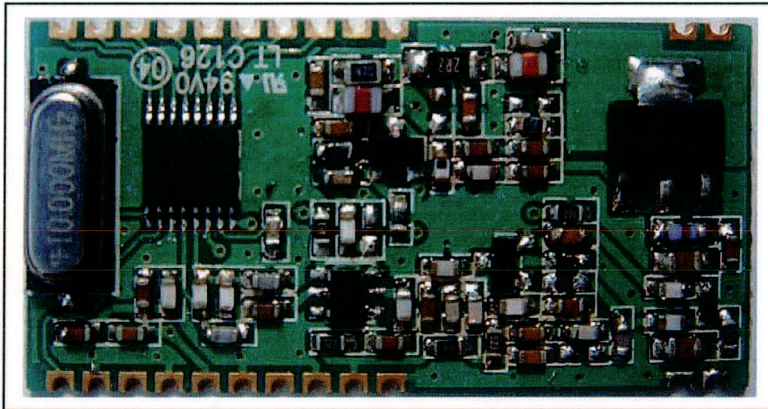


## UNIVERSAL ISM BAND FSK TRANSCEIVER MODULE

WITH 500mW OUTPUT POWER

### RFM12BP

(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 [RF12B datasheet](#))



## General Introduction

RFM12BP is a low costing ISM band transceiver module implemented with 500mW output power. It works signal ranges from 433/868/915MHZ bands, The SPI interface is used to communicate with microcontroller for parameter setting.

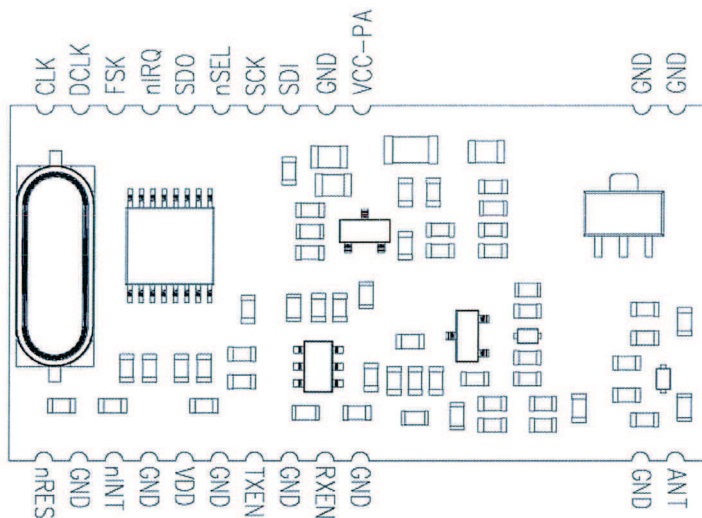
## Features:

- High output power with 500mW
- High input sensitivity with -117dBm
- Low costing, high performance and price ratio
- 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)
- 50 OHM antenna input/output
- Programmable TX power
- Programmable TX frequency deviation (from 15 to 240 KHz)
- Programmable receiver bandwidth (from 67 to 400 kHz)
- Analog and digital signal strength indicator (ARSSI/DRSSI)
- Automatic frequency control (AFC)
- Data quality detection (DQD)
- Internal data filtering and clock recovery
- RX synchron pattern recognition
- SPI compatible serial control interface
- Clock and reset signal output for external MCU use
- 16 bit RX Data FIFO
- Two 8 bit TX data registers
- Wakeup timer
- 2.2V – 3.8V power supply for FSK IC, 12V power supply for power amplifier
- Standby current less than 0.3uA
- Supports very short packets (down to 3 bytes)

## Typical Application:

- Remote control
- Remote sensor
- Wireless data collection
- Home security system
- Toys

## Pin Definition:



PIN number	definition	Type	Function
1	GND	S	ground
2	GND	S	ground
3	VCC-PA	S	Positive power supply for power amplifier (12V)
4	GND	S	ground
5	SDI	DI	SPI data input
6	SCK	DI	SPI clock input
7	nSEL	DI	Chip select (active low)
8	SDO	DO	Serial data output with bus hold
9	nIRQ	DO	Interrupts request output ( active low )
10	FSK/DATA/n FFS	DI/DO/DI	Transmit FSK data input/ Received data output (FIFO not used)/ FIFO select
11	DCLK/CFIL/F FIT	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
12	CLK	DO	Clock output for external microcontroller
13	nRES	DIO	Reset output ( active low )
14	GND	S	ground
15	nINT/VDI	DI/ DO	Interrupt input (active low)/Valid data indicator
16	GND	S	ground
17	VDD	S	Positive power supply for FSK IC(2.2V-3.8V)
18	GND	S	ground

