

User Manual TUYA AVS Smart Audio Module-VWRK4

Version : V1.0.1

TUYA AVS Smart Audio Module-VWRK4

User Manual

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1.1	Increase the introduction of amazon and app operation	Jia Zeng
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1、 Product Abstract

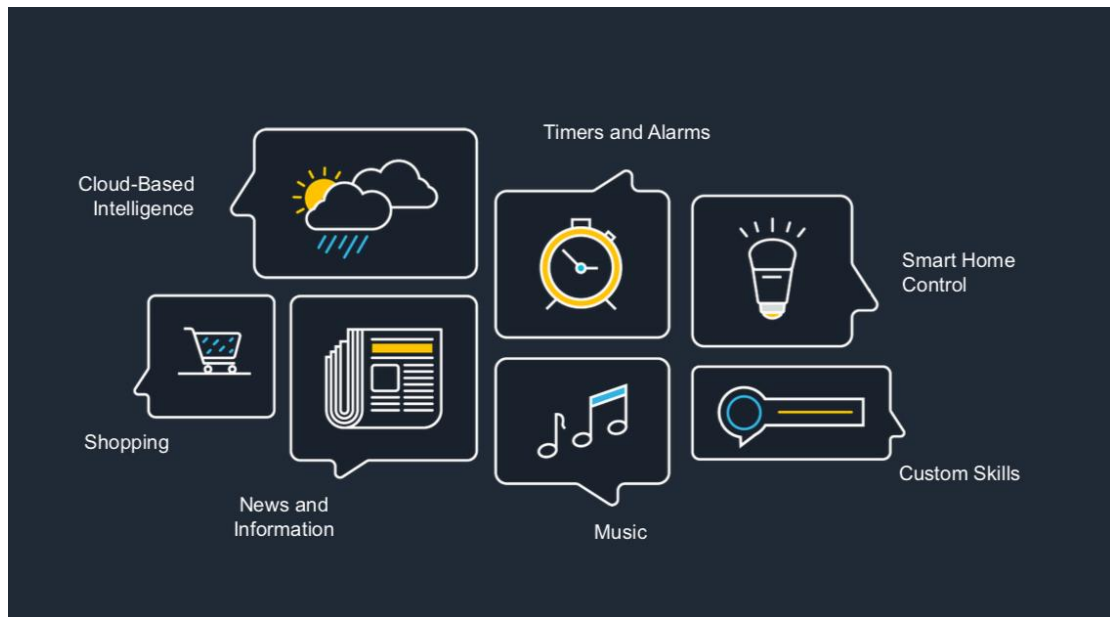
Tuya AVS voice module VWRK4 is based on the powerful RockChip 3308 IC which integrated with 4-Core 64 bit A35 ARM Core. The Module is integrated with voice wake & noise cancellation algorithm and which can be applied in the IoT device/gateway/smart speaker. The CPU RK3308's frequency is 1.3GHz, which can provide powerful computing ability. Also, the module is integrated with the RF chip RTL8723DS which contains WiFi Sing-band 1X1+BluetoothBR/EDR/BLE4.0 This can make it easy to connect to the Tuya IoT platform.

1.1 Features

- ✧ High powerful ARM 4-Core 64 bit A35 RochChip 3308 CPU
- ✧ Frequency : 1.3GHz
- ✧ Work voltage: 4.2-5.5V (5V default)
- ✧ Peripheral : 2*Uart, 7*MIC, RGB666, 1*SPI, 2*I2C, 2*USB, GPIOs, 3*ADC,
- ✧ Antenna : IPEX
- ✧ Sampling Rate:16K/16bit
- ✧ Audio Feature
 - 1) 4 ways mic pickup, stereo playback.
 - 2) 6 ways mic pickup, single channel playback.
 - 3) Audio output: stereo HPOUT and stereo LINEOUT
 - 4) Audio AUX IN: support
- ✧ Entertainment :

Approved : amazon music, audible, iHeartRadio, TuneIn
- ✧ Skill : All the skills contains in Alexa. For example:

Newest arrivals, Business & finance, Connected Car, Education & Reference, Food & Drink, Game & Trivia, Health & Fitness, kids, lifestyle, local, Movies & TV, Music & Audio, News, Novelty & Humor, Productivity, Shopping, Smart Home, Sports, Travel & Transportation, Utilities, Weather.



1.2 Applications

- ✧ Smart household and home appliances
- ✧ Smart Device
- ✧ Net Gateway Control
- ✧ Voice Control Panel

2、 Module Interfaces

2.1 Dimensions and Footprint

The Module has four rows of pins with 1mm Pin Width and 1.5mm pin spacing, the total number of pins is 82, and its dimensions is 35mm*35mm*3.2mm (W*L*H) , Figure 2-1 shows the Dimension views.

Note:

The default dimensional tolerance is $\pm 0.35\text{mm}$.

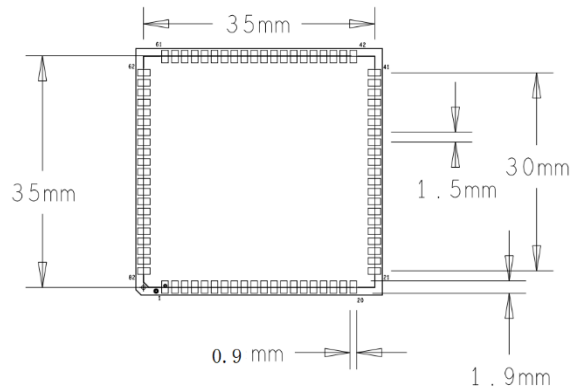


Figure 2-1 Dimensions of VWRK4

The total pins is 82 and the opposite side has the same number pins, one side is 20 and the other is 21. Figure 2-2 shows the footprint views.

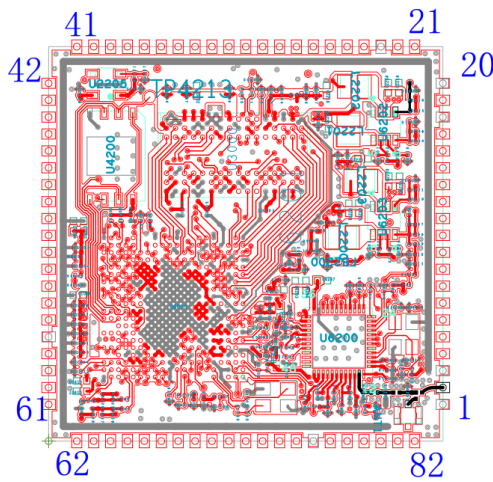
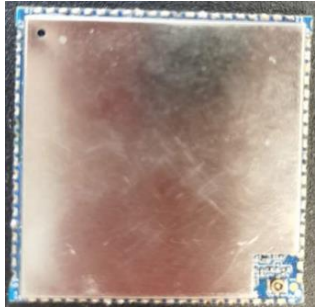


Figure 2-2 Footprint of VWRK4

2.2 Circuit Diagram

Table 2-1 Hardware Feature

MCU	RK3308	
Flash	128 MByte	
DDR	128 MByte	
Mic	2/4 mic array	
BT	BluetoothBR/EDR/BLE4.0	
WIFI	IEEE 802.11b/g/n (channel 1-14)	
Power Interface	MicroUSB 5V1A	
Antenna	IPEX Antenna	
Audio	MIC/HPOUT/LINEOUT	
LCD	LCD Interface	
Interface	Reserved UART/IIC/PWM/GPIO/USB interface	

