BEST MODULES

Sub-1GHz OOK RX Module

BM2302-6x-2

Revision: V1.00   Date: July 10, 2023
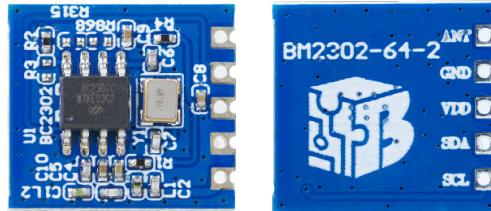
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Features

- Operating voltage: 2.4V~5.5V
- Operating current
  - 4.0mA @ 433MHz
  - 5.5mA @ 868MHz
- RX sensitivity (5V, 25, BER<0.1%)
  - -108dBm @ 10Ksps, 433MHz
  - -107dBm @ 10Ksps, 868MHz
- Wide RF input power range: Sensitivity~+10dBm
- Modulation: OOK
- Symbol rate: 0.5Ksps~40Ksps
- Interface: 5-pin both stamp and straight hole
- Size: 16.0mm(L)×15.0mm(W)×2.6mm(H)
- Operating temperature: -40°C~85°C

General Description

The BM2302-6x-2 are ultra-low power consumption, high-performance and low-cost Sub-1GHz Low-IF receiving modules whose design is based on the BC2302C/BC2302D devices. The module supports wireless applications in the 315, 433, 868 and 915MHz frequency bands and can be easily accessed using a two-wire I²C interface. The symbol rate is in a range from 0.5Kbps to 40Ksps. The receiving sensitivity can be up to -108dBm.
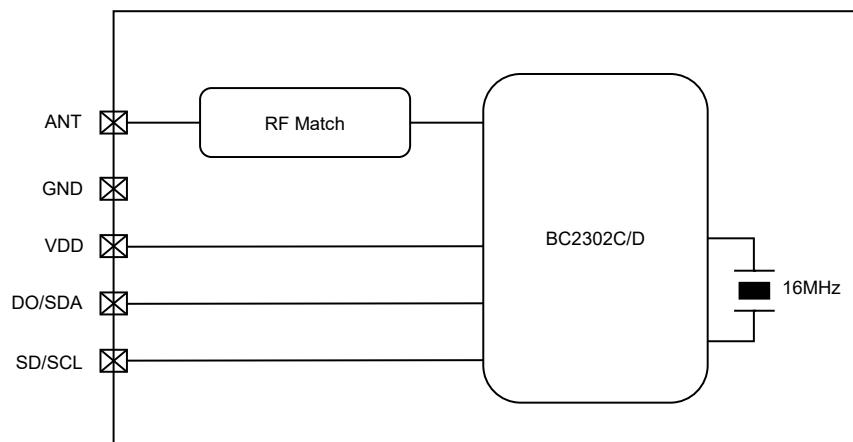
Applications

- Roller shutters
- Industrial control unidirectional RF products
- Home appliances
- Ceiling fans
- Drying rack for clothing
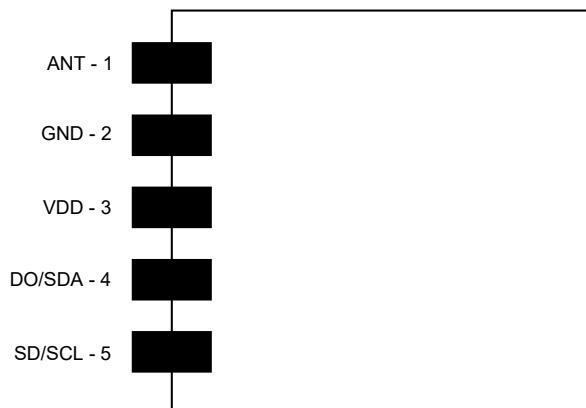
Selection Table

| Part Number	Optimal Operating Frequency	Applicable Frequency Range
BM2302-63-2	315MHz	288MHz~355MHz
BM2302-64-2	433.92MHz	394MHz~475MHz
BM2302-68-2	868.35MHz	819MHz~940MHz
BM2302-69-2	915MHz	861MHz~978MHz

