch	O		Input	Output/1
27	IO 11	Power off mode switch control signal to open or link the connection between system (Host) and module (client). *Low :; Connect* *High: Disconnect* *Default = Connect* (Low)	O		Input	Output / 0
9	IO 12/DCD	IO12/Data Carrier Detect	O		Input	Output / 0
24	IO 1/RI	IO1/Ring Indicator	O		Input	Output / 0

6 UART Interface

■ UART/RS232

The UART includes the following additional features

- Hardware flow control (DSR, RTS/CTS)
- Auto-bauding rate with the possibility of baud-rates ranging from 1200 to 115.2K bits.

Pin Name	Pin Out	Pull	Reset	Config	Description
TXD	34		1	Output/1	Transmit Data
RXD	33	PU	Input	Input	Receive Data
RTS	32		1	Output/1	Request to Send
CTS	31	PD	Input	Input	Clear to Send
DSR	30		Input	Input	Data Set Ready
IO 8/DTR	29		1	Output/0	Data Terminal Ready

Note: The difference between Reset and Config in the pin definition table

■ UART 2

Used for software debug.

Pin Name	Pin Out	Pull	Reset	Config	Description
TXD2	8		1	Output/1	Transmit Data
RXD2	37	PU	Input	Input	Receive Data

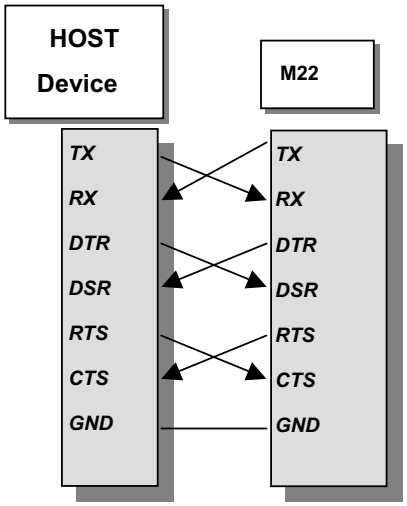
7 RS232 (HW flow control)

There are two types of UART connection able to implement the communication between the system (Host side) and module (Client side).

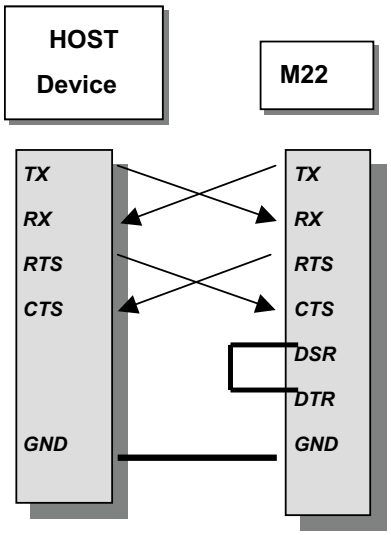
- **HW flow control**

When the hardware flow control type is recommended for communication between the Host and client, IO13 of the module must be pulled high to 3V to setup module into this condition. Regarding the hardware flow control mechanism between the system (host side) and module (client side), there are two connections possible and are illustrated as follows:

Option 1:



Option :2



Note: Since the DSR in M22 is PU 10K.

Autobaud Rate Mechanism

The M22 module UART is set at autobaud rate. This means when the M22 is powered on, it automatically detects the baud rate after the first AT command sent by the host. The baud rate is locked at the initially detected rate unless the following conditions:

For Option 1 autobaud rate detect process is reinitialized:

a) If the module is powered off then powered on;

Or

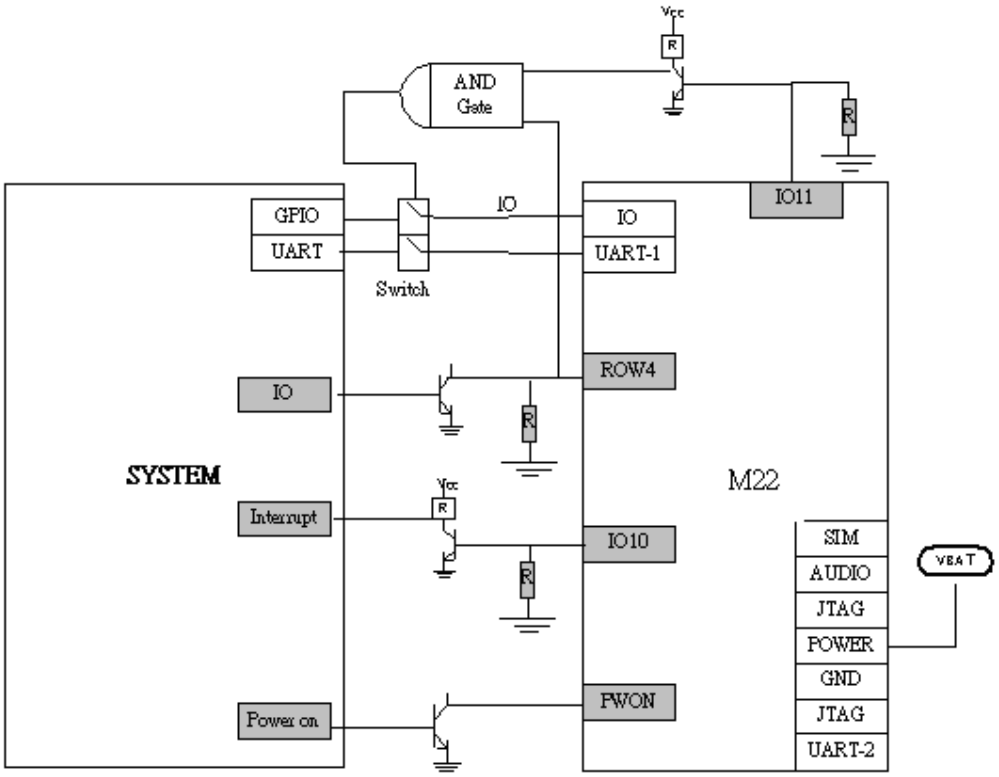
b) If the DSR pin of the UART is disabled and then enabled

For Option 2 autobaud rate detect process is reinitialized:

If the module is powered off then powered on.

8 Power On/Off Concerns

The designer should be careful when there are different status between System (Host) and M22 module. In other words, if the System (Host) is powered on and the M22 module is powered off or vice versa, problems of current leakage will arise. Therefore, we make the following recommendation to avoid the problem owing to the different status described as the following conditions between system (Host) and module (client).



Application Connection Diagram

M22 Power on condition

Condition 1: System (Host) is powered on but M22 do not need to be powered on

Since we don't need to power on the module, it is better to open the UART and IO connection between the system (Host) and module (Client). A buffer should be added to the PWON , ROW4 and IO10 pins.

M22 Power off condition

Condition 1: System (Host) is active and M22 needs to be turned off:

Switches should be added to the GPIOs which connects the System (Host) and M22 module. A buffer should be added to the PWON , ROW4 and IO10 pins.

The System (Host) should give an AT command to the M22 module and when M22 receives power off command, M22 return ACK via UART to inform system (Host) that M22 is going to enter power-off status. When M22 is powered off , the switch between the System (Host) and M22 will be open to avoid the current leakage to be happened.

Condition 2: System (Host) needs to be turned off:

The M22 module should be turned off with the System (Host) and follow Conditions 1.