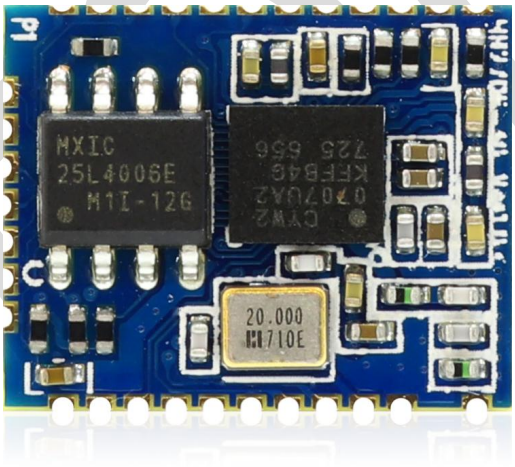
BB2706-30

Dual-Mode BT5 Module



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1. Device Overview

1.1 Features

- Bluetooth specificationV5.0 compliant
- BR 1Mbps,EDR 3Mbps, LE 1Mbps data rate
- LE profiles supported: GATT, HID over GATT (HOGP), Beacon
- Classic Bluetooth profiles supported: SPP, A2DP, HFP 1.6 with WBS, HID, PBAP, AVRCP, HSP, OBEX
- WeChat AirSync via SPP or BLE over GATT
- Apple Homekit, iPod Accessory Protocol (iAP2), Apple Notification Center Service (ANCS), Apple Media Service (AMS)
- Multi-connections: 6 SPP and 2 GATT concurrent connects
- UART or OTA firmware upgrade
- Serial port command for applications

1.2 Applications

- Bluetooth SPP or BLE to RS232 (RS483) serial data conversion
- Bluetooth wireless data transmission
- Medical and industrial telemetry
- Portable printers
- Barcode scanning devices
- Mobile POS devices
- Smart appliances
- Industrial automation
- Custom Bluetooth audio devices

1.3 Descriptions

The Module BB2706 has a notable merit that its firmware supports concurrent Bluetooth SPP and GATT connections. It establishes a Bluetooth bidirectional communication channel which is between the application MCU and the mobile phone through the UART interface. The application MCU can send a corresponding command to enable the Bluetooth module and to set it into different modes, then to send and receive communication data at the SPP or GATT level.The MCU can also read the mode status of the module through serial commands.

This module is designed with Cypress® CYW20706 dual mode Bluetooth 5.0 SoC. CYW20706 features 96 MHz Cortex M3 core, excellent receiving sensitivity down to -96 dBm (BLE GFSK), integrated PA to support Class 1 Tx power up to 12 dBm. These two RF parameters contribute to its best in class link budget to enable long Bluetooth communication distance around 100 meters or even farther.

As a dual mode Bluetooth module, it can realize both GATT and SPP connections concurrently, which provide the best interoperability for various iOS and Android mobile devices. It supports both BR (2 Mbps)

and EDR (3 Mbps) when running SPP. These high Classic Bluetooth data rate provides high throughput, enabling applications which require higher through than what BLE can provide. Its raw data through running SPP can reach up to 1 Mbps.

This module also supports Bluetooth audio profiles including but not limited to A2DP, HFP, and AVRCP. An external audio codec can be flexibly connected via PCM interface to drive a speaker and a microphone. This module can also support iAP2 and HomeKit for MFi licensed developers.

The module comes with a set of AT commands via UART interface for setting up a bidirectional Bluetooth data link easily between an application MCU and mobile phones.

