Getting Started with ReSpeaker XVF3800

Overview

The ReSpeaker XVF3800 USB 4-Mic Array is a professional 4-mic circular array with XMOS XVF3800, featuring AEC, AGC, DoA, beamforming, VAD, noise suppression, de-reverberation, 360° voice capture (up to 5m), and dual operation modes for advanced voice applications.



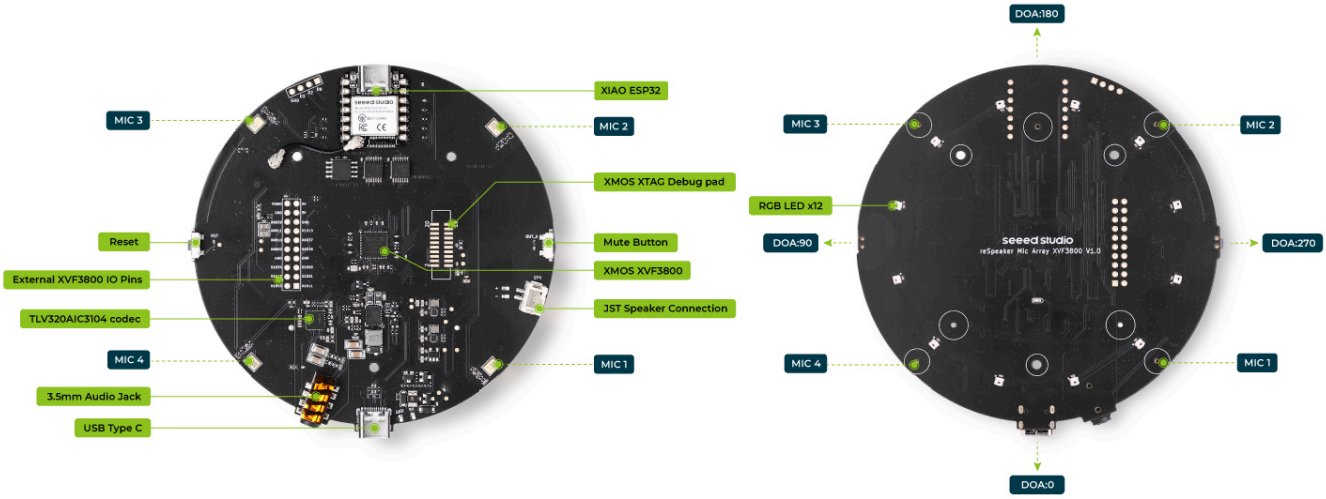
Get One Now

Features

- **Chip upgrade** :From XVF3000 to XVF3800
- **Quad Microphone Array** :4 high-performance mics in circular pattern for 360° far-field voice capture up to 5 meters

- **Advanced Audio Processing** :Powered by XVF3800 with AEC, multi-beamforming, de-reverberation, DoA detection, dynamic noise suppression, 60dB AGC range
- **Unique Device Serial Number** :Built-in SN enables multi-device deployments and advanced device management
- **Dual Operation Modes** :USB plug-and-play mode for instant PC connectivity and INT-Device (I2S) mode for integration with embedded systems—configurable via USB or I2C commands by switching the firmware accordingly
- **Open Source Compatible** :Works with USB hosts (Windows, macOS, Raspberry Pi OS) and I2S hosts (XIAO Series, ESP32, Arduino).
- **Visual Feedback** :Programmable RGB LEDs and status indicators show device states and voice activity
- **Equal or better audio quality** :compared to previous model

Hardware Overview



Main Components

Component / Feature	Description
Main Audio Processor	**XMOS XVF3800**, handles audio processing including AEC, beamforming, noise suppression, etc.

