ROK 101 007/1
Bluetooth Module

Description

ROK 101 007/1 is a short-range module for implementing Bluetooth functionality into various electronic devices. The module consists of three major parts that are mounted on a PCB; a baseband controller, a flash memory, and a radio that operates in the globally available 2.4–2.5 GHz ISM free band.

Both data and voice transmission is supported by the module. Communication between the module and the host controller is carried out using a high-speed USB interface compliant with USB Specifications 1.1 or an UART/PCM interface. When using the USB interface, the module appears as a USB slave device and therefore requires no PC resources.

Only one additional component is required and that is an antenna, which should be connected through a 50Ω interface.

Key Features

- 0dBm Output Power
- Built-in shielding
- Separate supply rail for the I/O ports
- Internal crystal oscillator
- No need for a modulator input since the baseband signal is generated internally
- Supplementary USB signals for wake-up and detach control
- Multiple interface for different applications
  - -USB for voice and data
  - -UART for data
  - -PCM for voice
- Firmware supported
- Approved for global use (FCC,ETSI)
- Pre-certified Bluetooth 1.0 Module

Suggested Applications

- Portable computers
- Handheld devices
- Cameras
- Computer peripherals
- Mobile phone accessories
- Interface to the fixed line access network

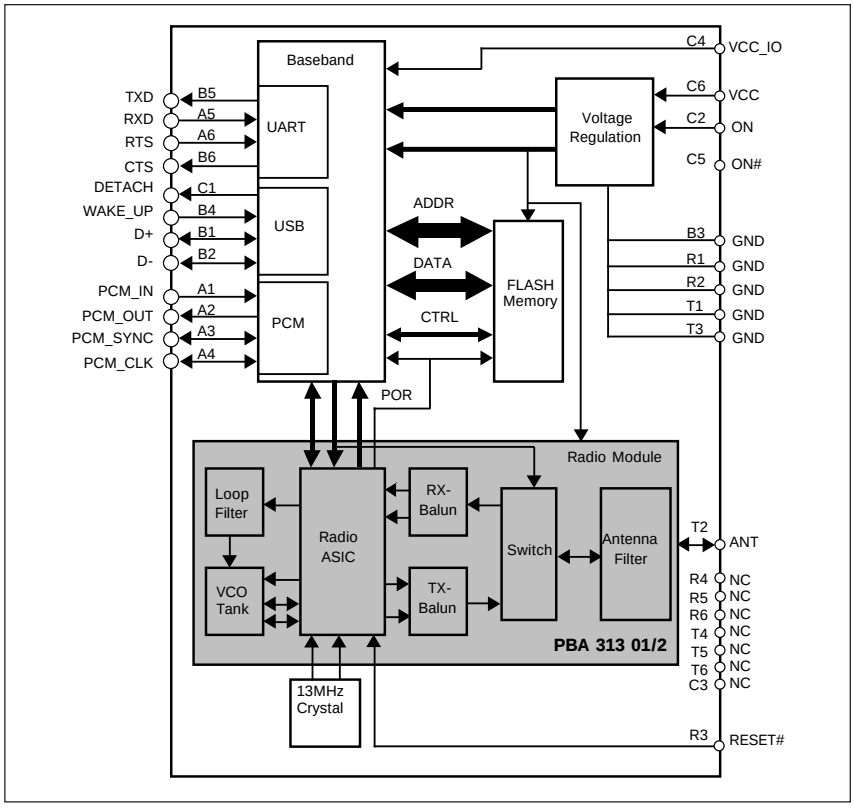
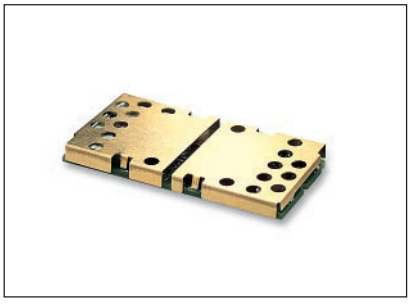


Figure 1. Block Diagram



Actual size of the Ericsson Bluetooth Module.

