

Bluetooth Module Datasheet

Model: AR-7105T

Version: V1.0

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List of Contents

1	INTRODUCTION.....	5
1.1	NAMING DECLARATION.....	5
1.2	BLOCK DIAGRAM.....	5
1.3	FEATURES.....	5
1.4	APPLICATIONS.....	6
2	GENERAL SPECIFICATION.....	6
3	PIN DEFINITION.....	7
3.1	PIN CONFIGURATION.....	7
3.2	PIN DEFINITION.....	8
4	PHYSICAL INTERFACES.....	9
4.1	RESETB.....	9
4.1.1	Digital Pin States on Reset.....	10
4.2	AUTOMATIC RESET PROTECTION.....	10
4.3	SERIAL INTERFACES.....	10
4.3.1	USB Interface.....	10
4.3.2	UART Interface.....	10
4.3.3	SPI.....	12
4.4	AUDIO INTERFACE.....	12
4.4.1	Audio Codec Interface.....	12
4.4.2	I2S Interface.....	18
4.4.3	aptx Codec.....	21
4.5	LED DRIVERS.....	21
4.6	RF INTERFACE.....	22
4.7	GENERAL PURPOSE ANALOGUE IO.....	22
4.8	GENERAL PURPOSE DIGITAL IO.....	23
5	ELECTRICAL CHARACTERISTIC.....	23
5.1	ABSOLUTE MAXIMUM RATING.....	23
5.2	RECOMMENDED OPERATING CONDITIONS.....	23
5.3	INPUT/OUTPUT TERMINAL CHARACTERISTICS.....	23
5.3.1	Digital Terminals.....	23
5.3.2	USB.....	24
5.3.3	Stereo Codec: Analog-To-Digital Converter.....	24
5.3.4	Stereo Codec: Digital-To-Analog Converter.....	25
5.3.5	Microphone Bias Generator.....	25
5.3.6	Currenta.....	26
6	REFERENCE DESIGN.....	27
7	MECHANICAL CHARACTERISTIC.....	28
8	RECOMMENDED PCB LAYOUT AND MOUNTING PATTERN.....	30
8.1	INPUT/OUTPUT TERMINAL CHARACTERISTICS.....	30
9	RECOMMENDED REFLOW PROFILE.....	31

10	ORDERING INFORMATION.....	33
10.1	Module function.....	33
10.2	The chip manufacturer.....	34
10.3	Module mounting mode.....	34
	IMPORTANT NOTICE.....	35

1 Introduction

AR-7105T is a small form factor, low power and highly economic Bluetooth radio module that allows OEM to add wireless capability to their products. The module supports multiple interfaces that make it simple to design into fully certified embedded Bluetooth solutions. With EVERY's AT+™ programming interfaces, designers can easily customize their applications to support different Bluetooth profiles, such as HS/HF, A2DP, AVRCP, SPP, and etc. The module supports Bluetooth® Enhanced Data Rate (EDR), BT5.0 and delivers up to 3 Mbps data rate for distances to 10M. The module is an appropriate product for designers who want to add wireless capability to their products.

1.1 Naming Declaration

Table 1: Naming Declaration

New Naming	Describe	Description
AR-7105T	Chip:QCC3007 Bluetooth version:V5.1	Without shielding case
AR-7106T	Chip:QCC3008 Bluetooth version:V5.1	Support aptX; Without a shielding case

1.2 Block Diagram

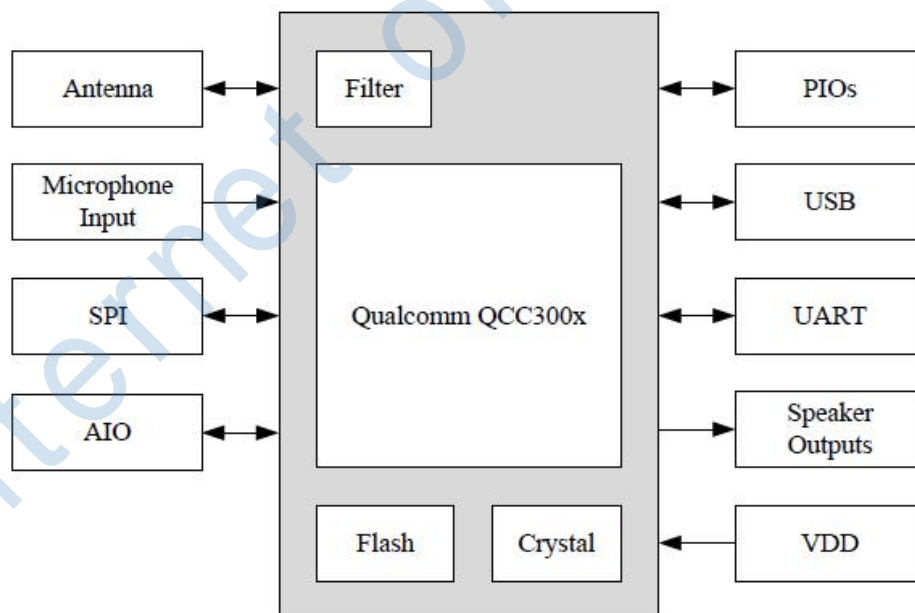


Figure 1: Block Diagram

1.3 Features

- Fully qualified single-chip dual mode Bluetooth v5.0
- Profiles including HS/HF, A2DP, AVRCP, SPP, and etc.

- UART and USB programming and data interfaces
- Small form factor
- SMT pads for easy and reliable PCB mounting
- Qualcomm TrueWireless™ Stereo (TWS), which allows two devices to be configured as a stereo pair
- SBC and AAC audio codecs
- AR-7106T support aptX and aptX low latency

1.4 Applications

- Automobile hands-free applications
- Stereo headset applications
- Cable replacements
- Bar code and RFID scanners
- Measurement and monitoring systems
- Industrial sensors and controls
- Medical devices
- Industrial PCs and laptops

2 General Specification

Table 2: General Specification

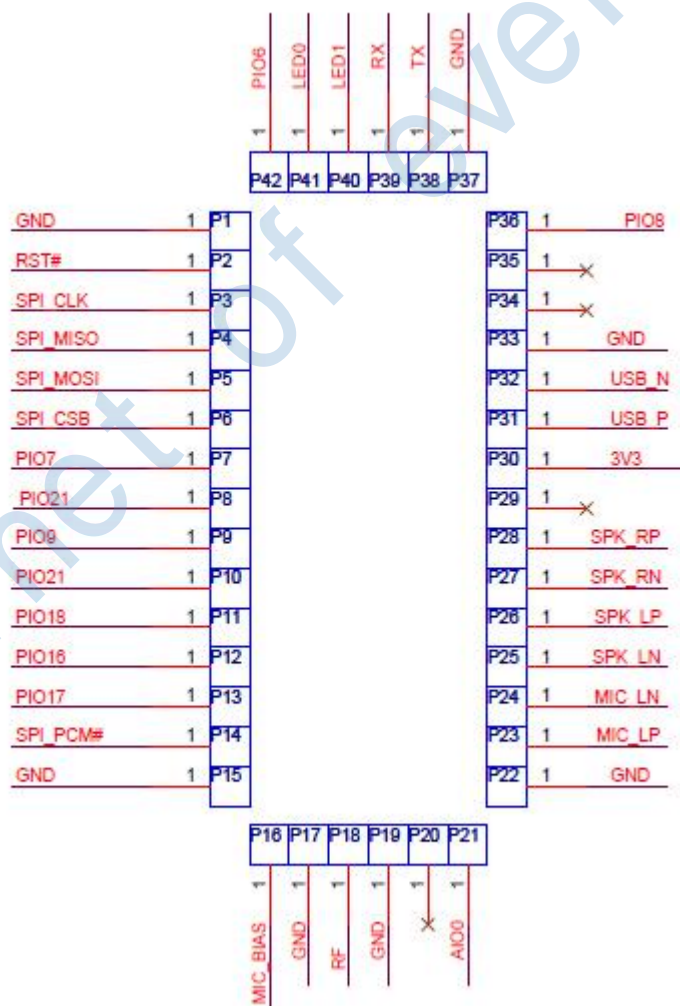
Bluetooth Specification	
Standard	Fully qualified single-chip dual mode Bluetooth v5.0, Class 1.5a
Profiles	HS/HF, A2DP, AVRCP, SPP, etc. detailed profiles depends on the firmware
Frequency Band	2.402GHz ~ 2.480GHz
Maximum Data Rate	3Mbps
RF Input Impedance	50 ohms
Baseband Crystal OSC	26MHz
Interface	UART, PIO, AIO, USB, SPI, Speaker, Microphone, etc.
Sensitivity	-85dBm@0.1%BER
RF TX Power	7dBm
Power	
Supply Voltage	2.7V ~ 3.6V DC
Working Current	Depends on profiles
Standby Current	TBD

Operating Environment	
Temperature	-40°C to +85°C
Humidity	10%~90% Non-Condensing
Certifications	TBD
Environmental	TBD
Dimension and Weight	
Dimension	23.2mm x 11.9mm x 2.0mm
Weight	TBD

a) The maximum RF TX Power is 9dBm.

