ReZolt® RZ707 Em-Fi™ Module
User Manual

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1. Introduction

ReZolt provides an embedded Wi-Fi module, RZ707MS, to enable low-power Embedded Wi-Fi (Em-Fi™) communication on deeply embedded devices. RZ707MS is a component of Em-Fi Platform from ReZolt Corporation. This document describes hardware specification of the module, as well as software usage

1.1   Intended Audience and Reading Suggestions

This document is intended for customers of ReZolt RZ707MS module, usually mounted on RZ707ES-LPS evaluation board.

1.2   Scope of the Document

This document describes detailed instructions to measure RF parameters of ReZolt RZ707MS module, mounted on a RZ707ES-LPS evaluation board, including

- Device driver installation and programming the RZ707ES-LPS board with the firmware for manufacturing test.
- Setting up the test environment.
- RF commands to initiate transmission and reception testing procedures, with various RF parameters.

2 RZ707MS Overview

RZ707MS is member of a family of low power embedded Wi-Fi modules from ReZolt Corporation. It is a component of ReZolt Em-Fi Platform and along with RZ707-ES-LPS Evaluation Board and Ubzrvr™ Device & Sensor Management System, offers an end-to-end solution that is easy-to-use, modular, and scalable thereby allowing cost-effective and rapid engineering development for OEM embedded Wi-Fi products.

Em-Fi Software provides an option to run customer applications on a host processor on the customer board with simple serial-to-Wi-Fi commands. Em-Fi Software also allows the customer applications to run on an RZ707 Module using the RZ707SDK.

2.1   Target Applications

- Energy Monitoring and Management
- Logistics and Supply Chain Management
- Healthcare
- Industrial and Building Automation

2.2   Highlights

- 802.11b/g/n with complete Wi-Fi functionality
- Low power and best in class networking and other features in easy-to-use, modular, scalable software
- Rich interfaces allow interfacing with a range of sensors and other peripherals
- ARM Cortex M3-based microcontroller with processing and memory headroom
- Supports fine-grained power management for low power operation and long battery life
- Optional on-module serial Flash facilitates data logging and firmware upgrade

2.3   Features

Module

- Based on Broadcom BCM43362 Wi-Fi and ST Micro STM32F205 Cortex M3 microcontroller
- Small form factor: 1.24 in X 0.85 in (31.5 mm X 21.6 mm)
- Rich in interfaces: Up to three UART, three SPI, two I2S, two I2C, one USB, JTAG and GPIOs, ADCs, DACs and timers
- On-board chip antenna or external antenna using u.FL connector
- Standby current < 5uA, transmission current < 330 mA, receiving current < 80 mA
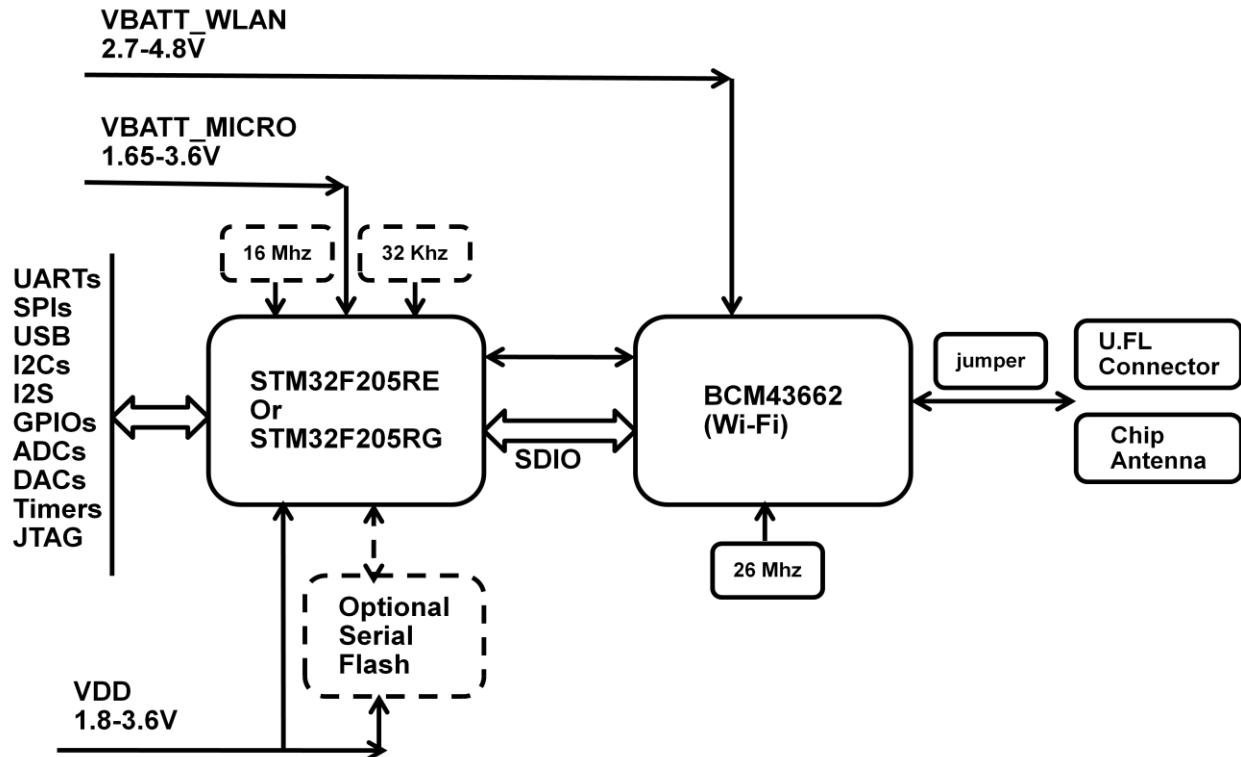- Worldwide regulatory compliance

