

Experiment 4

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1 Objective

1. Obtain and plot the VCO characteristics of IC-8038
2. Design and fabricate an FM modulator using IC-8038

2 Components and Equipment Required

IC-8038 *DSO *Power supply (variable)*connecting wire *Breadboard *probes *Resistance *DSO *Function generator

3 Theory

3.1 FM Modulation

In Frequency Modulation technique, Message signal voltage variation will be converted corresponding carrier signal frequency variation. This is known as Frequency modulation.

If we observe the below figure there are three waveforms: first one is the Message signal, second one is the Carrier signal, and the third one is the Frequency modulated signal. When the amplitude of the message signal is positive, the frequency of the carrier signal is high; when the message signal attains negative peak, the frequency of the carrier signal is very low. This represents information associated in Frequency Modulation technique in the form of carrier signal frequency variation.

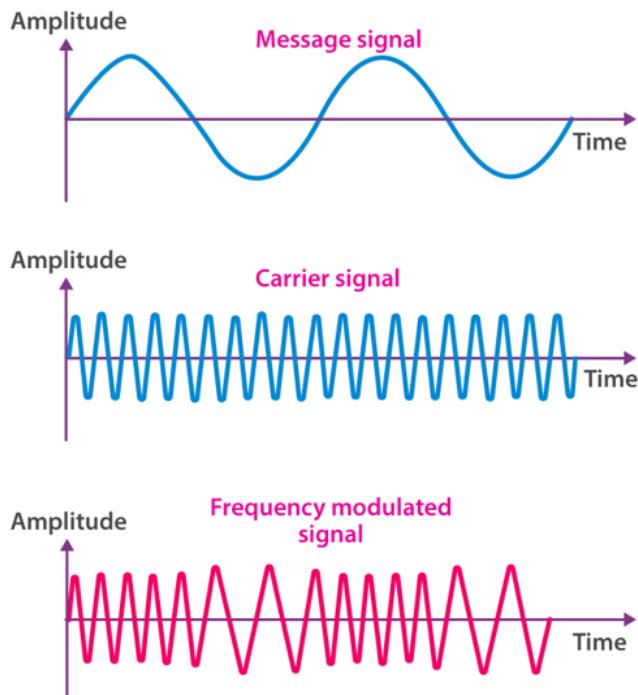


Figure 1: FM Modulation

3.2 Voltage Controlled Oscillator

Voltage-controlled oscillator is electronic oscillator the work of VCO is when we give variable voltage in VCO it generates varying frequency curve(Linear).This thing shown in below Figure In this experiment VCO circuit achieved by IC-8038

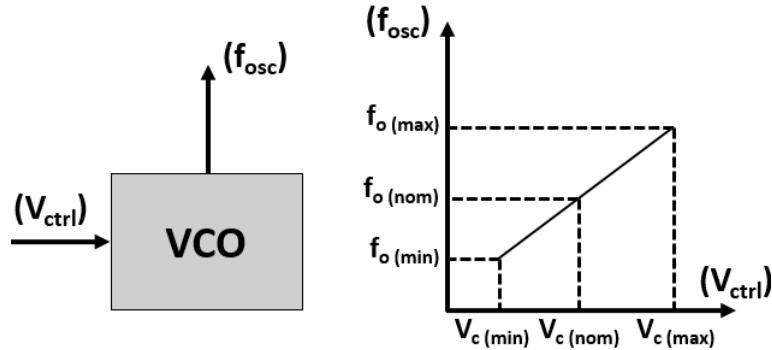
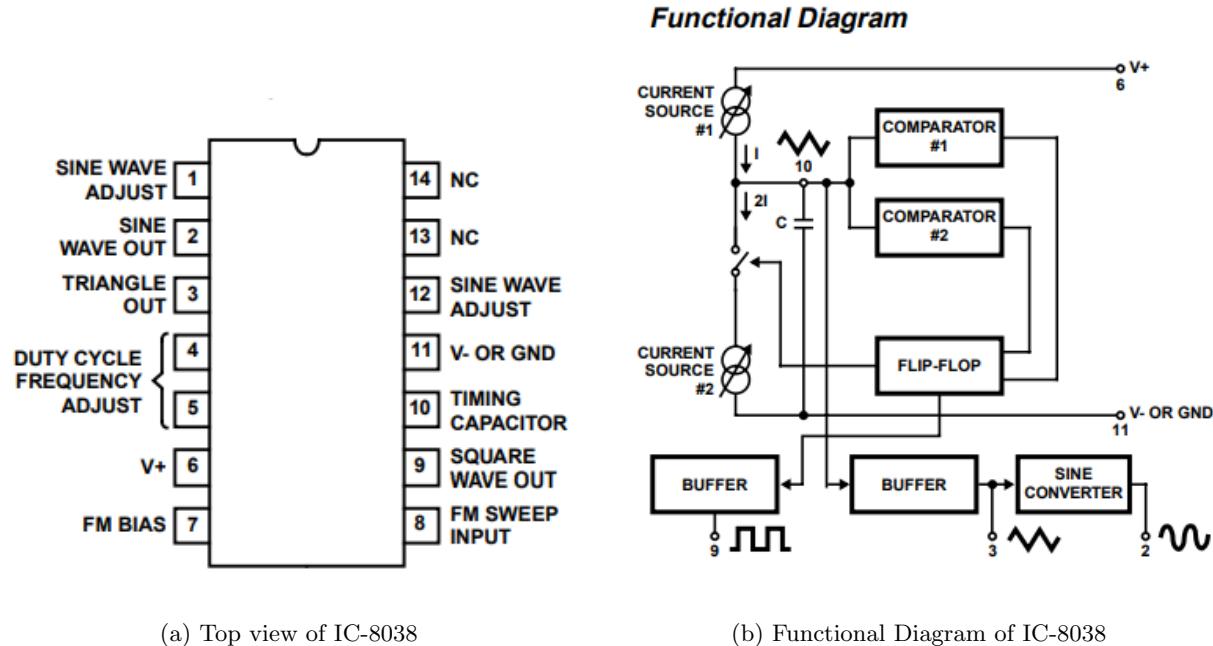


