RM-SS2

Sub-GHz module series

Datasheet

The RM-SS2 is a sub-GHz radio module targeted for applications where proven reliability, highly flexible network and low-power performance are key requirements.

The RM-SS2 module is based on STM S2-LP transceiver and STM ultra-low-power 32-bit MCU.

KEY FEATURES

- Sub-GHz communication
- MCU: 32-bit ARM® Cortex®-M0+ core
- Flash memory: up-to 192kB program memory
- RAM: 20 kB data memory
- Supply Voltage: +1.8 V to +3.6 V single power supply
- Operating Temperature Range: -20 °C to +85 °C
- Dimensions: 12.0 x 18.0 x 2.6 mm

1. Feature List

MCU

- 32-bit ARM® Cortex®-M0+ core with MPU
- From 32 kHz up to 32 MHz clock speed
- 0.95 DMIPS/MHz
- Up to 192-Kbyte Flash memory / 20 -Kbyte RAM / 6 Kbytes of data EEPROM with ECC
- 0.29 µA Standby mode (3 wakeup pins)
- 0.86 µA Stop mode + RTC + 20-Kbyte RAM retention
- Down to 93 µA/MHz in Run mode

ANALOG PERIPHERALS

- 12-bit ADC 1.14 Msps up to 7 channels
- 2x ultra-low-power comparators

DIGITAL PERIPHERALS

- 3x USART (2 with ISO 7816, IrDA), 1x UART (low power)
- 1x I2C (2 with SMBus/PMBus)
- 11x timers

ENVIRONMENTAL & REGULATORY

- Operating Temperature: -20 to +85°C
- CE Certified

DIMESIONS

- RM-SS2-P: 12.0 x 18.0 x 2.6 mm
- RM-SS2-U: 12.0 x 21.0 x 2.6 mm

RADIO FEATURES

- Frequency bands
  - 413-479 MHz (S2-LPQTR)
  - 452-527 MHz (S2-LPCBQTR)
  - 826-958 MHz (S2-LPQTR)
  - 904-1055 MHz (S2-LPCBQTR)
- Modulation schemes
  - 2(G)FSK, 4(G)FSK
  - OOK, ASK
- Air data rate from 0.1 to 500 kbps
- Ultra-low power consumption
  - 7 mA RX
  - 10 mA TX @ +10 dBm
- Excellent performance of receiver sensitivity: down to -130 dBm
- Excellent receiver selectivity and blocking
- Programmable RF output power up to +16 dBm

2. Ordering Information

Table 1 – Ordering information.

Product Code	Antenna	Flash	Data EEPROM	RAM	RF XTAL
RM-SS2-P1B	RF pad	128 kB	6 kB	20 kB	Standard XTAL
RM-SS2-P1Z	RF pad	192 kB	6 kB	20 kB	Standard XTAL
RM-SS2-U1B	u.FL connector	128 kB	6 kB	20 kB	Standard XTAL
RM-SS2-U1Z	u.FL connector	192 kB	6 kB	20 kB	Standard XTAL
RM-SS2-P2B	RF pad	128 kB	6 kB	20 kB	TCXO
RM-SS2-U2Z	RF pad	192 kB	6 kB	20 kB	TCXO
RM-SS2-P2B	u.FL connector	128 kB	6 kB	20 kB	TCXO
RM-SS2-U2Z	u.FL connector	192 kB	6 kB	20 kB	TCXO

Outline

3. System Overview

The RM-SS2 is a sub-GHz radio module targeted for sensor node applications where proven reliability, highly flexible network and low-power performance are key requirements.

The RM-SS2 module is based on STMicroelectronics S2-LP transceiver and ultra-low-power 32-bit host MCU. The module is principally designed for the ISM (Industrial, Scientific and Medical) and SRD (Short Radio Device) frequency bands, ranging from 868 to 930 MHz. Module features top-notch RF performances and unparalleled energy efficiency extending battery life from months to more than 10 years.

RM-SS2 module is ready for SIGFOX, Wireless M-Bus and IEEE 802.15.4g networking connectivity, simplifying the design of IoT applications and enabling remote sensors to directly connect to the Cloud without a local gateway.

