

Linkplay Wireless Smart Audio Module (A98M Series)

User Manual

Revision 0.3

December 14, 2020

Doc Title	Wireless Smart Audio Module-A98M Series Datasheet	Number	WMB01152020
		Version	0.3

HISTORY

Version	Date	Description
0.1	01/15/2020	Initial version release
0.2	03/24/2020	Update description of DVFS
0.3	12/14/2020	Add FCC related information

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1. Overview

Linkplay Wireless Smart Audio module–A98M, is our 3rd. generation smart audio modules developed to be used in the connected speaker, sound bar and other connected audio devices. It supports both ‘voice built-in’ and ‘work with voice’ applications. It integrates the low power Broadcom BCM43456 Wi-Fi/BT chip and Amlogic A113X application processor that is designed for the connected audio applications. It integrates a powerful CPU subsystem, advanced multi-format audio processing unit, a secured running environment and all major peripherals to form the low power audio SoC.

The main system CPU is a quad-core ARM Cortex-A53 CPU with L1 instruction/data cache for each core and a large unified L2 cache to improve system performance. Each Cortex-A53 CPU can run up to 1.2 GHz (DVFS + hot plug, run up to 1.2 GHz in A98M module) and has a wide bus connecting to the memory sub-system. When the system is suspended, the main CPU can be powered off and the cortex-M3 in the always-on power domain can resume the system from multiple interrupt sources to achieve very low power consumption.

The audio processing engine (APE) is based on ARM® NEON™ general-purpose SIMD architecture which works seamlessly with the main CPU to accelerate the multimedia processing algorithm and enhance the user experience. It is able to decode all major high-resolution audio formats including MP3, AAC, WMA, RM, FLAC, Ogg, etc. with the flexibility to support future audio encoding/decoding standards and processing.

The module supports all standard audio input/output interfaces including multiple TDM, PCM, I2S and SPDIF digital audio input/output interfaces, and 8 channel far-field PDM digital microphone (DMIC) inputs. Audio input has power detector to wake up from low activity states. It also has the dedicated hardware assisted synchronization blocks for the multiple room audio applications. Besides, audio input data can be restricted to trusted memory space to protect always-on audio privacy.

The module supports IEEE 802.11 a/b/g/n/ac 1x1 dual band 2.4 GHz and 5GHz Wi-Fi and BT5.0 with EDR and BLE. It also provides USB, I2S, I2C, PDM, SPI, UART etc. interfaces to control various types of peripheral devices.

The Linkplay embedded firmware is secure, pre-certified for many voice assistants such as Amazon Alexa voice services (AVS), Tencent Xiaowei, Naver Clova, Baidu DuerOS, Yandex Alice etc. among others. It also supports Apple Airplay 2, Spotify connect and numerous other music contents such as Spotify, iHeartRadio, Amazon Music, Tidal, TuneIn, Deezer and many others. It’s also compatible with digital living network alliance (DLNA) streaming standards. It supports Hi-Fi audio up to 192KHz, 24-bit with the most popular audio formats. It supports multi-room and multi-channel audio streaming with perfect synchronization.

In addition, the embedded software supports the audio front end processing such as acoustic echo cancellation (AEC) and denoising for voice UI and the sophisticated EQ processing for the high quality audio playback.

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 play any Internet audio contents such as music, podcast, radio or either the accompany audio in the movie directly from the Internet.

Features

- Amlogic A113X application processor
- 128MB DRAM (with 256MB, 512MB options)

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- 128MB NAND FLASH (with 256MB, 512MB options)
- AMPAK AP6256
- Support IEEE 802.11 a/b/g/n/ac Wi-Fi dual band 1x1
- Support BT5.0 with EDR and BLE

Application

- Connected speaker, sound bar
- Connected audio devices

1.1. Parameter

Type	Items	Performance
Wi-Fi	Certification	TBA
	WLAN Standard	IEEE 802.11 a/b/g/n/ac Wi-Fi compliant
Wi-Fi (2.4G)	Frequency Range	2.400 GHz ~ 2.4835 GHz (2.4 GHz ISM Band)
	Number of Channels	Ch1 ~ Ch13
	Modulation	802.11b : DQPSK, DBPSK, CCK
		802.11g/n : OFDM /64-QAM,16-QAM, QPSK, BPSK
	Output Power (Tolerance ± 1.5 dB The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard)	802.11b 1/2/5.5/11Mbps : 17 dB
		802.11g 6/9/12/18/24/36Mbps : 16 dB
		802.11g 48/54Mbps : 15 dB
		802.11n 20MHz MCS0-3 : 17 dB
		802.11n 20MHz MCS4 : 16 dB
		802.11n 20MHz MCS5 : 15 dB
		802.11n 20MHz MCS6/MCS7 : 14 dB
	Receive Sensitivity (Tolerance ± 2 dB CCK modulation PER \cong 8%、OFDM modulation PER \cong 10%) @8% PER	802.11b 1Mbps -96 dBm
		802.11b 2Mbps -90 dBm
		802.11b 5.5Mbps -88 dBm
		802.11b 11Mbps -87 dBm
		802.11g 6Mbps -91 dBm
		802.11g 9Mbps -88 dBm
		802.11g 12Mbps -87 dBm
		802.11g 18Mbps -85 dBm
		802.11g 24Mbps -83 dBm
802.11g 36Mbps -80 dBm		
802.11g 48Mbps -76 dBm		
802.11g 54Mbps -73 dBm		
802.11n 20MHz MCS0 -90 dBm		
802.11n 20MHz MCS1 -85 dBm		
802.11n 20MHz MCS2 -84 dBm		
802.11n 20MHz MCS3 -80 dBm		

