Waveshapping Circuits and Data Converters

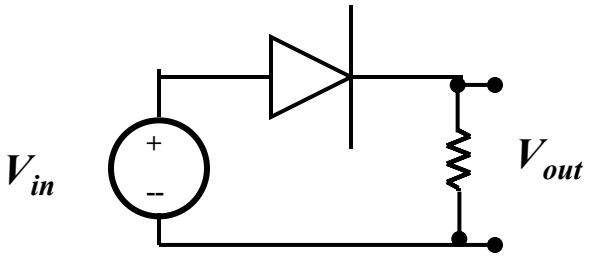
Lesson #20

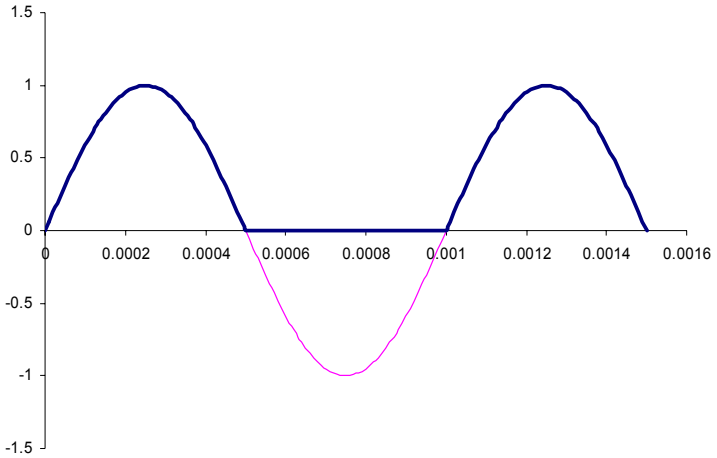
Rectifiers, Peak Detectors, Sample-and-Hold Circuits, Clamp Circuits

Section 12.4-7

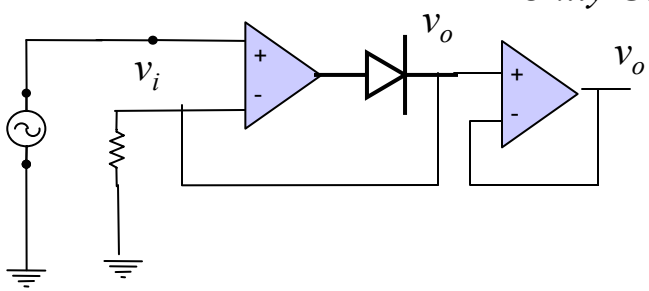
Rectifiers

- Half-wave and Full-wave
- Simple Half-wave
- Precision Half-wave
  - For positive values of the input, the output follows.
  - For negative values of the input, the diode becomes reverse biased and the circuit does not transmit the input