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit
Temperature					
Storage temperature	T_{Stg}	-30		+85	°C
Operating temperature	T_{Amb}	0		+75	°C
Module Case temperature	T_{Module}	0		+75	°C
Power Supply					
V_{CC} with respect to GND	V_{CC}	-0.3		+5.25	V
V_{CC_IO} with respect to GND	V_{CC_IO}	-0.8		+3.6	V
Input RF Power					
In-band				TBD	dBm
Out of band				TBD	dBm
Digital Inputs					
Input low voltage	V_{IL}	-0.5			V
Input high voltage	V_{IH}			V_{CC_IO} +0.3	V

Recommended Operating Conditions

Temperature				
Module Case temperature	T_{module}		TBD	°C
Ambient temperature, Test	T_{amb}		+23	°C
Power Supply				
Positive Supply Voltage with respect to Ground (GND)	V_{CC}		+3.3	V
I/O Ports Supply Voltage with respect to Ground (GND)	V_{CC_IO}		+3.3	V

Electrical Characteristics

DC Specifications

Unless otherwise noted, the specification applies for T_{Amb} = 0 to +70°C, V_{CC} = 3.3V

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Power Supply						
Supply Voltage		V_{CC}	3.175	3.3	5.25	V
I/O Ports Supply Voltage	See Note 3	V_{CC_IO}	2.7	3.3	3.6	V
Digital Inputs / Outputs						
Logical Input High	See Note 1	V_{IH1}	0.7 x V_{CC_IO}		V_{CC_IO}	V
Logical Input Low	See Note 1	V_{IL2}	0		0.3 x V_{CC_IO}	V
Logical Input High	ON signal only	V_{IH2}	2.0		V_{CC}	V
Logical Input Low	ON signal only	V_{IL2}	0		0.4	V
Logical Output High		V_{OH}	0.9 x V_{CC_IO}		V_{CC_IO}	V
Logical Output Low		V_{OL}	0		0.1 x V_{CC_IO}	V
Current Consumption	I_{CC}					
Average Current	Connect Mode	I_{CCC}		40		mA
Peak Current	Connect Mode	I_{CCC}		60		mA
Average Current	Standby Mode, See Note 2	I_{CCS}		0.55		mA
Peak Current	Standby Mode, See Note 2	I_{CCS}		60		mA
Power Down Current	Module turned off	I_{CCD}		1		mA
V_{CC_IO} Current	$V_{CC\_IO = 2.75V}$	I_{CCD}		2		mA

RF Specifications

Parameter	Condition	Symbol	Min	Typ	Max	Unit
General						
Frequency Range			2.402		2.495	GHz
Antenna load				50		W
Output VSWR				2:1		
Receive Performance	with respect to 0.1% BER					
Dynamic range			-70		-20	dBm
C/I_{AWGN}				21		dB
$C/I_{co\text{-}channel}$				14		dB
C/I_{1MHz}				TBD		dB
C/I_{2MHz}				-40		dB
Blocking, $C/I_{DC\text{-}1.91GHz}$	See Figure 2			TBD		dB
Transmitter Performance						
TX power			-1		+4	dBm
TX carrier drift in 1 slot	See Figure 3				25	kHz
TX carrier drift in 3,5 slots	See Figure 3				40	kHz
SSB Phase noise	Δf=0.5MHz				-89	dBc/Hz
	Δf=2.5MHz				-121	dBc/Hz
Adjacent channel (1 MHz) power					-20	dBm
Spurious free dynamic range					+30	DB
Timing Performance						
Timing Accuracy					20	ppm
Channel switching time	ch2 -> ch95 & ch95 -> ch2			150	170	ms
(carrier frequency within 50kHz)	See Figure 4					

Will be inserted in next revision

Figure 2.

