

Sub-mW Reconfigurable Front-end IC for Biosensing and Calibration

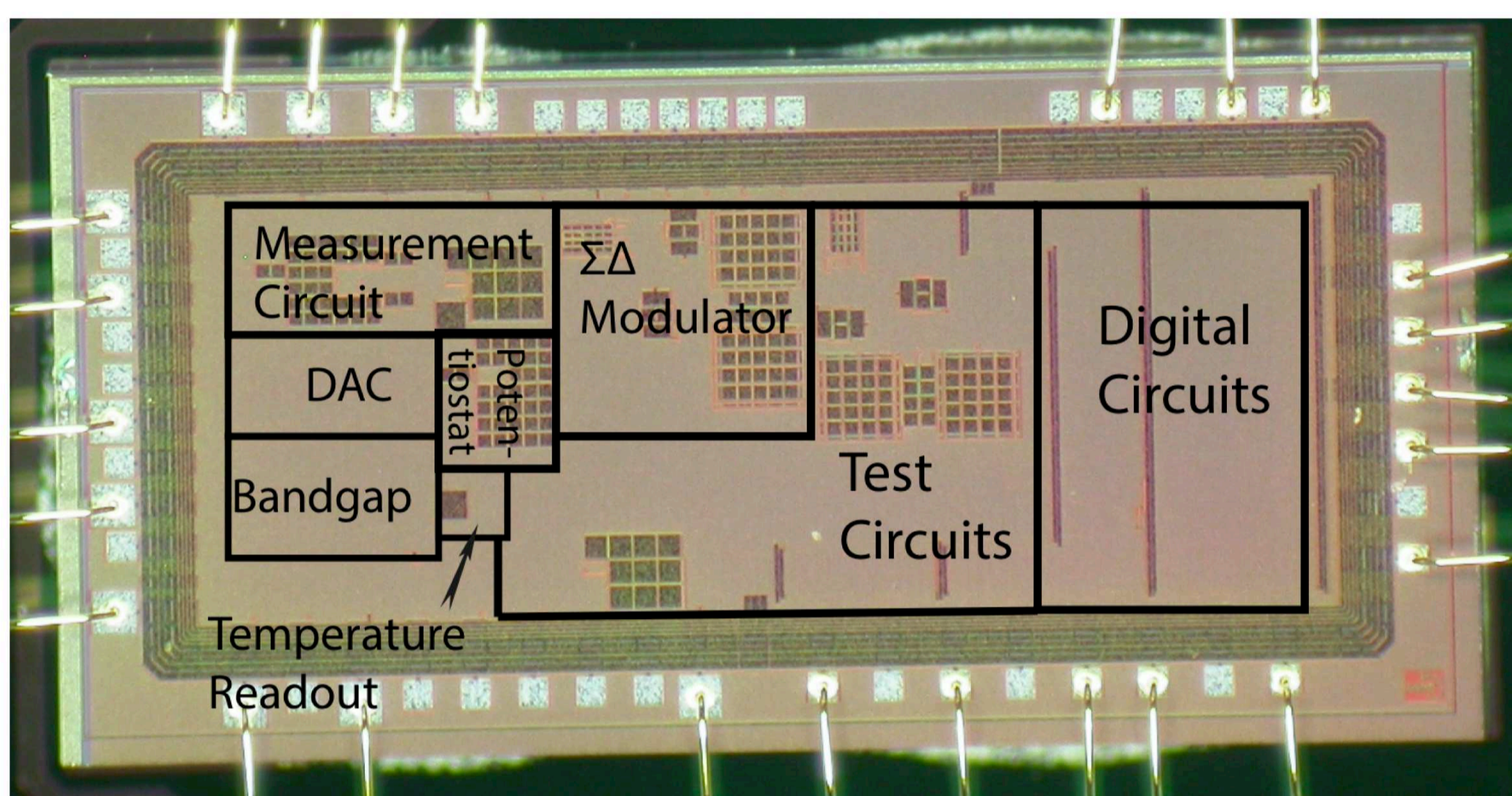
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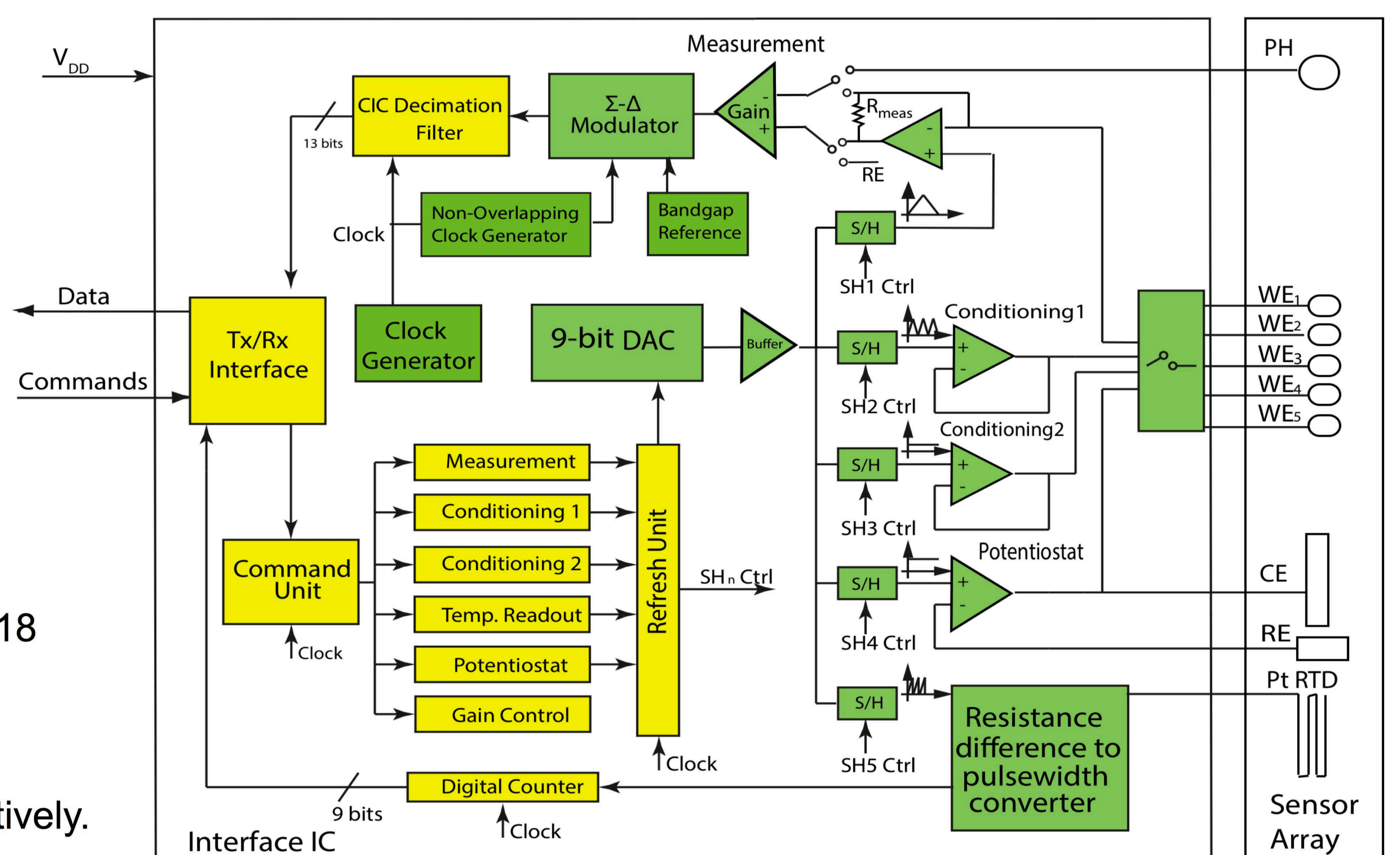
Design Goals for the Front-end IC

- Low power (< mW) to be remotely powered
