

## Features

- DSP with Voice Hardware Accelerators
- Dual  $\Delta\Sigma$  DACs with output sampling up to 48 kHz and internal output drivers
  - 4 single-ended or 2 differential Output Amps
- 44.1/48 kHz Stereo Music Playback with Voice
- Two Digital Microphone inputs supporting up to 3 Microphones
- Two TDM ports shared between PCM and Inter-IC Sound (I<sup>2</sup>S)
  - Each port provides sample rate conversion and synchronous and asynchronous TDM bus operation
- SPI Slave port for host processor interface
- Master SPI port for serial Flash interface
- 14 General Purpose Input/Output (GPIO) pins
  - Keypad Scanner (up to a 7x7 array)
- General purpose UART port
- Boots from SPI, UART, or Flash allowing easy firmware updates
  - Can run unattended (controllerless), self-booting into a configured operational state
- Ultra-low and Standby off power
- Full duplex operation supports AEC (up to 256 ms) in both Narrowband and Wideband operation (8 kHz or 16 kHz respectively)
- Psychoacoustic noise reduction
  - Single microphone
  - Stationary noise reduction
- AGC/ALC
- Dynamic Range Compression
- Built-in support for G.712 and G.722
- Single and Dual Tone Generation
- CID Type 1 and 2 Detection
- DTMF Detection
- Call Progress Tone Detection
- G.168 and G.169 compliant Line Echo Cancellation (LEC)
- *MiTuner™* GUI Software
  - Automated AEC tuning

Document ID# 147016

Version 5

May 2014

### Ordering Information

Device OPN <sup>(1)</sup>	Package	Packing
ZL38040LDF1	64-pin QFN (9x9)	Tape & Reel
ZL38040LDG1	64-pin QFN (9x9)	Tray

1. *The Green package meets RoHS 2 Directive 2011/65/EU of the European Council to minimize the environmental impact of electrical equipment.*

## Applications

- Wideband Speakerphone
- Home Automation

## Description

The Microsemi *AcuEdge* Technology ZL38040 *Advanced Wideband Audio Processor* is designed to provide leading edge acoustic echo cancellation and noise reduction for the Wideband Speakerphone and Home Automation markets.

The ZL38040 device is a highly adaptable hardware platform designed to support high performance audio processing applications. The ZL38040 provides a powerful DSP with voice specific hardware accelerators, two digital microphone interfaces, two independent 16-bit DACs, and two flexible TDM interfaces in a single 64-pin QFN package.

