

Circuit Simulation Project

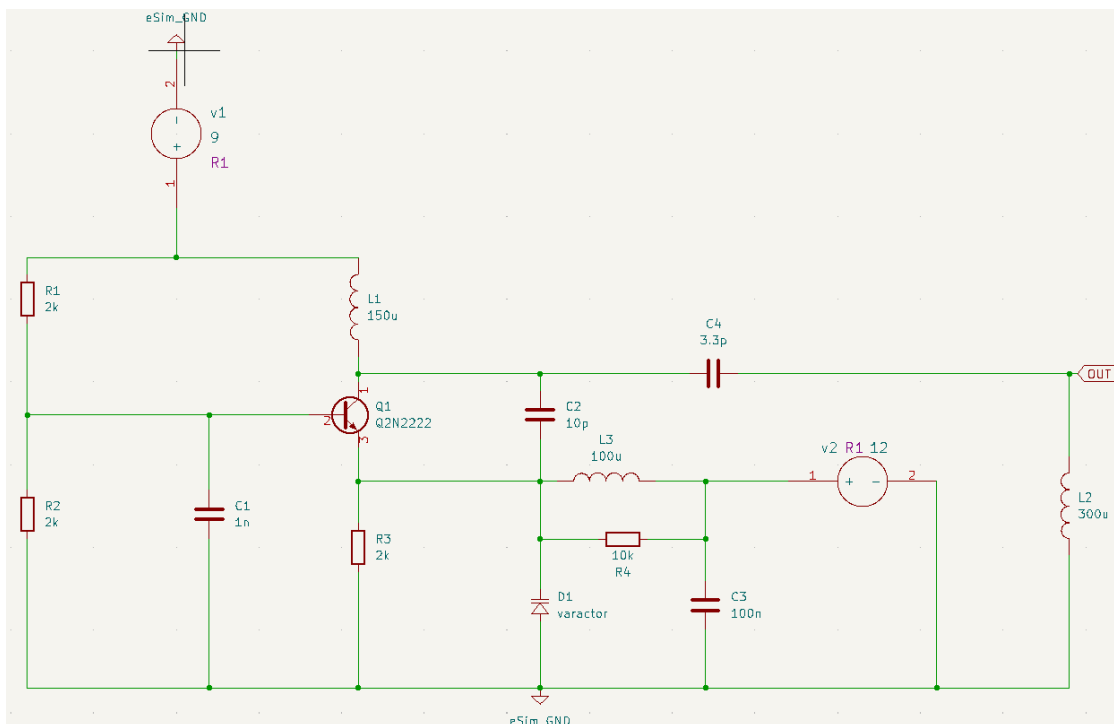
<https://esim.fossee.in/circuit-simulation-project>

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Title of the circuit : Fast Response Voltage to Frequency Converter

Theory/Description : A Voltage-to-Frequency Converter (VFC) is an analog circuit that produces a pulse train with frequency proportional to the applied input voltage. This technique is widely used in analog-to-digital conversion, data transmission, and sensor interfacing, because frequency signals are less susceptible to noise and distortion over long distances compared to direct voltage signals. By converting voltage into frequency, measurement systems can achieve higher accuracy, linearity, and stability.

Circuit Diagram:



Results (Input, Output waveforms and/or Multimeter readings) :

Fig – 1:

Start Time = 0ms; Step Time = 100us; Stop time = 5ms.

