AIS240A
SpectroMic MCM

Microphone and Spectral Engine

Mini DOS – Design Objective Specification

23 December 2024, V0.2

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1. Overview

1.1 Revision history

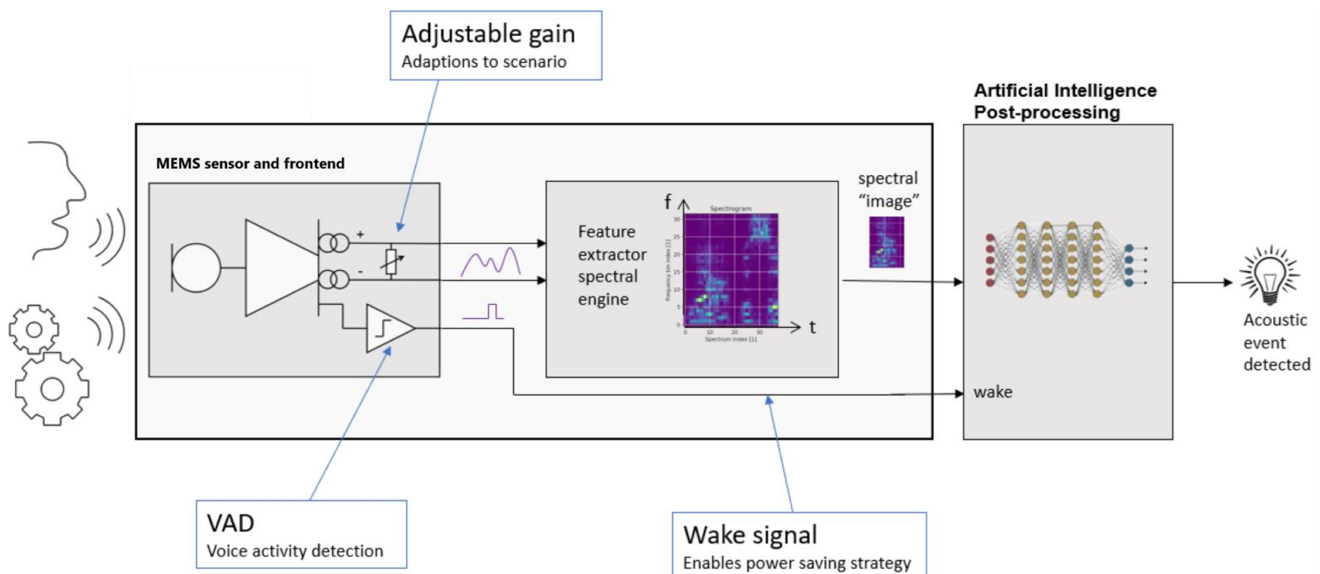
Revision	Comments	Author	Date
0.1	Initial Draft	Erik Sibrai, Matthias Steiner	20-Dec-24
0.2	Added BOM Cost	Erik Sibrai	23-Dec-24

1.2 Project goals

Develop an MCM, using Chimera TC1 MEMS interface chip, Monarch analog spectral engine and a high sensitivity MEMS that can directly interface via SPI to an external microcontroller to be used e.g. for KWS.

1.3 Spectrophone Features

- Acoustic activity detection with adjustable threshold level and frequency characteristic
- Wide gain adjustment range with internal programmable resistors, and/or external resistors
- SPI interface
- 2 Interrupts to wake microcontroller, one optional from VAD and one when spectral data ready
- Current consumption
  - o 19µA always-on
  - o < 300µA during spectral processing
- Single 1.8V supply
- 32 Configurable frequency bins
- 32KB SRAM for coefficient storage
- Single package with acoustic bottom port



2. MEMS

For the first revision it is planned to use the high sensitivity MEMS from Transducer Star.