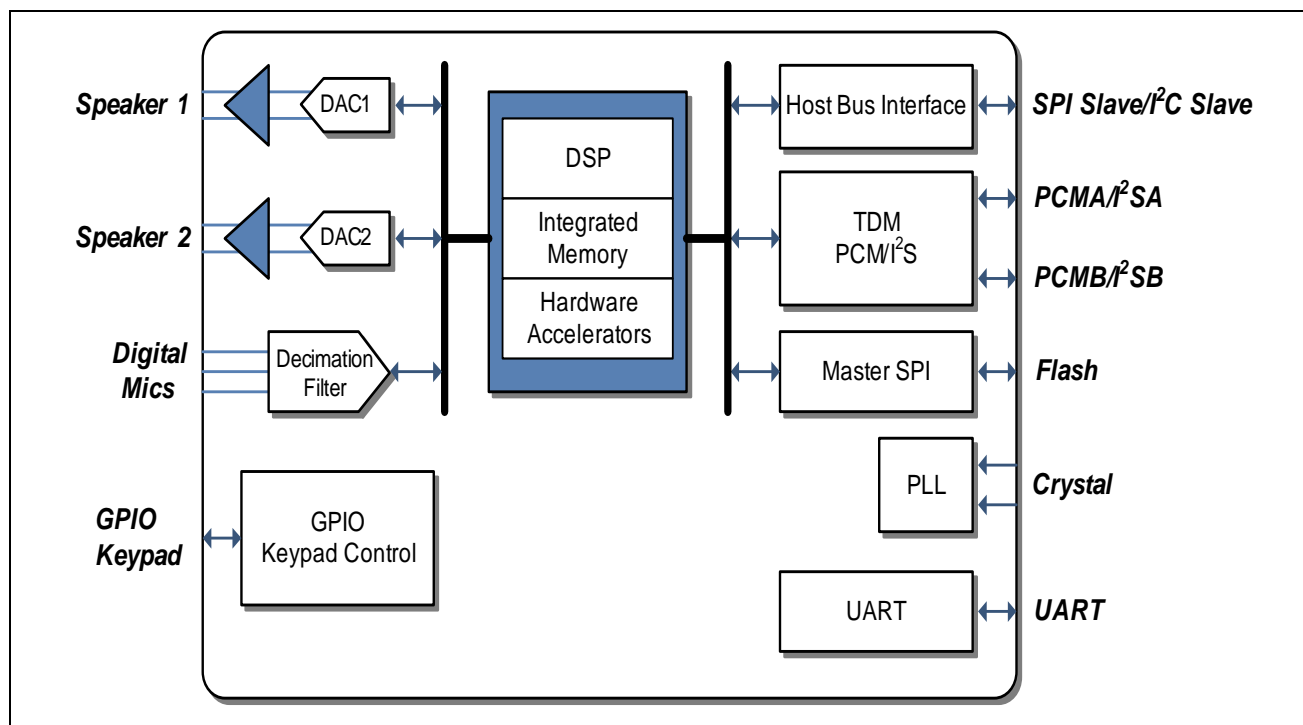
The Microsemi *AcuEdge* Technology ZLS38040 license-free Firmware provides Acoustic Echo Cancellation (AEC), noise reduction and a variety of other voice enhancements to improve both the intelligibility and subjective quality of voice in harsh acoustic environments.

## Performance

- AEC Tail Length: 256 ms
- AEC sampling rate: 8 and 16 kHz
- Single Talk TCLw: > 60 dB
- Double Talk TCLw: > 40 dB
- Double Talk Attenuation: < 3 dB
- Noise reduction up to 30 dB

## Voice Processing Series Solution Overview

Designed for world-class high definition voice applications, Microsemi's new ZL380 series of audio processors features the company's Microsemi *AcuEdge™* Technology. This innovative technology is a set of highly-complex and integrated algorithms that allows the user to extract more information from the audio environment. The new Microsemi *AcuEdge* Technology consists of license-free, royalty-free intelligent audio IP algorithms. When combined with Microsemi's highly-integrated ZL380 series of audio processors, the solution accelerates customers' time-to-market via validated reference design and easy-to-use development tools including the Microsemi Audio Interface Box (AIB) Kit which utilizes the *MiTuner™* GUI software.



**ZL38040 Block Diagram**

The ZL38040 Advanced Wideband Audio Processor provides the following enhanced voice processing feature set.

**Microsemi ZL38040 Hardware**

- Host Interface: SPI, UART, I<sup>2</sup>C
- Standalone (controllerless) auto-boot from Flash
- Two clock independent TDM ports (PCM or I<sup>2</sup>S)
- 14 GPIOs, configurable with built-in control features
- Crystal-less operation (with a valid TDM clock)
- Two digital microphone interfaces supporting three digital microphones
- Dual 16-bit digital-to-analog converters (DACs)
  - Headphone amps capable of four single-ended or two differential outputs
  - Two independent headphone drivers
  - 32 mW output drive power into 16 ohms
- Impulse pop/click protection

**Microsemi *AcuEdge*<sup>™</sup> Technology ZLS38040 Firmware**

- Wideband and Narrowband Acoustic Echo Cancellation
- Initial convergence conditioning
- Psychoacoustic noise reduction
  - Single microphone
  - Stationary noise reduction
- Keypad scanner
- Low active power consumption
- Multi-tone generation
- DTMF detection
- Call Progress Tone detection
- Caller ID Type 1 & 2 detection
- Signal mixing
  - 44.1 kHz/48 kHz music mixed with 8 kHz/16 kHz voice
- Howling detection/cancellation
- Various encoding/decoding options:
  - 16-bit 2's complement (linear)
  - G.711 A/μ law
  - G.722
- Send and receive path equalizers
  - 16-band for Narrowband mode
  - 22-band for Wideband mode
- Comfort noise generation
- 44.1 kHz/48 kHz bypass mode
- Configurable Cross-Point Switch

