SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

19EET202 / ANALOG ELECTRONICS

II YEAR / III SEMESTER

UNIT-4: AMPLIFIERS AND SWITCHING CIRCUITS

SCHMITT TRIGGER

What We'll Discuss

TOPIC OUTLINE

Introduction

Classification of Schmitt trigger

Working

Applications

Introduction

Basically, the Schmitt trigger is a multivibrator with two stable states, and the output stays in one of the steady states until further notice. The change from one stable condition to the other condition takes place as the input signal activates approximately.

The operation of multivibrator requires an amplifier with positive feedback with loop gain above unity. This circuit is frequently used to change square waves by gradually differing boundaries toward sharp edges used in digital circuits, as well as switch debouncing.

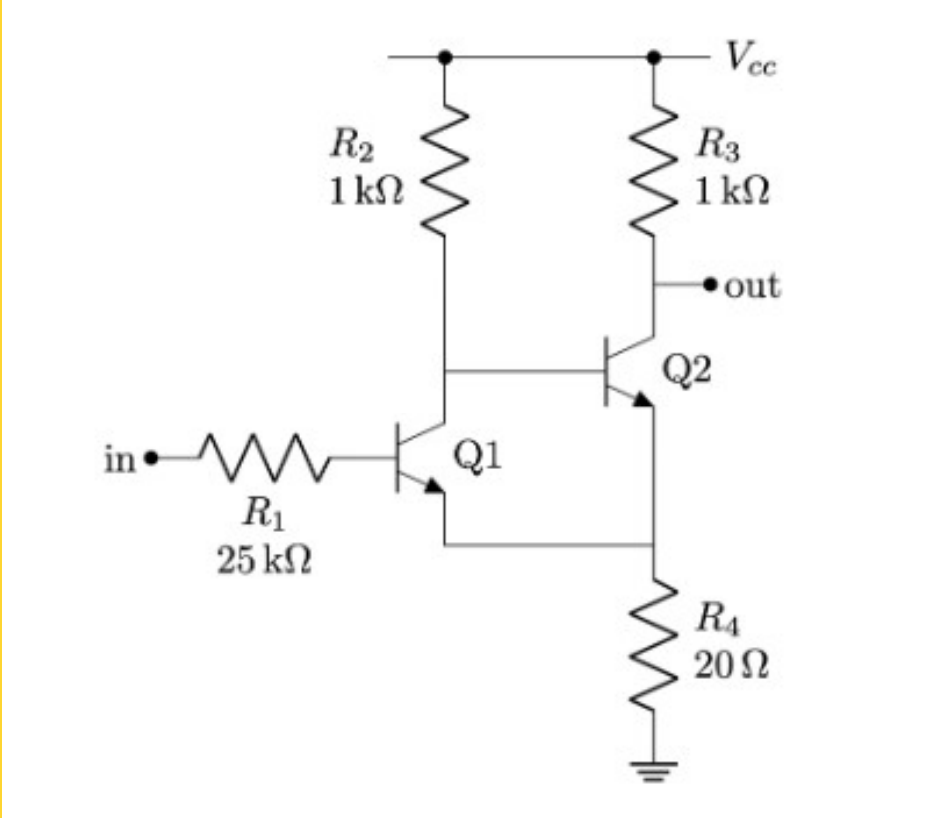
Definition

- Schmitt trigger can be defined as it is a regenerative comparator. It employs positive feedback and converts sinusoidal input into a square wave output.
- The output of Schmitt Trigger swings at upper and lower threshold voltages, which are the reference voltages of the input waveform.
- It is a bi-stable circuit in which the output swings between two steady-state voltage levels (High and Low) when the input reaches certain designed threshold voltage levels.

Schmitt Trigger using Transistors

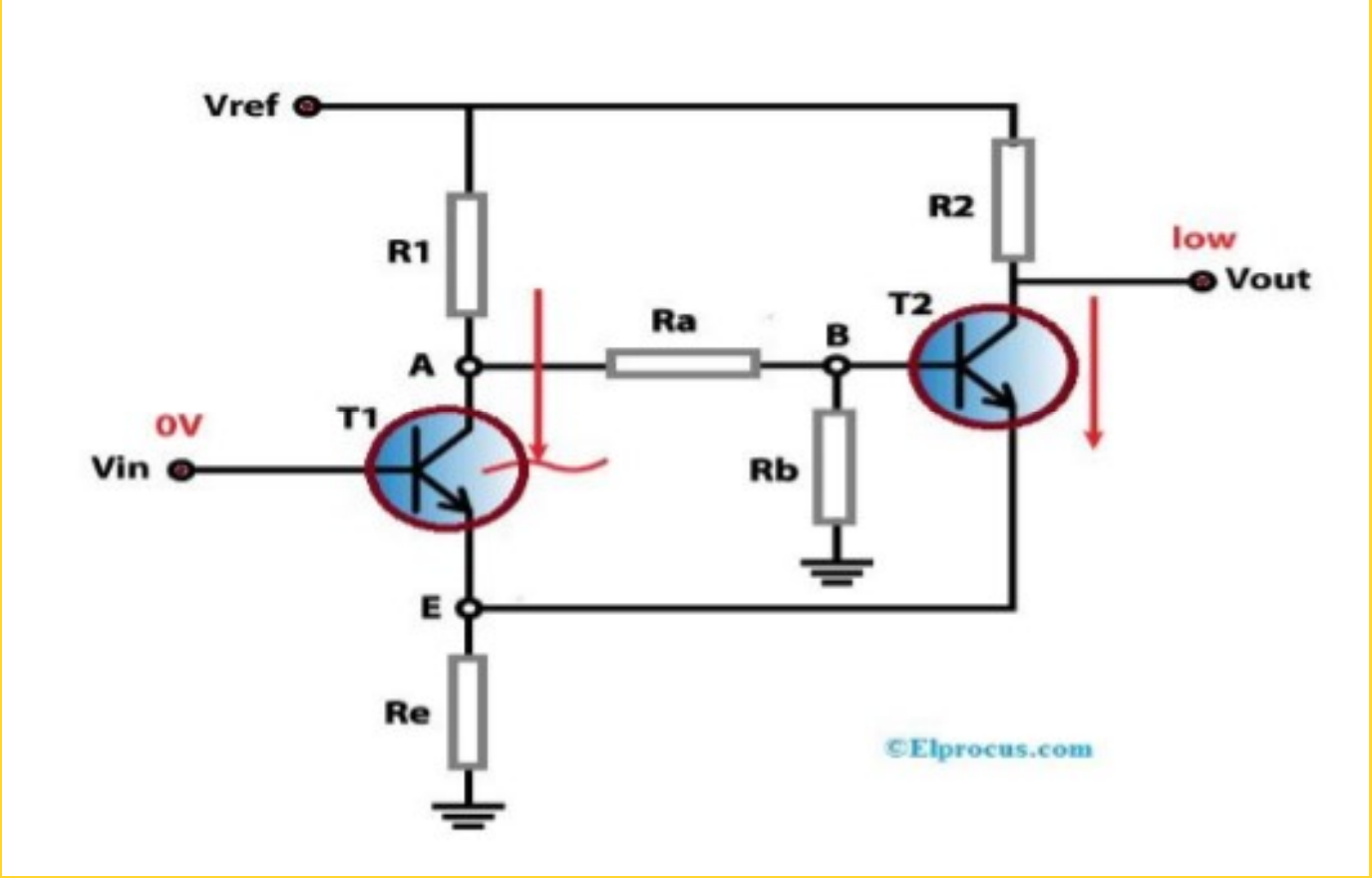
- The main purpose of a Schmitt trigger is to generate a digital signal, which stated in other words is a signal whose only possible values are VCC (logic 1) or ground (logic 0).
- The original analog signal can vary slowly in time so that the transition periods from high/low to low/high might not be fast enough.
- This circuit will act as a comparator with hysteresis whose thresholds for setting the output high or low will be defined by the design parameters.

