

Linkplay Wireless Smart Audio Module (A76D)

OEM/Integrators Installation Manual

Rev 1.7

July 20, 2017

NOTE: the module is limited to OEM installation only, separate approval is required for all other operating configurations, including portable configurations and different antenna configurations. When the module is used in host, it must consider FCC required, refer to FCC Radiation Exposure Statement and FCC Warning.

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		Version	1.7

HISTORY

Version	Date	Description
1.1	01/17/2017	Initial specification release
1.2	02/14/2017	Add the detailed reference design block
1.3	02/18/2017	Add power on sequence
1.4	04/25/2017	Change pin name and description
1.5	05/24/2017	Upgrade mechanical dimensions to new revision
1.6	06/14/2017	Add electrical specifications
1.7	07/20/2017	Update VDDRTC current parameters

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1. Overview

Linkplay Wi-Fi Audio module - A76D, is our third generation smart audio modules developed to be used in the connected speaker, sound bar and other connected audio devices. It integrates the low power Broadcom BCM43455 Wi-Fi/BT chip and Ingenic X1000E application processor. The CPU is running at 1GHz with hardware engine dedicated for floating point processing and the SIMD instruction acceleration. It supports IEEE 802.11 b/g/n/ac 2.4GHz and 5GHz. It also supports BT4.2 with EDR and BLE.

A76D module also provides USB, I2S, I2C, PWM, AUX in, SD/MMC etc. Interfaces.

The firmware is fully compatible with Apple AirPlay and digital living network alliance (DLNA) streaming standards. It supports Hi-Fi audio up to 192KHz, 24-bit with most popular audio formats. It supports multi-room and multi-channel audio streaming with perfect synchronization.

With this module, you can play the music on your speaker wirelessly from iPhone, iPad , iPod touch, Android devices or PC. More important, it enables the traditional speaker system to become the Internet enabled device through the wired or wireless connection provided by the module. Thus, you could freely playback any Internet audio contents such as music, podcast, radio or either the accompany audio in the movie directly from the Internet.

Feature

- Support IEEE 802.11 b/g/n/ac Wi-Fi dual band
- Support BT4.2+EDR and BLE

Application

- Connected speaker, sound bar
- Connected audio devices

1.1. Parameter

Mode	Items	Performance	
Wi-Fi	Certification	FCC/CE	
	Standard	802.11 b/g/n/ac 2.4GHz/5GHz	
	Frequency	2.400GHz - 2.497GHz 5.18 GHz ~ 5.845 GHz	
	2.4G Transmit		802.11b /CCK : 16 dBm \pm 1.5 dB @ EVM -9dB
			802.11g /64-QAM(R=3/4) : 15 dBm \pm 1.5 dB @ EVM -25dB
		802.11n /64-QAM(R=5/6) : 14 dBm \pm 1.5 dB	

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		@ EVM -27dB
	5G Transmit	802.11a /64-QAM(R=3/4) : 14 dBm ± 1.5 dB
		@ EVM -25dB
		802.11n /64-QAM(R=5/6) : 13 dBm ± 1.5 dB
		@ EVM -27dB
		802.11ac/256-QAM(R=3/4) : 12 dBm ± 1.5 dB
		@ EVM -30dB
		802.11ac/256-QAM(R=5/6) : 10 dBm ± 1.5 dB
		@ EVM -32dB
	Modulation	802.11b : DQPSK, DBPSK, CCK
		802.11g/n : 64-QAM,16-QAM, QPSK, BPSK
		802.11ac : 256-QAM, 64-QAM,16-QAM, QPSK, BPSK
	Receive sensitivity 2.4G (typical)	802.11b: 11Mbps PER=8% @ -87 dBm,
		802.11g: 54Mbps PER=10% @ -74 dBm
		802.11n(20MHZ) : MCS=7 PER=10% @ -71 dBm,
	Receive sensitivity 5G (typical)	802.11a(20MHZ): 54Mbps PER=10% @ -73 dBm
		802.11n(20MHZ): MCS=7 PER=10% @ -71 dBm
802.11n(40MHZ): MCS=7 PER=10% @ -68 dBm		
802.11ac(20MHZ): MCS=8 PER=10% @ -66 dBm		
802.11ac(40MHZ): MCS=9 PER=10% @ -63 dBm		
802.11ac(80MHZ): MCS=9 PER=10% @ -59 dBm		
Maximum receiver power	802.11b : -10dBm	
	802.11g/n : -20dBm	
	802.11ac : -30dBm	
Antenna	External: I-PEX, antenna gain 0~2 dBi, shared with BT	
BT	Version	Bluetooth V4.2
	Frequency	2402 MHz ~ 2480 MHz
	Number of Channel	79
	Modulation	FHSS, GFSK, DPSK, DQPSK
	Transmit (Class1.5)	8 dBm
	Receive sensitivity	@ BER=0.1% for GFSK (1Mbps) -86dBm
		@ BER=0.01% for π /4-DQPSK (2Mbps) -86dBm
		@ BER=0.01% for 8DPSK (3Mbps) -80dBm
	Maximum receiver power	GFSK (1Mbps) :-20dBm
π /4-DQPSK (2Mbps) :-20dBm		
8DPSK (3Mbps) :-20dBm		
Antenna	External: I-PEX, antenna gain 0~2 dBi, shared with BT	
Hardware	Work voltage	3.7-5.5V
	Work current	57mA - 115mA
	Standby current	<3mA
	Work temperature	-5°C~40°C
	Storage temperature	-40°C~135°C

