



**Philips MEMS & Micro Devices**

# MEMS Devices and Manufacturing for Medical Applications

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Semicon Europa

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innovation  you

# Philips MEMS & Micro Devices (MMD)

## For Innovators – from Prototype to Production



MEMS Foundry - 200mm Wafers  
2650 m<sup>2</sup> Cleanroom

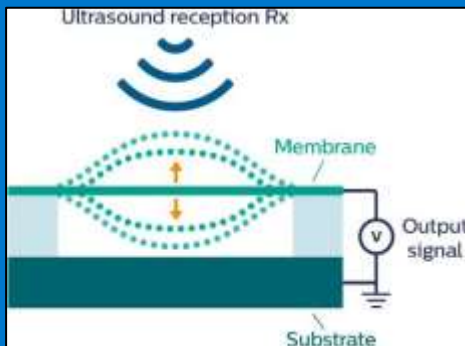
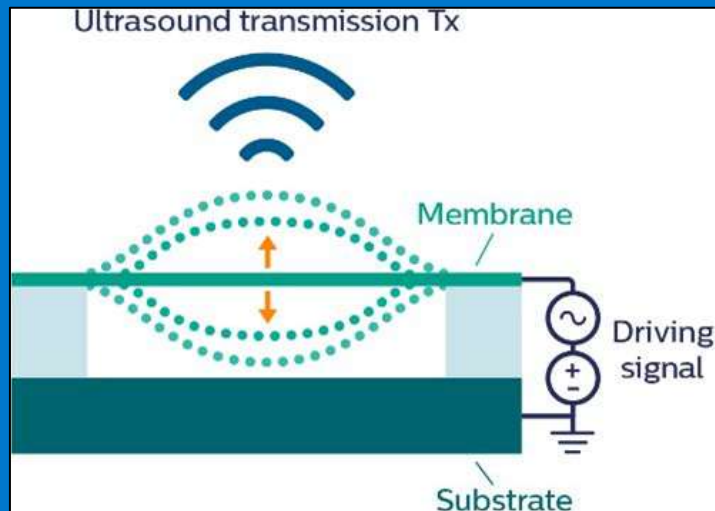


Micro Device Assembly - Die and PCBA level  
3500 m<sup>2</sup> Manufacturing

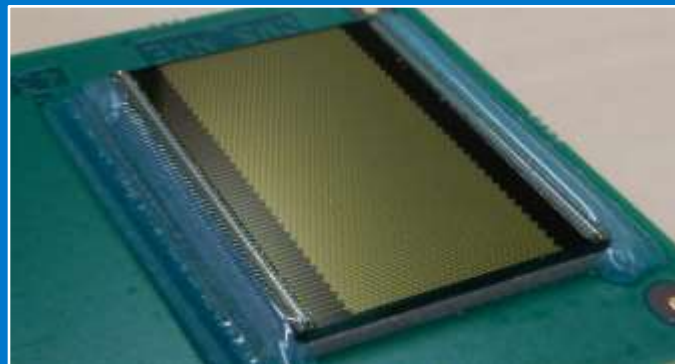
# Hand-held Ultrasound Imaging for Medical Applications



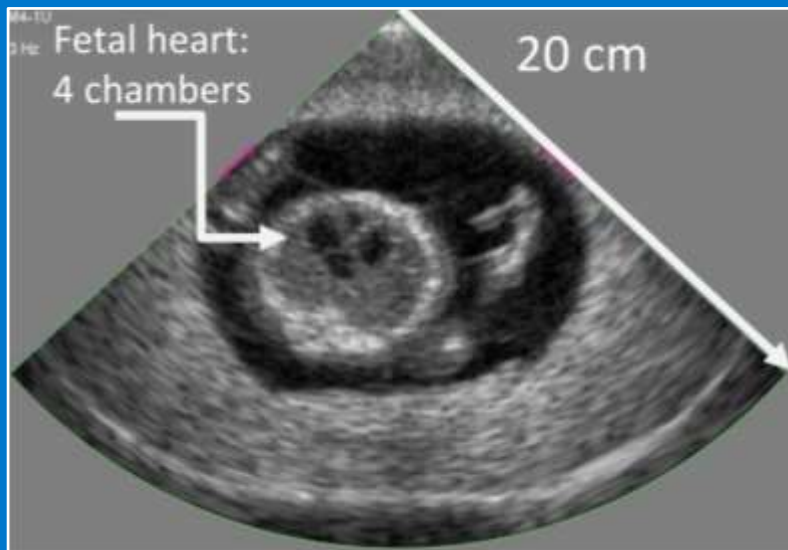
# Capacitive Micro-machined Ultrasound Transducer (CMUT)



