DS02101

RHF0M083 2.4GHz LoRa module Datasheet

Version: V1.0

Document information

Info	Content
Keywords	*RisingHF, LoRa, LR24, FLRC, 2.4GHz, Module, Antenna Diversity*
Abstract	This document is a datasheet of RHF0M083 2.4GHz LoRa module

Content

Figures

Tables

RHF0M083

Low Power 2.4GHz LoRa module

General description

RHF0M083 is a creative solution at 2.4GHz ISM band, benefit from Semtech proprietary Long Range Transceiver SX1281, it supports multi-modem RF communication, including LR24™, FLRC, and (G)FSK.

This datasheet will give some details of description of the module, including HW design info, performance validation, and application information.

Applications

- Home automation & appliances;
- Smart Security;
- Low-power wireless sensor network;
- Other 2.4GHz long range application.

Key features

- 2.4GHz ISM Band
- Low power consumption: 2.17uA in sleep mode
- Multi-modem:LR24™,FLRC,(G)FSK
- RF transceiver with matching network full RF solution
- Two 2.4GHz antennas Diversity to mitigate multipath effect
- Maximum TXOP=12.5dBm
- High sensitivity, down to -130dBm @SF12,BW=203.125kHz
- Programmable Data Rate 260kbps to 1.3Mbps for FLRC;0.5kbps to 200kbps for LR24
- Small size: 23mm x 28mm, 33 pins SMT package
- User-friendly interface
  SPI;
  USART;
  USB;
  ADC;
  GPIOs;
- RisingHF stack embedded, Easy use with AT command

RHF0M083 Module Outline

1 General description

The RHF0M083 incorporates SX1281 and STM32L072x, The internal interface communication interface is SPI between SX1281 and host MCU STM32L072x.