If Reference Voltage = 2V => Obtained Maximum Voltage = 4.1V

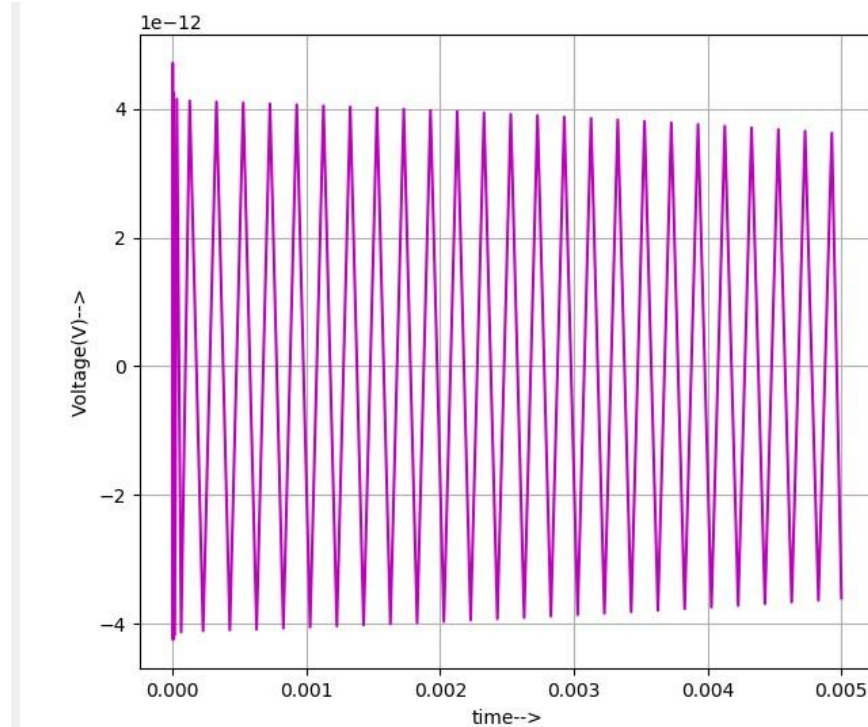


Fig – 2

Start Time = 0ms; Step Time = 100us; Stop Time = 5ms.

If Reference Voltage = 4v => Obtained Maximum Voltage = 1.6V

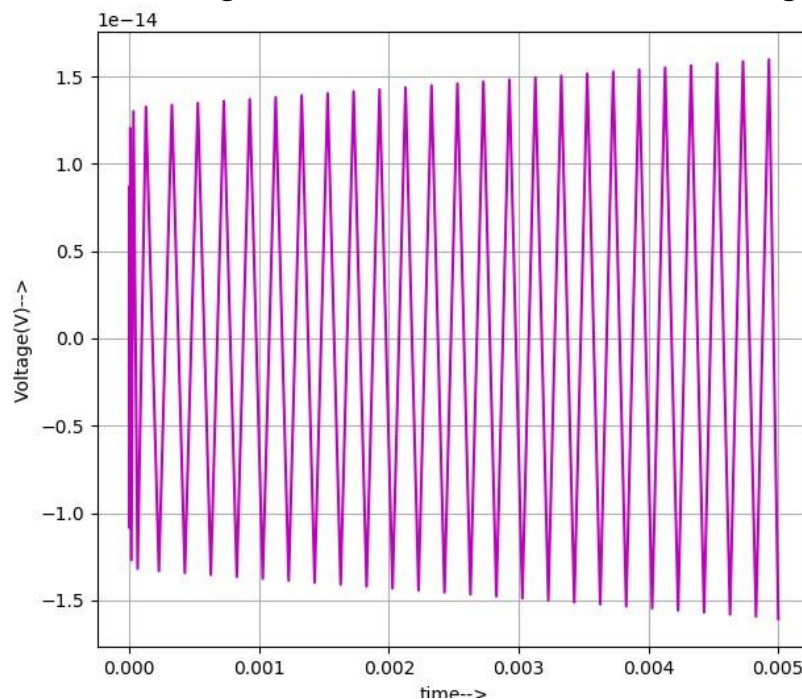


Fig – 3

Start Time = 0ms; Step Time = 100us; Stop Time = 5ms.

