

Circuit Simulation Project

<https://esim.fossee.in/circuit-simulation-project>

DESIGN OF SQUARE WAVE TO SAWTOOTH WAVE CONVERTOR CIRCUIT USING BJT

by

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THEORY AND DESCRIPTION:

Circuits which convert one form of wave form to another wave form are known as Waveform Converter Circuits. The function generator itself uses such circuits to generate different kinds of waveforms. A square wave is a non-sinusoidal periodic waveform in which the amplitude alternates at a steady frequency between fixed minimum and maximum values, with the same duration at minimum and maximum. In an ideal square wave, the transitions between minimum and maximum are instantaneous. The sawtooth wave (or saw

wave) is a kind of non-sinusoidal waveform. It is so named based on its resemblance to the teeth of a plain-toothed saw with a zero rake angle. These circuits are very much useful when some circuits require one specific kind of wave as an input. The sawtooth generator, also known as the ramp generator, analog time base, etc., is one of the standard building blocks in the linear design circuit.

DESIGN:

The circuit consists of a DC voltage source, four resistors, two BJTs, a capacitor and a pulse waveform generator. In the circuit resistors R_2 and R_3 form a voltage divider which determines, after V_{BE} drop the voltage on R_4 , forming the constant current to charge the capacitor. $R_2 || R_3$ should be low enough to avoid loading from the base current. Constant current and capacitor value determine the charge time. In this one transistor is used as a source to charge the capacitor. The other transistor is driven by the square wave generator or the pulse waveform generator to quickly discharge the capacitor on one state of the square wave signal.

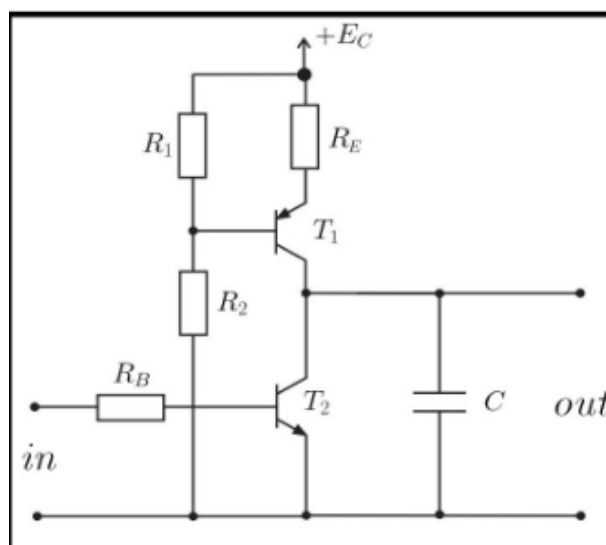
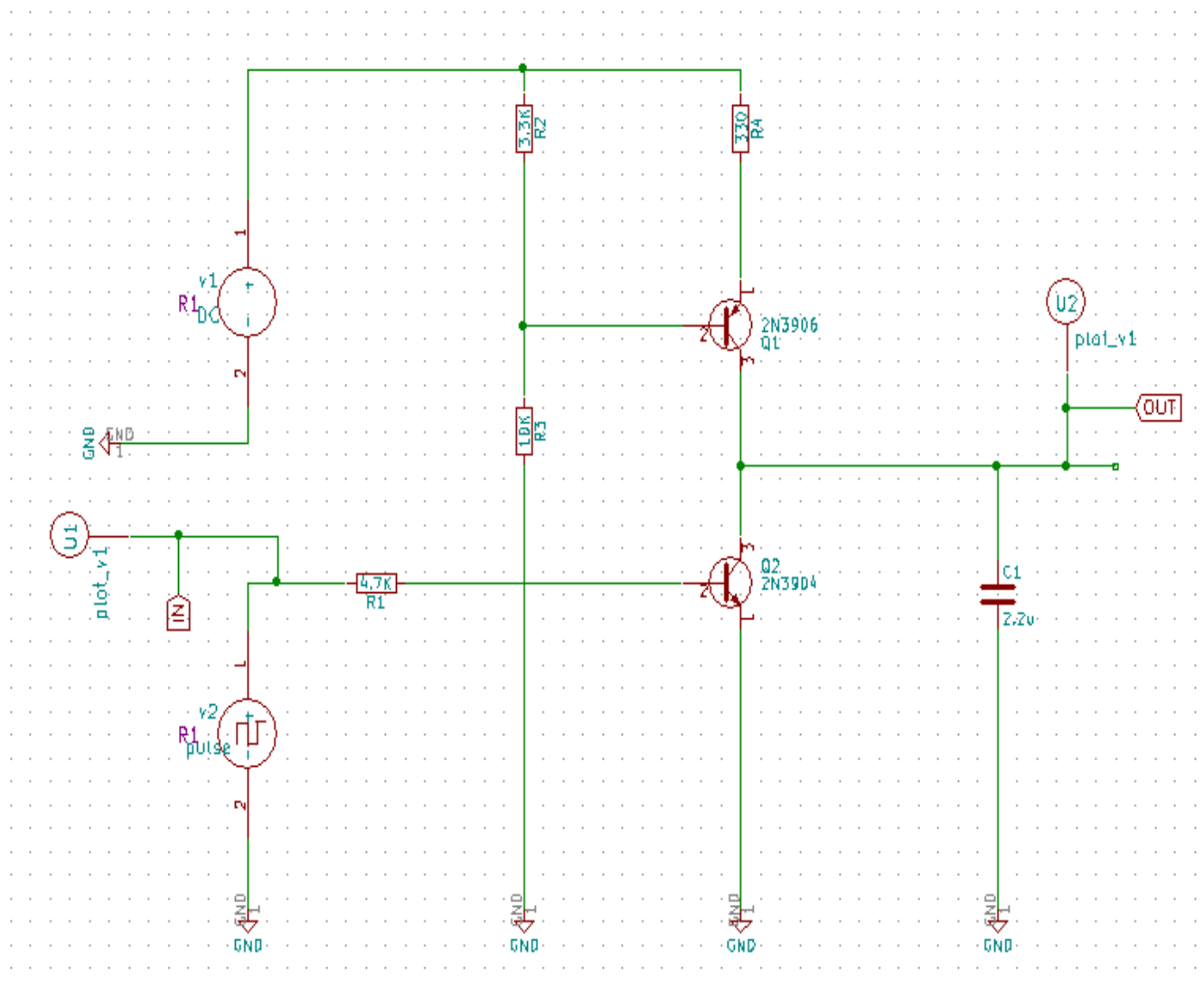