3 Pin Definition

3.1 Pin Configuration



3.2 Pin Definition

Table 3: Pin Definition

Pin	Symbol	I/O Type	Description
1	GND	Ground	Ground
2	RESETB	Input with strong pull-up	Reset if low. Pull low for minimum 5ms to cause a reset.
3	SPI_CLK	Bidirectional with weak pull-down	SPI_CLK: Debug SPI clock Alternative function:-I2S_SCK: I2S synchronous data clock
4	SPI_MISO	Bidirectional with weak pull-down	SPI_MISO: Debug SPI data output Alternative function:- I2S_SD_OUT: I2S synchronous data output
5	SPI_MOSI	Bidirectional with weak pull-down	SPI_MISO: Debug SPI data input Alternative function:-I2S_SD_IN:I2S synchronous data input
6	SPI_CSB	Bidirectional with weak pull-down	SPI_CSB: chip select for Debug SPI, active low Alternative function: -I2S_WS:I2S word select
7	PIO7	Bidirectional with strong pull-down	Programmable input/output line Alternative function: - I2S2_WS:I2S2 word select
8	PIO21	Bidirectional with weak pull-down	Programmable input/output line
9	PIO9	Bidirectional with strong pull-down	Programmable input/output line Alternative function: - I2S2_SD_SCK:I2S2 synchronous data clock -UART_CTS:UART clear to send, active low
10	PIO21	Bidirectional with weak pull-down	Programmable input/output line
11	PIO18	Bidirectional with weak pull-down	Programmable input/output line
12	PIO16	Bidirectional with strong pull-up	Programmable input/output line Alternative function: -UART_RTS:UART request to send, active low
13	PIO17	Bidirectional with strong pull-down	Programmable input/output line Alternative function: -UART_CTS:UART clear to send, active low
14	SPI_PCM#	Input with weak pull-up	SPI/I2S select input: - 0=I2S/PIO interface - 1=SPI
15	GND	Ground	Ground
16	MIC_BIAS	Analogue	Microphone Bias
17	GND	RF Ground	RF Ground
18	RF_IN	Analogue	Transceiver input/output line
19	GND	RF Ground	RF Ground
20	NC	NC	NC
21	AIO0	Bidirectional	Analogue Programmable input/output line
22	GND	Ground	Ground
23	MIC_LP	Analogue	Microphone input positive

24	MIC_LN	Analogue	Microphone input negative
25	SPK_LN	Analogue	Speaker output negative (left side)
26	SPK_LP	Analogue	Speaker output positive (left side)
27	SPK_RN	Analogue	Speaker output negative (right side)
28	SPK_RP	Analogue	Speaker output positive (right side)
29	NC	NC	NC
30	VDD	3.3v power input	3.3v power input
31	USB_P	Bidirectional	USB data plus with selectable internal 1.5k pull-up resistor
32	USB_N	Bidirectional	USB data minus
33	GND	Ground	Ground
34	NC	NC	NC
35	NC	NC	NC
36	PIO8	Bidirectional with strong pull-up	Programmable input/output line Alternative function: -I2S2_SD_IN:I2S2 synchronous data input -UART_RTS:UART request to send, active low
37	GND	Ground	Ground
38	UART_TX	Bidirectional with strong pull-up	UART data output
39	UART_RX	Bidirectional with strong pull-up	UART data input
40	LED1	Bidirectional	Open-drain output
41	LED0	Bidirectional	Open-drain output
42	PIO6	Bidirectional with strong pull-down	Programmable input/output line Alternative function: -I2S2_SD_OUT:I2S2 synchronous data output

NOTE: Pin8 and pin10 are connected inside the module to accommodate the needs of old customers.

4 Physical Interfaces

4.1 RESETB

AR-7105T is reset from several sources:

- RESETB pin
- Power-on reset
- Software configured watchdog timer
- UART break character

The RESETB pin is an active low reset. Assert the reset signal for a period > 5 ms to ensure a full reset.

At reset the digital I/O pins are set to inputs for bidirectional pins and outputs are set to tristate.

4.1.1 Digital Pin States on Reset

Table 4 shows the pin states of AR-7105T on reset.

Table 4: Pin Status on Reset

Pin Name / Group	I/O Type	Reset
USB_DP	Digital bidirectional	Tristate
USB_DN	Digital bidirectional	Tristate
PIO0	Digital bidirectional	Strong PU
PIO1	Digital bidirectional	Strong PD
PIO2	Digital bidirectional	Strong PD
PIO3	Digital bidirectional	Strong PD
PIO4	Digital bidirectional	Strong PU
PIO5	Digital bidirectional	Strong PD
PIO6	Digital bidirectional	Strong PD
PIO7	Digital bidirectional	Strong PD

4.2 Automatic Reset Protection

AR-7105T includes an automatic reset protection circuit that restarts the AR-7105T when an unexpected reset occurs, for example, ESD strike or lowering of RST#. This reset protection circuit automatically restarts the AR-7105T and enables the application to restore previous operation.

NOTE If RESETB is held low for > 2.4 s and VDD is not applied, AR-7105T turns off. A rising edge on VDD is then required to power on AR-7105T.

4.3 Serial Interfaces

4.3.1 USB Interface

AR-7105T has a full-speed (12 Mbps) USB interface for communicating with other compatible digital devices.

The USB interface on AR-7105T acts as a USB peripheral, responding to requests from a master host controller.

AR-7105T contains internal USB termination resistors and requires no external resistors.

AR-7105T supports the Universal Serial Bus Specification, Revision v2.0 (USB v2.0 Specification).

4.3.2 UART Interface

AR-7105T has a UART serial interface that provides a simple mechanism for communicating with other serial devices using the RS232 protocol, including for test and debug.

When AR-7105T is connected to another digital device, UART_RX and UART_TX transfer data between the 2 devices.

UART configuration parameters, such as baud rate and packet format, are set using the AR-7105T firmware.

NOTE: To communicate with the UART at its maximum data rate using a standard PC, the PC requires an accelerated serial port adapter card.

The use of UART and USB are mutually exclusive.

Table 5: Possible UART Settings

Parameter		Possible Values
Baud rate	Minimum	1200 baud ($\leq 2\%$ Error)
		9600 baud ($\leq 1\%$ Error)
	Maximum	4Mbaud ($\leq 1\%$ Error)
Flow control		None
Parity		None, Odd or Even
Number of stop bits		1 or 2
Bits per byte		8

Table 6 lists common baud rates and their associated error values for PSKEY_UART_BITRATE. To set the UART baud rate, load PSKEY_UART_BITRATE with the number of bits per second.

Table 6: Standard Baud Rates

Baud rate	PS Key value(bits per second)	Error
1200	1200	1.73%
2400	2400	1.73%
4800	4800	1.73%
9600	9600	-0.82%
19200	19200	0.45%
38400	38400	-0.18%
57600	57600	0.03%
76800	76800	0.14%
115200	115200	0.03%
230400	230400	0.03%
460800	460800	-0.02%
921600	921600	0.00%
1382400	1382400	-0.01%
1843200	1843200	0.00%

2764800	2764800	0.00%
3686400	3686400	0.00%

4.3.3 SPI

The synchronous serial port interface (SPI) can be used for system debugging. It can also be used for in-system programming for the flash memory within the module. SPI interface uses the SPI_MOSI, SPI_MISO, SPI_CSB and SPI_CLK pins.

The module operates as a slave and thus SPI_MISO is an output of the module. SPI_MISO is not in high-impedance state when SPI_CSB is pulled high. Instead, the module outputs 0 if the processor is running and 1 if it is stopped. Thus the module should NOT be connected in a multi-slave arrangement by simple parallel connection of slave SPI_MISO lines.

4.4 Audio Interface

4.4.1 Audio Codec Interface

The interface provides following features:

- Mono analogue input for voice band and audio band
- Stereo and mono analogue output for voice band and audio band

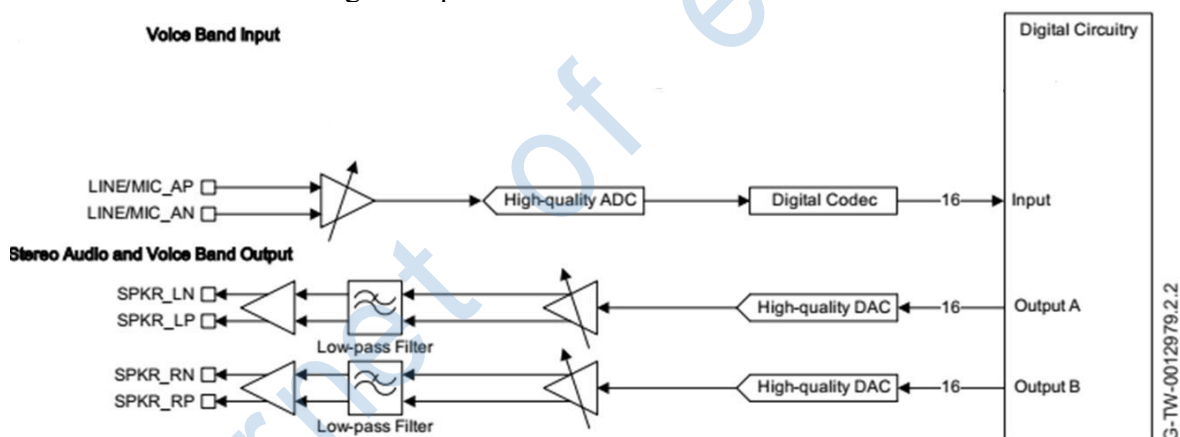


Figure 3: Audio Input and Output

The AR-7105T audio codec uses a fully differential architecture in the analog signal path. This architecture results in low common-mode-noise sensitivity and good power supply rejection while effectively doubling the signal amplitude. The module features a differential stereo audio output interfaces.