✧ Circuit Diagram of VWRK4 voice kit

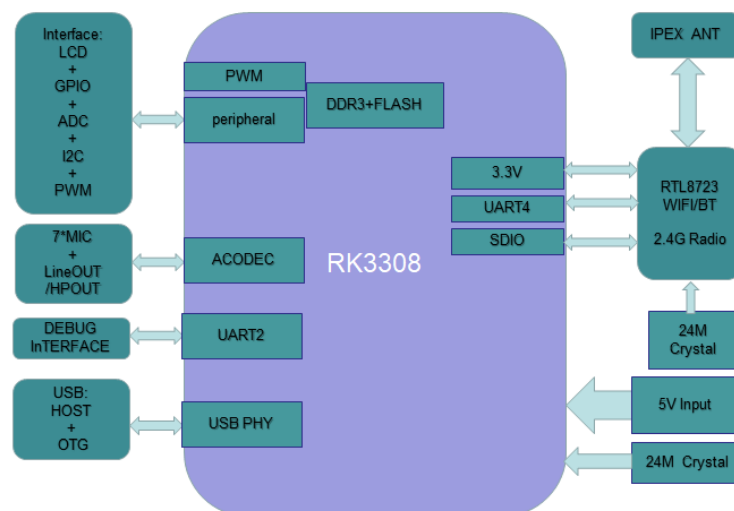


Figure 2-3 Circuit Diagram of VWRK4

2.3 Pin Definition

Table 2-2 Pin Definition of VWRK4

Pin No.	Pin Name	Pad Type	Function	
1	GND	P	Power Supply reference ground pin	
2	ANT	O	The RF ANT Interface	
3	GND	P	Power Supply reference ground pin	
4	ADC_KEY_IN2	AI	Analog of ADC Input	
5	SAR_ADC_IN3	AI	Analog of ADC Input	
6	UNO_RX	I/O	Debug UART RX	
7	UNO_TX	I/O	Debug UART TX	
8	USB_HOST_DM	I/O	USB Data PIN for Host	
9	USB_HOST_DP	I/O	USB Data PIN for Host	
10	USB_OTG_ID	I/O	USB ID PIN for OTG	
11	USB_OTG_DM	I/O	USB Data PIN for OTG	
12	USB_OTG_DP	I/O	USB Data PIN for OTG	
13	PHONE_CTRL	I/O	The General I/O Pin	
14	PHONE_DET	I/O	The General I/O Pin	
15	AUX_IN_CTRL	I/O	Selection of HPout or Lineout/ General I/O	
16	SPK_MUTE	I/O	Speaker mute Control Pin /The General I/O Pin	
17	MIC_LED	I/O	Control of Led Peripherals/ General I/O	
18	GND	P	Power Supply reference ground pin	
19	VCC-IO_OUT	P	Power supply pin for Peripherals	
20	GND	P	Power Supply reference ground pin	
21	VCC-5V	P	Power supply pin(5V)	
22	VCC-5V	P	Power supply pin(5V)	
23	GND	P	Power Supply reference ground pin	

24	IR_RX	I/O	IR Receive Pin / General IO Pin	
25	IR_TX	I/O	IR Transmit Pin / General IO Pin	
26	I2C_SDA	I/O	I2C SDA for Peripherals	
27	I2C_CLK	I/O	I2C CLK for Peripherals	
28	LCD_PWR	I/O	LCD Power Control Pin	
29	LCD_BL	I/O	LCD Back light / General IO Pin/PWM	
30	LCD_RST	I/O	LCD Reset Pin / General IO Pin	
31	LCD_DEN	I/O	LCD Data Enable/ General IO Pin	
32	LCD_HS	I/O	LCD Horizontal sync PIN/ General IO Pin	
33	LCD_VS	I/O	LCD Vertical sync PIN/ General IO Pin	
34	LCD_CLK	I/O	LCD Clk Pin / General IO Pin	
35	LCD_D0	I/O	LCD Data Pin / General IO Pin	
36	LCD_D1	I/O	LCD Data Pin / General IO Pin	
37	LCD_D2	I/O	LCD Data Pin / General IO Pin	
38	LCD_D3	I/O	LCD Data Pin / General IO Pin	
39	LCD_D4	I/O	LCD Data Pin / General IO Pin	
40	LCD_D5	I/O	LCD Data Pin / General IO Pin	
41	LCD_D6	I/O	LCD Data Pin / General IO Pin	
42	LCD_D11	I/O	LCD Data Pin / General IO Pin	
43	LCD_D10	I/O	LCD Data Pin / General IO Pin	
44	LCD_D8	I/O	LCD Data Pin / General IO Pin	
45	LCD_D7	I/O	LCD Data Pin / General IO Pin	
46	LCD_D13	I/O	LCD Data Pin / General IO Pin	
47	LCD_D14	I/O	LCD Data Pin / General IO Pin	
48	LCD_D9	I/O	LCD Data Pin / General IO Pin	
49	LCD_D17	I/O	LCD Data Pin / General IO Pin	