Block Diagram

Pin Assignment

Pin Description

Pin No.	Pin Name	Type	Function Description
1	ANT	AI	Antenna interface
2	GND	PWR	Negative power supply, GND
3	VCC	PWR	Positive power supply
4	DO/SDA	DI/DO	DO: Demodulated data output in the RX mode SDA: I²C data line in the Configuration mode
5	SD/SCL	DI	SD: RX mode Shut-down control, should be pulled low in the RX mode SCL: I²C clock input line in the Configuration mode

Legend: PWR=Power;   DI=Digital input;   DO=Digital output;   AI= Analog input

Technical Specifications

Absolute Maximum Ratings

Supply Voltage .... V_{SS}-0.3V to V_{SS}+5.5V

Input Digital Voltage .... V_{SS}-0.3V to V_{DD}+0.3V

Storage Temperature..-60°C to 125°C

Operating (Environment) Temperature ....-40°C to 85°C

ESD HBM ....>±2kV

Note: Devices being ESD sensitive. HBM (Human Body Mode) is based on MIL-STD-883.

D.C. Electrical Characteristics

Ta=25°C, V_{DD}=5.0V

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Operating Voltage	—	2.4	5.0	5.5	V
T_{op}	Operating Temperature	—	-40	—	85	°C
Current Consumption						
I_{SLP}	Deep Sleep Current Consumption	—	—	0.5	—	µA
I_{RX}	RX Current Consumption	@ 315MHz	—	4.4	—	mA
		@ 433MHz	—	4.0	—	
		@ 868MHz	—	5.5	—	
		@ 915MHz	—	5.5	—	
R_{PH}	Pull-high Resistance for I/O Ports	—	—	100	—	kΩ

RF Electrical Characteristics

Ta=25°C, V_{DD}=5.0V

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Receiver Characteristics						
f_{RF}	RF Frequency	BM2302-63-2	—	315	—	MHz
		BM2302-64-2	—	433.92	—	
		BM2302-68-2	—	868.35	—	
		BM2302-69-2	—	915	—	
SR	Symbol Rate (OOK Modulation)	I²C Configuration	0.5	—	40	Ksps
		Auto RX Mode	0.5	—	19	Ksps
P_{SENS}	RX Sensitivity – 315MHz (Instrument: Keysight E4438C)	SR=1Ksps, BER=0.1%	—	-109	—	dBm
		SR=10Ksps, BER=0.1%	—	-109	—	dBm
	RX Sensitivity – 433.92MHz (Instrument: Keysight E4438C)	SR=1Ksps, BER=0.1%	—	-108	—	dBm
		SR=10Ksps, BER=0.1%	—	-108	—	dBm
	RX Sensitivity – 868.35MHz (Instrument: Keysight E4438C)	SR=1Ksps, BER=0.1%	—	-107	—	dBm
		SR=10Ksps, BER=0.1%	—	-107	—	dBm
	RX Sensitivity – 915MHz (Instrument: Keysight E4438C)	SR=1Ksps, BER=0.1%	—	-106	—	dBm
		SR=10Ksps, BER=0.1%	—	-106	—	dBm
BW	RX Bandwidth	Auto RX Mode	—	100	—	kHz
SE_{RX}	Receiver Spurious Emission	25MHz~1GHz	—	—	-57	dBm
		Above 1GHz	—	—	-47	
	Blocking Immunity	±2MHz offset	—	42	—	dBc
		±10MHz offset	—	60	—	

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Cof_{ST}	Configuration Mode Settling Time (Deep Sleep Mode to Configuration Mode Settling Time	—	—	2	—	ms
RX_{ST}	RX Mode Settling Time (Deep Sleep Mode to RX Mode Data Out)	—	—	10	—	ms
LO Characteristics						
f_{LO}	Frequency Coverage Range (Note)	BM2302-63-2	288	—	355	MHz
		BM2302-64-2	394	—	475	
		BM2302-68-2	819	—	940	
		BM2302-69-2	861	—	978	
	Frequency Resolution	—	—	—	0.1	kHz
	Synthesizer Locking Time	—	—	130	—	µs

