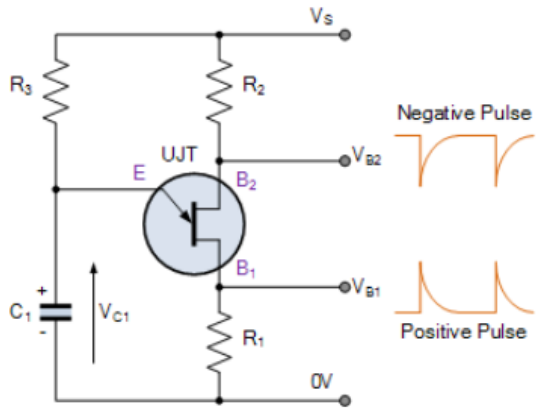
UJT relaxation oscillator

Introduction

It is a type of RC (resistor-capacitor) oscillator where the active element is a UJT (uni-junction transistor). UJT is an excellent switch with switching times in the order of nano seconds. It has a negative resistance region in the characteristics and can be easily employed in relaxation oscillators. The UJT relaxation oscillator is called so because the timing interval is set up by the charging of a capacitor and the timing interval is ceased by the the rapid discharge of the same capacitor.

Circuit Diagram and Working



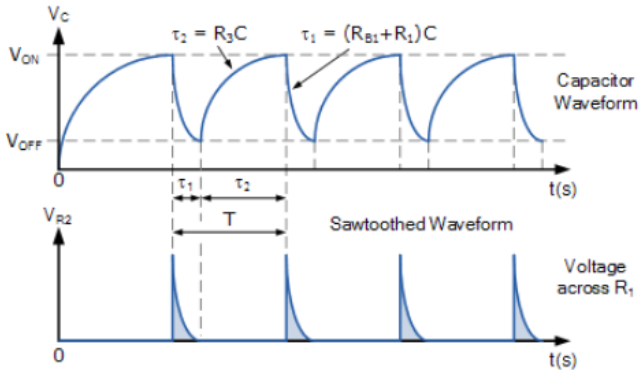
When a voltage (Vs) is firstly applied, the unijunction transistor is “OFF” and the capacitor C1 is fully discharged but begins to charge up exponentially through resistor R3. As the Emitter of the UJT is connected to the capacitor, when the charging voltage Vc across the capacitor becomes greater than the diode volt drop value, the p-n junction behaves as a normal diode and becomes forward biased triggering the UJT into conduction. The unijunction transistor is “ON”. At this point the Emitter to B1 impedance collapses as the Emitter goes into a low impedance saturated state with the flow of Emitter current through R1 taking place.

As the ohmic value of resistor R1 is very low, the capacitor discharges rapidly through the UJT and a fast rising voltage pulse appears across R1. Also, because the capacitor discharges more quickly through the UJT than it does charging up through resistor R3, the discharging time is a lot less than the charging time as the capacitor discharges through the low resistance UJT.

When the voltage across the capacitor decreases below the holding point of the p-n junction (V_{OFF}), the UJT turns “OFF” and no current flows into the Emitter junction so once again the capacitor charges up through resistor R3 and this charging and

discharging process between V_{ON} and V_{OFF} is constantly repeated while there is a supply voltage, Vsapplied.

UJT Oscillator Waveforms



Then we can see that the unijunction oscillator continually switches “ON” and “OFF” without any feedback. The frequency of operation of the oscillator is directly affected by the value of the charging resistance R3, in series with the capacitor C1 and the value of η. The output pulse shape generated from the Base1 (B1) terminal is that of a sawtooth waveform and to regulate the time period, you only have to change the ohmic value of resistance, R3 since it sets the RC time constant for charging the capacitor.

The time period, T of the sawtoothed waveform will be given as the charging time plus the discharging time of the capacitor. As the discharge time, τ_1 is generally very short in comparison to the larger RC charging time, τ_2 the time period of oscillation is more or less equivalent to $T \cong \tau_2$. The frequency of oscillation is therefore given by $f = 1/T$.