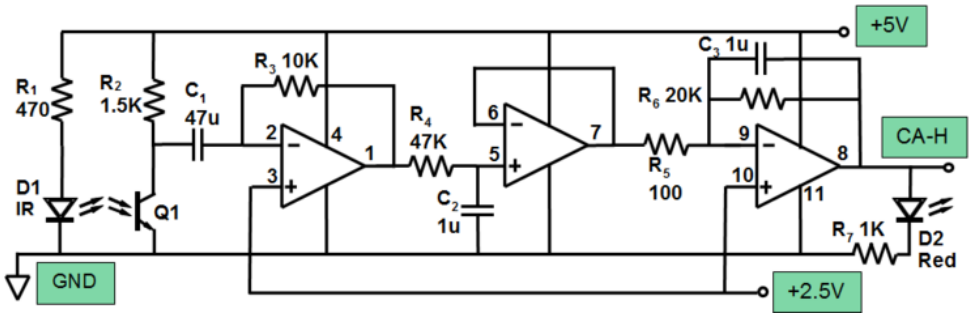
GE 1354 Tutorial
System Design Consideration

1. A 12V battery has an output resistance of 10mΩ.
   (a) What is the maximum current this battery could supply?
   (b) What is the potential difference across its terminals when it is supplying a current of 50A?
   (c) Draw a sketch graph to show how the **terminal** potential difference varies with the current supplied if the internal resistance remains constant. How could the internal resistance be obtained from the graph?

2. Discuss the operating principle of the following heart rate monitoring circuit.



Source: https://wiki.analog.com/university/courses/alm1k/alm-lab-heart-rate-mon

3. What is the function of "buffer amplifier" in a signal conditioning circuit?

4. Fig. Q4 shows the power part of the heart rate monitoring system.

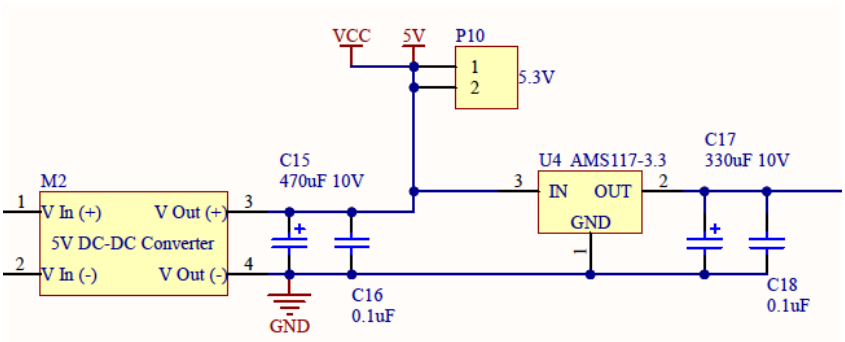


Fig. Q4

   (a) Why are there several voltage conversion stages?

   (b) What is the maximum output current of the integrated circuit AMS1117-3.3?

5*. Figs. Q5(a) and (b) show two configurations for powering up buffer amplifiers using operational amplifiers (op-amps). The op-amp in Fig. Q5(a) requires a single supply while the one in Fig. Q5(b) requires split (dual) supply.

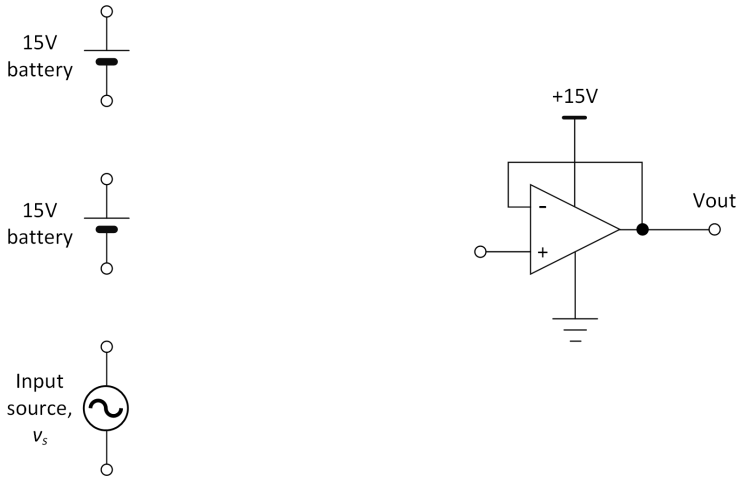


Fig. Q5(a) - With single supply.

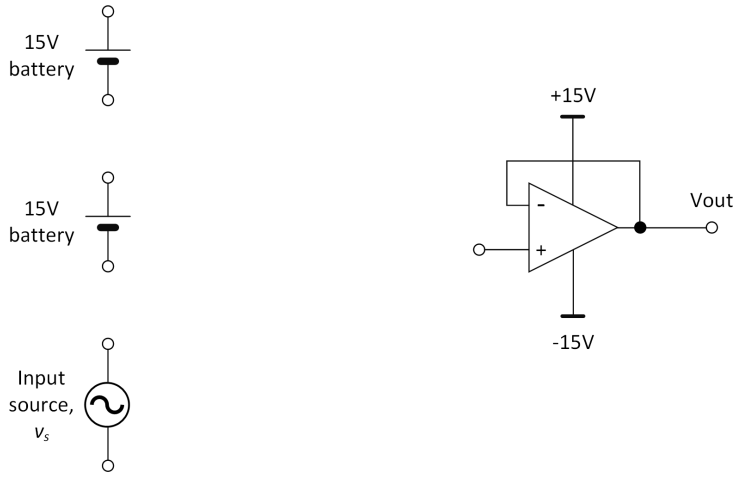


Fig. Q5 (b) – With split (dual) supply.

(a) Discuss how the two 15V batteries are connected to the op-amp in each figure.

(b) If a signal source v_s is connected to the input of the buffer amplifier, discuss how it is connected to the buffer amplifier.

6*. Is it possible to use two resistors to derive split supply from single supply for the buffer amplifier in Fig. Q5(b)?

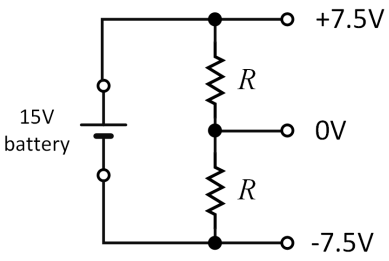


Fig. Q6