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	Wi-Fi work distance	60 meters at open environment
	IO Extension	USB, SD/MMC
	Dimension	41.7mm x 32.2mm 56-PIN DIP

Table1-1 Linkplay A76D module parameters

2. Hardware description

2.1. Description of hardware interface

A76D provides the option to connect with customer board through its 56-pins DIP. The detail is as follows.

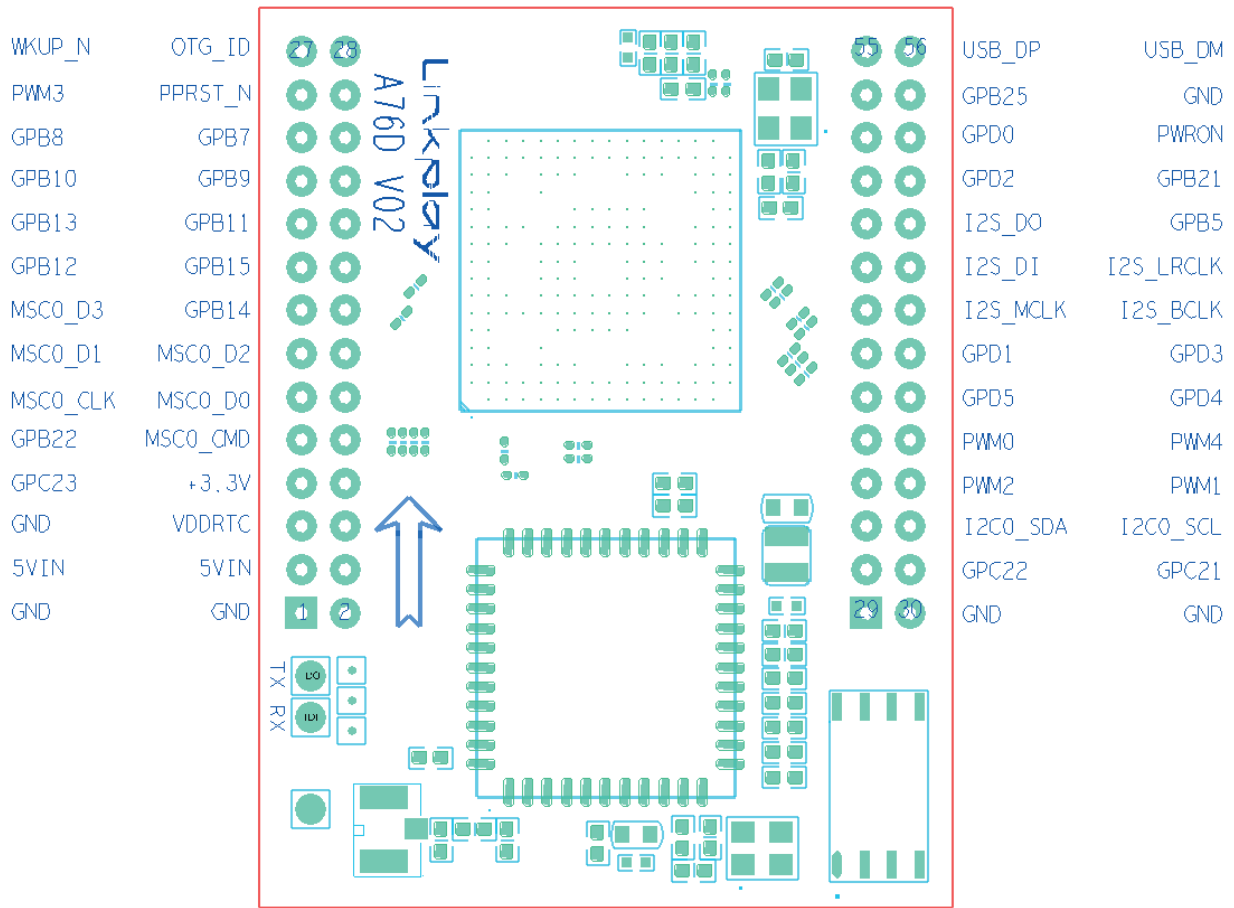


Figure 2-1 A76D interface pins

Pin description:

Pin No.	Pin Name	Type	Function0	Function1
1, 2, 5, 29, 30, 54	GND	Supply	Digital ground	
3, 4	5VIN	Power I	Power supply input > 500mA	