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		802.11n 20MHz MCS4 -77 dBm	
		802.11n 20MHz MCS5 -75 dBm	
		802.11n 20MHz MCS6 -72 dBm	
		802.11n 20MHz MCS7 -71 dBm	
	Maximum Input Level		802.11b : -10 dBm
			802.11g/n : -20 dBm
	Antenna Interface		External: I-PEX I with 0 ~ 2 dBi peak gain
	WLAN Standard		IEEE 802.11a/n/ac 1x1 & Wi-Fi compliant
	Frequency Range		5.15 ~ 5.35GHz、 5.47 ~ 5.725GHz、 5.725 ~ 5.85GHz (5GHz UNII Band)
	Number of Channels		5.18~5.35GHz: Ch36 ~ Ch64
			5.5~5.7GHz: Ch100 ~ Ch140
			5.745~5.825GHz: Ch149 ~ Ch165
	Modulation		802.11a : OFDM /64-QAM、 16-QAM、 QPSK、 BPS
			802.11n : OFDM /64-QAM、 16-QAM、 QPSK、 BPSK
			802.11ac : OFDM /256-QAM、 OFDM /64-QAM、 16-QAM、 QPSK、 BPSK
	Output Power (Tolerance ± 2 dB The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard)		802.11a 5180~5350GHz 6-9Mbps、 12-18Mbps、 24Mbps : 17 dBm
			802.11a 5180~5350GHz 36/48Mbps : 16 dB
			802.11a 5180~5350GHz 54Mbps : 15 dB
			802.11a 5500~5700GHz 6-9Mbps、 12-18Mbps、 24Mbps : 17 dB
			802.11a 5500~5700GHz 36/48Mbps : 16 dB
			802.11a 5500~5700GHz 54Mbps : 15 dB
			802.11a 5745~5825GHz 6-9Mbps、 12-18Mbps、 24Mbps : 17 dB
			802.11a 5745~5825GHz 36/48Mbps : 16 dB
			802.11a 5745~5825GHz 54Mbps : 15 dB
			802.11n 20MHz 5180~5350GHz MCS0-3 : 17 dB
			802.11n 20MHz 5180~5350GHz MCS4/5 : 16 dB
			802.11n 20MHz 5180~5350GHz MCS6 : 15 dB
			802.11n 20MHz 5180~5350GHz MCS7 : 14 dB
		802.11n 20MHz 5500~5700GHz MCS0-3 : 17 dB	
		802.11n 20MHz 5500~5700GHz MCS4/5 : 16 dB	
		802.11n 20MHz 5500~5700GHz MCS6 : 15 dB	
		802.11n 20MHz 5500~5700GHz MCS7 : 14 dB	
		802.11n 20MHz 5745~5825GHz MCS0-3 : 17 dB	
	802.11n 20MHz 5745~5825GHz MCS4/5 : 16 dB		
	802.11n 20MHz 5745~5825GHz MCS6 : 15 dB		
	802.11n 20MHz 5745~5825GHz MCS7 : 14 dB		

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		802.11n 40MHz 5180~5350GHz MCS0-3 : 17 dB
		802.11n 40MHz 5180~5350GHz MCS4/5 : 16 dB
		802.11n 40MHz 5180~5350GHz MCS6 : 15 dB
		802.11n 40MHz 5180~5350GHz MCS7 : 14 dB
		802.11n 40MHz 5500~5700GHz MCS0-3 : 17 dB
		802.11n 40MHz 5500~5700GHz MCS4/5 : 16 dB
		802.11n 40MHz 5500~5700GHz MCS6 : 15 dB
		802.11n 40MHz 5500~5700GHz MCS7 : 14 dB
		802.11n 40MHz 5745~5825GHz MCS0-3 : 17 dB
		802.11n 40MHz 5745~5825GHz MCS4/5 : 16 dB
		802.11n 40MHz 5745~5825GHz MCS6 : 15 dB
		802.11n 40MHz 5745~5825GHz MCS7 : 14 dB
		802.11ac 20MHz 5180~5350GHz MCS0-3 : 17 dB
		802.11ac 20MHz 5180~5350GHz MCS4/5 : 16 dB
		802.11ac 20MHz 5180~5350GHz MCS6 : 15 dB
		802.11ac 20MHz 5180~5350GHz MCS7 : 14 dB
		802.11ac 20MHz 5180~5350GHz MCS8 : 12 dB
		802.11ac 20MHz 5500~5700GHz MCS0-3 : 17 dB
		802.11ac 20MHz 5500~5700GHz MCS4/5 : 16 dB
		802.11ac 20MHz 5500~5700GHz MCS6 : 15 dB
		802.11ac 20MHz 5500~5700GHz MCS7 : 14 dB
		802.11ac 20MHz 5500~5700GHz MCS8 : 12 dB
		802.11ac 20MHz 5745~5825GHz MCS0-3 : 17 dB
		802.11ac 20MHz 5745~5825GHz MCS4/5 : 16 dB
		802.11ac 20MHz 5745~5825GHz MCS6 : 15 dB
		802.11ac 20MHz 5745~5825GHz MCS7 : 14 dB
		802.11ac 20MHz 5745~5825GHz MCS8 : 12 dB
		802.11ac 40MHz 5180~5350GHz MCS0-3 : 17 dB
		802.11ac 40MHz 5180~5350GHz MCS4/5 : 16 dB
		802.11ac 40MHz 5180~5350GHz MCS6 : 15 dB
		802.11ac 40MHz 5180~5350GHz MCS7 : 14 dB
		802.11ac 40MHz 5180~5350GHz MCS8 : 12 dB
		802.11ac 40MHz 5180~5350GHz MCS9 : 10.5 dB
		802.11ac 40MHz 5500~5700GHz MCS0-3 : 17 dB
		802.11ac 40MHz 5500~5700GHz MCS4/5 : 16 dB
		802.11ac 40MHz 5500~5700GHz MCS6 : 15 dB
		802.11ac 40MHz 5500~5700GHz MCS7 : 14 dB
		802.11ac 40MHz 5500~5700GHz MCS8 : 12 dB
		802.11ac 40MHz 5500~5700GHz MCS9 : 10.5 dB
		802.11ac 40MHz 5745~5825GHz MCS0-3 : 17 dB
		802.11ac 40MHz 5745~5825GHz MCS4/5 : 16 dB
		802.11ac 40MHz 5745~5825GHz MCS6 : 15 dB

