RF-SM-1077B2 Ultra-Low-Power 433 MHz & 470 MHz Wireless Module

Version 1.0

Shenzhen RF-star Technology Co., Ltd.

May 15th, 2020

TI CC13XX Sub-1 GHz Module List

Chipset	Core	FLASH (KB)	RAM (KB)	Model	Antenna	Freq. (MHz)	Dimension (mm)	TX Power (dBm)	Range (M)	Photo
CC1310 F128RGZ	M3	128	8	RF-SM-1077B1	IPEX	868 915	18 × 26	14	2500	
				RF-SM-1077B2	IPEX	433 470	18 × 26	15	2500	
CC1310 F128RSM	M3	128	8	RF-SM-1044B1	PCB	868 915	14 × 22	14	2500	
				RF-SM-1044B2	PCB	868 915	9 × 12.5	14	2500	
				RF-SM-1044B4	Half-hole	868 915	14 × 22	14	2500	
CC1352R	M4F	352	80	RF-TI1352B1	IPEX	868 915	16.8 × 26.5	5	BLE: 500	
								5	ZigBee: 300	
								14	868 MHz: 1500	
CC1352P	M4F	352	80	RF-TI1352P1	Half-hole	868 915	16.4 × 25	20	BLE 1M: 350	
								20	BLE Long Range: 2200	
								20	ZigBee: 1100	
								20	868 MHz: 2500	

Note:

1. The communication distance is the longest distance obtained by testing the module's maximum transmission power in an open and interference-free environment in sunny weather.
2. Click the picture to buy modules.

1 Device Overview

1.1 Description

RF-SM-1077B2 Sub-1 GHz module is based on TI CC1310, which combines a flexible, very low-power RF transceiver with a powerful 48 MHz ARM® Cortex®-M3 microcontroller supporting multiple physical layers and RF standards and a dedicated radio controller Cortex®-M0 handling RF protocol commands that are stored in ROM or RAM. RF-SM-1077B2 integrates a 24.0 MHz crystal, a balun, a band pass filter, an antenna matching and an IPEX antenna matching which make the module low cost, low power consumption and long wireless communication in Sub-1 GHz.

1.2 Key Features

- Microcontroller
  - Powerful ARM® Cortex®-M3 processor
  - EEMBC CoreMark® Score: 142
  - EEMBC ULPBench™ score: 158
  - Clock speed up to 48 MHz
  - 128 KB of in-system programmable flash
  - 8 KB of SRAM for Cache (or as general-purpose RAM)
  - 20 KB of ultra-low-leakage SRAM
  - 2-pin cJTAG and JTAG debugging
  - Supports over-the-air (OTA) update
- On-Chip Internal DC/DC Converter
- Ultra-Low-Power Sensor Controller
  - Can run autonomously from the rest of the
  - System
  - 16-bit architecture
  - 2 KB of ultra-low-leakage SRAM for code and data
- RF-Section
  - Excellent receiver sensitivity: –124 dBm @ long-range mode, –110 dBm @ 50 kbps
  - Excellent selectivity (±100 kHz): 56 dB
  - Excellent blocking performance (±10 MHz): 90 dB
  - Programmable output power up to +15 dBm
  - Differential RF interface
  - Suitable for systems targeting compliance with worldwide radio frequency regulations
    - ➢ ETSI EN 300 220, EN 303 204 (Europe)
    - ➢ FCC CFR47 Part 15 (US)
    - ➢ ARIB STD-T108 (Japan)
  - Wireless M-Bus (EN 13757-4) and IEEE® 802.15.4g PHY
- Peripherals
  - All digital peripheral pins can be routed to any GPIO
  - Four general-purpose timer modules (eight 16-bit or four 32-bit timers, PWM each)
  - 12-bit ADC, 200 ksamples/s, 8-channel analog MUX
  - Continuous time comparator
  - Ultra-low-power clocked comparator
  - Programmable current source
  - UART
  - 2× SSI (SPI, MICROWIRE, TI)
  - I^2C, I^2S
  - Real-time clock (RTC)
  - AES-128 security module
  - True random number generator (TRNG)
  - Support for eight capacitive sensing buttons
  - Integrated temperature sensor
- Low Power
  - Wide supply voltage range: 1.8 V to 3.8 V
  - RX: 5.4 mA
  - TX at +10 dBm: 13.4 mA
  - Active-mode MCU 48 MHz running Coremark: 2.5 mA (51 µA/MHz)
  - Active-mode MCU: 48.5 CoreMark/mA

- Active-mode sensor controller at 24 MHz: 0.4 mA + 8.2 µA/MHz
- Sensor controller, one wake-up every second performing one 12-bit ADC sampling: 0.95 µA
- Standby: 0.7 µA (RTC running and RAM and CPU retention)
- Shutdown: 185 nA (wakeup on external events)

1.3 Applications

- 433-, 470-MHz ISM and SRD systems
- Low-power wireless systems with 50-kHz to 5-MHz channel spacing
- Home and building automation
- Wireless alarm and security systems
- Industrial Monitoring and Control
- Smart grid and automatic meter reading
- Wireless healthcare applications
- Wireless sensor networks
- Active RFID
- IEEE 802.15.4g, IP-enabled smart objects (6LoWPAN), wireless M-Bus, KNX systems, Wi-SUN™, and proprietary systems
- Energy-harvesting applications
- Electronic shelf label (ESL)
- Long-range sensor applications
- Heat-cost allocators

