Sub-1GHz GFSK TRX Module

BM3602-0x-1

Revision: V1.00 Date: July 19, 2024

www.bestmodulescorp.com

Table of Contents

Features

- Operating voltage range: 1.9V~3.6V
- Frequency range: 315MHz~915MHz
- Modulation type: GFSK
- Symbol rate: 2Kbps~250Kbps
- TX output power: 0dBm~13dBm
- Operating current
  - 0.4μA (Typ.) @ 3.3V, Deep Sleep Mode
  - 4.2/5.5mA (Typ.) @ 3.3V, 433/868.3MHz RX 50Kbps
  - 4.6/6.1mA (Typ.) @ 3.3V, 433/868.3MHz RX 250Kbps
  - 22/24mA (Typ.) @ 3.3V, 433/868.3MHz TX 10dBm
- Receiver sensitivity
  - -113/-113dBm (Typ.) @ 3.3V, 433/868.3MHz, 10K symbol rate & BER=0.1%
  - -110/-108dBm (Typ.) @ 3.3V, 433/868.3MHz, 50K symbol rate & BER=0.1%
  - -102/-101dBm (Typ.) @ 3.3V, 433/868.3MHz, 250K symbol rate & BER=0.1%
- Maximum operating input power: 10dBm @ RF-in, BER=0.1%
- Interface: 12-pin stamp hole
- Dimension: 15.0mm(L)×18.5mm(W)×2.5mm(H)
- Operating temperature: -40°C~85°C

General Description

The BM3602-0x-1 is designed based on the BC3602 device and which forms a Sub-1GHz GFSK transceiver module. The module can be used for wireless applications in the 315MHz, 433MHz, 470MHz, 868MHz and 915MHz ISM (Industrial, Scientific and Medical) bands. The master MCU can communicate with the device via a 3 or 4 wire SPI interface for wireless data communications.

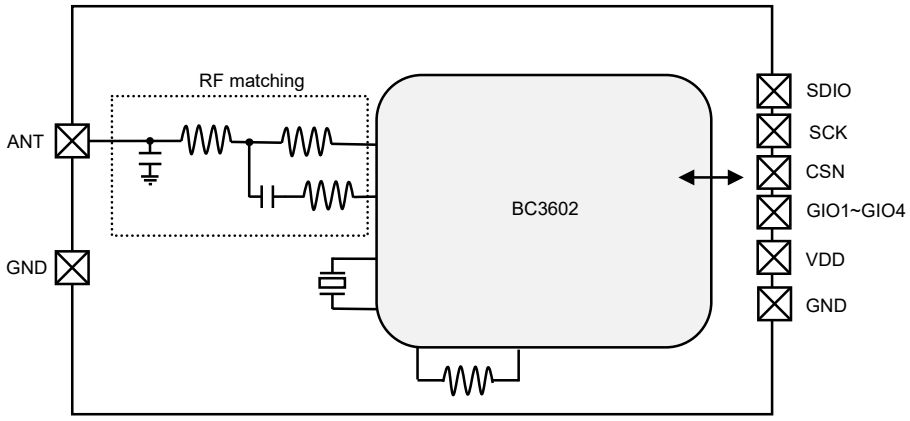
Applications

- Ceiling fan lights
- Wireless switches
- Wireless doorbells
- Wireless smoke sensors

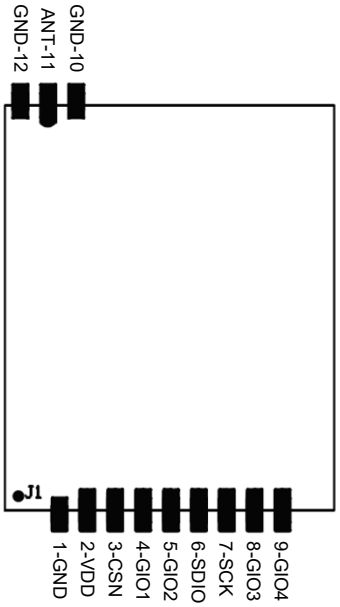
Selection Table

Module Part Number	Frequency Band	Operating Frequency Point
BM3602-03-1	315MHz	315MHz
BM3602-04-1	433MHz	433.92MHz
BM3602-08-1	868MHz	868.35MHz
BM3602-09-1	915MHz	915MHz