4.4.1.1 ADC

The ADC has a second-order Sigma-Delta converter.

The ADC is a separate channel with identical functionality.

Each channel has an analog and a digital gain stage.

4.4.1.2 ADC Sample Rate Selection

ADC supports the following sample rates: 8kHz, 11.025kHz, 16kHz, 22.05kHz, 24kHz, 32kHz, 44.1kHz, 48Khz.

4.4.1.3 ADC Audio Input Gain

The audio input gain consists of the following components:
An analog gain stage based on a pre-amplifier and an analog gain amplifier.
A digital gain stage.

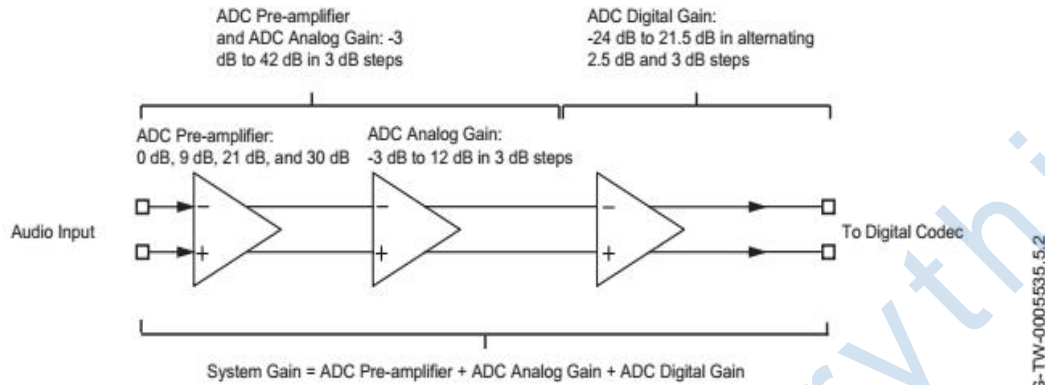


Figure 4: Audio Input Gain

4.4.1.4 ADC Pre-Amplifier And Analog/Digital Gain

The gain of the ADC inputs can be configured in the range of -27 dB to 63.5 dB steps, making it suitable for line and microphone input levels. 0 dB is 1600 mV pk-pk input.

The ADC input impedance is nominal 6 k Ω except when 0 dB pre-amplifier gain is selected when it becomes 12 k Ω .

If the input pre-amplifier is disabled, the input impedance varies between 6 k Ω and 34 k Ω depending on gain selection. In normal operation, the input pre-amplifier is enabled.

Calls connected by the VM stream automatically select the distribution of gain within the ADC for best performance. Alternatively, the individual gain stages can be set.

4.4.1.5 ADC Digital Gain

Table 7: ADC Audio Input Gain Selection

Digital Gain Selection Value	ADC Digital Gain Setting(Db)	Digital Gain Selection Value	ADC Digital Gain Setting(Db)
0	0	8	-24
1	3.5	9	-20.5
2	6	10	-18
3	9.5	11	-14.5
4	12	12	-12
5	15.5	13	-8.5
6	18	14	-6
7	21.5	15	-2.5

4.4.1.6 ADC Digital IIR Filter

The ADC contains 2 integrated anti-aliasing filters:

A long IIR filter suitable for music (> 44.1 kHz). G.722 filter. This is a digital IIR filter that improves the stop-band attenuation required for G.722 compliance. This filter is the best selection for 8 kHz/16 kHz/voice.

4.4.1.7 DAC

The DAC consists of two high-quality DACs:

Each DAC has a fourth-order Sigma-Delta converter.

Each DAC is a separate channel with identical functionality.

Each channel has an analog and a digital gain stage.

4.4.1.8 DAC Sample Rate Selection

DAC supports the following sample rates: 8kHz, 11.025kHz, 16kHz, 22.05kHz, 24kHz, 32kHz, 44.1kHz, 48Khz.

4.4.1.9 DAC Gain

The DAC outputs have two gain stages, a digital stage followed by an analog stage. The digital gain varies between -24 dB and 21.5 dB and the analog gain between 0 dB and -21 dB, giving a total range of -45 dB to 21.5 dB.

Calls connected by the VM stream automatically select the distribution of gain within the DAC for best performance. Alternatively, the individual gain stages can be set.

Table 8: DAC Digital Gain Selection

Digital Gain Selection Value	DAC Digital Gain Setting (Db)	Digital Gain Selection Value	DAC Digital Gain Setting (Db)
0	0	8	-24
1	3.5	9	-20.5
2	6	10	-18
3	9.5	11	-14.5
4	12	12	-12
5	15.5	13	-8.5

Table 9: DAC Analog Gain Selection

Analog gain selection value	DAC analog gain setting (dB)	Analog gain selection value	DAC analog gain setting (dB)
7	0	3	-12
6	-3	2	-15
5	-6	1	-18
4	-9	0	-21

4.4.1.10 DAC Digital FIR Filter

The DAC contains an integrated digital FIR filter with the following modes:

- A default long FIR filter for best performance at ≥ 44.1 kHz.
- A short FIR to reduce latency.
- A narrow FIR (a sharp roll-off at Nyquist) for G.722 compliance. Best for 8 kHz/16 kHz.

4.4.1.11 Microphone Bias Generator

AR-7105T contains an independent low-noise microphone bias generator. The microphone bias generator is recommended for biasing electret condenser microphones.

Figure 5 shows a typical biasing circuit for electret condenser microphones.

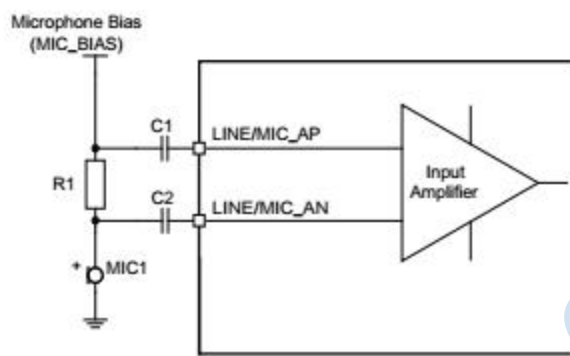


Figure 5: Micro phone Biasing

The microphone bias generator provides a selectable output voltage of 1.8 V or 2.6 V nominal.

No output capacitor is required.

4.4.1.12 Output Stage

The output stage digital circuitry converts the signal from 16 bit per sample, linear PCM of variable sampling frequency to bit stream, which is fed into the analog output circuitry.

The analog output circuit comprises a DAC, a buffer with gain-setting, a low pass filter, and a class AB output stage amplifier.

Figure 6 shows that the output is available as a differential signal between SPKR_LN and SPKR_LP for the left channel, and between SPKR_RN and SPKR_RP for the right channel.

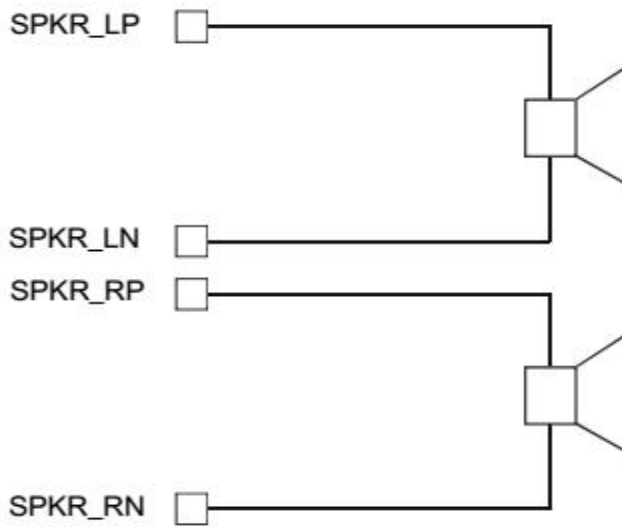


Figure 6: Speaker Output

4.4.1.13 Mono Operator

Mono operation is a single-channel operation of the stereo codec. The left channel represents the single mono channel for audio in and audio out. In mono operation, the right channel is the auxiliary mono channel for dual-mono channel operation.

In single channel mono operation, disable the other channel to reduce power consumption.