Module key applications include smart metering, smart home and smart city, home energy management systems, industrial monitoring and control, smart parking and asset tracking devices.

3.1. Module versions

In order to provide designer with maximum integration flexibility, RM-SS2 module is available in two variants, with different antenna options. RM-SS2-P variant features a 50 ohm RF pad whereas RM-SS2-U module option includes an u.FL RF connector.

RM-SS2-P

RM-SS2-U

3.2. Block diagram

Module basic block diagram is depicted in the image below. RM-SS2 is built on S2-LP ultra-low-power, high-performance, sub-1GHz RF transceiver from STMicroelectronics.

S2-LP chip is managed by means of STM32L0 low-power MCU. The 32-bit ARM® Cortex®-M0+ microcontroller has plenty of room to host both networking stacks and custom application code. STM32 host MCU ports and peripherals are routed to the module pins, providing designer with access to microcontroller main functionalities, including UARTs, I2C bus, analog peripherals and general purpose IOs.

The module architecture includes crystals for both accurate RF frequency synthesis and low-power module management.

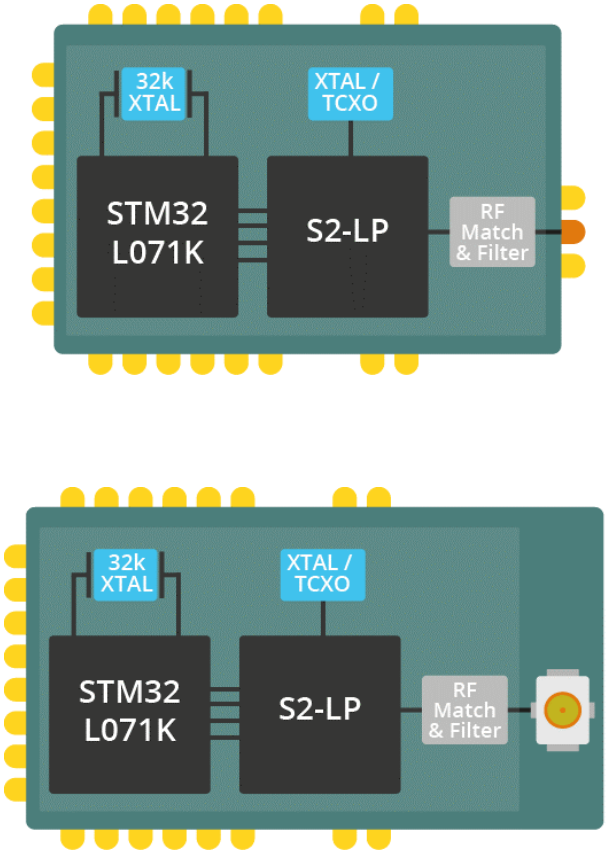

Figure 1 - Module block diagrams (RM-SS2-P and RM-SS2-U, respectively).

4. Module Specifications

4.1. General specifications

The following table describes the general specifications for the devices.

Table 2 – RM-SS2 module general specifications.

Specification	RM-SS2-P	RM-SS2-U
Operating frequency bands	868 ÷ 930 MHz	
Form factor	Surface mount	
Dimensions	12.0 x 18.0 x 2.6 mm	12.0 x 21.0 x 2.6 mm
Operating temperature range	-40 to +105 °C	-40 to +105 °C
Antenna	RF pad	u.FL connector

4.2. Electrical specifications

The following tables give detailed specifications for the RN-SS2 module series. T_{amb} = 25 °C for all specifications given, if not differently specified.

4.2.1 Nominal Operating Conditions

Table 3 – RM-SS2 module electrical specifications.

Parameter	Min	Typ	Max	Units	Condition/Notes
Operating Temperature	-20		+85	°C	
Supply Voltage (VDD_MCU, VDD_RF, VDD_UM)	1.8	3.3	3.6	V	

4.2.2 Absolute Maximum Ratings

Table 4 – RM-SS2 module absolute maximum ratings.