1.4 Functional Block Diagram

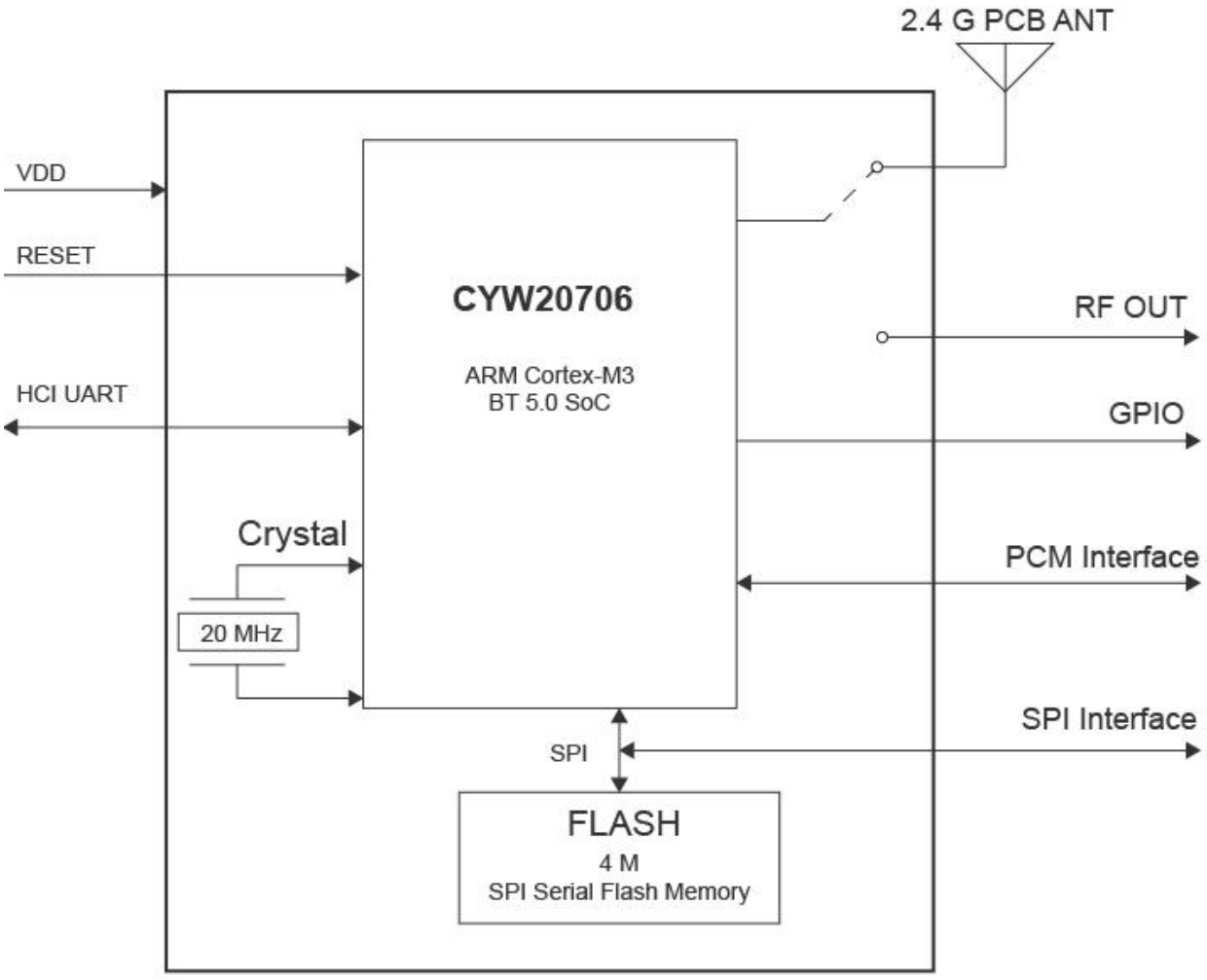

Figure 1.BB2706-30 Functional Block Diagram

2. Pin Configuration and Functions

2.1 Module Pin Diagram

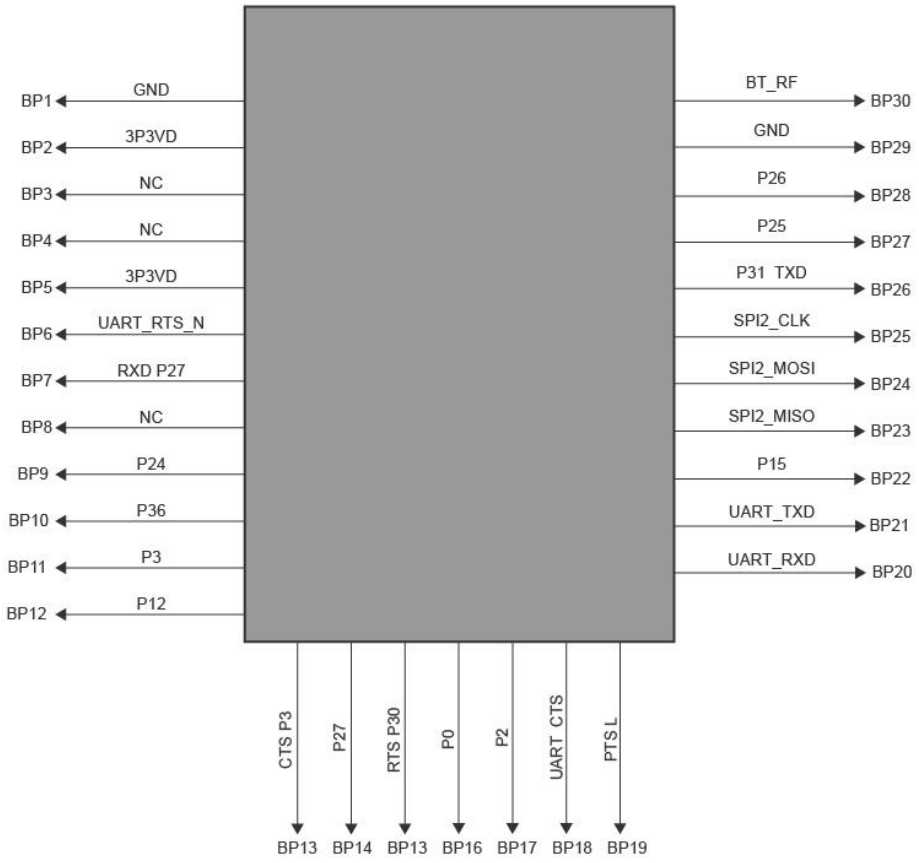

Figure 2.BB2706-30 Pin Diagram

2.2 Pin Functions

Pin	Name	Description	Typical
1	GND	Ground	Ground
2	3P3VD	Power	Power Supply: DC 2.7 V~3.6 V
3	NC	NC	/
4	NC	NC	/
5	3P3VD	Power	Internal connection with BP2
6	UART_RTS_N	I	Active-low reset input
7	P27	I	RXD for debugging
8	NC	NC	/
9	P24	O	GPIO
10	P36	I	GPIO
11	P3	I/O	GPIO