Figure 1. Circuit Schematic

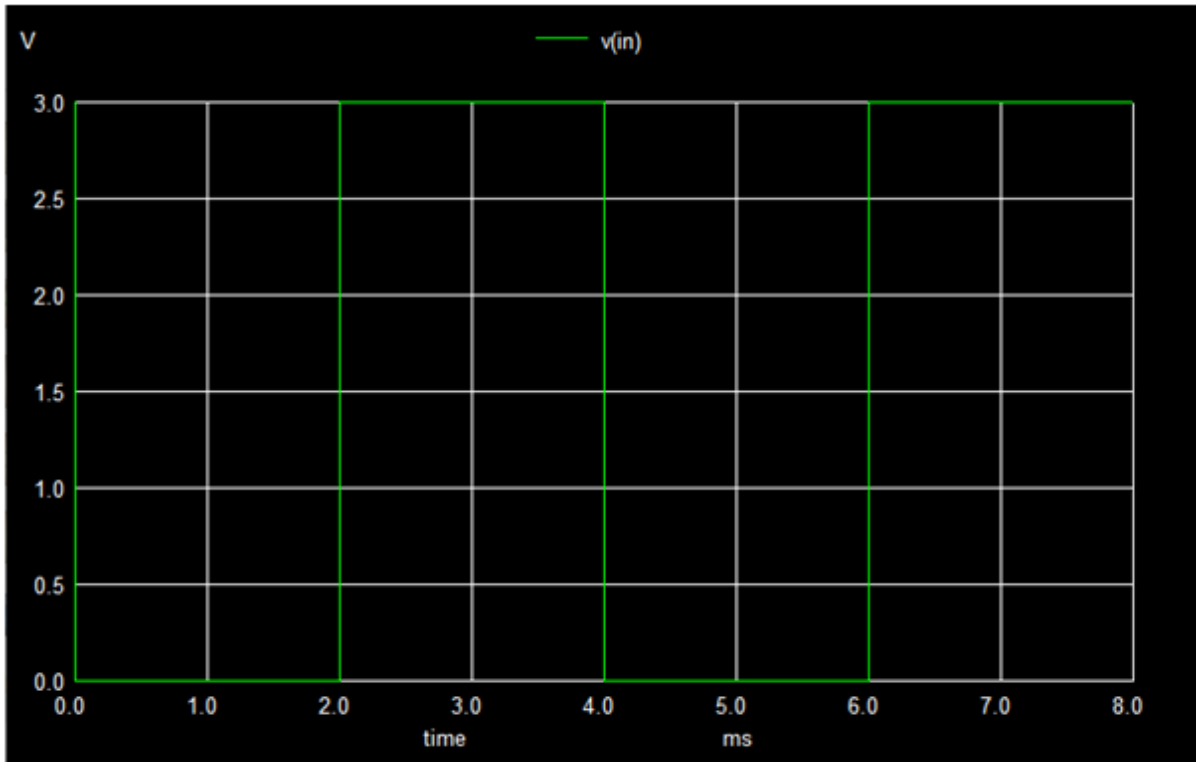
SCHEMATIC DIAGRAM:



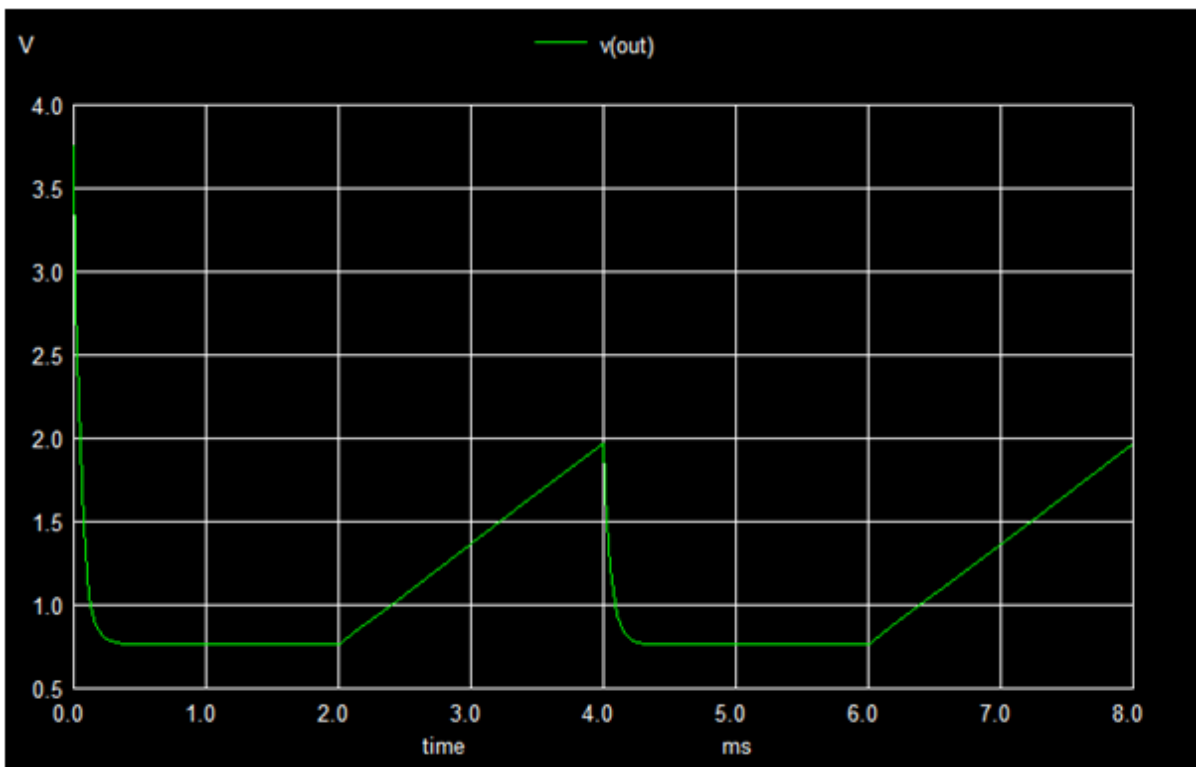
SIMULATION RESULTS:

NGSPICE PLOTS:

INPUT PLOT

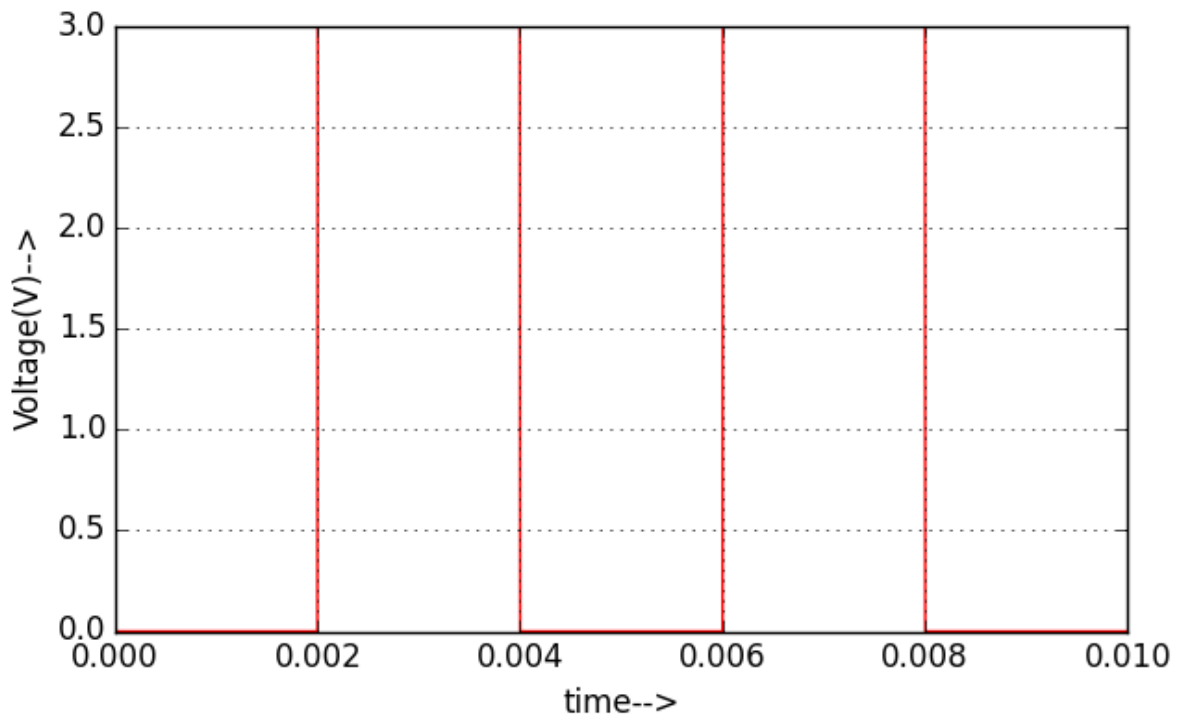


OUTPUT PLOT

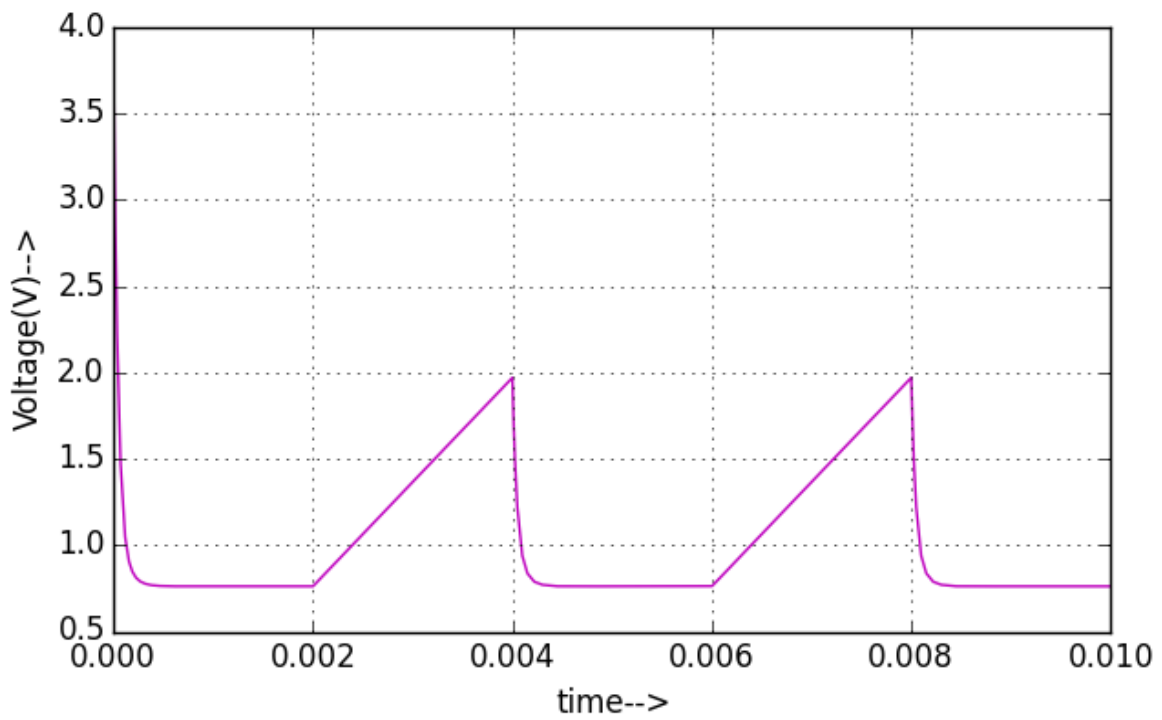


PYTHON PLOTS:

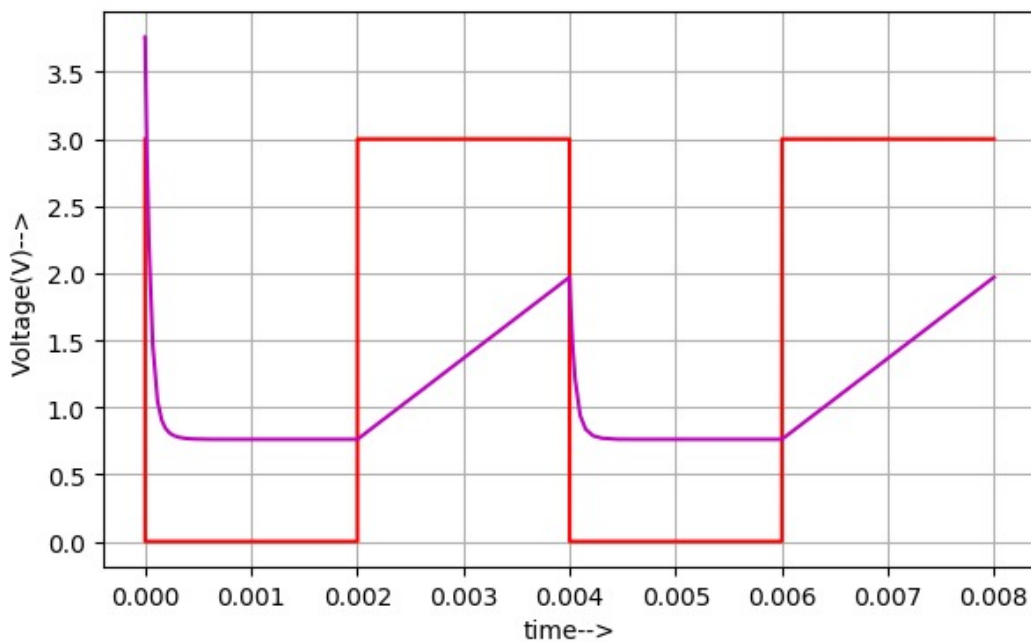
INPUT PLOT



OUTPUT PLOT



INPUT AND OUTPUT PLOT



CONCLUSION:

Hence, Square wave to Sawtooth wave converter circuit using BJT is designed and simulated on the eSim.

REFERENCES:

- <https://itectec.com/electrical/electronic-square-wave-to-sawtooth-wave-using-two-bjt/>
- <https://electronics.stackexchange.com/questions/446097/square-wave-to-sawtooth-wave-using-two-bjt>
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- https://en.wikipedia.org/wiki/Sawtooth_wave
- https://en.wikipedia.org/wiki/Square_wave#:~:text=A%20square%20wave%20is%20a,minimum%20and%20maximum%20are%20instantaneous.