1.4 Functional Block Diagram

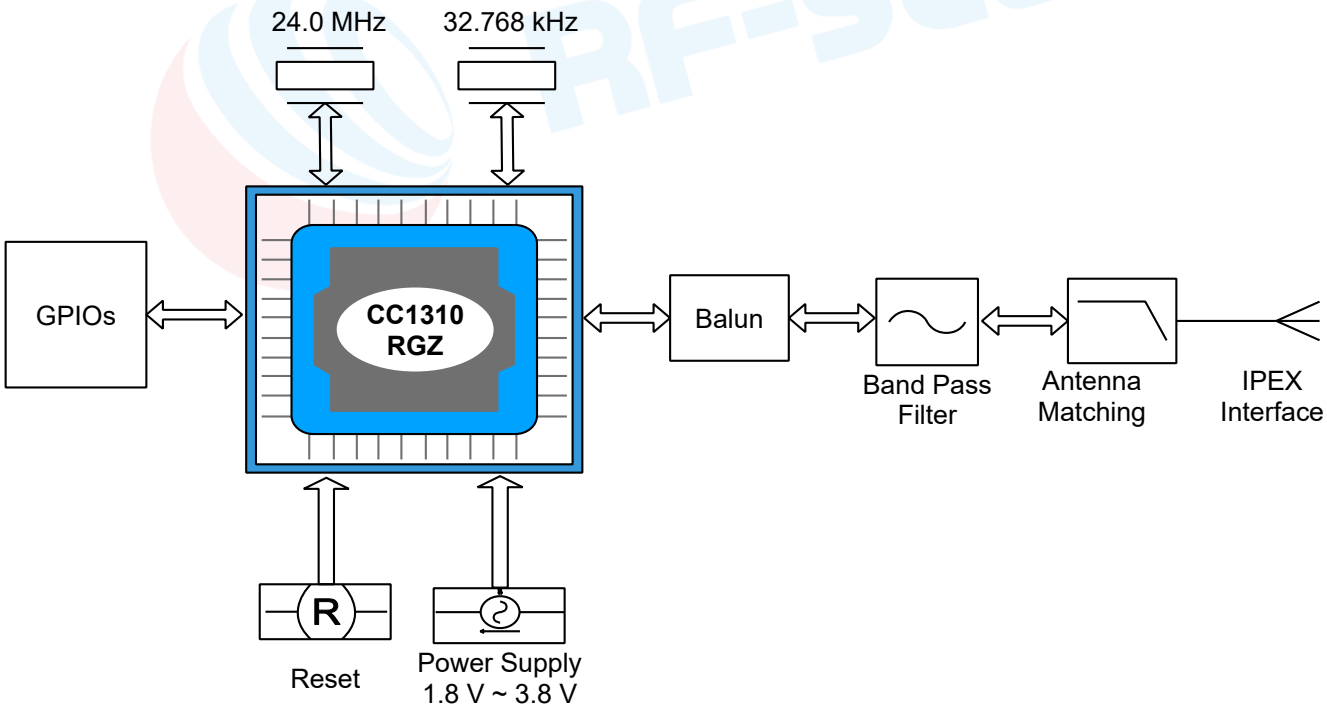

Figure 1. Functional Block Diagram of RF-SM-1077B2

1.5 Working Mode

Figure 2. Working Mode of RF-SM-1077B2

1.6 Part Number Conventions

The part numbers are of the form of RF-SM-1077B2 where the fields are defined as follows:

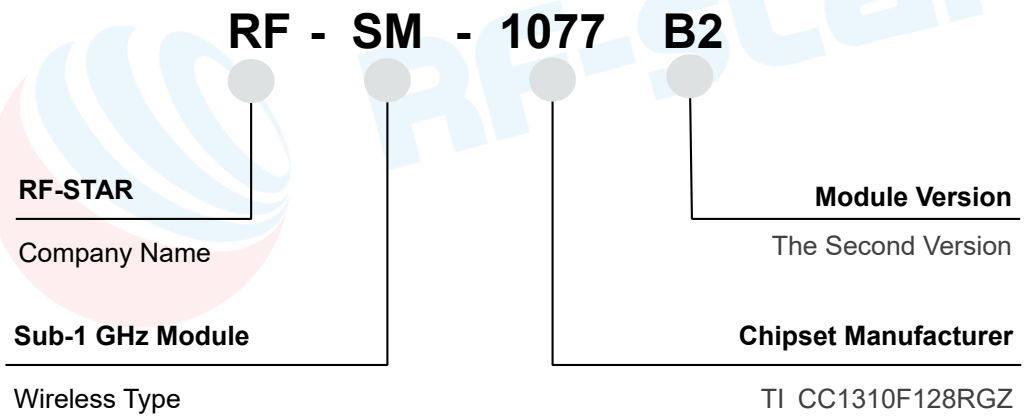

Figure 3. Part Number Conventions of RF-SM-1077B2

Table of Contents

TI CC13XX Sub-1 GHz Module List 1
1 Device Overview 2
1.1 Description 2
1.2 Key Features 2
1.3 Applications 3
1.4 Functional Block Diagram 3
1.5 Working Mode 4
1.6 Part Number Conventions 4
Table of Contents 5
Table of Figures 6
Table of Tables 7
2 Module Configuration and Functions 8
2.1 Module Parameters 8
2.2 Module Pin Diagram 9
2.3 Pin Functions 9
3 Specifications 11
3.1 Recommended Operating Conditions 11
3.2 Handling Ratings 11
3.3 Power Consumption 11
3.3.1 Current Consumption 11
3.3.2 Power Consumption Test 13
4 Application, Implementation, and Layout 14
4.1 Module Photos 14
4.2 Recommended PCB Footprint 14
4.3 Antenna 15
4.4 Schematic Diagram 16
4.5 Basic Operation of Hardware Design 16
4.6 Trouble Shooting 17
4.6.1 Unsatisfactory Transmission Distance 17
4.6.2 Vulnerable Module 17

4.6.3 High Bit Error Rate 18
4.7 Electrostatics Discharge Warnings 18
4.8 Soldering and Reflow Condition 18
4.9 Optional Packaging 19
5 Certification 20
5.1 Reach 20
5.2 RoHS 20
6 Revision History 21
7 Contact Us 22

Table of Figures

Figure 1. Functional Block Diagram of RF-SM-1077B2 3
Figure 2. Working Mode of RF-SM-1077B2 4
Figure 3. Part Number Conventions of RF-SM-1077B2 4
Figure 4. Pin Diagram of RF-SM-1077B2 9
Figure 5. Photos of RF-SM-1077B2 14
Figure 6. Recommended PCB Footprint of RF-SM-1077B2 (mm) 14
Figure 7. Specification of Antenna Seat 15
Figure 8. Specification of IPEX Wire 15
Figure 9. Schematic Diagram of RF-SM-1077B2 16
Figure 10. Recommended Reflow for Lead Free Solder 19
Figure 11. Optional Packaging Mode 19
Figure 12. SRRC Certificate 20
Figure 13. RoHS Certificate 20