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		802.11ac 40MHz 5745~5825GHz MCS7 : 14 dB
		802.11ac 40MHz 5745~5825GHz MCS8 : 12 dB
		802.11ac 40MHz 5745~5825GHz MCS9 : 10.5 dB
		802.11ac 80MHz 5180~5350GHz MCS0-3 : 17 dB
		802.11ac 80MHz 5180~5350GHz MCS4/5 : 16 dB
		802.11ac 80MHz 5180~5350GHz MCS6 : 15 dB
		802.11ac 80MHz 5180~5350GHz MCS7 : 14 dB
		802.11ac 80MHz 5180~5350GHz MCS8 : 12 dB
		802.11ac 80MHz 5180~5350GHz MCS9 : 10.5 dB
		802.11ac 80MHz 5500~5700GHz MCS0-3 : 17 dB
		802.11ac 80MHz 5500~5700GHz MCS4/5 : 16 dB
		802.11ac 80MHz 5500~5700GHz MCS6 : 15 dB
		802.11ac 80MHz 5500~5700GHz MCS7 : 14 dB
		802.11ac 80MHz 5500~5700GHz MCS8 : 12 dB
		802.11ac 80MHz 5500~5700GHz MCS9 : 10.5 dB
		802.11ac 80MHz 5745~5825GHz MCS0-3 : 17 dB
		802.11ac 80MHz 5745~5825GHz MCS4/5 : 16 dB
		802.11ac 80MHz 5745~5825GHz MCS6 : 15 dB
		802.11ac 80MHz 5745~5825GHz MCS7 : 14 dB
		802.11ac 80MHz 5745~5825GHz MCS8 : 12 dB
		802.11ac 80MHz 5745~5825GHz MCS9 : 10.5 dB
		802.11a 6Mbps -92 dBm
		802.11a 9Mbps -89 dBm
		802.11a 12Mbps -88 dBm
		802.11a 18Mbps -86 dBm
		802.11a 24Mbps -82 dBm
		802.11a 36Mbps -79 dBm
		802.11a 48Mbps -75 dBm
		802.11a 54Mbps -74 dBm
		802.11n 20MHz MCS0 -91 dBm
		802.11n 20MHz MCS1 -88 dBm
		802.11n 20MHz MCS2 -85 dBm
		802.11n 20MHz MCS3 -82 dBm
		802.11n 20MHz MCS4 -78 dBm
		802.11n 20MHz MCS5 -74 dBm
		802.11n 20MHz MCS6 -73 dBm
		802.11n 20MHz MCS7 -72 dBm
		802.11n 40MHz MCS0 -89 dBm
		802.11n 40MHz MCS1 -85 dBm
		802.11n 40MHz MCS2 -83 dBm
		802.11n 40MHz MCS3 -79 dBm

Receive Sensitivity
(Tolerance ± 2 dB
OFDM modulation PER
 $\cong 10\%$)

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	802.11n 40MHz MCS4 -76 dBm	
	802.11n 40MHz MCS5 -71 dBm	
	802.11n 40MHz MCS6 -70 dBm	
	802.11n 40MHz MCS7 -68 dBm	
	802.11ac 20MHz MCS0 -90 dBm	
	802.11ac 20MHz MCS1 -87 dBm	
	802.11ac 20MHz MCS2 -84 dBm	
	802.11ac 20MHz MCS3 -81 dBm	
	802.11ac 20MHz MCS4 -77 dBm	
	802.11ac 20MHz MCS5 -73 dBm	
	802.11ac 20MHz MCS6 -71 dBm	
	802.11ac 20MHz MCS7 -70 dBm	
	802.11ac 20MHz MCS8 -67 dBm	
	802.11ac 40MHz MCS0 -88 dBm	
	802.11ac 40MHz MCS1 -83 dBm	
	802.11ac 40MHz MCS2 -81 dBm	
	802.11ac 40MHz MCS3 -78 dBm	
	802.11ac 40MHz MCS4 -75 dBm	
	802.11ac 40MHz MCS5 -70 dBm	
	802.11ac 40MHz MCS6 -68 dBm	
	802.11ac 40MHz MCS7 -66 dBm	
	802.11ac 40MHz MCS8 -65 dBm	
	802.11ac 40MHz MCS9 -63 dBm	
	802.11ac 80MHz MCS0 -85 dBm	
	802.11ac 80MHz MCS1 -82 dBm	
	802.11ac 80MHz MCS2 -78 dBm	
	802.11ac 80MHz MCS3 -74 dBm	
	802.11ac 80MHz MCS4 -71 dBm	
	802.11ac 80MHz MCS5 -69 dBm	
	802.11ac 80MHz MCS6 -65 dBm	
	802.11ac 80MHz MCS7 -63 dBm	
	802.11ac 80MHz MCS8 -61 dBm	
	802.11ac 80MHz MCS9 -60 dBm	
Maximum Input Level	802.11a/n : -20 dBm 802.11ac : -30 dBm	
Antenna Reference	External: I-PEX I with 0~2 dBi peak gain	
Bluetooth	Certification	BQB
	Bluetooth Standard	GFSK、DQPSK、8DPSK、LE(1Mbps)、2LE(2Mbps)
	Antenna Interface	External: I-PEX I shared with Wi-Fi 0~2 dBi peak gain
	Frequency Band	2402 MHz ~ 2480 MHz
	Number of Channels	79 channels for classic、40 channels for BLE
	Modulation	FHSS, GFSK, DPSK, DQPSK

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	BDR Output Power	CL1: 6dBm、 CL2: 2dBm
	EDR Output Power	CL1: 4dBm、 CL2: 2dBm
	LE Output Power	CL1: 5dBm、 CL2: 2dBm
	Sensitivity @ BER=0.1% for GFSK (1Mbps)	-86 dBm, Typical
	Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)	-87 dBm, Typical
	Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-83 dBm, Typical
	Sensitivity @ BER=0.01% for LE (1Mbps)	-90 dBm, Typical
	Sensitivity @ BER=0.01% for LE (2Mbps)	-90 dBm, Typical
	Maximum Input Level	GFSK (1Mbps):
$\pi/4$ -DQPSK (2Mbps) :		-20dBm
8DPSK (3Mbps) :		-20dBm
Hardware	Working Voltage	3.5-5.5V
	Working Current	200 ~ 240mA (STA mode)
	Standby Current	5mA
	Operating Ambient Temperature	0°C ~ 40°C
	Storage Temperature	-5°C ~ 45°C
	Wi-Fi Working Distance	2.4G 80 meters/5G 150meters
	IO Extension	USB, I2S, I2C, PWM, SPI, UART
	Dimension	NGFF golden finger 67PIN