If Reference Voltage = 8v => Obtained Maximum Voltage = 6V

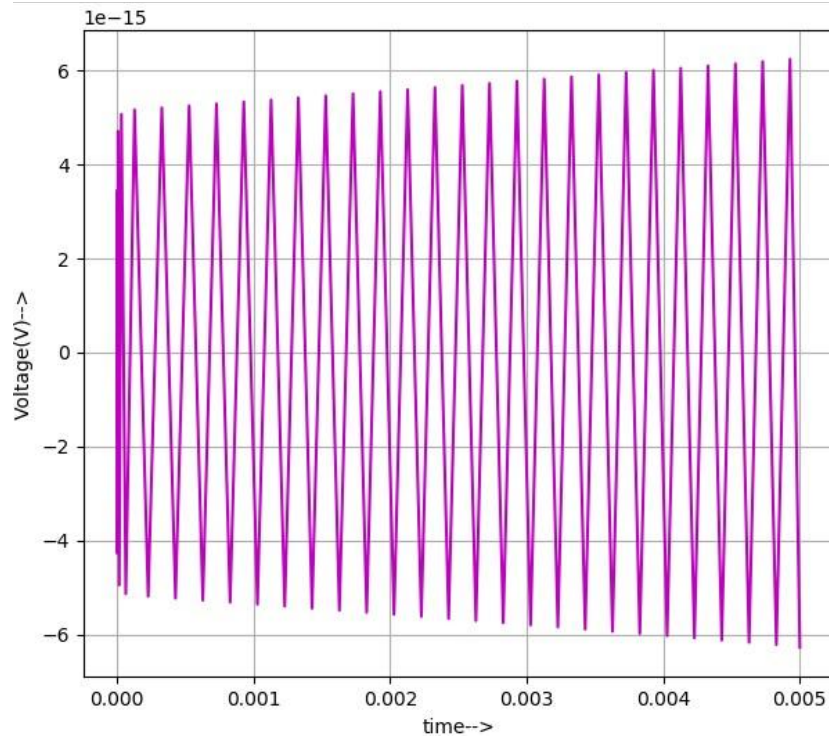
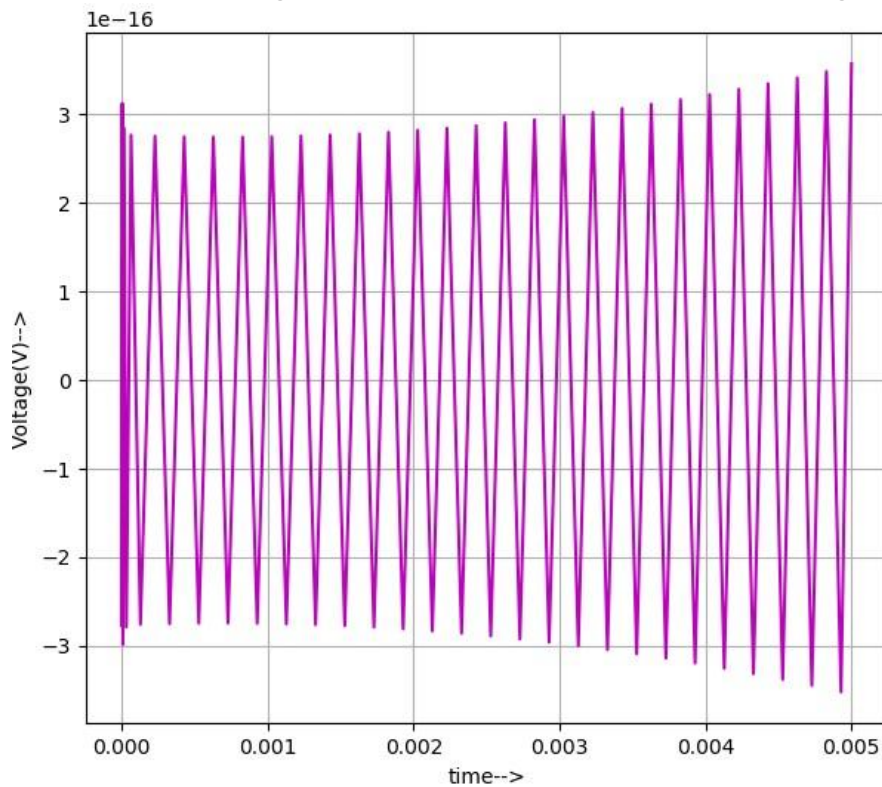


Fig – 4

Start Time = 0ms; Step Time = 100us; Stop Time = 5ms.

If Reference Voltage = 8v => Obtained Maximum Voltage = 3.8V



Practical:

Considered Reference Voltage is 12V.

The transient simulation was run with the same parameters:

- Start Time = 0ms
- Step Time = 100μs
- Stop Time = 5ms

At this reference voltage, the maximum output amplitude observed was 3.8 V. Measuring over N = 50 cycles gave a total elapsed time $\Delta t = 12.2 \mu s$.

$$F = 50/(12.2 \times 10^{-6}) = \mathbf{4.10 MHz}$$

Formula

$$f = 1/(2 \times \pi \times \sqrt{LC})$$

$$\square L = 150 \mu H = 150 \times 10^{-6} H$$

$$\square C = 10 pF = 10 \times 10^{-12} C \quad f = 1/2\pi \times \sqrt{LC}$$

$$= 1/(2.433235 \times 10^{-7})$$

$$= 4.10936 \times 10^6 Hz = \mathbf{4.109 MHz}$$

Source/Reference(s) :

<https://www.digikey.com/en/articles/the-basics-of-voltage-controlled-oscillators-vcos>