ROOBO Smart Audio Dev Kit DDKL4Q1

User Guide

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ROOBO provides this product to help accelerate the development of customizable in-home assistants, in-car assistants, smart speaker, IoT devices, or other voice-enabled devices, but not for other purposes.

Figures, photos, schematics and other information are included in this document to show the technical specifications and/or tools instructions. If interested in mass production, please contact ROOBO to obtain additional documents that require an NDA. ROOBO makes no representations or warranties with respect to the accuracy or completeness of the contents presented in this document.

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1.Introduction

This Dev kit For Microsoft Speech Services Complete, end-to-end system reference designs. The Linear 4-Mic array Dev Kit is a pre-tuned end-to-end reference design that enables the commercial device manufacturers to efficiently build high-quality speech enabled devices using Microsoft Speech Services. Developers can integrate the Microsoft Speech Services into smart speakers, set-top boxes, and other IoT devices with this kit and leverage premium Microsoft voice recognition technology. It can also be easily configured into a Linear 2-Mic array by disabling the outer 2 mics, for evaluating it as a lower cost device.

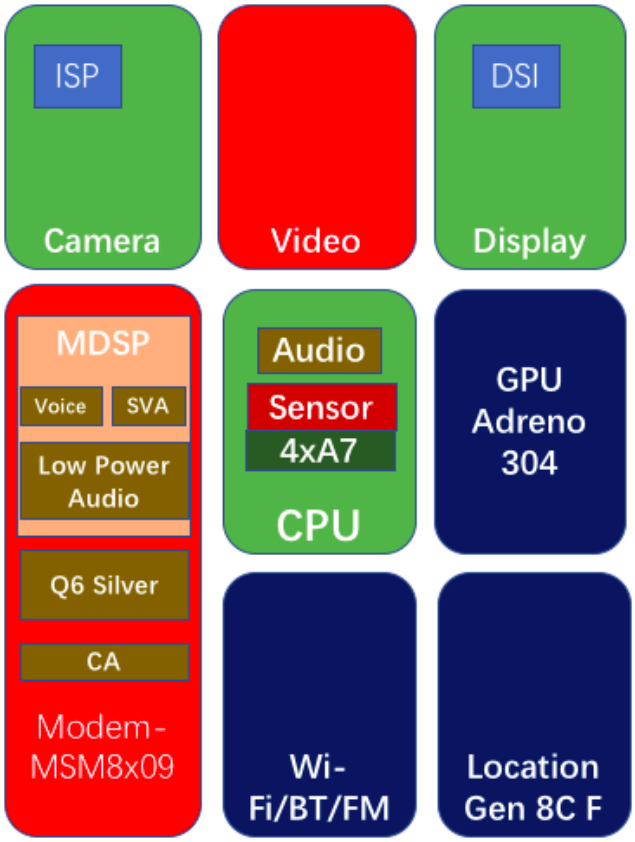
With the Microsoft Speech Devices SDK, it enables a range of advanced features such as
- Multi-mic array, noise suppression, echo cancellation.
- Customizable Key Word Spotting (English only).
- Integration with the world-class Microsoft Speech Services and Bot Framework, and more.

1.1 In the Box

•1x 4 digital microphone array board
•1x mainboards held by acrylic stand
•1x Gain antenna
•1x USB Power cable

1.2 Dev Kit Specification

Items	Specs
CPU	Qualcomm APQ8009 Quad core A7 1.1GHz CPU
GPU	Adreno304
OS	Android 5.1
WIFI	802.11b/g/n
Bluetooth	NA
RAM	LPDDR3+eMMC, 1GB + 8GB
MIC Array	Linear 4-MIC/2-MIC
Audio Line out	1 x 3.5mm Line out
Data Interface	1 x Micro USB Interface
Power Interface	1 x Micro USB Interface
UART Interface	1 x UART Interface
IIC	1 x I²C
GPIO Interface	3 x GPIO Interface
TF Card	Support up to 128GB（FAT32）
Button	4 x Buttons（Reset, Mute, Volume Up, Volume Down）
Power Indicator	Support Power Indicator
Mic Array Indicator	NA
Work Temperature	-4~131℉(-20~55℃)
Certification	FCC ID

