Gas Sensors Comparison 2018

Bosch, ams & Sensirion

MEMS report by Audrey LAHRACH

October 2018 – version 1
Table of Contents

Overview / Introduction 5
- Executive Summary
- Devices Analyzed
- Reverse Costing Methodology

Company Profile 11
- ams
- CMOS Cambridge Sensor
- Bosch
- Sensirion

Physical and Cost Comparison

Structure, Process and Cost Review 21
- ams
  - AS-MLV-P2
    - Physical Analysis
    - Manufacturing Process
    - Component Cost Overview
  - CCS801 (Cambridge CMOS Sensor)
    - Physical Analysis
    - Manufacturing Process
    - Component Cost Overview
  - ams Component Comparison

- Bosch
  - BME680
    - Physical Analysis
    - Manufacturing Process
    - Component Cost Overview

- Sensirion
  - SGP30
    - Physical Analysis
    - Manufacturing Process
    - Component Cost Overview

Feedbacks 148
SystemPlus Consulting services 150
Executive Summary

System Plus Consulting has reviewed four different gas sensors from three manufacturers. We analyze and compare the AS-MLV-P2 and the CCS801 from ams, the BME680 from Bosch and the SGP30 from Sensirion. We provide insights into their structure, technical choices, design, processes, supply chain positions and costs.

Coming from industrial applications, ams’ AppliedSensor unit uses technologies that are reliable, robust, accurate and mature. Meanwhile, ams’ Cambridge CMOS Sensor subsidiary uses some of the latest technologies developed for the MEMS microphones to miniaturize devices.

The BME680 environmental sensor can detect a broad range of gases, including volatile organic compounds, using a smaller gas sensor die compared to competitor companies like ams and Sensirion.

SGP30 is Sensirion’s first multi-gas sensor. To reduce the component size, Sensirion placed the gas sensor above the application-specific integrated circuit (ASIC) and packaged it with the same molding compound, reducing the number of bonding processes, and increasing signal-to-noise ratio.

This report includes an analysis of the packaging and the sensor die along with a cost analysis for all devices. Finally, we compare devices to highlight their manufacturers’ technical choices.
Devices Analyzed – Gas Sensor

- **AS-MLV-P2** (2015)
- **CCS801** (2015)
- **SGP30** (2017)
- **BME680** (2017)

Not to scale

**Gas Sensor – MEMS Only**

**ASIC & Gas Sensor on the same die.**

**Environmental sensor**

(MEMS: - Humidity, Temperature & Pressure

+ ASIC - Gas)
Package Views & Dimensions

- **Package:** xxx 4-pin (xxx)
- **Dimensions:** 9.2 x 9.2 x 4.6mm
- **Marking:**
  - AS-MLV-P2
  - SN14006849

**Dimensions**

- 1: Sensor electrode 1
- 2: Heater 1
- 3: Sensor electrode 2
- 4: Heater 2

**Package Views**

- **Package Top View**
- **Package Bottom View**
- **Package Side View**

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**Physical Analysis**
- **ams**
  - AS-MLV-P2
    - Physical Analysis
    - Process
    - Component Cost
  - CCS801
    - Physical Analysis
    - Process
    - Component Cost
- **Bosch**
  - BME680
    - Physical Analysis
    - Process
    - Component Cost
- **Sensirion**
  - SGP30
    - Physical Analysis
    - Process
    - Component Cost

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**Package Opening**

**Physical Analysis**
- **ams**
  - AS-MLV-P2
    - Physical Analysis
      - Process
      - Component Cost
  - CCS801
    - Physical Analysis
      - Process
      - Component Cost
- **Bosch**
  - BME680
    - Physical Analysis
      - Process
      - Component Cost
- **Sensirion**
  - SGP30
    - Physical Analysis
      - Process
      - Component Cost

**PCB**
- xxx x layers
- 9.2x9.2mm
- Thickness: xmmm

**Cap**
- Cap in xxx
- Diameter: xxxmm
- Height: xmmm
- Thickness: xxxµm
- Weight: xxg

**Membrane**
- The Protection Membrane is assembled with x xxxx xxxx.

**Gas Sensor**
- Material: xxxx + xxxx
- Diameter: xmm
- Thickness: xxmmm
The cap is xxxx with the package.
Die Overview & Dimensions

- Die Area: \( xx \text{ mm}^2 \)  
  
- Nb of PGDW per 8-inch wafer: \( xxxx \)  

- Pad number: \( x \)  
  
  The die marking includes the logo of Cambridge CMOS Sensors and:

  \( xxxx \)
Metal Oxide Film & Gas Sensor

Physical Analysis
- ams
  - AS-MLV-P2
    - Physical Analysis
    - Process
    - Component Cost
  - CCS801
    - Physical Analysis
    - Process
    - Component Cost
- Bosch
  - BME680
    - Physical Analysis
    - Process
    - Component Cost
- Sensirion
  - SGP30
    - Physical Analysis
    - Process
    - Component Cost

Physical, Cost & Price Comparison

Company Profile & Supply Chain

Overview / Introduction

Physical Analysis

Physical, Cost & Price Comparison

Related Reports

About System Plus

The xxxxx film is connected to the sensor pads.
The xxxxx and the xxx perform a xxxxxxx xxxxxxx.
The xxxxx value changes with the concentration of VOC in the xxxxx.
The xxxxx is xxx.
The xxxxx resistor = xx% of the die area.
Gas Sensor – Process Flow (3/3)

Electrode

• Lithography x
• xxxx etching xxx/xxxx
• Xxxx deposition

Cavity

• Backgrinding
• xxxx deposition
• Lithography x

Cavity

• xxxx

Physical, Cost & Price Comparison

Related Reports

About System Plus
SGP30 MEMS Gas Die Cost

The BME680 MEMS Gas die cost is estimated to be $xxxx.

- The **Front-End cost** represents xx% of the component cost.
- The **Back-end (Probe Test & Dicing)** represents xx% of the component cost.
- The **Yield Losses cost** represents xxx% of the component cost.
SGP30 Component Cost

The Component cost is estimated to be $xxxx.

- The **ASIC/MEMS Gas Die cost** represents xx% of the component cost.
- The **Packaging cost** represents xx% of the component cost (assembler profit included)
- The **Final Test & Calibration cost** represents xx% of the component cost.
- The **Yield Losses cost** represent xx% of the component cost.
MEMS Die Cost Comparison

The MEMS Die cost is estimated at $xxx xxxxxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx.
Related Reports

REVERSE COSTING ANALYSES - SYSTEM PLUS CONSULTING

PACKAGING
• Sensirion SGP30 Gas Sensor
• Bosch BME680 Environmental Sensor with Integrated Gas Sensor
• SciO Molecular Sensor from Consumer Physics: Mobile Spectrometer Dongle
• Hamamatsu C12880MA Micro-spectrometer

MARKET AND TECHNOLOGY REPORTS - YOLE DÉVELOPPEMENT

ADVANCED PACKAGING
• Status of the MEMS Industry 2018

PATENT ANALYSIS - KNOWMADE

PACKAGING
• Miniaturized Gas Sensors Patent Landscape
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