Table of Tables

Table 1. Parameters of RF-SM-1077B2 8
Table 2. Pin Functions of RF-SM-1077B2 9
Table 3. Recommended Operating Conditions of RF-SM-1077B2 11
Table 4. Handling Ratings of RF-SM-1077B2 11
Table 5. Current Consumption of RF-SM-1077B2 11
Table 6. Power Consumption of RF-SM-1077B2 13
Table 7. Temperature Table of Soldering and Reflow 18

2 Module Configuration and Functions

2.1 Module Parameters

Table 1. Parameters of RF-SM-1077B2

Chipset	CC1310F128RGZ
Supply Power Voltage	1.8 V ~ 3.8 V, recommended to 3.3 V
Frequency	433 MHz, 470 MHz
Maximum Transmit Power	+15.0 dBm
Receiving Sensitivity	-124.0 dBm (@long range mode) -110.0 dBm (@50 kpbs)
GPIO	30
Crystal	24 MHz, 32.768 kHz
RAM	20 KB
Flash	128 KB
Package	SMT Packaging
Frequency Error	±20 kHz
Dimension	26.0 mm x 18.0 mm x (2.3 ± 0.1) mm
Type of Antenna	IPEX interface
Operating Temperature	-40 ℃ ~ +85 ℃
Storage Temperature	-40 ℃ ~ +125 ℃

2.2 Module Pin Diagram

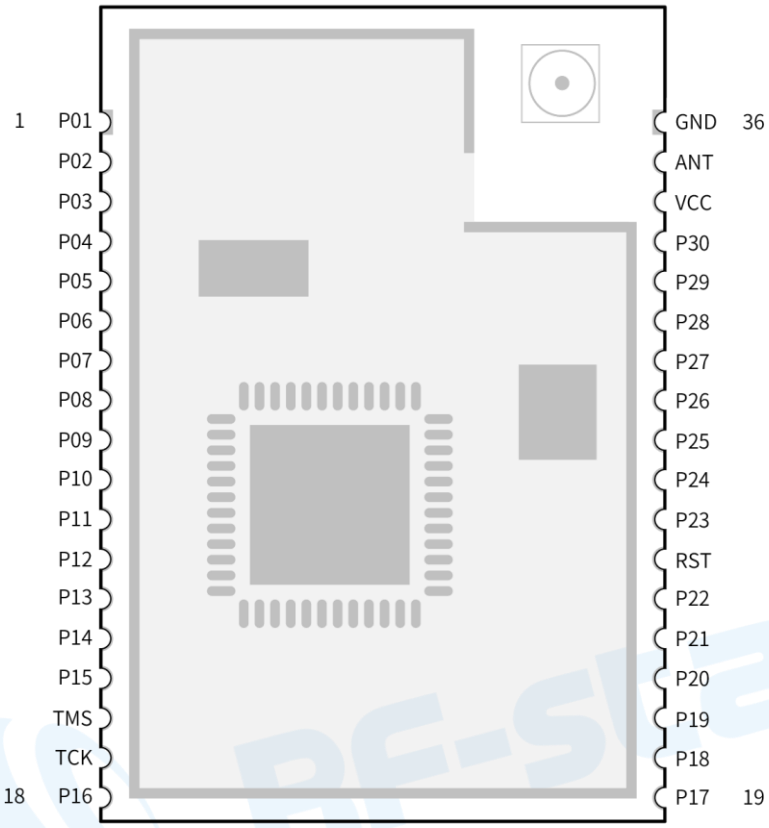

Figure 4. Pin Diagram of RF-SM-1077B2

2.3 Pin Functions

Table 2. Pin Functions of RF-SM-1077B2

Pin	Name	Chip Pin	Pin Type	Description
1	P01	DIO_1	Digital I/O	GPIO, Sensor Controller
2	P02	DIO_2	Digital I/O	GPIO, Sensor Controller
3	P03	DIO_3	Digital I/O	GPIO, Sensor Controller
4	P04	DIO_4	Digital I/O	GPIO, Sensor Controller
5	P05	DIO_5	Digital I/O	GPIO, Sensor Controller
6	P06	DIO_6	Digital I/O	GPIO, Sensor Controller
7	P07	DIO_7	Digital I/O	GPIO, Sensor Controller
8	P08	DIO_8	Digital I/O	GPIO
9	P09	DIO_9	Digital I/O	GPIO

10	P10	DIO_10	Digital I/O	GPIO
11	P11	DIO_11	Digital I/O	GPIO
12	P12	DIO_12	Digital I/O	GPIO
13	P13	DIO_13	Digital I/O	GPIO
14	P14	DIO_14	Digital I/O	GPIO
15	P15	DIO_15	Digital I/O	GPIO
16	TMS	JTAG_TMSC	-	JTAG TMS
17	TCK	JTAG_TCKC	-	JTAG TCK
18	P16	DIO_16	Digital I/O	JTAG TDO
19	P17	DIO_17	Digital I/O	JTAG TDI
20	P18	DIO_18	Digital I/O	GPIO
21	P19	DIO_19	Digital I/O	GPIO
22	P20	DIO_20	Digital I/O	GPIO
23	P21	DIO_21	Digital I/O	GPIO
24	P22	DIO_22	Digital I/O	GPIO
25	RESET	RESET_N	-	Reset, active low. No internal pullup.
26	P23/ADC0	DIO_23	Digital or analog I/O	GPIO, Sensor Controller, analog
27	P24/ADC1	DIO_24	Digital or analog I/O	GPIO, Sensor Controller, analog
28	P25	DIO_25	Digital or analog I/O	GPIO, Sensor Controller, analog
29	P26	DIO_26	Digital or analog I/O	GPIO, Sensor Controller, analog
30	P27	DIO_27	Digital or analog I/O	GPIO, Sensor Controller, analog
31	P28	DIO_28	Digital or analog I/O	GPIO, Sensor Controller, analog
32	P29	DIO_29	Digital or analog I/O	GPIO, Sensor Controller, analog
33	P30	DIO_30	Digital or analog I/O	GPIO, Sensor Controller, analog
34	VCC	VCC	-	1.8 V ~ 3.8 V, recommended to 3.3 V
35	ANT	-	-	External antenna pin
36	GND	GND	-	Ground

3 Specifications

3.1 Recommended Operating Conditions

Functional operation does not guarantee performance beyond the limits of the conditional parameter values in the table below. Long-term work beyond this limit will affect the reliability of the module more or less.