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6	VDDRTC	Power I	RTC power supply input < 40uA	
8	+3.3V	Power O	Output for I/O power < 100mA	
7	GPC23	I	SDIO0 card detect, external pull-up required	
9	GPB22	I/O	General purpose input output, external pull-up required	
10	MSC0_CMD	O	SDIO0 command, external pull-up required	
11	MSC0_CLK	O	SDIO0 clock	
12	MSC0_D0	I/O	SDIO0 data 0, external pull-up required	
13	MSC0_D1	I/O	SDIO0 data 1, external pull-up required	
14	MSC0_D2	I/O	SDIO0 data 2, external pull-up required	
15	MSC0_D3	I/O	SDIO0 data 3, external pull-up required	
16	GPB14	I/O	General purpose input output, external pull-up required	
17	GPB12	I/O	General purpose input output, external pull-up required	
18	GPB15	I/O	General purpose input output, external pull-up required	
19	GPB13	I/O	General purpose input output, external pull-up required	
20	GPB11	I/O	General purpose input output, external pull-up required	
21	GPB10	I/O	General purpose input output, external pull-up required	
22	GPB9	I/O	General purpose input output, external pull-up required	
23	GPB8	I/O	General purpose input output, external pull-up required	
24	GPB7	I/O	General purpose input output, external pull-up required	
25	PWM3	I/O	Pulse width modulation	GPB6(General purpose input output, external pull-up required)
26	PPRST_N	I	CPU reset, internal pull-up RC delay	
27	WKUP_N	I	Wake-up, internal pull-up	
28	OTG_ID	I	OTG ID signal, internal pull-up	
31	GPC22	I/O	General purpose input output,	

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			external pull-up required	
32	GPC21	I/O	General purpose input output, external pull-up required	
33	I2C0_SDA	I/O	I2C0 data, internal pull-up	
34	I2C0_SCL	I/O	I2C0 clock, internal pull-up	
35	PWM2	I/O	Pulse width modulation	
36	PWM1	I/O	Pulse width modulation	
37	PWM0	I/O	Pulse width modulation	
38	PWM4	I/O	Pulse width modulation	
39	GPD5	I/O	General purpose input output, external pull-up required	
40	GPD4	I/O	General purpose input output, external pull-up required	
41	GPD1	I/O	General purpose input output, external pull-up required	I2C2_SDA
42	GPD3	I/O	General purpose input output, external pull-up required	UART1_TXD
43	I2S_MCLK	I/O	I2S master clock	
44	I2S_BCLK	I/O	I2S bit clock	
45	I2S_DI	I	I2S data input	
46	I2S_LRCLK	I/O	I2S L/R clock	
47	I2S_DO	O	I2S data output	
48	GPB5	I/O	General purpose input output, external pull-up required	
49	GPD2	I/O	General purpose input output, external pull-up required	UART1_RXD
50	GPB21	I/O	General purpose input output, external pull-up required	
51	GPD0	I/O	General purpose input output, external pull-up required	I2C2_SCL
52	PWRON	O	Power on output	
53	GPB25	I/O	General purpose input output, external pull-up required	Internal development use only
55	USB_DP	I/O	USB data plus	
56	USB_DM	I/O	USB data minus	

Table 2-1 Linkplay A76D module pin description

Notes:

