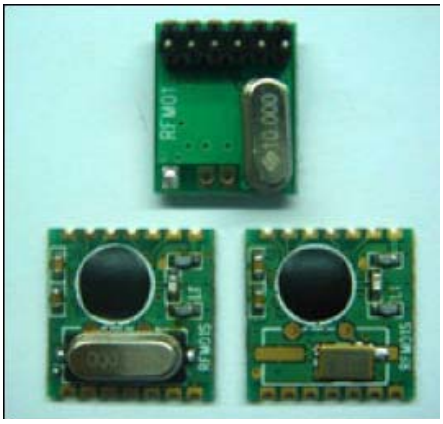
ISM BAND FSK RECEIVER MODULE

RFM01

（the purpose of this spec covers mainly for the physical characteristic of the module, for register configure and its related command info please refer to RF01 data sheets）

RFM01



General Introduction

RFM01 is a low costing ISM band receiver module implemented with unique PLL and zero IF design approach. It works with FSK modulated signal ranges from 315/433/868/915MHZ bands, comply with FCC, ETSI regulation. The SPI interface is used to communicate with microcontroller for parameter setting. RFM01 works with RFM02 transmitter module. At 433MHZ band, the pair of module can work up to 300m in the free open air.

Features:

- Low costing, high performance and price ratio
- Tuning free during production
- FSK reception
- PLL and zero IF technology
- Fast PLL lock time
- High resolution PLL with 2.5 KHz step
- High data rate (up to 115.2 kbps with internal demodulator，with external RC filter highest data rate is 256 kbps)
- Differential antenna input
- Automatic antenna tuning
- Programmable receiver bandwidth (from 67 to 400 kHz)
- Analog and digital signal strength indicator (ARSSI/DRSSI)
- AFC
- DQD
- Internal demodulator
- SPI interface
- Clock and reset signal output for external MCU use
- 16 bits FIFO
- Low power mode (<0.5mA averaged current consumption)
- 10MHz crystal for PLL timing
- Wakeup timer
- Low battery detection
- Programmable capacitor bank
- 2.2V - 5.4V power supply
- Low power consumption

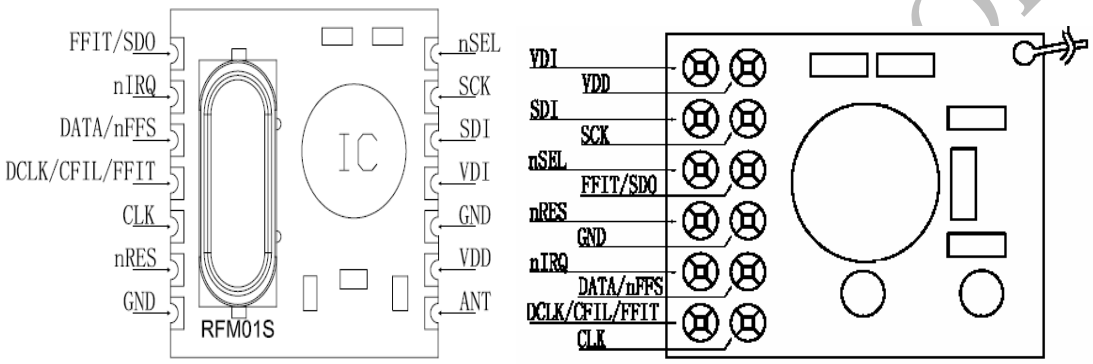
• Stand by current less than 0.3uA

Typical Application：

• Remote control
• Remote sensor
• Wireless data collection
• Home security system
• Toys
• Tire pressure monitoring system

Pin Definition：

SMD **DIP**



definition	Type	Function
VDI	DO	Valid data indicator
VDD	S	Positive power supply
SDI	DI	SPI data input
SCK	DI	SPI clock input
nSEL	DI	Chip select (active low)
FFIT/SDO	DO	FIFO fill interrupt(active low) or status read data output
nRES	DO	Reset output（active low）
GND	S	Power ground
nIRQ	DO	Interrupts request output（active low）
DATA/nFFS	DO/DI	Data input(non FIFO mode)/ FIFO select
DCLK/CFIL/FFIT	DO/AIO/DO	Clock output (no FIFO)/ external filter capacitor(analog mode)/ FIFO interrupts(active high)when FIFO level set to 1, FIFO empty interruption can be achieved
CLK	DO	Clock output for external microcontroller

Electrical Parameter：

Maximum（not at working mode）

symbol	parameter	minimum	maximum	Unit
V_{dd}	Positive power supply	-0.5	6.0	V
V_{in}	All pin input level	-0.5	Vdd+0.5	V
I_{in}	Input current except power	-25	25	MA
ESD	Human body model		1000	V
T_{st}	Storage temperature	-55	125	℃
T_{ld}	Soldering temperature(10s)		260	℃