CMUT Array



# Embryonic Monitoring with CMUT

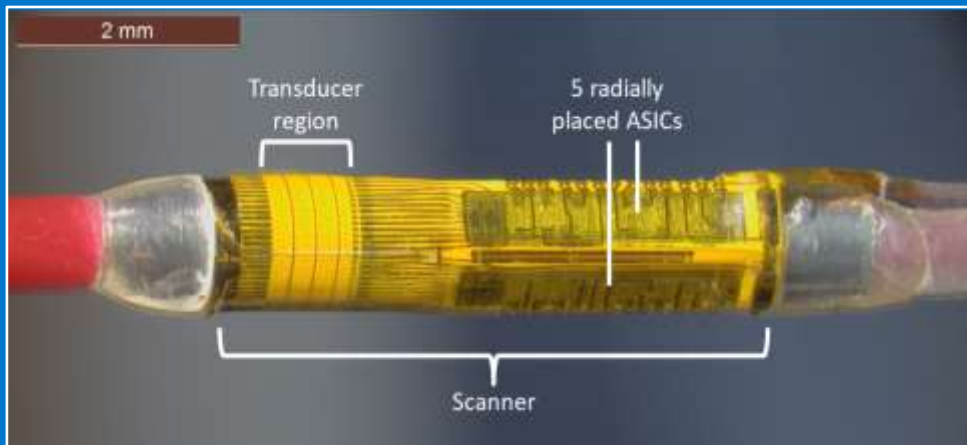


24 weeks phantom



# Ultrasound Imaging for In-body Applications

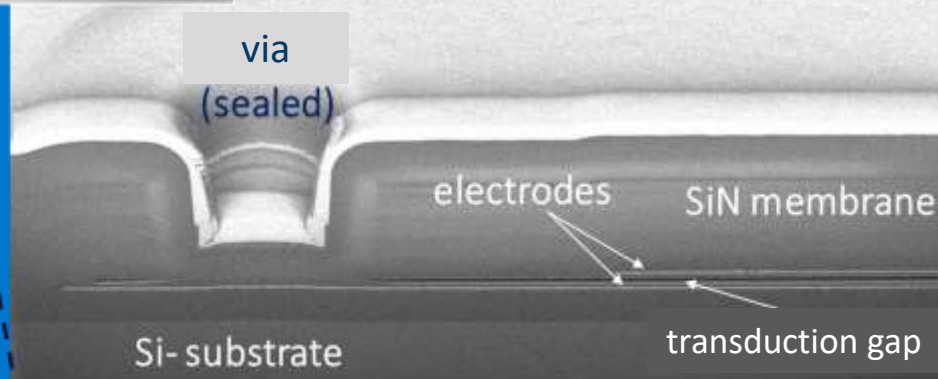
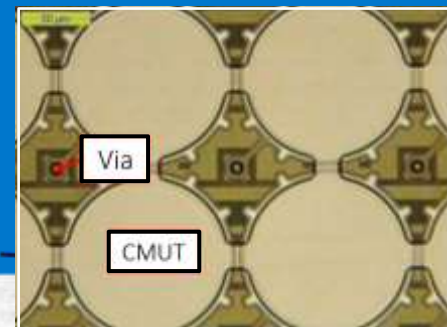
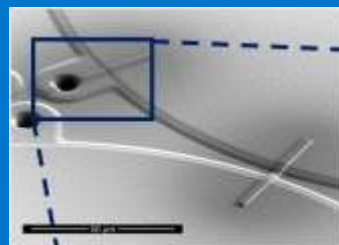
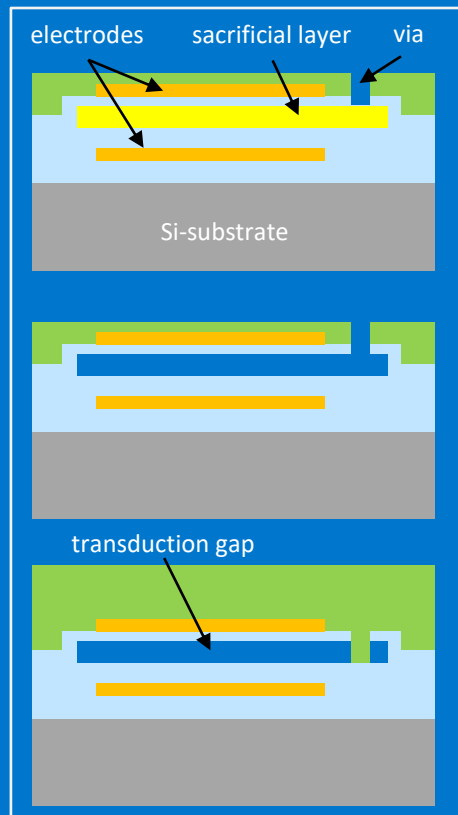
## The Micro Assembly Challenge