4.4.1.14 Sidetone

In some applications, it is necessary to implement sidetone. This sidetone function applies configurable gain to the microphone signal and feeds it into the DAC stream. The sidetone routing selects the version of the microphone signal from before or after the digital gain in the ADC interface and adds it to the output signal before or after the digital gain of the DAC interface.

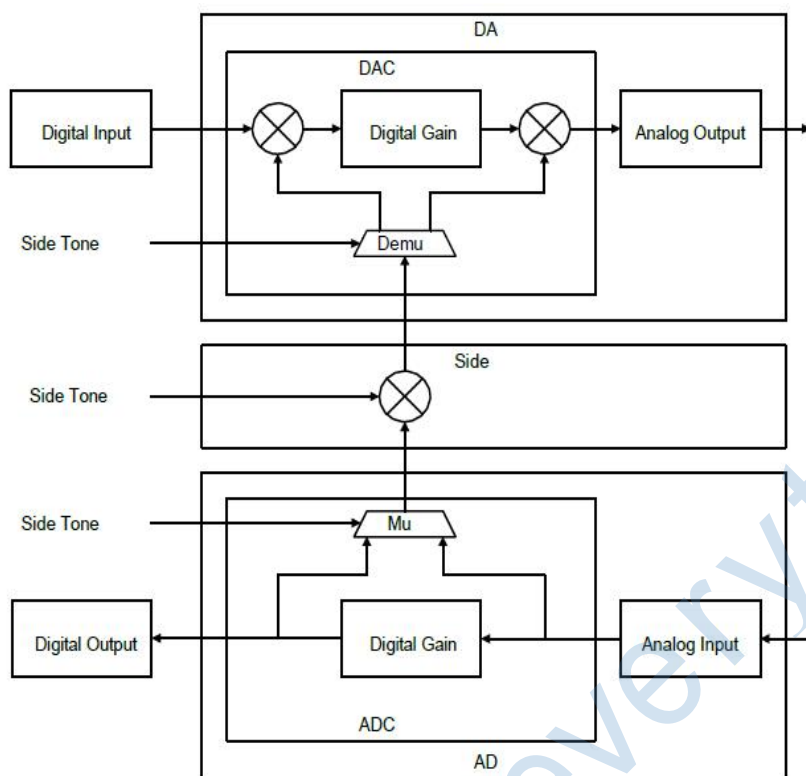


Figure 7: Sidetone

The ADC provides simple gain to the sidetone data. The gain values range from -32.6 dB to 12.0 dB in alternating steps of 2.5 dB and 3.5 Db

Table 10: Sidetone Gain

Value	Sidetone Gain(dB)	Value	Sidetone Gain(dB)
0	-32.6	8	-8.5
1	-30.1	9	-6.0
2	-26.6	10	-2.5
3	-24.1	11	0
4	-20.6	12	3.5
5	-18.1	13	6.0
6	-14.5	14	9.5
7	-12.0	15	12.0

4.4.1.15 Integrated Digital IIR Filter

AR-7105T has a programmable digital filter integrated into the ADC channel of the codec.

The filter is a 2-stage, second-order IIR and is for functions such as custom wind noise reduction.

The filter also has optional DC blocking.

The filter has 10 configuration words in this order:

- 1 for gain value
- 8 for coefficient values (b01, b02, a01, a02, b11, b12, a11, a12)
- 1 for enabling and disabling the DC blocking

The gain and coefficients are all 12-bit two's complement signed integer with the format NN.NNNNNNNNNN.

NOTE The position of the binary point is between bit[10] and bit[9], where bit[11] is the most significant bit.

4.4.2 I2S Interface

AR-7105T supports I²S input and output via its industry-standard I²S digital audio interface.

AR-7105T also supports several alternative PCM data formats. When in PCM mode, the following pin name to function mappings apply.

I ² S Pin	PCM Function
I2Sn_SD_IN	PCM_IN
I2Sn_SD_OUT	PCM_OUT
I2Sn_WS	PCM_SYNC
I2Sn_SCK	PCM_CLK

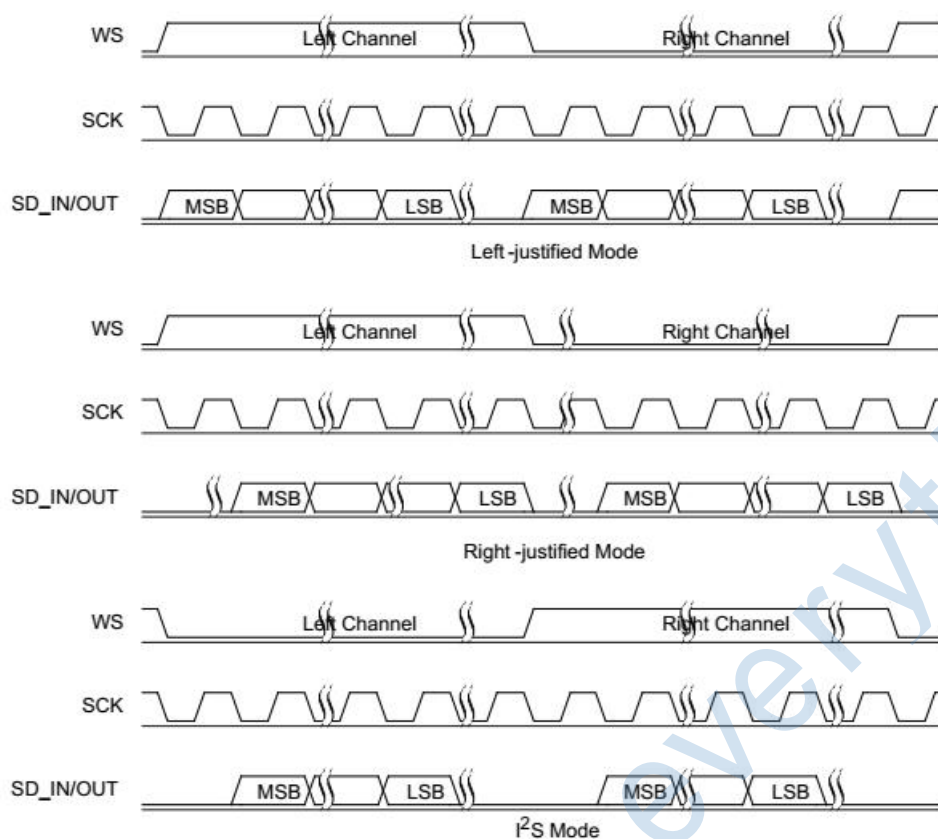


Figure 8: Digital Audio Interface Modes

The internal representation of audio samples within the AR-7105T QFN is 16-bit and data on SD_OUT is limited to 16-bit per channel.

Table 11: Digital Audio Interface Slave Timing

Symbol	Parameter	Min	Typ	Max	Unit
—	SCK Frequency	—	—	6.2	kHz
—	WS Frequency	—	—	96	kHz
T _{ch}	SCK high time	80	—	—	Ns
T _{ch}	SCK low time	80	—	—	Ns

Table 12: I²S Slave Mode Timing

Symbol	Parameter	Min	Typ	Max	Unit
t _{ssu}	WS valid to SCK high set-up time	20	—	—	Ns
t _{sh}	SCK high to WS invalid hold time	2.5	—	—	Ns
t _{opd}	SCK low to SD_OUT valid delay time	—	—	20	ns
t _{isu}	SD_IN valid to SCK high set-up time	20	—	—	ns
t _{ih}	SCK high to SD_IN invalid hold time	2.5	—	—	ns

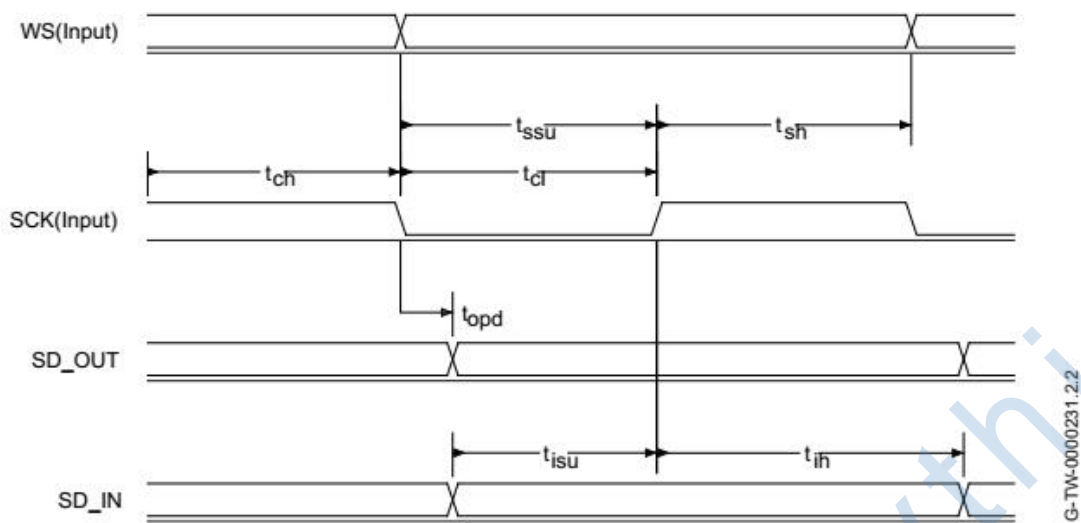


Figure 9: Digital Audio Interface Slave Timing

Table 13: Digital Audio Interface Master Timing

Symbol	Parameter	Min	Typ	Max	Unit
—	SCK Frequency	—	—	6.2	MHz
—	WS Frequency	—	—	96	kHz