Recommended working range

symbol	parameter	minimum	maximum	Unit
V_{dd}	Positive power supply	2.2	5.4	V
T_{op}	Working temperature	-40	85	℃

DC characteristic

symbol	parameter	Remark	minimum	typical	maximum	Unit
I_{dd}	Current consumption	315,433MHz band 868,915MHz band		9 10.5	11 12.5	mA
I_x	Stand by current	Crystal and base band on		3．0	3．5	mA
I_{pd}	Sleep mode current	All blocks off**(Note)**		0.3		uA
I_{lb}	Low battery detection			0.5		uA
V_{lb}	Low battery step	0.1V per step	2.2		5.3	V
V_{lba}	Low battery detection accuracy			75		mV
V_{il}	Low level input				0.3*V_{dd}	V
V_{ih}	High level input		0.7*V_{dd}			V
I_{il}	Leakage current	V_{il}=0V	-1		1	uA
I_{ih}	Leakage current	V_{ih}=V_{dd},V_{dd}=5.4V	-1		1	uA
V_{ol}	Low level output	I_{ol}=2mA			0.4	V
V_{oh}	High level output	I_{oh}=-2mA	V_{dd}-0.4			V

Note: before entering sleep mode, all interrupt should be handled, otherwise the crystal oscillator still running and consume 3mA appr. current.

AC characteristic

symbol	parameter	remark	min	typical	max	Unit
f_{ref}	PLL frequency	Parallel fundamental	8	10	12	MHz
f_{LO}	frequency (10MHz crystal used)	315 MHz band,2.5KHz step 433 MHz band,2.5KHz step 868 MHz band,5KHz step 915 MHz band,7.5KHz step	310.24 430.24 860.48 900.72		319.75 439.75 879.51 929.27	MHz

f_{LO}	frequency (8MHZ crystal used)	315 MHz band,2.5KHz step 433 MHz band,2.5KHz step 868 MHz band,5KHz step 915 MHz band,7.5KHz step	248.19 344.19 688.38 720.57		255.80 351.80 703.61 743.41	MHz
f_{LO}	frequency (12MHZ crystal used)	315 MHz band,2.5KHz step 433 MHz band,2.5KHz step 868 MHz band,5KHz step 915 MHz band,7.5KHz step	372.28 516.28 1032.5 1080.8		383.71 527.71 1055.4 1115.1	MHz
BW	Receiver bandwidth	1 2 3 4 5 6	60 120 180 240 300 360	67 134 200 270 350 400	75 150 225 300 375 450	kHz
t_{lock}	PLL lock time	After 10MHz step hopping, frequency error <10 kHz		20		us
$T_{st, p}$	PLL start time	After crystal stabilized		250		us
BR	Data rate	With internal digital demodulator			115.2	kbps
BRA	Data rate	With external RC filter			256	kbps
P_{min}	sensitivity	BW=134KHz,BR=1.2kbps,315MHz band		**-109**	**-100**	dBm
		BW=134KHz,BR=1.2kbps,433MHz band		**-109**	**-100**	
		BW=134KHz,BR=1.2kbps,868MHz band		**-105**	**-98**	
		BW=134KHz,BR=1.2kbps,915MHz band		**-105**	**-98**	
AFC_{range}	AFC working range	δF_{fsk}: received signal modulation depth		0.8* δF_{fsk}		
RS_A	RSSI accuracy			±5		dB
RS_R	RSSI range			46		dB
C_{ARSSI}	ARSSI filter			1		nF
RS_{STEP}	RSSI programmable step			6		dB
RS_{RESP}	DRSSI response time	RSSI output high after valid , C_{ARRSI}=5nF		500		us
C_{XL}	Capacitor bank	Programmable step with 0.5pF step, +/- 10%	8.5		16	pF
T_{POR}	PWR time	V_{dd} reach 90%		50	100	mS
T_{PBT}	Wakeup timer period	Calibrated each 30s	0．96		1．08	mS
$T_{WAKE-UP}$	Programmable wakeup time		1		5*10E11	mS
T_{SX}	Crystal start up time	Crystal ESR < 100 Ohms			5	mS
$C_{IN,D}$	Load capacitance				2	pF
$T_{r,F}$	Output rising edge	With 15PF load			10	ns