Note: The f_{LO} is a supported frequency range, the reception sensitivity varies greatly for different frequency points within the range. Therefore, a receive sensitivity at a frequency point within the range may not be guaranteed. It is recommended to use the optimal operating frequency directly, to use other frequency points, users need to evaluate the actual test.
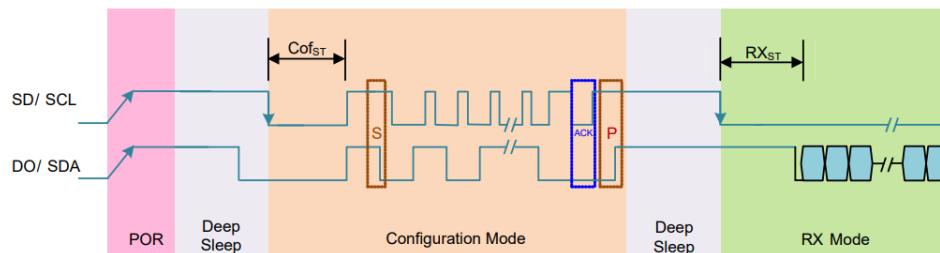
Functional Description

The BM2302-6x-2 are Sub-1GHz Low-IF OOK receiving modules, which provide three operation modes, including the Deep Sleep mode, Configuration mode and RX mode.

In the Deep Sleep mode, there is less than 1µA of sleep mode leakage current with register data retention.

When the BM2302-6x-2 SDA is low and a SCL falling edge occurs, the modules enter the Configuration mode after a 2ms delay time. In the Configuration mode, the BM2302-6x-2 are operated as I²C slaves, users can configure their internal registers through the SDA and SCL pins to implement the required RF functions. The modules will exit the Configuration mode and return to the Deep Sleep mode by setting the CFOMSD bit (Bit 0) in the 42h register high.

In the Deep Sleep mode, if the SCL pin is pulled low, the BM2302-6x-2 will enter the RX mode. In the RX mode, the module will receive the RF signal and then output the demodulated data onto the DO/SDA pin. The BM2302-6x-2 will exit the RX mode and return to the Deep Sleep mode by pulling the SCL high.

I²C Communication Format

The SDA and SCL of the BM2302-6x-2 form an I²C communication interface that can be used to configure and read data from the module's internal registers in the Configuration mode. The modules support the I²C format for byte write, page write, byte read and page read formats. Every byte placed onto the SDA line must be 8-bits long. The module device address is fixed to 0x23. Refer to the BC2302C/D datasheet for details.

Byte Write

| S | DADDR[6:0] | W | A | RADDR[7:0] | A | DATA | A | P |

Page Write

| S | DADDR[6:0] | W | A | RADDR[7:0] | A | DATA | A | DATA(n+1) | A | DATA(n+x) | A | P |

Byte Read

| S | DADDR[6:0] | W | A | RADDR[7:0] | A | RS | DADDR[6:0] | R | A | DATA | NA | P |

Page Read

| S | DADDR[6:0] | W | A | RADDR[7:0] | A | RS | DADDR[6:0] | R | A | DATA(n) | A | DATA(n+1) | A | DATA(n+x) | NA | P |

Bus Direction: ▮ : Host to device;   ▮ : Device to host;

Symbol Definitions: S: Start;   **RS:** Repeated Start;   **P:** Stop;
DADDR[6:0]: Device Address, 23h;   **R:** Read(1);
W: Write(0);   **RADDR[7:0]:** register address;
A: ACK(0);   **NA:** NAK(1)