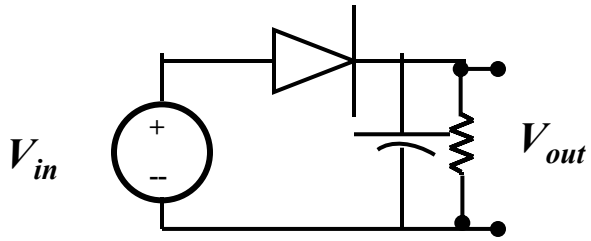




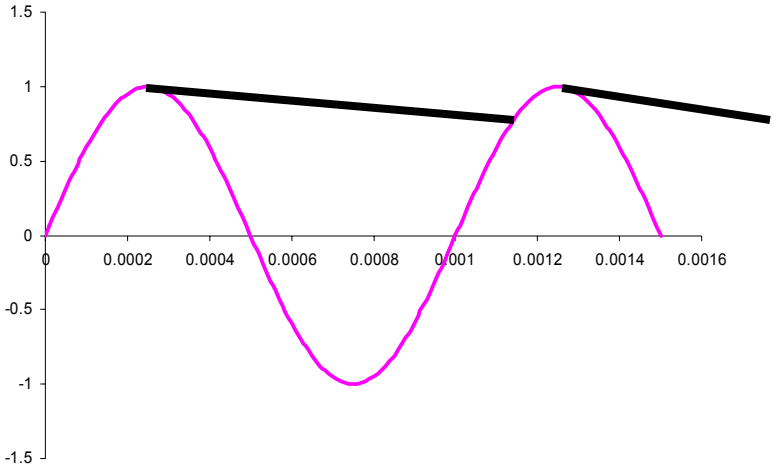
Unity Gain

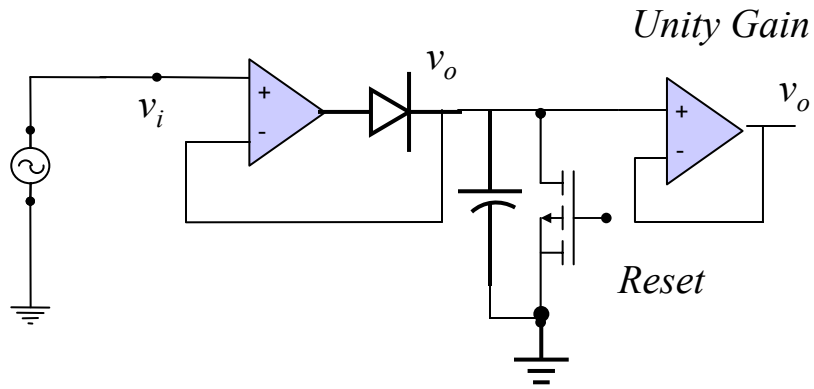


Peak Detectors



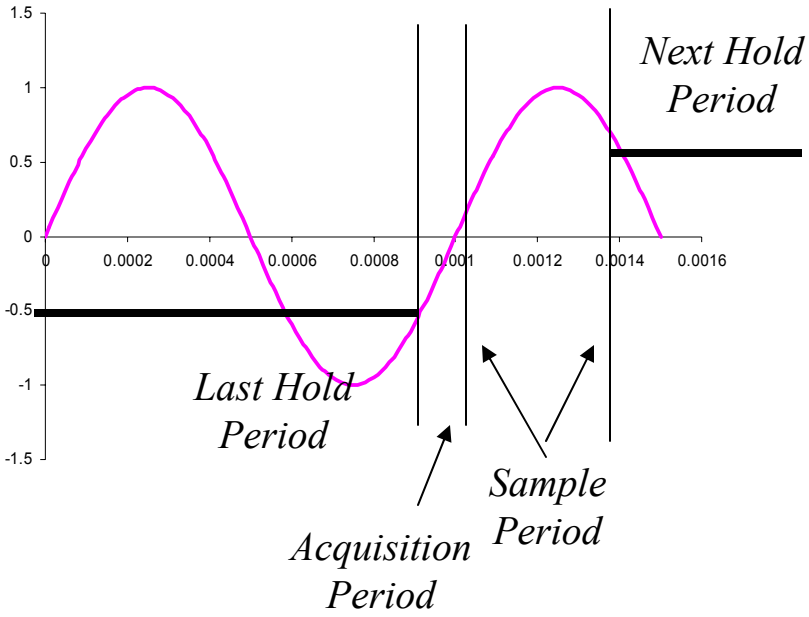
- Simple Circuits
- Precision Circuits
  - Initially, the diode is fb and the capacitor is charging.
  - Once the input goes negative, the diode becomes rb and the output stays constant until the input goes higher or the circuit is reset by the FET

