Rosonix Technology, Inc.

RX-2503

User Manual

RX-2503 DATA SHEET

DESCRIPTION

The RX-2503 module is a Zigbee™ network solution that integrates a 2.4Ghz, IEEE 802.15.4-compliant transceiver with a 16-bit XAP2b microprocessor. It contains integrated Flash and RAM memory and peripherals of use to designers of Zigbee-based applications.
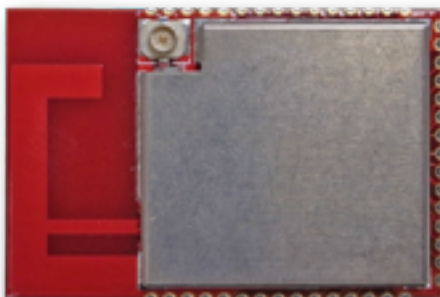
The transceiver utilized an efficient architecture in which the integrated receiver channel filtering allows for co-existence with other communication standards in the 2.4Ghz spectrum such as WiFi and Bluetooth. An optional high performance radio mode (boost mode) is software selectable to boost dynamic range by a further 3dB. The highly integrated antenna, power regulator, and Xtal keep the external component count low. The internal PCB traced antenna and an external U.FL connector port is user selectable. This maximum the flexibility for the designer to minimize the cost or maximize the system performance.

The EM250 has 128kB of embedded Flash memory and 5kB of integrated RAM for data and program storage. The EM250 software stack employs an effective wear-leveling algorithm in order to optimize the lifetime of the embedded Flash.

To support user-defined application, a number of peripherals such as GPIO, UART, SPI, I²C, ADC, and general purpose timers are integrated. Also, an integrated voltage regulator, power-on-reset circuitry, sleep timer, and low-power sleep modes are available. The deep sleep mode draws less than 2uA, allowing products to achieve long battery life. The equipped internal watch-dog timer allows the system to be reactivated once the system go into a dead-lock state. This mechanism makes the system more reliable and available.

Target application for the RX-2503 include:

- Home automation and control
- Building automation and control
- Smart energy monitoring and control
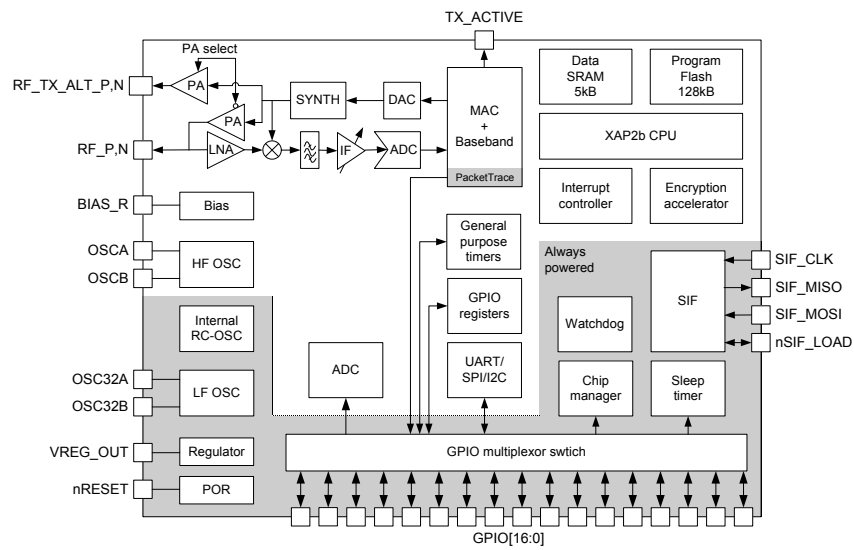- Tele-healthcare
- Asset tracking

GENERAL FEATURES

- Ember™ EM250 platform
- 128KB Flash memory
- 5KB SRAM
- 16-bit XAP2b microprocessor
- 17 general purpose I/O ports
- DMA-SPI, I2C and UART interfaces
- Integrated 12-bit resolution ADC
- Designed for EmberZNet Zigbee Pro compliant networks
- Miniature footprint: 2cm x 3cm
- Integrated PCB trace antenna and U.FL external antenna connector
- 16 RF channels
- Over indoor 30m and outdoor visual contact 100m of range
- Non-intrusive debug interface (SIF)
- AES 128-bit encryption
- Low power consumption
- Constant RF out power over 2.1~3.6 V voltage range
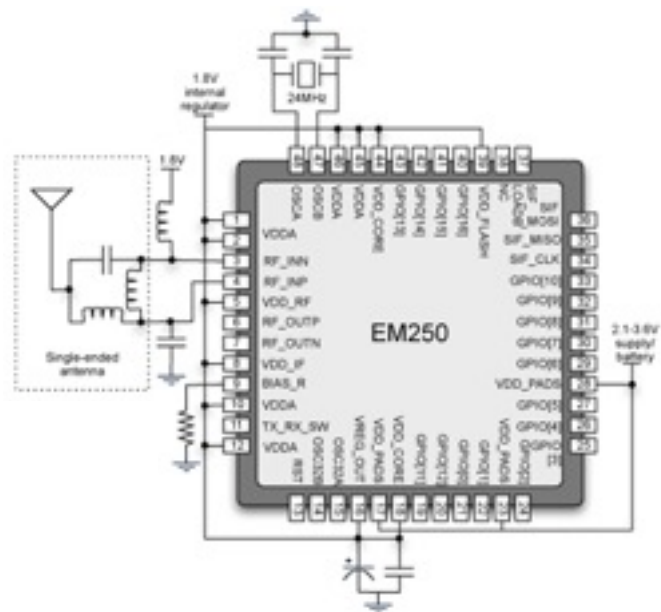- FCC and NCC certification in process
- RoHS compliant

Product Specification

Chip Set	Ember EM250 SoC
Operation Voltage	2.1~3.6V
Network Standard	IEEE 802.15.4
Modulation	DSSS PHY employing Offset-QPSK
Network Architectures	Star or Mesh
Data Rate	250Kbps
Integrated Memory	128KB of Flash, 5KB of SRAM
Power Consumption	TX: under 40mA, RX: under 40mA Deep sleep: under 2uA
Watchdog	Internal watchdog timer and power-on-reset circuitry
Encryption	Integrated 128-bit AES encryption accelerator
Operating Frequency Band	2.405Ghz ~ 2.480Ghz (16 Channels with 5MHz wide)
Antenna Type	1. Internal PCB Traced Planar Inverted-F Antenna (3.74dBi) 2. U.FL Connector for External Antenna (5dBi, 2dBi)
TX Output Power	Max. +3dBm (+5dBm in Boost mode) , Min. -43dbm
RX Sensitivity	Typical -95dBm (-96dBm in Boost mode) at 1% packet error rate
Operating Temperature (Ambient)	-40 °C ~ +85 °C
Humidity (Non-condensing)	0~95% RH

