

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
6.071 Introduction to Electronics, Signals and Measurement
Spring 2006

IR transmission and detection. IR diodes and phototransistors

InfraRed (IR) signals are used extensively for short range communication. Devices ranging from entertainment systems to transportation and security systems use some sort of IR signals for “remote communication”. In this lab we will explore the characteristics of these signals from generation to detection and will also design and construct support circuits for the detection of such signals. The lab is designed to assist us with your final project: the heart rate lab.

Experiment 1.

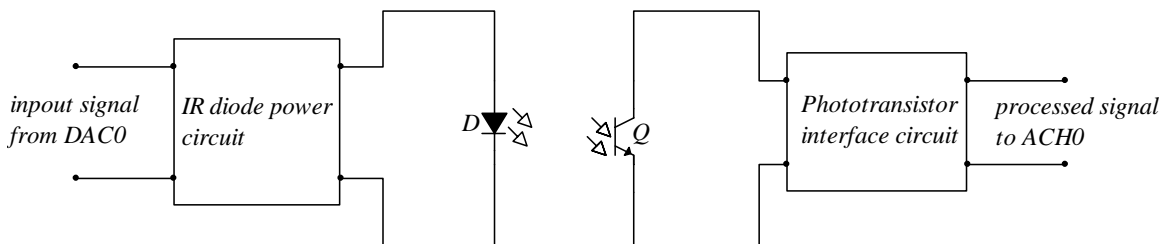
We will explore a few concepts that you are likely to encounter in your heart rate project laboratory.

You will use the IR diode QED123 and the phototransistor QSD124 to transmit through the air and detect a certain signal. The signal is provided by the instrument called **IR_Laboratory.vi**. This instrument generates a signal with the following properties:

- DC offset
- Slow varying DC value
- Small amplitude pulse with a frequency of 1 Hz
- 60 Hz noise signal

Your task is to use this signal to power your IR diode, use your phototransistor to detect the signal transmitted by the IR diode and process the signal so that only the pulse signal remains.

The block diagram of the experiment is shown below:



The first step in the design of the IR diode power circuit and the phototransistor interface circuit is to look at the data sheets of these devices. The data sheets are available on the class web site.

Show your designs and your observations on this page.

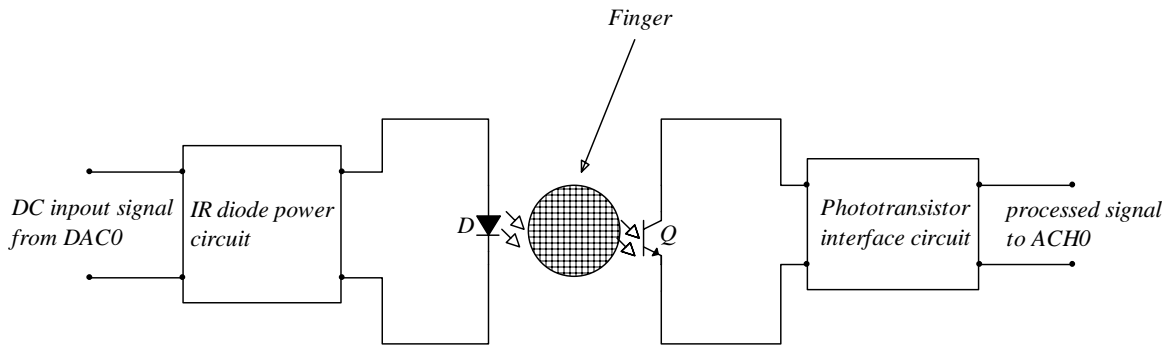
Experiment 2

You may now be able to actually see some rudimentary form of a signal that corresponds to your heart pulse.

Here is the idea:

Use again the **IR_Laboratory** instrument to generate the desired DC voltage to power your IR diode. Set the amplitude of the Pulse Signal to be zero. You may want to test the performance of your circuit with and without the noise.

By placing your finger between the diode and the phototransistor, the fluctuations of the blood volume in your finger will result in fluctuations of the transmitted IR through the finger and thus in fluctuations of the energy seen at the base of the phototransistor. This will in turn produce fluctuations of the phototransistor output signal which you should be able to see.



Observations: