Advanced MEMS and Microsystems

Dr. Danick Briand & Prof. Guillermo Villanueva

Course content and schedule

Dates	Topics	Lecturers
18.02	Introduction Transducers review: pre-recorded lectures	D. Briand / G. Villanueva
25.02	Sensors part I Exercices	D. Briand
04.03	Sensors part II Industrial seminar #1	D. Briand
11.03	Students presentations	D. Briand / G. Villanueva
18.03	Actuators and Optical MEMS Industrial seminar #2	D. Briand
25.03	Acoustic and Ultrasonic MEMS Industrial seminar #3	G. Villanueva
01.04	RF-MEMS	G. Villanueva
08.04	NEMS	G. Villanueva
15.04	Interactive session	D. Briand / G. Villanueva
29.04	Thermal and gas sensors Industrial seminar #4	D. Briand
06.05	Packaging	D. Briand
13.05	Packaging Industrial seminar #5	D. Briand
20.05	PowerMEMS Industrial seminar #6	D. Briand
27.05	Quiz + oral exam instructions Evaluation of the course	All

Announcements

TODAY 15 April 2025

- Interactive Session

WEEK 29 April 2025

- Danick Briand will take over on Thermal microsystems and Gas Sensors
- Industrial Seminar 4 – APIX

WEEK 6 May 2025

- Lecture on MEMS packaging
- Hand-In Answers to Questions on Industrial Seminar 4 – APIX

Interactive Session

Danick Briand & Guillermo Villanueva

EPFL – STI – IGM

Interactive Session

Phase 1: Experts (45 min)

- **Form 4 Groups of ~3-4 People**
- **4 Topics are attributed**
- **Discuss the topic presented and answer the questions.**
- **Individuals are now ‘ambassadors’ of their topic.**

Phase 2: Experts explain to Non-Experts (40 min)

- **Re-Shuffle: Form 4 Groups consisting of 1 expert from each topic each.**
- **Each expert explains the topic to the 3 other non-experts**

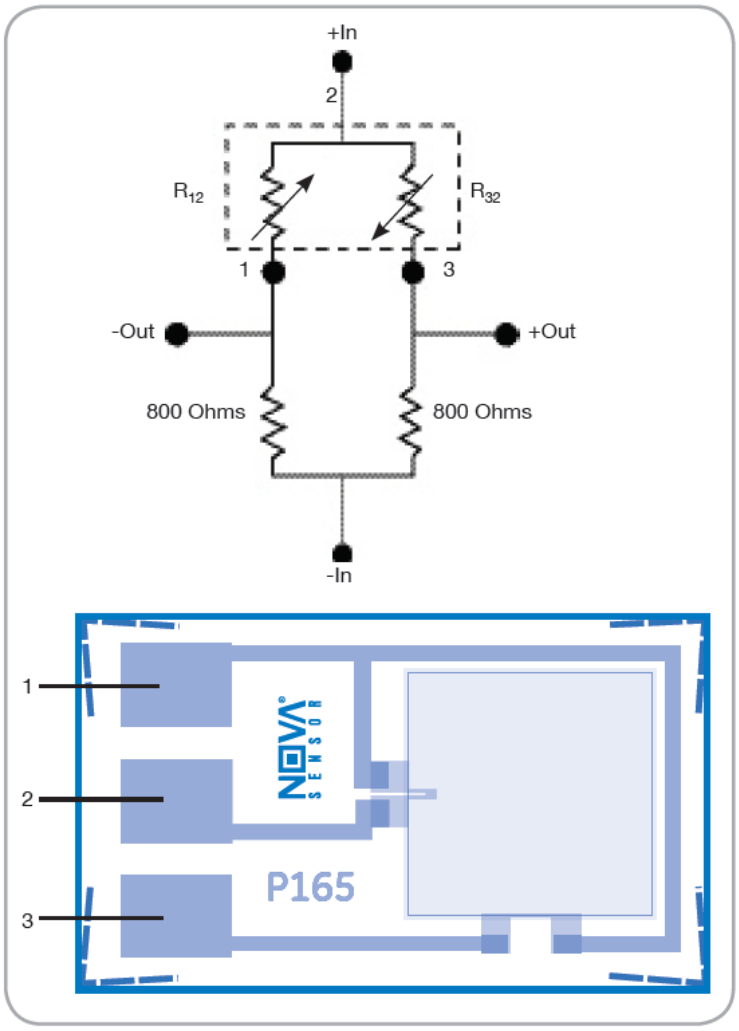
Phase 3: Re-Group (10 min)

- **Re-form the initial groups.**
- **Re-assess the initial findings (any questions, new info that might have come up)**

Phase 4: Questions & Answers by topic (4 x 10 min)

- **Everybody is welcome to ask questions, precisions**
- **Teachers are welcome as well to ask questions**