12	P12	I/O	GPIO
			I2S_DI/PCM_IN
13	P3	I/O	GPIO
			I2S_DI/PCM_OUT
14	P27	I	RXD for debugging
15	P30	I/O	GPIO
16	P0	I/O	GPIO
			I2S_WS/PCM_SYNC
17	P2	I/O	GPIO
			I2S_CLK/PCM_SYNC
18	UART_CTS_N	I	UART for flow control CTS
19	RST_L	I	External reset signal input, active low, internal self-pullup
20	UART_RXD	I	UART data Rx by default
			GPIO
21	UART_TXD	O	UART data Tx by default
			GPIO
22	P15	I/O	GPIO
23	SPI2_MISO	I/O	SPI_MISO
24	SPI2_MOSI	I/O	SPI_MOSI
25	SPI2_CLK	I/O	SPI clock
26	P31	O	TXD for debugging
27	P25	I/O	GPIO
28	P26	O	GPIO for state output to a LED
29	GND	Ground	Ground
30	BT_RF	O	RF pin connecting to an antenna

3. Specifications

3.1 Absolute Maximum Ratings

Caution! The absolute maximum ratings in the following table indicates voltages levels where permanent physical damage to the device can occur, even if these limits were exceeded for only a brief duration.

Parameter	Specifications			Unit
	Min.	Typ.	Max.	
3P3VD	-0.5	3	3.795	V
Ambient Temperature	-30	25	+85	℃
Storage Temperature	-40	-	+105	℃
Latch-up	-200	-	3.795	mA

3.2 RF Characteristics

3.2.1 Transmitter RF Parameters

Parameter	Conditions	Min.	Typ.	Max.	Unit
General					
Frequency Range	-	2402	-	2480	MHz
Class1: GFSK TX Power	-	-	12	-	dBm
Class1: EDR TX Power	-	-	9	-	dBm
Class2: GFSK TX Power	-	-	2	-	dBm
Power Control Step	-	2	4	8	dB
Modulation Accuracy					
π/4-DQPSK Frequency Stability	-	-10	-	10	kHz
π/4-DQPSK RMS DEVM	-	-	-	20	%
π/4-QPSK Peak DEVM	-	-	-	35	%
π/4-DQPSK 99% DEVM	-	-	-	30	%
8-DPSK Frequency Stability	-	-10	-	10	kHz
8-DPSK RMS DEVM	-	-	-	13	%
8-DPSK Peak DEVM	-	-	-	25	%
8-DPSK 99% DEVM	-	-	-	20	%
In-Band Spurious Emissions					
1.0 MHz < |M-N| < 1.5 MHz	-	-	-	-26	dBm
1.5 MHz < |M-N| < 2.5 MHz	-	-	-	-20	dBm
|M-N| ≥ 2.5 MHz	-	-	-	-40	dBm
Out-of-Band Spurious Emissions					
30 MHz ~ 1 GHz	-	-	-	-36	dBm
1 GHz ~ 12.75 GHz	-	-	-	-30	dBm

1.8 GHz ~ 1.9 GHz	-	-	-	-47	dBm
5.15 GHz ~ 5.3 GHz	-	-	-	-47	dBm
GPS Band Noise Emissions (Without a front-end band filter)					
1572.92 MHz ~ 1577.92 MHz	-	-	-150	-127	dBm/Hz
Out-of-Band Noise Emissions (Without a front-end band filter)					
65 MHz ~ 108 MHz	FM RX	-	-145	-	dBm/Hz
746 MHz ~ 764 MHz	CDMA	-	-145	-	dBm/Hz
869 MHz ~ 960 MHz	CDMA	-	-145	-	dBm/Hz
925 MHz ~ 960 MHz	EDGE/GSM	-	-145	-	dBm/Hz
1805 MHz ~ 1880 MHz	EDGE/GSM	-	-145	-	dBm/Hz
1930 MHz ~ 1990 MHz	PCS	-	-145	-	dBm/Hz
2110 MHz ~ 2170 MHz	WCDMA	-	-140	-	dBm/Hz

Note:

All specifications are for industrial temperature.

All specifications are single-ended. Unused input are left open,

+12 dBm output for GFSK measured with PA VDD = 2.5 V.

+9 dBm output for EDR measured with PA VDD = 2.5 V.

Maximum value is the value required for Bluetooth qualification.

Meets this spec using a front-end bandpass filter.