Component / Feature	Description
Microphone Array	**Quad PDM MEMS microphones** in circular pattern, supporting **360° far-field voice capture (5m)**.
Audio Codec	**TLV320AIC3104**, handles audio conversion and output.
Amplifier	**LM48511**, Class D amplifier
RGB LEDs	**12x WS2812** individually-addressable RGB LEDs for visual feedback (e.g., status, voice activity).
Mute Button	Press to **mute/unmute** the microphone input.
Mute Indicator LED	Lights up (typically red) to show that audio is muted.
Reset Button	Hardware reset for the board/system.
USB Type-C Port	Used for both **power and data** (USB Audio Class 2.0 compliant).
3.5mm AUX Headphone Jack	Audio output for headphones or active speakers.
Speaker Connector	**JST speaker interface**, supports **5W amplified speakers**.
Debug Pads	Debug access for **XTAG4** or other programmers.
I2C & I2S Headers	Exposed headers for **I2C and I2S communication** with external devices.
Unused IO Pads (XIAO)	Additional I/O solder pads connected to XIAO module.
I2S & I2C Communication	Supports connection to external hosts like Raspberry Pi, PC, etc. using these protocols.
USB & INT-Device Modes	Dual-mode operation: plug-and-play USB or internal INT device mode via I2S.

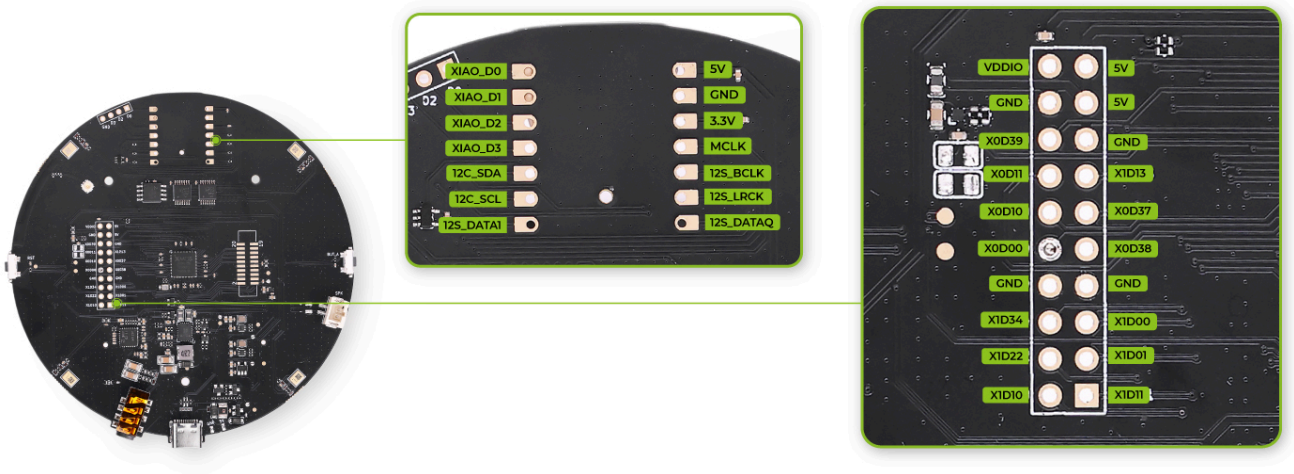
Component / Feature	Description
Unique Serial Number	Built-in **device SN** for identification and multi-device management.
Open Source Compatibility	Works with **Arduino, Raspberry Pi, PC/Mac**, and compatible with **XIAO Series**.
Advanced Audio Features	AEC, beamforming, dereverberation, **DoA detection**, DNN-based noise suppression, 60dB AGC.
Visual Feedback	Device state and audio activity shown via **RGB LED patterns** and **status indicators**.
Audio Quality	Equal or better than the **previous XVF3000-based designs**.