Wi-Fi

- Single stream 802.11n support for 20 MHz channel bandwidth provides rates up to 65 Mbps
- WPA/WPA2 Personal for powerful encryption and authentication
- AES and TKIP acceleration in hardware for faster data encryption and 802.11i compatibility
- 802.11d, e(WMM, QoS, WMM-PS), h, i, j, k, r, w; Wi-Fi Protected Setup (WPS)

Software

- Em-Fi Software integrates Wi-Fi and network stack, including UDP, TCP/IP (IPv4), DHCP Client and Server, ARP, DNS, FTP Client, SSL/TLS engine, HTTP/HTTPS Client and Server, and XML parser
- Run your application code on an external host microcontroller interfacing to RZ707 Module using serial commands
- Run your application on the on-board STM32F205 Cortex-M3 microcontroller using RZ707 Software Development Kit

2.4 System Architecture

RZ707MS Module consists of two main components: STM32F205RE (512KB flash, 128KB SRAM) or STM32F205RG (1MB flash, 128KB SRAM), an ARM Cortex-M3 based 32-bit microcontroller that runs Em-Fi Software and Broadcom BCM43362 Wi-Fi device. It also includes an optional serial Flash (1MB or 2MB), an on-board chip antenna and a u.FL connector for optional external antenna.

Voltage Input

RZ707 Module supports a flexible power supply. VBATT_WLAN, required for the Wi-Fi device, can be in the range of 2.7V to 4.8V. VBATT_MICRO can be in the range of 1.65V to 3.6V. Vdd, used by the microcontroller and the optional flash, can be in the range of 1.8V to 3.6V.

I/O Interface

STM32F205RE/RG offers a host of interfaces enabling a rich and flexible hardware design. These include not only the standard interfaces such as UARTs, SPIs, I2C, I2S, GPIOs, ADCs, DACs, and Timers but also USB for easy connectivity for data and provisioning.

Radio Frequency

BCM43362 Wi-Fi device supports 802.11bgn with the latest Wi-Fi functionality including security and provisioning and enabling a broad range of embedded Wi-Fi products.

This module operates within the frequency range between 2412 and 2464 Mhz, which correspond to the central frequency of channel 1 and channel 11 for IEEE 802.11 b/g/n standard.

Chip Antenna

The chip antenna included on the module (which is also used for FCC test) is manufactured by Johanson, with part number 2450AT42B100E. The datasheet of the antenna is attached to this document.