3.2.2 Receiver RF Parameters

Parameter	Conditions	Min.	Typ.	Max.	Unit
General					
Frequency Range	-	2402	-	2480	MHz
RX Sensitivity	GFSK, 0.1% BER, 1 Mbps	-	-93.5	-	dBm
	π/4-DQPSK, 0.01% BER, 2 Mbps	-	-95.5	-	dBm
	8-DPSK, 0.01% BER, 3 Mbps	-	-89.5	-	dBm
Maximum Input	GFSK, 1 Mbps	-	-	-20	dBm
Maximum Input	π/4-DQPSK, 8-DPSK, 2/3 Mbps	-	-	-20	dBm
Interference Performance					
GFSK Modulation					
C/I cochannel	GFSK, 0.1% BER	-	9.5	11	dB
C/I 1 MHz adjacent channel	GFSK, 0.1% BER	-	-5	0	dB

C/I 2 MHz adjacent channel	GFSK, 0.1% BER	-	-40	-30	dB
C/I ≥ 3 MHz adjacent channel	GFSK, 0.1% BER	-	-49	-40	dB
C/I image channel	GFSK, 0.1% BER	-	-27	-9	dB
C/I 1 MHz adjacent to image channel	GFSK, 0.1% BER	-	-37	-20	dB
QPSK Modulation					
C/I cochannel	π/4-DQPSK, 0.01% BER	-	11	13	dB
C/I 1 MHz adjacent channel	π/4-DQPSK, 0.01% BER	-	-8	0	dB
C/I 2 MHz adjacent channel	π/4-DQPSK, 0.01% BER	-	-40	-30	dB
C/I ≥ 3 MHz adjacent channel	8-DPSK, 0.1% BER	-	-50	-40	dB
C/I image channel	π/4-DQPSK, 0.01% BER	-	-27	-7	dB
C/I 1 MHz adjacent to image channel	π/4-DQPSK, 0.01% BER	-	-40	-20	dB
8PSK Modulation					
C/I cochannel	π/4-DQPSK, 0.01% BER	-	17	21	dB
C/I 1 MHz adjacent channel	8-DPSK, 0.1% BER	-	-5	5	dB
C/I 2 MHz adjacent channel	8-DPSK, 0.1% BER	-	-40	-25	dB
C/I ≥ 3 MHz adjacent channel	8-DPSK, 0.1% BER	-	-47	-33	dB
C/I image channel	8-DPSK, 0.1% BER	-	-20	0	dB
C/I 1 MHz adjacent to image channel	8-DPSK, 0.1% BER	-	-35	-13	dB
Out-of-Band Blocking Performance (CW)					
30 MHz ~ 2000 MHz	0.1% BER	-	-10	-	dBm
2000 MHz ~ 2399 MHz	0.1% BER	-	-27	-	dBm
2498 MHz ~ 3000 GHz	0.1% BER	-	-27	-	dBm
3000 MHz ~ 12.75 MHz	0.1% BER	-	-10	-	dBm
Out-of-Band Blocking Performance, Modulated Interferer					
776 MHz ~ 764 MHz	CDMA	-	-10	-	dBm
824 MHz ~ 849 MHz	CDMA	-	-10	-	dBm
1850 MHz ~ 1910 MHz	CDMA	-	-23	-	dBm
824 MHz ~ 849 MHz	EDGE/GSM	-	-10	-	dBm
880 MHz ~ 915 MHz	EDGE/GSM	-	-10	-	dBm
1710 MHz ~ 1785 MHz	EDGE/GSM	-	-23	-	dBm

1850 MHz ~ 1910 MHz	EDGE/GSM	-	-23	-	dBm
1850 MHz ~ 1910 MHz	WCDMA	-	-23		dBm
1920 MHz ~ 1980 MHz	WCDMA	-	-23		dBm
Intermodulation Performance					
BT, Df = 4MHz	-	-39	-	-	dBm
Spurious Emissions					
30 MHz ~ 1 GHz	-	-	-	-62	dBm
1 GHz ~ 12.75 GHz	-	-	-	-47	dBm
65 MHz ~ 108 MHz	FM RX	-	-147	-	dBm
746 MHz ~ 764 MHz	CDMA	-	-147	-	dBm/Hz
851 MHz ~ 894 MHz	CDMA	-	-147	-	dBm/Hz
925 MHz ~ 960 MHz	EDGE/GSM	-	-147	-	dBm/Hz
1805 MHz ~ 1880 MHz	EDGE/GSM	-	-147	-	dBm/Hz
1930 MHz ~ 1990 MHz	PCS	-	-147	-	dBm/Hz
2110 MHz ~ 2170 MHz	WCDMA	-	-147		dBm/Hz

Note:

All specifications are single ended. Unused inputs are left open.

All specifications, except typical, are for industrial temperature.

Typical operating conditions are 3.3 V VBAT and 25 ℃ ambient temperature.

The receiver sensitivity is measured at BER of 0.1% on the device interface.

Typical GFSK CI numbers at -7 MHz, -5 MHz and -3 MHz are -45 dB, -42 dB and -41 dB, respectively.