Block Diagram



Pin Assignment



Pin Description

Pin	Function	Type	Description
1	GND	PWR	Negative power supply, GND
2	VDD	PWR	Positive power supply
3	CSN	DI	SPI chip select, low active
4	GIO1	DI/DO	Multi-function I/O 1
5	GIO2	DI/DO	Multi-function I/O 2
6	SDIO	DI/DO	SPI data input / output
7	SCK	DI	SPI clock input
8	GIO3	DI/DO	Multi-function I/O 3
9	GIO4	DI/DO	Multi-function I/O 4
10	GND	PWR	Negative power supply, GND

Pin	Function	Type	Description
11	ANT	AI	Antenna input
12	GND	PWR	Negative power supply, GND

Legend: DI: Digital Input; DO: Digital Output; AI: Analog input; PWR: Power.

Technical Specifications

Absolute Maximum Ratings

Supply Voltage ..... V_{SS}-0.3V~V_{SS} +3.6V

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

Storage Temperature..... -60℃~150℃

Operating (Ambient) Temperature ..... -40℃~85℃

ESD HBM ..... >±2kV

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

Electrical Characteristics

Ta=25°C, V_{DD}=3.3V, f_{XTAL}=16MHz, GFSK modulation with matching circuit and low/high pass filter
RF output is powered by V_{DD} (3.3V), unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
T_{OP}	Operating Temperature	—	-40	—	85	°C
V_{DD}	Supply Voltage	—	1.9	3.3	3.6	V
Current Consumption						
$I_{DeepSleep}$	Deep Sleep Mode Current Consumption	—	—	0.4	1.0	μA
I_{IL}	Idle Mode Current Consumption	LIRC on, X'tal off	—	1.8	—	μA
$I_{LightSleep}$	Light Sleep Mode Current Consumption	X'tal on	—	0.55	—	mA
$I_{Standby}$	Standby Mode Current Consumption @ 315/433MHz	X'tal on, Synthesizer on	—	2.2	—	mA
	Standby Mode Current Consumption @ 868/915MHz		—	3.0	—	

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{RX}/I_{TX}	315MHz Band Current Consumption	RX mode @ 50Kbps	—	4.1	—	mA
		RX mode @ 250Kbps	—	4.4	—	
		TX mode @ 0dBm P_{OUT}	—	14	—	
		TX mode @ 10dBm P_{OUT}	—	24	—	
		TX mode @ 13dBm P_{OUT}	—	30	—	
	433MHz Band Current Consumption	RX mode @ 50Kbps	—	4.2	—	
		RX mode @ 250Kbps	—	4.6	—	
		TX mode @ 0dBm P_{OUT}	—	14	—	
		TX mode @ 10dBm P_{OUT}	—	22	—	
		TX mode @ 13dBm P_{OUT}	—	30	—	
	868MHz Band Current Consumption	RX mode @ 50Kbps	—	5.5	—	
		RX mode @ 250Kbps	—	6.1	—	
		TX mode @ 0dBm P_{OUT}	—	15	—	
		TX mode @ 10dBm P_{OUT}	—	24	—	
		TX mode @ 13dBm P_{OUT}	—	32	—	
	915MHz Band Current Consumption	RX mode @ 50Kbps	—	6	—	
		RX mode @ 250Kbps	—	6.5	—	
		TX mode @ 0dBm P_{OUT}	—	15	—	
		TX mode @ 10dBm P_{OUT}	—	24	—	
		TX mode @ 13dBm P_{OUT}	—	32	—	