Philips Eagle Eye Ø 1.2mm Catheter

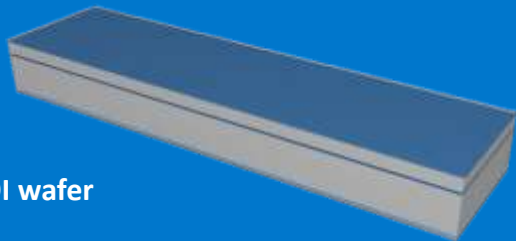


# CMUT Membrane Manufacturing



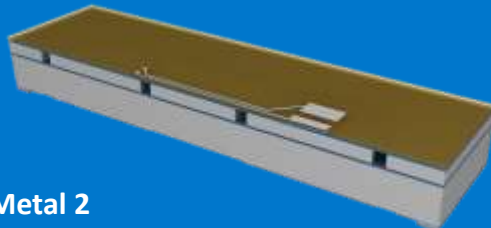
# Flex-to-Rigid (F2R) CMUT Wafer Fabrication

**SOI wafer**



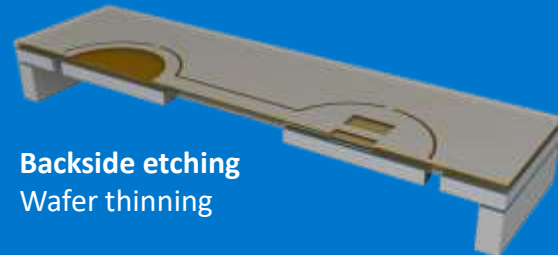
**Metal 2**

Interconnect between Silicon parts



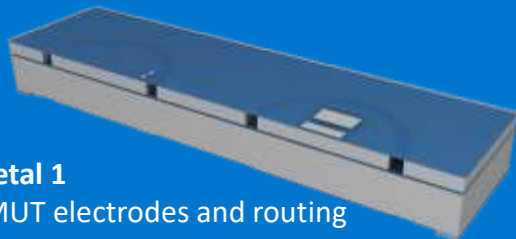
**Backside etching**

Wafer thinning