1.1 Simplified Block Diagram

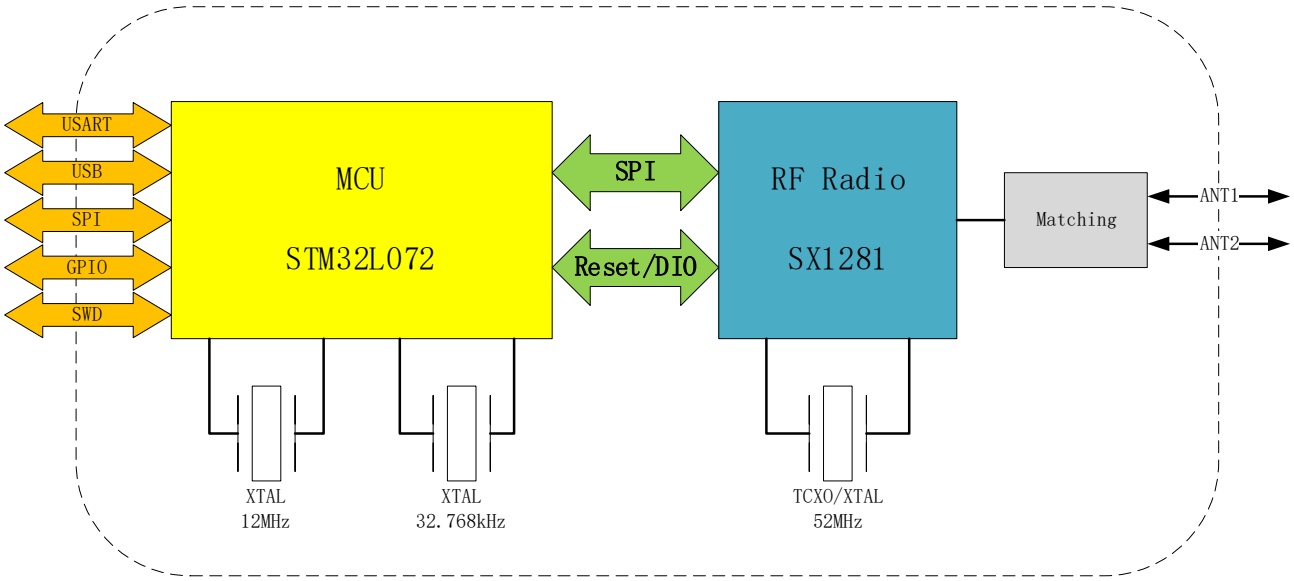

Figure 1-1 Block Diagram of RHF0M083

1.2 Pin description

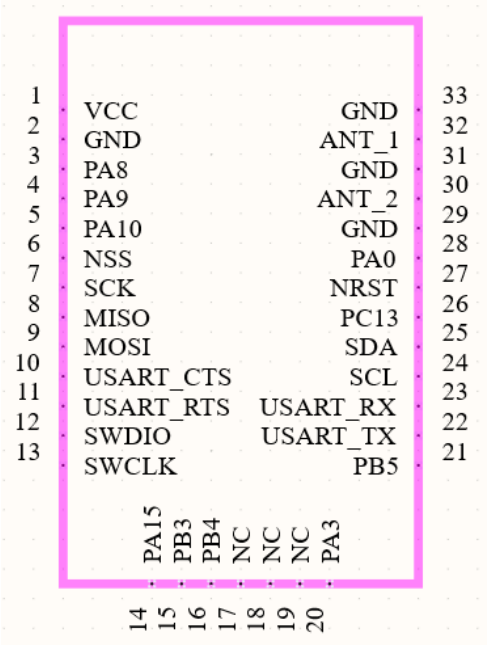

Figure 1-2 Pin Locations of RHF0M083

Table 1-1 pin description

Number	Name	Type	Description
1	VCC	-	Supply voltage for the module
2	GND	-	Ground
3	PA8	I/O	GPIO from MCU, PA8
4	PA9	I/O	GPIO from MCU, PA9
5	PA10	I/O	GPIO from MCU, PA10
6	NSS	I/O	NSS of SPI1 from MCU; or GPIO from MCU, PB12
7	SCK	I/O	SCK of SPI1 from MCU; or GPIO from MCU, PB13
8	MISO	I/O	MISO of SPI1 from MCU; or GPIO from MCU, PB14
9	MOSI	I/O	MOSI of SPI1 from MCU; or GPIO from MCU, PB15
10	USART1_CTS	I/O	USART1_CTS from MCU; or GPIO from MCU, PA11
11	USART1_RTS	I/O	USART1_RTS from MCU; or GPIO from MCU, PA12
12	SWDIO	I/O	SWDIO of SWIM for program download
13	SWCLK	I/O	SWCLK of SWIM for program download
14	PA15	I/O	GPIO from MCU, PA15
15	PB3	I/O	GPIO from MCU, PB3
16	PB4	I/O	GPIO from MCU, PB4
17	NC	-	Connected to Ground
18	NC	-	Connected to Ground
19	NC	-	Connected to Ground
20	PA3/ADC3	I/O	GPIO from MCU, PA3; or ADC3 input
21	PB5	I/O	GPIO from MCU, PB5
22	USART1_TX	I/O	USART1_TX from MCU; or GPIO from MCU, PB6
23	USART1_RX	I/O	USART1_RX from MCU; or GPIO from MCU, PB7
24	I2C_SCL	I/O	SCL of I2C from MCU; or GPIO from MCU, PB8
25	I2C_SDA	I/O	SDA of I2C from MCU; or GPIO from MCU, PB9
26	PC13/Wkup2	I/O	Wake up pin for MCU; or GPIO from MCU, PC13
27	NRST	I	Reset trigger input for MCU
28	PA0/ADC0	I/O	GPIO from MCU, PA0; or ADC0 input
29	GND	-	Ground
30	ANT_2	-	RF input/output PORT2
31	GND	-	Ground
32	ANT_1	-	RF input/output PORT1
33	GND	-	Ground

2 Electrical Characteristics

2.1 Absolute Maximum Ratings

As stated that the values listed below may cause permanent device failure. Exposure to absolute maximum ratings for extended periods may affect device reliability

Table 2-1 Absolute Maximum Ratings

Item	Description	min	max	unit
VCCmr	Supply voltage	-0.3	+3.9	V
Tmr	Temperature	-55	+115	℃
Hmr	Humidity	5%	95%	Non-Condensing
Pmr	RF input level	-	+10	dBm

2.2 Operating range

Table 2-2 Operating Range

Item	Description	min	max	unit
VCCop	Supply voltage	+1.8	+3.6	V
Top	Temperature	-40	+85	℃
Hop	Humidity	10%	95%	Non-Condensing
Pop	RF input level	-	+10	dBm

2.3 Module Specifications

The tables below give the electrical specifications of the transceiver under the following conditions: Supply voltage VDD=3.3 V, temperature = 25 ℃.

