

### 3 November 2021 Exercise session

The following figure shows a generic block diagram of a pulse oximeter :

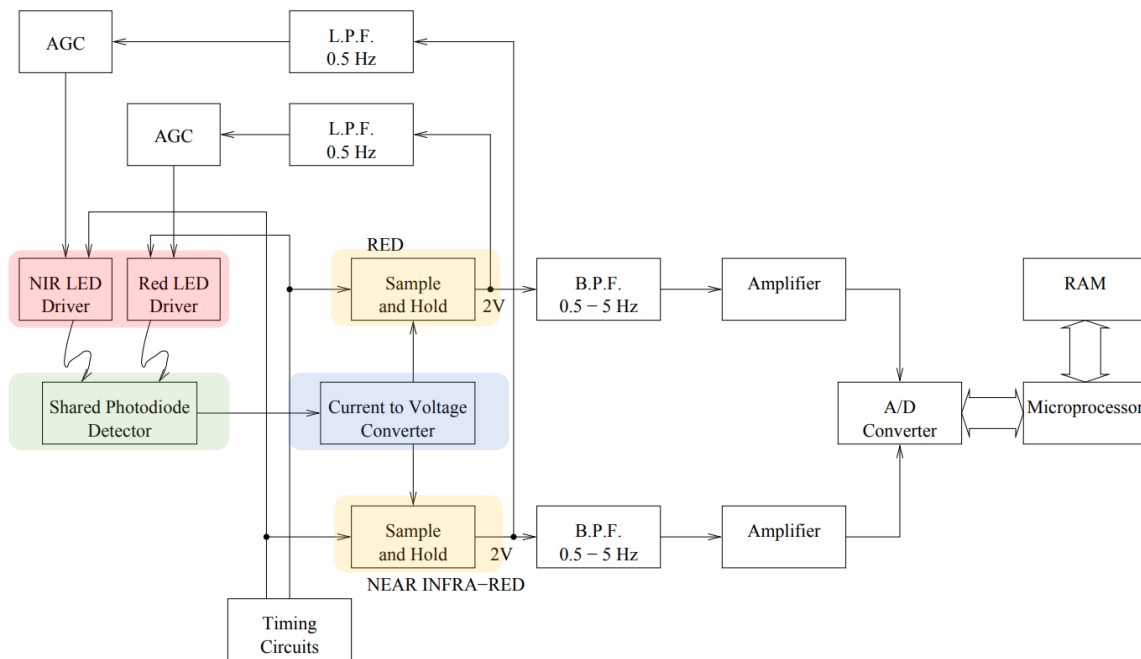


Figure 1 - Pulse Oximeter Block Diagram

- Design a simple constant current source to drive each LED under a constant current of 1A. You have access to a single 12V supply voltage. Aim for maximum accuracy (this will impact your component choices).
- You wish to drive the LEDs in pulsed mode for lower power dissipation, so you choose to use the classic 555 timer IC in astable mode for this application. Using the 555 Datasheet, calculate the auxiliary component values required to obtain:
  - cycle frequency of 1kHz
  - average current consumption of ONE driver circuit of 50mA/cycle.
- You are using a photodetector that under full illumination has an equivalent resistance of 120M $\Omega$ , and you are using the following circuit for its readout:

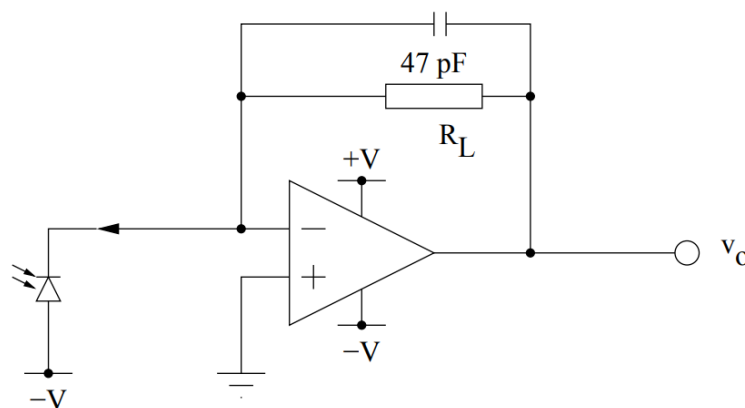


Figure 2 - Photodetector readout

Assuming that the negative voltage rail is at -12V, calculate the value of  $R_L$  such that under full illumination the output voltage  $v_o$  is equal to 2V.

- Bonus Question: Discuss on the role of the 47 pF capacitor in the feedback loop and if/how it affects the functionality of the circuit.