Microchip Timberwolf™ Audio Processor Webinar

A Leading Provider of Smart, Connected and Secure Embedded Solutions

Terry Kim – Senior Embedded Solutions Engineer

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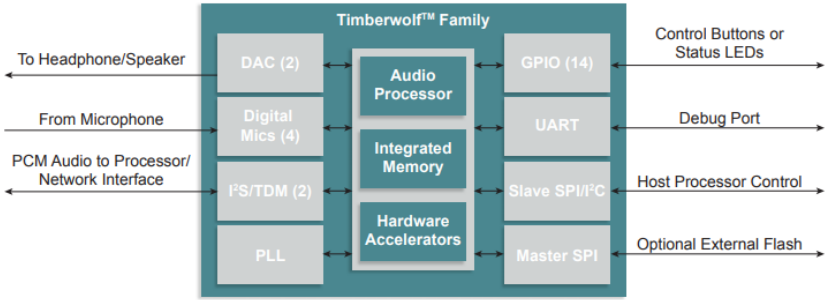
Agenda

- **Objective**
  - Introduction to Timberwolf™ ZL38063 Embedded Automatic Speech Recognition (ASR) with Cyberon DSpotter Wake Word Engine (WWE)
- **Topics**
  - Timberwolf Voice Processor Refresher
  - ASR Options and Metrics
  - Markets and Use-cases
  - Supporting Collateral
  - Customer Journey

Timberwolf™ Voice Processor Refresher

Timberwolf™ Audio Processor

Dedicated Audio Processor	• Offload host processor • Optimized for audio with HW accelerators • Low power mode
Patented Voice & Audio IP	• Best-in-class stereo echo cancellation and noise reduction • Leading-edge audio intelligence features • Royalty free & license free firmware
Validated Reference Design	• 2 & 3-MIC Amazon far-field certified • Field proven to pass industry standards • Quick turnkey development
Easy to use MiTuner™ Tool	• Tune for best audio performance • Get to market fast



HW Feature

- 300MHz DSP
- Voice Specific HW Accelerators
- Up to 4 Digital Mic Input
- Two internal 16 ohm speaker driver
- Power regulation (LDO)
- Two PCM ports
- MASTER ad SLAVE SPI/I2C
- Up to 14 I/Os

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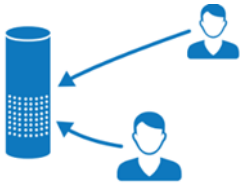
Voice Processing Features for ASR

Beamforming

- Points a beam to the person speaking
- Increases voice clarity
- Minimizes non-stationary noise

Far Field Processing

- Instantly adjusts gains to prevent clipping
- Amplifies distant signals

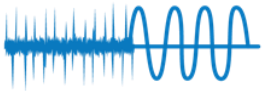


Stereo Barge-in/ASR

- Highly accurate key word detection
- Responds while playing audio from a device speaker

Noise Reduction

- Reduces ambient noise
- Air conditioners
- Fans
- Electronics



Direction of Arrival

- Sound locator finds the location of an audio source

Embedded ASR

- Trigger & command word detection
- Local voice control without network connection