- Enable high accuracy (>12 bits) measurement
- Provide sensor control as well as readout
- Different electrochemical methods:
 - Cyclic voltammetry and Chronoamperometry
 - Enable calibration with temperature and pH
- Reconfigurable to allow different measurement configurations
- Stable interface to measure different sensors with different RC equivalent models
- Enable sensor conditioning in parallel with measurement
- digital output data for better post processing and analysis

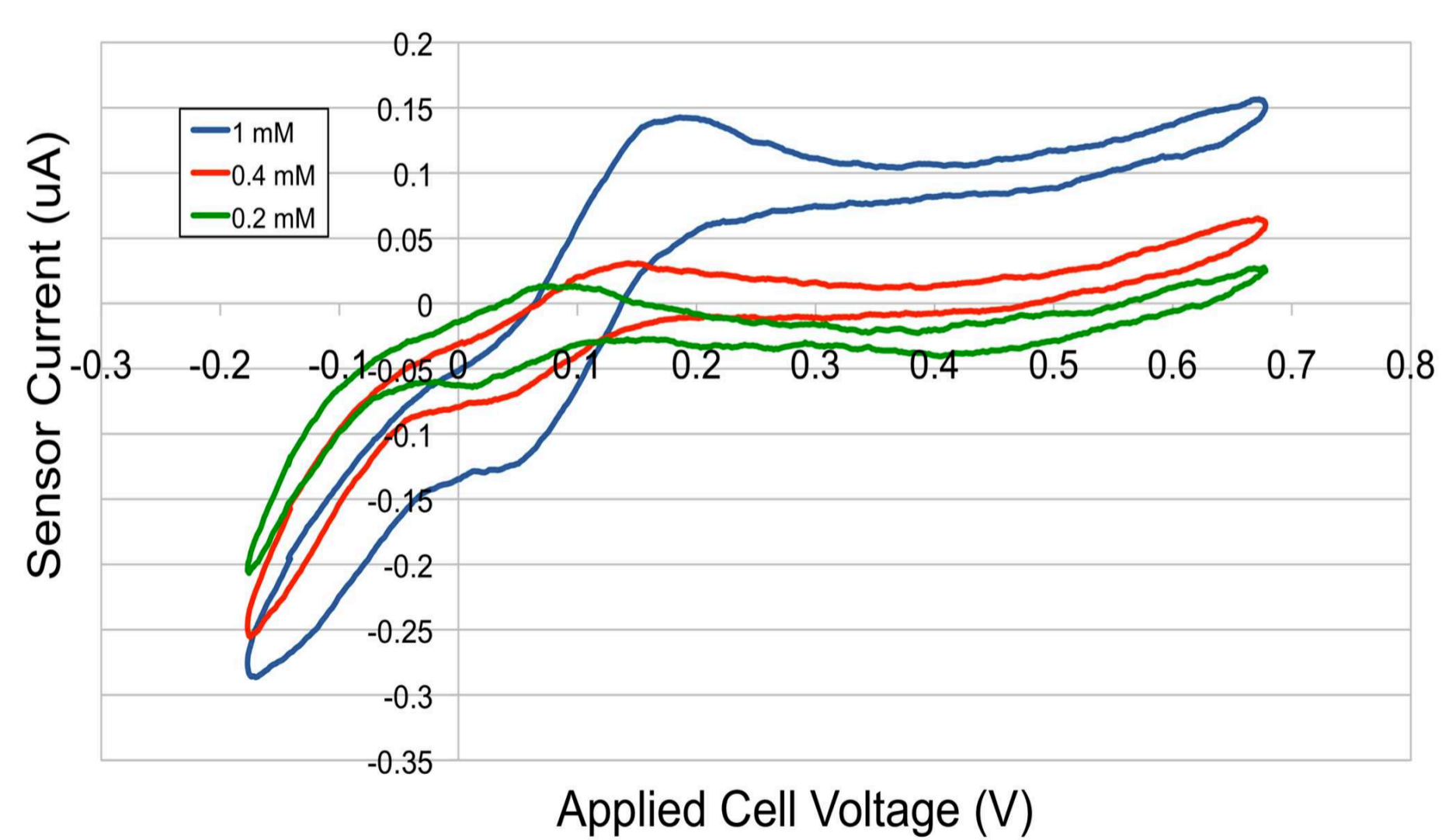
IC Architecture and Layout