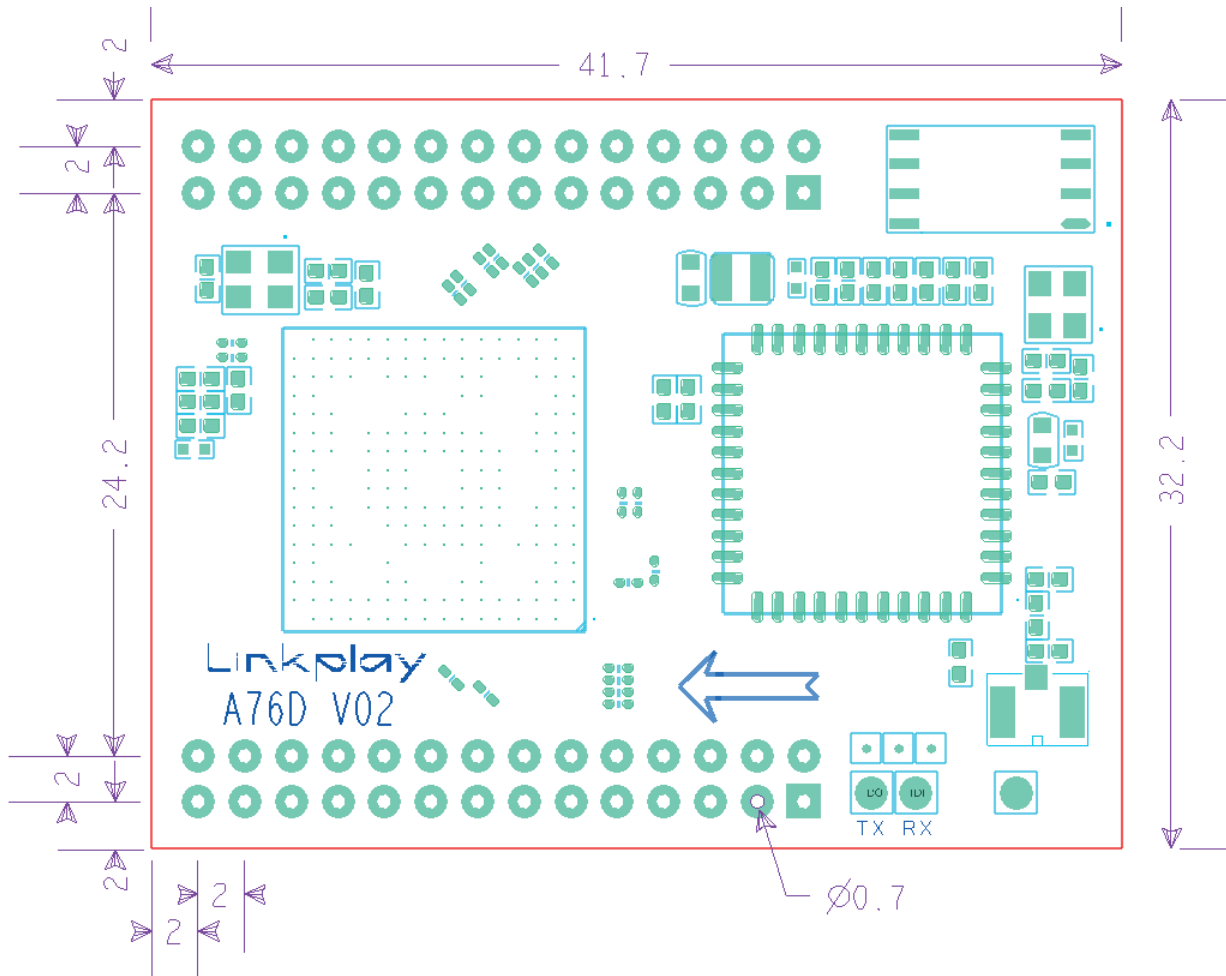
1. I: Input
2. O: Output
3. P: Power

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4. PU: Internal Pull Up
5. PD: Internal Pull Down