Table 2-3 Module Specifications

ITEMs	Parameter	Specifications	Unit
Structure	Size	23(W) X 28(L) X 3(H)	mm
	Package	33 pins, SMT	
Electrical Characteristics	power supply	3.3V type, 1.8V~3.6V range	V
	Operation frequency	2400~2500	MHz
	Frequency offset	Typical < ±10ppm ,@25℃,XTAL is used	ppm
	Programmable Data Rate	0.5kbps to 200kbps for LR24	bps
	Sleep current	2.17uA	uA
	TX current (Receiver + MCU)	38.5mA @12.5dBm	mA
	TX current (Lowpower mode)	26mA @12.5dBm	mA
	RX current LR24 modem (Receiver + MCU)	15.0mA for BW=203.125kHz 16.5mA for BW=812.5kHz	mA
	RX current LR24 modem (Lowpower mode)	6.0mA for BW=203.125kHz 7.5mA for BW=812.5kHz	mA
	Output power max	12.5dBm	dBm
	Sensitivity LR24 modem	-130dBm @ SF12,BW=203.125kHz	dBm
		-105dBm @ SF7,BW=812.5kHz	dBm
Interface	RFIO	ANT_1 and ANT_2	
	SPI	1 group of SPI, include 4 pins	
	USART	1 group of USART, include 2pins	
	USB	1 group of USB, include 2 pins	
	I2C	1 group of I2C, include 2 pins	
	ADC	2 ADC Input, include 2 pins	
	GPIOs	8 GPIOs more except the interface above	
	NRST	Manual reset pin input	

3 Typical Performance Characteristics Measurement

The tables below give the electrical specifications of the transceiver under the following conditions: Supply voltage VDD=3.3 V, temperature = 25℃.

Table 3-1 RHF0M083 max Tx output power @ 2400MHz~2500MHz

Freq/MHz	2400	2420	2440	2460	2480	2500
Current/mA	26.78	26.86	26.27	25.23	25.32	25.92
TXOP/dBm	12.02	12.11	12.04	11.96	12.15	12.26
H2/dBm	-40.93	-42.51	-43.69	-46.29	-47.73	-49.15

H3/dBm	-70.21	-65.75	-66.04	-63.72	-60.36	-52.22
H4/dBm	-38.66	-39.22	-41.02	-44.47	-46.22	-45.05
H5/dBm	-38.89	-39.16	-39.89	-40.59	-42.20	-42.64

Table 3-2 RHF0M083 Rx sensitivity @ 2400MHz~2500MHz,BW=203.125kHz

Freq(MHz) / SF	2400	2420	2440	2460	2480	2500
SF5	-109	-109	-109	-108	-109	-109
SF6	-112	-112	-111	-111	-111	-111
SF7	-114	-115	-115	-113	-115	-115
SF8	-118	-117	-118	-117	-118	-118
SF9	-120	-120	-121	-120	-120	-121
SF10	-123	-122	-123	-123	-124	-124
SF11	-126	-126	-127	-126	-127	-127
SF12	-129	-130	-130	-130	-130	-130