Features and Benefits Summary

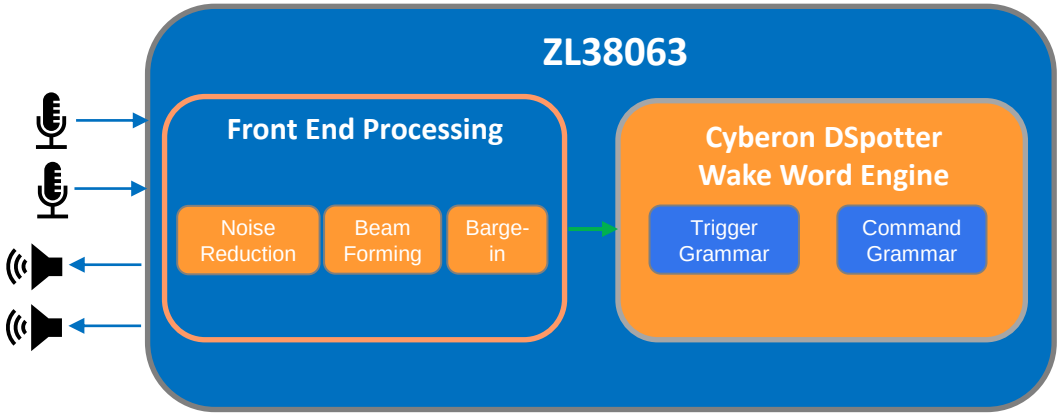
Features	Description	Benefits
Full-band Stereo DACs	• DACs enabled to play full-band (48 kHz) audio from TDM Bus	• Enables smart-speaker platforms to use Timberwolf™ DACs for stereo music playback
Beamforming & Sound Location	• Far-field capable 2-MIC beamforming to increase SNR • Additional sound locator function across 180 degrees	• Beamforming enables better performance in presence of both stationary *and* non-stationary noises • Sound locator provides angle of speech arrival for user-interfaces
Stereo Acoustic Echo Cancellation	• Hardware accelerated AEC, capable of cancelling stereo echo at high volumes	• Enables far-field barge-in for smart-speakers
Noise Reduction	• Noise reduction algorithm optimized for speech recognition	• Enables accurate ASR in high-noise devices and environments
De-reverberation	• Reduces room reverberation to increase speech quality for speech recognition	• Enables far-field performance in large rooms
Dynamic range control	• Automatically adjusts audio levels using compression, limiting and expansion	• Maintains consistent level of audio for ASR performance in near-field and far-field

Features and Benefits Summary

Features	Description	Benefits
Embedded Speech Recognition	• Engine capable of simultaneous wake word + up to 20 commands • Detection score and configurable detection threshold	• ASR engines optimized for high detection rate with minimal false alarms • Detection thresholds can be tuned to specific application
Grammar Swapping	• Grammar models can be swapped dynamically from host or external flash	• Enables support of multiple languages or multiple wake words
Application Swapping	• ZL38063 can run ZLS38063.0 firmware for two-way communication mode	• Enables full-duplex two-way audio communication by swapping firmware for IP camera/intercom applications

Embedded ASR
(Automatic Speech Recognition)

Embedded ASR for Local Voice Control



Front-end Processing

- 2-MIC Beamforming
- Stereo Barge-in
- Noise Reduction
- De-reverberation
- Dynamic Range Processing

Automatic Speech Recognition

- Local Speech Recognition
- Voice and control responses

ZL38063 with Embedded ASR

- **All-in-one solution** for voice processing
  - Front-end processing
  - Embedded Automatic Speech Recognition
- **Local voice command & control**
  - Cyberon DSpotter Wake Word Engine
  - Limited vocabulary and grammar
- **Key Attributes**
  - Optimized BOM
  - High functionality
  - High performance

Local vs. Cloud Command/Control

Functions	Markets	Applications	Common Features	Differentiating Attributes
Automatic Speech Recognition (ASR)	Cloud-based Traditional voice assistant	• Home automation connected appliances • Alarm panels • Set top boxes	• Far-field processing • Beamforming • Stereo barge-in • Background noise reduction • De-reverberation • Dynamic range processing	• 1,2,3-mic beamforming • Cloud artificial intelligence • Naturally spoken language • Amazon Alexa, Google Assistant • Host processor for Wake Word Engine
	Local Voice control with embedded ASR	• Home automation • Fitness equipment • Medical • Commercial • Toys and education		• 1,2-mic beamforming • Private • Limited local commands • Low complexity • Voice control responses • Optimized BOM

- **Local command control using Cyberon is ideal for private, low-cost/complexity applications with a fixed set of commands**
- **Timberwolf™ voice processing provides the front-end audio "clean up"**

Cyberon DSpotter WWE Examples

- **General Commands**
  - Play Music
  - Stop Music
  - Previous Song
  - Next Song
  - Volume Louder
  - Volume Softer