RF Electrical Characteristics

Ta=25°C, V_{DD}=3.3V, f_{XTAL}=16MHz, GFSK modulation with matching circuit and low/high pass filter
RF output is powered by V_{DD} (3.3V), unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
RF Characteristics						
f_{RF}	RF Frequency Band	315MHz band	—	315	—	MHz
		433MHz band	—	433.92	—	
		470~510MHz band	—	490	—	
		868MHz band	—	868.3	—	
		915MHz band	—	915	—	
DR	Data Rate	GFSK modulation	2	—	250	Kbps
Transmitter						
P_{OUT}	TX Output Power	433MHz band	0	—	13	dBm
		868MHz band	0	—	13	
S.E.$_{TX}$	TX Spurious Emission (P_{OUT}=10dBm)	f < 1GHz	—	—	-36	dBm
		47MHz < f < 74MHz	—	—	-54	
		87.5MHz < f < 118MHz				
		174MHz < f < 230MHz				
		470MHz < f < 862MHz				
		2^{nd}, 3^{rd} Harmonic	—	—	-30	

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Receiver						
$t_{ST,RX}$	RX Settling Time	Light Sleep mode to RX mode	—	150	—	μs
P_{Sens}	315MHz RX Sensitivity @ BER=0.1%	2Kbps (f_{DEV}=8kHz)	—	-119	—	dBm
		10Kbps (f_{DEV}=40kHz)	—	-112	—	
		50Kbps (f_{DEV}=18.75kHz)	—	-110	—	
		125Kbps (f_{DEV}=46.875kHz)	—	-106	—	
		250Kbps (f_{DEV}=93.75kHz)	—	-103	—	
	433MHz RX Sensitivity @ BER=0.1%	2Kbps (f_{DEV}=8kHz)	—	-120	—	dBm
		10Kbps (f_{DEV}=40kHz)	—	-113	—	
		50Kbps (f_{DEV}=18.75kHz)	—	-110	—	
		125Kbps (f_{DEV}=46.875kHz)	—	-106	—	
		250Kbps (f_{DEV}=93.75kHz)	—	-102	—	
	868MHz RX Sensitivity @ BER=0.1%	2Kbps (f_{DEV}=8kHz)	—	-119	—	dBm
		10Kbps (f_{DEV}=40kHz)	—	-113	—	
		50Kbps (f_{DEV}=18.75kHz)	—	-108	—	
		125Kbps (f_{DEV}=46.875kHz)	—	-105	—	
		250Kbps (f_{DEV}=93.75kHz)	—	-101	—	
	915MHz RX Sensitivity @BER=0.1%	2Kbps (f_{DEV}=8kHz)	—	-119	—	dBm
		10Kbps (f_{DEV}=40kHz)	—	-112	—	
		50Kbps (f_{DEV}=18.75kHz)	—	-109	—	
		125Kbps (f_{DEV}=46.875kHz)	—	-105	—	
		250Kbps (f_{DEV}=93.75kHz)	—	-102	—	
$P_{IN,max}$	Maximum Input Power @ BER=0.1%	—	—	—	10	dBm
IR	Image Rejection	—	—	25	—	dB
S.E.$_{RX}$	RX Spurious	25MHz~1GHz	—	—	-57	dBm
		Above 1GHz	—	—	-47	
	RSSI Range	AGC on	-110	—	-10	dBm
LO Characteristics						
f_{LO}	RF Frequency Coverage Range	315MHz band	290	—	335	MHz
		433MHz band	415	—	490	
		868MHz band	830	—	1000	
		915MHz band	870	—	1050	
f_{STEP}	LO Frequency Resolution	—	—	—	1	kHz
PN_{LO}	315MHz Phase Noise	@ 100kHz offset	—	-86	—	dBc/Hz
		@ 1MHz offset	—	-107	—	
	433MHz Phase Noise	@ 100kHz offset	—	-85	—	
		@ 1MHz offset	—	-106	—	
	868MHz Phase Noise	@ 100kHz offset	—	-82	—	
		@ 1MHz offset	—	-103	—	
	915MHz Phase Noise	@ 100kHz offset	—	-82	—	
		@ 1MHz offset	—	-103	—	