**Metal 1**

CMUT electrodes and routing



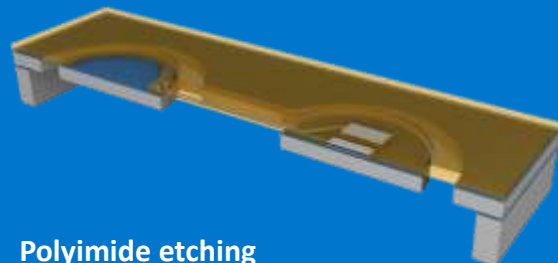
**Dielectric 2**

Polyimide full wafer deposition



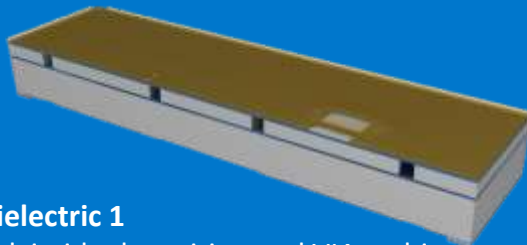
**Polyimide etching**

Device is suspended by Polyimide tabs



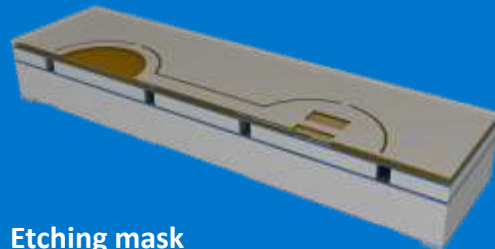
**Dielectric 1**

Polyimide deposition and VIA etching

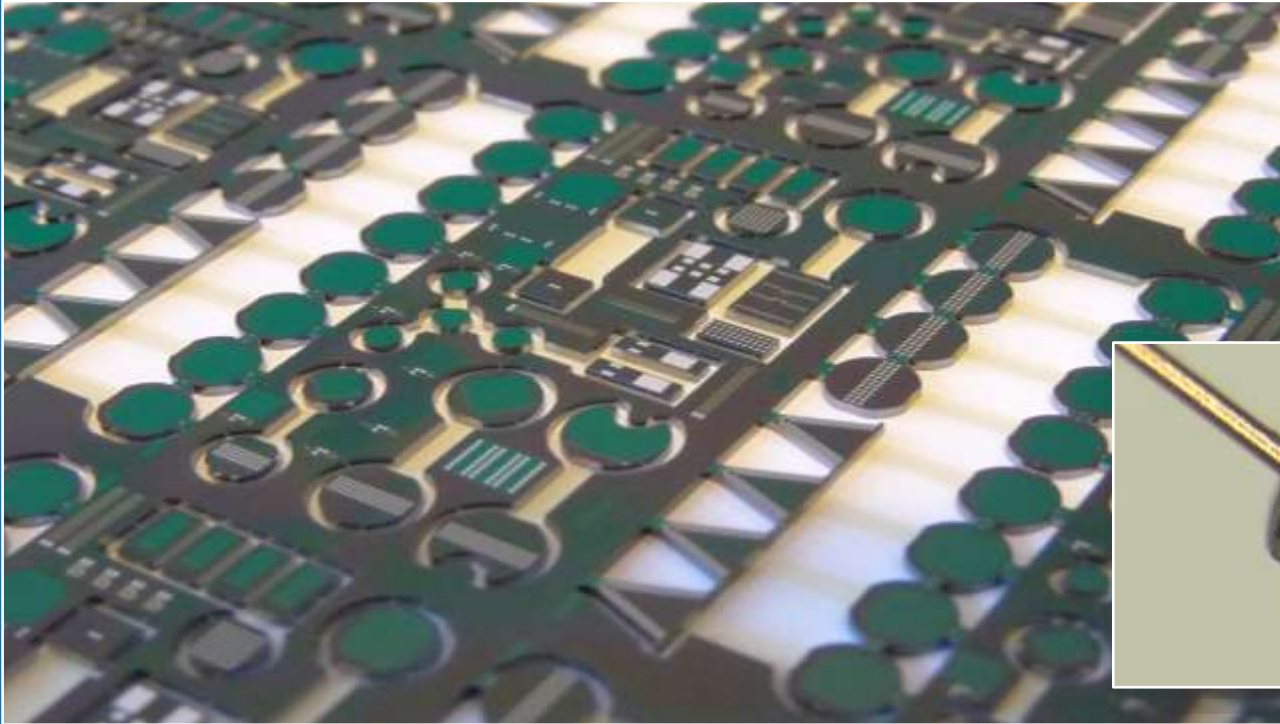