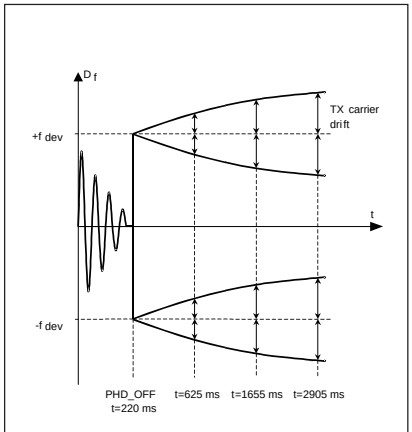


Figure 3. TX Carrier Drift

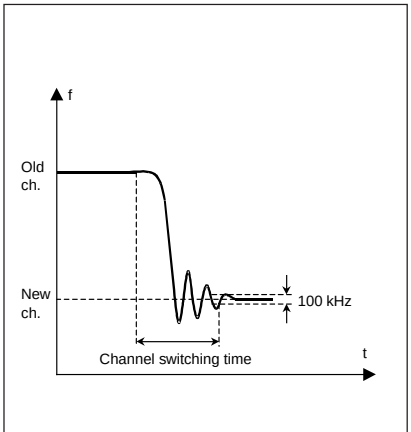


Figure 4. Channel switching time

Pin Description

Pin	Pin Name	Type	Direction	Description
A1	PCM_IN	CMOS	Input	PCM data input, see note 4
A2	PCM_OUT	CMOS	Output	PCM data output, see note 4
A3	PCM_SYNC	CMOS	In/Out	Sets the PCM data sampling rate, see note 4
A4	PCM_CLK	CMOS	In/Out	PCM clock that sets the PCM data rate, see note 4
A5	RXD	CMOS	Input	RX data from the UART, see note 4
A6	RTS	CMOS	Input	Flow control signal, Request To Send data from UART, see note 4
B1	D+	CMOS	In/Out	USB data pin, see note 3
B2	D-	CMOS	In/Out	USB data pin, see note 3
B3	GND	Power	Power	Signal ground
B4	WAKE_UP	CMOS	Output	Indicates that the module wants to be attached to the USB, active high
B5	TXD	CMOS	Output	TX data from the UART
B6	CTS	CMOS	Output	Flow control signal, Clear To Send data from UART
C1	DETACH	CMOS	Input	Indicates that the module wants to be suspended from the USB, active high, see note 4
C2	ON	Power	Input	When tied to V_{CC}, the module is enabled.
C3	NC	-	-	Do not connect – Vendor test point
C4	VCC_IO	Power	Power	External supply rail to the Input / Output ports
C5	ON#	-	-	This pin has been used for compatibility reasons and this signal is not connected on the Ericsson module.
C6	VCC	Power	Power	Supply Voltage
R1	GND	Power	Power	Signal ground
R2	GND	Power	Power	Signal ground
R3	RESET#	CMOS	Input	Active low reset, see note 5
R4	NC	-	-	Do not connect – Vendor test point
R5	NC	-	-	Do not connect – Vendor test point
R6	NC	-	-	Do not connect – Vendor test point
T1	GND	Power	Power	Signal Ground
T2	ANT	RF	In/Out	50Ω Antenna connection
T3	GND	Power	Power	Signal Ground
T4	NC	-	-	Do not connect – Vendor test point
T5	NC	-	-	Do not connect – Vendor test point
T6	NC	-	-	Do not connect – Vendor test point

Note: The CMOS buffers are low voltage TTL compatible signals.

Notes

1. All inputs except ON
2. Standby is defined as only page scan is activated.(Inquiry scan is not activated)
3. To be compliant with the USB 1.1 specification, VCC_IO ≥ 3.11V
4. 100kΩ pull-up resistors to V_{CC_IO} are used on the module
5. RESET# signal must be fed from an open drain output.