Parameter	Min	Max	Units
Supply Voltage (VDD_MCU, VDD_RF, VDD_UM)	-0.3	3.9	V

Storage Temperature	-40	+105	°C
Operating Temperature	-40	+105	°C
ESD (Human Body Model)		2000	V

Stresses beyond those listed in this table may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions beyond those indicated in the operating conditions of the specification is not implied. Exposure to the absolute maximum rating conditions for extended periods may affect device reliability.

5. Connection Diagrams

Connect RM-SS2 module according to the following guidelines:

- place 100 nF decoupling capacitors between VDD bus (i.e. VDD_MCU, VDD_UM, VDD_RF) and GND;
- place an impedance matching network between RF output pin and RF antenna.

6. Layout Guidelines

6.1. Recommended placement on the application PCB

6.1.1 RM-SS2

For optimal performance of the RM-SS2 module with RF pin output, please follow these guidelines:

- place an impedance matching network (e.g. pi network) between RF output pin and RF antenna;
- connect all ground pads directly to a solid ground plane;
- place ground vias as close to the ground pads as possible.

7. Pin Definitions

7.1. Pin Numbering

7.1.1 RM-SS2-P

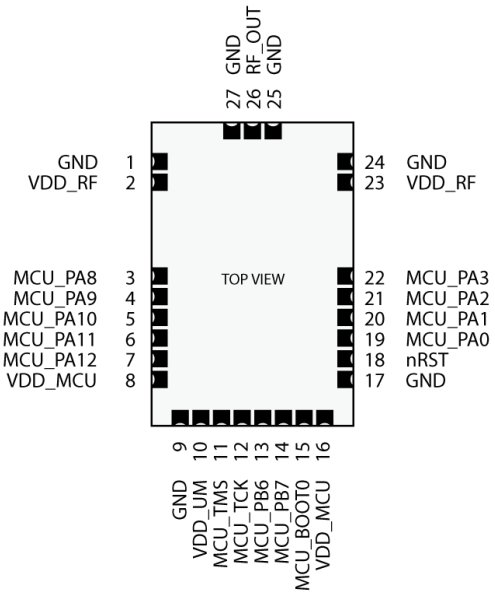

Figure 2 – RM-SS2-P pinout

7.1.2 RM-SS2-U

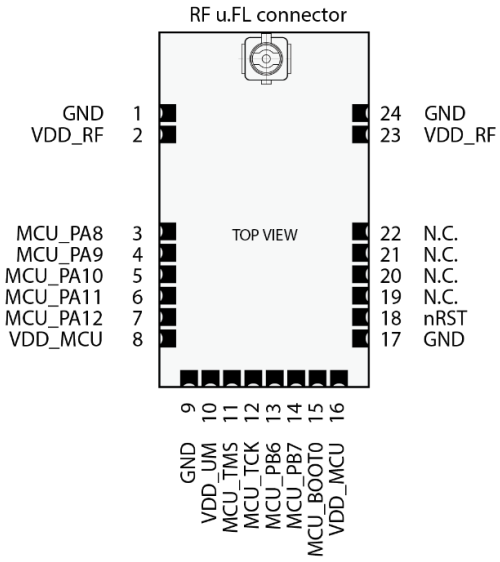

Figure 3 - RM-SS2-U pinout.

7.2. Pin Description

Device pinout is detailed in the table below. Several STM32L071 host MCU ports and peripherals are routed to the module pins, providing designer with access to microcontroller main functionalities (see "MCU Pin #" column).

Table 5 - RM-SS2-x module pin connections and descriptions.