50	LCD_D12	I/O	LCD Data Pin / General IO Pin	
51	LCD_D15	I/O	LCD Data Pin / General IO Pin	
52	LCD_D16	I/O	LCD Data Pin / General IO Pin	
53	LCD_SPI_RX	I/O	SPI Data Pin for LCD / General IO Pin	
54	LCD_SPI_CLK	I/O	SPI Clk Pin for LCD / General IO Pin	
55	LCD_SPI_CS	I/O	SPI CS Pin for LCD / General IO Pin	
56	LCD_SPI_TX	I/O	SPI Data Pin for LCD / General IO Pin	
57	GND	P	Power Supply reference ground pin	
58	HPOUT_R	AO	Headphone output Right	
59	HPOUT_L	AO	Headphone output Left	
60	LINEOUT_R	O	Line output Right	
61	LINEOUT_L	O	Line output Left	
62	MIC2N	AI	The Audio Analog input	
63	MIC2P	AI	The Audio Analog input	
64	MIC3N	AI	The Audio Analog input	
65	MIC3P	AI	The Audio Analog input	
66	MIC4N	AI	The Audio Analog input	
67	MIC4P	AI	The Audio Analog input	
68	MIC5N	AI	The Audio Analog input	
69	MIC5P	AI	The Audio Analog input	
70	MIC6N	AI	The Audio Analog input	
71	MIC6P	AI	The Audio Analog input	
72	MIC7N	AI	The Audio Analog input	
73	MIC7P	AI	The Audio Analog input	
74	MIC8N	AI	The Audio Analog input	
75	MIC8P	AI	The Audio Analog input	

76	GND	P	Power Supply reference ground pin	
77	AP_CTS	I/O	UART1 CTS PIN / General IO Pin	
78	AP_RTS	I/O	UART1 RTS PIN / General IO Pin	
79	AP_RX	I/O	UART1 RX PIN / General IO Pin	
80	AP_TX	I/O	UART1 TX PIN / General IO Pin	
81	RST	0	The System HardWare Reset Pin	
82	ADC_KEY_IN1	AI	Analog of ADC Input	

Note :

- 1 . P indicates power supply pins, I/O indicates input/output pins, and AI indicates analog input pins, AO indicates analog output pins.
- 2 . RST is only a hardware reset pin.
- 3 . UNO_TX/RX are user-side serial interface pins, can be used for debug the system.