Crystals

There are three crystals used on the module. Two crystals connected to STM32F205RG work at 16 Mhz and 32 Khz, respectively. The single crystal connected to BM43362 works at 26 Mhz. STM32F205RG has an internal PLL circuitry, which works at 96 Mhz when it is turned on.

Radio Power

A piece of software runs on STM32F205RG to control the radio operation. By default, the software always transmits at full power (which is used during test for FCC certificate). ReZolt provides software API to customers in order to lower down the transmission power from the default state, but never beyond the default state.

Specifically, following function is provided to customers in order to lower the radio transmission power from the default number:

Status wdd_adjust_tx_power(uint8_t pwr),

where parameter pwr is in unit of dBm and always capped by the default power number when the software processes this function call.

3 Pin Description

Pin	Name	Function on RZ707ES Board	Alternate Functions									
			UART	SPI/I2S	GPIO	I2C	ADC	DAC	CAN	Timer	Other
1	GND	GND									
2	VBATT_WLAN	VBATT for WLAN									
3	VBATT_MICRO	VBATT for Micro									
4	Alarm output	Alarm output			GPIO						
5	NRST	Micro reset									
6	PC0	GPIO			GPIO		ADC123_IN10				
7	PC1	ADC			GPIO		ADC123_IN11				
8	PC2	GPIO		SPI2_MISO	GPIO		ADC123_IN12				
9	PC3	GPIO		SPI2_MOSI	GPIO		ADC123_IN13				
10	PA0	WKUP pin			GPIO		ADC123_IN0			TIM	
11	PA2	ADC	USART2_TX		GPIO		ADC123_IN2			TIM	
12	GND	GND									
13	VDD	VDD for Micro									
14	PA3	ADC	USART2_RX		GPIO		ADC123_IN3			TIM	
15	PA4*	NC, used internally as SPI1_NSS for on-module serial flash		SPI3_NSS / I2S3_WS	GPIO		ADC12_IN4	DAC1_OUT			
16	PA5**	SPI1_SCK			GPIO		ADC12_IN5	DAC2_OUT		TIM	
17	PA6**	SPI1_MISO			GPIO		ADC12_IN6			TIM	
18	PA7**	SPI1_MOSI			GPIO		ADC12_IN7			TIM	
19	PB0*	NC, used internally for PwrEN of on-module serial flash			GPIO		ADC12_IN8			TIM	
20	PB1	GPIO			GPIO		ADC12_IN9			TIM	
21	PB10	USART3_TX		SPI2_SCK / I2S2_CK	GPIO	I2C2_SCL				TIM	
22	PB11	USART3_RX			GPIO	I2C2_SDA				TIM	
23	GND	GND									
24	PB12	SPI2_NSS	USART3_CLK	I2S2_WS	GPIO	I2C2_SMBA			CAN2_RX	TIM	
25	PB13	SPI2_SCK	USART3_CTS	I2S2_SCK	GPIO				CAN2_TX	TIM	
26	PB14	SPI2_MISO	USART3_RTS		GPIO					TIM	
27	PB15	SPI2_MOSI		I2S2_SD	GPIO					TIM	RTC_50Hz
28	PA8*	NC, used internally for Write Protection of on-module serial flash	USART1_CLK		GPIO					TIM	MCO1
29	PA9	USB_DET	UART1_TX		GPIO					TIM	
30	PA10	USB_FS_ID	UART1_RX		GPIO					TIM	
31	PA11	USB_FS_DM	UART1_CTS		GPIO				CAN1_RX	TIM	
32	PA12	USB_FS_DP	UART1_RTS		GPIO				CAN1_TX	TIM	
33	GND	GND									
34	PA13	JTAG_TMS			GPIO						
35	PA14	JTAG_TCK			GPIO						
36	PA15	JTAG_TDI		SPI1_NSS / SPI3_NSS / I2S3_WS	GPIO					TIM	
37	PB3	JTAG_TDO		SPI1_SCK / SPI3_SCK / I2S3_CK	GPIO					TIM	
38	PB4	JTAG_TRST		SPI1_MISO / SPI3_MISO	GPIO					TIM	
39	PB5	GPIO		SPI1_MOSI / SPI3_MOSI / I2S3_SD	GPIO	I2C1_SMBA			CAN2_RX	TIM	
40	PB6	USART1_TX			GPIO	I2C1 SCL			CAN2_TX	TIM	
41	PB7	USART1_RX			GPIO	I2C1 SDA				TIM	
42	BOOT0	BOOT0 switch			GPIO						
43	PB8	I2C1_SCL			GPIO	I2C1_SCL			CAN1_RX	TIM	
44	PB9	I2C1_SDA		SPI2_NSS / I2S2_WS	GPIO	I2C1_SDA			CAN1_TX	TIM	
45	GND	GND									

4 Electrical Characteristics

All the interfaces available on the module are to STM32F205RE/RG microcontroller. Please refer to the STM32F205RE/RG datasheet for further details.

4.1   Absolute Maximum Ratings

	Min	Max	Unit
Storage Temperature	-40	+125	Deg. C
Supply Voltage – VBAT_WLAN	-0.5	+6	V
Supply Voltage – VBATT_MICRO	-0.3	+4	V
Supply Voltage – Vdd	-0.3	+4	V

4.2   Operating Conditions

	Min	Typical	Max	Unit
Operating Temperature	-30	+25	+85	Deg. C
Supply Voltage – VBATT_WLAN	2.7	3.6	4.8	V
Supply Voltage – VBATT_MICRO	1.8	1.8 or 3.3	3.6	V
Supply Voltage – Vdd	1.65	1.8 or 3.3	3.6	V

4.3   Low-Power State Characteristics

State	Current	CPU Clock	Registers & SRAM	PLL & HSE/HSI**	RTC Clock***	RTC SRAM
Run*	27 mA	ON	Retained	ON	ON	Retained
Sleep	8 mA	OFF	Retained	ON	ON	Retained
Stop	350 uA	OFF	Retained	OFF	ON	Retained
Standby	6 uA	OFF	Lost	OFF	ON	Retained

* CPU clock running at 90 MHz, executing instructions out of flash, with all peripherals disabled except SDIO and some GPIOs