Typical QPSK CI numbers at -7 MHz, -5 MHz and -3 MHz are -46 dB, -43 dB and -42 dB, respectively.

Typical 8PSK CI numbers at -7 MHz, -5 MHz and -3 MHz are -50 dB, -45 dB and -45 dB, respectively.

Meets this specification using front-end band pass filter.

Numbers are referred to the pin output with an external BPF filter.

F0=-64 dBm Bluetooth-modulated signal, f1=-39 dBm sine wave, f2=-39 dBm Bluetooth-modulated signal, f0=2f1-f2, and |f2-f1|=n*1 MHz, where n is 3, 4 or 5. For the typical case, n=4.

Includes baseband radiated emissions.

3.2.3 Antenna Requirements

The module requires to configure with external 2.4 antenna.

3.3 Power Consumption

3.3.1 SPP (Under Dual-mode)

Operation Mode	AVG Current	Note
Shutdown	8 μA	
MCU idle + nodiscoverable	1.1 mA	
MCU idle + discoverable	1.2 mA	500 ms broadcast interval
MCU active + discoverable	1.9 mA	500 ms broadcast interval
connected+ MCU idle (no data)	1.85 mA	
connected+ MCU active (no data)	1.9 mA	
Connected + transfer data	8.23 mA	Data transmit rate 2.6 KB/s

3.3.2 Low Energy (Under Dual-mode)

Operation Mode	AVG Current	Note
Shutdown	8 μA	
MCU idle + no adv	1.1 mA	
MCU idle + adv	1.2 mA	500 ms broadcast interval
MCU active + adv	1.9 mA	500 ms broadcast interval
connected+ MCU idle (no data)	1.85 mA	
connected+ MCU active (no data)	1.9 mA	
Connected + transfer data	3.15 mA	Data transmit rate 2.6 KB/s

3.3.3 Low Energy (Under BLE-mode)

Operation Mode	AVG Current	Note
Shutdown	8 μA	
MCU idle + no adv	60 μA	
MCU idle + adv	120 μA	500 ms broadcast interval
MCU active + adv	1.1 mA	500 ms broadcast interval
connected+ MCU idle (no data)	220 μA	
connected+ MCU active (no data)	320 μA	
Connected + transfer data	3.15 mA	Data transmit rate 2.6 KB/s