Figure 2: Voltage-controlled oscillator

3.2.1 IC-8038

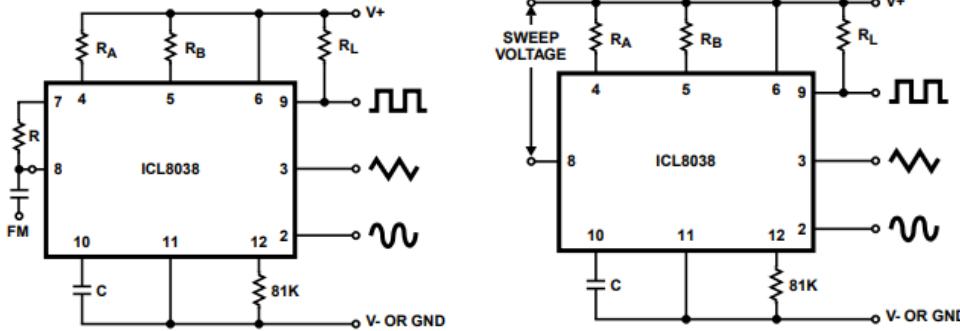
IC-8038 is 14 pin ic,which is used to generate high accuracy sine, square,triangular, sawtooth and pulse waveforms.



3.3 Frequency Modulation and Sweeping

Frequency at output of IC is direct function of DC voltage at pin-8.For small deviations (e.g. $\pm 10\%$) the modulating signal can be applied directly to pin 8.an external Resistor between pin7-8 is not necessary

For larger FM deviations or for frequency sweeping, the message signal is applied between supply voltage and pin 8.In this way the entire bias for the current sources is created by the Message signal, and a very large sweep range is created.in this configuration(Fig(b)) the charge current is no longer a function of the supply voltage and the frequency becomes dependent on the supply voltage.



(a) CONNECTIONS FOR FREQUENCY MODULATION (b) CONNECTIONS FOR FREQUENCY SWEEP

4 Observation/Results

4.1 IC-8038

Pin-4,5 connected through 10kohm resistor to 10 volt DC

Pin-6 connected to 10v DC

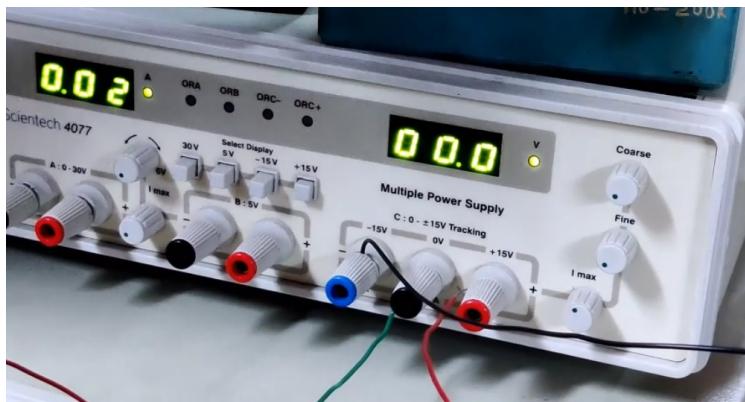
pin-9 connected to 10v through 10kohm resistor and also give square wave at pin-9

