



## Introduction

High-quality audio in webcams is crucial to enable effective communication in video conferencing and enthusiast content creators. By implementing Soundskrit directional microphones, a webcam can have professional high-quality audio so that users will be heard clearly on calls and will not need additional equipment to start making digital content. Directional MEMS microphones have several unique design considerations compared to traditional microphone approaches. This guide will walk through implementing Soundskrit directional microphones in a webcam using the simplest method, the thru-hole configuration. This method enables clear voice pickup with the background noise and reverb rejection capabilities of Soundskrit microphones.

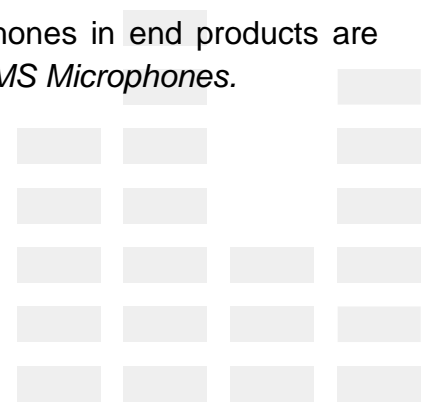
The follow-up to this guide, *AN-411 XY Configuration Implementation Guide for Webcams*, provides details on how to implement XY microphones using in-plane techniques such as the “V” configuration. The XY configuration enables more advanced features such as collaboration mode and true stereo recording.

## Integrating Thru-Hole Directional Microphones

The thru-hole configuration is used when the two sound ports of Soundskrit’s directional microphones need to be placed on opposite faces of the webcam. Using a thru-hole, one sound port will be on the front of the webcam facing the user, and the other on the backside of the webcam, facing away from the user. This orients the dipole microphone toward the user to isolate their voice from their surroundings. With the thru-hole configuration, microphones can often be placed in the same location where omnidirectional microphones are typically placed. This enables the use of directional microphones with minimal modification to existing designs.

A webcam can use a single directional microphone or an array of two directional microphones. As the positioning in both cases is very similar to their omnidirectional microphone counterpart, traditional audio processing techniques for omnidirectional microphones can be used with minimal modification and tuning.

Considerations and recommendations for implementing thru-hole microphones in end products are described in application note *AN-130: Integration Guide for Directional MEMS Microphones*.



## Single Dipole Webcam

The simplest method of integrating Soundskrit microphones in webcams is to use a single microphone. In this configuration, the dipole pattern must point toward the user. This maximizes the user's voice while rejecting environmental sounds from the sides. This simple system uses just one Soundskrit microphone to reduce ambient noise and provide microphone directionality. This system will provide better noise isolation than webcams using beamformers using two omnidirectional microphones. Figure 1 below shows a webcam using a thru-hole microphone:

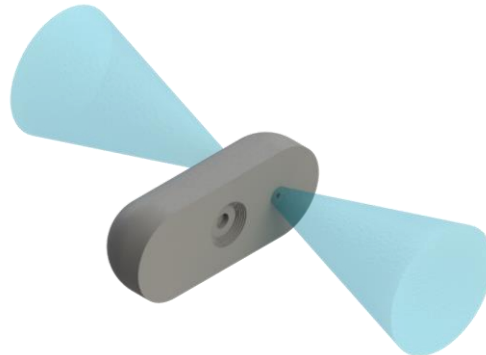


Figure 1: A webcam with a single Soundskrit Directional Microphone

Figure 2 below shows a gasket design for the Soundskrit microphone in the thru-hole configuration inside a webcam. Several key dimensions must be taken into consideration when designing the microphone gasket:

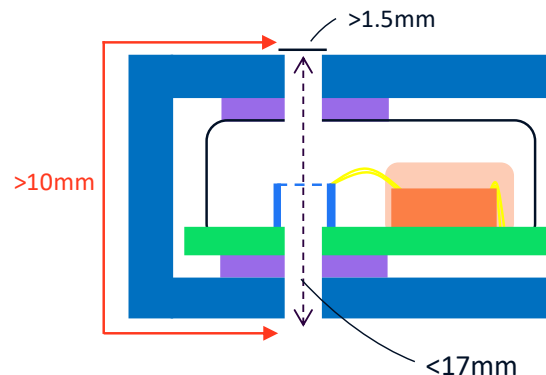


Figure 2: Thru-hole microphone gasket dimensions

- The path length between the two sound ports (red) should be greater than 10mm.
- Each sound port should have a diameter of at least 1.5mm.
- The acoustic channel length of the gasket should not exceed 17mm.

## Integrating a Directional Microphone in a Webcam

Tubes are a simple way to create acoustic channels to pair the acoustic ports on the exterior of the webcam to the microphone. Oftentimes, these tubes can extend off the plastic shell of the webcam itself as illustrated in Figure 3. It is important that the acoustic channel is sealed to the microphone. To seal the channels, foam or adhesive is recommended.



Figure 3: Cross section (left) and exploded view (right) of Soundskrit Microphones in a Webcam

## Dual Dipole Webcam

For additional performance and further voice isolation, two front-facing dipole microphones can be positioned into the webcam using thru-holes. The two microphones are placed left and right of the webcam center, as shown in Figure 4.

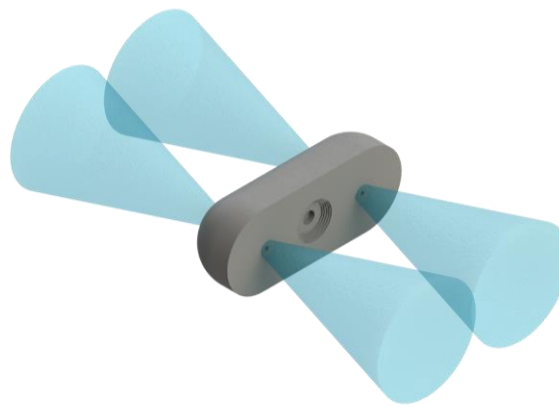


Figure 4: Webcam with Dual Dipoles

With this configuration, the outputs of the two dipoles can be added to provide further directionality in the direction facing the user, thereby rejecting even more surrounding noise. Traditional delay-and-sum processing techniques may be used to process the outputs of the two dipoles. For a broadside array, a spacing of 60mm between the sound ports is recommended.

## Performance when Integrated into Webcams

When following the recommended integration techniques, Soundskrit microphones maintain very high performance when integrated into a webcam. Below is an example of a 3D-printed webcam mockup using two front-facing Soundskrit microphones (labeled “Y1” and “Y2”) and performance measurements. The webcam is 17mm thick, maintaining a 17mm acoustic channel length for each of the directional microphones/



Figure 5: Webcam with 2 front-face Soundskrit Microphones

The graphs in Figure 6 show the directivity index and polar pattern of the microphone when integrated inside the webcam shell. Note that the response of the Y1 dipole microphone and Y2 are the same.

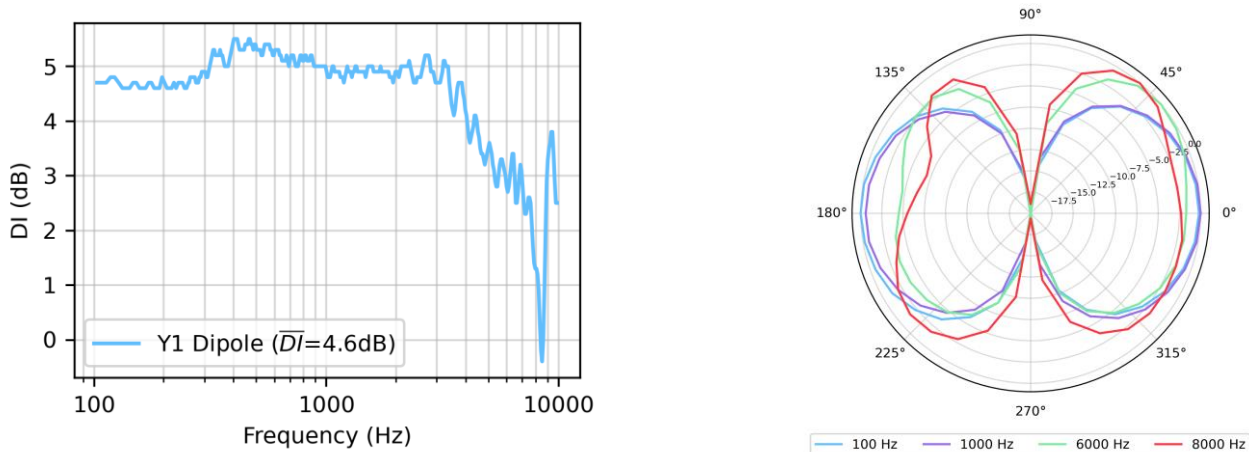


Figure 6: Directivity Index and Polar Plot of the thru-hole microphones

As shown in Figure 6, if the thickness of the webcam is 17mm or less, the microphone maintains a relatively ideal dipole pattern up to 8kHz, spanning the full frequency range for important speech frequencies. Because the acoustic channel length of the microphone is dictated by the webcam, using thinner webcam bodies can result in even higher directivity indexes at higher frequencies.

## Summary

By following the guidelines provided, directional microphones can improve webcam audio with minimal modification to existing designs. Even a single directional microphone will provide the user with higher-quality audio without needing heavy processing. For a more advanced feature set and further improved audio quality, please continue to read *AN-411 XY Configuration Implementation Guide for Webcams*.

If you are trying to integrate Soundskrit microphones into your webcam or other audio products, we are always ready to provide additional design resources and support please reach out to us with any questions or help you need.

## Additional Support

For further information on Soundskrit's products, visit our website at <http://www.soundskrit.ca> where you can find more application notes, datasheets, and purchasing information. If you have any questions or need technical support, please reach out to [applications@soundskrit.ca](mailto:applications@soundskrit.ca).

Revision Label	Revision Date	Sections Revised
-	November 2022	Initial release



## ABOUT US

Soundskrit has developed the world's first bio-inspired high-performance directional microphone that eliminates background noise and reverberation. Our intuitive sensory technology isolates the speaker's voice from all other ambient sounds, creating immersive audio experiences. Soundskrit replaces traditional microphone arrays in a wide range of devices and consumer electronics, including laptops, webcams, headsets, conference systems, smart home devices, smartphones, hearing aids, wearables and more.

Soundskrit was founded in 2019 and is headquartered in Montreal, Quebec with an R&D facility in Ann Arbor, Michigan.

