Foundry solutions for medical semiconductor sensors

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X-FAB Silicon Foundries SE
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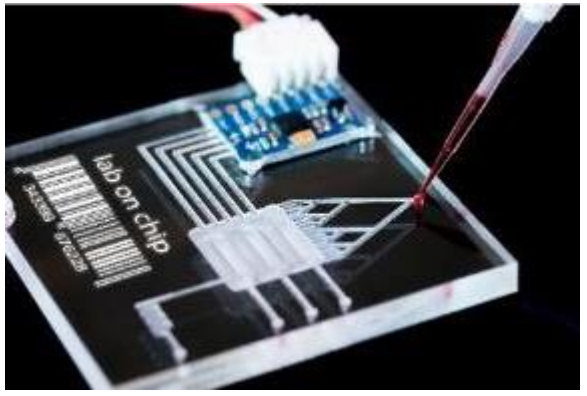
Who we are

- We are a specialty foundry **offering a unique combination** of analog/mixed-signal, high-voltage and embedded non-volatile memory options with sensor and actuator integration.
- We support **long product lifecycles of 20+ years** and focus on automotive, industrial and medical end markets.
- We provide **best-in-class design** and **prototyping support** to enable first-time-right design.
- All of our sites are **automotive certified**.

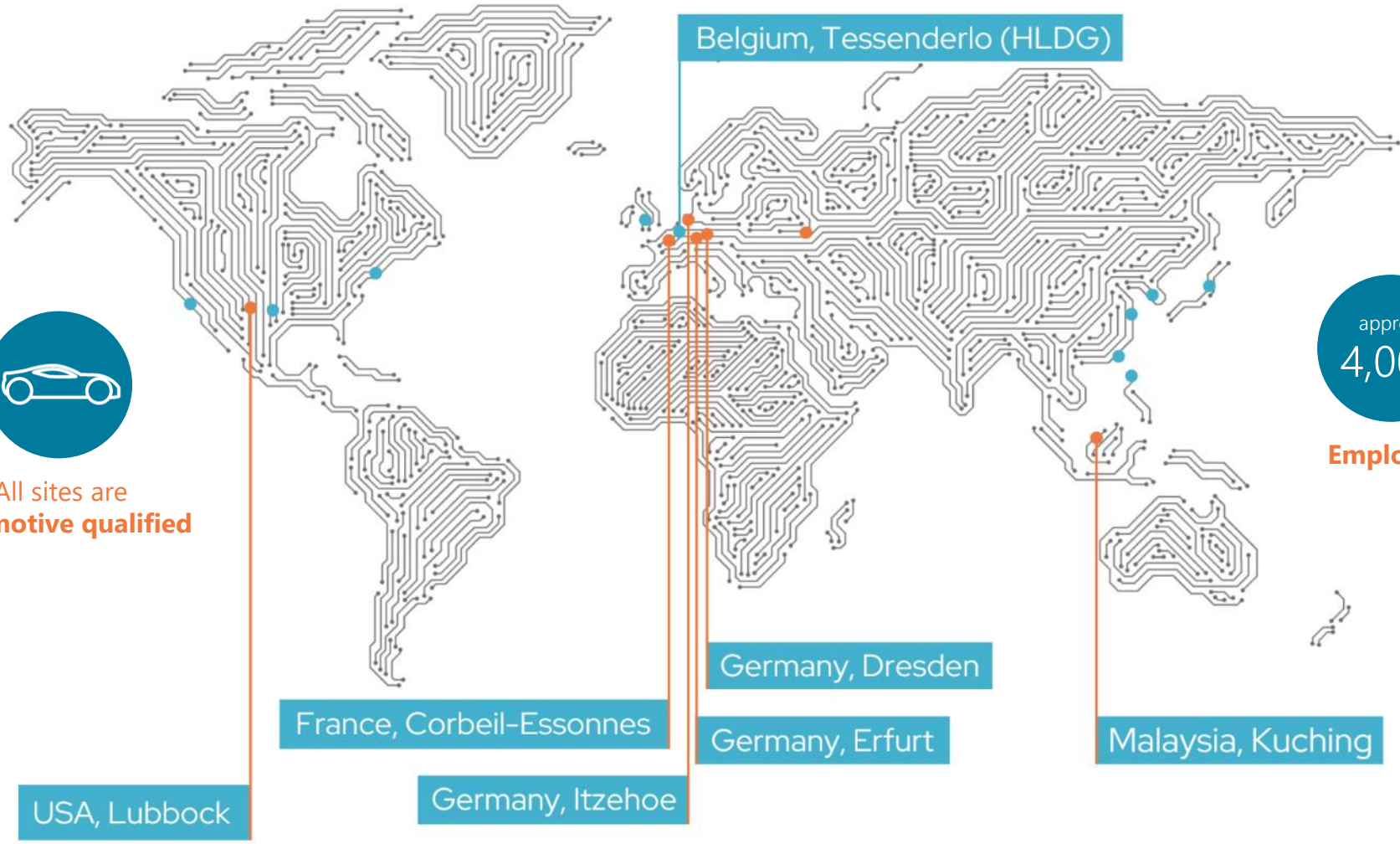


X-FAB at a glance

6
Manufacturing facilities

All sites are **automotive qualified**

420
Customers in 4 key markets