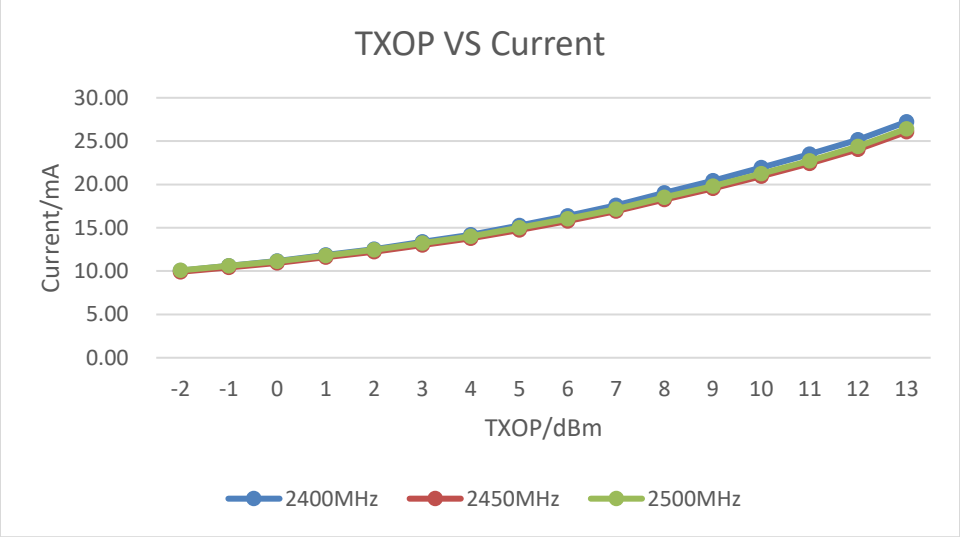

Figure 3-3 TXOP VS Current

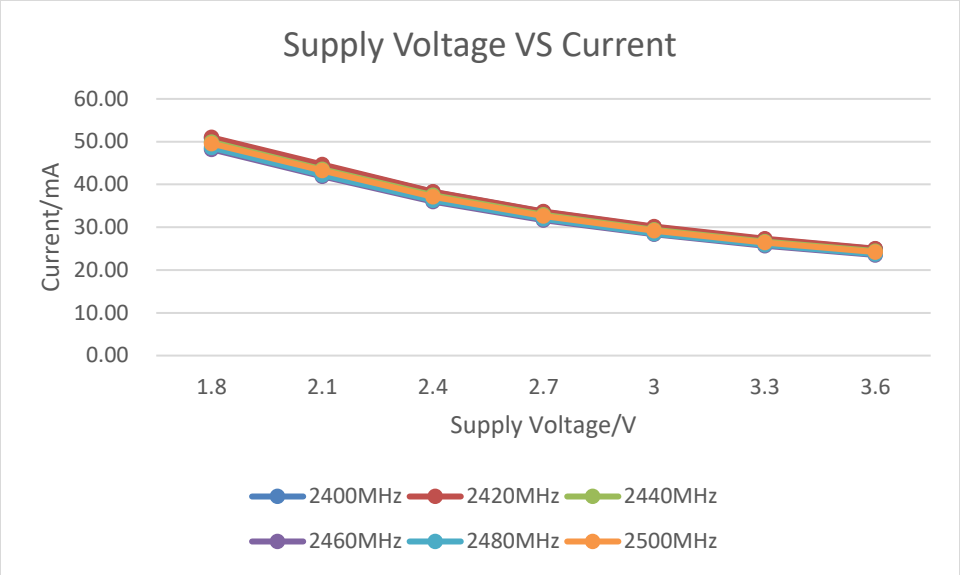

Figure 3-4 Supply Voltage VS Current

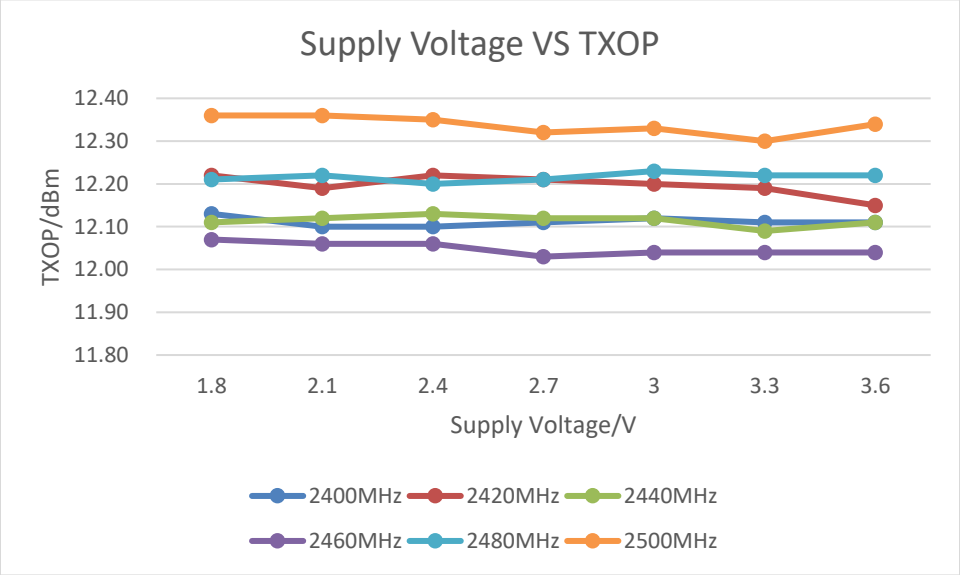

Figure 3-5 Supply Voltage VS TXOP

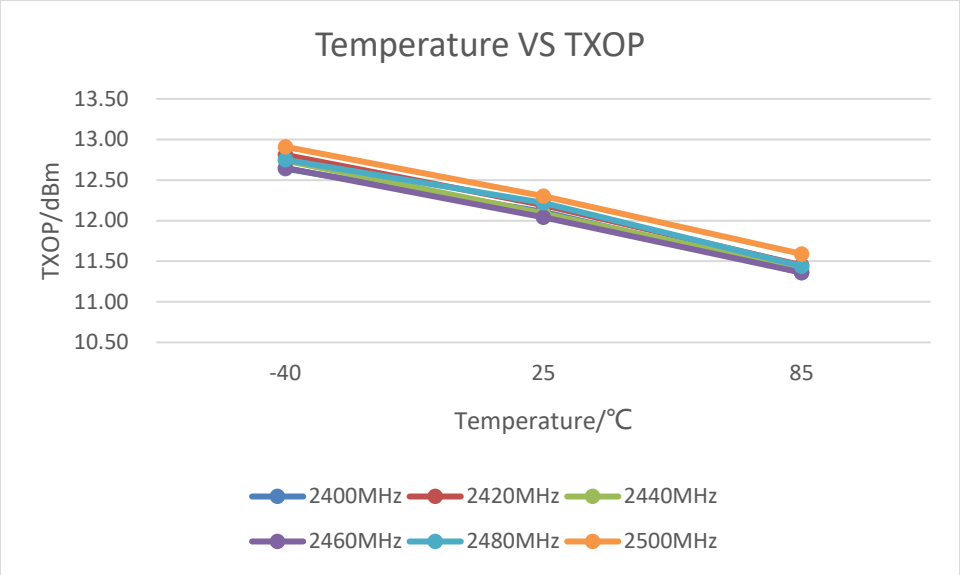