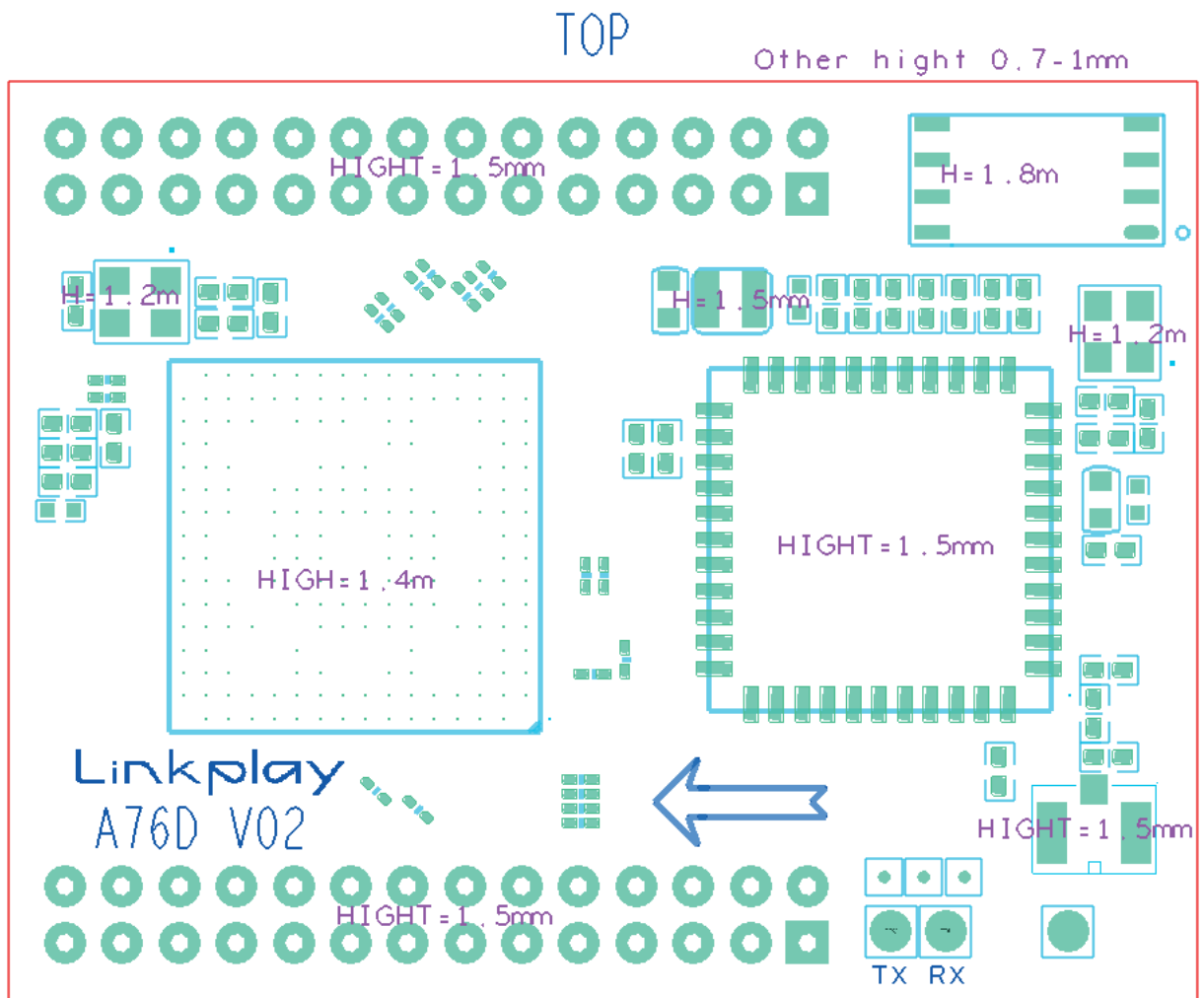
2.2. Mechanical Dimension

Linkplay A76D module has the dimension of 41.7mm x 32.2mm. The detailed layout will be given shortly below.
Unit: mm



TOP Components High Limit

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BOTTOM Components High Limit

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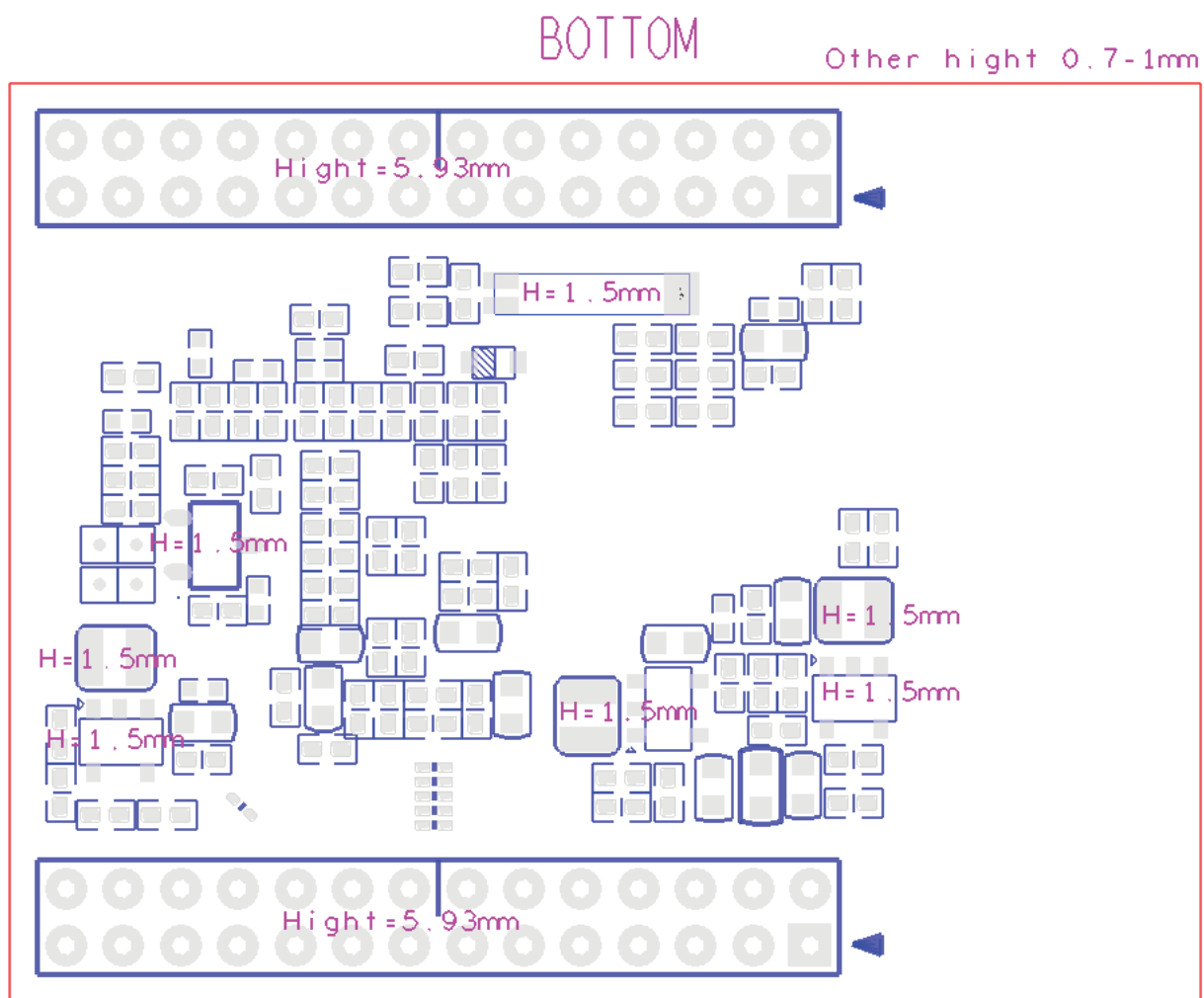