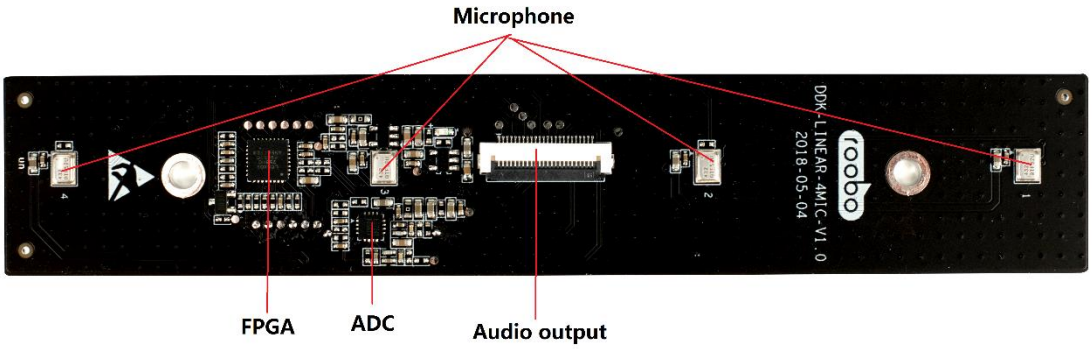


1.2 Linear 4-Mic/ 2-Mic Array

1.2.1 Mic Array Specs

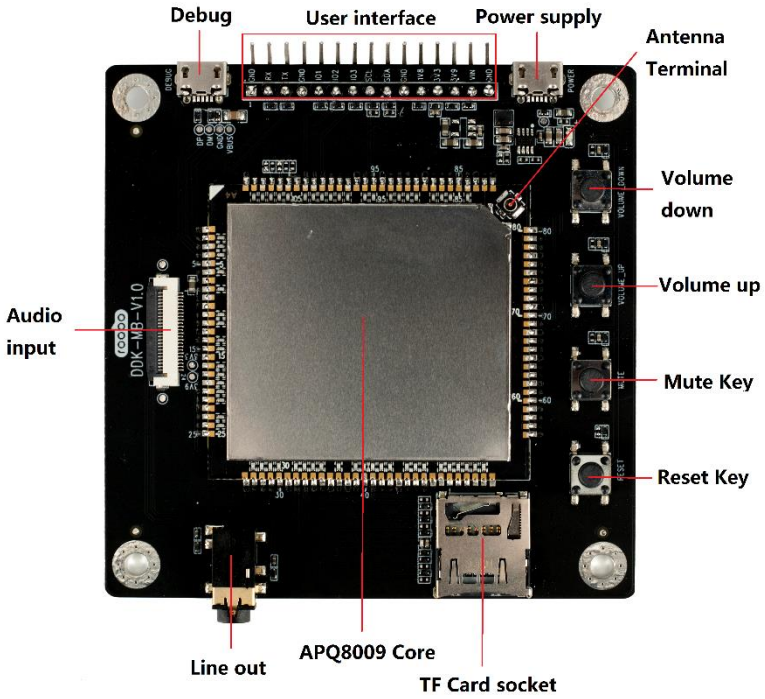
Items	Performance
Array Type	Linear 4-Mic/ Linear 2-Mic
Mic Quantity	4 /2digital MEMS microphone（ I2S）
Dimension	Mics are placed horizontally, evenly in a line and microphone ports face upward.
Array Distance	40mm
Wakeup Distance	<10m
Listening Range	<5m (Room environment)
Signal to Noise Ratio	65dBA
Sampling Rate	16K
Sensitivity	>-26dBV @94dB 1kHz

1.2.2 Mic Array Board Sample and layout



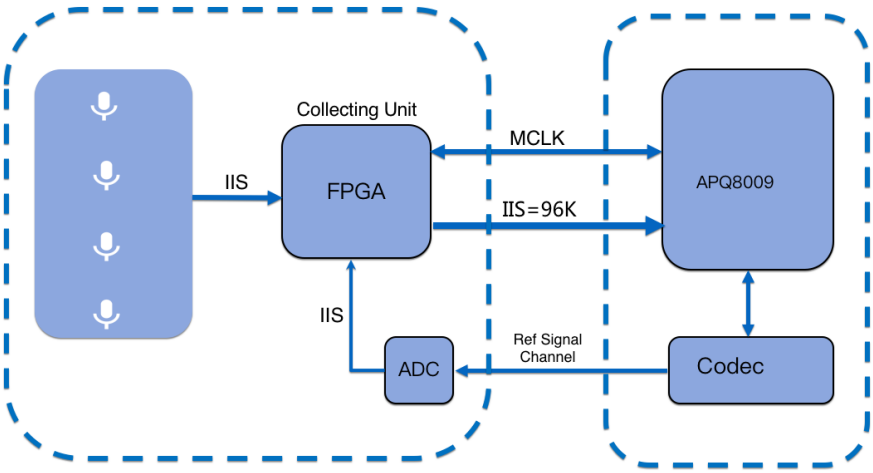
Items	Description
Digital MEMS Microphone	Pick up the audio from bottom，Sensitivity：-26dB
ADC	I2S interface, 24bit ADC
FPGA	Used to pack data
Audio output	Pin pitch 0.5mm, 24 pins, Connected to core board

1.3 Core Board Sample and Layout



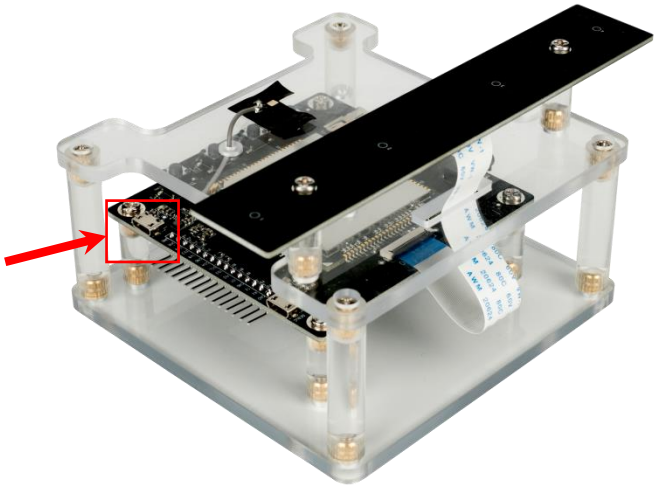
Items	Description
Antenna Terminal	2.4GHz wifi antenna terminal
Line out	3.5mm Audio interface
USB Debug Interface	USB 2.0 Device
Audio input	Pin pitch 0.5mm, 24 pins, Connected to mic array board
TF card socket	Insert TF card
APQ8009 Core	APQ8009 Core board
Reset key	Key for reset
Mute key	Key for mute
Volume up key	Key for system volume up
Volume down key	Key for system volume down
Power supply	Micro USB 5V supply
User interface	Io,uart,i2c,power interface

1.4 Audio Data Path



2. Dev Kit Set up

Plug in the power adapter, the dev kit should start running automatically.



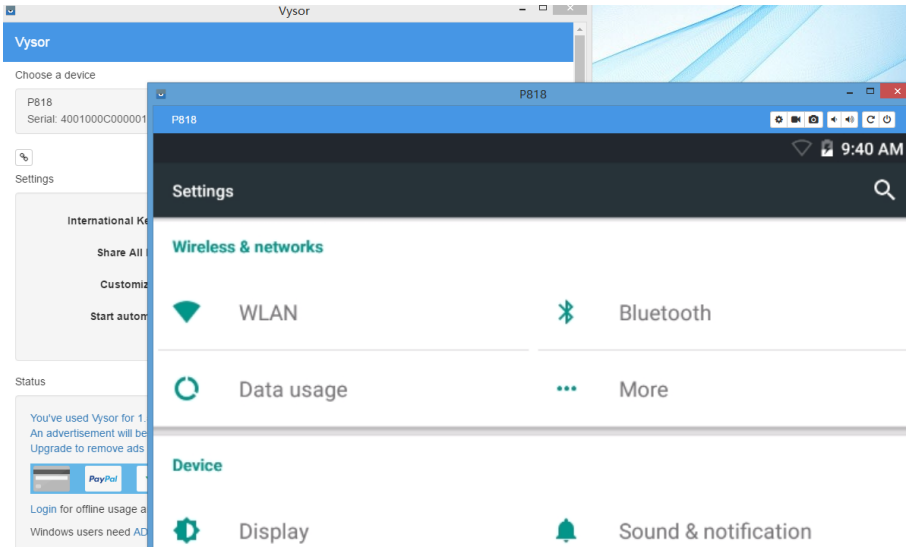
3. ADB Debug

You can log onto the dev kit's board, push or pull files by using the adb tool.
On Windows 10:
(1) After the board is running, in the Windows Device Manager, we can see a USB port:

(2) In a Windows cmd window, input command "adb shell", then hit Enter
Notes:
You'll need to have the adb tool installed on your computer and make sure the adb tool is usable.

4. Vysor

The dev kit has no Screen， you will need a tool to "remote" into it for easy interaction. You can download and install the Vysor from http://vysor.io/download/.



5. Record and Playback

If you wish to test the microphones, you can use the roobopri_4mic or roobopri_7mic to capture the mic array PCM data, which is the raw audio data from the microphones. It can save the PCM data to a TF card every one hour.

The format of the file name is RB_FileIndex*XXX*_d_chn*X*.pcm. XXX is the number which increases one by one each hour, and the X is the mic number in the mic array.

If the recording is less than one hour long, the temporary files will be stored in the /mnt/obb directory.

```
root@P818:/mnt/obb # ls -l
-rw-rw-rw- root     root      1351680 1970-01-01 12:12 RB_FileIndex0000_chn0.pcm
-rw-rw-rw- root     root      1351680 1970-01-01 12:12 RB_FileIndex0000_chn1.pcm
-rw-rw-rw- root     root      1351680 1970-01-01 12:12 RB_FileIndex0000_chn2.pcm
-rw-rw-rw- root     root      1351680 1970-01-01 12:12 RB_FileIndex0000_chn3.pcm
-rw-rw-rw- root     root      1351680 1970-01-01 12:12 RB_FileIndex0000_chn4.pcm
```

Notes:

- *The only supported filesystem of the Tflash is **FAT32***
- *The last channel number is the reference data from the playback path.*

If you want to playback a wav file, first input the below commands to config the audio out path.

tinymix 'PRI_MI2S_RX Audio Mixer MultiMedia1' 1

tinymix 'RX2 MIX1 INP1' 'RX1'

tinymix 'RDAC2 MUX' 'RX2'

tinymix 'HPHR' 1

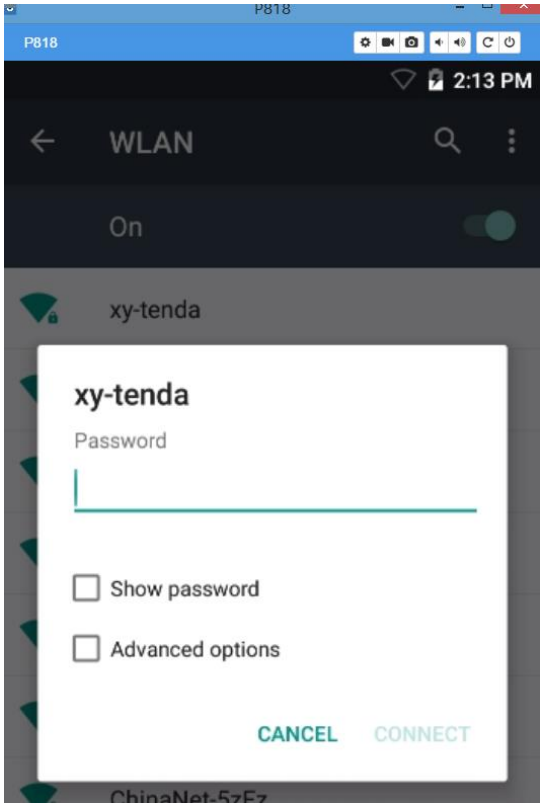
Then you can use tinyplay to play the wav file.

6. Wi-Fi Config

1. Through adb command.

svc Wi-Fi ssid: xxx password: xxxx

2. Config Wi-Fi by Vysor tool



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 equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter. To comply with FCC RF exposure compliance requirements, this grant is applicable to only Mobile Configurations. The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.