Interface

SPI Communication Format

The BC3602 communicates with a master MCU via a 3-wire SPI interface (CSN, SCK, SDIO) or a 4-wire SPI interface (SDO from GIO1 or GIO2) with a data rate of up to 4Mbps. An SPI transmission is an (8+8×n) bits sequence which consists of an 8-bit command and n×8 bits of data, where n can be 0 or any natural number. If the number n is greater than the address boundary, the address will return to zero. The master MCU should pull the CSN (SPI chip select) pin low in order to access the BC3602. Using the SPI interface, user can access the control registers and issue Strobe commands. When writing data to the RF chip, the SPI data will be latched into the registers at the rising edge of the SCK signal. When reading data from the RF chip registers, the bit data will be transferred at the falling edge of the SCK signal after the target register address has been input.

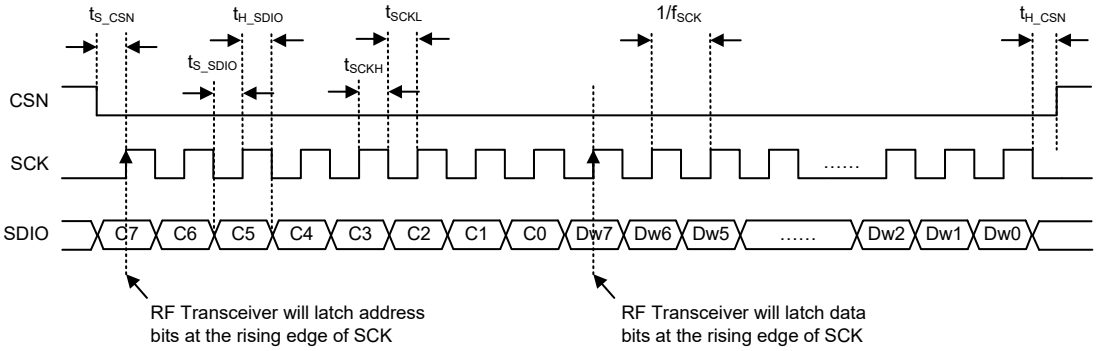
Command (8 bits)								Data (8 bits)							
C7	C6	C5	C4	C3	C2	C1	C0	D7	D6	D5	D4	D3	D2	D1	D0

SPI Command Format

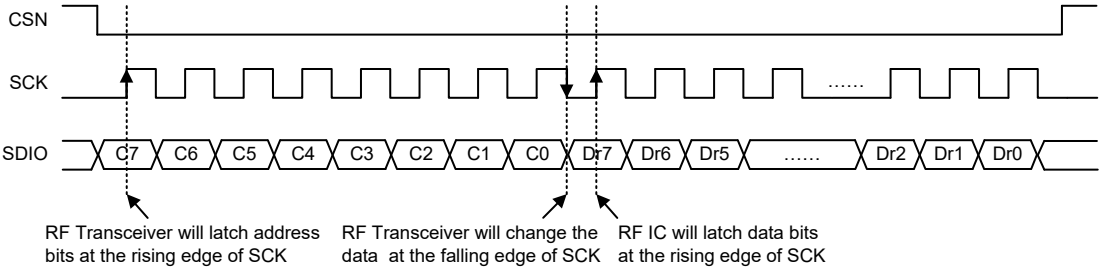
Two kinds of command are defined. One is 1-byte command only, named CmdO, and the other is 1-byte command followed by n-byte data, named CmdD.