Figure 2-2: Linkplay A76D physical dimension

2.3. External Antenna

A76D uses the external antenna for the best Wi-Fi performance. To use external antenna, please choose the antenna type that meets the requirement of IEEE 802 b/g/n/ac Wi-Fi standard running at 2.4GHz/5GHz frequency. The detailed parameters are shown in the table below.

Item	Parameter
Frequency range	2.4~2.5GHz/5GHz
Impedance	50 Ohm
VSWR	2 (Max)
Reflection loss	-10dB (Max)
Connector	I-PEX or populate directly

Table 2-5 External antenna parameters for A76D

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2.4. Typical Application

WiFiAudio-A76D's typical reference design:

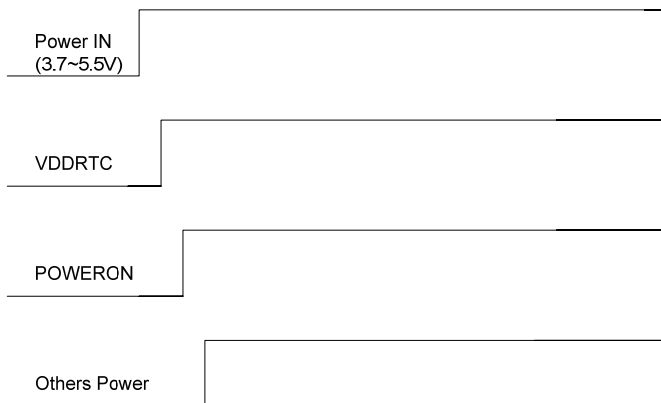
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2.5. Power ON Sequence

A76D module has two power domains: VDDRTC and 5VIN. The following is recommended power on sequence.



There are three I/O pins in RTC power domain:

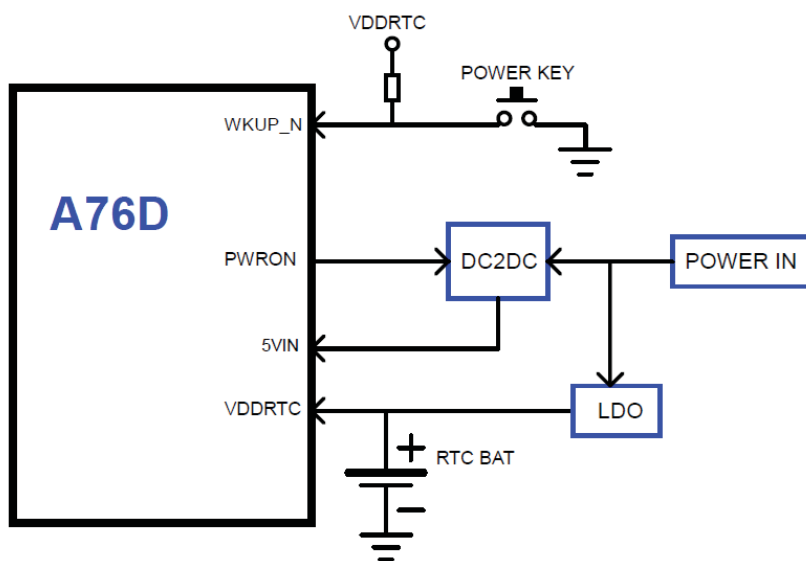
1. PPRST_N: Power on reset and hardware reset signal input
2. WKUP_N: Power on signal input
3. PWRON: Power on signal output to turn on DCDC/LDO/Power switches

Note: There is an R-C delay circuit on A76D for power on reset sequence, so you may consider PPRSET_N only as HW reset.

