The Schmitt Trigger

Objectives

1. To understand the characteristic of the Schmitt Trigger by using operational amplifier (Op-Amp) in inverting configuration.
2. To observe the input-output waveform transition of Schmitt Trigger.

Components & Equipment

1. Op-Amp IC 741
2. Resistors (25kΩ and 10kΩ)
3. Function Generator
4. Oscilloscope
5. Power supply

Theory

Schmitt Trigger is a circuit that converts a regular or irregular shape of waveform to the square/pulse output waveform. A Figure 1 shows a Schmitt Trigger connection in inverting configuration with positive feedback. This due to when the input voltage, Vin at every time it exceed upper and lower threshold voltage, it will triggers (change of state) the output voltage, Vout. The distance between the threshold voltages is called the hysteresis.

These voltage levels are obtained from voltage divider R1-R2 where voltage across R1 is fed back into (+) input. The voltage across R1 is variable reference voltage which depends on the value and polarity of output voltage. When Vout = +Vsat, voltage across R1 become upper threshold voltage, Vut and Vin must be more positive than Vut in order for output to switch from +Vsat to –Vsat. When Vout = -Vsat, voltage across R1 become lower threshold, Vlt and Vin must be more negative than Vlt in order for output to switch from –Vsat to +Vsat.

Voltage Divider Rule:

$$V_{threshold} = \frac{R1}{R1 + R2} V_{saturation}$$

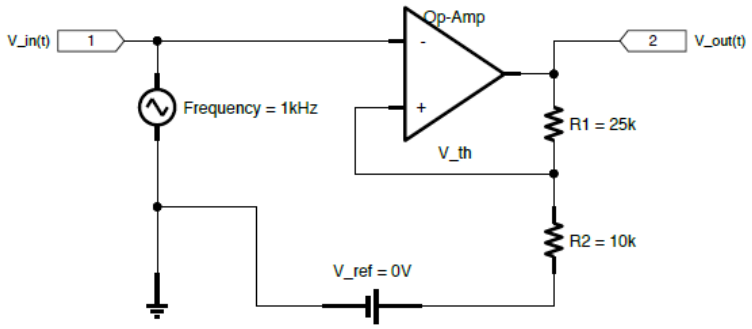

Figure 1

Procedure

1. Construct a circuit as shown in Figure 1.
2. Set the DC power supply to provide +VCC and VEE at ±15V at respective pins of Op-Amp IC 741.
3. Set the function generator to provide 3V (p-p) sine wave at 1kHz. Supply AC input at pin 2 (Inverting) of Op-Amp IC 741.
4. Vary the input signal frequency to 1kHz and amplitude 2V(p-p).

Observation

1. Observe the output of the circuit on oscilloscope
2. Measure the output readings and voltage.
3. Plot the input and output signal waveforms on the same axis.
4. Observe the output waveform when vary the input frequency.

Results

The circuit of Schmitt Trigger using Op-Amp IC741 was constructed in inverting configuration of op-amp with input sine wave signal set at 2V (p-p) and 500Hz frequency. The output waveform observed is square wave for sine wave input signal. The input triggers output every time it exceeds threshold voltage levels for both upper and lower.