Markets and Use-cases

ASR for Local Control/Command Benefits

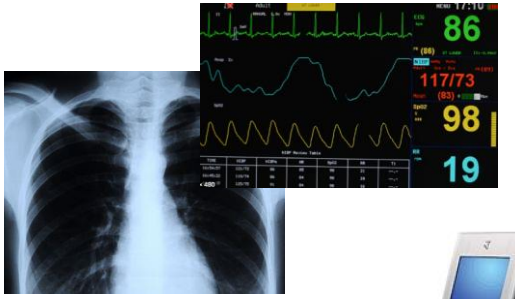
- **Voice Control**
  - No physical contact for areas requiring cleanliness
  - No searching for the remote control or switch on the wall
  - Achieve instant response to voice command
- **Private**
  - Keep voice and commands out of the cloud
  - Minimize control latency with immediate, local response
- **Simple and Robust**
  - Embedded solution offloads host MPU from overhead required for cloud
  - Grammar swapping to support multiple languages
  - Multi-modal App-Swapping to switch between embedded ASR, 2-way audio and event detection

Target Markets and Applications

- **Voice Control for Home Automation**
  - Smart speaker
  - Smart lighting/switches
  - Thermostat
  - Blinds / curtains
  - Vacuum cleaners
  - Kitchen appliances
- **Fitness Equipment**
  - Cardio equipment: treadmill / cycle / elliptical
  - Smart training assistants

Target Markets and Applications

- **Medical**
  - Alert for help in hospital or nursing home
  - Contact-less interfaces
  - Paging/Intercom
  - Voice control for medical assistive devices
    - Adjust room, bed settings in hospital
- **Commercial**
  - Point-of-sale/ self-service kiosks/ vending machines/ elevator
- **Toys & Education**
  - Robots
  - Interactive games
  - Early education speech and reading assistance



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Supporting Collateral

EVB, Tools, Documentation

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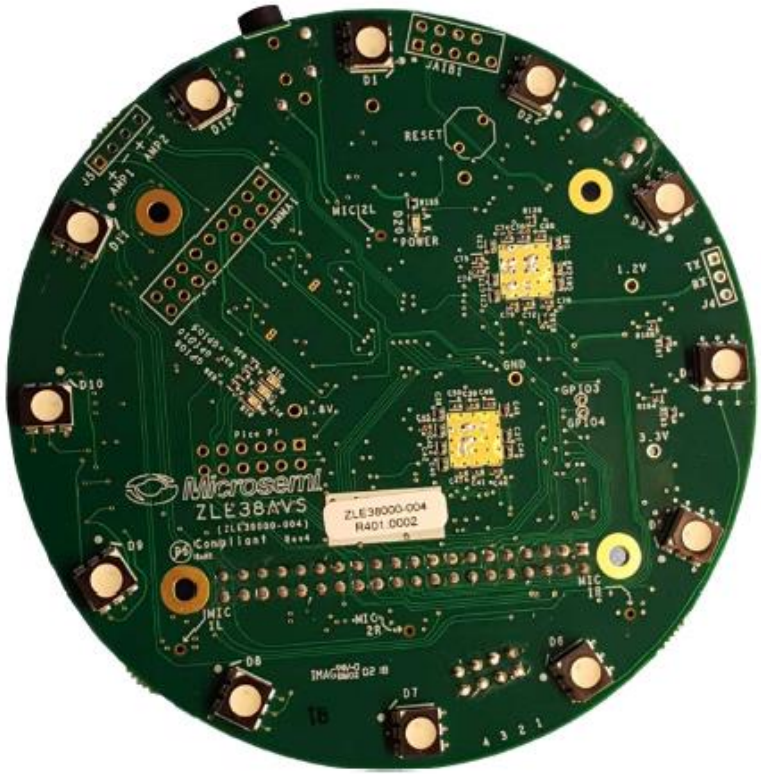
Timberwolf™ Development Board (EV08Z13A)



- **Evaluate Timberwolf ZL380xx Audio Processors**
- **Use with Timberwolf Demo Tool & MiTuner™**
  - 2-way voice communication
  - Embedded speech recognition
  - Audio event detection
- **Key Features**
  - Four on-board digital MEMS Microphones in recommended array geometries
  - I^2C LED Controller with 12 RGB LEDs
  - Headphone/Speaker Output Jack
  - Audio via ZL38090 USB to I^2S Port B bridge
  - Raspberry Pi 3B 40-pin header for Amazon AVS Far-field Reference Solution *(Raspberry Pi not included)*
  - UART interface for debugging
  - I^2S Port A Header
  - Quick Start Guide in the Box
- **Buy from Microchip for $499.95**