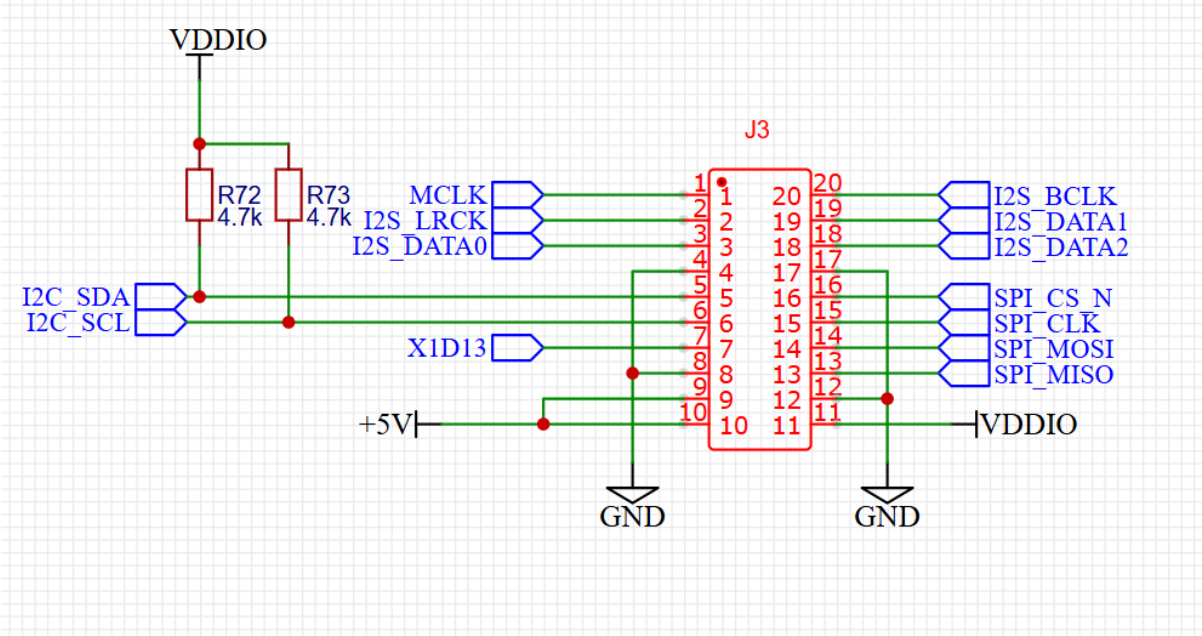
> **NOTE**
>
> The ReSpeaker XVF3800 is offered in two variants—one without XIAO and another with the XIAO ESP32S3 onboard. The version without XIAO operates with default USB firmware. To use the XIAO-integrated version, you must flash firmware built for **INT-Device (I2S) mode**. For detailed setup instructions, refer to the official wiki guide.

XIAO ESP32S3 support

- Stereo I2S input/output with multiple output options; I2C interface for configuring and managing XVF3800 parameters.
- XIAO reset via IO pin
- Interface and solder pads

Pin Out





GPIO Overview

The reSpeaker XVF3800 exposes 3 input pins (GPI) and 5 output pins (GPO) for external control. You can use these to read button states or control hardware like the mute LED, amplifier, or LEDs.

Pin Name	Direction	Function
X1D09	Input (RO)	Mute button status (high when released)
X1D13	Input (RO)	Floating
X1D34	Input (RO)	Floating
X0D11	Output (RW)	Floating

Pin Name	Direction	Function
X0D30	Output (RW)	Mute LED + mic mute control (high = mute)
X0D31	Output (RW)	Amplifier enable (low = enabled)
X0D33	Output (RW)	WS2812 LED power control (high = on)
X0D39	Output (RW)	Floating

