

5.10 FREQUENCY TO VOLTAGE CONVERTORS (F-V)

- F-V convertors applications: Tachometer in motor speed control Rotational speed measurement.
- Ideal characteristics of V-F converter and F-V converter is shown in figure 5.10.1.
- Two types of it: Pulse integrating Phase locked loop

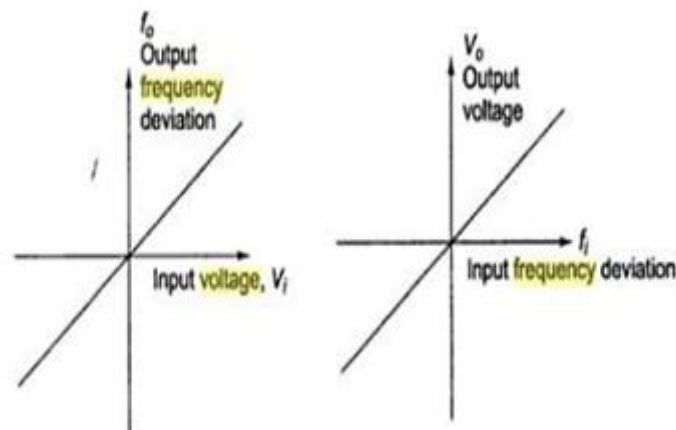


Figure 5.10.1 Ideal characteristics of V-F converter and F-V converter

[source: https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/]

- F-V convertor produces an output voltage whose amplitude is a function of input signal frequency.
- $V_o = k_f f_i$ k_f is sensitivity of F-V convertor
- Frequency to voltage converter using VFC32 is shown in figure 5.10.2.
- It is basically a FM discriminator.

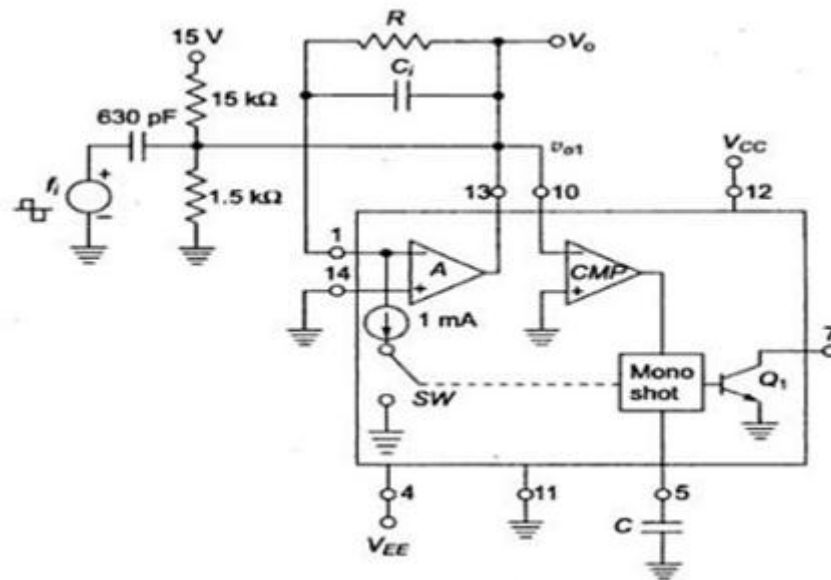


Figure 5.10.2 Frequency to voltage converter using VFC32

[source: https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/]

- Input frequency is applied to comparator A.
- Resistor R acts as feedback element.
- Capacitor Ci enables charge-balancing,
- High pass network conditions input signal

For negative spike of V_{O1} , comparator COMP triggers one shot multivibrator with threshold 7.5V. The output of multivibrator closes the switch SW, for a time T_H , this causes voltage V_o to build up and inject thru R and this continues until current out of summing input of opamp is equal to that injected by V_o through R continuously. Input-output characteristics of Frequency to voltage converter using VFC32 is shown in figure 5.10.3

$$V_o = 10^{-3} * T_H * R * f_i \quad \text{as } T_H = 7.5 C / 1 \times 10^{-3}$$