Table 14: I²S Master Mode Timing Parameters, WS And SCK As Outputs

Symbol	Parameter	Min	Typ	Max	Unit
t_{spd}	SCK low to WS valid delay time	—	—	39.27	ns
t_{opd}	SCK low to WS valid delay time	—	—	18.44	ns
t_{isu}	SD_IN valid to SCK high set-up time	18.44	—	—	ns
t_{ih}	SCK high to SD_IN invalid hold time	0	—	—	ns

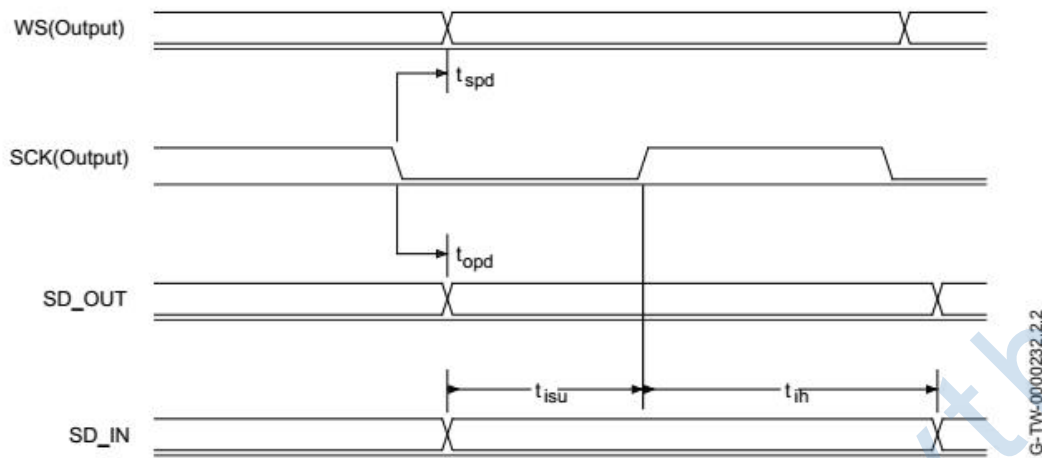


Figure 10: Digital Audio Interface Master Timing

4.4.3 aptX Codec

The aptX audio codec is available for high-quality stereo audio over Bluetooth. When incorporated in Bluetooth A2DP stereo products, aptX audio coding delivers full wired audio quality. The aptX audio codec source material is delivered transparently over the Bluetooth link, whether it is stored uncompressed or in an alternative compression (AAC, FLAC) format.

The aptX codec has the following target applications:

- Bluetooth stereo headphones/headsets
- Bluetooth automotive audio
- Bluetooth stereo speakers

The aptX codec has the following benefits:

- Outstanding Bluetooth Stereo audio quality
- Faithful reproduction of full audio bandwidth
- Minimization of lip-sync issues via low-delay audio decoding techniques
- Nondestructive transcoding from other standard coded audio formats
- Low code memory and data memory requirements
- A2DP-compliant negotiation back to the SBC codec when connecting with legacy audio sources

The aptX codec has the following key features:

- Multiple audio sample rate support, including $F_s = 44.1$ kHz and $F_s = 48$ kHz
- Conveyance of CD-quality audio (16-bit and $F_s = 44.1$ kHz) over Bluetooth at a data rate of 352 kbps
- Frequency response maintained from 10 Hz to 22 kHz for $F_s = 48$ kHz
- Algorithmic delay less than 1.89 ms for $F_s = 48$ kHz
- Dynamic range for 16-bit audio in excess of 92 dB

NOTE: AR-7106T can support aptX only.

4.5 LED Drivers

AR-7105T includes two 3-pad synchronised PWM LED drivers for driving RGB LEDs for producing a wide range of colours. All LEDs are controlled by firmware.

The terminals are open-drain outputs, so the LED must be connected from a positive supply rail to the pad in series with a current-limiting resistor.

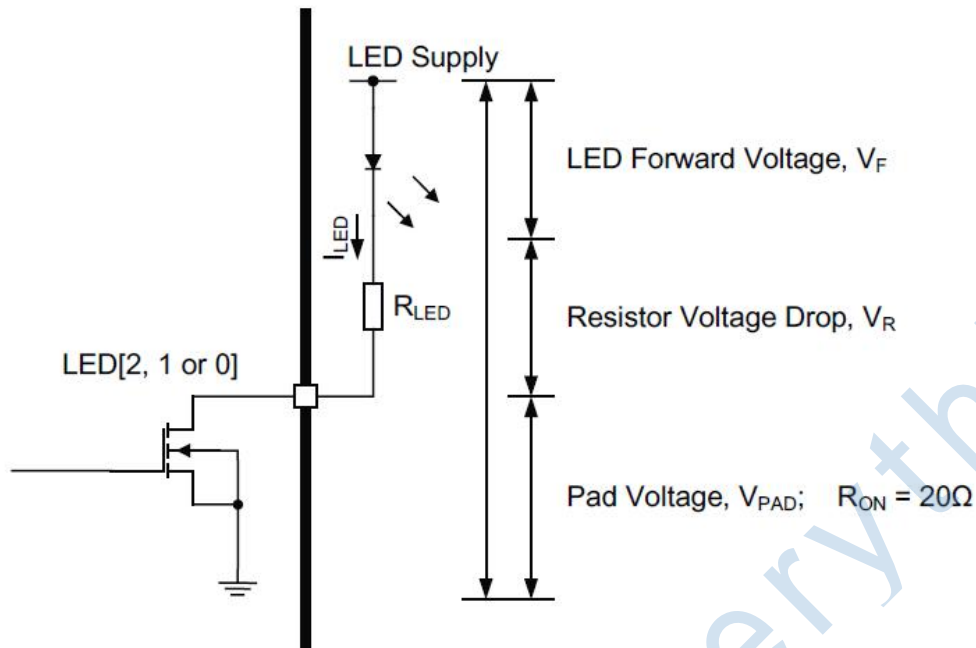


Figure 11: LED Equivalent Circuit

From Figure 3 it is possible to derive Equation 1 to calculate I_{LED} . If a known value of current is required through the LED to give a specific luminous intensity, then the value of R_{LED} is calculated.

$$I_{LED} = \frac{V_{SUPPLY} - V_F}{R_{LED} + R_{ON}}$$

Equation 1: LED Current

For the LED pads to act as resistance, the external series resistor, R_{LED} , needs to be such that the voltage drop across it, V_R , keeps V_{PAD} below 0.5V. Equation 2 also applies.

$$V_{SUPPLY} = V_F + V_R + V_{PAD}$$

Equation 2: LED PAD Voltage

Note:

The LED current adds to the overall current. Conservative LED selection extends battery life.

4.6 RF Interface

The module integrates a filter. The user can connect a 50ohms antenna directly to the RF port.

4.7 General Purpose Analogue IO

The general purpose analog IO can be configured as ADC inputs by software. Do not connect it if not use.

4.8 General Purpose Digital IO

There are eight general purpose digital IOs defined in the module. All these GPIOs can be configured by software to realize various functions, such as button controls, LED displays or interrupt signals to host controller, etc. Do not connect them if not use.

5 Electrical Characteristic

5.1 Absolute Maximum Rating

Table 15: Absolute Maximum Rating

Rating	Min	Max	Unit
Storage Temperature	-40	+85	°C
PIO/AIO Voltage	-0.4	3.60	V
VDD	-0.4	3.60	V
USB_DP/USB_DN Voltage	-0.4	3.60	V
Other Terminal Voltages except RF	-0.4	3.60	V

5.2 Recommended Operating Conditions

Table 16: Recommended Operating Conditions

Operating Condition	Min	Typical	Max	Unit
Storage Temperature	-40	—	+85	°C
Operating Temperature Range	-40	—	+85	°C
VDD	+3.1	+3.3	+3.6	V
PIO	+1.7	+1.8	+3.6	V

5.3 Input/output Terminal Characteristics

5.3.1 Digital Terminals

Table 17: Digital Terminal

Supply Voltage Levels	Min	Typical	Max	Unit
Input Voltage Levels				
VIL input logic level low	-0.4	—	+0.4	V
VIH input logic level high	0.7VDDIO	—	VDDIO+0.4	V
Tr/Tf	—	—	25	ns
Output Voltage Levels				
VOL output logic level low, IOL = 4.0mA	—	—	0.4	V
VOH output logic level high, IOH = -4.0mA	VDDIO-0.2	—	—	V
Tr/Tf	—	—	5	ns

Input and Tri-state Current				
With strong pull-up	-150	-40	-10	μ A
With strong pull-down	10	40	150	μ A
With weak pull-up	-5	-1.0	-0.33	μ A
With weak pull-down	0.33	+1.0	5.0	μ A
I/O pad leakage current	-1	0	+1	μ A
CI Input Capacitance	1.0	—	5.0	pF

VDDIO is the supply domain for this i/o. Typical value is 1.8V.