Circuit diagram

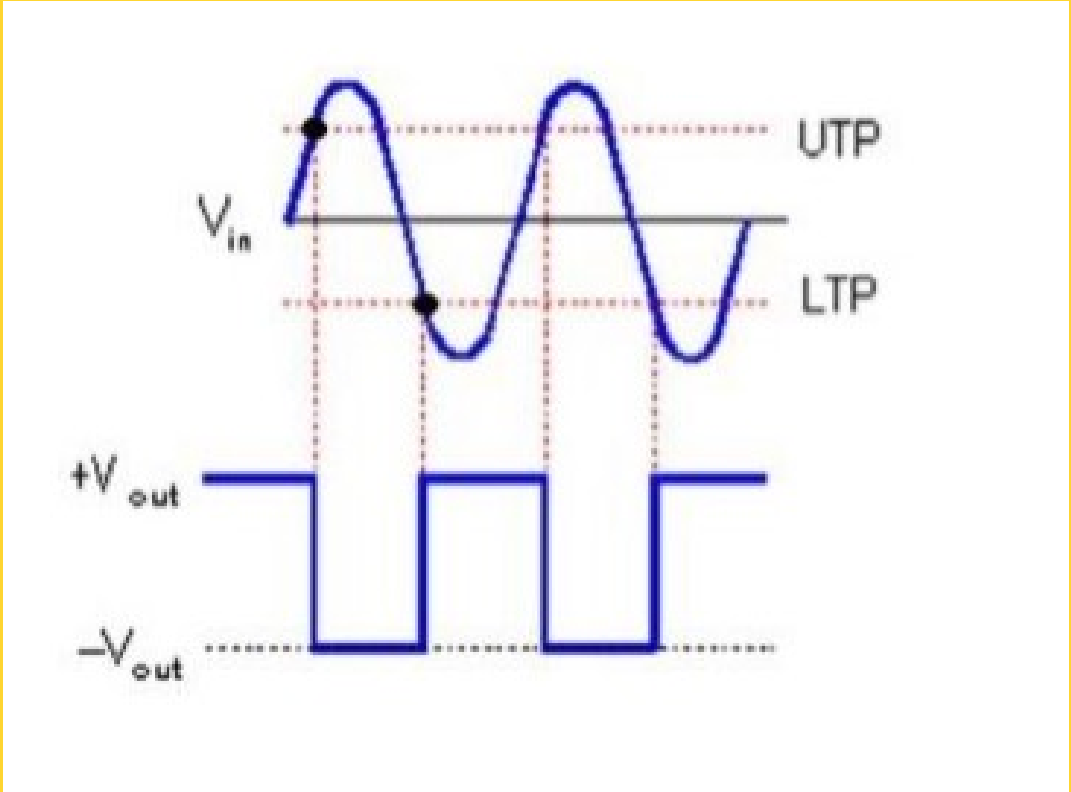


- When the input voltage (Vin) is 0 V, then the T1 transistor will not conduct, whereas the T2 transistor will conduct due to the voltage reference (Vref) with the voltage1.98.
- At node B, the circuit can be treated as a voltage divider to calculate the voltage with the help of following expressions.

Circuit diagram



Output waveform



Working

- The conducting voltage of the T2 Transistor is low & the transistor emitter terminal voltage will be 0.7 V is lesser than the base terminal of the transistor that will be 1.28 V.

$$Vin = 0V, Vref = 5V$$
$$Va = (Ra + Rb/ Ra + Rb + Rl) * Vref$$
$$Vb = (Rb/Rb + Rl + Ra) * Vref$$

Contd...

- When we increase the input voltage, the T1 transistor value can be crossed so the transistor will conduct. This will be the reason to drop the base terminal voltage of the transistor T2.
- When the T2 transistor is not conducting longer then the output voltage will be increased. Subsequently, the Vin (input voltage) at the T1 transistor base terminal will begin refusing & it will deactivate the transistor as the transistor base terminal voltage will be above 0.7 V of its emitter terminal.

Working

- This will occur when the emitter current will refuse to an end wherever the transistor will find into the mode of forward-active. So the voltage at the collector will rise, and also the base terminal of the T2 transistor.
- This will reason to flow little current through the T2 transistor further it will drop the voltage of the emitters of the transistor and also turn off the T1 transistor.
- In this case, the input voltage requires dropping 1.3V to deactivate the T1 transistor. So finally the two threshold voltages will be 1.9V & 1.3V.

Applications

- Schmitt triggers are mainly used for changing a sine wave to square wave.
- They must be utilized in the switch de-bouncer circuit for a noisy otherwise slow input requirements like to be cleaned up or speed up
- These are normally utilized in applications like signal conditioning for removing signals noise in digital circuits.
- These are used to implement relaxation oscillators for closed loop negative response designs
- These are used in switching power supplies as well as function generators

THANK YOU