Mechanical Specification

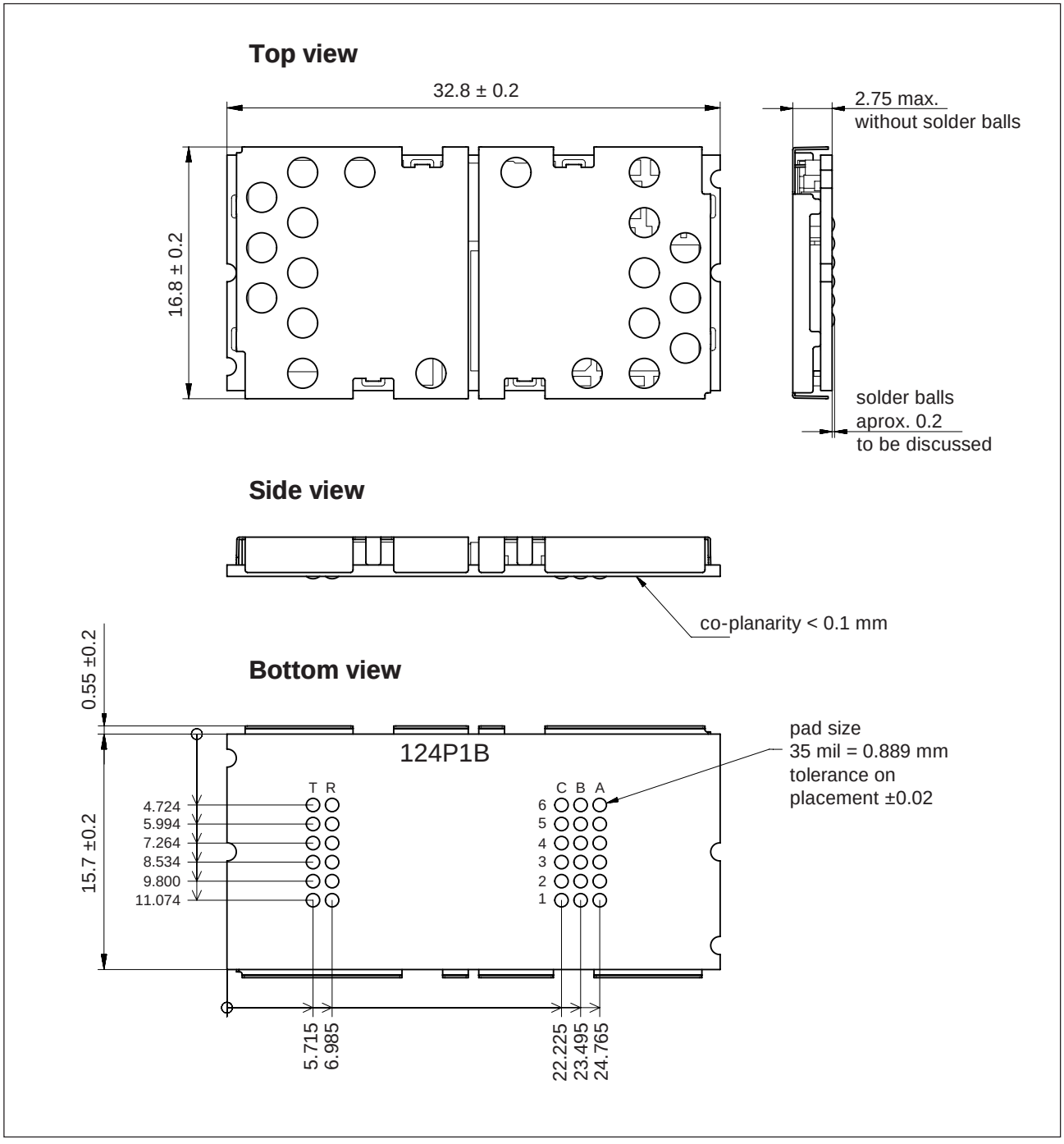


Figure 5. Mechanical dimensions

Functional Description

The ROK 101 007/1 is a complete Bluetooth module that has been specified and designed according to the Bluetooth Specification. Its implementation is based on a high-performance integrated radio transceiver (PBA 313 01 /2) working with a baseband controller, a flash memory and surrounding secondary components. The nominal range of the module with a typical antenna is up to a range of 10 m (or 0 dBm).

Figure 6 shows the complete module software stack configuration. The Host Controller Interface (HCI) is where the USB or PCM/UART interface is implemented. The HCI section inside the module is “HCI firmware”.

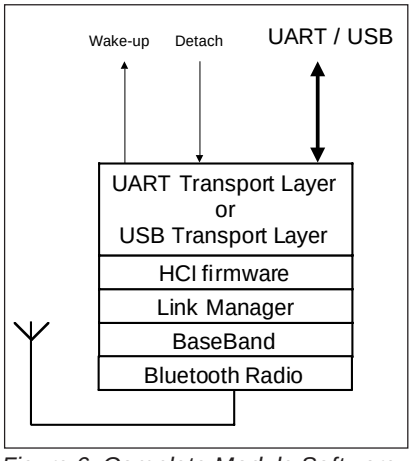


Figure 6. Complete Module Software Stack

Bluetooth uses an ad-hoc, piconet structure and operates in the international 2.4 GHz ISM band, at a gross data rate of 1 Mbit/s, and features low energy consumption for use in battery operated devices. To sustain a high transfer rate in busy radio environment, a packet switching protocol with frequency hopping and advanced coding techniques are employed.
Please refer to the ‘Specification of the Bluetooth System v1.0’ for further information regarding the Bluetooth standard.