C7	C6	C5	C4	C3	C2	C1	C0	Description	CmdO	CmdD
0	1	A5	A4	A3	A2	A1	A0	Write to control registers		√
1	1	A5	A4	A3	A2	A1	A0	Read from control registers		√
0	0	1	x	x	x	B1	B0	Set register bank	√	
0	0	0	1	x	x	x	0	Write SYNCWORD command		√
1	0	0	1	x	x	x	0	Read SYNCWORD command		√
0	0	0	1	x	x	x	1	TX FIFO write command		√
1	0	0	1	x	x	x	1	RX FIFO read command		√
1	0	0	1	1	1	1	1	Read Chip ID command		√
0	0	0	0	1	0	0	0	Software reset command	√	
0	0	0	0	1	0	0	1	TX FIFO address pointer reset command	√	
1	0	0	0	1	0	0	1	RX FIFO address pointer reset command	√	
0	0	0	0	1	0	1	0	Deep Sleep mode	√	
0	0	0	0	1	0	1	1	Idle mode	√	
0	0	0	0	1	1	0	0	Light Sleep mode	√	
0	0	0	0	1	1	0	1	Standby mode	√	
0	0	0	0	1	1	1	0	TX mode	√	
1	0	0	0	1	1	1	0	RX mode	√	

SPI Timing



3-Wire SPI Interface Write 1-byte Data Operation

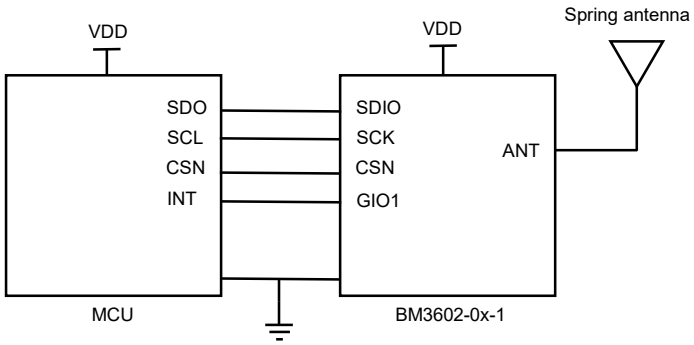


3-Wire SPI Interface Read 1-byte Data Operation

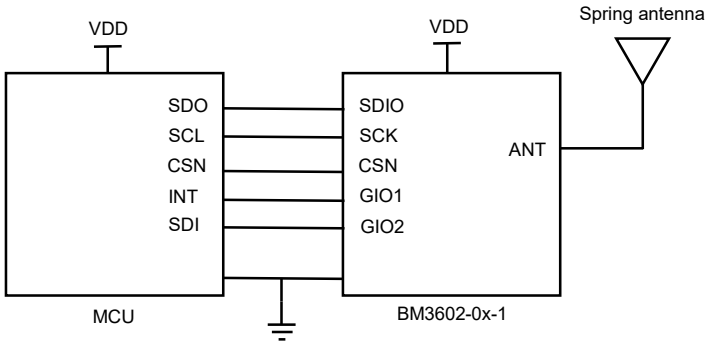
* Products are available from Best Modules.