**Etching mask**

For Polyimide removal after backside etching

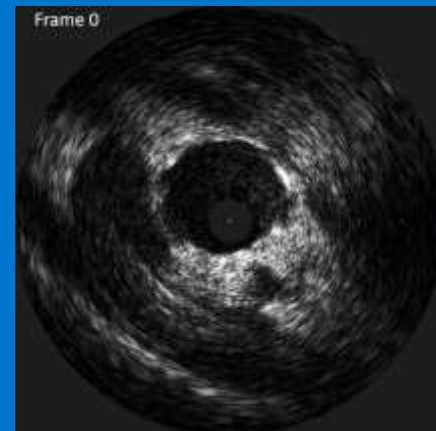
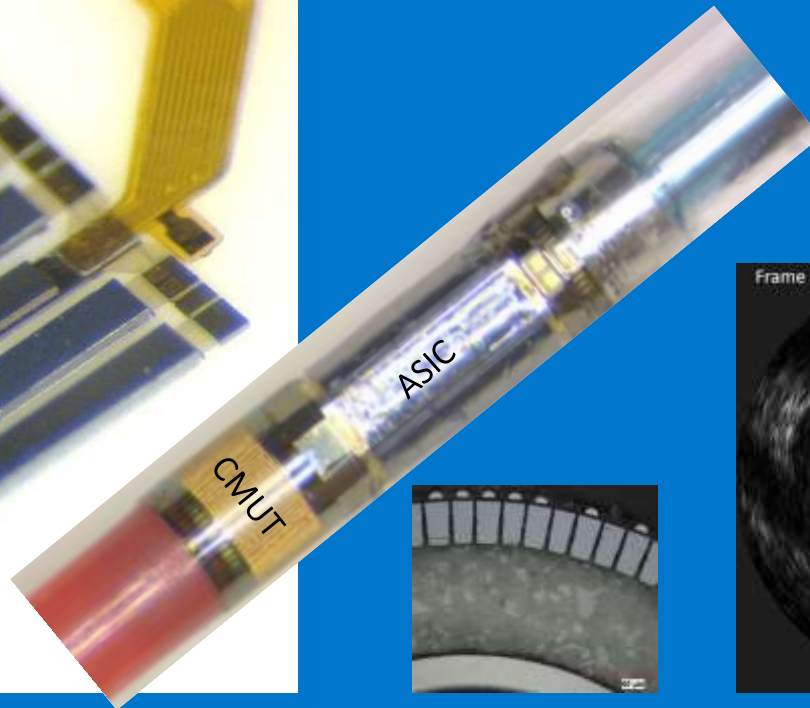
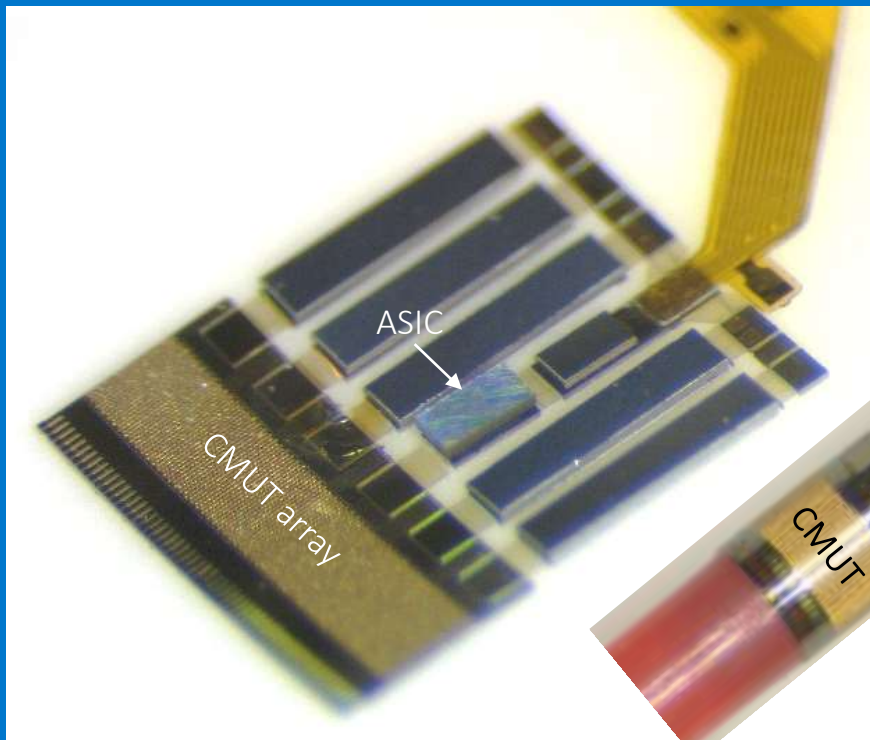


# F2R Wafer Level Manufacturing



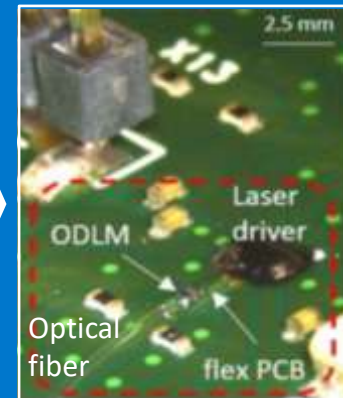
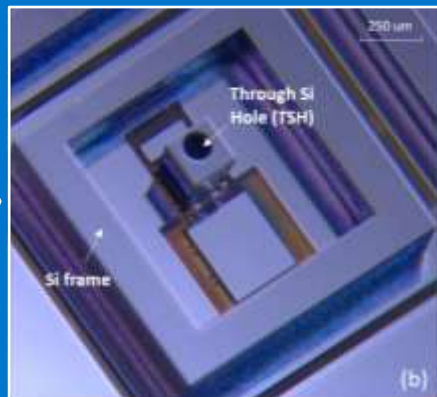
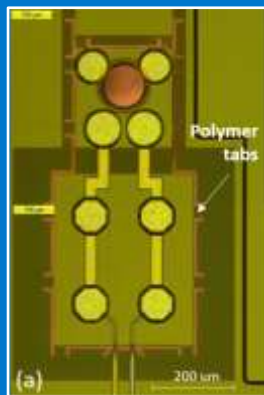
# F2R Micro Assembly Platform