Block Diagram

ROK 101 007/1 has five major operational blocks. Figure 7 illustrates the interaction of the various blocks. The functionality of each block is as follows:

1. Radio functionality is achieved by using the Bluetooth Radio, PBA 313 01/ 2. Six operational blocks are shown for the radio section and their operation is as follows:

1a) VCO-tank is a part of the phase locked loop. The modulation is performed directly on the VCO. To ensure high performance the VCO-tank is laser trimmed.

1b) Loop filter, filters the tuning voltage of the VCO-tank.

1c) RX-balun handles transformation from unbalanced to balanced transmission.

1d) TX-balun handles biasing of the output amplifier stage and transformation from balanced to unbalanced transmission.

1e) Antenna switch directs the power either from the antenna filter to the receive ports or from the ASIC output ports to the antenna filter.

1f) Antenna filter band-pass filters the radio signal.

2. The baseband controller is an ARM7-Thumb based chip that controls the operation of the radio transceiver via one of the interface methods; USB or PCM. Additionally, the baseband controller has a PCM Voice interface.

3. A Flash memory is used in co-ordination with the baseband controller. Please refer also to the **Software** section.

4. The power management block regulates and filters the supply voltage. V_{CC} is typically 3.3V and two regulated voltages are produced, 2.8V and 2.2V_{NOM}.

5. An internal clock is required on the module in order to fulfill the FCC requirement. The clock frequency is 13MHz and is generated from a crystal oscillator that guarantees a timing accuracy within 20ppm.

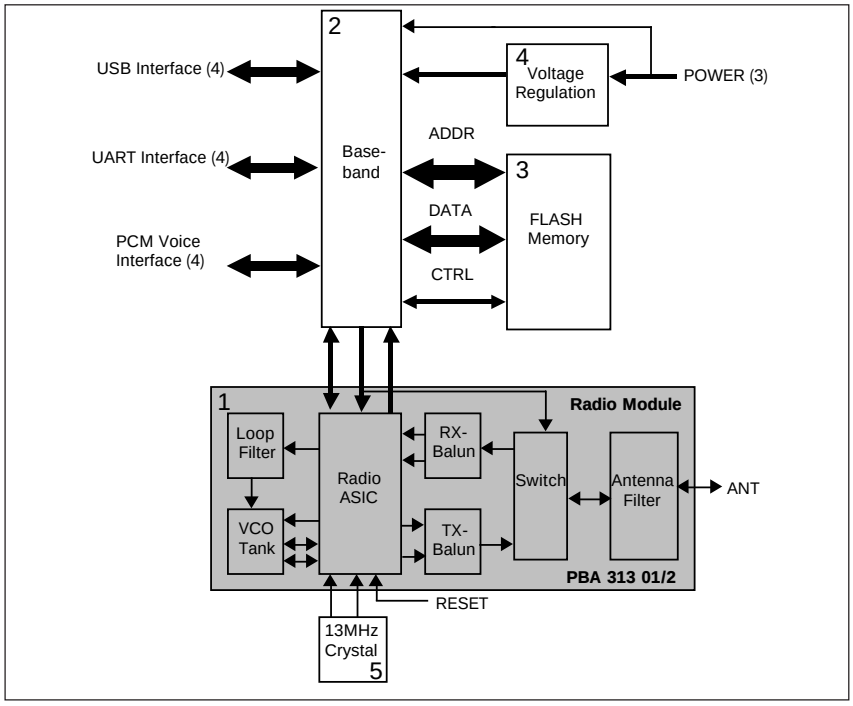


Figure 7. Simplified Block Diagram

I/O Signal Description

USB Interface
The module is a USB high-speed class device (12Mbps) that has the full functionality of a USB slave and is compliant to the USB 1.1 specification. Data transfer occurs on the bi-directional ports, D+ & D-

Additionally, there are two side band signals for a notebook application. Two side band signals Wake_up and Detach are used to control the state from which the notebook resumes. When the host is in a power down mode, Wake_up wakes the host up when the Bluetooth system receives an incoming connection. The host indicates that it is in Suspend mode by using the Detach signal. See also figure 10.