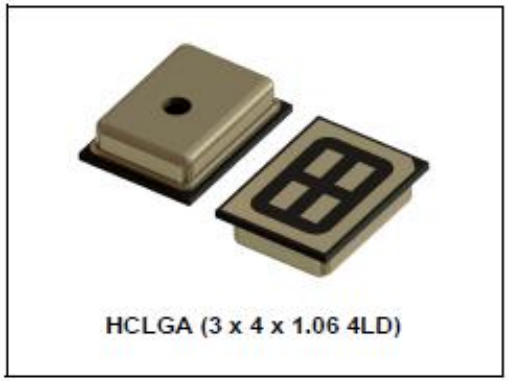
Topic 1

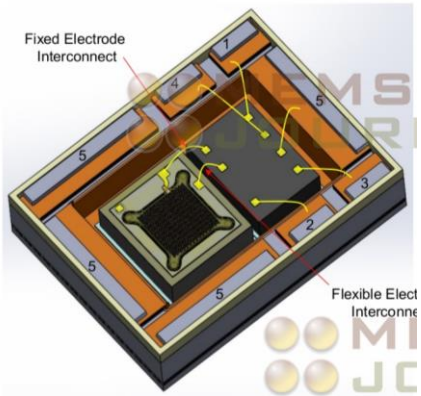


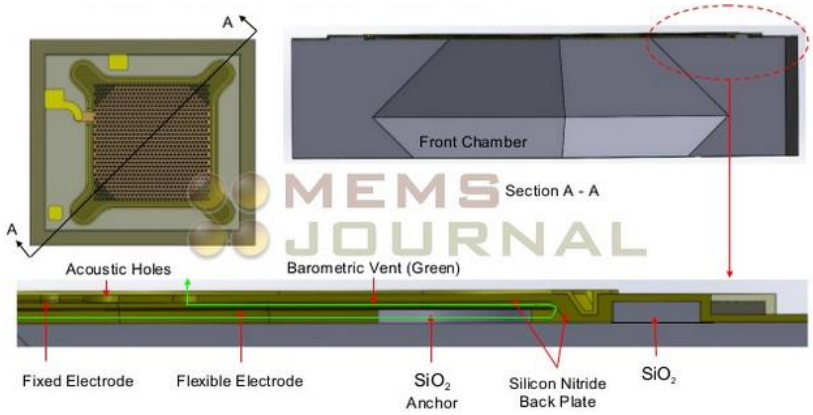
Die dimensions (l x w x h): 1150 µm x 725 µm x 170 µm,
Pad Size: 200 x 150 um, Pad Material: Au
P165 schematic diagrams

- **The figure to the left from a data sheet. https://www.amphenol-sensors.com/en/novasensor/pressure-sensor-die/3387-p165**
- **What is it?**
- **How does it work?**
- **What is the readout mechanism and why?**
- **Why are the resistors placed in this way?**
- **How is it made?**
- **What are approximate membrane dimensions? Why?**
- **What is presumably the wafer orientation?**
- **What is the intended use for the sensor (applications)? Discuss MEMS suitability for these applications.**

Topic 2

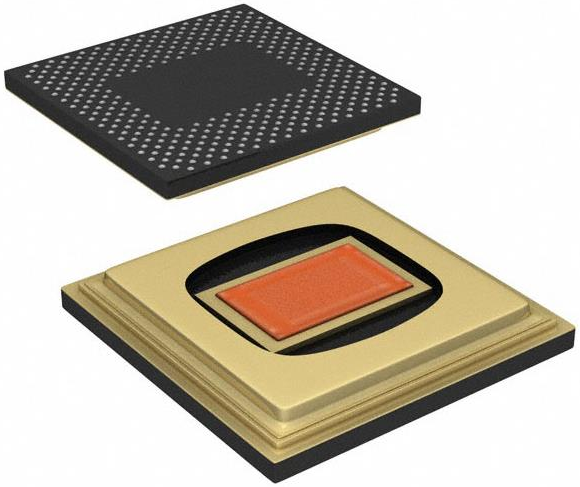


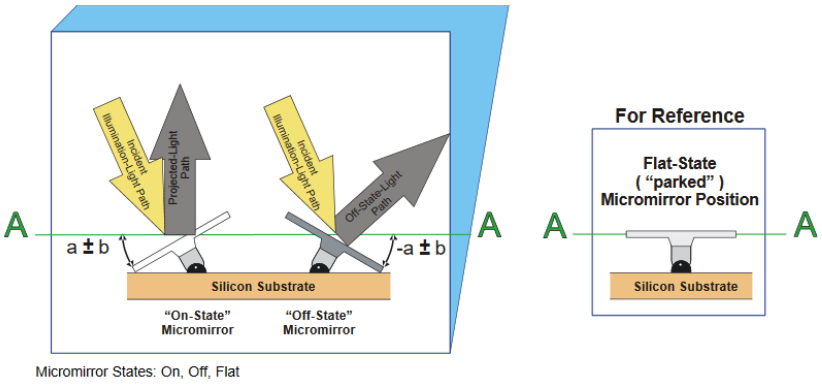




- **The top figure is from a datasheet (*https://www.st.com/resource/en/datasheet/mp34dt01-m.pdf*), the two bottom figures from a reverse engineering report (https://www.slideshare.net/MikePinelisPhD/stmicroelectronics-mems-microphone-reverse-engineering-analysis)**
- **What is it?**
- **How does it work?**
- **What is the readout mechanism and why?**
- **How is it made?**
- **What are approximate membrane dimenions? Why?**
- **What is presumably the wafer orientation?**
- **What is the intended us for the sensor (applications)? Discuss MEMS suitability for these applications**

Topic 3

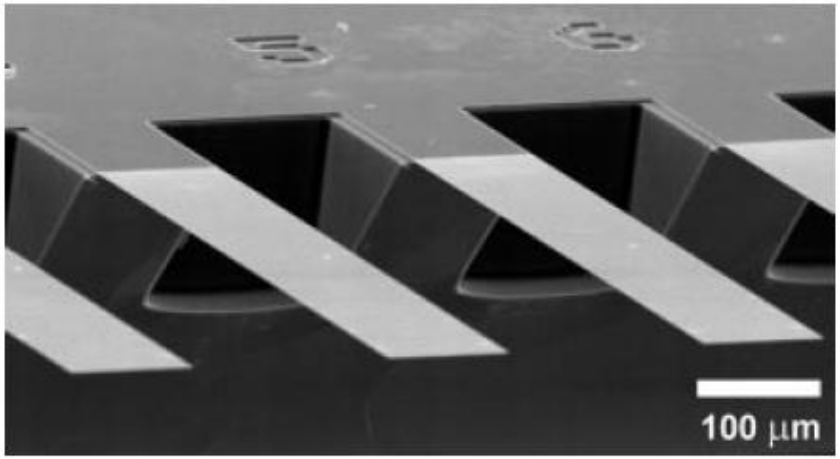


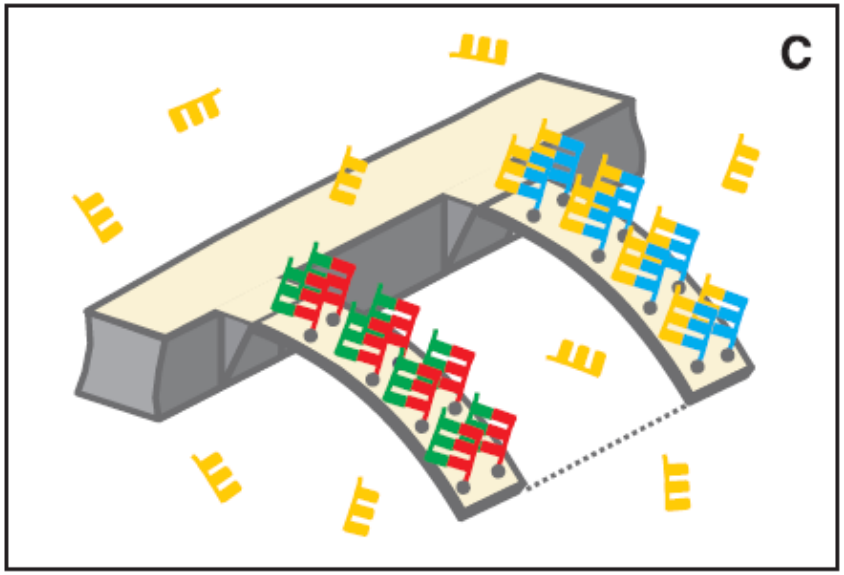


Micromirror States: On, Off, Flat

- **The top figure is from from the digikey product list https://www.digikey.com/product-detail/en/texas-instruments/DLP9000XBFLS/296-48269-ND/6595649 and the bottom figure from a data sheet. http://www.ti.com/lit/ds/symlink/dlp9000x.pdf**
- **What is it?**
- **How does it work?**
- **What is the actuation mechanism and why?**
- **How is it made?**
- **What are approximate dimensions? Why?**
- **What are important key data in the datasheet?**
- **What is the intended use (applications)? Discuss MEMS suitability for these applications**

Topic 4





- **The figures are from a paper:**

https://www.science.org/doi/10.1126/science.288.5464.316

- **What is it?**
- **How does it work?**
- **What is the readout mechanism and why?**
- **How is it made?**
- **What are approximate dimensions? Why?**
- **How would you optimize performance?**
- **Why are there more than 1 cantilever?**