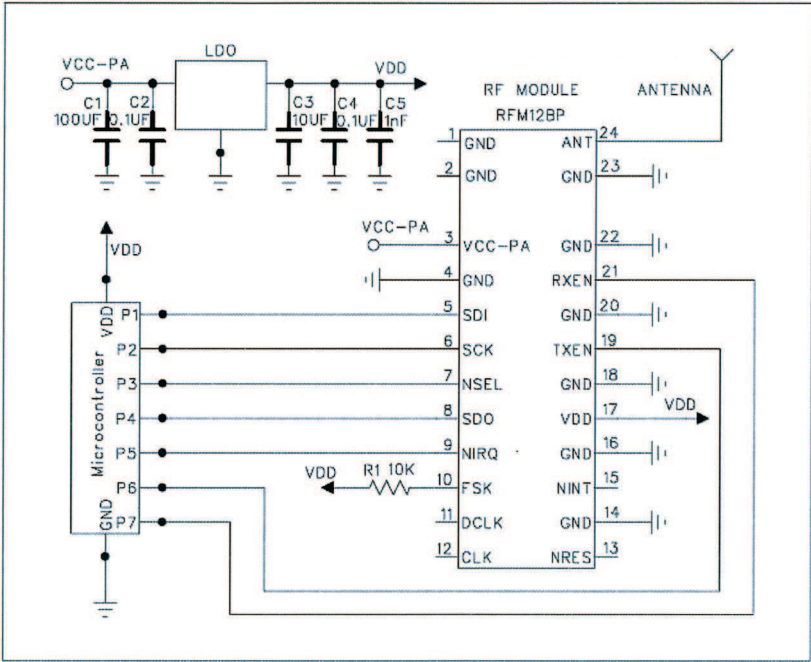
# RFM12BP

Datasheet REV2.3

19	TXEN	AI	TX enable (active high ), Drive current $\geq 3\text{mA}$ . TX disable(active low).
20	GND	S	ground
21	RXEN	AI	RX enable (active high), Drive current $\geq 3\text{mA}$ . RX disable(active low).
22	GND	S	ground
23	GND	S	ground
24	ANT	AIO	RF signal output/input (50 OHM)

## Typical Application

**Typical application with FIFO usage**



## Electrical Parameter:

**Maximum ( not at working mode)**

symbol	parameter	minimum	maximum	Unit
VDD	Positive power supply for FSK IC	-0.5	4.0	V
VCC-PA	Positive power supply for power amplifier	-0.5	13	V
V <sub>in</sub>	All pin input level except VDD,VCC-PA,GND,ANT	-0.5	VDD+0.5	V
I <sub>in</sub>	Input current except VDD,VCC-PA,GND,ANT	-25	25	mA
ESD	Human body model		1000	V
T <sub>st</sub>	Storage temperature	-55	125	°C
T <sub>ld</sub>	Soldering temperature(10s)		260	°C

# RFM12BP

Datasheet REV2.3

## Recommended working range

symbol	parameter	min	max	Unit
VDD	Positive power supply	2.2	3.8	V
VCC-PA	Positive power supply for power amplifier	11	13	V
T <sub>op</sub>	Working temperature	-40	85	°C

## DC characteristic

symbol	parameter	Remark	min	typ	max	Unit
I <sub>dd_TX_PMA</sub> x	Supply current (TX mode, P <sub>out</sub> = 500mW)	433MHz band 868/915MHz band		200 230		mA
I <sub>dd_RX</sub>	Supply current (RX mode)	433MHz band 868/915MHz band		20 23		mA
I <sub>x</sub>	Idle current	Crystal oscillator on		0.62	1.2	mA
I <sub>pd</sub>	Sleep mode current	All blocks off		0.3		uA
I <sub>lb</sub>	Low battery detection			0.5		uA
V <sub>lb</sub>	Low battery detect threshold	0.1V per step	2.2		3.8	V
V <sub>lba</sub>	Low battery detection accuracy		0		5	%
V <sub>il</sub>	Low level input				0.3*V <sub>dd</sub>	V
V <sub>ih</sub>	High level input		0.7*V <sub>dd</sub>			V
I <sub>il</sub>	Leakage current	V <sub>il</sub> =0V	-1		1	uA
I <sub>ih</sub>	Leakage current	V <sub>ih</sub> =V <sub>dd</sub> , V <sub>dd</sub> =4V	-1		1	uA
V <sub>ol</sub>	Low level output	I <sub>ol</sub> =2mA			0.4	V
V <sub>oh</sub>	High level output	I <sub>oh</sub> =-2mA	V <sub>dd</sub> -0.4			V