100,000
Wafer starts per month*

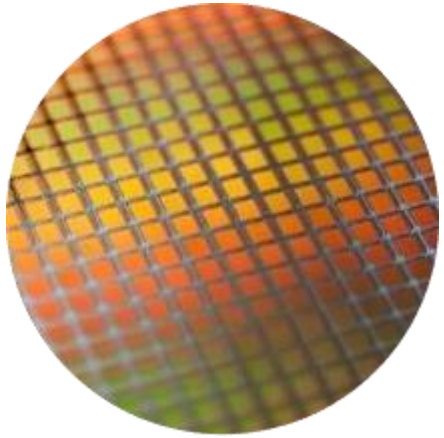
approx. **4,000**
Employees

658 million $
Revenue 2021

Fabs/subsidiaries Sales offices

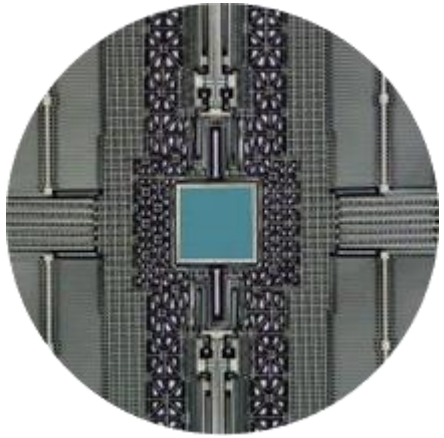
* 200mm equivalent

Technology portfolio



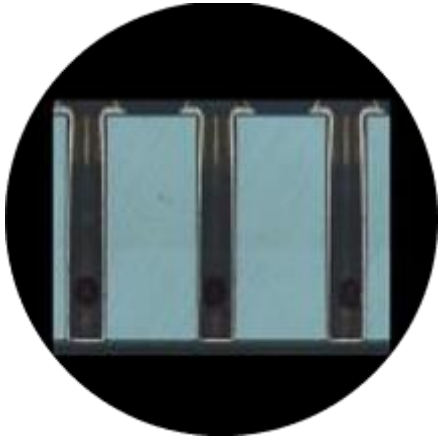
CMOS & SOI

13 process families with over 450 options



MEMS

MEMS with or without integrated CMOS



Heterogeneous integration

3D integration and wafer level package solutions

SiC & GaN

First 6-inch SiC foundry offering worldwide

Medical electronics

X-FAB enables medical products for diagnostics, therapy and analysis

Personal medical devices

- Pacemakers
- Hearing aids
- Infrared thermometer
- Glucose meters
- Blood pressure monitors
- Cochlear implants
- Retina implants
- Cardioverter defibrillators
- Deep brain stimulators

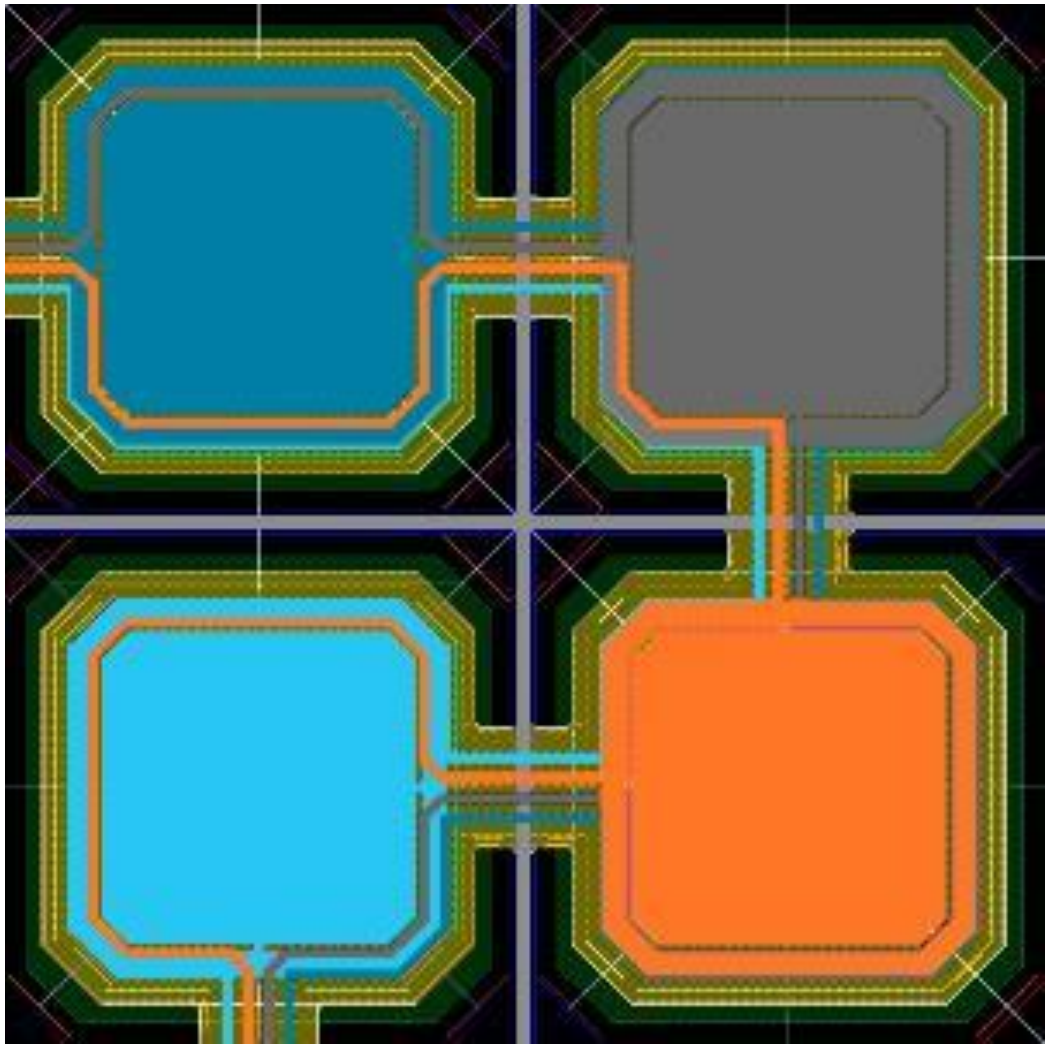
Medical equipment

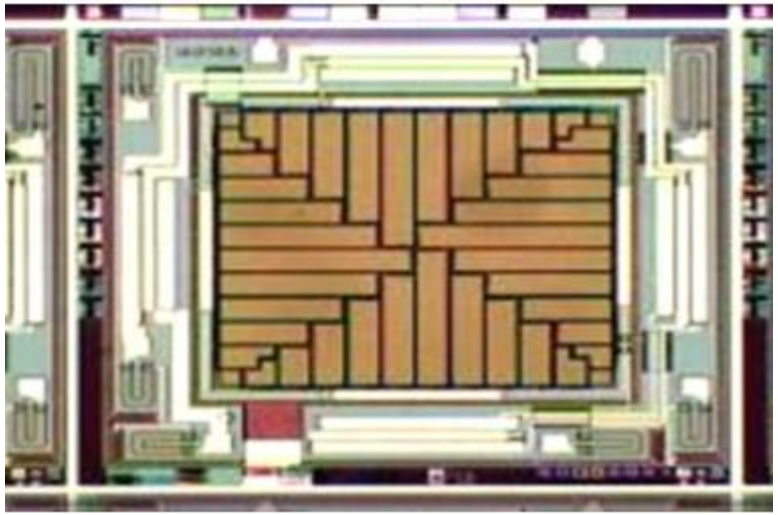
- Ultrasound probe heads
- X-ray sensors
- Computed tomography
- Positron Emission Tomography
- Temperature measurement
- Pressure sensors
- Motor drivers
- Gas and liquid flow control

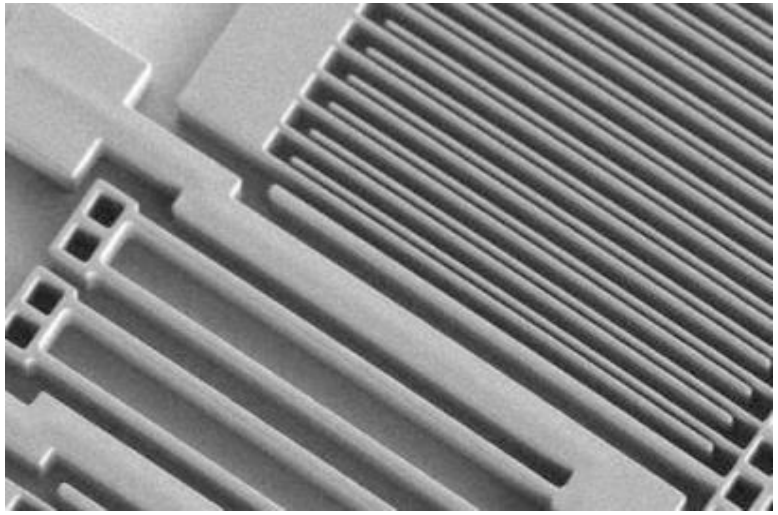
Lab-on-a-chip

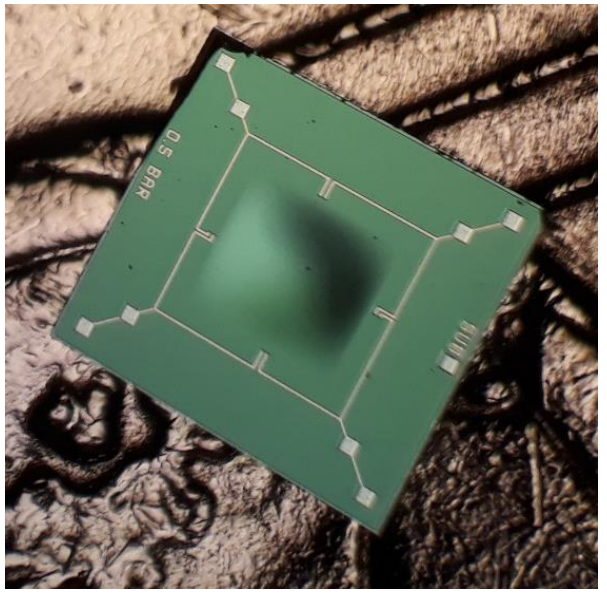
- DNA sequencing
- DNA synthesis
- Cancer cell sorting
- Sepsis detection
- Allergy testing
- Patch clamps
- Inhaler nozzles
- On-chip PCR
- In vitro diagnostic

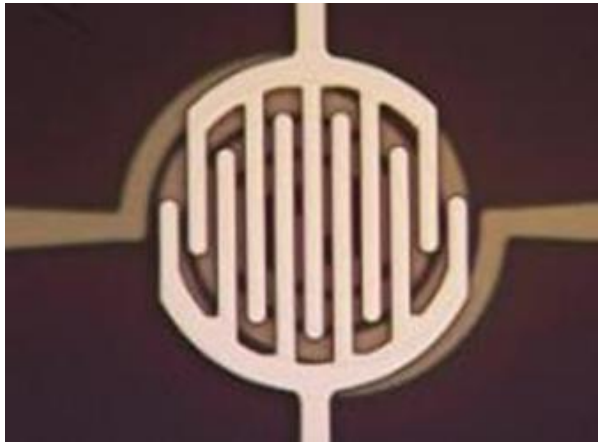
Sensors for medical applications





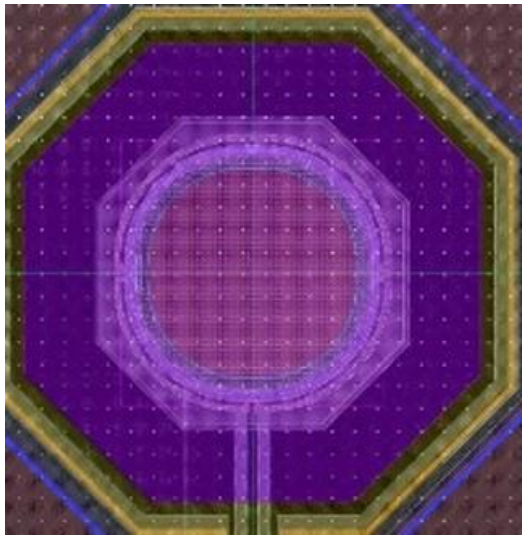


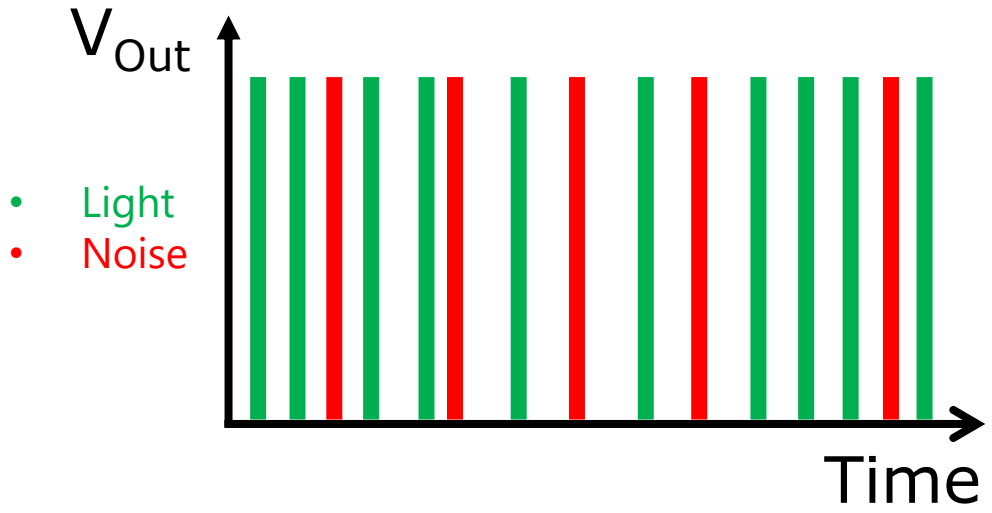


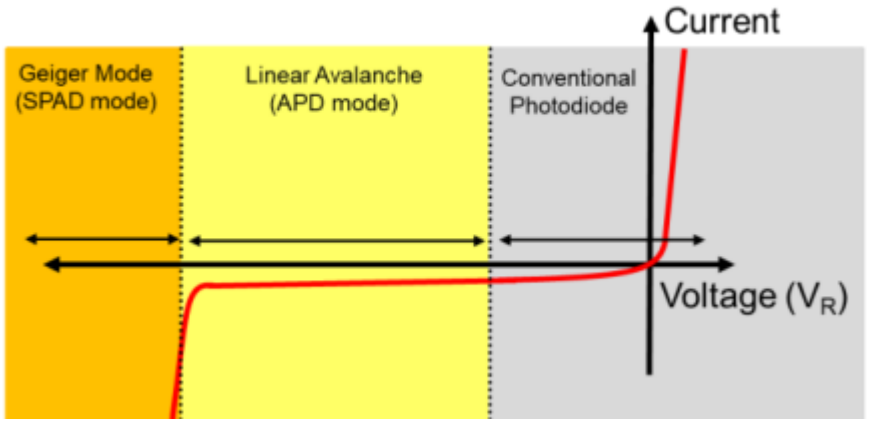


Avalanche Photodiodes / Single-Photon Avalanche Diodes

- SPAD is a photodiode reverse biased above the breakdown voltage
- Very sensitive devices with very fast response time
  - Enable possibility to count single photons
- Integrated in 180 nm mixed-signal CMOS process
  - Enable arrays of SPADs, parallelism and on-chip data processing
- Suitable for photon detection or acquisition of timing information





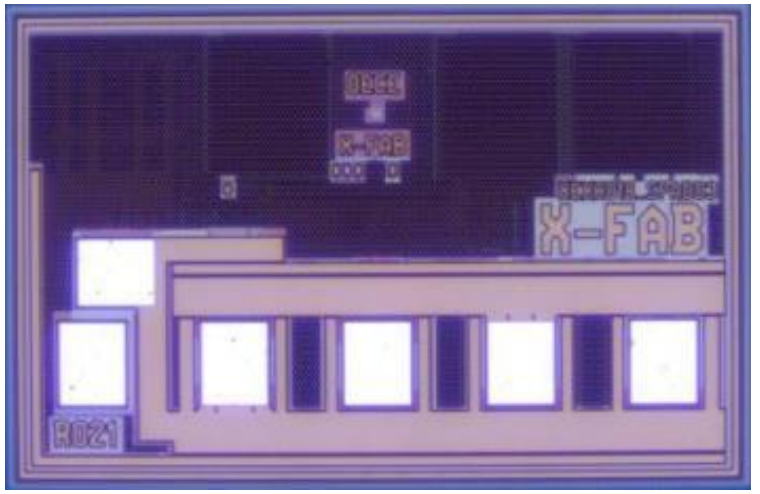


Life-sciences applications of APD/SPAD

- Fluorescence lifetime imaging
- Single-molecule fluorescence spectroscopy
- …

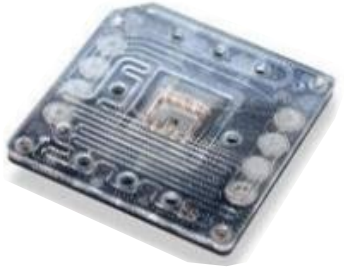
- Each application has its own special requirements on
  - noise behavior of the SPAD sensor
  - timing performance