Application Circuits

3-Wire SPI Mode

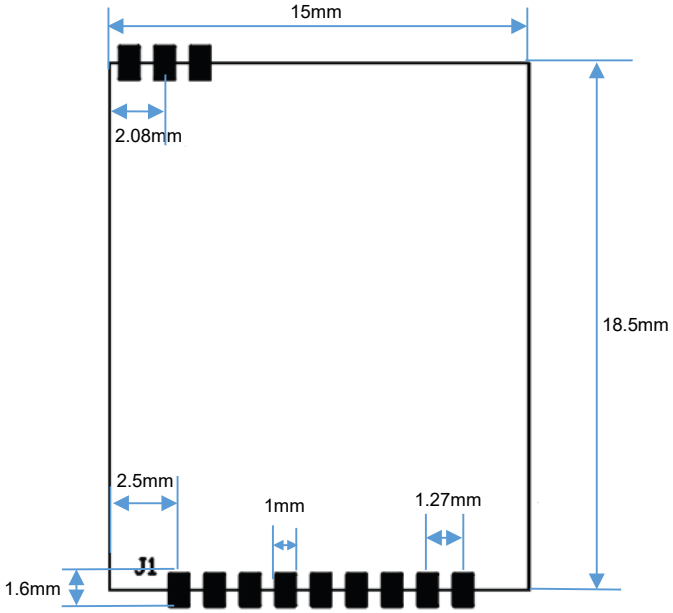


4-Wire SPI Mode



Layout Description

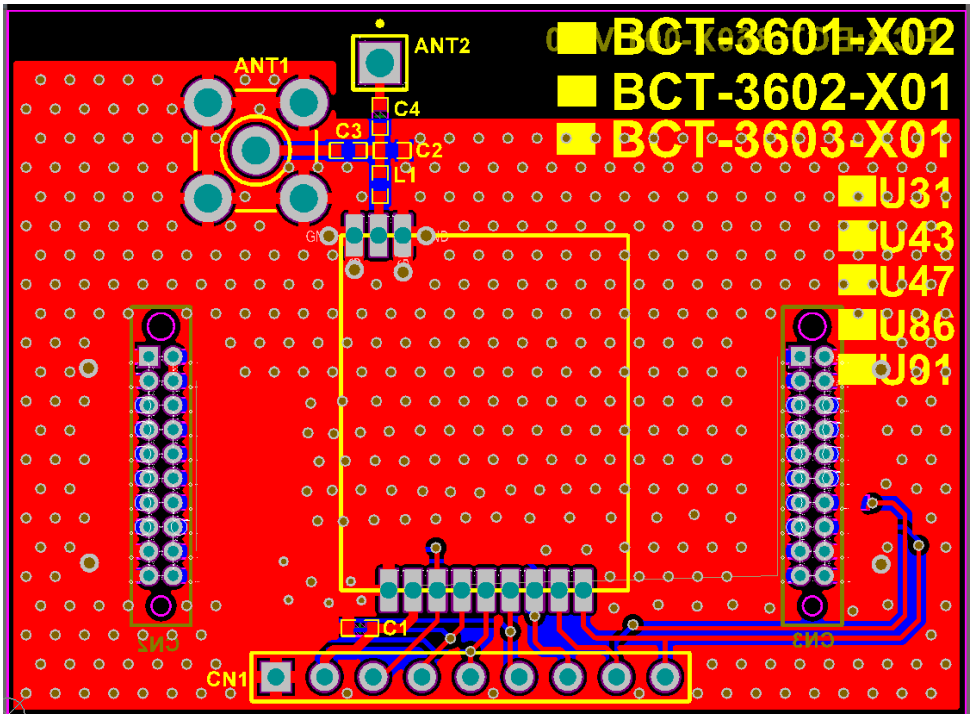
PCB Footprint



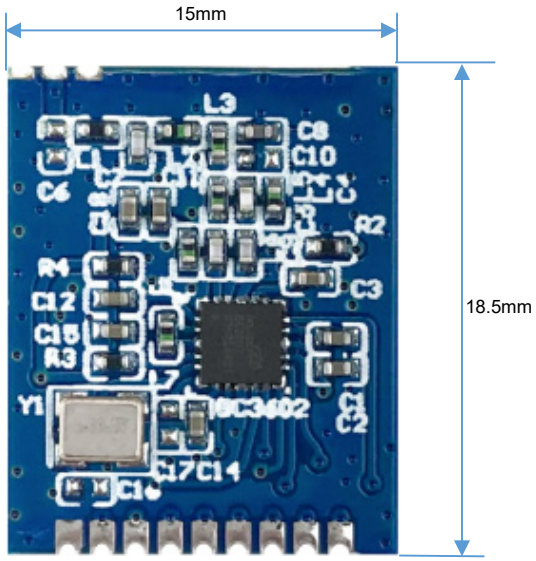
Layout Guidelines

1. Provide a stable power supply and add appropriate filter capacitors.
2. Keep away from the DC-DC circuit as much as possible.
3. Reserve a π matching circuit for the antenna.
4. In practical applications ensure that metallic objects are kept as far away as possible from the antenna within 1cm.

Layout Example



Dimensions



Reference Information

Modification History

Date	Author	Issue	Modification Information
2024.07.8	Zahi	V1.00	First Version

Relevant Document

BC3602 Development Board Application Examples - Holtek

Buy Online

Best Modules