Table 3. Recommended Operating Conditions of RF-SM-1077B2

Items	Condition	Min.	Typ.	Max.	Unit
Operating Supply Voltage	Battery Mode	1.8	3.3	3.8	V
Operating Temperature	/	-40	+25	+85	℃
Environmental Hot Pendulum	/	-20		+20	℃/min

3.2 Handling Ratings

Table 4. Handling Ratings of RF-SM-1077B2

Items	Condition	Min.	Typ.	Max.	Unit
Storage Temperature	Tstg	-40	+25	+125	℃
Human Body Model	HBM		±3000		V
Moisture Sensitivity Level			2		
Charged Device Model			±500		V

3.3 Power Consumption

3.3.1 Current Consumption

The current consumption characteristics of this module are categorized into different running modes. The overall product level current consumption is averaged over time on different power modes the device runs on. The peripheral circuitry's current consumption also adds in.

Table 5. Current Consumption of RF-SM-1077B2

Parameter		Test Conditions	Min.	Typ.	Max	Unit
Core Current Consumption						
I_{core}	Core current consumption	Reset. RESET_N pin asserted or VDDS below power-on-reset (POR) threshold		100		nA
		Shutdown. No clocks running, no retention		185		nA
		Standby. With RTC, CPU, RAM and (partial)		0.7		μA

		register retention. RCOSC_LF				
		Standby. With RTC, CPU, RAM and (partial) register retention. XOSC_LF		0.8		µA
		Idle. Supply Systems and RAM powered.		570		µA
		Active. MCU running CoreMark at 48 MHz		1.2 mA + 25.5 µA/MHz		
		Active. MCU running CoreMark at 48 MHz		2.5		mA
		Active. MCU running CoreMark at 24 MHz		1.9		mA
		Radio RX, 868 MHz		5.5		mA
		Radio TX, 10-dBm output power, (G)FSK, 868 MHz		13.4		mA
		Radio TX, OOK modulation, 10-dBm output power, AVG		11.2		mA
		Radio TX, boost mode (VDDR = 1.95 V), 14-dBm output power, (G)FSK, 868 MHz		23.5		mA
		Radio TX, OOK modulation, boost mode (VDDR = 1.95 V), 14 dBm, AVG		14.8		mA
		Radio TX, boost mode (VDDR = 1.95 V), 15-dBm output power, (G)FSK, measured on RF-SM-1077B2, 433.92 MHz		25.1		mA
		Radio TX, 10-dBm output power, measured on RF-SM-1077B2, 433.92 MHz		13.2		mA
Peripheral Current Consumption (Adds to core current I_{core} for each peripheral unit activated) (1) (2) (3)						
I_{peri}	Peripheral power domain	Delta current with domain enabled		20		µA
	Serial power domain	Delta current with domain enabled		13		µA
	RF Core	Delta current with power domain enabled, clock enabled, RF core idle		237		µA
	µDMA	Delta current with clock enabled, module idle		130		µA

	Timers	Delta current with clock enabled, module idle		113		μA
	I^2C	Delta current with clock enabled, module idle		12		μA
	I^2S	Delta current with clock enabled, module idle		36		μA
	SSI	Delta current with clock enabled, module idle		93		μA
	UART	Delta current with clock enabled, module idle		164		μA

Note:

(1) Adds to core current I_{core} for each peripheral unit activated.

(2) I_{peri} is not supported in standby or shutdown modes.

(3) Measured at 3.0 V.

3.3.2 Power Consumption Test

Table 6. Power Consumption of RF-SM-1077B2

Mode	Min. Current	Max. Current	Average Current	Samples
Idle	1.29 mA	1.32 mA	1.31 mA	5000
Standby	68 nA	69.2 μA	980 nA	5000
Shutdown	52 nA	88 nA	79 nA	5000
RF-RX	5.2 mA	5.7 mA	5.4 mA	5000
RF-TX	-	25.2 mA (15 dBm)	-	-

Note:

Test conditions: battery power supply: 2.88 V. Test instrument: RIGOL DM3068 digital multimeter.

Data of RF-TX only provide peak value as a reference, the average power is proportional to the frequency of data transmission.