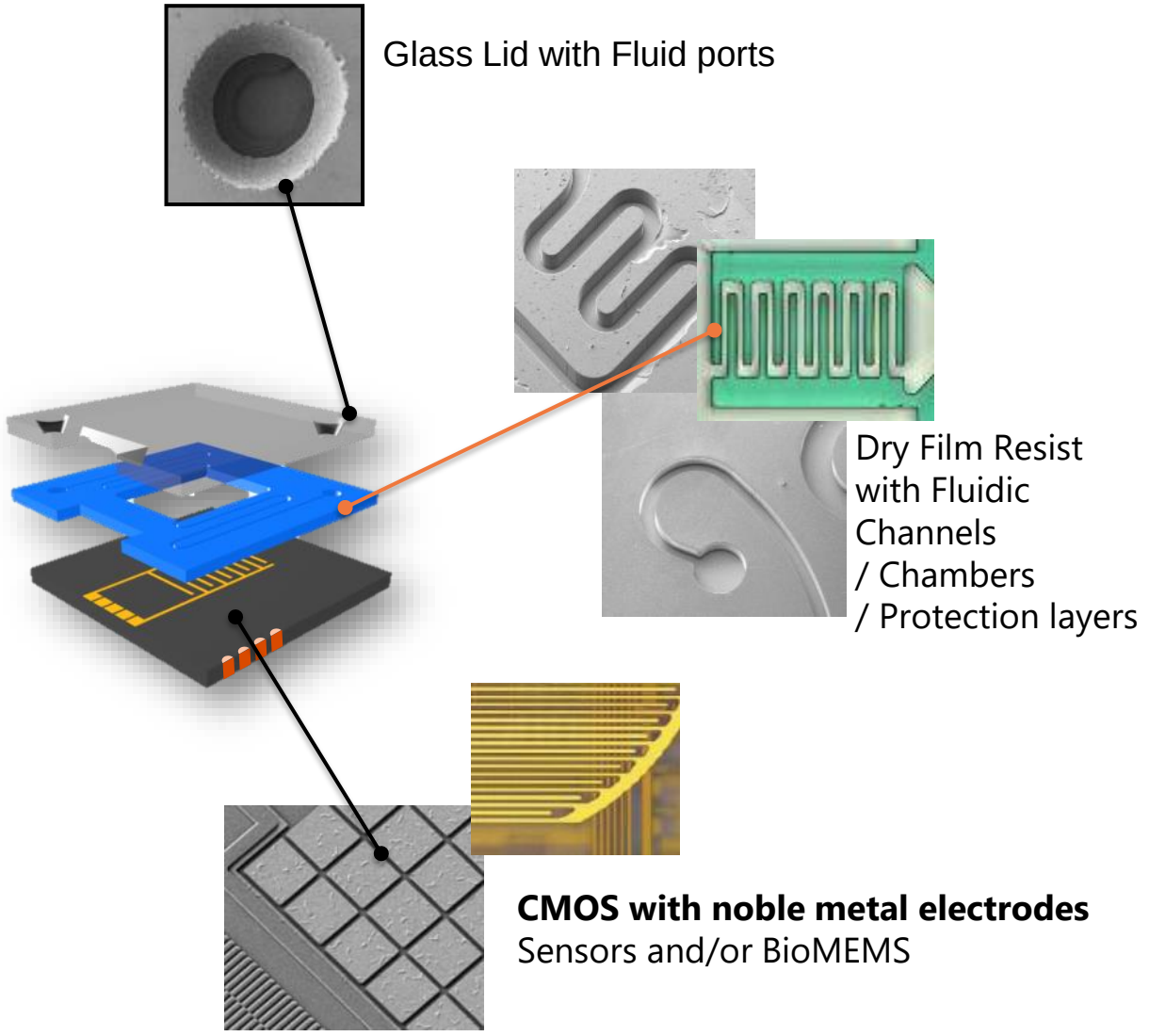
- Key features of X-FAB's APD/SPAD
  - High sensitivity and photon detection probability from UV up to NIR
  - Application evaluation kit
  - SPAD design library
  - Optical and electrical models for IC simulation