Getting Started

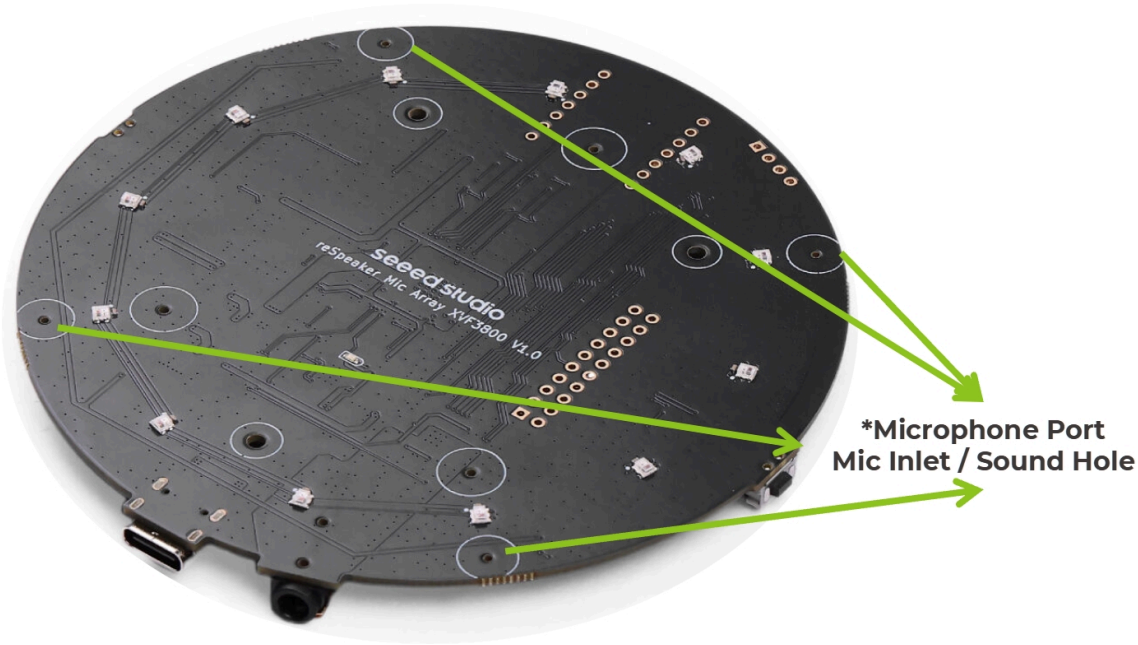
Hardware Preparation

- USB Type-C cable
- Host computer or Raspberry Pi

Software Preparation

Out of Box Usage

> **NOTE**
>
> To ensure optimal voice pickup performance and proper operation of the audio algorithms, please make sure the Microphone Port (Mic Inlet / Sound Hole) on the back side of the device is facing toward the sound source. The microphone port is located on the side with the Seeed Studio logo printed on it.



To ensure optimal audio pickup performance:

1. Keep the Microphone Port unobstructed
2. Face the side with the Seeed Studio logo (where the Microphone Port is located) toward the sound source

DOA (Direction of Arrival)

You can experience the LED array following the direction of the incoming voice.

Mute Button

The **Mute button** on your ReSpeaker is used to temporarily **disable voice capture** from the microphone array. What happens when you press the Mute button?

- The **microphones are muted** — external voices will no longer be captured or processed.
- A **red LED lights up** to indicate that **mute mode is active**.
- This means the ReSpeaker will **not send any audio input** to your computer or host device.

Try It Yourself with Audacity

Reset Button

The reset (RST) button provides a hardware reset for the XVF3800—when pressed, it restarts the chip and reinitializes the system from the very beginning, just like a full power cycle.

Speaker Connection

Here you can see how to connect speakers using either the 3.5mm AUX headphone jack or the onboard JST speaker interface, depending on your audio output preference.

Safe Mode

Safe Mode is a special recovery mode on the ReSpeaker XVF3800 that allows you to flash firmware via USB DFU or I2C—for devices like the Raspberry Pi and ESP32. If you've previously flashed the I2S firmware and want to switch back to the USB firmware, you can enter Safe Mode and reflash the USB firmware using USB DFU.

> **NOTE**
>
> Each type of firmware on the ReSpeaker XVF3800 supports different update methods:
>
> - The **USB firmware** only supports **USB DFU**, which means you can update the device using a USB connection. However, it **does not support I2C DFU**.
> - The **I2S firmware** is the opposite—it supports **I2C DFU**, allowing firmware updates over an I2C interface, but it **does not support USB DFU**.
> - The **Safe Mode firmware**, which is stored in the Factory partition, is the most flexible. It supports **both USB DFU and I2C DFU**.

When to Use Safe Mode

- Your firmware isn't working properly (e.g. USB not detected, LED not lighting up as expected).
- You need to re-flash a new firmware but the current one won’t respond.
- You accidentally flashed something wrong and want to recover.

How to Enter Safe Mode

- Power off the device completely.
- Press and hold the Mute button.
- While holding the mute button, reconnect the power.
- The red LED will start blinking — this confirms the device is now in Safe Mode.

- Now the device runs the Safe Mode firmware stored in the Factory partition.

Update Firmware

Three firmware versions are available in the official GitHub repository. You can choose and flash the appropriate firmware depending on your application requirements. For more details and downloads, please refer to the Github Link

> **NOTE**
>
> Do **NOT** use "save as" to download the firmware files from GitHub as they will get corrupt. Clone the repository or use "Download as ZIP" to download the whole repository (and all included files) as ZIP file.

USB I2S HA

USB firmware

The USB firmware is intended for host systems such as Windows, Linux, and macOS. The official USB firmware changelog marks v2.1.0 as the current release, and the current firmware directory contains these v2.1.0 images:

Firmware image	Repository-labeled USB profile
`respeaker_xvf3800_usb_dfu_firmware_v2.1.0.bin`	Standard v2.1.0 USB image. Its filename does not state a sample rate or channel count.
`respeaker_xvf3800_usb_dfu_firmware_v2.1.0_16k6ch.bin`	16 kHz, 6-channel USB image.
`respeaker_xvf3800_usb_dfu_firmware_v2.1.0_48k2ch.bin`	48 kHz, 2-channel USB image.

Choose the image whose labeled profile matches your application. For 48 kHz, two-channel USB capture, use the exact `_48k2ch` image; do not infer 48 kHz support from the generic v2.1.0 filename.

The firmware directory and changelog do not publish a USB Audio Class descriptor dump for these binaries. After flashing, verify the formats reported by the host before configuring the recording application. Do not state a USB sample width or any additional sample-rate/channel combinations without device-descriptor evidence.

Connect the reSpeaker XVF3800 to your PC via the USB cable. Note that you need to use the XMOS USB-C port(close to 3.5mm jack port) to flash XMOS's firmware.

Install DFU Util

`dfu-util` is a command line tool for Device Firmware Upgrade via USB.

Windows macOS Linux

- Download `dfu-util-0.11-binaries.tar.xz` and extract it, e.g., `D:\dfu-util-0.11-binaries\win64\`
  Download Link
- Add the path to `dfu-util.exe` to your system `Path` variable:
  `My Computer > Properties > Advanced > Environment Variables > Path`
- Open **Command Prompt** (`cmd`) and verify installation:

```
dfu-util -V
```

- Connect the ReSpeaker XVF3800 and check device detection:

```
dfu-util -l
```

> If you get:
> `Cannot open DFU device 2886:001a ... (LIBUSB_ERROR_NOT_SUPPORTED)`
> Proceed with the driver installation step below.

- Install Zadig
  - Open Zadig → `Options > List All Devices`

- Select `reSpeaker 3800` or `reSpeaker XVF3800 4-Mic Array`
- Install **WinUSB** driver
- Power-cycle the device
- Run `dfu-util -l` again to confirm detection.

Flash Firmware

Download the complete firmware repository from GitHub here `XMOS XVF 3800`

- Run the following command to flash the firmware

```
dfu-util -R -e -a 1 -D /path/to/dfu_firmware.bin
```

- On Linux, run it with sudo

```
sudo dfu-util -R -e -a 1 -D /path/to/dfu_firmware.bin
```

- The `-R` option will automatically restart the board after flashing.

- Check the firmware version again with `dfu-util -l` command, to make sure the new firmware is flashed

Recording and Playback

Windows | **macOS** | **Raspberry Pi / Linux**

Setup Audacity (Windows)

1. Open **Audacity**
2. Go to **Audio Setup** > **Audio Settings**

3. Set:
   - **Host**: `Windows WASAPI`

- **Recording Device**: `reSpeaker 3800`
- **Channels**: `2 (Stereo)`
- **Sample Rate**: `16000 Hz` (for both **Project** and **Default Sample Rate**)
- **Sample Format**: `24-bit`

1. Click **OK**
2. You're ready — start recording!

How to Tuning parameters?

Tuning allows users to configure parameters of the built-in audio algorithms and communicate directly with the XMOS chip.

A dedicated Python control interface is provided for parameter configuration and device interaction.

Python Control Directory

Using the provided Python scripts, you can:

- Configure built-in audio algorithm parameters
- Retrieve DoA (Direction of Arrival) data
- Retrieve VAD (Voice Activity Detection) data
- Control onboard LEDs
- Control the voice processing pipeline
- Communicate directly with the XMOS device

System Requirements

The following dependencies are required to use the Python control interface:

- Python 3.6 or later
- `pyusb` Python library
- `libusb` system library

Installation & Dependencies

Install the required Python dependency using:

```
pip install pyusb
```

Depending on your operating system, you may also need to install the `libusb` package separately.

Usage

Basic Syntax

```
python xvf_host.py [options] command [value(s)...]
```

Command Options

Option	Description
`-l`, `--list`	List all supported commands with detailed information
`--vid`	Set USB Vendor ID (default: `0x2886`)
`--pid`	Set USB Product ID (default: `0x001A`)
`--values`	Provide values for write commands (optional)

Usage Examples

List Available Commands

Display all supported firmware commands.

```
python xvf_host.py --list
```

Read Firmware Version

Retrieve the firmware version currently running on the device.

```
python xvf_host.py VERSION
```

Example Output

```
VERSION: [2, 0, 7]
```

Read Direction of Arrival (DOA)

Retrieve the detected sound source direction.

```
python xvf_host.py DOA_VALUE
```

Example Output

```
DOA_VALUE: [135]
```

Set LED Color

Configure the LED color using a hexadecimal RGB value.

```
python xvf_host.py LED_COLOR --values 0xFF0000
```

Set LED Brightness

Adjust LED brightness percentage.

```
python xvf_host.py LED_BRIGHTNESS --values 50
```

Read Microphone Array Geometry

Retrieve the microphone coordinates used by the acoustic processing algorithms.

```
python xvf_host.py AEC_MIC_ARRAY_GEO
```

Example Output

```
AEC_MIC_ARRAY_GEO:
[0.033, -0.033, 0.000,
 0.033,  0.033, 0.000,
-0.033,  0.033, 0.000,
-0.033, -0.033, 0.000]
```

reSpeaker XVF_HOST Application

The `xvf_host` application is a host-side utility used to communicate with the reSpeaker XVF3800 through USB. It can be used to read or modify XVF3800 control parameters, check the firmware version, read GPIO values, and access functions such as Direction of Arrival (DoA).

Host Controller application can be find in here

Host Application Files

The host application is located under the `host_control` directory of the repository.

Typical platform directories include:

```
host_control/
├── linux_x86_64/
├── mac_arm64/
├── win32/
└── ...
```

Each platform directory contains the host application and the libraries required by that application.

For example:

Windows

```
host_control/win32/
├── command_map.dll
├── device_usb.dll
└── xvf_host.exe
```

Linux

```
host_control/linux_x86_64/
├── libcommand_map.so
├── libdevice_usb.so
└── xvf_host
```

macOS

```
host_control/mac_arm64/
├── libcommand_map.dylib
├── libdevice_usb.dylib
├── libusb-1.0.0.dylib
└── xvf_host
```

> **Important:** Keep the complete platform directory together when copying the host application to another computer. The executable depends on the libraries located in the same directory.

Windows | Linux | macOS

1. Connect the XVF3800

Connect the reSpeaker XVF3800 to the Windows PC using USB.

2. Open Command Prompt or PowerShell

Navigate to the Windows host application directory:

```
cd C:\path\to\reSpeaker_XVF3800_USB_4MIC_ARRAY\host_control\win32
```

3. Check the Host Application

Run:

```
xvf_host.exe --help
```

If the application is working correctly, the help information will be displayed.

To display all available control commands:

```
xvf_host.exe --list-commands
```

The `--list-commands` option shows the commands supported by the host application.

4. Check the XVF3800 Connection

Run:

```
xvf_host.exe VERSION
```

A successful connection should produce output similar to:

```
Device (USB)::device_init() -- Found device VID: 10374 PID: 26 interface: 3
VERSION 2 0 10
```

The firmware version will depend on the firmware installed on the XVF3800.

The `VERSION` command is a simple way to verify that `xvf_host.exe` can communicate with the XVF3800.

5. Read GPI Values

```
xvf_host.exe GPI_READ_VALUES
```

6. Read GPO Values

```
xvf_host.exe GPO_READ_VALUES
```

7. Read Direction of Arrival (DoA)

```
xvf_host.exe AEC_AZIMUTH_VALUES
```

The returned azimuth value can be used to determine the detected direction of the sound source.