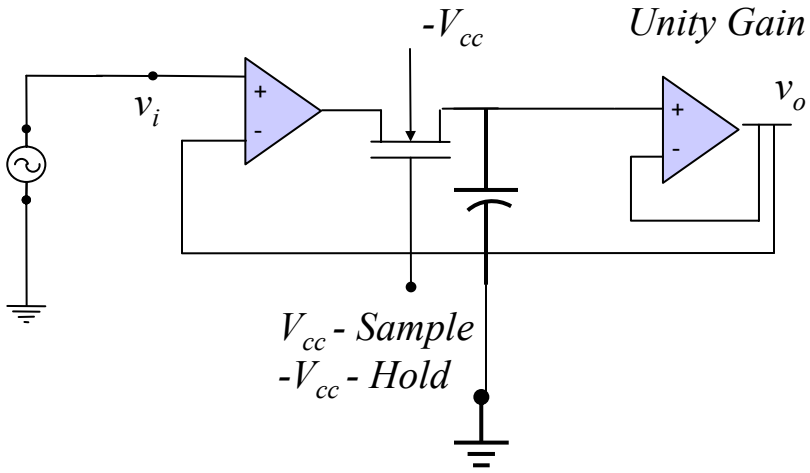




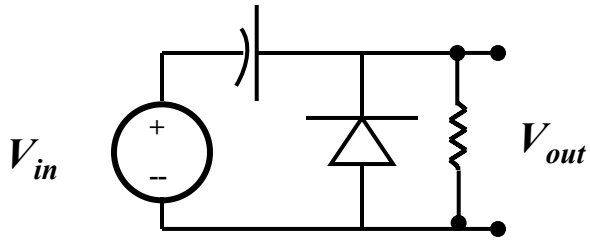
Sample-and-Hold Circuits

- Similar to a peak detector except that this circuit samples an input signal based on the digital control signal.
- When the digital control signal is applied, the circuit "acquires" the input signal and holds the last value of the input signal when the control signal is removed.

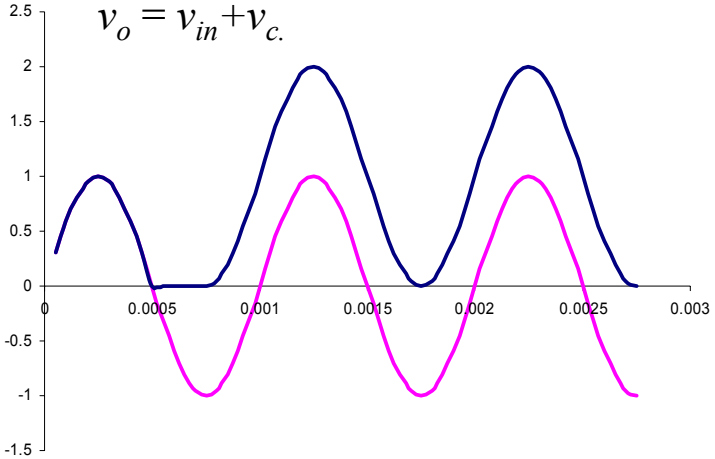


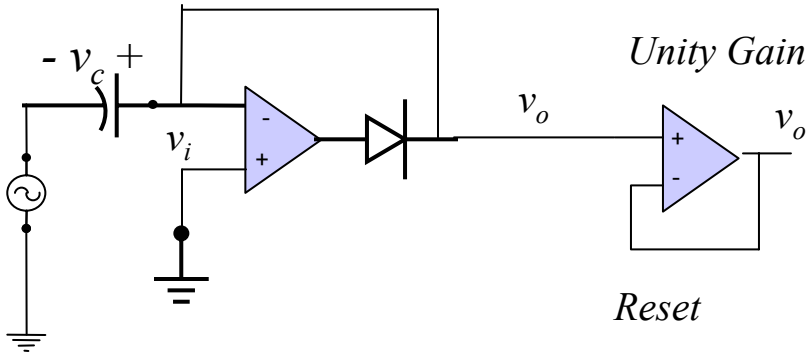


Clamping Circuits



- Simple Circuits
- Precision Circuits
  - Initially, as the input goes positive, the diode is rb biased since the input voltage is connected to the inverting input. In addition, no current flows (from the op amp) to charge the capacitor.
  - When the input goes negative the diode conducts and there is a path to charge the capacitor such that $v_{in}+v_c = v_i = 0$; therefore, $v_c = -v_{in\ peak}$.
  - When the input changes is direction, v_i goes positive and the diode becomes rb and $v_o = v_{in}+v_c$.





Homework

- Rectifiers, Peak Detectors, Sample-and-Hold Circuits, Clamp Circuits
  - Problems: 12.23, 12.27, 12.28, 12.30, 12.32