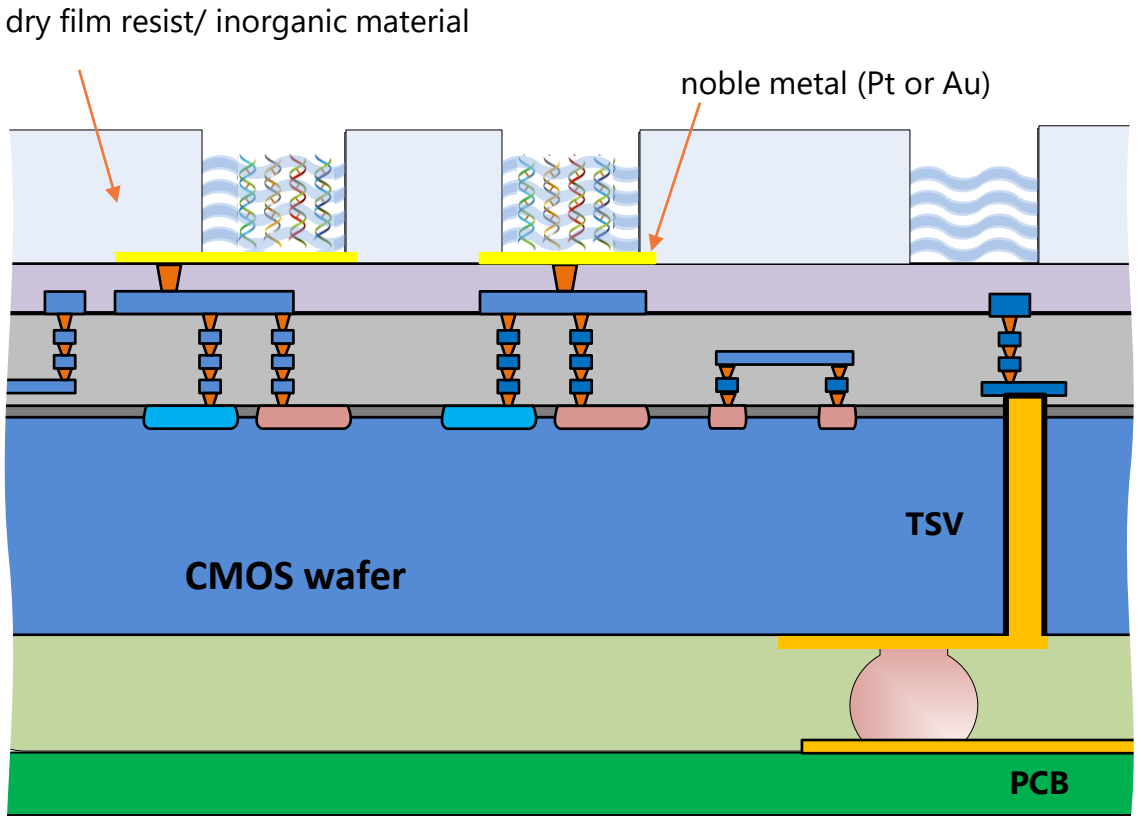
Biosensors for Lab-on-a-chip applications

- Microsystems to handle tiny quantities of fluids
- On-Chip combination of electronics with microfluidic structures and surfaces
  - Integrated on CMOS/SOI ASIC
  - Noble-metal electrodes forming the interface to the bio probe
  - Controlled surface and wetting properties
  - Dry-film resist layer with fluidic structures
  - Glass lid to form cavity
- Detect electro chemical reactions on top of electrodes





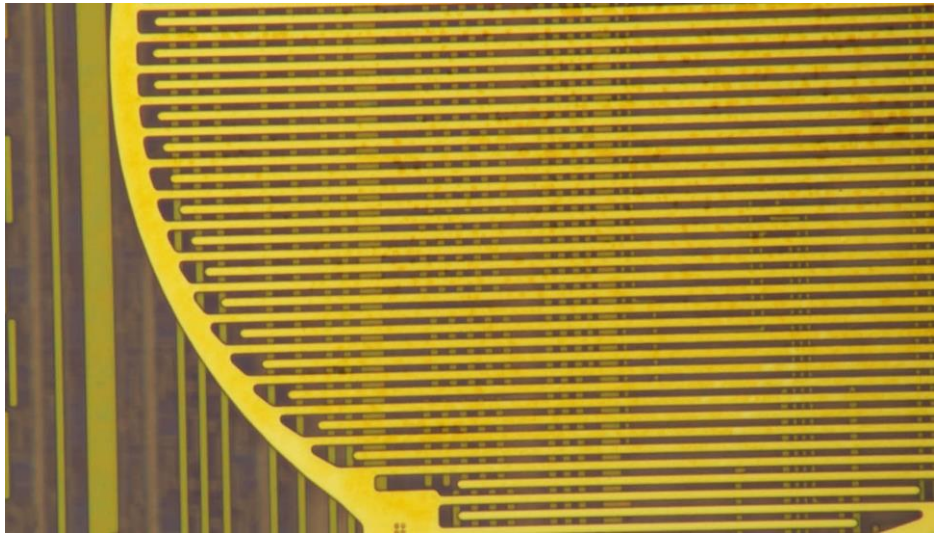
Application-specific device setup

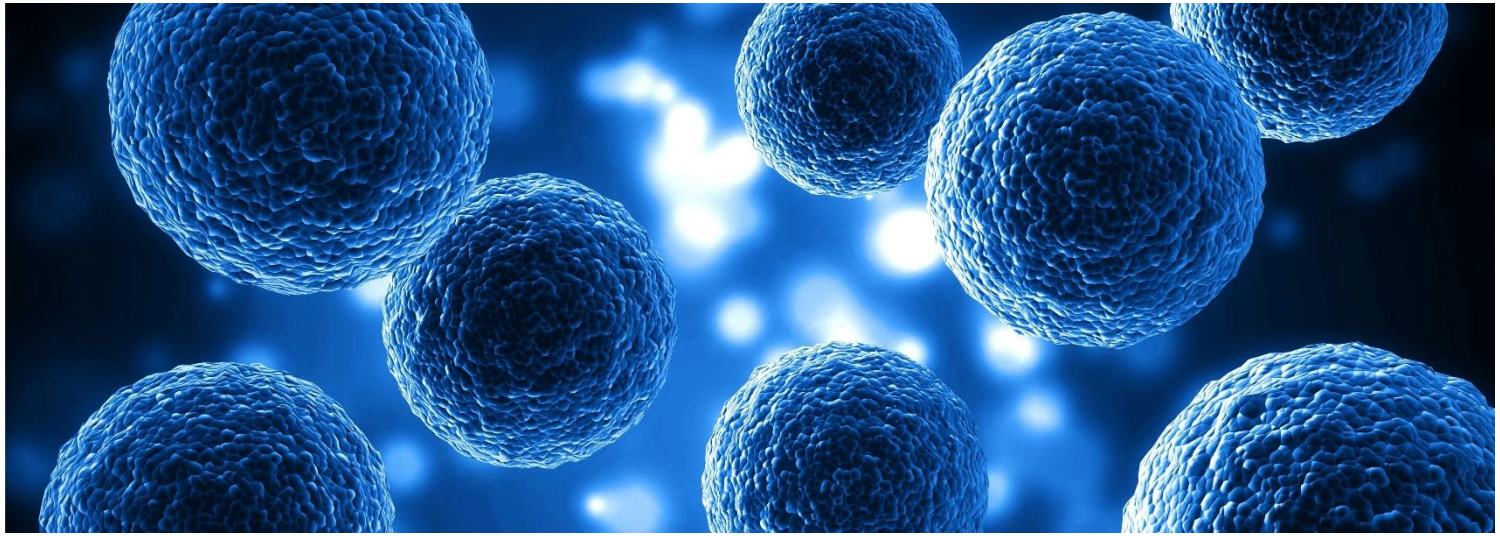


- Mixed-signal 350 nm and 180 nm analog/mixed-signal CMOS/SOI technology
- Tailored passivation interface and noble-metal electrodes
  - Integrated tungsten through passivation vias
  - Deposited and patterned of noble metals (Pt or Au)
- Post processing to create microfluidic structures on top
- Must be compatible with
  - Product finalization (Dicing, bonding, Through Silicon Vias, plastic molding)
  - Biofunctionalization, cells attachment
  - Fluidic environment during usage (for cells cultures, for DNA detection, immunoassays)

Applications of biosensors

- Point-of-care (POC) testing for viral and microbiological diagnostic
- Analysis of single molecules, including DNA, RNA and proteins.
- Micro Electrode Arrays for electrical cells monitoring





Summary

- Integrated sensors offer the option to record various physiological parameters
- Development of medical sensors requires knowledge of both, sensors and biology
- Sensors from semiconductor foundries can be the starting point for medical products

Your foundry partner for medical products

Thank you.

Meet us in Hall C3, booth C3.452

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