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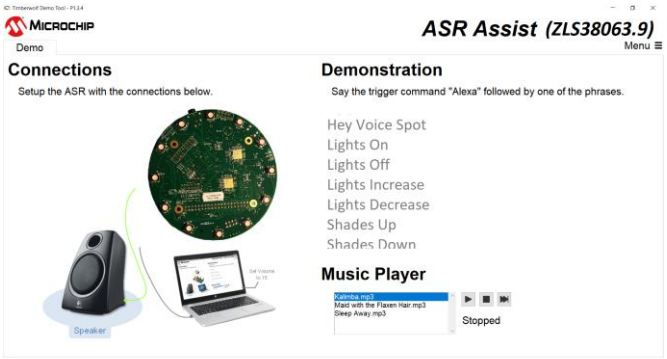
Timberwolf™ Demo Tool

- **To evaluate the key features of Timberwolf Audio Processors on development board**
  - Audio event detection
  - Beamforming
  - Two-way audio communication
  - Embedded ASR assist with barge-in
    - Cyberon (Trigger + 6 commands)
- **Available for download in Timberwolf Design Center (Microchip Website)**



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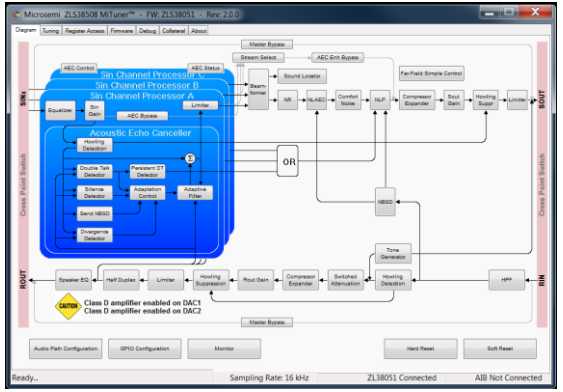
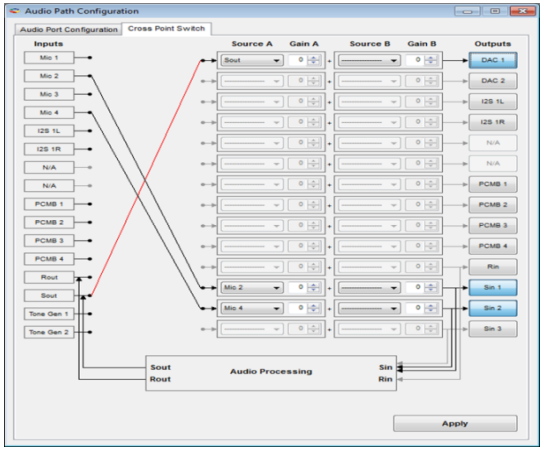
MiTuner™ GUI

- **Easy-to-use GUI for**
  - Setting audio path configuration
  - Setting cross point switch
  - Access registers
  - Register firmware and configuration record loading
- **Benefits**
  - Visually shows mic and speaker data paths
  - Click on diagram blocks to configure algorithm parameters
  - Manual Tuner guide walks customer through AEC tuning process