3、Electrical Parameters

3.1 Absolute Electrical Parameters

Table 3-1 Absolute Electrical Parameters

Parameter	Description	Minimum Value	Maximum Value	Unit
Ts	Storage Temperature	-40	70	C°
VCC	Power Supply Voltage	-0.3	5.5	V
ESD (HBM)	TAMB-25C°	N/A	2000	V
ESD (MM)	TAMB-25C°	N/A	500	V

3.2 Electrical Conditions

Table 3-2 Normal Electrical Conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	单位
Ta	Working temperature	-20	NA	60	C°
VCC	Power Supply Voltage	4.2	5	5.5	V
Vil	IO Low-level input	NA	NA	0.8	V
Vih	IO high-level input	2	NA	3.3+0.3	V
Vol	IO Low-level output	NA	NA	0.4	V
Voh	IO high-level output	2.9	3.3	-	V
I _{max}	IO Drive Current	-	2	8	mA

3.3 Working Current

Table 3-3 Power Consumption during working mode

Working Mode	Status (Ta=25C°, VCC=5V)	Typical Value	Peak Value	Unit
EZ	In EZ mode and wifi indicator blinks quickly	193	876	mA
Connected and idle	The module is connected to the network and wifi indicator is steady on	145	788	mA
Connected and Communicate	The module is connected to the network and the wifi is transmit data	239	892	mA

Note : the power consumption is tested at the supply voltage is 5V.

3.4 Transmit power

3.4.1 WIFI transmit power

Table 3-4 WIFI transmit Power Consumption

Wifi TX	Parameter			Typical	Unit
	Mode	Rate	Transmit Power		
IRF	11b	11Mbps	+17dBm	267.2	mA
	11g	54Mbps	+14.5dBm	272.0	mA
	11n/HT20	MCS7	+13.5dBm	246.0	mA
	11n/HT40	MCS7	+13.5dBm	246.0	mA

Note: working condition, VBAT=5V, VDD_ANA=1.8V, internal TOP LDO supply

3.4.2 WIFI Receive Power

Table 3-5 WIFI Receive Power Consumption

WIFI RX	Parameter	Typical	Unit

ACTIVE	1M DSSS	72	mA
	54M OFDM	84	mA
DEEP	11b	55	mA
SLEEP	11g	-	mA

Note: working condition, VBAT=5V, VDD_ANA=1.8V,internal TOP LDO supply

3.4.3 Bluetooth transmit power

Table 3-6 Bluetooth transmit Power Consumption

BT TX	Parameter			Typical	Unit
	Mode	Rate	Transmit Power		
IRF	BR	1Mbps	9dBm	267.2	mA
	EDR	3Mbps	8dBm	272.0	mA
	BLE	1Mbps	+8.5dBm	246.0	mA

Note: working condition, VBAT=5V, VDD_ANA=1.8V,internal TOP LDO supply

3.4.4 Bluetooth Receive Power

Table 3-7 Bluetooth Receive Power Consumption

BT RX	Mode	Parameter	Typical	unit
IRF	BR	DH1	-93	dBm
		DH5	-93	dBm
	EDR	2Mbps	-92	dBm
		3Mbps	-85	dBm
	BLE	1Mbps	-98	dBm
		DH1	-93	dBm

Note : VBAT=5V, VDD_ANA=1.8V,internal TOP LDO supply。

4、RF Features

4.1 basic RF characteristics

Parameter	description
Work frequency	2.400~2.484GHz
Wi-Fi standard	IEEE802.11b/g/n20/n40(channel 1-14)
BLE standard	BRV2.0/EDR/BLEV4.0
WIFI modulation type	802.11b: CCK, DQPSK, DBPSK 802.11g: 64-QAM,16-QAM, QPSK, BPSK 802.11n: 64-QAM,16-QAM, QPSK, BPSK
BLE modulation type	8DPSK, $\pi/4$ DQPSK, GFSK
WIFI data transfer rate	11b:1,2,5.5,11(Mbps) 11g:6,9,12,18,24,36,48,54(Mbps) 11n:HT20MCS0~7 11n:HT40MCS0~7
BLE data transfer rate	Basic Rate : 1 Mbps BLE: 1Mbps Enhanced Data Rate(EDR) : 2Mbps/3 Mbps
Antenna type	Support IPEX external antenna/ on board antenna connect

4.2 Output Power (TX continuous transmit power,VBAT=5V)

4.2.1 WIFI transmit power

Parameter		Min	Typical	Max	Unit
RF average output power, 802.11bCCKMode	11M	-	17	-	dBm

RF average output power , 802.11gOFDMMode	54M	-	14.5	-	dBm
RF average output power , 802.11n/20M Mode	MCS7	-	13.5	-	dBm
RF average output power , 802.11n/40M Mode	MCS7	-	13.5	-	dBm
Frequency error		-20	-	20	ppm

4.2.2 BLE transmit power

Parameter		Min	Typical	Max	Unit
RF average output power, BR Mode	1M	-	+5.5	-	dBm
RF average output power, EDR Mode	3M	-	+5.5	-	dBm
RF average output power, BLE Mode	1M	-	+5.5	-	dBm
Frequency error		-10	-	10	ppm

4.3 receive sensitivity (RX sensitivity, VBAT=5V)

4.3.1 WIFI Receive Sensitivity

Parameter		Min	Typical	Max	Unit
RF average output power , 802.11b Mode	1M		-92	-	dBm
RF average output power , 802.11bCCKMode	11M		-86	-	dBm
RF average output power , 802.11gOFDMMode	54M		-74	-	dBm
RF average output power , 802.11nOFDMMode	MCS7		-72	-	dBm
RF average output power , 802.11n/40M Mode	MCS7	-	-72	-	dBm

4.3.2 BLE receive sensitivity

Symbol	Parameter			Unit
	Mode	Rate	Typical	
I _{RF}	BR	DH1	-91	dBm
I _{RF}		DH5	-91	dBm
I _{RF}	EDR	2Mbps	-90	dBm
I _{RF}		3Mbps	-84	dBm
I _{RF}	BLE	1Mbps	-95	dBm

5、 Antenna Information

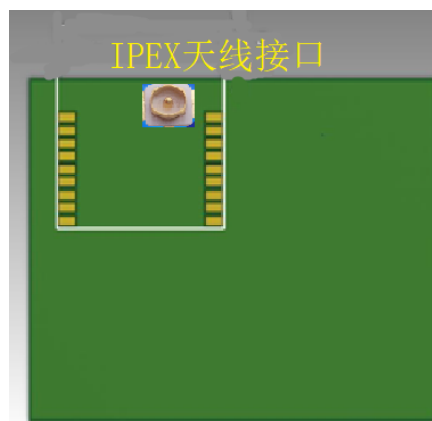
5.1 Antenna type

VWRK4 module uses the on board IPEX connector to connect with the external FPC antenna.

5.2 Reduce Antenna Interference

For a better performance, some suggestions to the users:

- A. The distance between the module antenna and other metal parts must be at least 15mm.
- B. If you use the IPEX Antenna, The Following options are some advice you should pay attention。



IPEX ANT interface

1 : Place the IPEX interface near the outline of the board.

2 : No shield should cover on the IPEX interface.

These suggestions are for the extend ANT interface pin used for IPEX ANT.

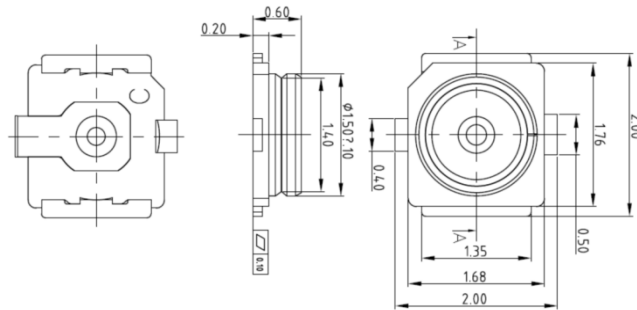
5.3 FPC Antenna

VWRK4 module can use an external IPEX antenna by the on board IPEX connector.

The FPC antenna is designed by Tuya cooperation, and manufacture by Dongguan UB

electronic company.