4 Application, Implementation, and Layout

4.1 Module Photos

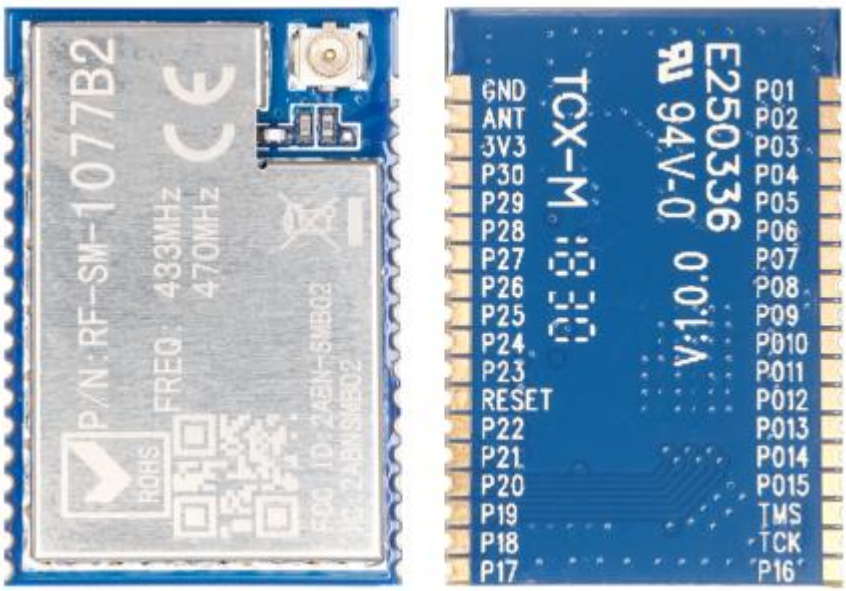

Figure 5. Photos of RF-SM-1077B2

4.2 Recommended PCB Footprint

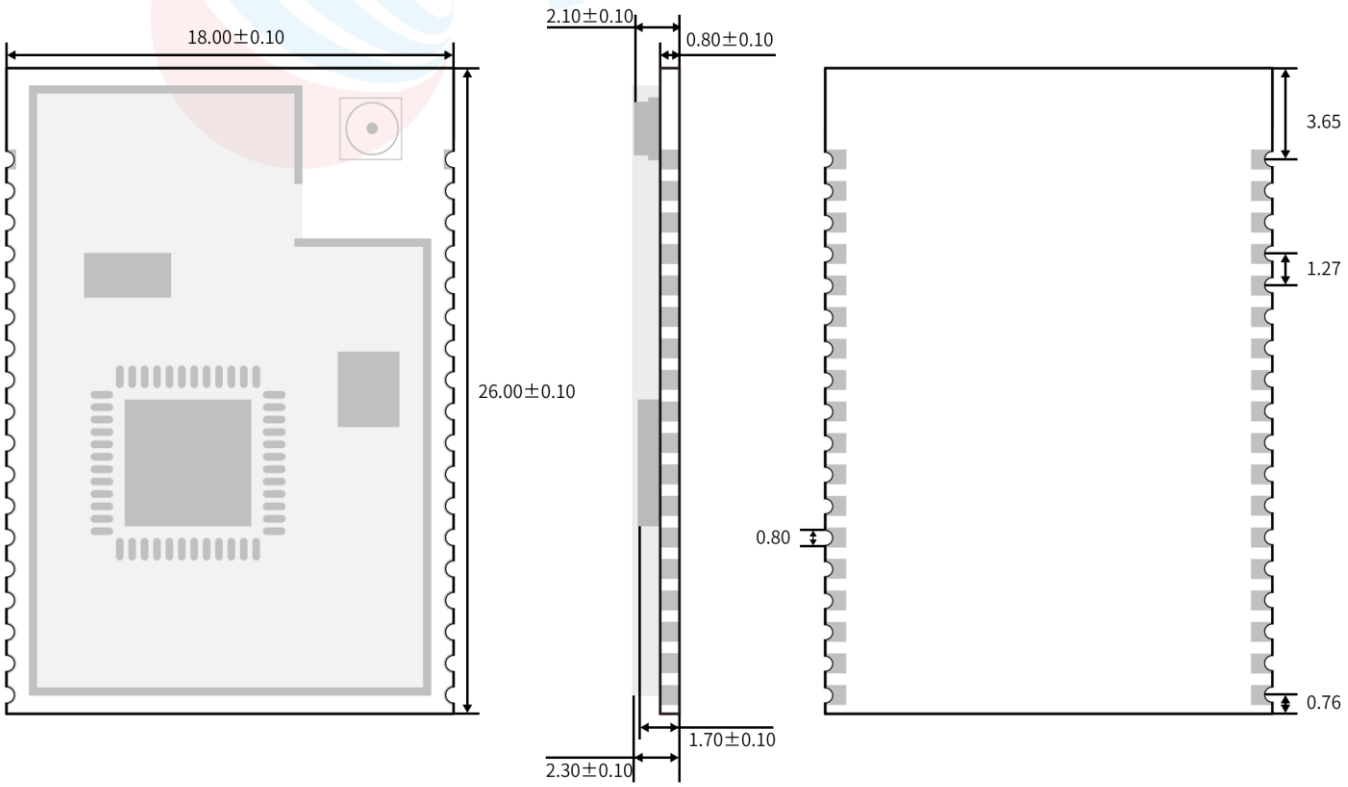

Figure 6. Recommended PCB Footprint of RF-SM-1077B2 (mm)

4.3 Antenna

RF-SM-1077B2 module is integrated the IPEX version 1 antenna seat, the specification of antenna seat is as follow:

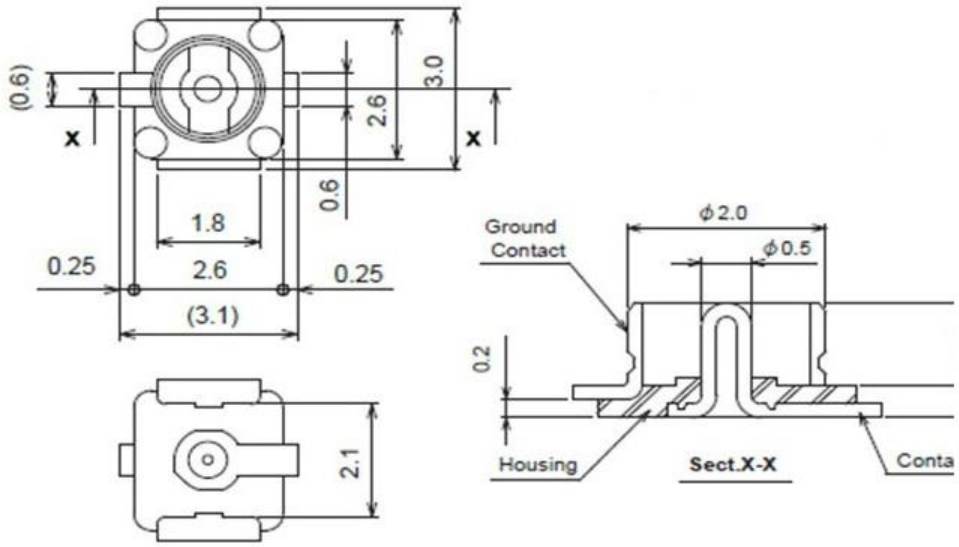

Figure 7. Specification of Antenna Seat

The specification of IPEX wire end is as follow:

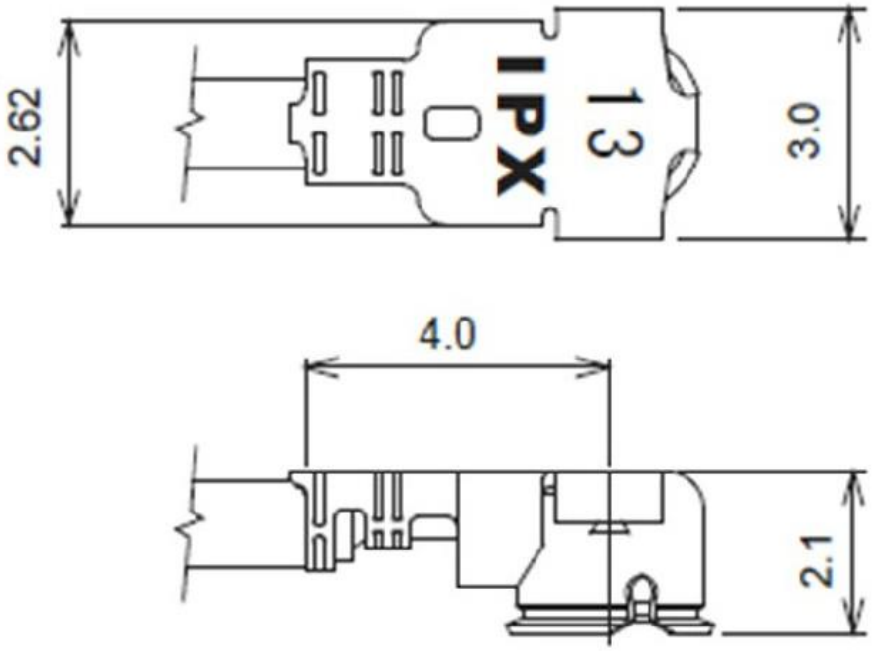

Figure 8. Specification of IPEX Wire

4.4 Schematic Diagram

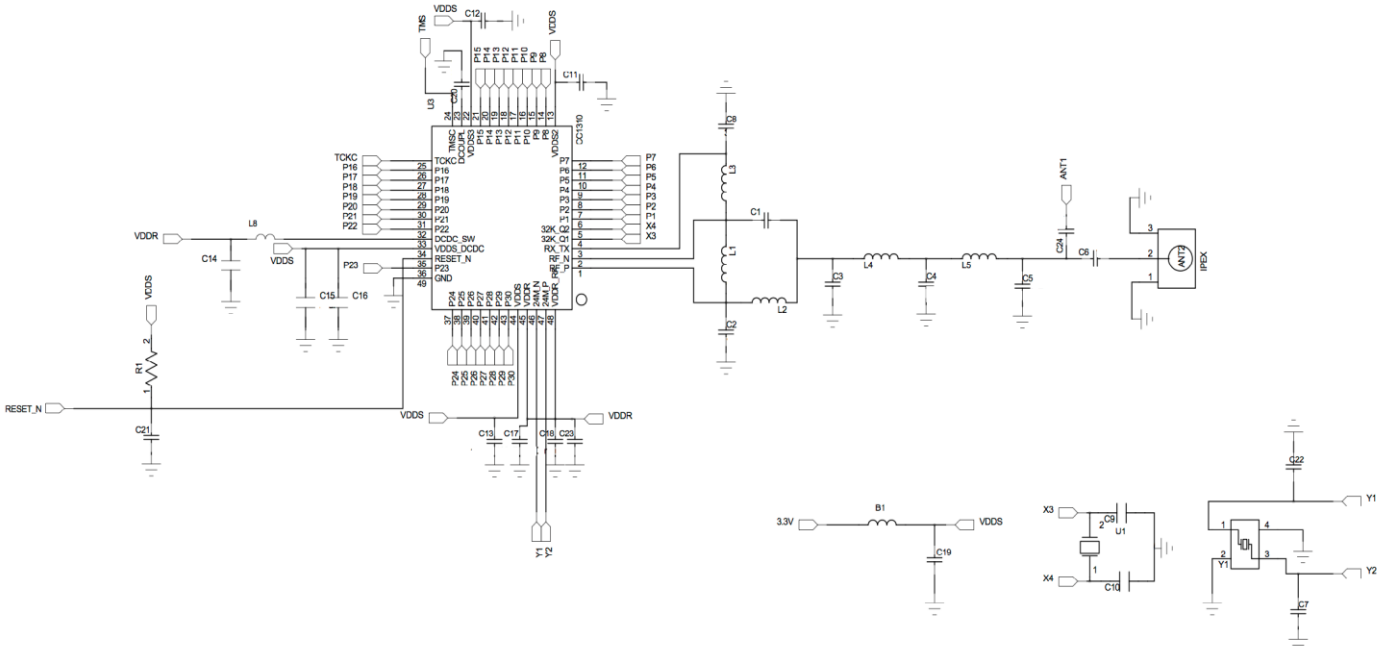

Figure 9. Schematic Diagram of RF-SM-1077B2

4.5 Basic Operation of Hardware Design

1. It is recommended to offer the module with a DC stabilized power supply, a tiny power supply ripple coefficient and the reliable ground. Please pay attention to the correct connection between the positive and negative poles of the power supply. Otherwise, the reverse connection may cause permanent damage to the module;
2. Please ensure the supply voltage is between the recommended values. The module will be permanently damaged if the voltage exceeds the maximum value. Please ensure the stable power supply and no frequently fluctuated voltage.
3. When designing the power supply circuit for the module, it is recommended to reserve more than 30% of the margin, which is beneficial to the long-term stable operation of the whole machine. The module should be far away from the power electromagnetic, transformer, high-frequency wiring and other parts with large electromagnetic interference.
4. The bottom of module should avoid high-frequency digital routing, high-frequency analog routing and power routing. If it has to route the wire on the bottom of module, for example, it is assumed that the module is soldered to the Top Layer, the copper must be spread on the connection part of the top layer and the module, and be close to the digital part of module and routed in the Bottom Layer (all copper is well grounded).
5. Assuming that the module is soldered or placed in the Top Layer, it is also wrong to randomly route the Bottom Layer or other layers, which will affect the spurs and receiving sensitivity of the module to some degrees;
6. Assuming that there are devices with large electromagnetic interference around the module, which will greatly affect

the module performance. It is recommended to stay away from the module according to the strength of the interference. If circumstances permit, appropriate isolation and shielding can be done.