Table1-1 A98M Module Parameters

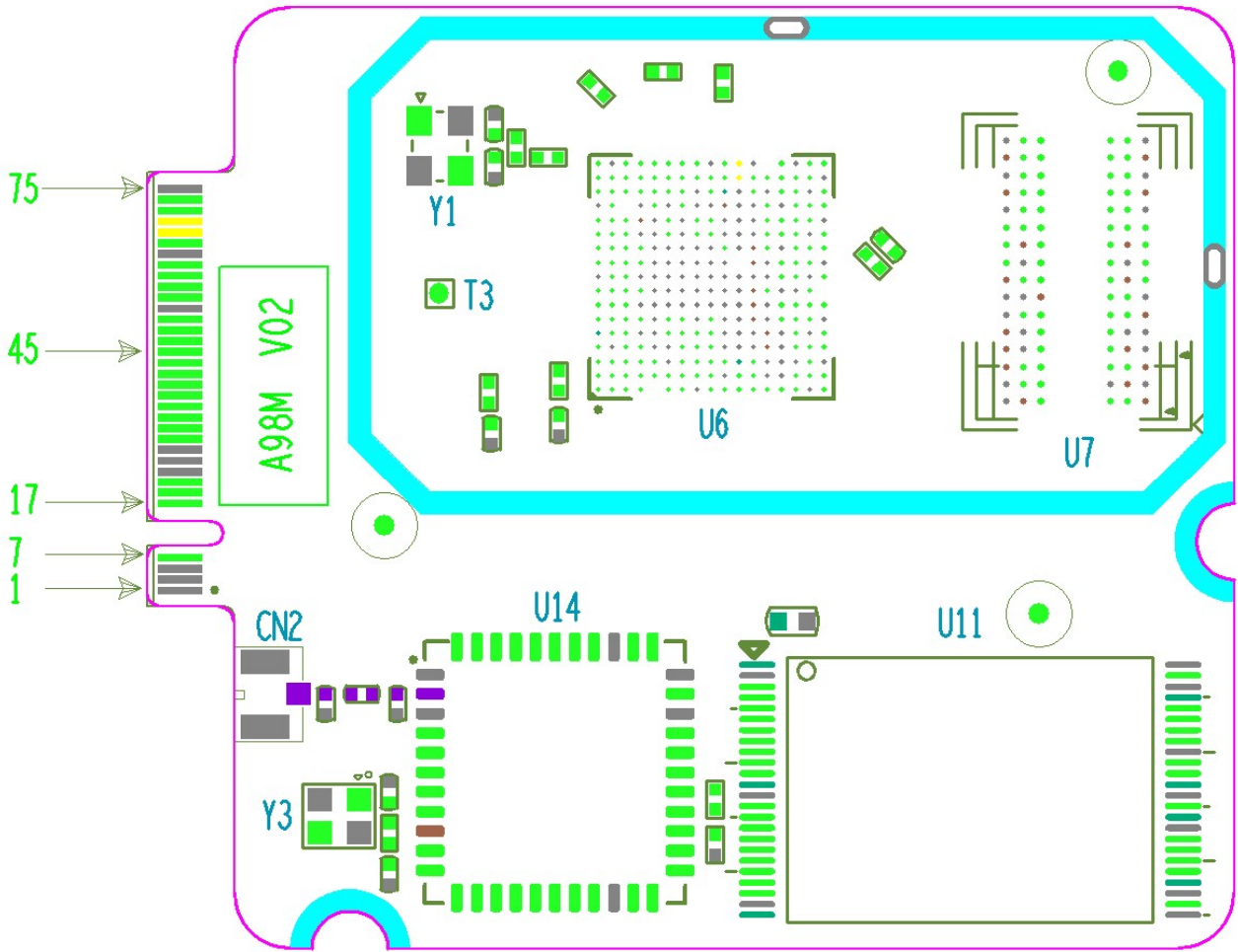
Note: The Bluetooth output power is able to be configured by firmware (hcd file).

2. Hardware Description

2.1. Description of Hardware Interface

A98M provides the option to connect with customer board through its 67-pins NGFF golden finger. The detail is as follows.

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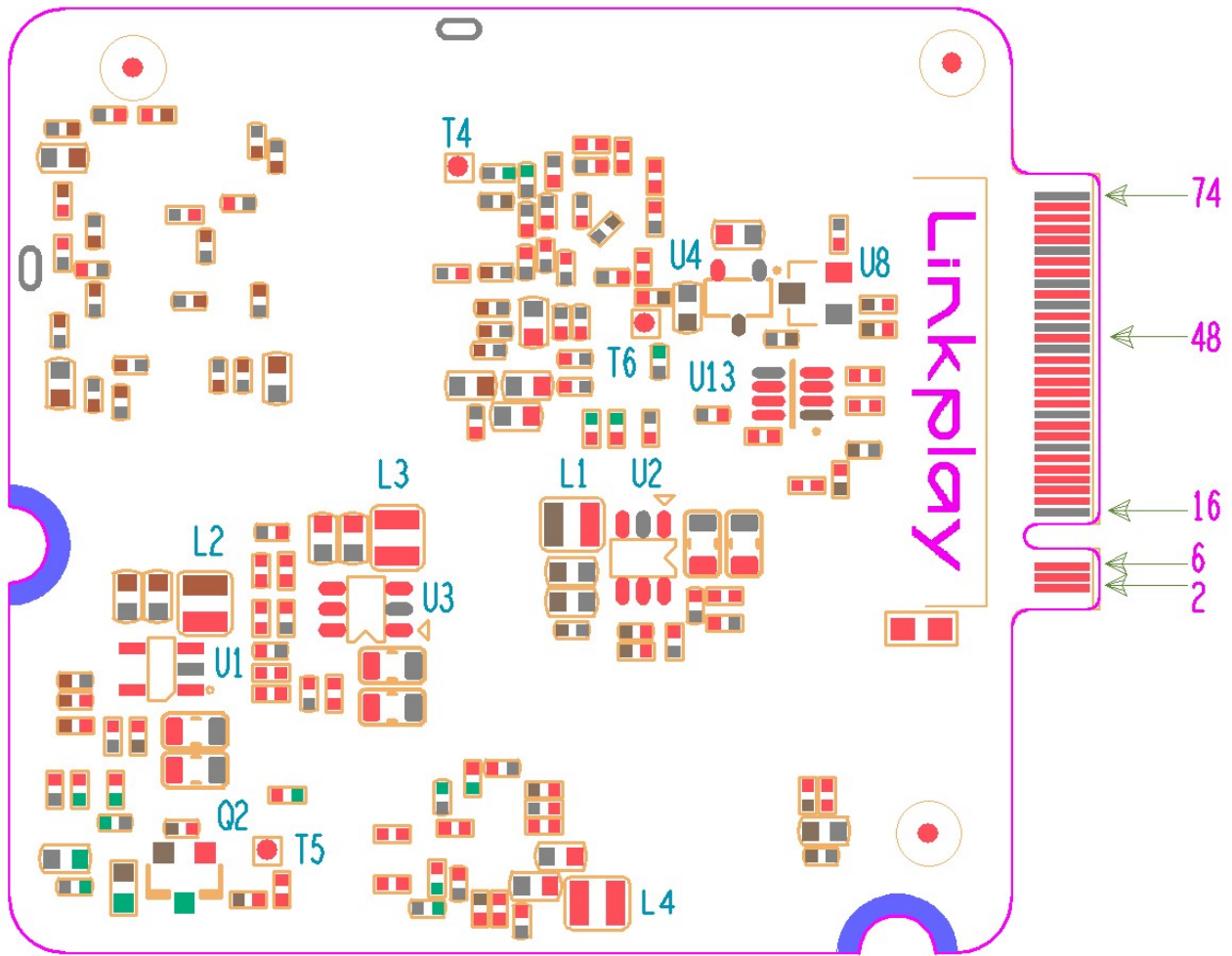