5.3.2 USB

Table 18: USB Terminal

USB Terminals	Min	Typical	Max	Unit
Input Threshold				
VIL input logic level low	—	—	0.3VDD	V
VIH input logic level high	0.7VDD	—	—	V
Output Voltage Levels to Correctly Terminated USB Cable				
VOL output logic level low	0.0	—	0.2	V
VOH output logic level high	2.8	—	VDD	V

5.3.3 Stereo Codec: Analog-To-Digital Converter

Analog-To-Digital Converter					
Parameter	Conditions	Min	Typ	Max	Unit
Resolution	—	—	—	16	Bits
Input sample rate, F_{sample}	—	8	—	48	kHz
Maximum ADC input signal amplitude	0dB = 1600 mVpk-pk	13	—	2260	mVpk-pk
SNR	$f_{\text{in}} = 1 \text{ kHz}$ $B/W = 20\text{Hz} \rightarrow F_{\text{sample}}/2 (20\text{kHz max})$ A- Weighted THD+N < 0.1% 1.6Vpk-pk input	F_{sample}			
		8 kHz	—	94.4	dB
		16 kHz	—	92.4	dB
		32 kHz	—	92.5	dB
		44.1 kHz	—	93.2	dB
		48 kHz	—	91.9	dB
THD+N	$f_{\text{in}} = 1 \text{ kHz}$ $B/W = 20\text{Hz} \rightarrow F_{\text{sample}}/2 (20 \text{ kHz max})$ 1.6Vpk-pk input	F_{sample}			
		8 kHz	—	0.004	%
		48 kHz	—	0.016	%
Digital gain	Digital gain resolution = 1/32	-24	—	21.5	dB
Analog gain	Pre-amplifier setting = 0 dB, 9dB, 21dB or 30 dB	-3	—	42	dB

	Analog setting $\approx -3\text{dB}$ to 12 dB in 3dB steps					
Stereo separation (crosstalk)			—	-89.9	—	dB

5.3.4 Stereo Codec: Digital-To-Analog Converter

Digital-To-Analog Converter							
Parameter	Conditions			Min	Typ	Max	Unit
Resolution	—			—	—	16	Bits
Output sample rate, Fsample	—			8	—	48	kHz
SNR	fin=1 kHz B/W= 20Hz →20 kHz A- Weighted THD+N<0.1% 0dBFSinput	Fsample	Load				
		48kHz	100k0	—	95.4	—	dB
		48kHz	320	—	96.5	—	dB
		48kHz	160	—	95.8	—	dB
THD+N	fin=1 kHz B/W= 20Hz →20 kHz 0dBFSinput	Fsample	Load				
		8kHz	100k0	—	0.0021	—	%
		8kHz	320	—	0.0031	—	%
		8kHz	160	—	0.0034	—	%
		48kHz	100k0	—	0.0037	—	%
		48kHz	320	—	0.0029	—	%
		48kHz	160	—	0.0042	—	%
Digital gain	Digital gain resolution =1/32			-24	—	21.5	dB
Analog gain	Analog gain resolution =3 dB			-21	—	0	dB
Output voltage	Full-scale swing (differential)			—	—	778	mVrms
Stereo separation (crosstalk)				—	-90.5	—	dB

5.3.5 Microphone Bias Generator

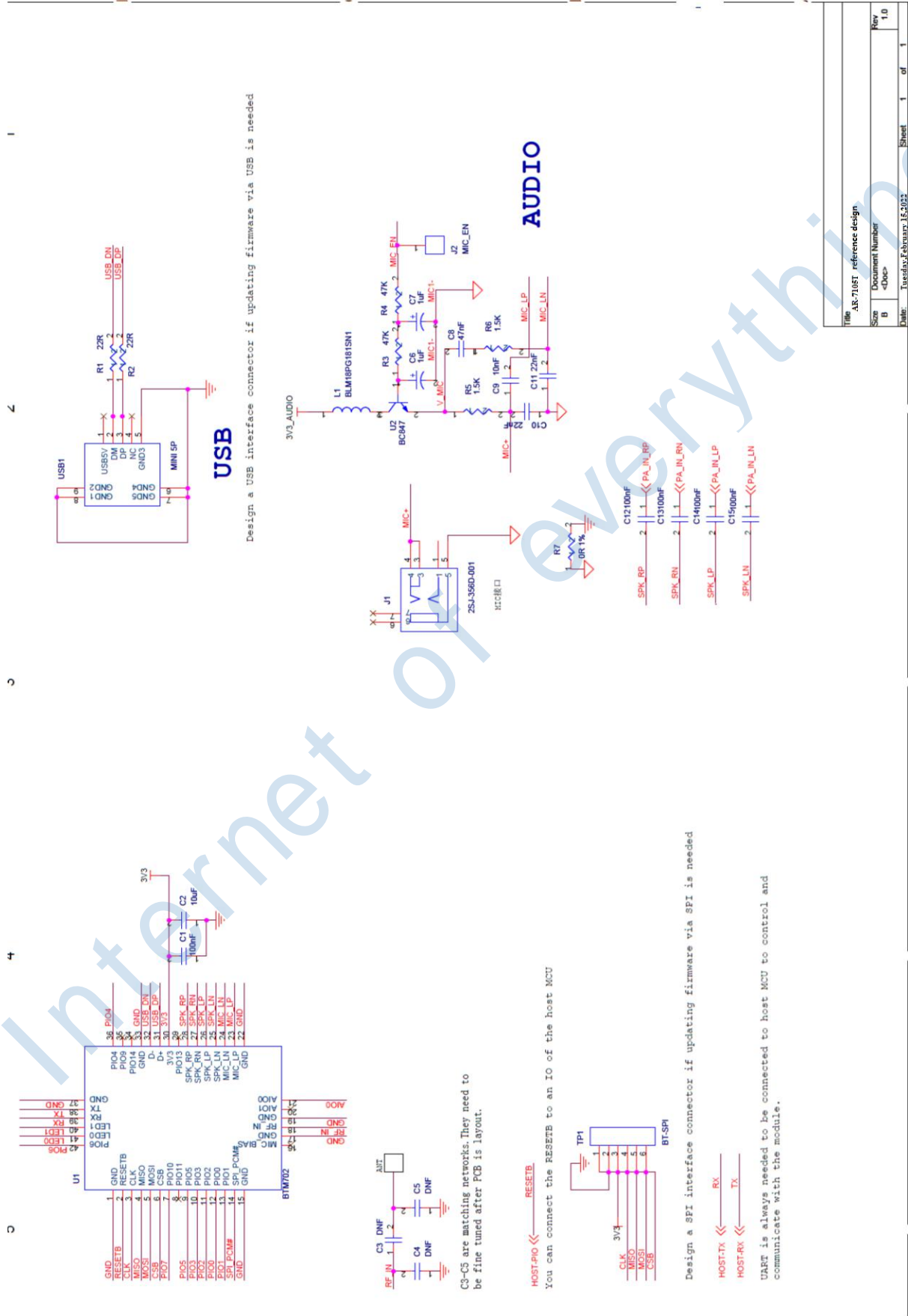
Microphone Bias Generator	Min	Typ	Max	Unit
Output voltage (1.8 V selected)	1.62	1.8	1.98	V
Output voltage (2.6 V selected)	2.34	2.6	2.86	V
Drop out from VBAT input	—	—	300	mV
Output current available	—	—	2.8	mA
Minimum load for stated performance	70	—	—	uA