4. Application, Implementation, and Layout

4.1 Application Block Diagram

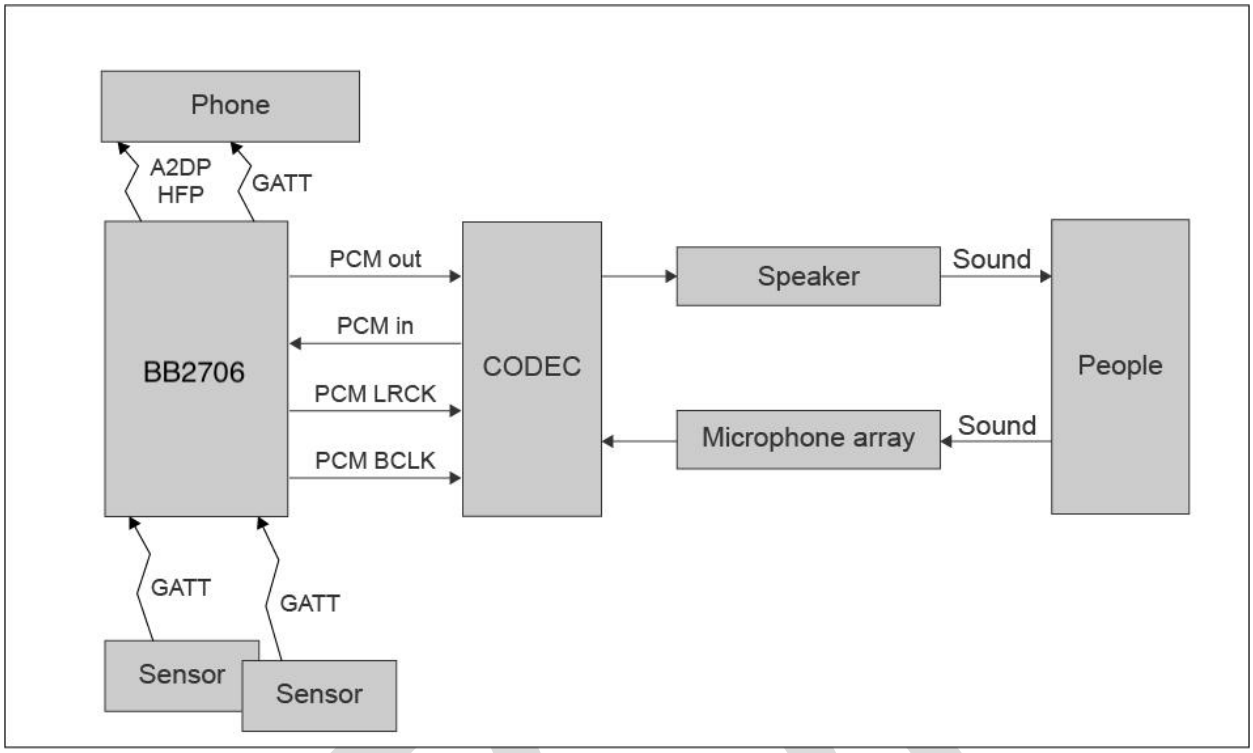

Figure 3.Audio Application Block Diagram

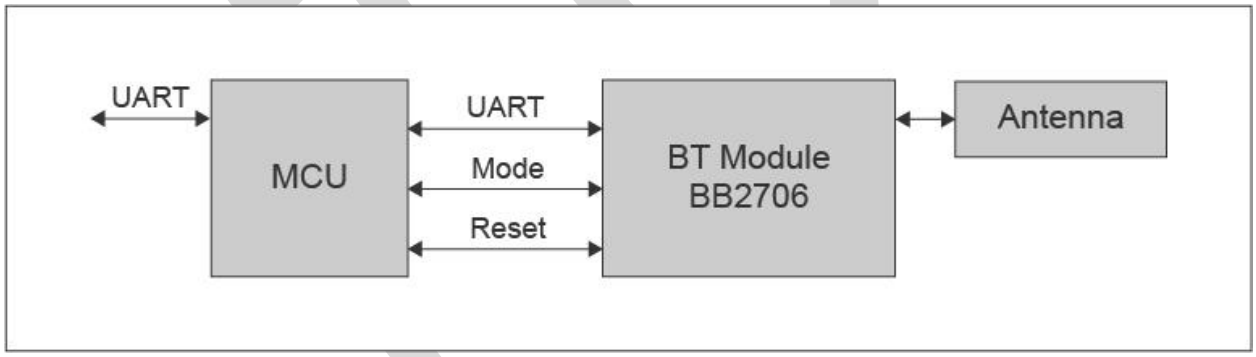

Figure 4.Transparent Transmission Block Diagram

4.2 Typical Application Schematic Diagram

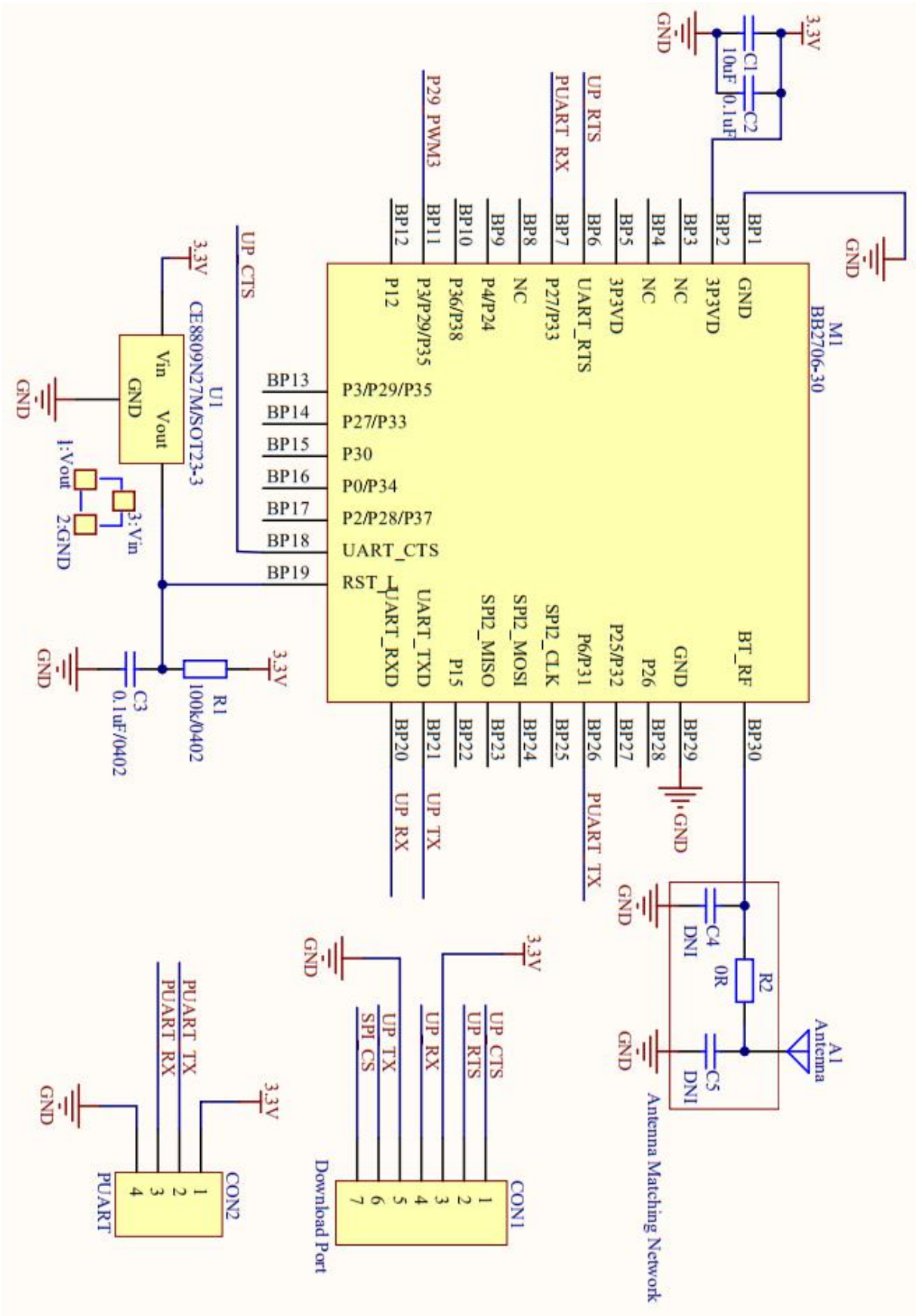

Figure 5.Typical Application Schematic Diagram of BB2706-30

4.3 Layout Guideline

1. Keep RF traces with 50 Ohm impedance.
2. The antenna requires enough clearance area.
3. The filter capacitor should be as close as possible to the module.