Figure 3-6 Temperature vs TXOP

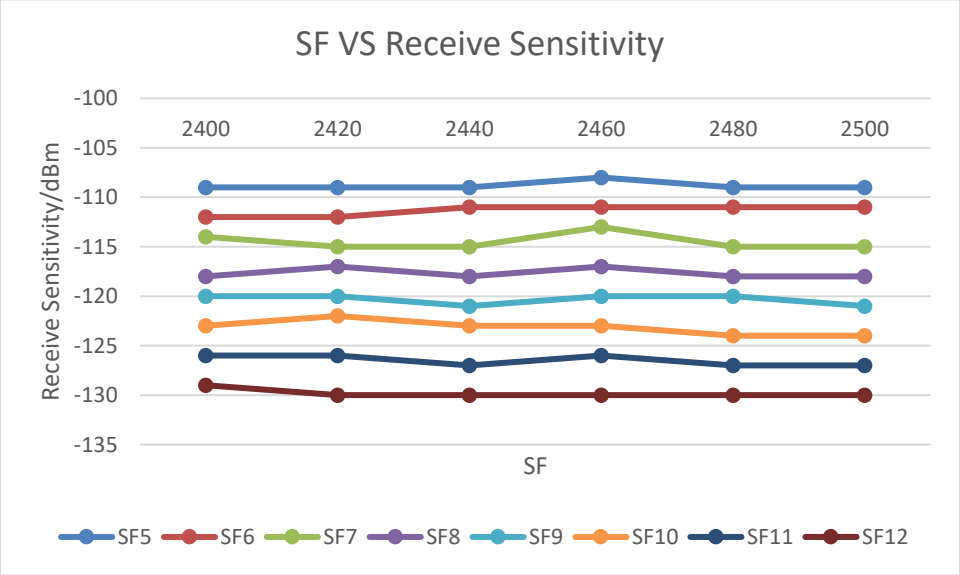

Figure 3-7 SF VS Receive Sensitivity @BW=203.125kHz

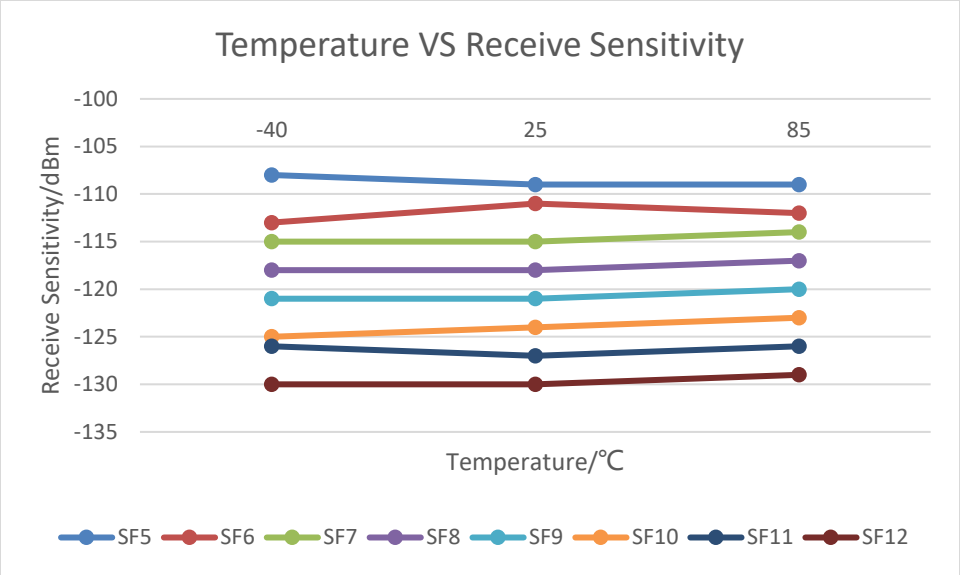

Figure 3-8 Temperature VS Receive Sensitivity @BW=203.125kHz

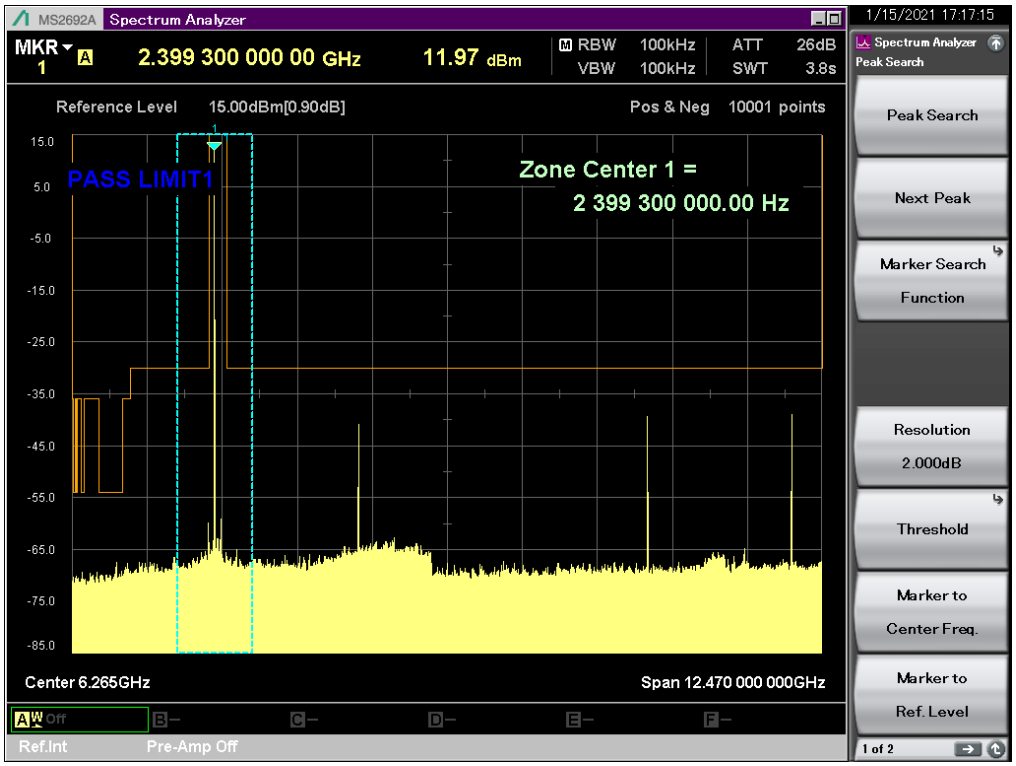