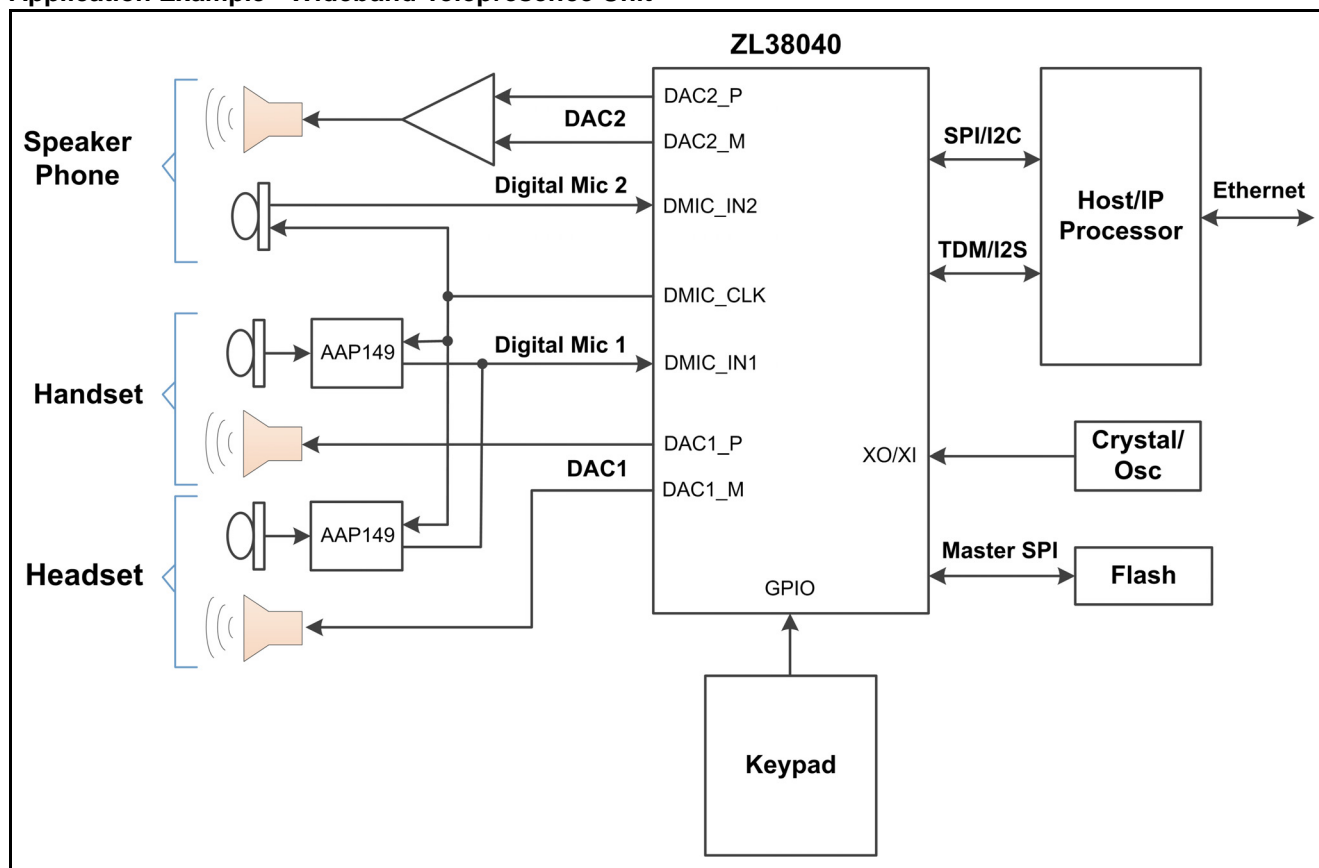
## AEC Auto-Tuning

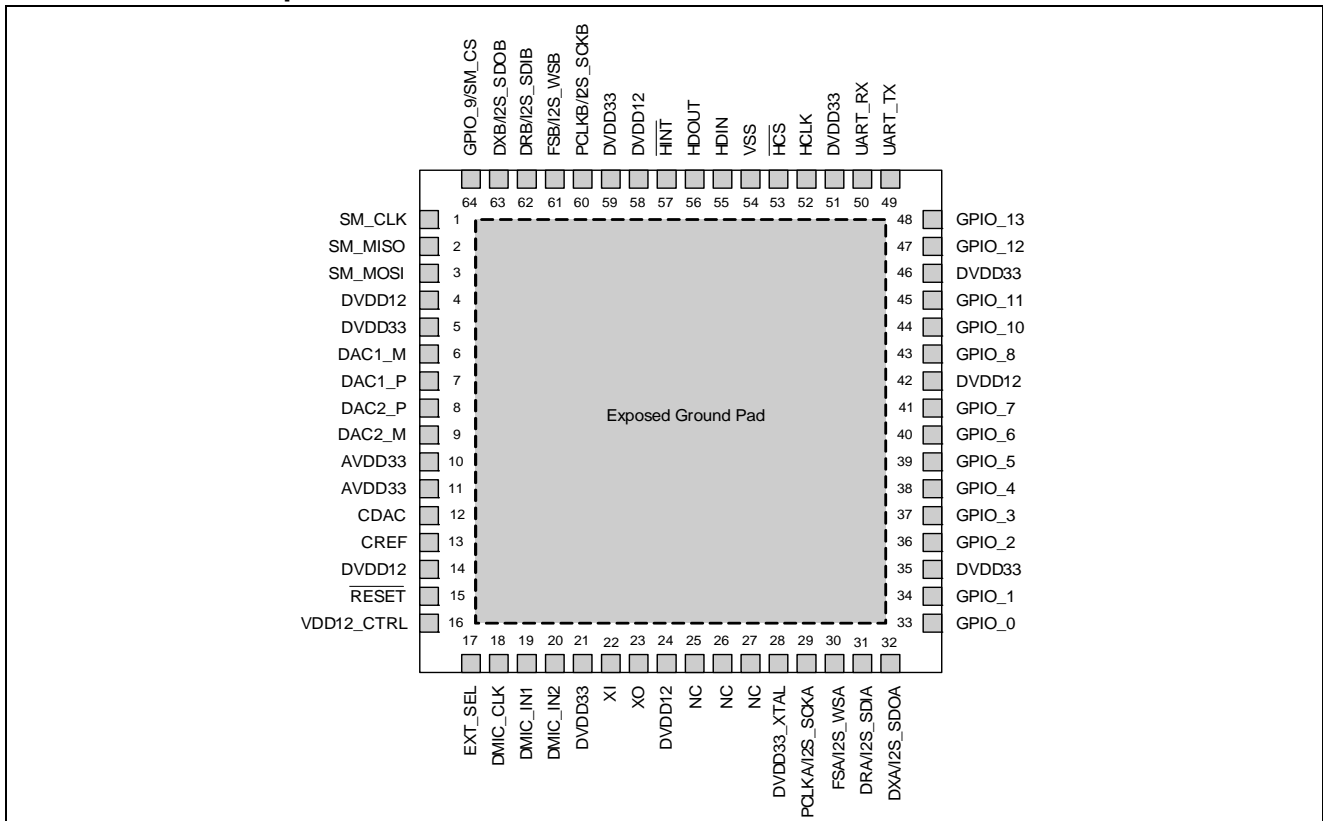
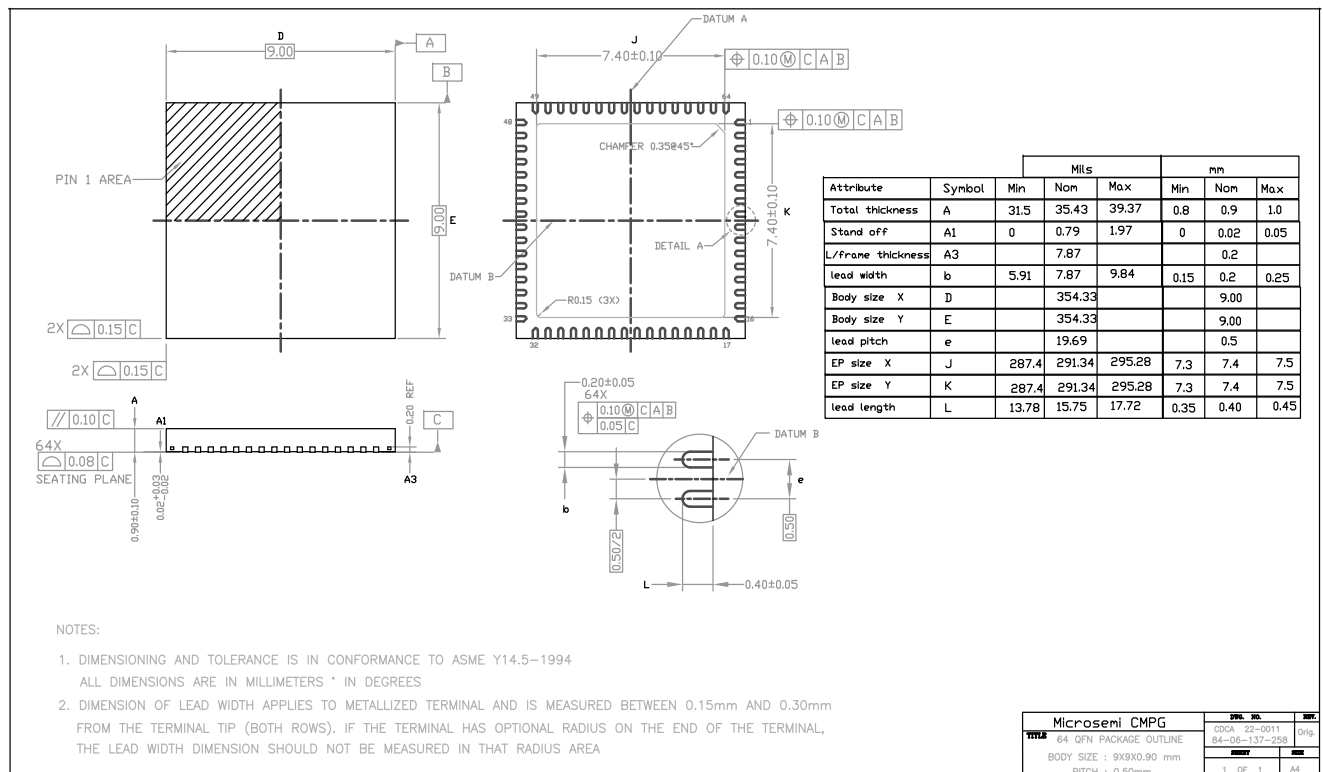
To optimize the acoustic properties of a given system design, the Audio Processor firmware requires gain and level tuning. The mechanical design, including the speaker and microphone quality and placement, will all affect the system's acoustic performance. Microsemi has developed *MiTuner™* GUI Software (ZLS38508) and the Microsemi Audio Interface Box (AIB) hardware (ZLE38470) to automatically optimize the firmware's tunable parameters for a given hardware design, facilitating the system design process and eliminating the need for tedious manual tuning. The *MiTuner* GUI Software provides step-by-step instructions that allow the software's algorithms to achieve a high level of acoustic performance for a given enclosure.

## Highly Configurable for Multiple Applications

- Wideband Telepresence device (shown below)
- Home Automation
- Wideband phone

### Application Example - Wideband Telepresence Unit



**Device Pinout - Top View**

**Package Outline (64-Pin QFN)**


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