Pin #	Pin Name	Type	Description	MCU Pin #
1	GND	GND	Ground Connection	4-16-31
2	VDD_RF	Power Supply	Power Supply Input (1.8 V ÷ 3.6 V)	---
3	MCU_PA8	Digital I/O	GPIO / USART1_CK	18
4	MCU_PA9	Digital I/O	GPIO / USART1_TX / I2C1_SCL	19
5	MCU_PA10	Digital I/O	GPIO / USART1_RX / I2C1_SDA	20
6	MCU_PA11	Digital I/O	GPIO / SPI1_MISO / USART1_CTS	21
7	MCU_PA12	Digital I/O	GPIO / SPI1_MOSI / USART1_RTS	22
8	VDD_MCU	Power Supply	Power Supply Input (1.8 V ÷ 3.6 V)	5-17-32
9	GND	GND	Ground Connection	4-16-31
10	VDD_UM	Power Supply	Power Supply Input (1.8 V ÷ 3.6 V)	24
11	MCU_TMS	Debug TMS	Debug TMS Port – SWDIO	23
12	MCU_TCK	Debug TCK	Debug TCK Port – SWDCK	25
13	MCU_PB6	Digital I/O	GPIO / USART1_TX / I2C1_SCL	28
14	MCU_PB7	Digital I/O	GPIO / USART1_RX / I2C1_SDA	29
15	MCU_BOOT0	Boot Config		30
16	VDD_MCU	Power Supply	Power Supply Input (1.8 V ÷ 3.6 V)	5-17-32
17	GND	GND	Ground Connection	4-16-31
18	nRST	Reset	Module Reset, Active Low	3
19	MCU_PA0	Digital I/O	GPIO / USART4_TX	6
20	MCU_PA1	Digital I/O	GPIO / USART4_RX	7
21	MCU_PA2	Digital I/O	GPIO / USART2_TX	8
22	MCU_PA3	Digital I/O	GPIO / USART2_RX	9
23	VDD_RF	Power Supply	Power Supply Input (1.8 V ÷ 3.6 V)	---

24	GND	GND	Ground Connection	4-16-31
25[1]	GND	GND	Ground Connection	4-16-31
26	RF_OUT	RF Pin	RF Output Pin	---
27	GND	GND	Ground Connection	4-16-31

[1] Module pins 25÷27 available on RM-SS2-P variant only.

8. Package Specifications

8.1. Module dimensions

8.1.1 RM-SS2-P

The figure below shows the RM-SS2-P module dimensions.

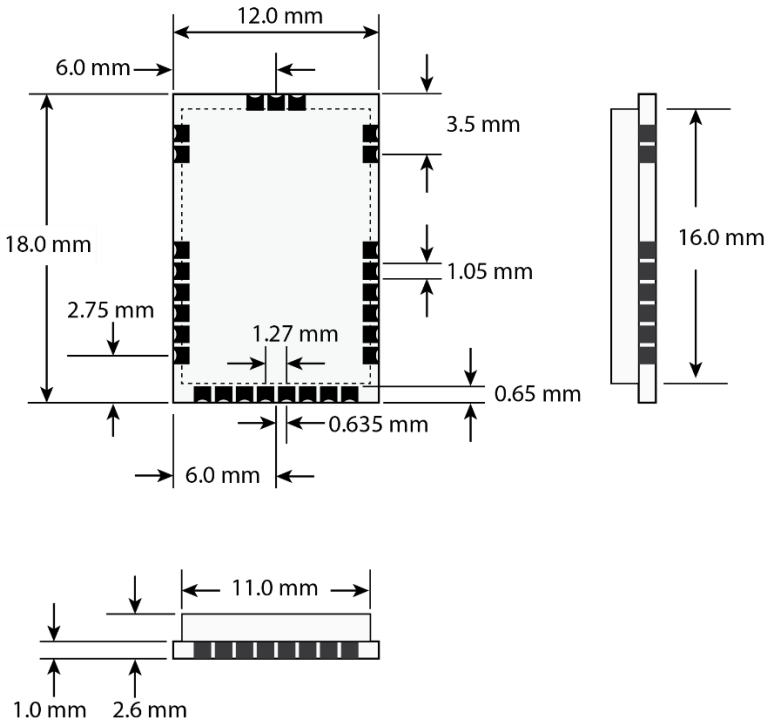

Figure 4 - RM-SS2-P module dimensions.

8.1.2 RM-SS2-U

The figure below shows the RM-SS2-U module dimensions.