Figure 3-9 Harmonics measurement @Frf=2400MHz, TXOP=13dBm

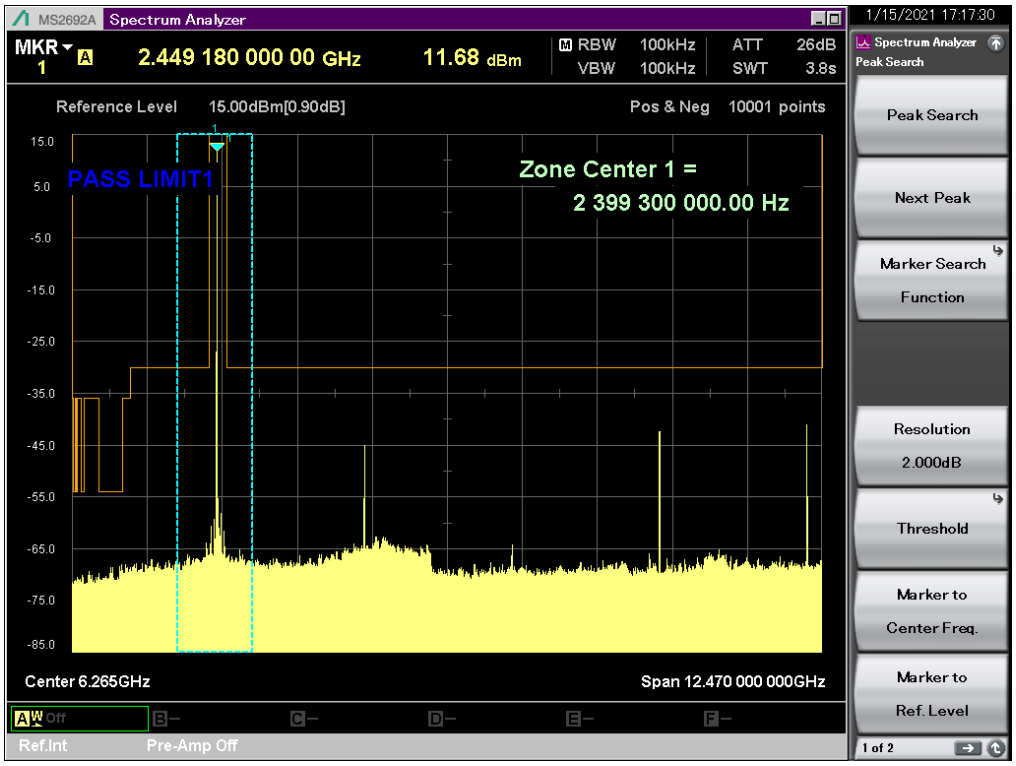

Figure 3-10 Harmonics measurement @Frf=2450MHz, TXOP=13dBm

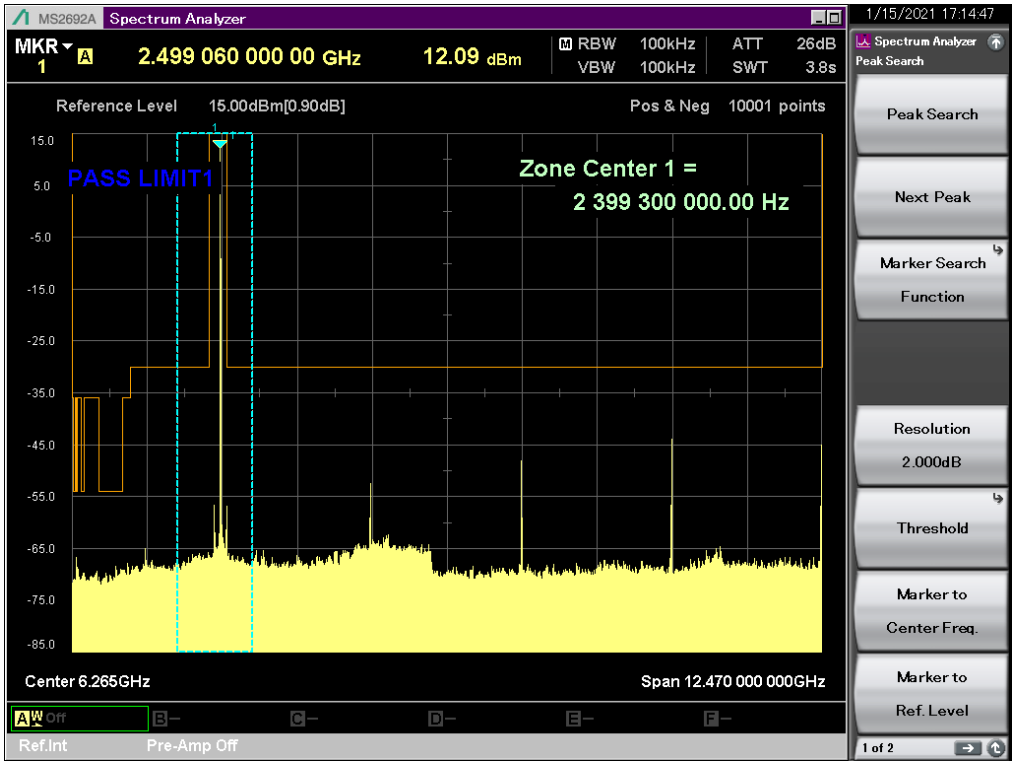

Figure 3-11 Harmonics measurement @Frf=2500MHz, TXOP=13dBm

4 Application information

4.1 Package Information

The RHF0M083 is available in a 33-lead SMD package as shown below:

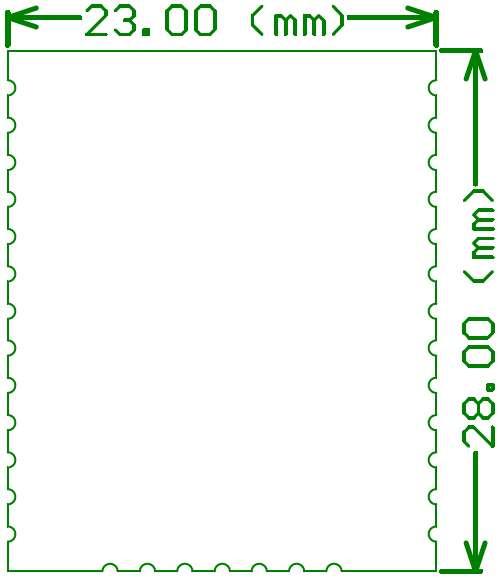

Figure 4-1 package outline drawing

Figure 4-2 show the recommended land pattern for layout.