I²C START and STOP Conditions

I²C START condition   I²C STOP condition
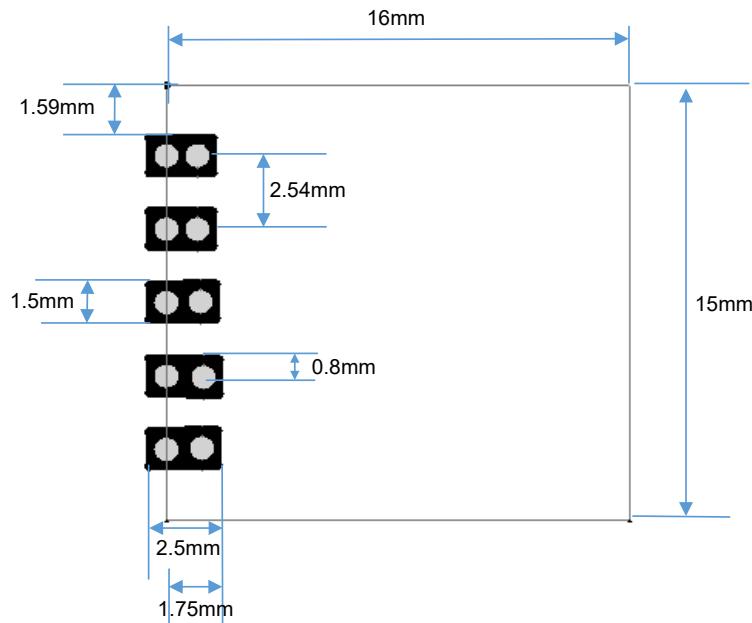
Application Circuits
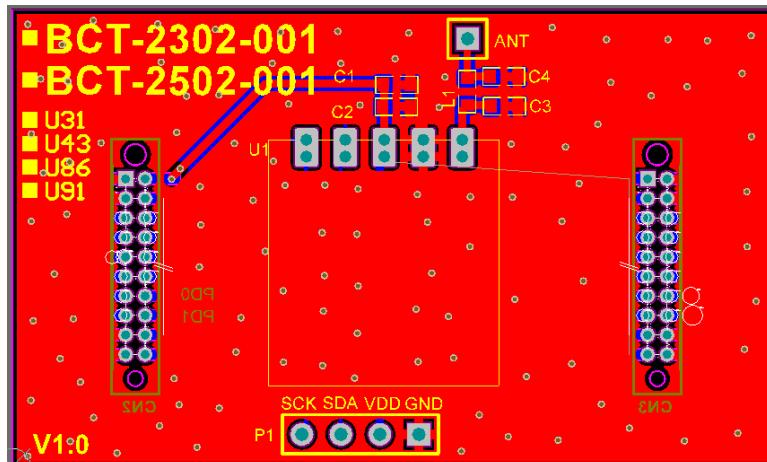
Layout Description

PCB Footprint
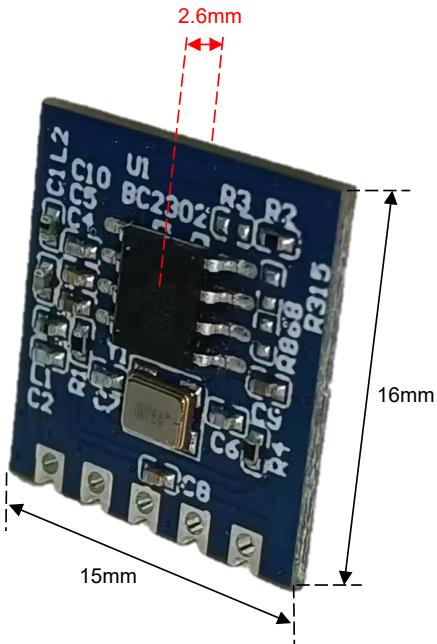
Layout Example

Note: L1, C3 and C4 are reserved antenna matching circuits, if the used antenna impedance is not 50Ω, the antenna impedance can be adjusted by these components, such as the antenna impedance is 50Ω, only need to connect 0R resistance to L1.

Dimensions

Reference Information

Modification History

Data	Author	Issue	Modification Information
2023.05.25	江振東	V1.00	First Version

Relevant Document

Refer to the BC2302C/D Development Board Application Note sample program description document for details

Buy Online

- BM2302-63-2
- BM2302-64-2
- BM2302-68-2
- BM2302-69-2

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