Ripple Voltage, $V_r(\max) = 7.5 C / C_i$

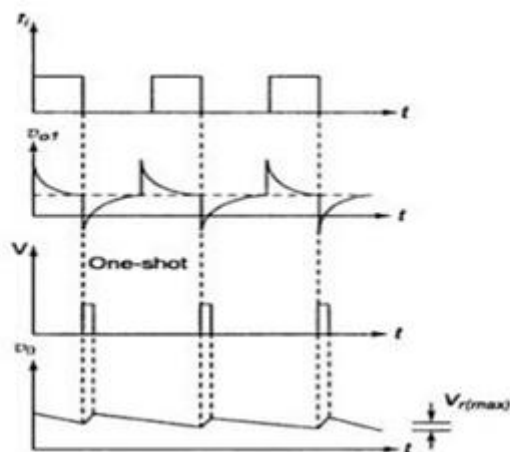


Figure 5.10.3 input –output characteristics

[source: https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/]

VOLTAGE TO FREQUENCY CONVERTOR

Principle: Charge balancing technique-the process of charging and discharging results in frequency proportional to input signal $F_0 = k V_i$

Operation: Op-amp A converts input V_i to current $I_i = V_i/R$ into summing junction. When switch SW is open the current flows into capacitor C_i and charges it, and node voltage V_{o1} produce ramp down. When $V_{o1} = 0$ CMP triggers and sends a triggering signal to one shot multivibrator that closes the switch SW and turns transistor Q ON for time T_H . Voltage – Frequency using VF32 and its input –output characteristics is shown in figure 5.10.4.

The threshold of mono shot = 7.5 V and $T_H = 7.5 C/10^{-3}$

During T_H , V_{o1} ramps upward by amount $\Delta V_{o1} = (1\text{mA} - I_i) T_H / C_i$

Time duration T_L for v_{o1} to return to 0 is $T_L = C \Delta V_{o1} / I_i$

$$T_L + T_H = 1\text{mA} T_H / I_i = T$$

$$F_0 = V_i / 7.5 RC$$

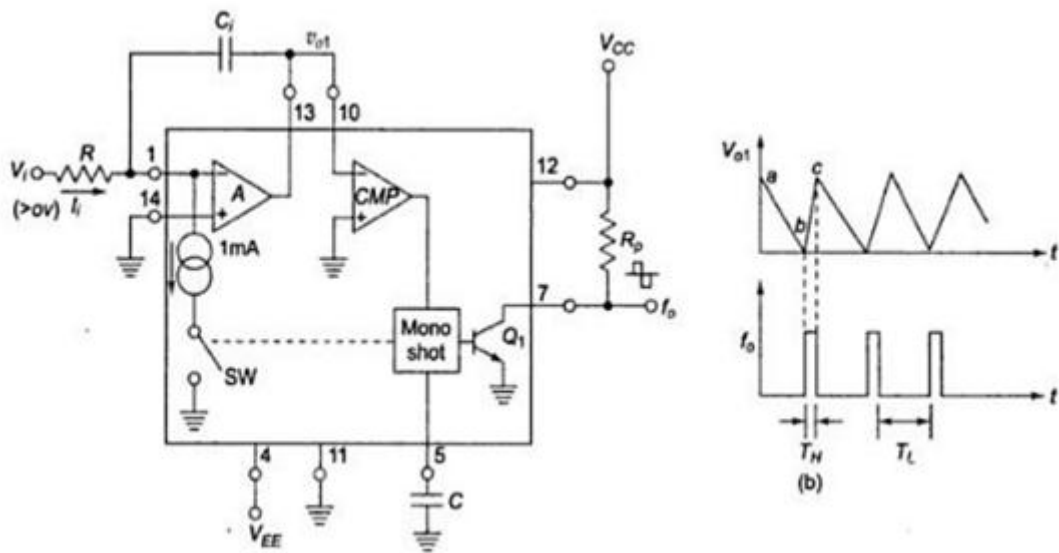


Figure 5.10.4 Voltage –Frequency using VF32 and its input –output characteristics

[source: https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/]