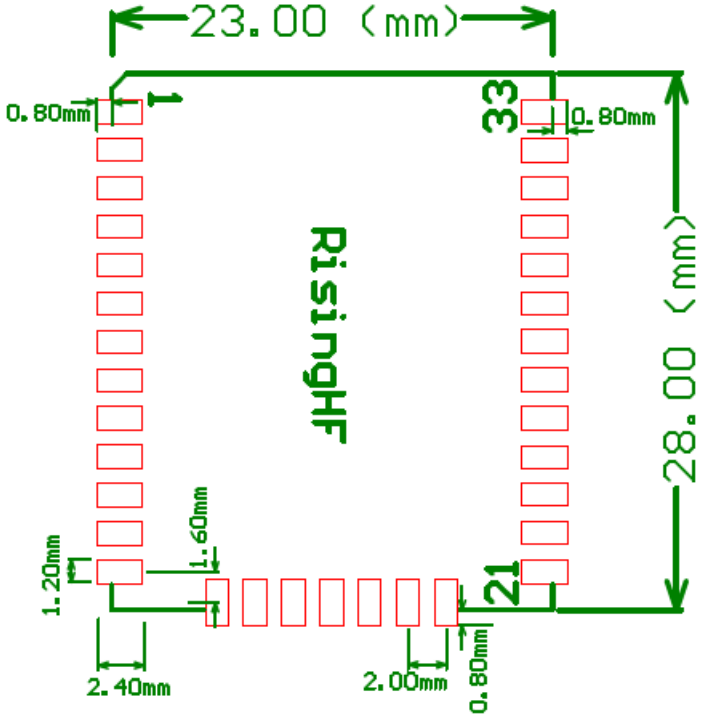

Figure 4-2 Recommended land pattern

Figure 4-3 Label information of RHF0M083

4.2 Internal connection

Table 4-1 and Table 4-2 provides the internal connection which could help customers who would design their own firmware instead of using RisingHF AT command mode.

Table 4-1 Internal IO connection between MCU (STM32L072x) and Radio (SX1281)

Chip	SX1281		STM32L072x	
Item	Pin Num	Description	Pin Num	Description
Internal IO connection Between radio chip and MCU	Pin3	SX1281_NRESET	Pin18	PB0
	Pin7	Busy	Pin21	PB10
	Pin8	DIO1_SX	Pin20	PB2
	Pin9	DIO2_SX	Pin19	PB1
	Pin16	MISO_SX	Pin16	PA6
	Pin17	MOSI_SX	Pin17	PA7
	Pin18	SCK_SX	Pin15	PA5
	Pin19	NSS_SX	Pin14	PA4

Table 4-2 RF control logic

	MCU Pin11/PA1	MCU Pin12/PA2	RF Port selection
RF Switch Control	Logic low	Logic High	ANT_1
	Logic High	Logic low	ANT_2
	Logic low	Logic low	Not allowed
	Logic High	Logic High	Not allowed

5 Application with RHF0M083

5.1 Application with RHF0M083

RHF0M083 is AT command modem, With RisingHF stack embedded. Customer just need use a simple host MCU to control the modem via USART, so that an end application device could be designed easily. This will help customer to promote their own devices to market quickly.
User could also design their own firmware instead of using RisingHF AT command mode, they can make use of the internal MCU inside the module.

5.2 RHF0M083 Reference design

RHF0M083 is integrated with RisingHF protocol and can be controlled by AT command. Customer can easily use the module through a host MCU, Just connect the USART and NRST to host MCU and send AT command.

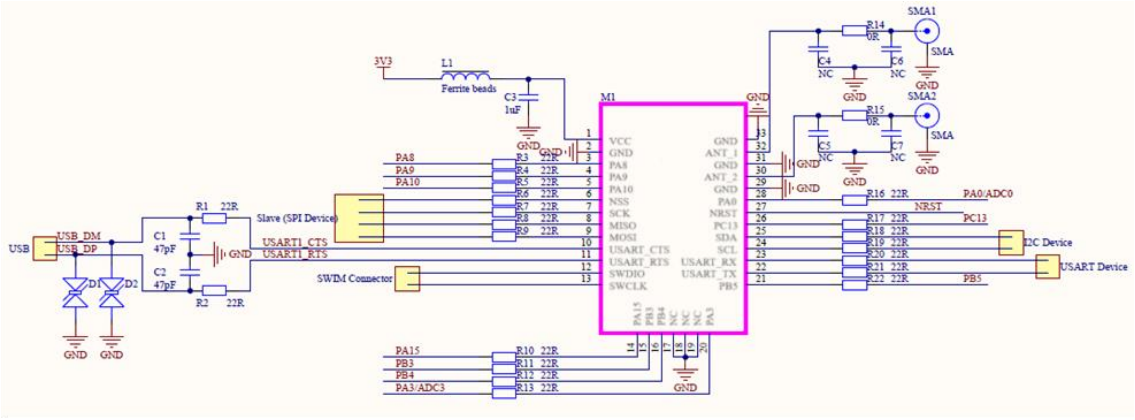

Figure 5-1 RHF0M083 Reference design

6 Ordering information

Technical Support: Support@RisingHF.com
Business:
China: Salescn@RisngHF.com
Others: Salesww@RisingHF.com

Table 6-1 Ordering information

Part Number	MCU	TX Power (dBm)	AT Modem
RHF0M083	ROM 128KB / RAM 20KB	12.5 max	Yes

Revision

V1.0 2021-02-01

- Creation

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