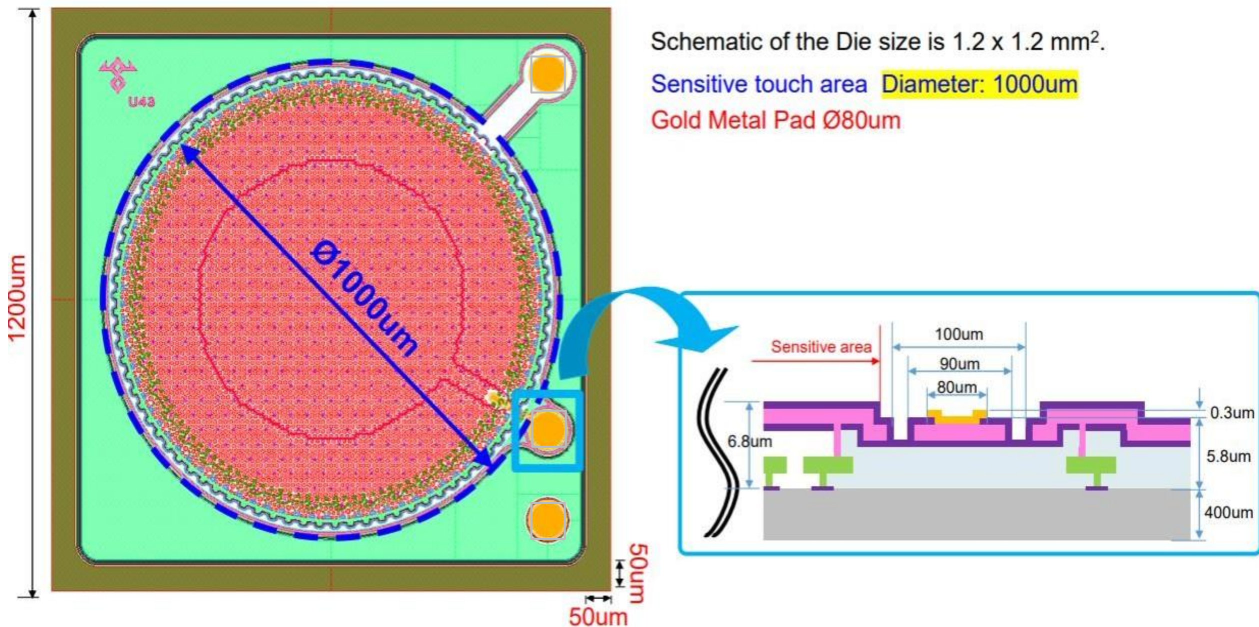


Figure 2-1 Transducer Star MEMS

3. Package

3.1 Dimensions

Spectrophone will be packaged into a MEMS package with 15 pins. The package size is expected to be 5.4mm x 5.4mm.

3.2 Pin list

#	Pins	Function
1	VDD	1.8V Supply
2	AVDD	1.2V Regulator for Analog
3	DVDD	1.2V Regulator for Digital
4	GND	Ground
5	AP	Audio positive channel
6	AN	Audio negative channel
7	APF	Audio positive filtered channel
8	NCS_SP	SPI: Low active Chip select for Chimera TC1
9	NCS_MO	SPI: Low active Chip select not for Monarch
10	SI	SPI: Slave In
11	SO	SPI: Slave Out
12	SCLK	SPI: Clock
13	IRQ	Chimera TC1 IRQ output
14	GPIO0	Monarch IRQ output
15	GPIO5	Monarch External Clock input