5.3.6 Currenta

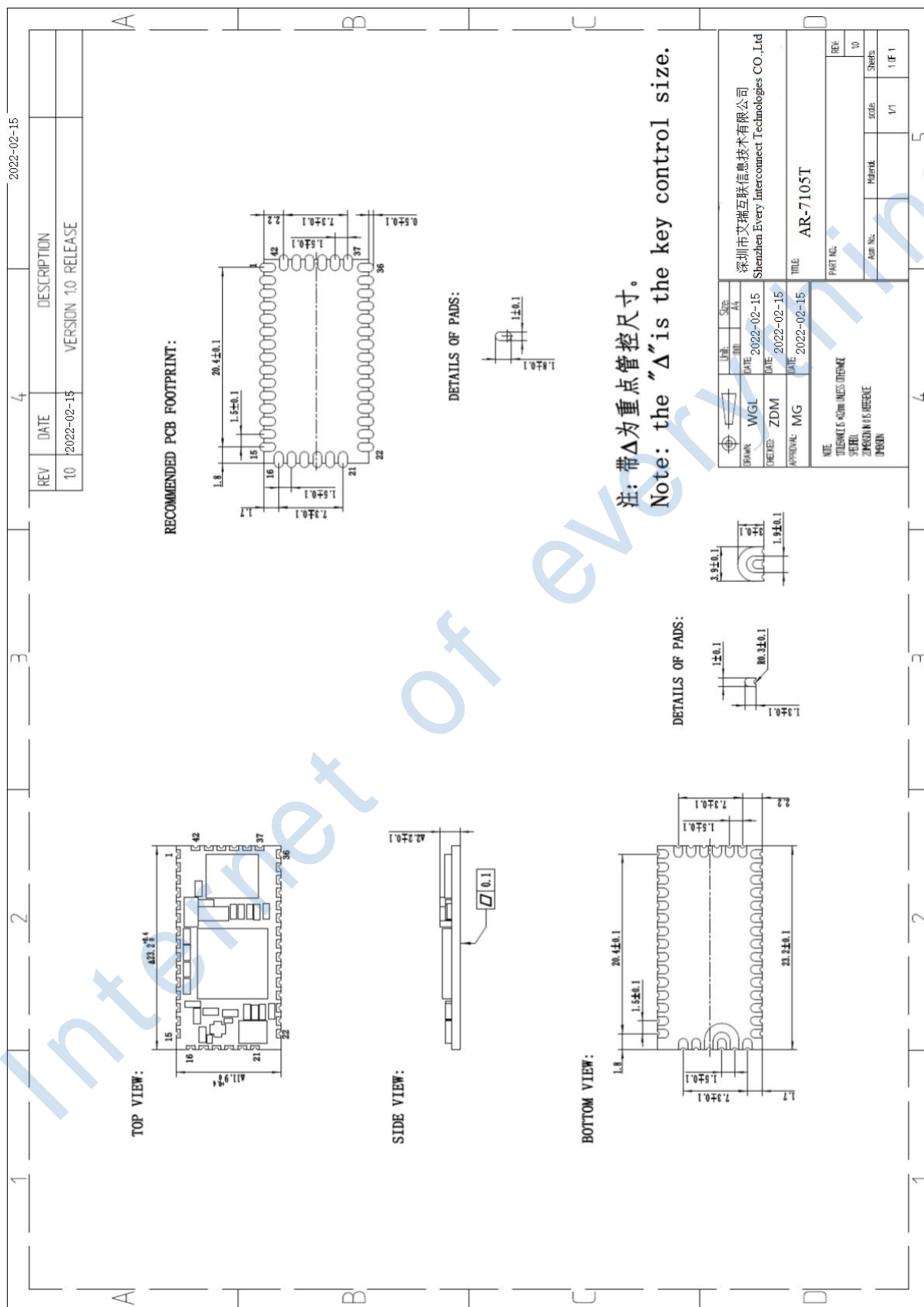
Mode	Current(Ma)		
	Min	Type	Max
Limbo(Sleep)	—	1	—
Limbo(Idle)	—	4.8	—
Connectable(Idle)	—	TBD	—
Discoverable	—	TBD	—
Connected	—	10.5	—
Activecall	—	15.5	—

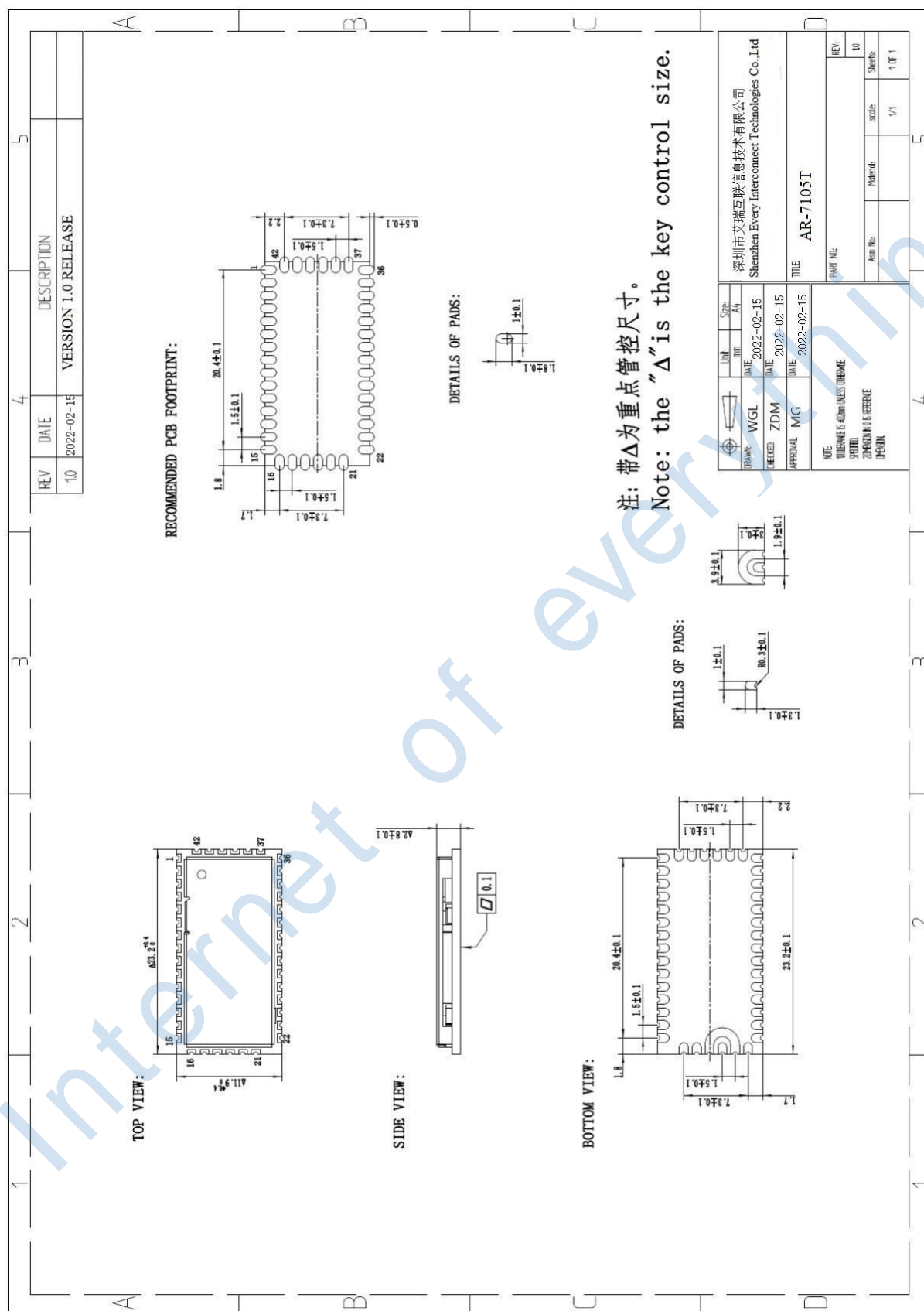
a:The current is related to the firmware version.

6 Reference Design



7 Mechanical Characteristic





8 Recommended PCB Layout and Mounting Pattern

Placement and PCB layout are critical to optimize the performances of a module without on-board antenna designs. The trace from the antenna port of the module to an external antenna should be 50 Ω and must be as short as possible to avoid any interference into the transceiver of the module. The location of the external antenna and RF-IN port of the module should be kept away from any noise sources and digital traces. A matching network might be needed in between the external antenna and RF-IN port to better match the impedance to minimize the return loss.

As indicated in figure 12 below, RF critical circuits of the module should be clearly separated from any digital circuits on the system board. All RF circuits in the module are close to the antenna port. The module, then, should be placed in this way that module digital part towards your digital section of the system PCB.

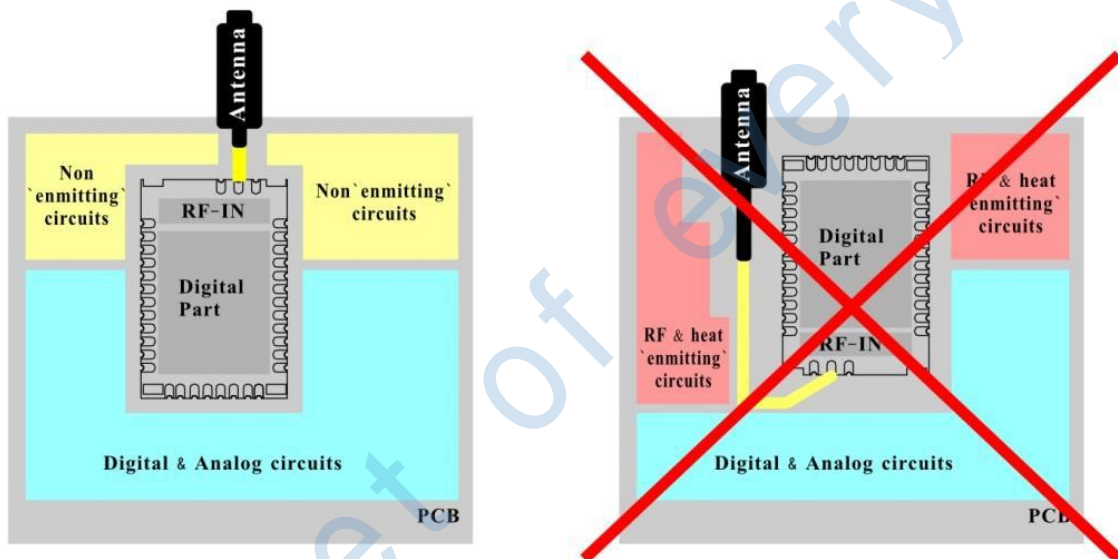


Figure 12: Placement the Module on a System Board

8.1 Input/output Terminal Characteristics

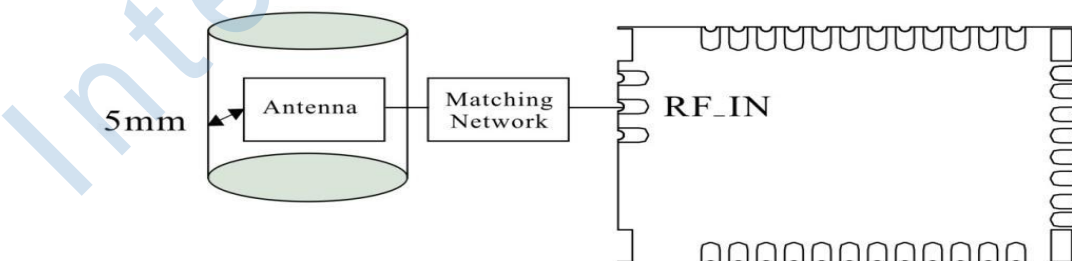


Figure 13: Leave 5mm Clearance Space from the Antenna

General design recommendations are:

- The length of the trace or connection line should be kept as short as possible.
- Distance between connection and ground area on the top layer should at least be as large

as the dielectric thickness.

- Routing the RF close to digital sections of the system board should be avoided.
- To reduce signal reflections, sharp angles in the routing of the micro strip line should be avoided. Chamfers or fillets are preferred for rectangular routing; 45-degree routing is preferred over Manhattan style 90-degree routing.

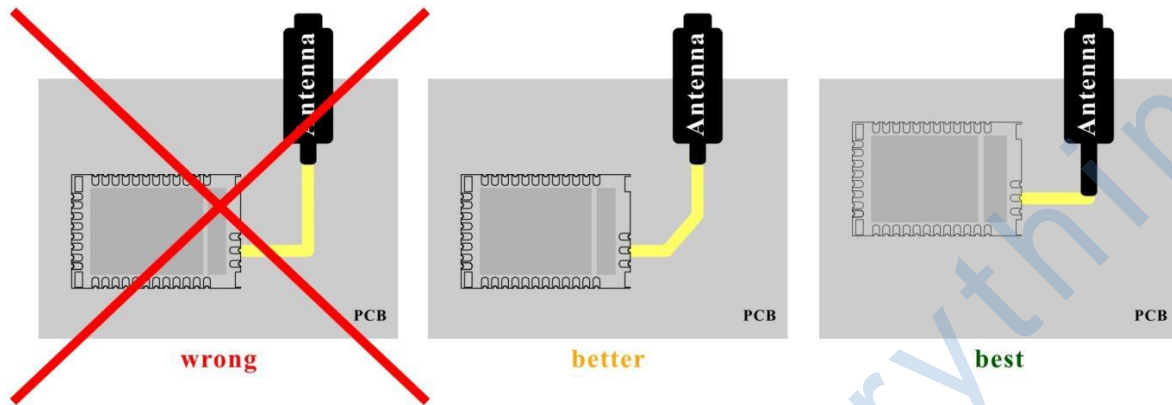


Figure 14: Recommended Trace Connects Antenna and the Module

- Routing of the RF-connection underneath the module should be avoided. The distance of the micro strip line to the ground plane on the bottom side of the receiver is very small and has huge tolerances. Therefore, the impedance of this part of the trace cannot be controlled.
- Use as many vias as possible to connect the ground planes.

9 Recommended Reflow Profile

The soldering profile depends on various parameters necessitating a set up for each application. The data here is given only for guidance on solder reflow.

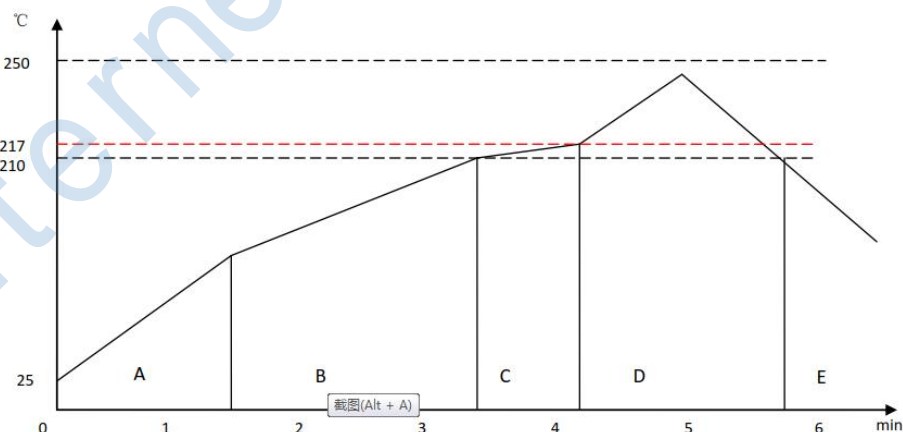


Figure 15: Recommended Reflow Profile

Pre-heat zone (A) — This zone raises the temperature at a controlled rate, typically 0.5 – 2

C/s. The purpose of this zone is to preheat the PCB board and components to 120 ~ 150

°C. This stage is required to distribute the heat uniformly to the PCB board and completely

remove solvent to reduce the heat shock to components.

Equilibrium Zone 1 (B) — In this stage the flux becomes soft and uniformly encapsulates solder particles and spread over PCB board, preventing them from being re-oxidized. Also with elevation of temperature and liquefaction of flux, each activator and rosin get activated and start eliminating oxide film formed on the surface of each solder particle and PCB board.

The temperature is recommended to be 150° to 210 ° for 60 to 120 second for this zone.

Equilibrium Zone 2 (c) (optional) — In order to resolve the upright component issue, it is recommended to keep the temperature in 210 – 217 ° for about 20 to 30 second.

Reflow Zone (D) — The profile in the figure is designed for Sn/Ag3.0/Cu0.5. It can be a reference for other lead-free solder. The peak temperature should be high enough to achieve good wetting but not so high as to cause component discoloration or damage.

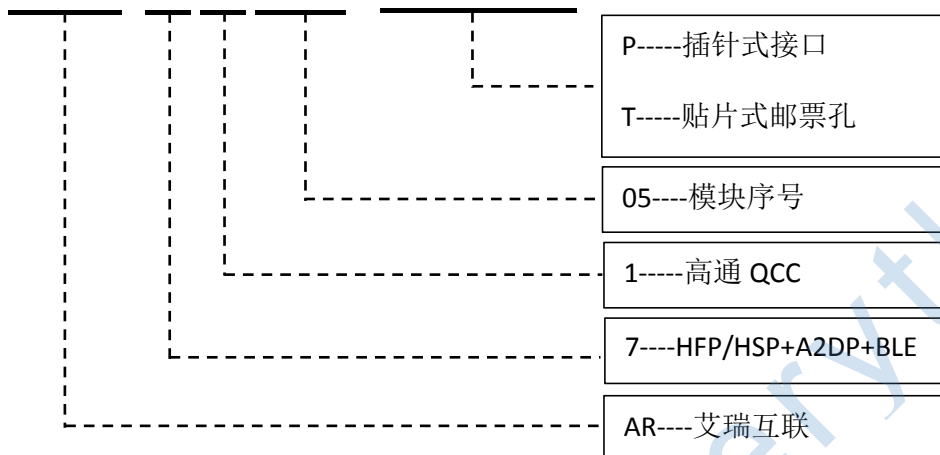
Excessive soldering time can lead to intermetallic growth which can result in a brittle joint.

The recommended peak temperature (Tp) is 230 ~ 250°C. The soldering time should be 30 to 90 second when the temperature is above 217°C.

Cooling Zone (E) — The cooling rate should be fast, to keep the solder grains small which will give a longerlasting joint. **Typical cooling rate should be 4°C.**

10 Ordering Information

AR-7105-P/T/D



10.1 Module function

功能序号	产品主要功能	说明	备注
2	HID		
3	SPP 数传		
4	BLE 数传		
5	SPP+BLE 数传		
6	A2DP	仅音频	
7	HFP/HSP+A2DP+BLE	电话+音频+数传	全功能
8	WiFi		
9	Bluetooth+WiFi		

10.2 The chip manufacturer

厂家序号	芯片厂家	说明
1	高通 QCC	
2	中科蓝讯 AB	
3	杰理 JL	
4	锐迪科 RDA	
5	中芯微 WS	
6	TI	
7	NORDIC	
8	瑞昱 REALTEK	
9	南方硅谷	

10.3 Module mounting mode

序号	贴装方式	说明
1	P	插针式
2	T	邮票孔贴装
3	D	邮票孔+插针

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