Figure 2-1 A98M Interface Pins

Pin Description:

Pin No.	Pin Name	Type	Description	Power Domain
1, 3, 5, 16, 23, 25, 27, 28, 34, 46, 50, 53, 54, 58, 63, 64, 74, 75	GND	Supply	Digital ground	GND
2, 4, 6	VDD_5V	Power	Power supply input > 800mA	3.5 - 5.5V
7	GPIOZ_7	I/O	General purpose input output	3.3V
17	I2C1_SCL	I/O	I2C bus1 clock	3.3V
19	I2C1_SDA	I/O	I2C bus1 data	3.3V
21	GPIOZ_3	I/O	General purpose input output	3.3V

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29	GPIOZ_6	I/O	General purpose input output	3.3V
31	PWM_B	O	Pulse Width Modulation B	3.3V
33	PWM_D	O	Pulse Width Modulation C	3.3V
35	PWMAO_C	O	Pulse Width Modulation AO_C	3.3V
37	PWMAO_D	O	Pulse Width Modulation AO_D	3.3V
39	UART0_RXD	I	UART0 receive	3.3V
41	UART0_TXD	O	UART0 transmit	3.3V
43	GPIOAO_7	I/O	General purpose input output	3.3V
45	GPIOAO_6	I/O	General purpose input output	3.3V
47	PWMAO_A	O	Pulse Width Modulation AO_A	3.3V
49	I2C0_SDA	I/O	I2C0 bus data	3.3V
51	I2C0_SCL	I/O	I2C0 bus clock	3.3V
55	GPIOA_19	I/O	General purpose input output	3.3V
57	ADC_CH0	I/IPU	ADC input	1.8V
59	MCLK_C	O	Master clock C	3.3V
61	GPIOAO_13	I/O	General purpose input output	3.3V
65	GPIOA_20	I/O	General purpose input output	3.3V
67	USB_DM	I/O	USB data minus	3.3V
69	USB_DP	I/O	USB data plus	3.3V
71	USB_VBUS	I	USB voltage detection	5V
73	USB_ID	I	USB ID	1.8V
18	GPIOZ_5	I/O	General purpose input output	3.3V
20	GPIOZ_1	I/O	General purpose input output	3.3V
22	GPIOZ_0	I/O	General purpose input output	3.3V
24	PWM_C	I/O	Pulse Width Modulation C	3.3V
26	GPIOZ_2	I/O	General purpose input output	3.3V
30	UART1_RXD	I	UART1 receive	3.3V
32	UART1_TXD	O	UART1 transmit	3.3V
36	PDM_DIN3	I	PDM input data 3 signal	3.3V
38	PDM_DIN1	I	PDM input data 1 signal	3.3V
40	PDM_DIN2	I	PDM input data 2 signal	3.3V
42	PDM_DCLK	O	PDM output clock	3.3V
44	PDM_DIN0	I	PDM input data 0 signal	3.3V
48	TDMB_DIO1	I/O	TDM B input and output data1	3.3V
52	TDMB_SCLK	I/O	TDM B bit clock	3.3V
56	TDMB_DIO0	I/O	TDM B input and output data0	3.3V
60	TDMB_FS	I/O	TDM B L/R clock	3.3V
62	TDMC_DIO1	I/O	TDM C input and output data1	3.3V
66	TDMC_DIO0	I/O	TDM C input and output data0	3.3V
68	TDMC_FS	I/O	TDM C L/R clock	3.3V
70	TDMC_SCLK	I/O	TDM C bit clock	3.3V

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72	MCLK_B	O	Master clock B	3.3V
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Table 2-1 Linkplay A98M module pin description

Notes:

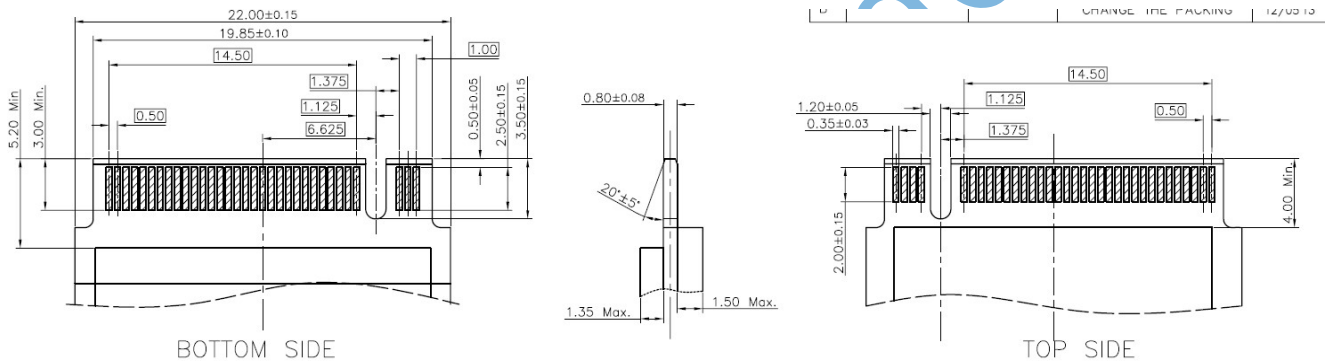
1. I: Input
2. O: Output
3. P: Power
4. IPU: Internal Pull Up
5. IPD: Internal Pull Down