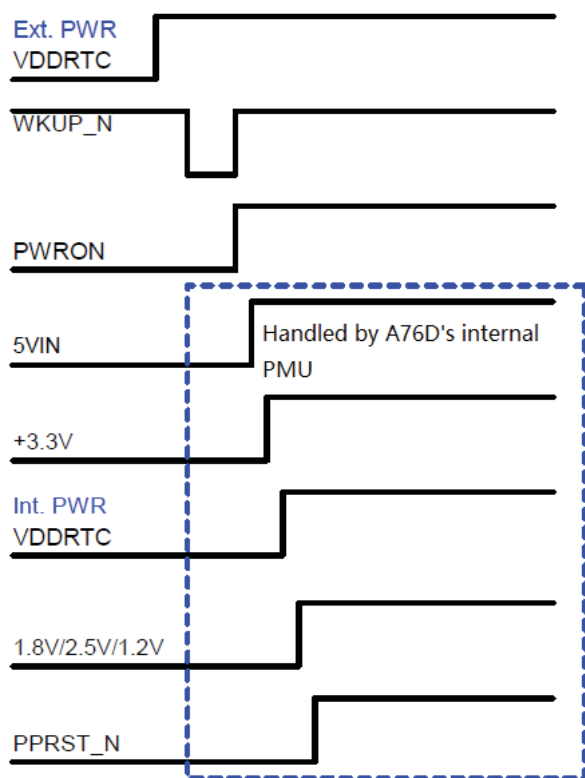
The following are two power on sequences for typical applications

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Typical Application 1



Power ON Sequence 1



Power on Sequence #1:

Step 1: Input 1.8V~3.3V power from DC IN or Battery to “VDDRTC” pin, then RTC power domain turns active

Step 2: Input a pulse (low level active, more than 160ms) to “WKUP_N” pin

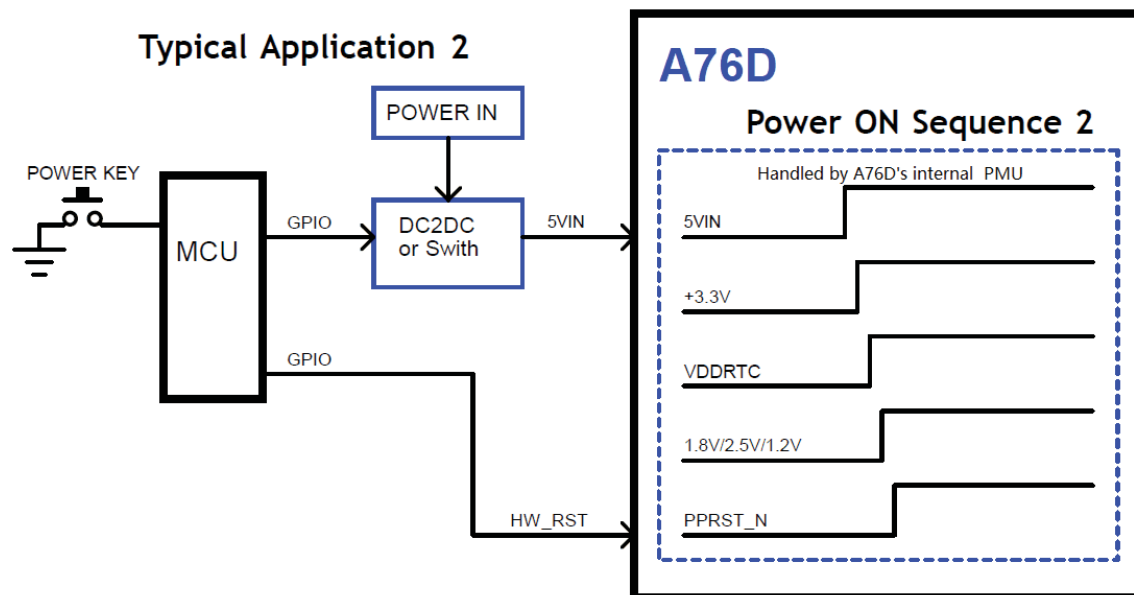
Step 3: Once A76D gets this pulse , it will continuously output a high level signal from PWRON pin to turn on every DCDC/LDO

Step 4: DCDC on, 5V power supply to A76D 5VIN pin

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Step 5:A76D generate every power voltage needed inside the module

Step 6:A76D generate power-on reset inside the module, system boot up



Power on sequence #2: (Apply to the user case that there is external MCU in the system)

Step 1: MCU turn on the DC/DC and 5V power supply to A76D through “5VIN”

Step 2:A76D generate every power voltage needed inside the module.

Step3:A76D generate power-on reset inside the module and system boot up.

Note 1: Once 5VIN power is stable, current drain from “VDDRTC” pin is no longer exist, A76D will generate a voltage supply to VDDRTC power domain itself, on purpose of reducing power consumption of RTC battery.

Note 2: During the process of system power-on, every signal connected to A76D(I2S,I2C,GPIO,UART etc..) should configured as GPIO and set to High-Z or input mode. Please strictly avoid high level signals on these traces, otherwise it may cause wrong power sequence and system boot up failed.