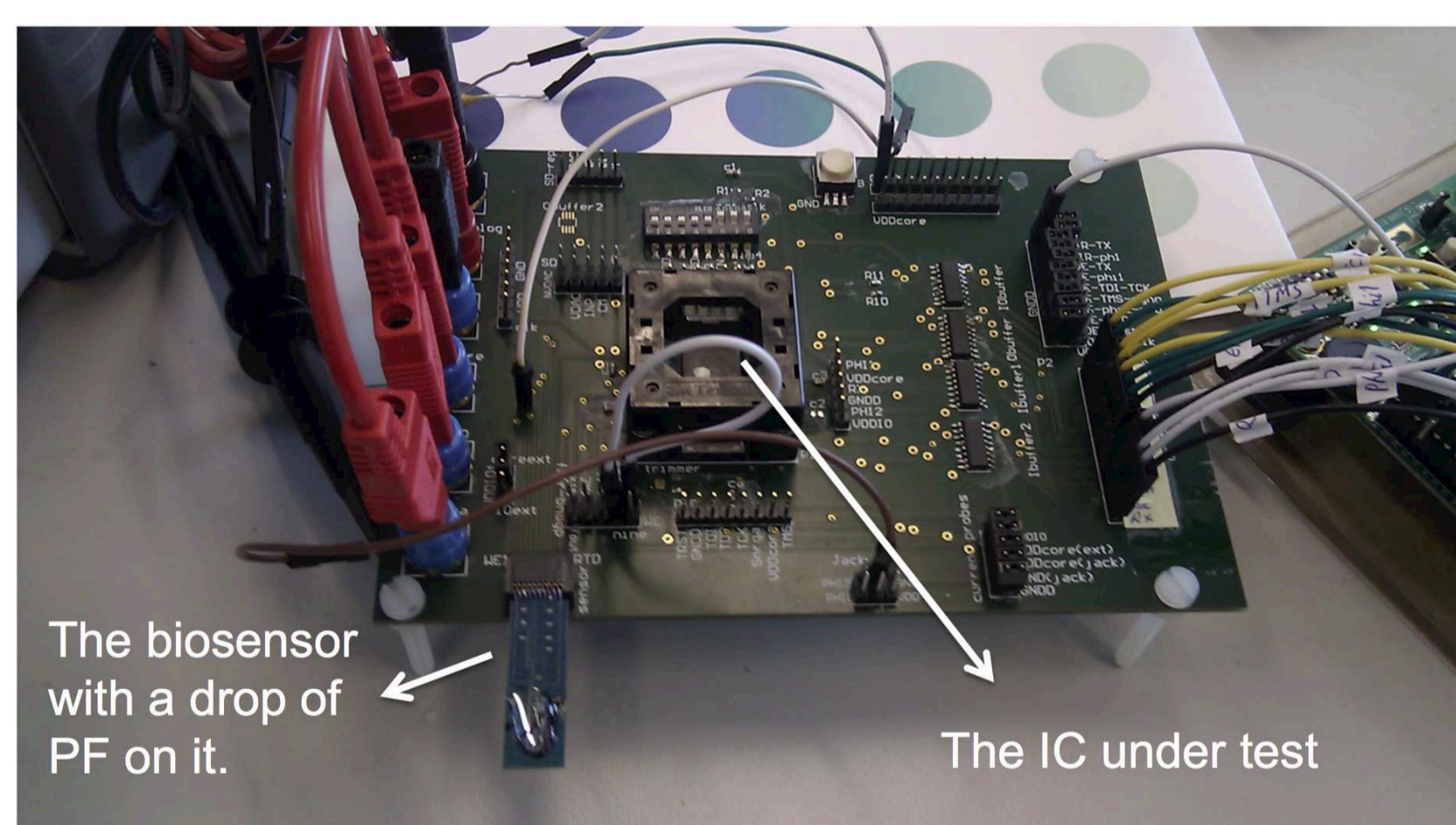
- Microphotograph of the IC implemented in UMC 0.18 μm technology. Its area is 3.2 mm x 1.5 mm.
- Power consumption: 933 μW from V_{DD} of 1.8 V
- The blocks colored in yellow and in green are implemented with analog and digital circuits, respectively.