The FPC Antenna is together with the VWRK4 module. if the costumer use their own new Antenna, the FCC should be tested with the new Antenna.



The following table is the main technical specifications of the FPC Antenna.

Items	Main technical specifications
Manufacturer	UB
Product model	UB01C07F3D1388A
Frequency Range (MHZ)	2400~2500
Impedance(Ω)	50
AVG Gain(dBi)	2.13
VSWR	≤ 1.92
Admitted Power	1W
Polarization	Line
Connector Type	RF Cable+Terminal
Antenna Base	FPC
Operating Temp	-20C° ~ +70C°
Storage Temp	-20C° ~ +70C°

The Figure 5-5 is the Picture of the FPC antenna. All the features of the FPC antenna can be reviewed from the “The Specification of the FPC antenna”.

Figure 5-5 The FPC Antenna



6、Packaging Information

6.1 Mechanical Dimensions

The following is the mechanical dimensions of the VWRK4 module, the width and the length are 35mm*35mm.

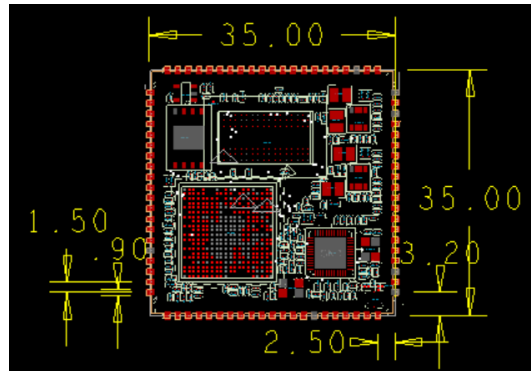


Figure 6-1 VWRK4 mechanical dimensions of top side

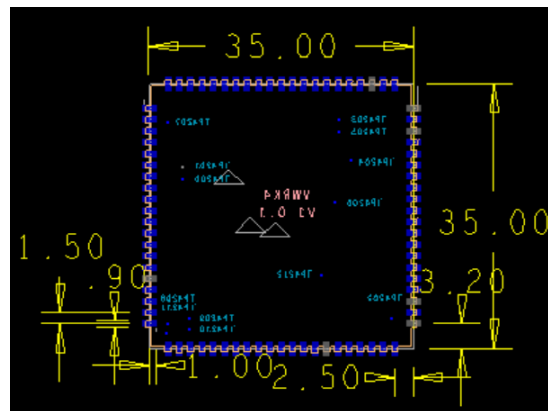


Figure 6-1 VWRK4 mechanical dimensions of bottom side

Note : The Pads beyond the dimensions are cutted and half left, if you want to design the package of the VWRK4, be careful of the pad dimensions.

6.2 Product instructions

Appendix: Statement

Federal Communications Commission (FCC) Declaration of Conformity

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

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: 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.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled rolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

Important Note

This radio module must not installed to co-locate and operating simultaneously with other radios in host system except in accordance with FCC multi-transmitter product procedures. Additional testing and equipment authorization may be required to operating simultaneously with other radio.

The availability of some specific channels and/or operational frequency bands are country

dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible by the end user.

The host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

The end user manual shall include all required regulatory information/warning as shown in this manual, including: This product must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

This device have got a FCC ID : 2ANDL-VWRK4.The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID:2ANDL-VWRK4"

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

- 1) The antenna must be installed such that 20cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Declaration of Conformity European notice



Hereby, Hangzhou Tuya Information Technology Co., Ltd declares that this module product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EU,2011/65/EU.A copy of the Declaration of conformity can be found at <https://www.tuya.com>



This product must not be disposed of as normal household waste, in accordance with EU directive for waste electrical and electronic equipment (WEEE- 2012/19/EU). Instead, it should be disposed of by returning it to the point of sale, or to a municipal recycling collection point.

The device could be used with a separation distance of 20cm to the human body.