Block diagram

EM250 Block Diagram

RX-2503 Block Diagram

I/O PIN ASSIGNMENT

Pin #	Name	Type	Description
1	GND	GND	Ground
2	GND	GND	Ground
3	GND	GND	Ground
4	GND	GND	Ground
5	GND	GND	Ground
6	NC	NC	No Connection
7	NC	NC	No Connection
8	VCC	PWR	Power Supply Input
9	nRESET	DI	Reset, active low
10	GPIO_11 nCTS MCLK TMR2IA.1	DI/DO DI DO DI	General Purpose Digital I/O 11 UART CTS handshake of Serial Controller SC1 SPI master clock of Serial Controller SC1 Capture Input A of Timer 2
11	GPIO_12 nRTS TMR2IB.1	DI/DO DO DI	General Purpose Digital I/O 12 UART RTS handshake of Serial Controller SC1 Capture Input B of Timer 2
12	GPIO_0 MOSI TMR1IA.1	DI/DO DI/DO DI	General Purpose Digital I/O 0 SPI master_data_out/slave_data_in of Serial Controller SC2 Capture Input A of Timer 1
13	GPIO_1 MISO SDA TMR2IA.2	DI/DO DI/DO DI/DO DI	General Purpose Digital I/O 1 SPI master_data_in/slave_data_out of Serial Controller SC2 I2C data of Serial Controller SC2 Capture Input A of Timer 2
14	GPIO_2 MSCLK SCL TMR2IB.2	DI/DO DI/DO DI/DO DI	General Purpose Digital I/O 2 SPI master/slave clock of Serial Controller SC2 I2C clock of Serial Controller SC2 Capture Input B of Timer 2
15	GND	GND	Ground
16	GND	GND	Ground
17	GPIO_3 nSSEL TMR1IB.1	DI/DO DI DI	General Purpose Digital I/O 3 SPI slave select of Serial Controller SC2 Capture Input B of Timer 1
18	GPIO_4 ADC_0 PTI_EN	DI/DO AI DO	General Purpose Digital I/O 4 ADC Input 0 Frame signal of Packet Trace Interface (PTI)
19	GPIO_5 ADC1 PTI_DATA	DI/DO AI DO	General Purpose Digital I/O 5 ADC Input 1 Data signal of Packet Trace Interface (PTI)
20	VCC	PWR	Power Supply Input
21	GND	GND	Ground
22	GPIO_6 ADC2 TMR2CLK TMR1ENMSK	DI/DO AI DI DI	General Purpose Digital I/O 6 ADC Input 2 External clock input of Timer 2 External enable mask of Timer 1
23	GPIO_7 ADC3 REG_EN	DI/DO AI DO	General Purpose Digital I/O 7 ADC Input 3 External regulator open collector output
24	GPIO_8 VREF_OUT TMR1CLK TMR2ENMSK IRQA	DI/DO AO DI DI DI	General Purpose Digital I/O 8 ADC reference output External clock input of Timer 1 External enable mask of Timer 2 External interrupt source A

Pin #	Name	Type	Description
25	GPIO_9 TXD MO MSDA TMR1IA.2	DI/DO DO DO DI/DO DI	General Purpose Digital I/O 12 UART transmit data of Serial Controller SC1 SPI master data out of Serial Controller SC1 I2C data of Serial Controller SC1 Capture Input A of Timer 1
26	GPIO_10 RXD MI MSCL TMR1IB.2	DI/DO DI DI DI/DO DI	General Purpose Digital I/O 10 UART receive data of Serial Controller SC1 SPI master data in of Serial Controller SC1 I2C clock of Serial Controller SC1 Capture Input B of Timer 2
27	SIF_CLK	DI	Programming and debug Interface, clock (internal pull-down)
28	SIF_MISO	DO	Programming and debug Interface, master_in/slave_out
29	GND	GND	Ground
30	GND	GND	Ground
31	GND	GND	Ground
32	SIF_MOSI	DI	Programming and debug Interface, master_out/slave_in
33	nSIF_LOAD	DI/DO	Programming and debug Interface, load strobe (open-collector with internal pull-up)
34	GPIO_16 TMR1OB TMR2IB.3 IRQD	DI/DO DO DI DI	General Purpose Digital I/O 16 Waveform Output B of Timer 1 Capture Input B of Timer 2 External interrupt source D
35	GPIO_15 TMR1OA TMR2IA.3 IRQC	DI/DO DO DI DI	General Purpose Digital I/O 15 Waveform Output A of Timer 1 Capture Input A of Timer 2 External interrupt source C
36	GPIO_14 TMR2OB TMR1IB.3 IRQB	DI/DO DO DI DI	General Purpose Digital I/O 14 Waveform Output B of Timer 2 Capture Input B of Timer 1 External interrupt source B
37	GPIO_13 TMR2OA TMR1IA.3	DI/DO DO DI	General Purpose Digital I/O 13 Waveform Output A of Timer 2 Capture Input A of Timer 1
38	VCC	PWR	Power Supply Input
39	NC	NC	No Connection
40	ANT_SEL	DI	Antenna Select
41	GND	GND	Ground
42	GND	GND	Ground
43	GND	GND	Ground
44	NC	NC	No Connection
45	GND	GND	Ground

Type Definition

PWR: Power Input   DI: Digital Input   AI: Analog Input
GND: Ground   DO: Digital Output   AO: Analog Output

ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

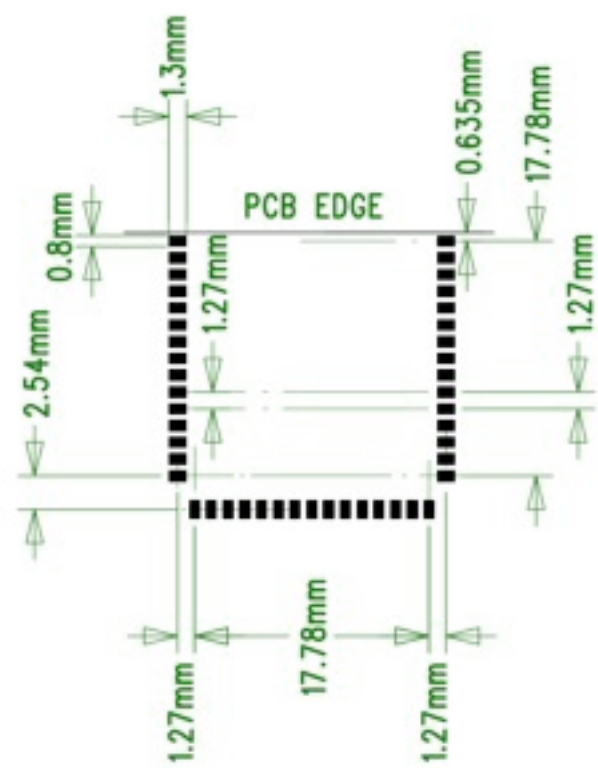| Parameter	Min.	Typ.	Max.	Unit
Power supply voltage	-0.3		3.6	V
Voltage on any digital pin	-0.3		VCC + 0.3 Max 3.6	V
Storage temperature range	-40		125	°C

Note: Exceeding the maximum ratings may cause permanent damage to the module or devices.
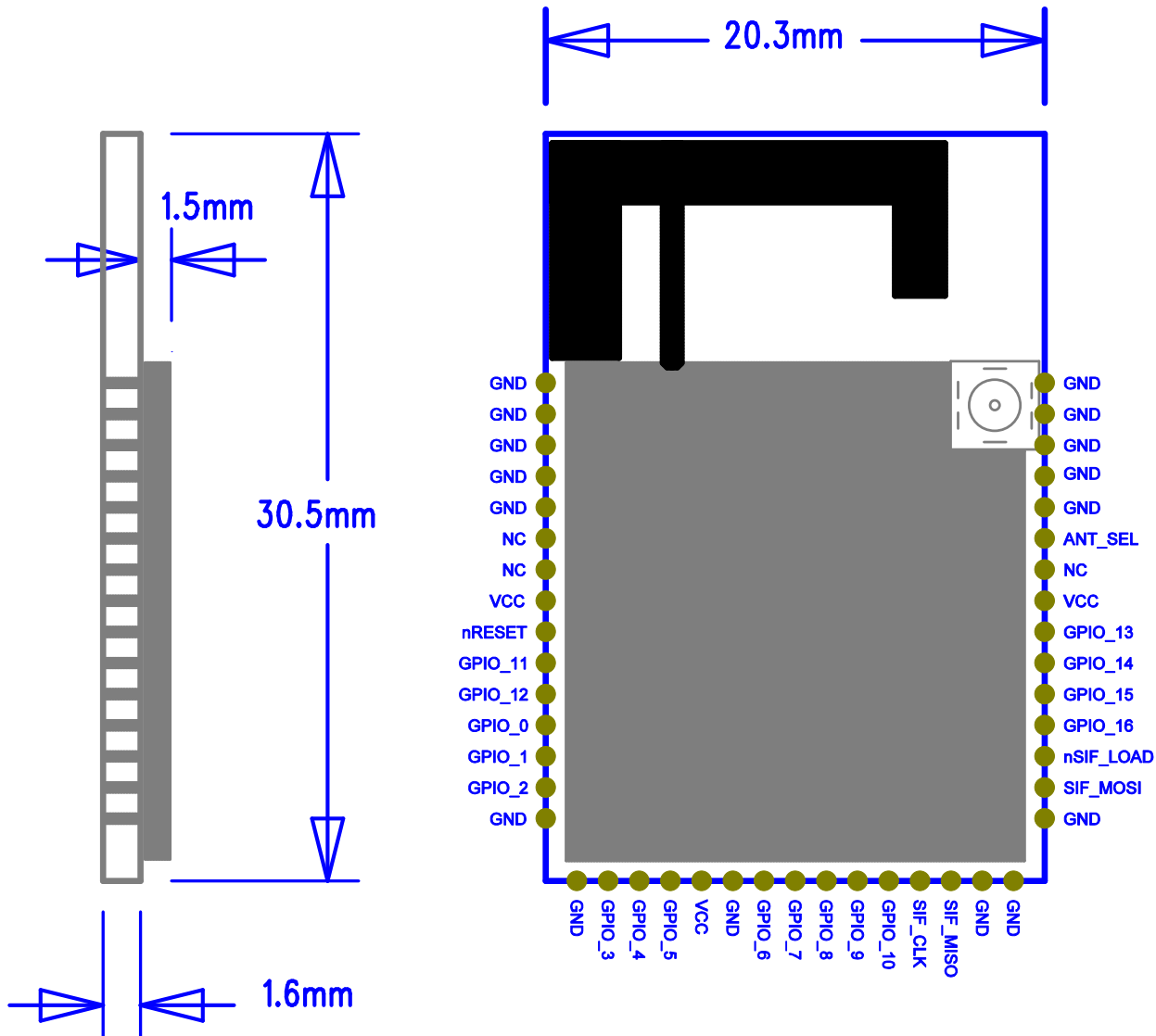
Operating Conditions