pin-10 connected through 3.3nf capacitor to -10 volt DC

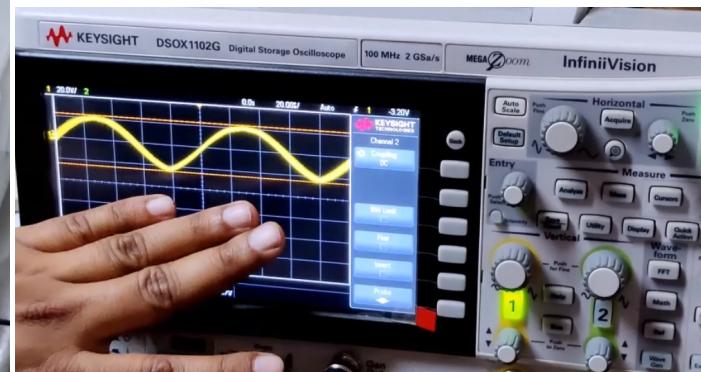
pin-11 connected directly -10v dc

pin-12 connected through 82kohm resistor to -10 volt DC

pin-7,8 we supply different voltage and observe that frequency is decreases and we plot this frequency vs voltage apply at pin7-8.



(a) Supply voltage=0v



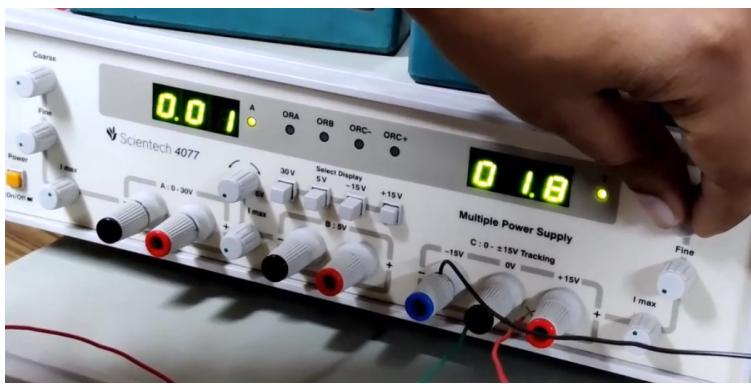
(b) Output waveform



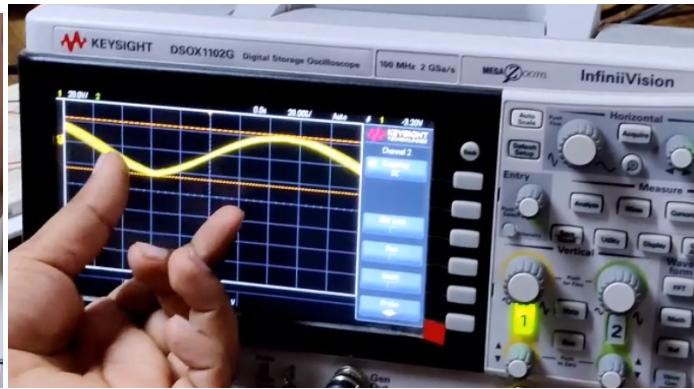
(a) Supply voltage=1.1v



(b) Output waveform



(a) Supply voltage=1.8v



(b) Output waveform

so we plot this varying frequency with respect to supply voltage and we observe that when supply voltage increases then frequency decreases. But in theoretically we studied that frequency is direct function of voltage but here when we increases the voltage, frequency is decreases. how this possible? Because when we connected the probe of power supply we connect in negative way that means we increases voltage but that's increases in Negative direction that means overall decreases so here voltage decreases.