## AC characteristic

symbol	parameter	remark	min	typical	max	Unit
f <sub>ref</sub>	PLL frequency		9	10	11	MHz
f <sub>LO</sub>	frequency (10MHz crystal used)	433 MHz band,2.5KHz step 868 MHz band,5KHz step 915 MHz band,7.5KHz step	430.24 860.48 900.72		439.75 879.51 929.27	MHz
f <sub>LO</sub>	frequency (9MHz crystal used)	433 MHz band,2.5KHz step 868 MHz band,5KHz step 915 MHz band,7.5KHz step	387.22 774.43 810.65		395.76 791.56 836.34	MHz
f <sub>LO</sub>	frequency (11MHz crystal used)	433 MHz band,2.5KHz step 868 MHz band,5KHz step 915 MHz band,7.5KHz step	473.26 946.53 990.79		483.73 967.46 1022.2	MHz
BW	Receiver bandwidth	mode 0 mode 1 mode 2	60 120 180	67 134 200	75 150 225	KHz

# RFM12BP

Datasheet REV2.3

		mode 3	240	270	300	
		mode 4	300	350	375	
		mode 5	360	400	450	
$t_{lock}$	PLL lock time	After 10MHz step hopping, frequency error <10 kHz		30		us
$t_{st, P}$	PLL startup time	With a running crystal oscillator		200	300	us
BR	Data rate	With internal digital demodulator	0.6		115.2	kbps
BR <sub>A</sub>	Data rate	With external RC filter			256	kbps
P <sub>min</sub>	Sensitivity (BER 10 <sup>-3</sup> , BW=134KHz, BR=1 .2kbps,)	433MHz band 868MHz band 915MHz band		-118 -114 -112	-116 -112 -110	dBm
AFC <sub>range</sub>	AFC working range	df <sub>FSK</sub> : FSK deviation in the received signal		0.8* df <sub>FSK</sub>		

## AC characteristic(Transmitter)

symbol	parameter	remark	min	typical	max	Unit
P <sub>max_50</sub>	Max. output power delivered to 50Ohm load	433MHZ band 868MHZ band 915MHZ band	26 25 25	27 27 27		dBm
BR <sub>TX</sub>	FSK bit rate	Via internal TX data register			172	kbps
BR <sub>A</sub> <sub>TX</sub>	FSK bit rate	TX data connected to the FSK input			256	kbps
df <sub>fsk</sub>	FSK frequency deviation	Programmable in 15 kHz steps	15		240	KHZ

## AC characteristic(Turn-on/Turnaround timings)

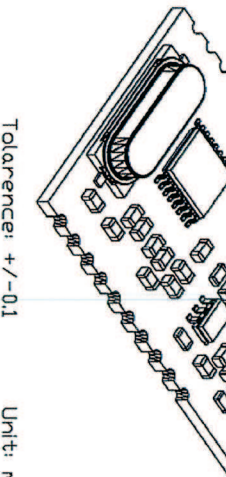
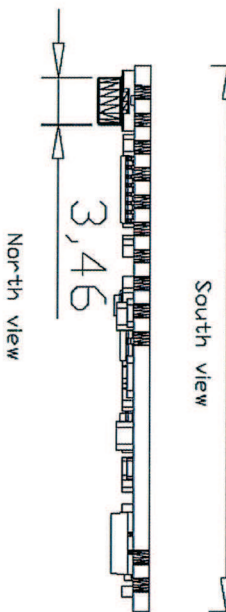
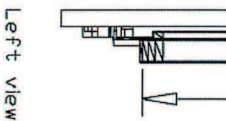
symbol	parameter	remark	min	typical	max	Unit
T <sub>st</sub>	Crystal oscillator startup time	Crystal ESR < 100		1	5	ms
T <sub>tx_XTAL_ON</sub>	Transmitter turn-on time	Synthesizer off, crystal oscillator on with 10 MHz step		250		us
T <sub>rx_XTAL_ON</sub>	Receiver turn-on time	Synthesizer off, crystal oscillator on with 10 MHz step		250		us
T <sub>tx_rx_SYNT_ON</sub>	Transmitter – Receiver turnover time	Synthesizer and crystal oscillator on during TX/RX change with 10 MHz step		150		us

# RFM12BP

Datasheet REV2.3

$T_{rx\_tx\_SYNT\_ON}$	Receiver – Transmitter turnover time	Synthesizer and crystal oscillator on during RX/TX change with 10 MHz step		150		us
$C_{xl}$	Crystal load capacitance	Programmable in 0.5 pF steps, tolerance+/- 10%	8.5		16	pf
$t_{POR}$	Internal POR timeout	After $V_{dd}$ has reached 90% of final value			100	ms
$t_{PBt}$	Wake-up timer clock period	Calibrated every 30 seconds	0.96		1.05	ms
$C_{in, D}$	Digital input capacitance				2	pf
$t_{r, f}$	Digital output rise/fall time	15pF pure capacitive load			10	ns

# Mechanical Dimen



## Module Model Definition

model=module-operation band

**RFM12BP – 433**

module type

operation band

- example: 1. RFM12BP module at 433MHz band, RFM12BP-433.  
2. RFM12BP module at 868MHZ band, RFM12BP-868.