2.2. Mechanical Dimension

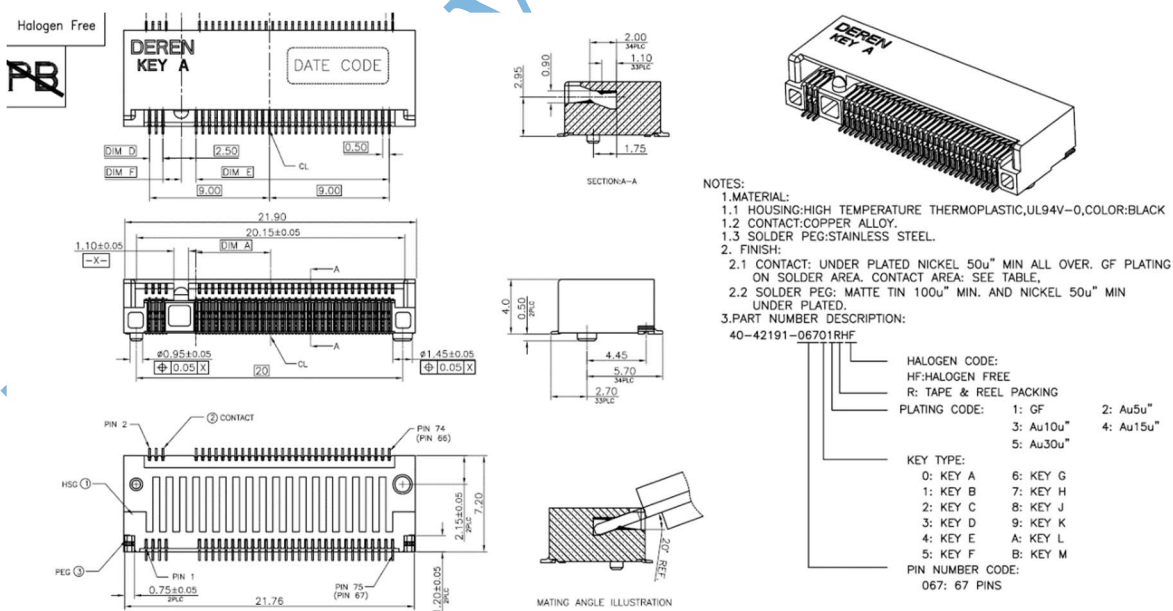
Linkplay A98M module has the dimension of 50mm x 43.33mm. The detailed layout will be given shortly below.

Unit: mm

PLUG PCB dimensions:

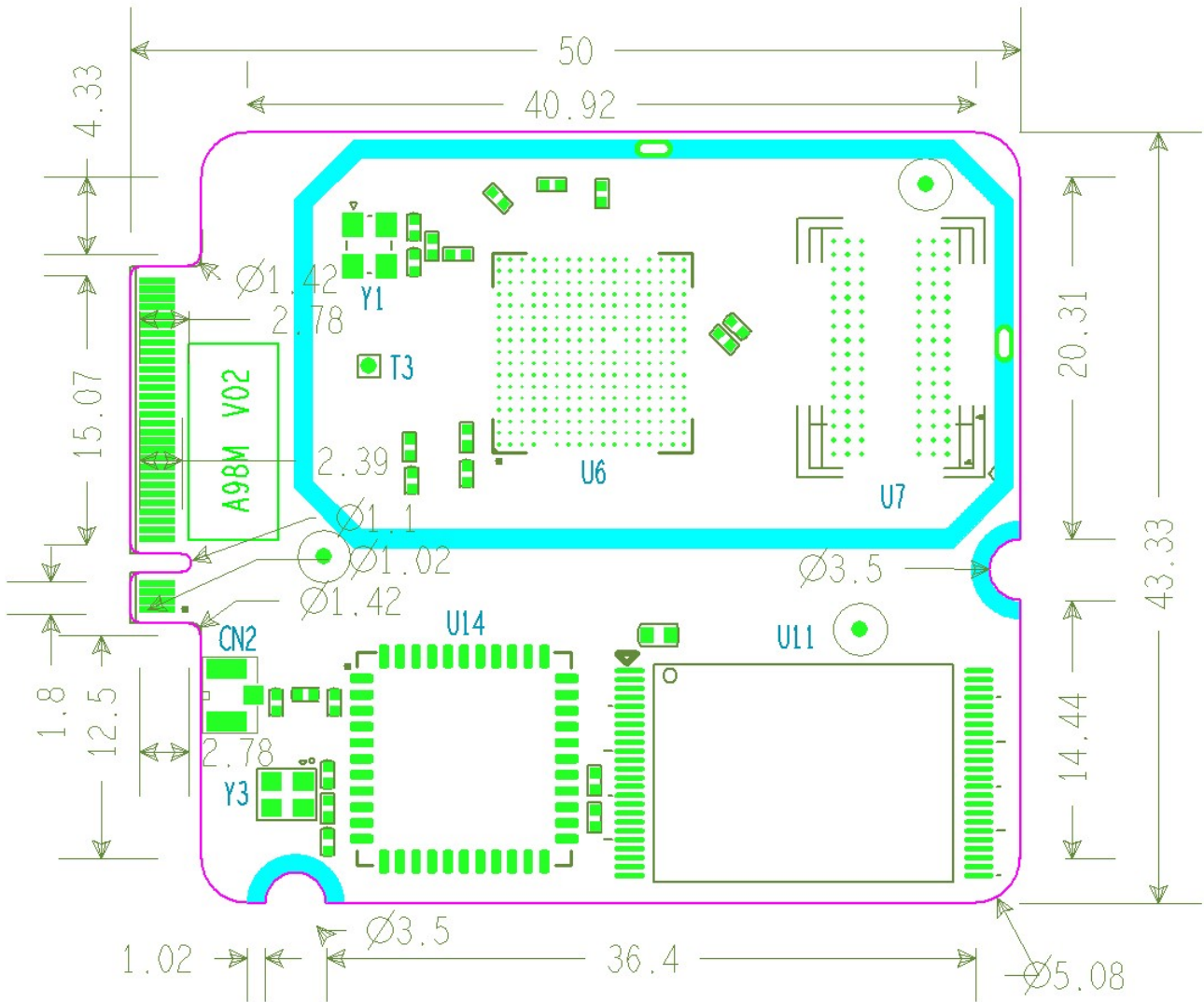


NGFF connector dimensions:



Top View Dimensions

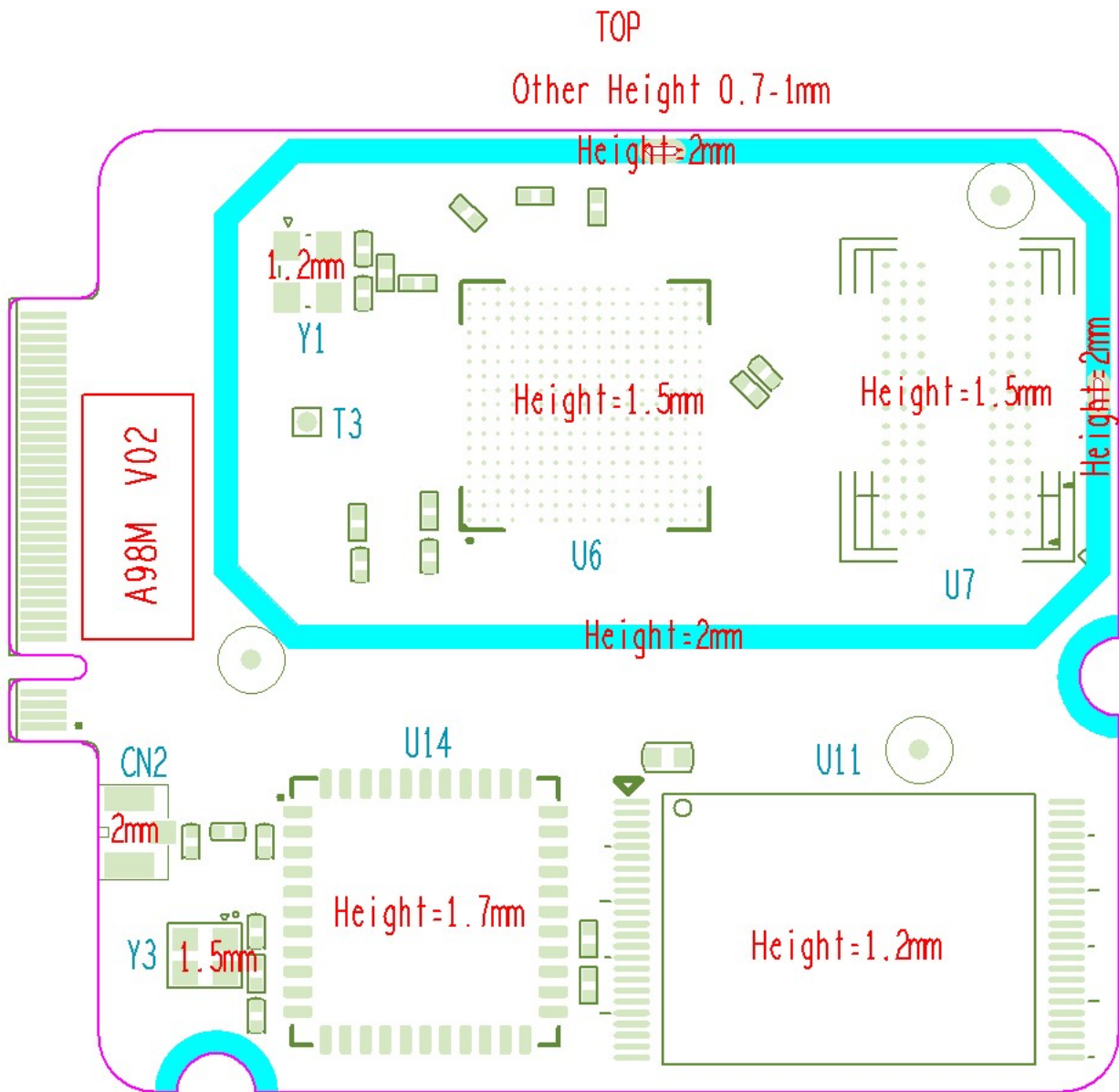
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TOP Height Limit

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Bottom Height Limit

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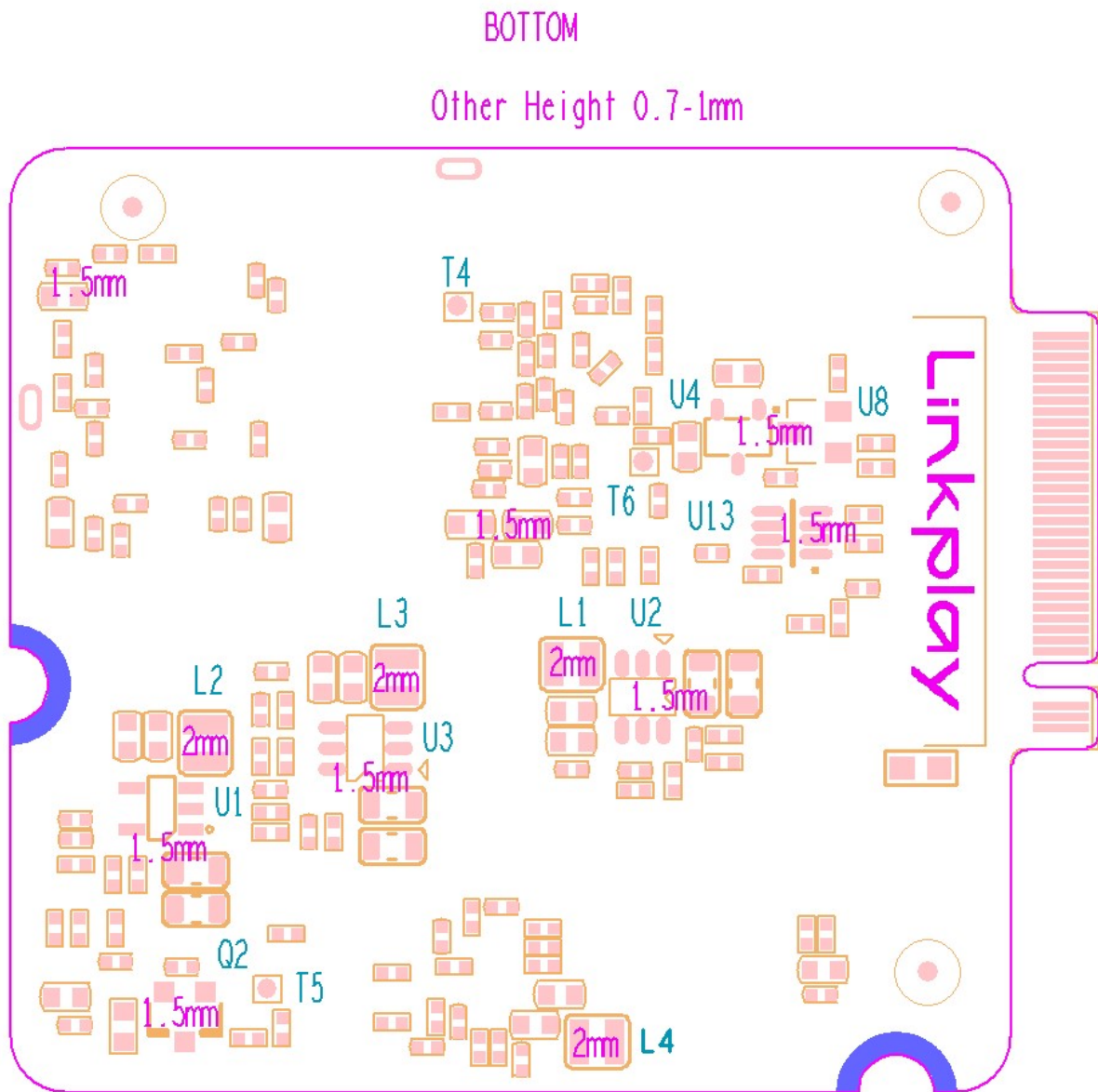