## Catheter Assembly for Intra Vascular Ultrasound (IVUS)



# F2R Micro Assembly Platform

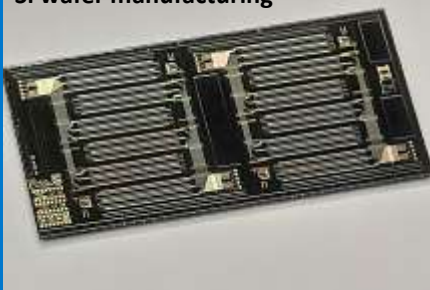
## Optical Data Link Module



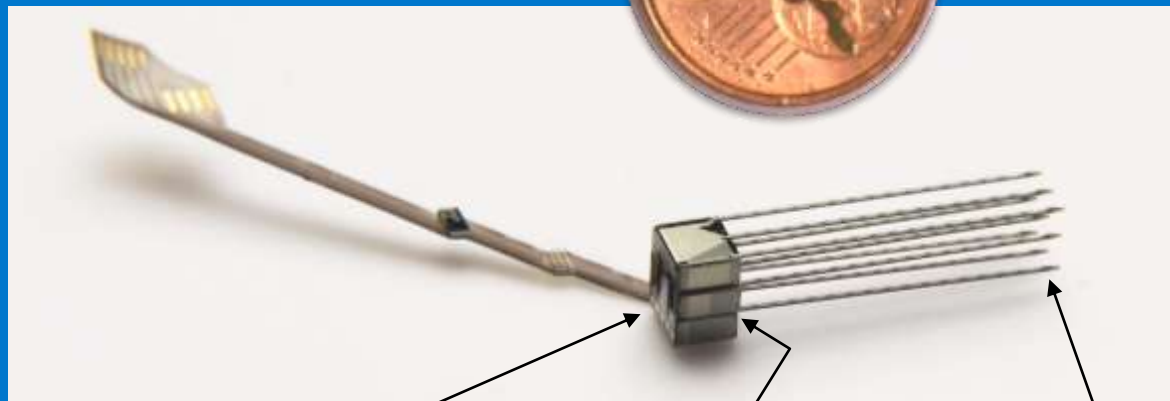
# F2R Micro Assembly Platform

## Micro Needle Array for 3D Neural Probing

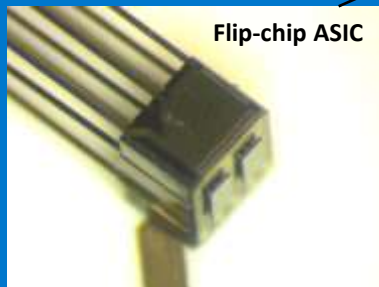
Si wafer manufacturing



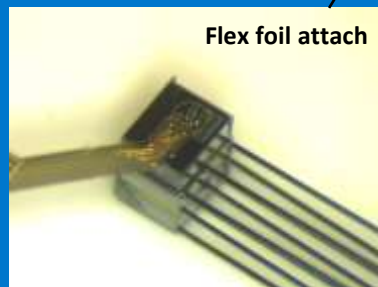
Laser cutting and folding



Flip-chip ASIC



Flex foil attach



Au electrode array



# Customized Solutions

## Phase-gated Development & Industrialization

Process Development

Industrialization

Definition

Concept

Design

Engineering

Qualification

Production

# Conclusion

- Wafer level Flex-to-Rigid manufacturing
- Superior system integration and form factor
- Micro assembly of:
  - Highly compact catheter for ultrasound imaging
  - Micro needle arrays for 3D neural probing
  - Miniature photonic modules
  - ... and more
- Customized Solutions – from Feasibility to Production

Seemingly impossible  
manufacturing challenge?

**We continue where others stop**

innovation  you

***Visit Philips MEMS & Micro Devices at the  
Holland High Tech Pavilion - B1.233***