2.6. USB Host Port

Please follow the design rule below to populate the USB host interface:

Item	Parameter
Signal Group	USB
Topology	Differential Pair Point-to-Point
Reference Plane	Ground Referenced
Characteristic Trace Impedance (Zo)	90 Ω ±10%
Trace Width	4 mils

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Serpentine Spacing(center to center)	8.5 mils
Minimum Isolation Spacing to Clock Signals	50 mils
Minimum Isolation Spacing to Low-Speed Signals	20 mils
Minimum Isolation Spacing to other USB Pair	20 mils
Total Length (with package length)	< 8000 mils
Maximum Recommended Via Count	2 (per side)
DM to DP Length Matching(with package length)	Match total length to within ± 10 mils

Table 2-2 A76D USB design rule

3. Electrical Specifications

3.1. Absolute Maximum Ratings

The absolute maximum ratings for the processors are listed in Table 3-1. Do not exceed these parameters or the part may be damaged permanently. Operation at absolute maximum ratings is not guaranteed.

Table 3-1 Absolute Maximum Ratings

Parameter	Min	Max	Unit
Storage Temperature	-40	135	°C
Operation Temperature	-5	40	°C
5VIN power supplies voltage	-0.5	5.3	V
Input voltage to VDDRTC supplied non-supply pins	-0.5	3.6	V
Maximum ESD stress voltage, Human Body Model; Any pin to any supply pin, either polarity, or Any pin to all non-supply pins together, either polarity. Three stresses maximum.		2000	V

3.2. Recommended operating conditions

The recommended operating conditions are listed in Table 3-2.

Table 3-2 Recommended operating conditions for power supplies

Symbol	Description	Min	Typical	Max	Unit
5VIN	Power supply input	3.7	5.0	5.25	V
VDDRTC	RTC power supply input	3.0	3.3	3.6	V

3.3 Power consumption

The consumption of various operating conditions are listed in Table 3-3.

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Table 3-3 Operating conditions for power consumption

Mode	Power			Unit
	Function on	Connected w/o data transmission	Data transmission	
BLE on only	58-61	58-64	58-62	mA
A2DP on only	58-60	57-60	66-70	mA
BLE+A2DP ON	57-61	58-63	67-70	mA
BLE+A2DP off	57-60			mA
Wi-Fi ON	99-111 (Soft AP)	63-109	65-115	mA
Wi-Fi off	60			mA
Hibernation	3			mA

4. Software Introduction

4.1. Feature list

- “Easy Setup” to setup your network, with the help of one button of your device, you can connect the device to your home router quickly.
- Music stream protocol
Support Spotify Connect, Airplay, DLNA and QPlay protocol
- Amazon Alexa
- Music content
Support iHeartRadio, Napster/Rhapsody, Tidal, Deezer, vTune, Qobuz, Audible, Radio.de, NPR, Ximalaya, Qingting FM, QQ FM, Douban FM inside, with the help of App, you can search, stream, playback and preset the musics of the above music services.
- Multiroom
Support multiroom.
Support Airplay, Spotify, Bluetooth, Aux-in multiroom playback.
- Music format
HTTP/HTTPS/RTSP/MMS/TS protocol
HLS/ASX/M3U playlist format
MP3/AAC/FLAC/ALAC/WMA/APE/OGG codec
- BT
Support 4.2: A2DP, AVRCP, HFP, HID profiles
Support BLE
Support EDR
- Preset
With the help of App, you can store the music account token and playlist in the A76D. Then the end user can play the playlist by the button/voice or timer even without the App.

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4.2. App support

- iOS App
>= iOS6.1, suggest iOS10 and above
- Android App
>= Android 4.3.3
- Quick customization
With the help of the Linkplay compile server, you can change the brand and some strings, change the logo and some pictures to get a customization App.

4.3. Certifications

Linkplay can help you to finish follow certifications::

- Wi-Fi Logo
- BQB
- Amazon Alexa
- MFI
- Spotify Connect
- DLNA
- QPlay

5. Module picture and package

1) A76D module picture (insert later)

Notes:

Linkplay: Linkplay logo

A76D: Module No.

V01: MP version of A76D module

2) Delivery

Notes:

One tray = 30pcs

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One box = 15 trays

On box in total: $15 \times 30\text{pcs} = 450\text{pcs}$

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance.

Note 1: This module certified that complies with RF exposure requirement under mobile or fixed condition, this module is to be installed only in mobile or fixed applications.

A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

A fixed device is defined as a device is physically secured at one location and is not able to be easily moved to another location.

Note 2: Any modifications made to the module will void the Grant of Certification, this module is limited to OEM installation only and must not be sold to end-users, end-user has no manual instructions to remove or install the device, only software or operating procedure shall be placed in the end-user operating manual of final products.

Note 3: Additional testing and certification may be necessary when multiple modules are used.

Note 4: The module may be operated only with the antenna with which it is authorized. Any antenna that is of the same type and of equal or less directional gain as an antenna that is authorized with the intentional radiator may be marketed with, and used with, that intentional radiator.

Note 5: To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, Linkplay Technology Inc.. shall provide guidance to the host manufacturer for compliance with the Part 15B requirements.

Note 6: FCC ID label on the final system must be labeled with “Contains FCC ID: 2ANOG-A76D” or “Contains transmitter module FCC ID: 2ANOG-A76D”.

FCC Warning

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: Any changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.