7. Assuming that there are routings of large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power routings), which will also greatly affect the module performance. It is recommended to stay away from the module according to the strength of the interference. If circumstances permit, appropriate isolation and shielding can be done.
8. It is recommended to stay away from the devices whose TTL protocol is the same 433 MHz physical layer.
9. The antenna installation structure has a great influence on the module performance. It is necessary to ensure the antenna is exposed and preferably vertically upward. When the module is installed inside of the case, a high-quality antenna extension wire can be used to extend the antenna to the outside of the case.
10. The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.

4.6 Trouble Shooting

4.6.1 Unsatisfactory Transmission Distance

1. When there is a linear communication obstacle, the communication distance will be correspondingly weakened. Temperature, humidity, and co-channel interference will lead to an increase in communication packet loss rate. The performances of ground absorption and reflection of radio waves will be poor, when the module is tested close to the ground.
2. Seawater has a strong ability to absorb radio waves, so the test results by seaside are poor.
3. The signal attenuation will be very obvious, if there is a metal near the antenna or the module is placed inside of the metal shell.
4. The incorrect power register set or the high data rate in an open air may shorten the communication distance. The higher the data rate, the closer the distance.
5. The low voltage of the power supply is lower than the recommended value at ambient temperature, and the lower the voltage, the smaller the power is.
6. The unmatchable antennas and module or the poor quality of antenna will affect the communication distance.

4.6.2 Vulnerable Module

1. Please ensure the supply voltage is between the recommended values. The module will be permanently damaged if the voltage exceeds the maximum value. Please ensure the stable power supply and no frequently fluctuated voltage.
2. Please ensure the anti-static installation and the electrostatic sensitivity of high-frequency devices.
3. Due to some humidity sensitive components, please ensure the suitable humidity during installation and application.

If there is no special demand, it is not recommended to use at too high or too low temperature.

4.6.3 High Bit Error Rate

1. There are co-channel signal interferences nearby. It is recommended to be away from the interference sources or modify the frequency and channel to avoid interferences.
2. The unsatisfactory power supply may also cause garbled. It is necessary to ensure the power supply reliability.
3. If the extension wire or feeder wire is of poor quality or too long, the bit error rate will be high.

4.7 Electrostatics Discharge Warnings

The module will be damaged for the discharge of static. RF-star suggest that all modules should follow the 3 precautions below:

1. According to the anti-static measures, bare hands are not allowed to touch modules.
2. Modules must be placed in anti- static areas.
3. Take the anti-static circuitry (when inputting HV or VHF) into consideration in product design.
   Static may result in the degradation in performance of module, even causing the failure.

4.8 Soldering and Reflow Condition

1. Heating method: Conventional Convection or IR/convection.
2. Solder paste composition: Sn96.5 / Ag3.0 / Cu0.5
3. Allowable reflow soldering times: 2 times based on the following reflow soldering profile.
4. Temperature profile: Reflow soldering shall be done according to the following temperature profile.
5. Peak temperature: 245 ℃.

Table 7. Temperature Table of Soldering and Reflow

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63 / Pb37	Sn96.5 / Ag3.0 / Cu0.5
Min. Preheating Temperature (T_{min})	100 ℃	150 ℃
Max. Preheating Temperature (T_{max})	150 ℃	200 ℃
Preheating Time (T_{min} to T_{max}) (t_1)	60 s ~ 120 s	60 s ~ 120 s
Average Ascend Rate (T_{max} to T_p)	Max. 3 ℃/s	Max. 3 ℃/s
Liquid Temperature (T_L)	183 ℃	217 ℃
Time above Liquidus (t_L)	60 s ~ 90 s	30 s ~ 90 s
Peak Temperature (T_p)	220 ℃ ~ 235 ℃	230 ℃ ~ 250 ℃
Average Descend Rate (T_p to T_{max})	Max. 6 ℃/s	Max. 6 ℃/s

Time from 25 ℃ to Peak Temperature (t_2)	Max. 6 minutes	Max. 8 minutes
Time of Soldering Zone (t_P)	20±10 s	20±10 s

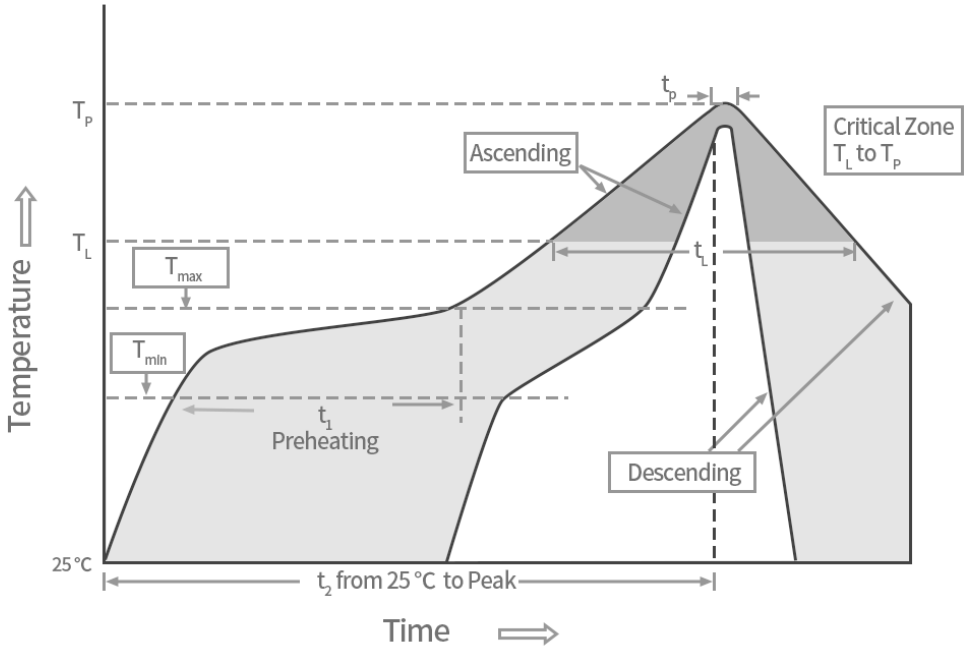

Figure 10. Recommended Reflow for Lead Free Solder

4.9 Optional Packaging

Figure 11. Optional Packaging Mode

Note: Default tray packaging.