UART Interface
The UART implemented on the module is an industry standard 16C450 and supports the following baud rates: 300, 600, 900, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 and 460800 bits/s.

Four signals will be provided for the UART interface. TxD & RxD are used for data flow, and RTS & CTS are used for flow control. The module is a DCE. See also figure 11. Refer to a 16C450 data sheet for a full description of an UART.

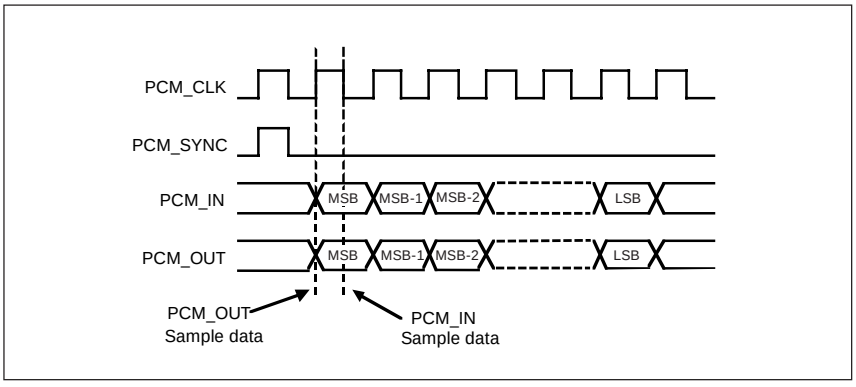


Figure 8. PCM Interface Diagram

PCM Voice Interface
The standard PCM interface has a sample rate of 8 kHz (PCM_SYNC). The PCM clock is variable between 200 kHz and 2.048 MHz. The PCM data can be linear PCM (13-16bit), μ-law (8bit) or A-law (8bit).

RESET#
The assignment of the RESET# input is to generate a reset signal to the complete Bluetooth module. During power-up the reset signal is set 'low' so that power supply glitches are avoided. Therefore no reset input is required after power-up. The reset signal must be fed from an open drain output.

Power
There are three inputs to the Voltage Management section (V_{CC}, V_{CC_IO}, ON). V_{CC} is the supply voltage that is typically 3.3V.
A separate power supply rail (V_{CC_IO}) is provided for the I/O ports, UART, PCM and USB. To be compliant with the USB 1.1 specification, V_{CC_IO} > 3.11V. V_{CC_IO} can either be connected to V_{CC} or to a dedicated supply rail, which is the same as the logical interface of the host.
The ON input is the only signal that is required to activate the module. The ON# pin has only been used for compatibility reasons and this signal is not connected on the Ericsson module. See also Power-up Sequence section.

Antenna
The ANT pin should be connected to a 50Ω antenna interface, thereby supporting the best signal strength performance. Ericsson Microelectronics can recommend application specific antennas.

Shielding / EMC Requirements
The module has its own RF shielding and is approved according to the standards by FCC and ETSI. Each module will be labeled with a FCC approval number. If the approval number is not visible on the outside when the module is utilized in the final product, an exterior label must state that there is a transmitter module inside the product.

Software
The module includes firmware for the host controller interface, HCI, and the link manager, LM. Additional software (Bluetooth layers L2CAP and RFCOMM) are available in a generic form, i.e. to be adapted to various operating systems.

