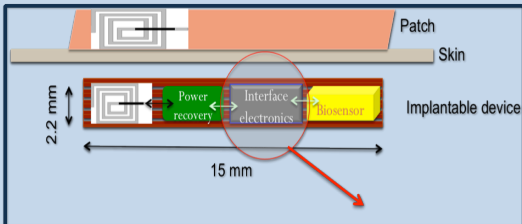


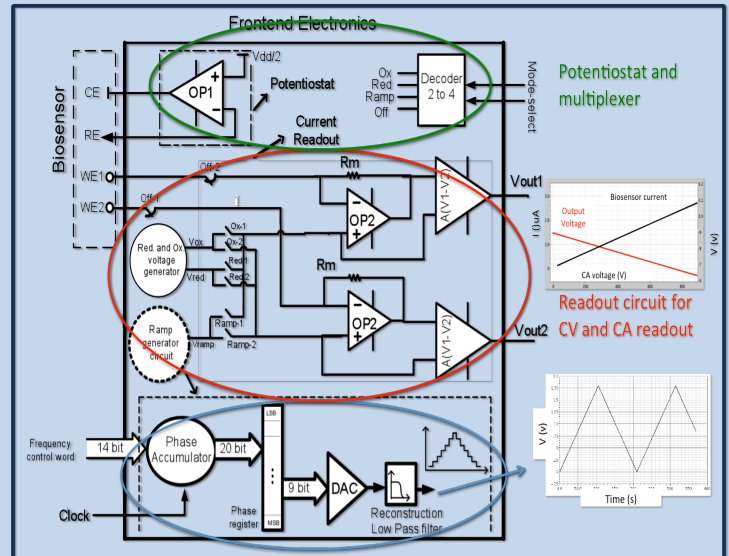
Circuit design For multi-target biosensor readout

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The goal of this work is
Design and implementation of low power analog/ mixed-signal integrated circuits To develop the *interface electronics (IE)* for *implantable multi-target biosensors*.
The IE consists of both readout part and the actuation part for many different biosensors. The biosensors are for advanced diagnosis and drug monitoring in human body.



To implement the IE we need

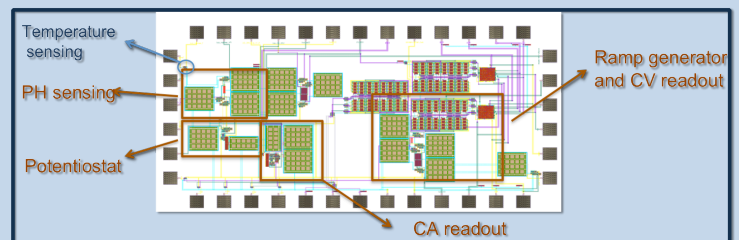
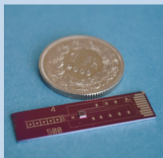
- +Sensor Readout
 - A current readout circuit
 - and converter to voltage or frequency
- +Sensor Actuation
 - A potentiostat to apply a voltage to the biosensor:
 - A very slow ramp voltage for Cyclic voltammetry
 - A fixed voltage for Chronoamperometry
- +Multiplexing multiple sensors data

Conclusion

- +Different circuits are designed for biosensor IE.
- + Lactate detection is done using the chip. It shows a good sensitivity.

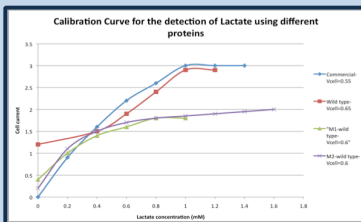
Future plan

- Tests and measurement of the chip by using silicon electrode
- Biosensor noise measurement
- Integrate the IE, biosensor and Remote powering in a single substrate



What we have designed has

- ✓ Capability for up to 5 different target detection
- ✓ Enabled CV actuation and readout for up to 2 targets with sub μA current
- ✓ Enabled CA initiation and readout for up to 3 targets with sub μA current
- ✓ Current to frequency converter
- ✓ Embedded PH and temperature sensing that are needed for data calibration
- ✓ Low power consumption due to remotely powering of the implantable device
- ✓ Low noise to handle the weak sensor signal
- ✓ multiplexing scheme



Measurement results

for lactate detection using the fabricated chip. Different proteins have been used as the enzyme in the detection of Lactate:

- +Commercial
- +Wild type
- +Modified wild type[4]

References

- 1- Sara Ghoreishizadeh et al., "Nano-Sensor and Circuit Design for Anti-Cancer Drug Detection" LiSSA 2011.
- 2- Giovanni De Micheli et al., "An Integrated Platform for Advanced Diagnostics", in proceeding of DATE 2011.
- 3- Sandro Carrara et al., "Multiplexing pH and Temperature in a Molecular Biosensor", IEEE BioCAS 2010.
- 4- Irene Taurino et al., "Comparative study of three lactate oxidizes from Aerococcus viridans for biosensing applications", in preparation