5 Certification

5.1 Reach

Reach Certificate No.: C181213010001

CPST

Test Report No. C181213010001 Date: Dec 20, 2018 Page 1 of 39

SHENZHEN RF STAR TECHNOLOGY CO.,LTD.
2F,Block8,Dist.A,Internet Industry Base,Baoyuan Road ,Baoan Dist,Shenzhen,China

The following samples were submitted and identified on behalf of the clients as

Sample Name:	Wireless module
Model:	RF-SM-1077B1;RF-SM-1077B2
CPST Internal Reference No.:	C181213010
Sample Received Date:	Dec 13, 2018
Test Period:	Dec 13, 2018 to Dec 20, 2018
Test Method:	Please refer to next pages.
Test Result:	Please refer to next pages.

CONCLUSION :

TESTED SAMPLES	TEST ITEM	RESULT
Wireless module	1. As specified by client, SVHC screening is performed according to: One hundred and ninety-one (191) Substances in the Candidate List of Substances of Very High Concern (SVHC) for authorization published by European Chemical Agency (ECHA) on and before Jun 27, 2018 published by European Chemical Agency (ECHA) regarding regulation (EC) No. 1907/2006 concerning the REACH. According to the specified scope and analytical techniques, concentrations of SVHC(191SVHC) are less than 0.1%(w/w) in the sample.	PASS

Signed for and on behalf of
Eurones Consumer Products Testing Service Co., Ltd

TESTED BY :	REVIEWED BY:	APPROVED BY:
Andy Wang	Sunshine Liu	Will Pan
Wang Guang Yu, Andy Project Leader	Liu Xiao Fang, Sunshine Report Reviewer	Pan Jian Ding, Will Technical Supervisor

This Test Report is issued by the Company subject to its General Conditions of Service printed overleaf or available on request and accessible at www.cpstlab.com. Attention is drawn to the limitations of liability, indemnification and jurisdictional issues defined therein. Unless otherwise stated the results shown in the test report refer only to the sample(s) tested. This test report cannot be reproduced, except in full, without prior written permission of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this report is unlawful and offenders may be prosecuted to the fullest extent of the law.

400 111 6218 Eurones (Dongguan) Consumer Products Testing Service Co., Ltd. T:(86-769) 3889768 F:(86-769) 3889769 Http://www.cpstlab.com
2/F., Huafeng Building, No.77, Hefan Avenue, Houjie, Dongguan, Guangdong, China Postcode: 523945 E-mail: service@cpstlab.com

Figure 12. SRRC Certificate

5.2 RoHS

Reach Certificate No.: C181213010002

CPST

Test Report No. C181213010002 Date: Dec 20, 2018 Page 1 of 8

SHENZHEN RF STAR TECHNOLOGY CO.,LTD.
2F, Block8, Dist.A, Internet Industry Base, Baoyuan Road, Bao'an Dist, Shenzhen, China

The following samples were submitted and identified on behalf of the clients as

Sample Name:	Wireless module
Model No.（M/N）.:	RF-SM-1077B1;RF-SM-1077B2
Trade mark:	N/A
CPST Internal Reference No.:	C181213010
Sample Received Date:	Dec 13, 2018
Test Period:	Dec 13, 2018 to Dec 20, 2018
Test Method:	Please refer to next pages
Test Result:	Please refer to next pages

CONCLUSION :

TESTED SAMPLES	TEST ITEM	RESULT
Wireless module	1.RoHS Directive 2011/65/EU Annex II amending Annex (EU)2017/2102 —Lead, Cadmium, Mercury, Hexavalent Chromium, PBBs and PBDEs Content	PASS
	—Di-(2-ethylhexyl) phthalate(DEHP), Benzylbutyl phthalate(BBP), Dibutyl phthalate (DBP), Diisobutyl phthalate(DIBP) Content	PASS

Signed for and on behalf of
Eurones Consumer Products Testing Service Co., Ltd

TESTED BY :	REVIEWED BY:	APPROVED BY:
Andy Wang	Sunshine Liu	Will Pan
Wang Guang Yu, Andy Project Leader	Liu Xiao Fang, Sunshine Report Reviewer	Pan Jian Ding, Will Technical Supervisor

This Test Report is issued by the Company subject to its General Conditions of Service printed overleaf or available on request and accessible at www.cpstlab.com. Attention is drawn to the limitations of liability, indemnification and jurisdictional issues defined therein. Unless otherwise stated the results shown in the test report refer only to the sample(s) tested. This test report cannot be reproduced, except in full, without prior written permission of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this report is unlawful and offenders may be prosecuted to the fullest extent of the law.

400 111 6218 Eurones (Dongguan) Consumer Products Testing Service Co., Ltd. T:(86-769) 3889768 F:(86-769) 3889769 Http://www.cpstlab.com
2/F., Huafeng Building, No.77, Hefan Avenue, Houjie, Dongguan, Guangdong, China Postcode: 523945 E-mail: service@cpstlab.com

Figure 13. RoHS Certificate

6 Revision History

Date	Version No.	Description	Author
2017.10.19	V1.0	The initial version is released.	Levi
2018.03.12	V1.0	Add commands.	Levi
2018.01.24	V1.0	Add inquiry MAC address function.	Levi
2018.08.02	V1.0	Update module datasheet.	Sunny Li
2020.05.15	V1.0	Add TI CC13XX Sub-1 GHz module list.	Sunny Li

Note:

1. The document will be optimized and updated from time to time. Before using this document, please make sure it is the latest version.
2. To obtain the latest document, please download it from the official website: www.szrfstar.com.

7 Contact Us

SHENZHEN RF-STAR TECHNOLOGY CO., LTD.

Shenzhen HQ:

Add.: Room 601, Block C, Skyworth Building, High-tech Park, Nanshan District, Shenzhen, Guangdong, China

Tel.: 86-755-3695 3756

Chengdu Branch:

Add.: No. B3-03, Building No.1, Incubation Park, High-Tech District, Chengdu, Sichuan, China, 610000

Tel.: 86-28-6577 5970

Email: sunny@szrfstar.com, sales@szrfstar.com

Web.: www.szrfstar.com