4. Do not place strong interference lines under the module.

5. Mechanical and Package

5.1 Recommended PCB Footprint

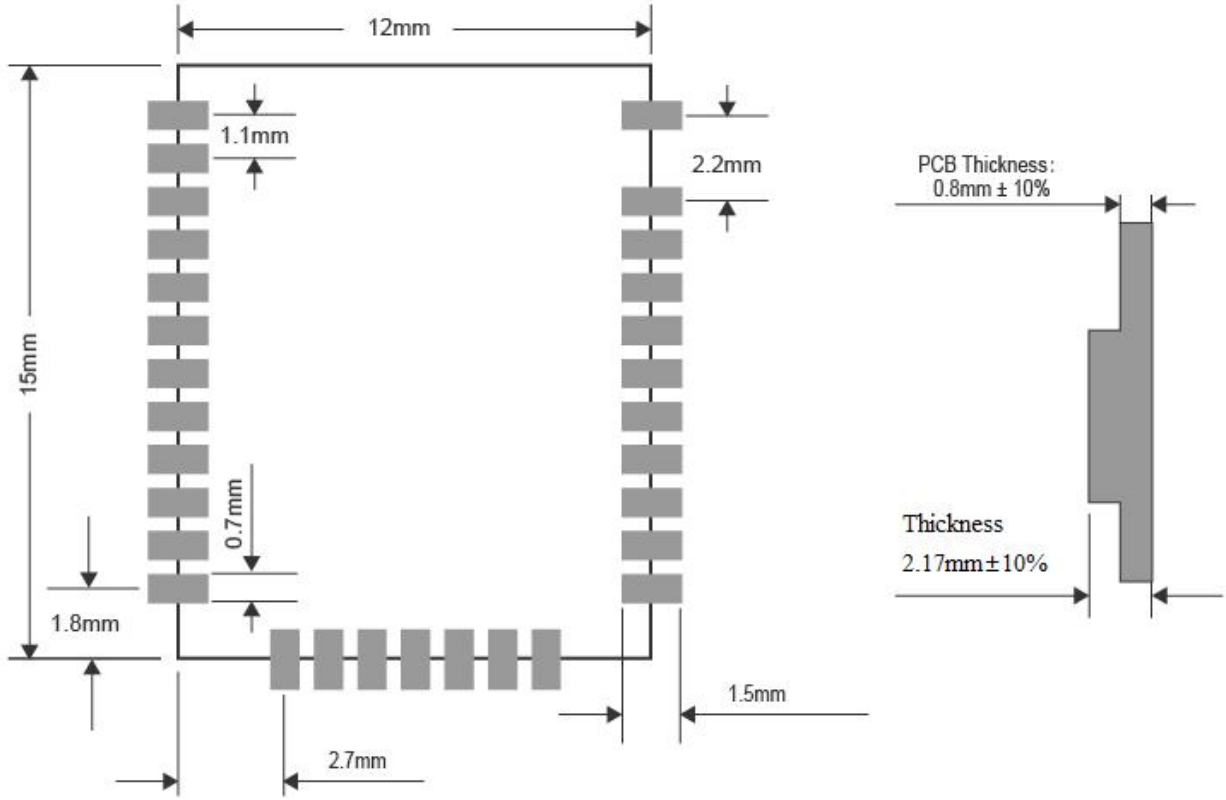

Figure 6.Recommended PCB Footprint of BB2706-30

Note:

1. The RF trace on the product board connecting to the RF pin needs to be controlled at 50 Ohm impedance. Normally an L/C matching network is needed in between.
2. The decoupling capacitor for 3P3VD input should be as close to the module as possible.
3. Strong interference line at the bottom of the module should be forbidden.