Application Block Schematics

UART or PCM Application

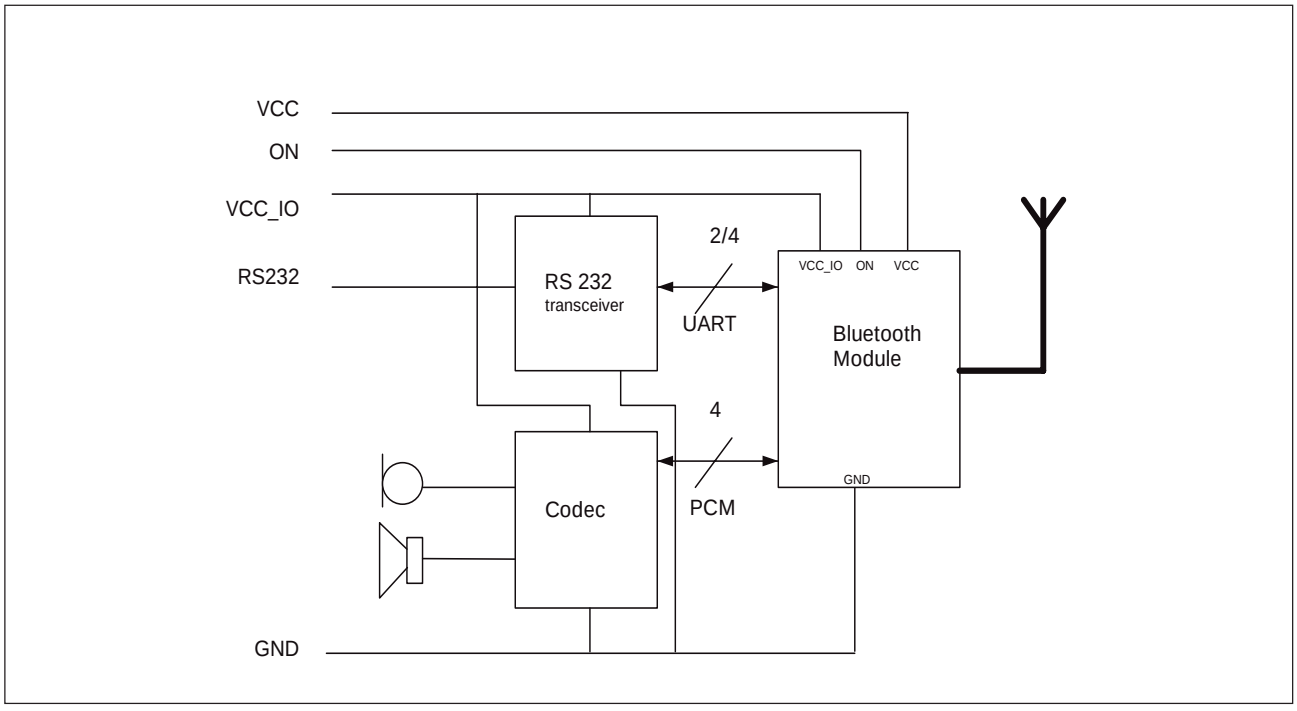


Figure 9. A typical UART or PCM configuration.

USB Application

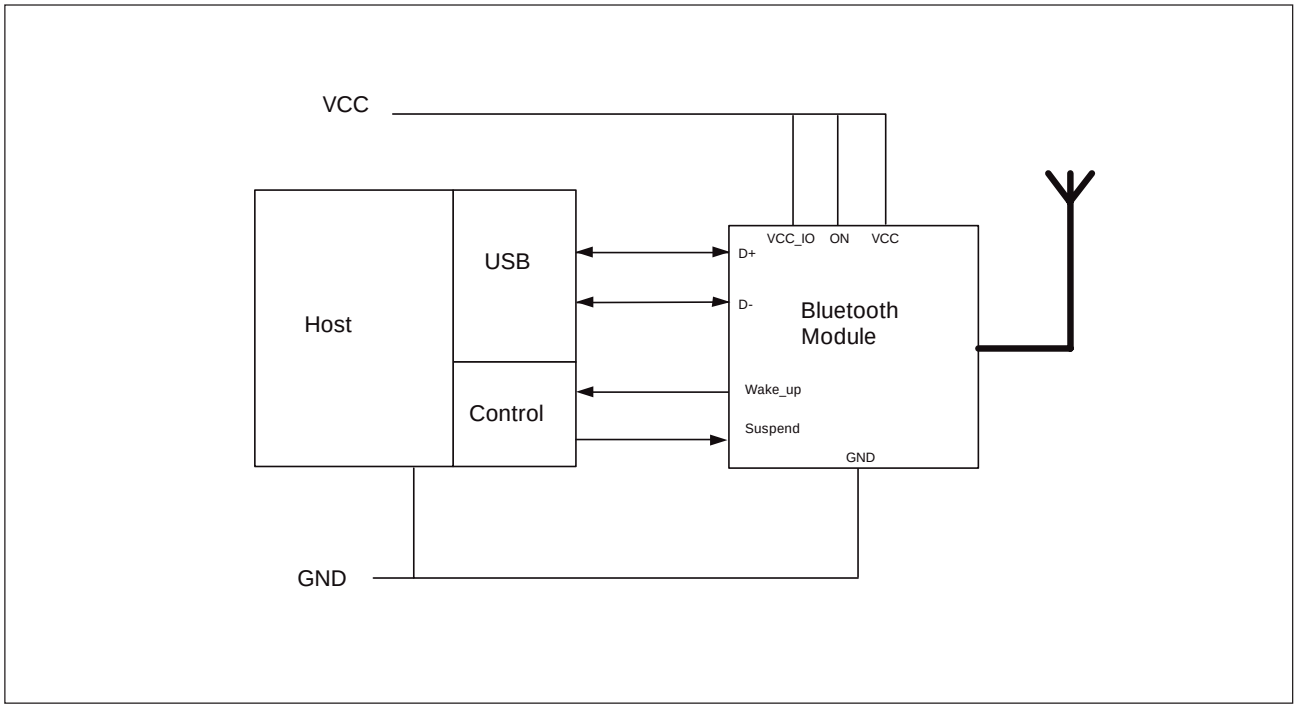


Figure 10. A typical USB configuration.

Design Considerations

Power-up Sequence
A power-up sequence must be applied as according: connection of the supply rails, GND and then V_{CC}; then the ON signal should be applied in order to initiate the internal regulators; and finally, the V_{CC_IO} supply rail can be activated. The RESET# signal is generated automatically in the module and is shown in grey.

The power-down sequence is similar to the power-up procedure but in the reverse format. Therefore, the disconnection of the signals shall be as follows: V_{CC_IO}, ON,V_{CC} and finally GND.

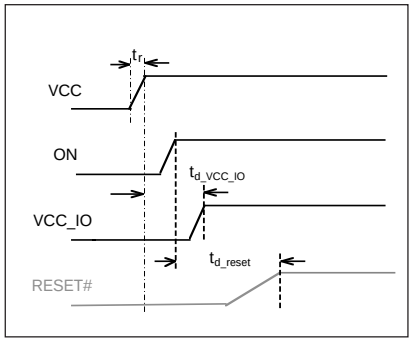


Figure 11. Typical Power-up Timing Diagram

Parameter	Min	Typ	Max	Unit
t_r	TBD			µs
$t_{d\_VCC\_IO}$	TBD			µs
t_{d_reset}	TBD			ms

Figure 12. Power-up Timing Table

Assembly Guidelines
Assembly guidelines will be inserted here in next revision.

Ground
Ground should be distributed with very low impedance as a ground plane. Connect all GND pins to the ground plane.

Marking
Every module is marked with the following information on the:

a) Component designation: “ROK 101 007/1”.
b) Ericsson’s name and logotype.
c) Manufacturing code (place, year, week) and batch number.

Ordering Information

Package	Part No.
30 SSM	ROK 101 007/1

Packaging
All devices will be delivered in a package protecting them from electrostatic discharges and mechanical shock. The package will be marked with the following information:
a) Delivery address.
b) Purchase order-number
c) Type of goods and component designation.
d) Ericsson’s name and logotype.
e) Date of manufacture and batch number.
f) Number of components in the package.

Abbreviations

ASIC	-	Application Specific Integrated Circuit
BER	-	Bit Error Rate
BGA	-	Ball Grid Array
CMOS	-	Complementary Metal Oxide Semiconductor
C/I	-	Carrier to Interference Ratio
DCE	-	Data Communication Equipment
HCI	-	Host Controller Interface
ISM	-	Industrial Scientific and Medical
LTCC	-	Low Temperature Co-fired Ceramic
PCB	-	Printed Circuit Board
PCM	-	Pulse Code Modulation
PDA	-	Personal Digital Assistant
Rx	-	Receive
SSM	-	Screen Solder Mask
Tx	-	Transmit
UART	-	Universal Asynchronous Receiver Transmitter
USB	-	Universal Serial Bus
VCO	-	Voltage Controlled Oscillator

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