8. List Available Commands

To see all available XVF3800 host commands:

```
xvf_host.exe --list-commands
```

You can then use any supported command with:

```
xvf_host.exe <COMMAND>
```

For example:

```
xvf_host.exe VERSION
```

Common Commands

The following commands are useful for basic XVF3800 testing:

Command	Description
`--help`	Display host application help
`--list-commands`	Display available XVF3800 commands
`VERSION`	Read the XVF3800 firmware version
`GPI_READ_VALUES`	Read GPI values
`GPO_READ_VALUES`	Read GPO values
`AEC_AZIMUTH_VALUES`	Read the current DoA/azimuth value

More Commands can be find in here

reSpeaker Console Application

We have prepared a desktop application to control and configure your reSpeaker device.

With this application, you can:

- Connect to your reSpeaker device
- Configure audio settings (Noise Suppression, Gain, AEC, and Channel Configuration)
- Monitor Direction of Arrival (DoA) and Voice Activity Detection (VAD)
- Control LED effects
- Adjust device parameters

Installing the Application

Download the latest release from:

https://github.com/respeaker/respeaker-console/releases

Platform	Architecture	Package Type
Windows	x64	`.msi` / `.exe`
macOS	Apple Silicon	`.dmg` (aarch64)
macOS	Intel	`.dmg` (x86_64)
Linux	x64	`.deb` / `.AppImage`

Windows: USB Driver Setup

Before using the application for the first time, install the **WinUSB** driver using **Zadig**.

Step 1: Download and run **Zadig**.

Step 2: Select **Options** → **List All Devices**.

Step 3: Select **reSpeaker 3800** or **reSpeaker XVF3800 4-Mic Array** from the device list.

Step 4: Choose **WinUSB** as the driver.

Step 5: Click **Install Driver**.

Step 6: Unplug and reconnect the device.

Step 7: Run the following command to verify that the device is detected:

```
dfu-util -l
```

> **NOTE**
>
> `dfu-util.exe` is bundled with the application, so no separate installation is required.

Linux: Install dfu-util and Configure USB Permissions

Install **dfu-util**:

```
sudo apt install dfu-util
```

USB access also requires a **udev** rule.

Create the following file:

```
/etc/udev/rules.d/99-respeaker.rules
```

Add the following line:

```
SUBSYSTEM=="usb", ATTRS\{idVendor\}=="2886", MODE="0666", GROUP="plugdev"
```

Reload the udev rules:

```
sudo udevadm control --reload-rules && sudo udevadm trigger
```

Finally, disconnect and reconnect your device.

macOS: Install dfu-util

Install **dfu-util** before using the firmware update feature.

```
brew install dfu-util
```

Using the Application

After installing the application, launch it to access the **reSpeaker Console**.

Let's go through each section of the sidebar.

Device Connection

First, connect your reSpeaker device.

1. Click **Scan Devices**.
2. The application will list all detected devices.
3. Select your device.
4. Click **Connect** to establish the connection.

Audio

The **Audio** tab allows you to configure and enhance the audio processing pipeline.

Here you can configure:

- Non-stationary Noise Suppression
- Stationary Noise Suppression
- Automatic Gain Control (AGC)
- Acoustic Echo Cancellation (AEC)
- Output channel configuration
- Left and right channel mapping

Monitor

The **Monitor** tab provides real-time visualization of the microphone processing.

You can monitor:

- Direction of Arrival (DoA)
- Voice Activity Detection (VAD)
- Beam energy levels

These indicators help you verify that the device is detecting speech correctly.

LEDs

The **LEDs** tab lets you customize the LED ring.

Available features include:

- Breathing effect
- Rainbow effect
- Ring effect
- Brightness adjustment
- Animation speed control
- RGB color selection

Parameters

The **Parameters** tab provides access to all configurable device parameters.

The settings are organized into categories such as:

- Audio
- Acoustic Echo Cancellation (AEC)
- Post Processing
- LEDs / GPIO
- System

From this interface, you can update parameter values directly.