Note: Pin order can be changed

3.3 Drawing and Illustration

Figure 3-1 Spectrophone Package Illustration

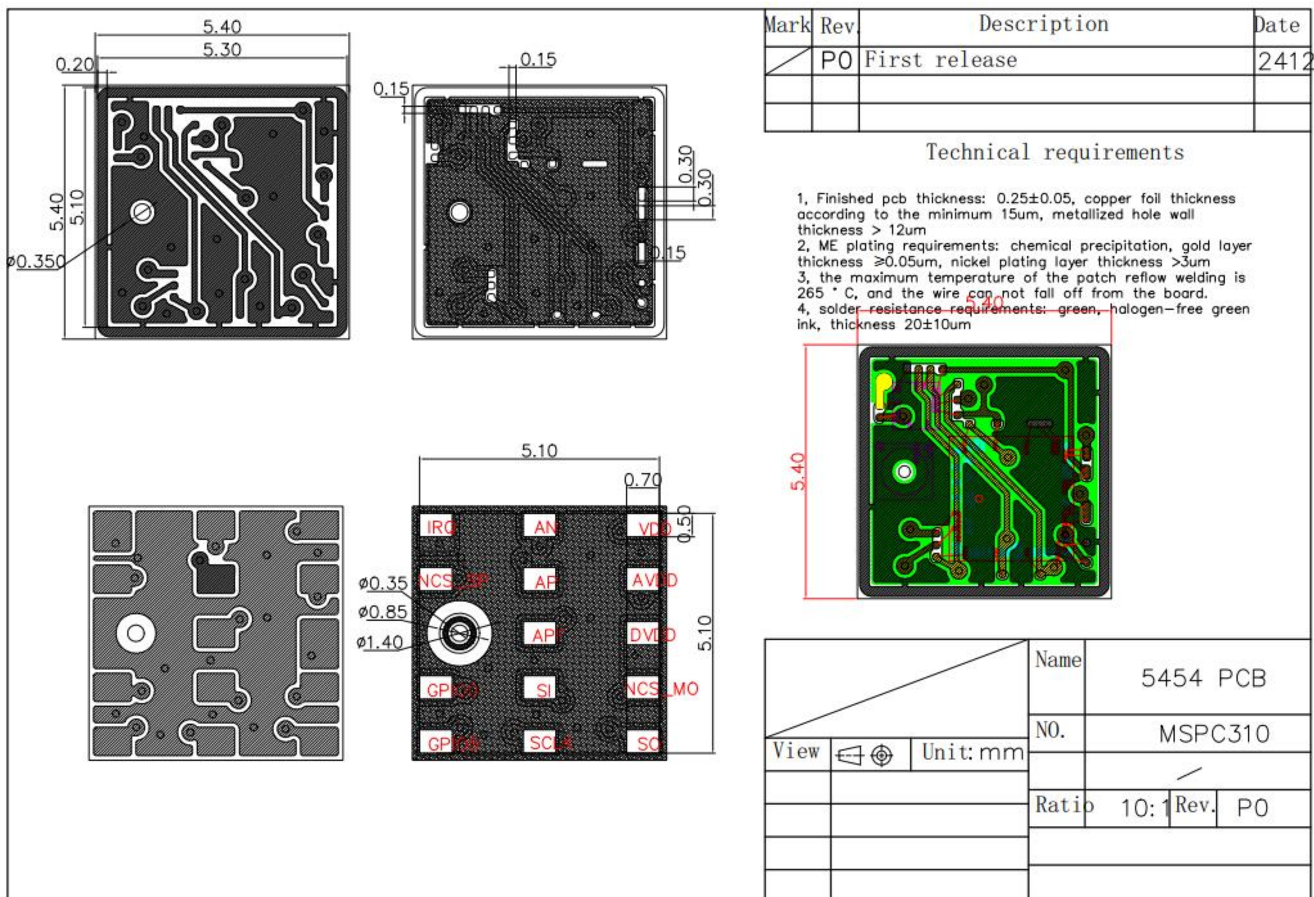


Figure 3-2 Spectrophone Package Drawing

3.4 Bonding Overview

The bonding overview will be used for the feasibility study from the packaging house.
Die sizes:

- MEMS: 1.2 mm x 1.2 mm
- Chimera TC1: 1 mm x 1 mm
- Monarch: 2.65 mm x 2.65 mm

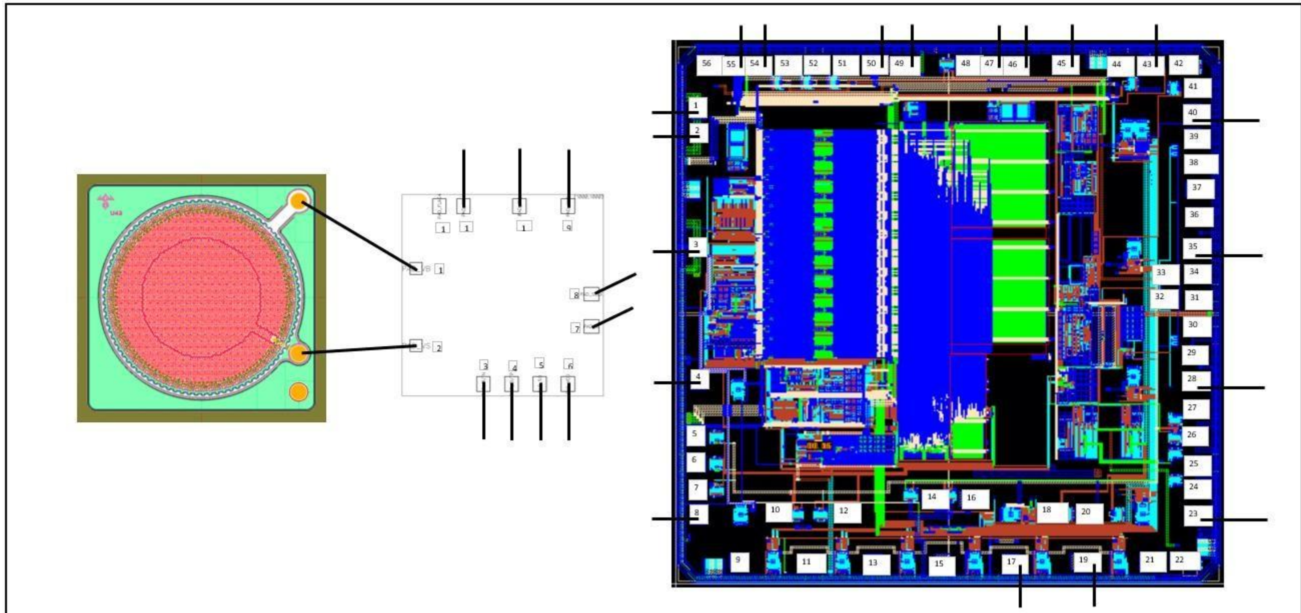


Figure 3-3 Spectrophone Bonding Overview

4. Typical Application

Spectrophone requires only five external passive components to operate.

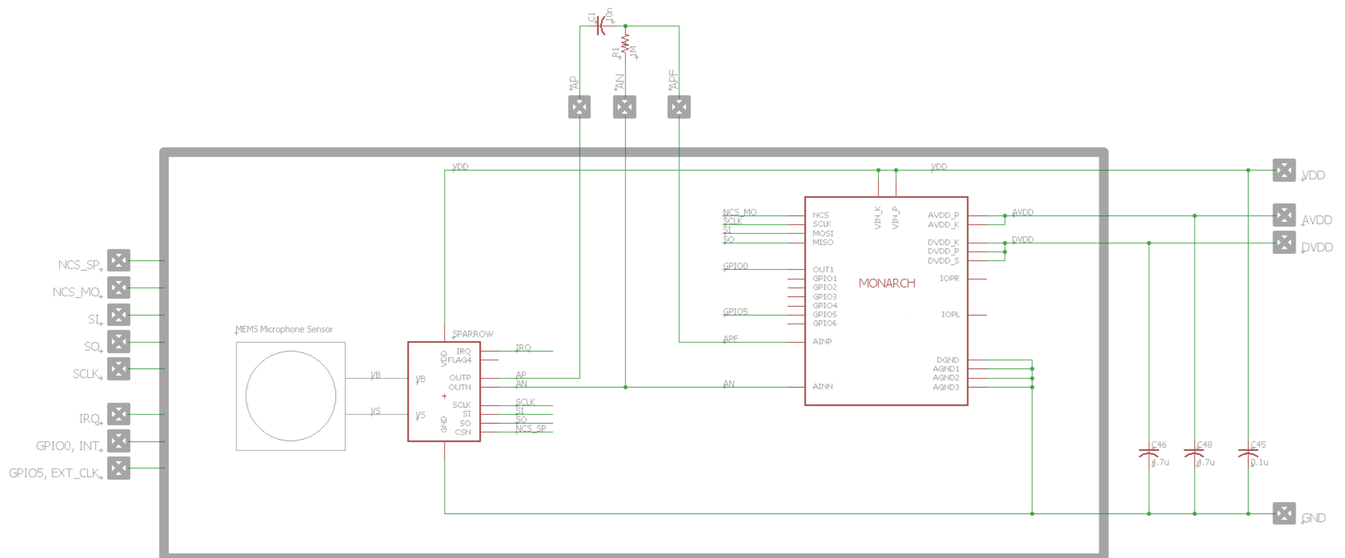


Figure 4-1 Spectrophone Typical Application Drawing

5. BOM Cost

	COST (cent)
Monarch die	28.5
Chimera TC die	3.5
MEMS	8.5
Packaging	20
Test	6
T&R	2
TOTAL (estimate)	**68.5**

Note: Estimated die cost based on 95 % yield and 24 USD per layer (Monarch 40, Sparrow 35), estimated test cost based on 6s test time (dual site), price for packaging and T&R are estimated ballpark numbers

6. Minimum acceptance criteria

- Same or better electrical and audio behavior than ChimeaLight PCB. (confirmed by lab measurements)

7. Timeline

Task	Due date
Bonding diagram available at packaging house	06.12.2024
Approved mini-DOS	27.12.2024
Approved blue prints for packaging	20.12.2024
Datasheet available	20.12.2024
Packaged parts available	06.02.2024*
Demo hardware available	06.02.2024*
Demo software available	06.02.2024*

*Estimate based on package start end of December 2024 and 4 weeks of production (3 weeks substrate making and 1 week packaging)

8. Abbreviations

KWS .... *Key Word Spotting*
MCM .... *Multi-Chip-Module*