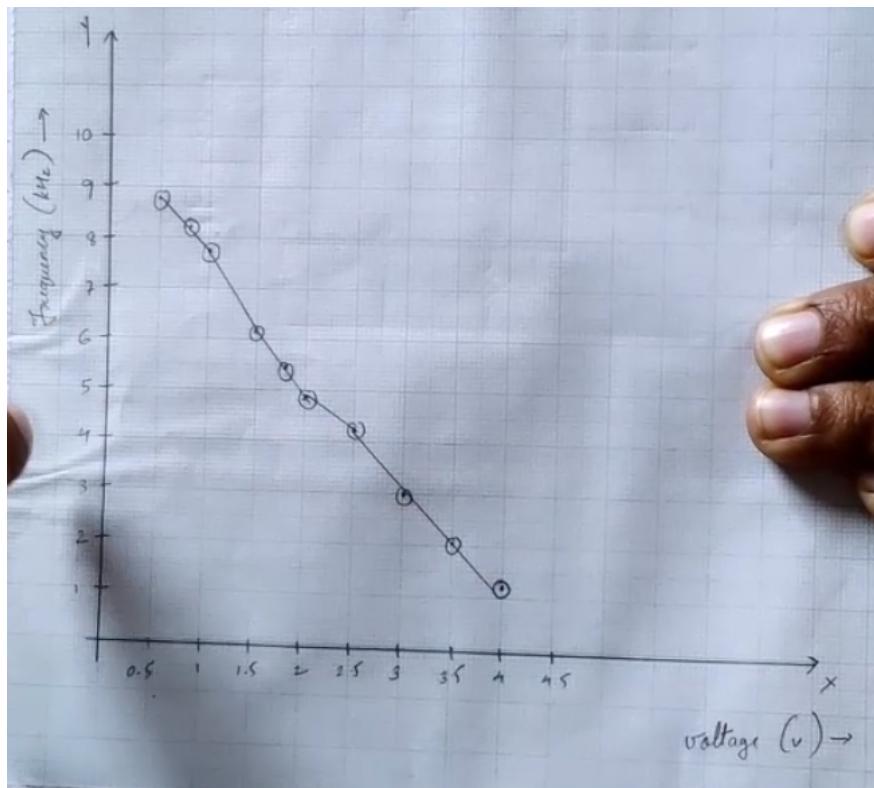


Figure 8: Supply voltage vs Frequency

4.2 FM modulation

Pin-4,5 connected through 10kohm resistor to 10 volt DC

Pin-6 connected to 10v DC

pin-9 connected to 10v through 10kohm resistor and also give square wave at pin-9

pin-10 connected through 3.3nf capacitor to -10 volt DC

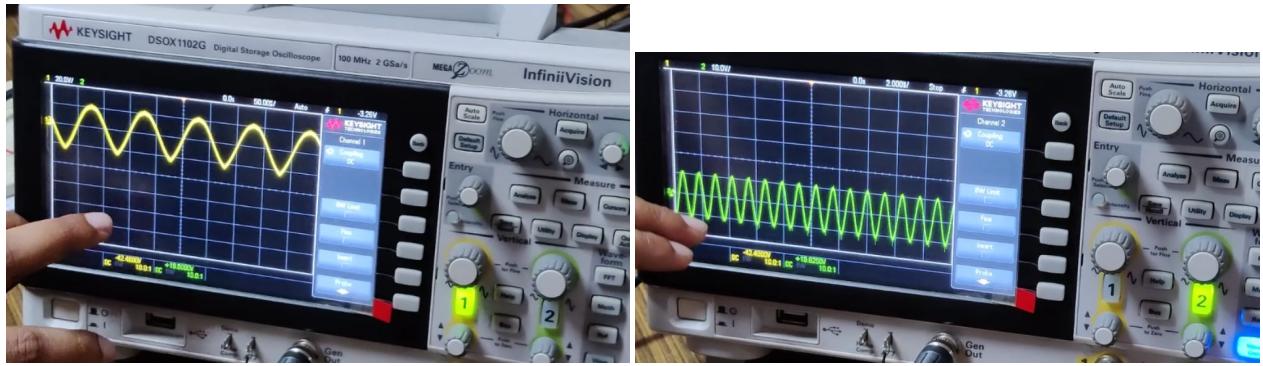
pin-11 connected directly -10v dc

pin-12 connected through 82kohm resistor to -10 volt DC

pin-7,8 we supply sin wave (3 Vp-p, fm=820 Hz)

PIN-2 output taken

and observe that frequency is decreases or increases.when amplitude changes of sin wave.and we see when amplitude decreases then frequency decreases and when amplitude increases then frequency increases.



(a) Carrier signal

(b) Message signal

so Modulated signal is

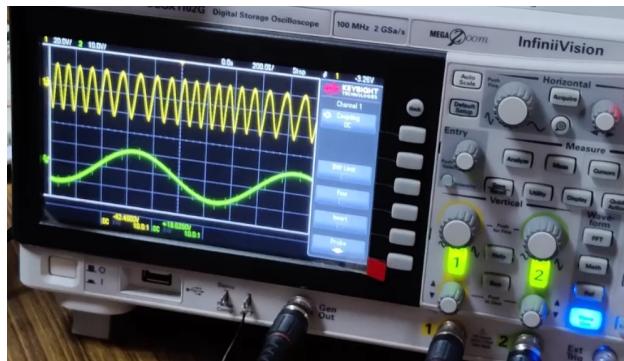


Figure 10: Modulated signal

5 Conclusion/Sources of error

In this Experiment we study about Characteristic of VCO using IC-8038.and there is minor difference between Theoretical graph and practical graph.because we taken negative voltage.

also if we observe the graph not exactly linear because and if we observe the DSO screen Frequency is varying when amplitude of message signal is varying(Frequency Modulation) this same thing we study Theoretically.