Each parameter includes a description to help you understand its purpose and the recommended value range.

Troubleshooting

Does playback sound from speaker output not enough ?

If the speaker output volume of the **ReSpeaker XVF3800** is too low on Linux, you may need to adjust the **ALSA mixer levels** for the XVF3800 sound card. Follow the steps below to increase the output volume.

Step 1: Open ALSA Mixer

1. Open a terminal.
2. Type the following command and press **Enter**:

```
alsamixer
```

Step 2: Select the XVF3800 Sound Card

1. Press **F6** to open the sound card selection menu.
2. Use the **up/down arrow keys** to highlight the **XVF3800** sound card.
3. Press **Enter** to confirm the selection.

Step 3: Adjust the PCM-1 Volume

1. Use the **left/right arrow keys** to navigate to **PCM-1**.
2. Use the **up arrow key** to increase the volume level up to **100%**.

Step 4: Save ALSA Settings

1. Press **ESC** to exit `alsamixer`.
2. Before unplugging the XVF3800, run the following command to save your settings:

```
sudo alsactl store
```

Step 5: Additional Option (Using PulseAudio)

If you still cannot hear sound clearly after adjusting ALSA levels, try installing **PulseAudio Volume Control** for more detailed volume adjustments:

```
sudo apt install pavucontrol -y
```

You can then open **pavucontrol** and increase the output volume beyond 100% if needed.

After reinstalling the USB drivers, my ReSpeaker doesn't record and playback

Uninstall all drivers associated with the ReSpeaker in Device Manager. This resolved the issue.

Cannot use as sound devices in Windows after flashing firmware ?

Open the start menu and type Device manager. Find related reSpeaker XVF 3800 devices, right click them and select Uninstall devices. After that, restart the device (usb plug and unplugged) and Windows will re-install the right sound card driver for it.

How can I open the casing without damaging it?

You can use your fingernails to gently lift the edges of the casing. There are three locking clips securing the cover. Once you release one of the clips, the casing can be opened relatively easily. Please handle the casing carefully to avoid damaging the clips or enclosure.

Why is my reSpeaker XVF3800 not detected as a sound device?

The reSpeaker XVF3800 ESP32 version is shipped with I2S firmware by default, so it will not appear as a USB audio device when connected to a PC. This information is mentioned on our Bazaar product page and official documentation.

If you want to use the device as a **USB audio device**, you need to reflash it with the USB firmware. Please follow these steps:

1. **Enter Safe Mode first:** Safe Mode instructions
2. **Flash the USB firmware:** Firmware update instructions

Why are some channels silent with the XVF3800 6-channel firmware?

The raw microphone channels may need to be enabled through the system's audio mixer controls after flashing the 6-channel firmware.

On Linux, first check the audio card ID:

```
arecord -l
```

For example, if the XVF3800 appears as **card 1**, enable the capture channels and set their volume:

```
amixer -c 1 cset numid=8 on,on,on,on,on,on
amixer -c 1 cset numid=10 60,60,60,60,60,60
```

Adjust the volume values as needed, then save the settings:

```
sudo alsactl store 1
```

After applying these settings, all six channels should capture non-zero audio.

Windows: If some channels remain silent, try uninstalling the XVF3800 device driver from **Device Manager**, then unplug and reconnect the device. This allows Windows to reconfigure the device and driver.

How to Use I2C Commands to Control reSpeaker XVF3800 USB Mic Array with XIAO ESP32S3?

We provide a detailed I2C command list and code examples. Please refer to the Using I2C Commands to Control reSpeaker XVF3800 USB Mic Array with XIAO ESP32S3 section.

Resources

- ReSpeaker XVF3800 2D File

- ReSpeaker XVF3800 3D File
- ReSpeaker XVF3800 3D-Enclosure-Up File
- ReSpeaker XVF3800 3D-Enclosure-Down File

Reference

- XMOS XVF3800 Chip Datasheet

Tech Support & Product Discussion

Thank you for choosing our products! We are here to provide you with different support to ensure that your experience with our products is as smooth as possible. We offer several communication channels to cater to different preferences and needs.

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Last updated on ***Nov 10, 2025*** *by* ***Kasun Thushara***

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