LAB 2 – ASK Modulation and Demodulation

Objectives

• Understanding the principle of ASK.
• Measuring ASK signals.
• Implementing ASK modulation and demodulation.

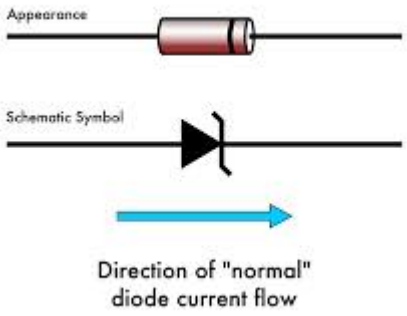
Experiment Equipments

- dc power supply
- function generator
- oscilloscope

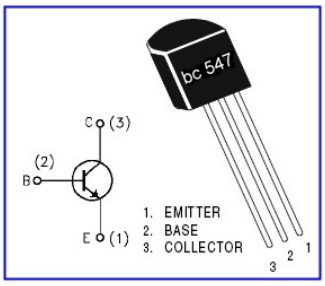
Components: 1N4737, BC547, UA741.

PINOUT

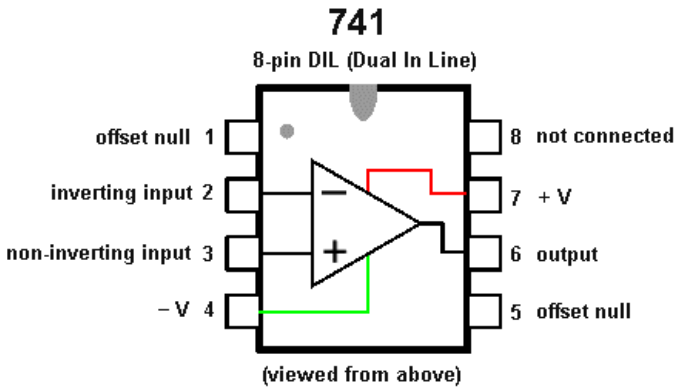
1N4737:



BC547:

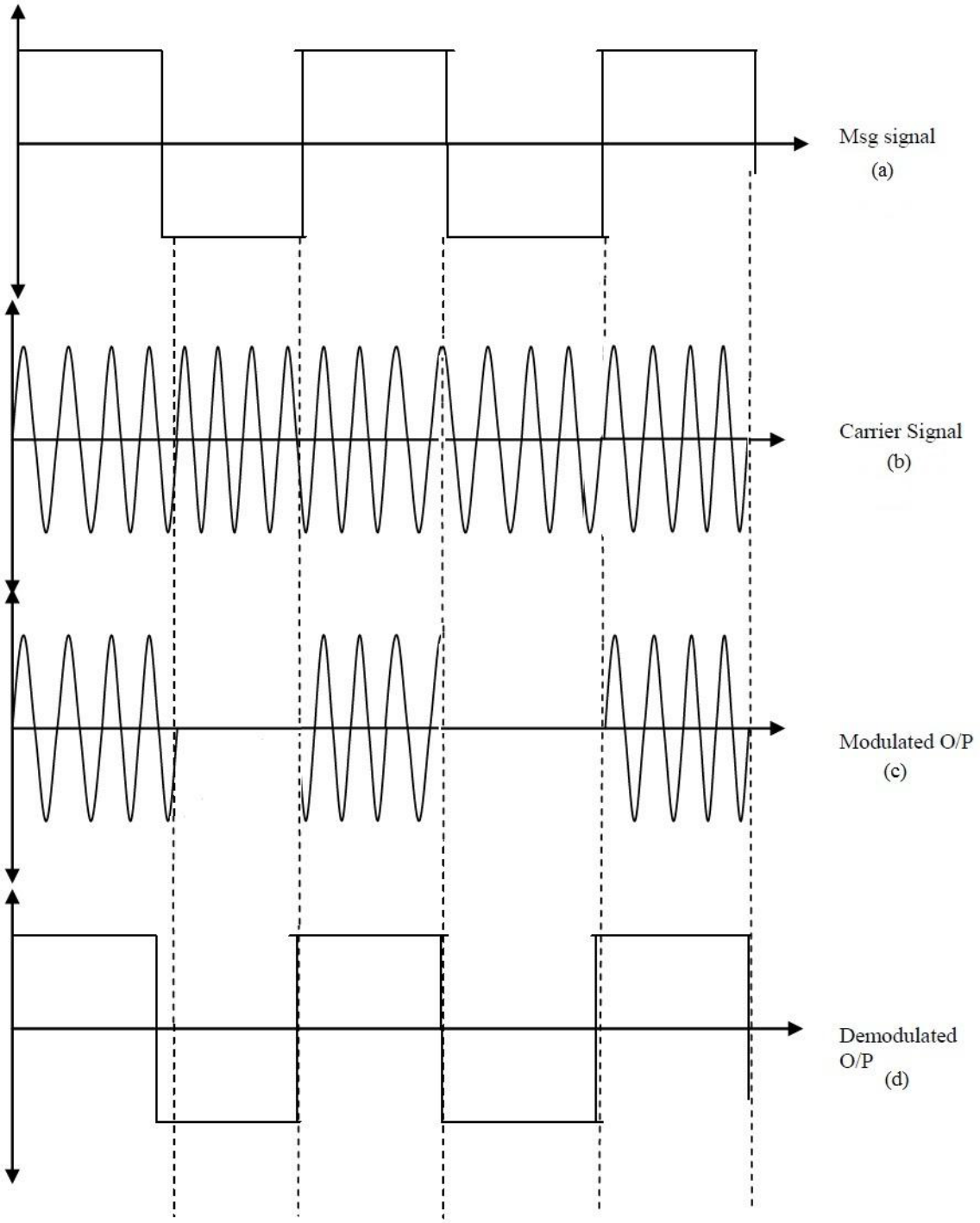


OpAmp 741:



Amplitude Shift Keying (ASK)

A binary ASK wave is obtained by multiplying the message signal with a carrier. The modulated signal has two levels '1' and '0' representing the presence and absence of the sinusoid, respectively. This is shown in the waveform below.



ASK Modulator

The ASK modulator circuit is designed using transistor as a switch. Message signal is given at the base of the transistor and carrier signal is given at the collector of the transistor. Output is taken from the emitter of the transistor. As input has only two values '1' and '0' , so transistor is "ON" only when input is '1' and 'OFF' when input is '0'. The sinusoidal carrier wave comes at the output as a burst signal when the transistor is "ON", i.e., when input is '1'. Thus ASK modulated signal is obtained at the output.

Circuit Diagram:

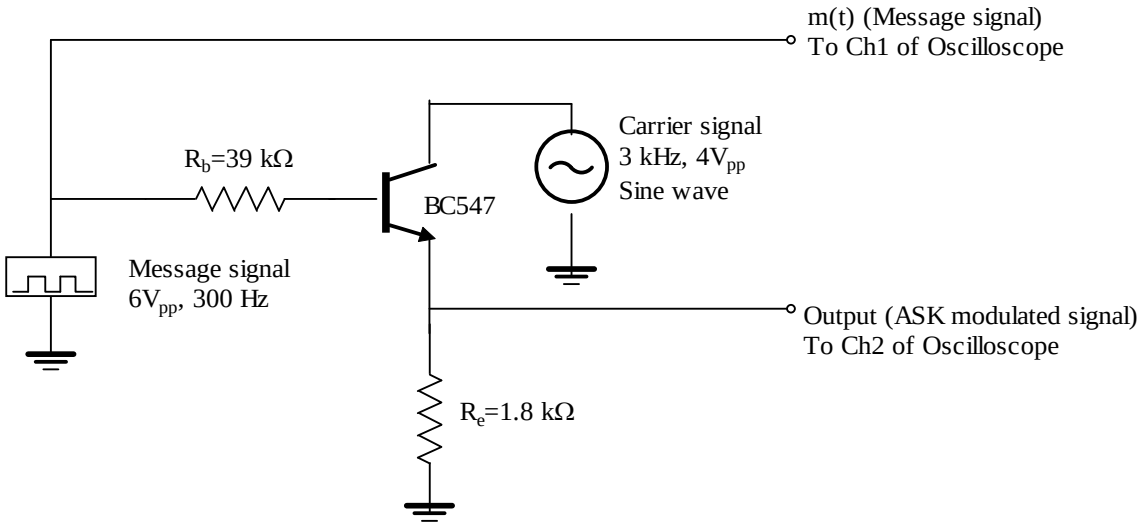


Fig.1

ASK Demodulator

An ASK signal can be demodulated using an envelope detector. A simple envelope detector circuit is shown in Fig.2.

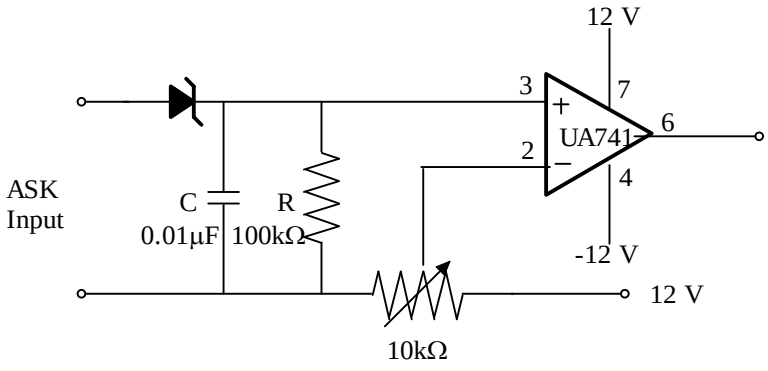


Fig.2

The demodulator circuit consists of an envelope detector and an OpAmp comparator. When the ASK signal is passed through the envelope detector, an envelope is created. This envelope is then passed through the comparator, which converts the envelope to the same '0' and '1' format as the message signal. The reference voltage of the comparator can be adjusted with the help of a variable resistor. The capacitance C and resistance R in Fig.2 should satisfy the condition

$$\frac{1}{f_c} << RC < \frac{1}{B}$$

where B is the bandwidth of the message signal and f_c is the carrier frequency.

Procedure

ASK modulation

1. Using the Function Generator I, generate a square wave of 6V peak to peak and 300 Hz frequency.
2. Using the Function Generator II, generate a sinusoidal wave of 4V peak to peak and 3 kHz frequency.
3. Connect the output of the Function Generator I to the message signal input and the output of the Function Generator II to the carrier signal input of the circuit.
4. Connect the output of the Function Generator I to Ch1 and the ASK modulated output to Ch2 of the oscilloscope.
5. Adjust the oscilloscope to obtain the readable form. You can adjust the trigger knob; if the display is still flickering, press RUN/STOP so that you can see a stable figure.
6. Ch1 displays the square wave, i.e., message signal, while Ch2 displays a burst of sinusoid when the message signal is '1', i.e., ASK modulated signal.
7. Observe the waveforms of the message signal and ASK modulated signal.
8. Save the screen shot of waveforms displayed in the oscilloscope for message signal and ASK modulated signal.

ASK demodulation

1. Connect the ASK modulator output to the ASK demodulator input, and the ASK demodulator output to Ch2 of the oscilloscope.
2. If you do not obtain any output, vary the variable resistance value slightly by rotating its head knob. Adjust the value of variable resistor to obtain the output display at Ch2 of the oscilloscope.
3. Ch2 will display the square wave which is the demodulated output.
4. Save the screen shot of waveforms displayed in the oscilloscope for the demodulated signal.
5. Re-design the demodulator in order to provide optimum detection for a 50 Hz modulating signal and 500 Hz carrier frequency. Replace the components R and C in Fig.2, repeat the steps 1-4.