Application Report

Presence Detection with TAS5825M using Ultrasound

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Table of Contents

1 Introduction 2
2 Concept 2
3 Summary 3
4 References 3

List of Figures

Figure 2-1. System Block Diagram 2

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1 Introduction

What do you think of when you think of “smart” technology? Smart phones, smart appliances, smart watches, smart homes, and smart TVs might be just a few that come to mind. However, the word smart is now getting smarter. Consumers are constantly looking for that next great feature to make their technology more advanced. One feature that a lot of this smart technology is trying to adopt is presence detection, meaning if a TV is on, but can detect that a user is not within the viewing area for a certain amount of time it would turn off, pause the show, go to standby, etc. Similarly with speakers, it can go to a standby mode which allows for higher efficiency. This can be done with the TAS5825M from Texas Instruments using ultrasound technology, which can be used to map the acoustics of an environment and determine how sound reflects off the surroundings to project audio accordingly.

2 Concept

Ultrasound applications include TVs, smart speakers and other IoT devices. The algorithm that can be developed utilizes existing hardware of the TAS5825M to generate ultrasonic tones at 96kHz sampling to make applications smarter and give users new, exciting, and valuable experiences. One of these experiences could be people detection; by detecting motion a smart speaker can double as a security system, pause a podcast when you leave the room, or change its volume based on a user’s distance. This can also be used for directivity where barriers or walls are detected and use multiple speakers to beam-form audio to create the best audio experience based on the surrounding. Another experience that utilizes ultrasound on the application is gesture detection where the user will use gestures to control the device (swipe to skip, or tap to pause). The forth option is for inter-speaker communication. Different devices can use ultrasonic tones to communicate basic information with each other, such as which AI speaker is closer to the source of a voice command.

Proprietary algorithms and tone generation can operate with existing speaker and mic architecture to incorporate all previously discussed features. This means the user’s design with the TAS5825M can remain the same and only incorporate the algorithm in software. TI Audio’s quality amplifiers provide high sampling rates and adequate frequency response to deliver the tones without adulteration. The TAS5825M supports late audio mixing to do processing on audio without affecting the ultrasound signal. Refer to the block diagram below for an example implementation.

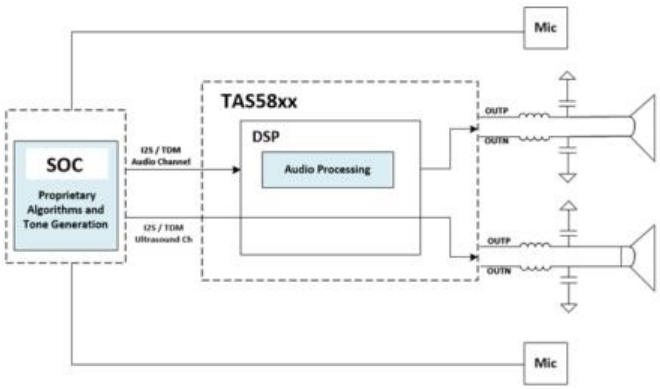

Figure 2-1. System Block Diagram

This plug in play option can also be achieved using one of TI’s third-party partners for the algorithm implementation. Since the solution is optimized with integrated tone generation into TAS5825, there’s far less demand for custom development on the host SOC. The amplifier’s DSP can generate tones at the high sampling rate necessary and reduce the processing burden on the host.

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3 Summary

In conclusion, smart technology is continuously getting smarter. Smart speakers and personal assistants like the Google Assistant, Amazon's Echo, or Apple's HomePod and others could now have the ability to detect presence and respond to gestures. TVs are also continuously developing smart features like turning off when the device detects a user is not presence. Given the most important aspect of hoe devices is privacy, having your smart devices (speaker, TV, appliance, etc.) know that you are there leads to multiple capabilities as previously mentioned. Texas Instrument's audio amplifier, TAS5825M, can already incorporate these features without adjusting the user's design with the device. For more information on Texas Instruments, ultrasound technology in smart devices, the TAS5825M, or other TI audio amplifiers, please visit the links below.

4 References

- Texas Instruments, TAS5825M Product Folder
- Texas Instruments, TAS5825M EVM

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