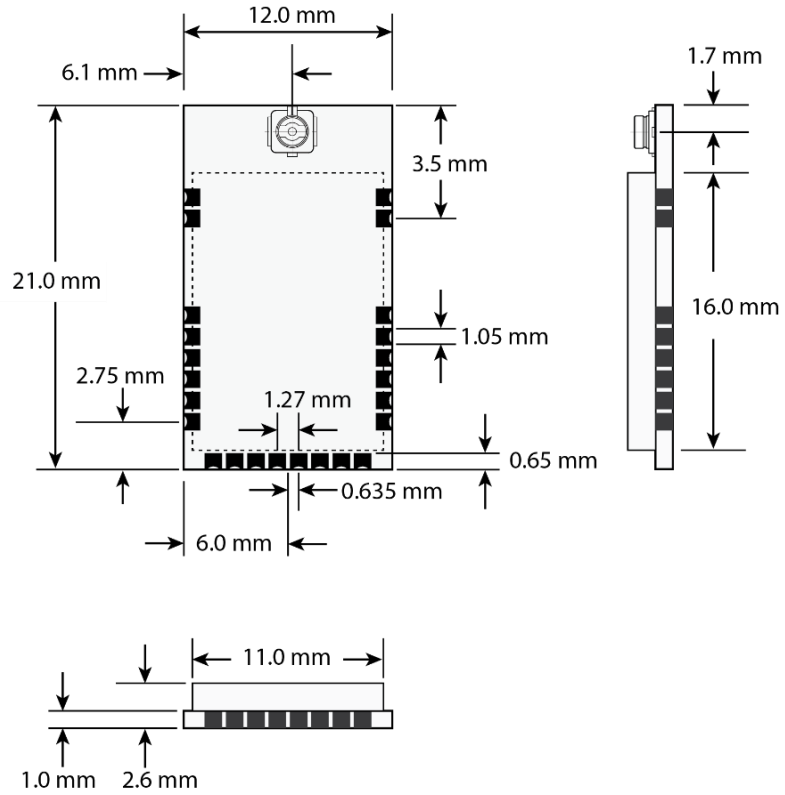

Figure 5 - RM-SS2-U module dimensions.

8.2. Module land pattern

8.2.1 RM-SS2-P

The figure below shows the RM-SS2-P module recommended land pattern.

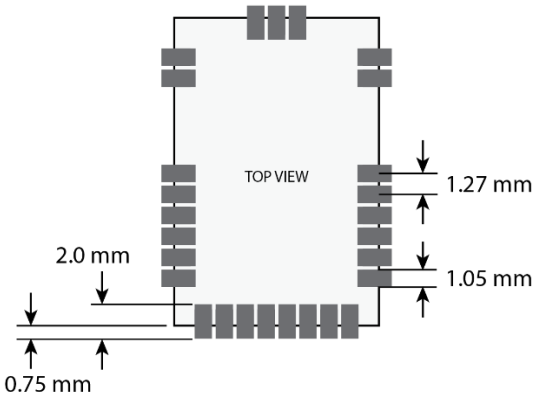

Figure 6 - RM-SS2-P suggested footprint.

8.2.2 RM-SS2-U

The figure below shows the RM-SS2-U module recommended land pattern.

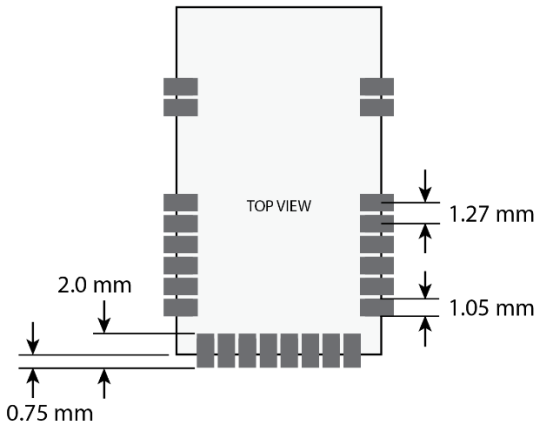

Figure 7 - RM-SS2-U suggested footprint.

References

[1] STMicroelectronics, “S2-LP – Datasheet”, DS11896 – Rev 6.

[2] STMicroelectronics, “STM32L071x8 STM32L071xB STM32L071xZ Datasheet”, DS10690 – Rev 7.

Revision History

REVISION	DATE	STATUS / COMMENTS	AUTHOR
1.0	15/06/2020	Initial release	AR
1.1	27/10/2021	Minor updates	AR

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