Parameter	Min.	Typ.	Max.	Unit
Power supply voltage	2.1		3.6	V
Input current for logic 0			-0.5	µA
Input current for logic 1			0.5	µA
Input voltage for logic 0	0		20% VCC	V
Input voltage for logic 1	80% VCC		VCC	V
Output voltage for logic 0	0		18% VCC	V
Output voltage for logic 1	82% VCC		VCC	V
Input pull-up resistor value		30		KΩ
Input pull-down resistor value		30		KΩ
Output source current (standard current pad)			4	mA
Output sink current (standard current pad)			4	mA
Output source current high current pad: GPIO[16:13]			8	mA
Output sink current high current pad: GPIO[16:13]			8	mA
Ambient temperature range	-40	25	+85	°C

PCB COPPER PATTERN LAYOUT

DIMENSIONS

20.3mm

1.5mm

30.5mm

1.6mm

GND	GND
GND	GND
GND	GND
GND	GND
GND	GND
NC	ANT_SEL
NC	NC
VCC	VCC
nRESET	GPIO_13
GPIO_11	GPIO_14
GPIO_12	GPIO_15
GPIO_0	GPIO_16
GPIO_1	nSIF_LOAD
GPIO_2	SIF_MOSI
GND	GND

GND
GPIO_3
GPIO_4
GPIO_5
VCC
GND
GPIO_6
GPIO_7
GPIO_8
GPIO_9
GPIO_10
SIF_CLK
SIF_MISO
GND
GND

USA - Federal Communications Commission (FCC)

FCC Radiation Exposure Statement

⚠ CAUTION:

- The radiated output power of Module devices is far below the FCC radio frequency exposure limits. Nevertheless, Module devices should be used in such a manner that the potential for human contact during normal operation is minimized. To avoid the possibility of exceeding the FCC radio frequency exposure limits, you should keep a distance of at least 20 cm between you (or any other person in the vicinity) and the antenna that is built into the notebook.

Interference Statement

These devices comply with Part 15 of the FCC Rules. Operation of the devices is subject to the following two conditions: (1) The devices may not cause harmful interference, and (2) The devices must accept any interference that might cause undesired operation.

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

- Relocate this device.
- Increase the separation between the device and the receiver.
- Connect the device into an outlet on a circuit different from that of other electronics.
- Consult the dealer or an experienced radio technician for help.

✎ NOTE:

- Module must be installed and used in strict accordance with the manufacturer's instruction as described in the user documentation that comes with the product. Any other installation or use will violate FCC Part 15 regulations. Modifications not expressly approved by Billion could void your authority to operate the equipment.
- he devices must not be co-located or operating in conjunction with any other antenna or transmitter.