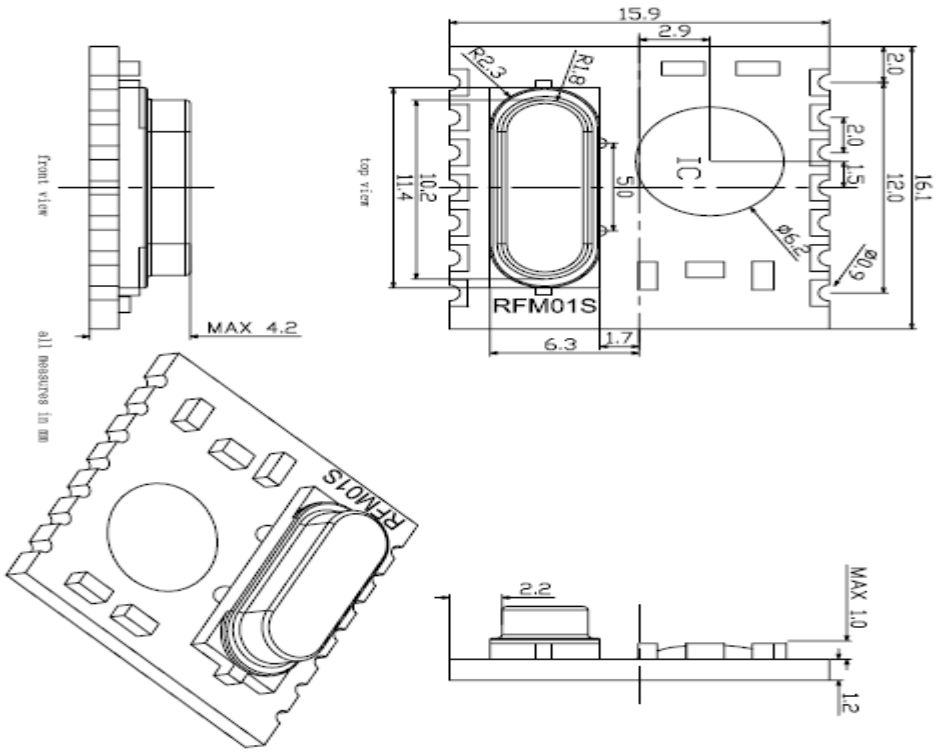
Field testing range

Band	Test condition	Distance
433MHz band	Receiver bandwidth =134KHz, data rate=1.2kbps, transmitter modulation=60KHZ（matches with RF02B） In free open area	>300M
868MHz band	Receiver bandwidth=134KHz,data rate =1.2kbps Transmitter modulation=60KHZ（matches with RFM02B）in free open area	>200M
915MHz band	Receiver bandwidth=134KHz,data rate =1.2kbps Transmitter modulation=60KHZ（matches with RFM02B）in free open area	>200M