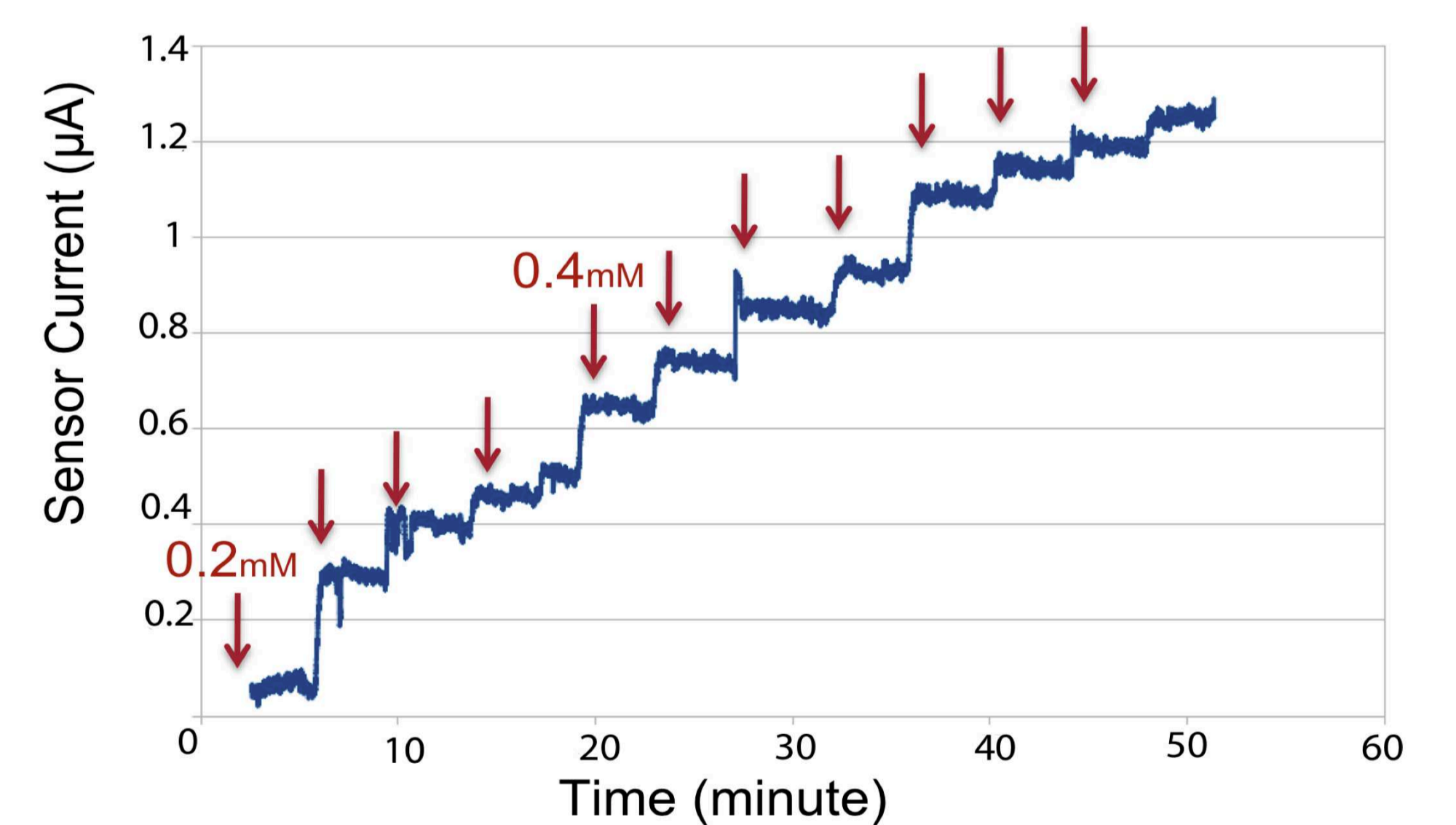
Electrochemical Measurements Acquired with the IC



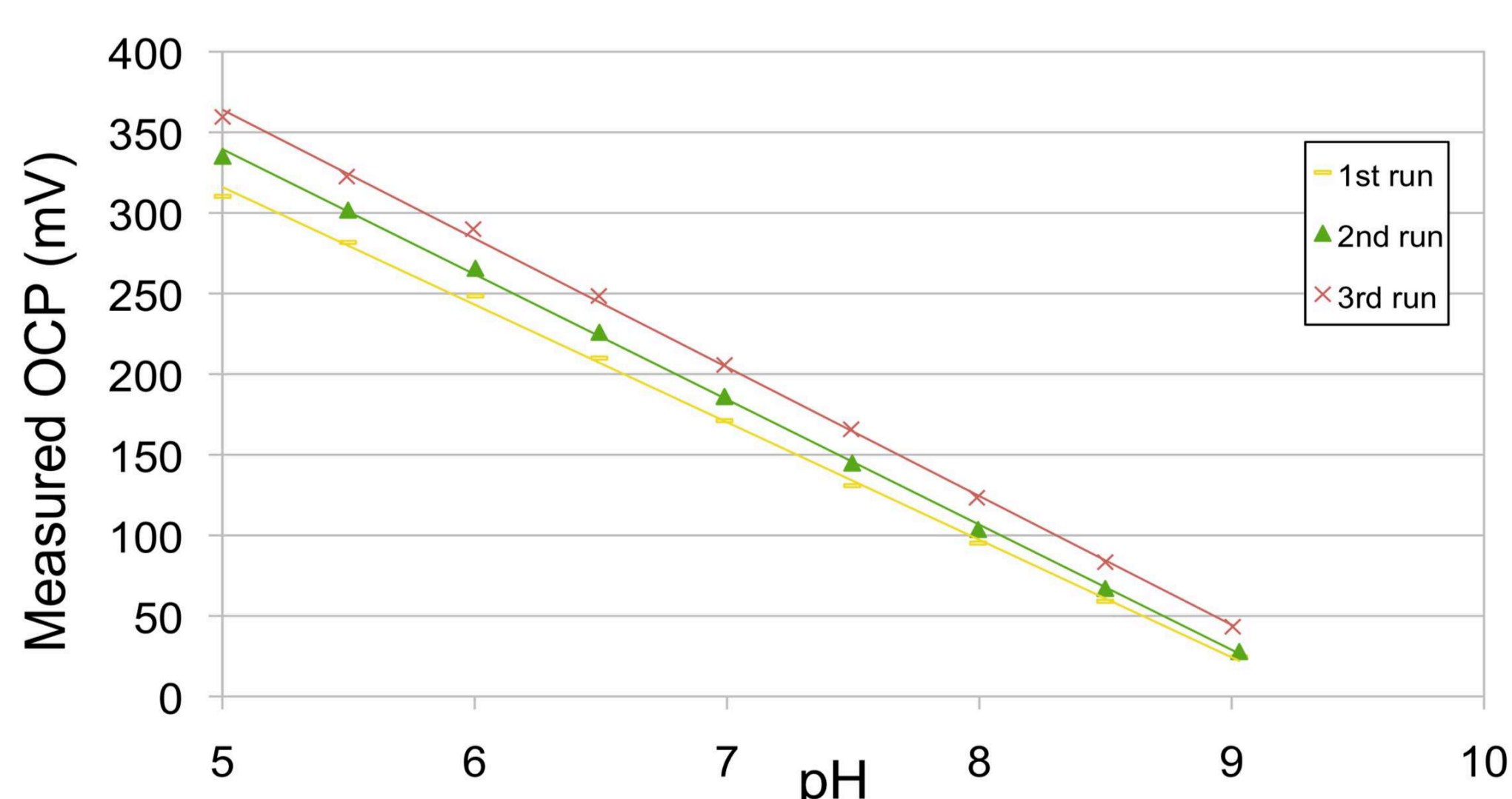
1) Cyclic voltammetry on different concentrations of Potassium Ferricyanide (PF)