Audio Path Config



Cross Point Switch



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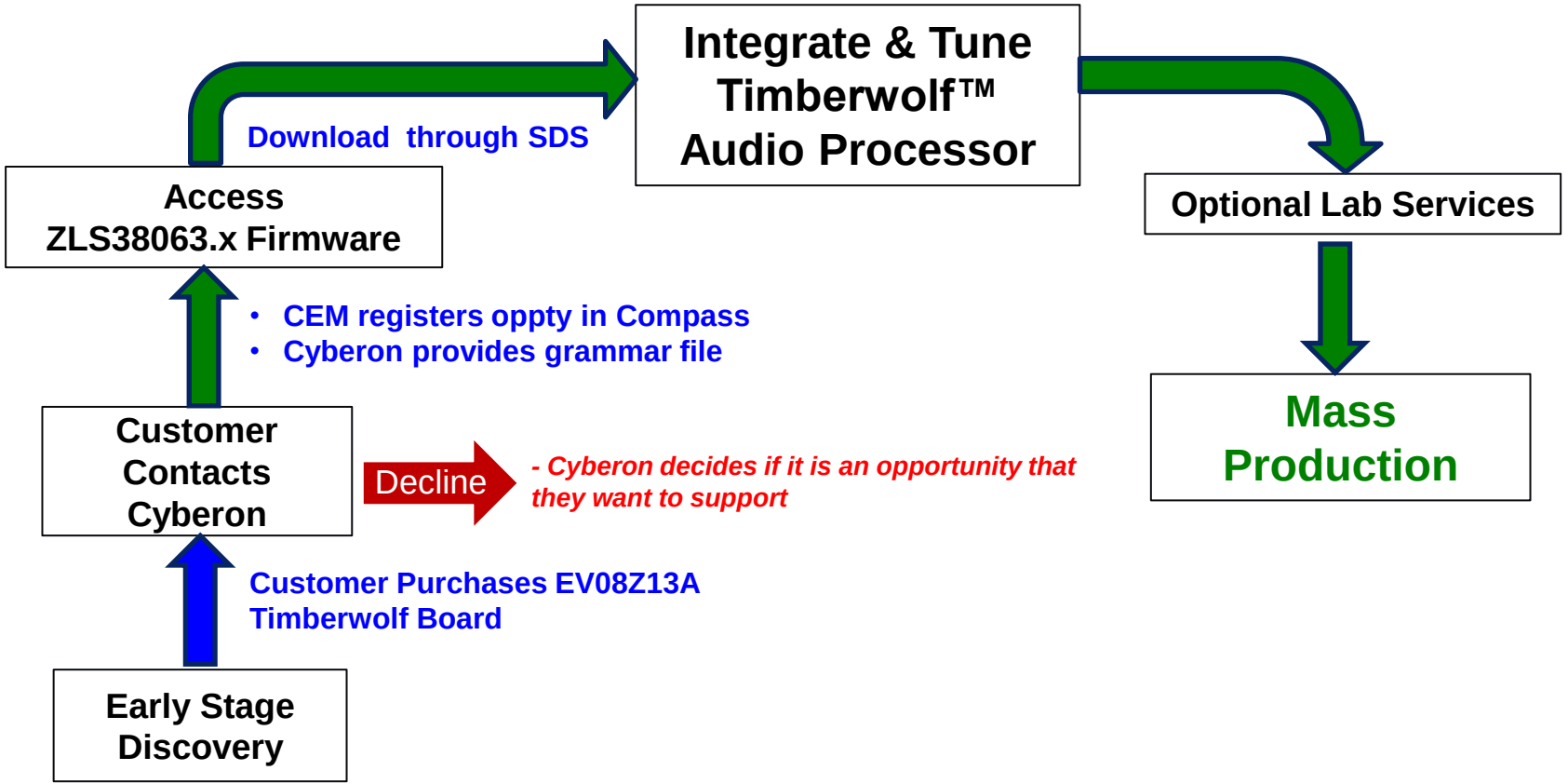
Firmware and Documentation Distribution

Download	Content	For ASR Release
Dev Kit Package	Dev Kit Hardware Design User Guide	Microchip AVS GitHub
	Dev Kit Quick Start	
AVS Guide	Dev Kit AVS Guide	Microchip AVS GitHub
Demo Tool	Timberwolf™ Demo Tool	EV08Z113A Product Page
ZL38063 Datasheet	063 Datasheet	ZL38063 Product Page

- **Contact Microchip sales for access to Firmware and MiTuner™**

Customer Journey

Timberwolf™ Embedded ASR Customer Journey



Customer Journey for Embedded ASR

Optional Service – Audio Lab

- **Amazon AVS Acoustic Pre-Certification**
  - Rental of Microchip's ASR testing lab and equipment
  - AVS Self-Test Services for FRR, RAR, and FAR testing
  - Prioritized ASR tuning support with Factory Apps team
- **Full-Duplex Two-way Audio Certification**
  - Rental of Microchip's Fully Anechoic Acoustic Chamber and Head Acoustics testing equipment
  - Standards-based test suites and report generation available
  - Prioritized two-way audio tuning support with Factory Apps team
- **System-level Acoustic Testing**
  - Rental of Microchip's fully Anechoic Acoustic Chamber (4 pi > 160 Hz)
  - Acoustic Performance Testing, including:
    - Frequency Response, CSD, Mic-Speaker Coupling
    - Distortion (THD) measurements for speaker, microphone, and combined system (echo path)
    - Speech Quality & Intelligibility Tests

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Thank You