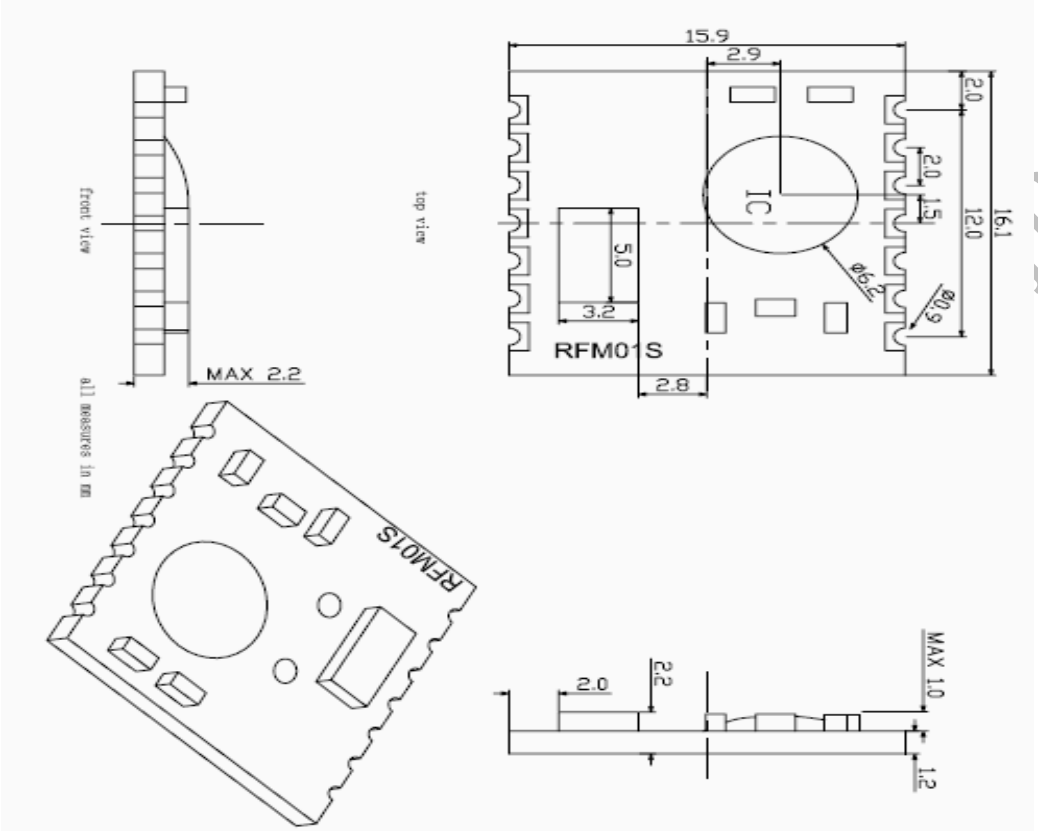
Mechanical Dimension

（units in mm）

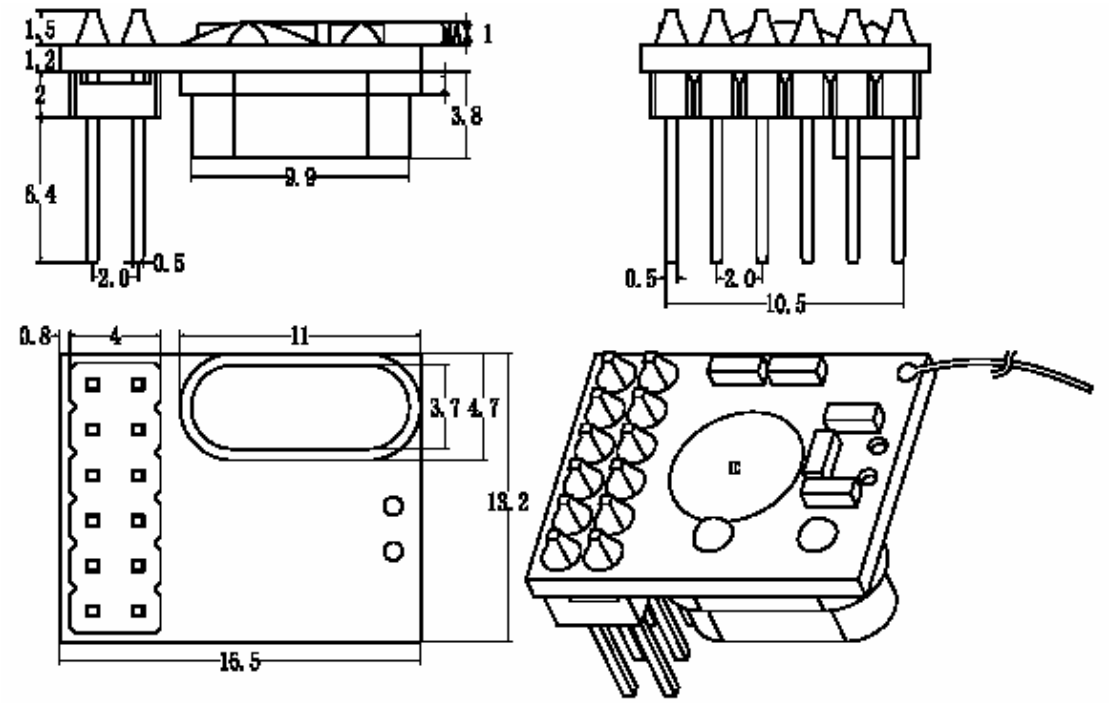
SMD PACKAGE（S1）



SMD PACKAGE（S2）



DIP PACKAGE（D）



Module Model Definition

model=module-operation_band-package_type

RFM01-433-D

module type operation band Package

Note: SMD packages is divided into two kinds based on thickness: 1. thickness is 4.2mm, 2. thickness is 2.2mm

example：1，RFM01 module at 433MHz band ,DIP: RFM01-433-D。

2，RFM01 module at 868MHZ band,SMD, thickness at 4.2mm: RFM01-868-S1。

RF01 And RFM01 Product Change Notification

Prior Product Revision #: **J**

New Product Revision #: **J1**

	FUNCTION / ISSUE	IMPLEMENTED CHANGES
1	Wake Up Timer calibration	The control of the wake up timer's internal calibration has been changed to prevent an unnecessary Xosc on state
2	Wake Up Timer startup	The Wake Up Timer has been modified to provide faster start up.
3	Unlocking of the PLL in 315 MHz band	The reference clock duty cycle was tuned closer to 50%, which eliminated the 315 MHz PLL lock issues.
4	Unknown VDI state when the receiver chain is switched off	VDI is set to logic low when receiver chain is switched off
5	When the device wakes from sleep mode, no clock is available on the CLK (PIN 8).	The modifications eliminated this problem.
6	If the µC CLK output was used in LPDM mode, the internal logic control did not switch off the crystal oscillator during the idle period of the LPDM cycle.	The modifications eliminated this oblem.

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