5.2 Packaging Information

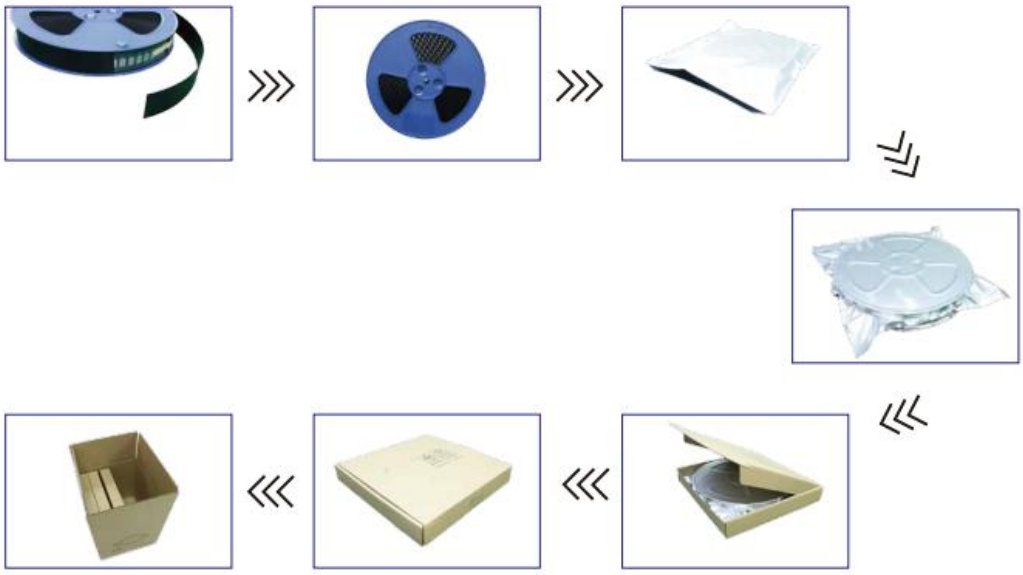

Figure 7.Brief Packaging Process of BB2706-30 Modules

6. Thermal Reflow

Referred to IPC/JEDEC standard.

Peak temperature: <250°C

Number of times: ≤2

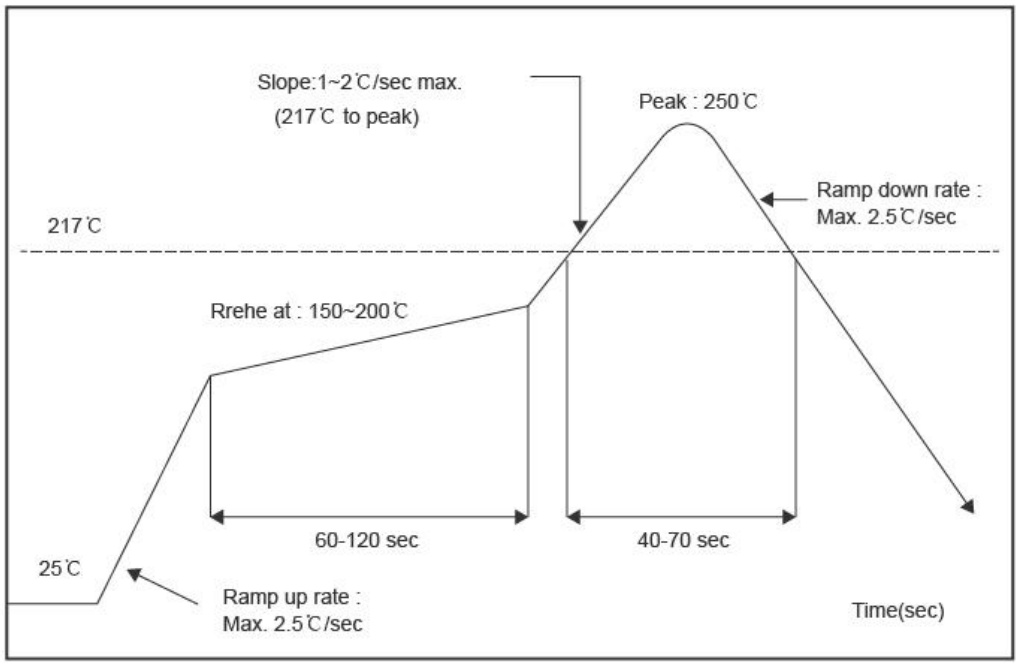

Figure 8.Recommended Reflow for Lead Free Solder

Note: The module is recommended not to go through reflow oven twice;

7. Ordering Information

Part NO.	Working Voltage	ANT	Shielding Cover	Remark
BB2706-30	2.7V~3.V	Not included	Not included	

8. Revision History

Version	Change Content	Reviser	Date
V0.1	The draft version	Lihong Peng	2017.02.02
V0.2	Modified the pin functions	Lihong Peng	2017.12.11
V0.3	Modified the baud rate specifications	Lihong Peng	2017.12.20
V1.1	Updated the version.	Renzhi Xing	2019.03.07
V2.0	Edited the English Version	Renzhi Xing	2020.03.30
V2.1	Verified Ambient and Storage Temperature	Renzhi Xing	2020.06.09