** HSE: External High-Frequency Crystal, 60 uA

   HSI: Internal High-Frequency RC oscillator, 1 mA
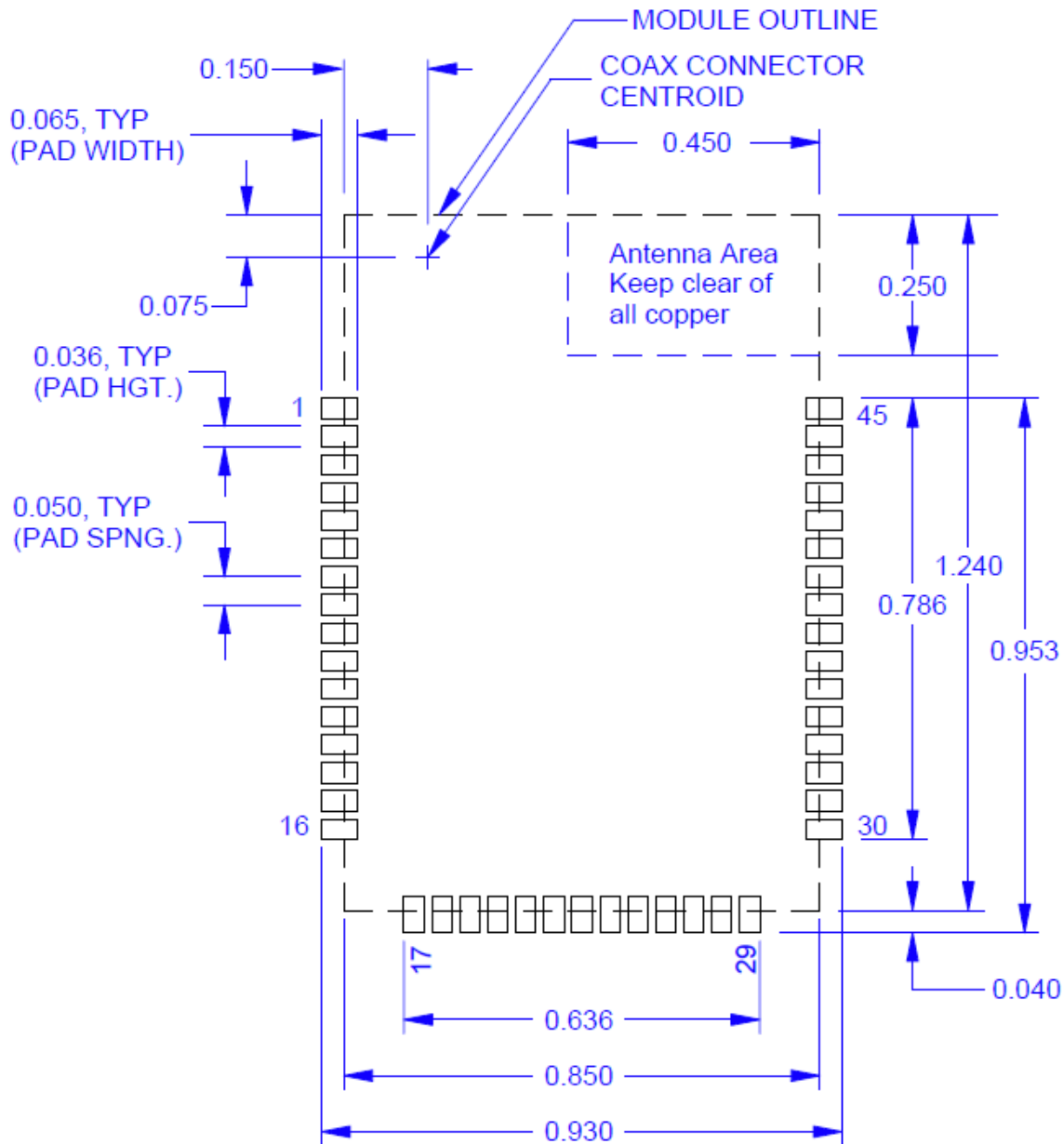
   PLL: 1.3 mA

*** RTC on Internal low frequency oscillator (LSI): 0.4 uA

State	Exit Methods	Wake up delay (uS)			
		CPU	HSI*	PLL	Total
Sleep	Any interrupt	1	0	0	1
Stop	RTC Alarm/Wkup	17	2.2	200	220
Standby	RTC Alarm/Wkup	375	2.2	200	577

* If using HSE, its startup time is usually 2 ms after Vdd is stabilized

5 Installation Guidelines

5.1 Layout Guidelines

The module footprint is shown in the above figure. There are two ways of using/connecting antennas

- To use the on-module chip antenna. In this case, the Antenna Area labeled above needs to be kept clear of copper to ensure good RF performance.
- To use external antenna, via the u.FL coax connector. In this case, it is OK to overlap the Antenna Area with copper. However, to ensure the external antenna meets the requirements of MIC/TELEC, the user needs to contact ReZolt Corporation with detailed specification of the antenna.

In addition to the above guidelines, note the following suggestions:

- Place external bypass capacitors as close as possible to the module pins.
- To achieve better communication quality, keep metallic objects away from the antenna (either the on-module chip antenna or external antennas) as far as possible.

5.2 Surface Mount Assembly

Table below lists recommended reflow parameters.

Preheat	
Ramp up rate from 25 to 150°C	TBD
Soak or dryout	
Temperature Min (T_{smin})	TBD
Temperature Max (T_{smax})	TBD
Time (T_s) from T_{smin} to T_{smax}	TBD
Reflow	
Liquidus Temperature (T_L)	TBD
Time (t_L) maintained above T_L	TBD
Peak temperature (Tp)	TBD
Ramp up rate from T_L to T_p	TBD
Time (t_p) within 5°C of T_p	TBD
Ramp up rate from T_p to T_L	TBD
Time 25°C to T_p	TBD

6 Limitations

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Revision History

Date	Version	Changes
8/13/2012	0.1	First draft.