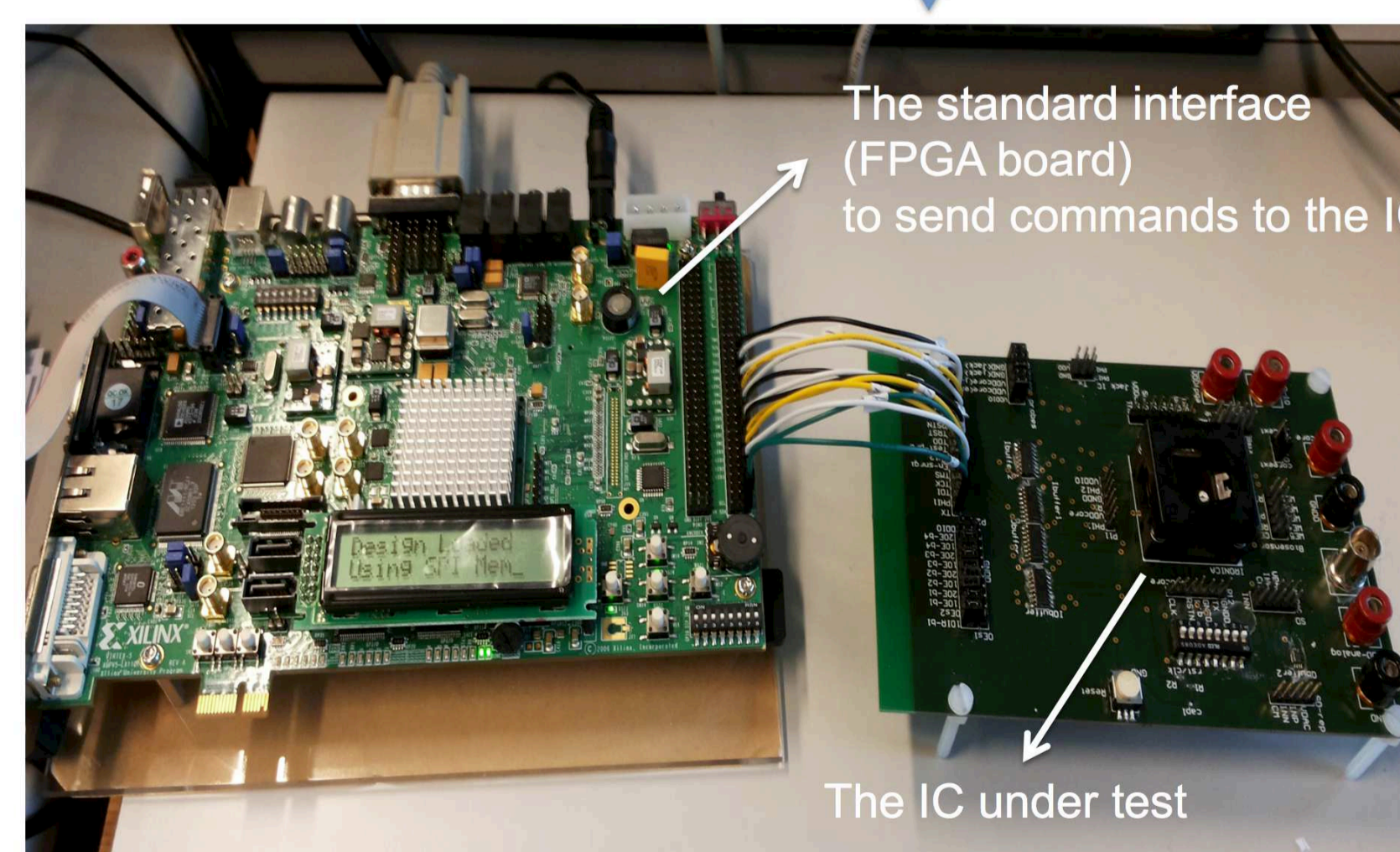
Measurement set-up



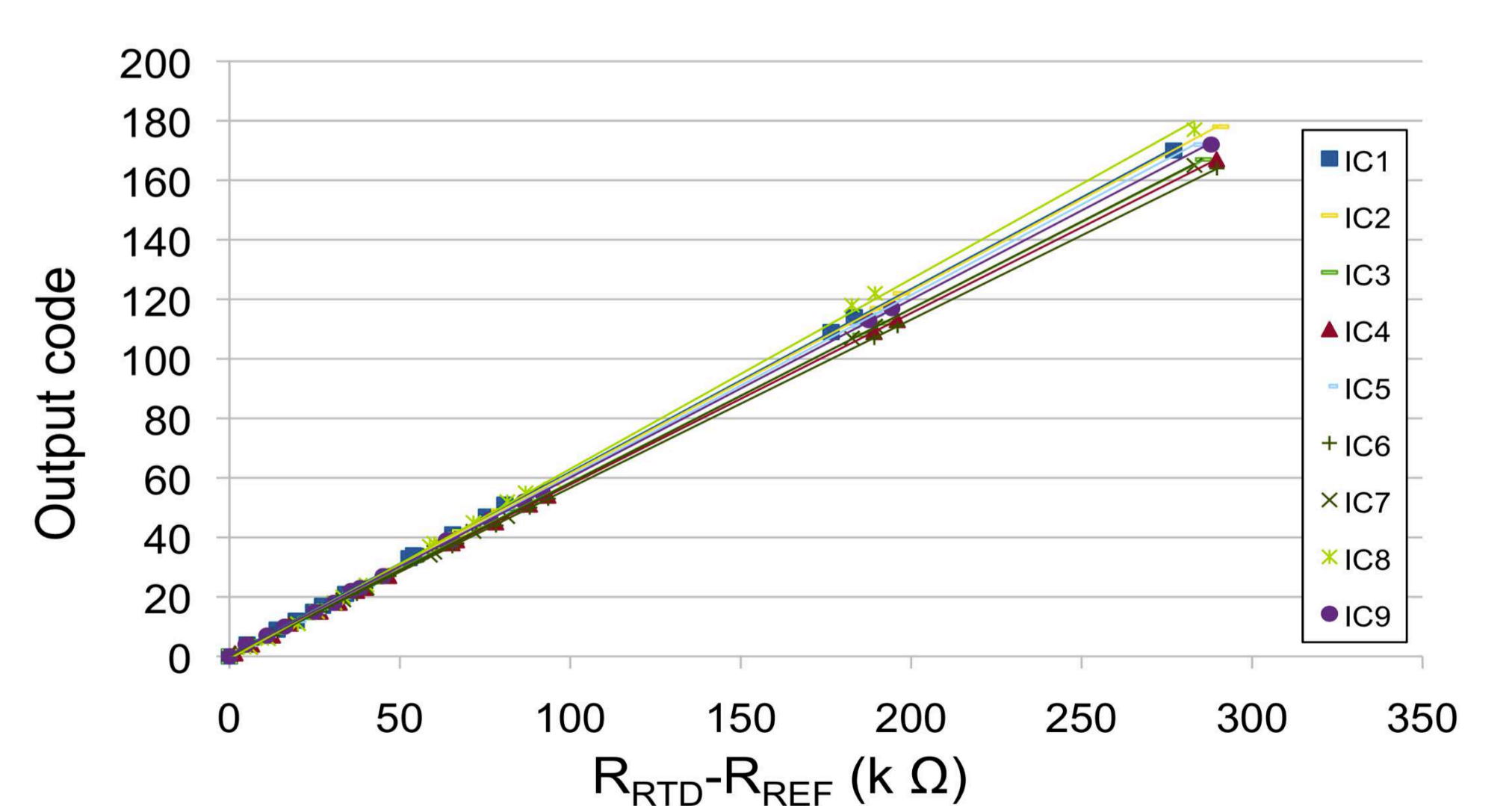
2) Chronoamperometry at different concentration of H_2O_2



3) Open circuit potential (OCP) measurement for pH sensing



The standard interface (FPGA board) to send commands to the IC



4) Resistance measurement for Temperature sensing

[1] S. Ghoreishizadeh, S. Carrara, and G. De Micheli, "A configurable IC to control, readout, and calibrate an array of biosensors", ECCTD 2013

[2] S. Ghoreishizadeh et al., A sub-mW reconfigurable interface IC for electrochemical sensing and calibration, In preparation