Figure 2-2 A98M Physical Dimension

2.3. External Antenna

A98M 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 a/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/4.9 ~ 5.8GHz
Impedance	50 Ohm
VSWR	2 (Max.)
Reflection loss	-10dB (Max.)

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Connector	I-PEX or populate directly
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Table 2-5 External Antenna Parameters for A98M

2.4. Typical Application

A98M series application schematics: A98X_PCM5121_REFERENCE_V07.pdf

2.6 USB OTG 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 \pm 10%
Trace Width	4 mils
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 \pm 10 mils

Table 2-2 A98M USB design rule

3. Software Introduction

3.1. Feature List

- OOBE
Setup your network, with the help of BLE and SPP, you can connect the device to the home router quickly
- Audio front end
Support software based 2, 4, 6 MIC denoising and stereo acoustic echo cancellation
- Audio post processing
Support software based EQ processing tool such as DSP concept's audio weaver
- Music stream protocol
Support Spotify Connect, Apple Airplay 2, DLNA and QQ Music QPlay protocol
- Voice Assistant

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Support Amazon Alexa, Tencent Xiaowei, Naver Clova, Yandex Alice, and GVA etc.

- Music content
Support Spotify, Amazon Music, iHeartRadio, Napster, TuneIn, 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 music of the above music services in one App
- Multiroom
Support multiroom with hardware assisted synchronization block
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 5.0: A2DP, AVRCP, HFP, HID profiles
Support BLE
Support EDR
- Preset
With the help of App, you can store the music playlist on the G20 flash memory. Then the end user can play the playlist by the button/voice or timer even without the App.

3.2. APP Support

- iOS App
≥ iOS6.1, suggest iOS10 and above
- Android APP
≥ Android 4.3.3
- Connect to Linkplay device cloud
Support firmware OTA both from App and background
Log App and device exceptions to the device cloud
- 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 brand customized App

3.3. Certifications

Linkplay can help you complete the following certifications to achieve the fast time to market for product launch.

- Wi-Fi Alliance
- BQB
- Amazon Alexa
- Tencent Xiaowei
- Naver Clova
- Yandex Alice

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- Google Voice Assistant
- MFi
- Spotify Connect
- DLNA
- QPlay
- Apple Airplay2

4. Module Environmental and Package

4.1. Environmental Ratings

The environmental ratings are shown as following table.

Characteristic	Value	Units	Conditions/Comments
Storage Temperature	-5 ~ 45	°C	
Relative humidity	Less than 60	%	Storage
	Less than 80	%	Operation

4.2. Electrostatic Discharge Specifications

Extreme caution must be exercised to prevent electrostatic discharge (ESD) damage. Proper use of wrist and heel grounding straps to discharge static electricity is required when handling these devices. Always store unused material in its antistatic packaging.

ESD Specifications

Type	Symbol	Condition	ESD Rating	Unit
ESD Handling	ESD_HAND_HBM	Human Body Model Contact Discharge per JEDEC EID/JESD22-A114	1000	V
Machine Model (MM)	ESD_HAND_MM	Machine Model Contact	30	V
CDM	ESD_HAND_CDM	Charged Device Model Contact Discharge per JEDEC EIA/JESD22-C101	300	V

5. Ordering Information

Table 5-1 Part Ordering Information

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Part Number	Package	Description	Remark
A98M	67-PIN NGFF Golden Fingers	RAM: 128MB Flash: 128MB	
A98M-12	67-PIN NGFF Golden Fingers	RAM: 128MB Flash: 256MB	
A98M-22	67-PIN NGFF Golden Fingers	RAM: 256MB Flash: 256MB	
A98MG	67-PIN NGFF Golden Fingers	RAM: 512MB Flash: 512MB	

6. FCC Information

RF Exposure Information: To maintain compliance with FCC RF exposure requirements, use the product that maintain a 20cm separation distance between the user's body and the host.

MPE limit for RF exposure at prediction frequency is 0.003mW/cm² for Bluetooth, 0.013mW/cm² for WLAN 2.4GHz and 0.015mW/cm² for WLAN 5GHz. It satisfy RF exposure compliances

FCC statements:

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: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device is intended only for OEM integrators under the following conditions:

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1. The antenna must be installed such that 20 cm is maintained between the antenna and users.
2. The transmitter module may not be co-located with any other transmitter or antenna. As long as the two conditions above are met, additional transmitter testing will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for the installed module.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Federal Communications Commission of the U.S. Government (FCC) and the Canadian Government authorizations are no longer considered valid and the FCC ID and IC ID cannot be used on the final product. In these circumstances, the OEM integrator shall be responsible for re-evaluating the end-product (including the transmitter) and obtaining a separate FCC and IC authorization in the U.S. and Canada.

OEM Integrators - End Product Labeling Considerations:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains, FCC ID: 2ANOG-A98M. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

OEM Integrators - End Product Manual Provided to the End User:

The OEM integrator shall not provide information to the end user regarding how to install or remove this RF module in end product user manual. The end user manual must include all required regulatory information and warnings as outlined in this document.

The module only includes RF (AP6256) shielding cover, OEM integrators shall evaluate the RSE when installing this module to ensure that the module still meets regulatory requirements when installed into their system.

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