

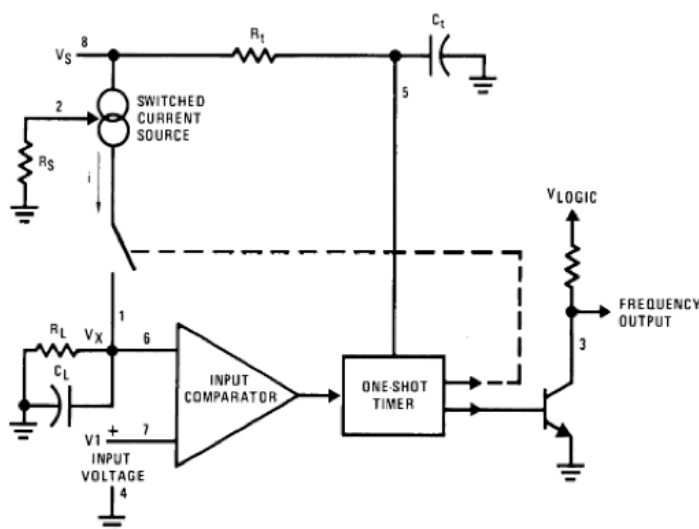
Theory of Operation

The operation of these blocks is best understood by going through the operating cycle of the basic V-to-F converter, Figure 2, which consists of the simplified block diagram of the LM231/331 and the various resistors and capacitors connected to it.

The voltage comparator compares a positive input voltage, V_1 , at pin 7 to the voltage, V_x , at pin 6. If V_1 is greater, the comparator will trigger the 1-shot timer. The output of the timer will turn ON both the frequency output transistor and the switched current source for a period $t = 1.1 R_t C_t$. During this period, the current i will flow out of the switched current source and provide a fixed amount of charge, $Q = i \times t$, into the capacitor, C_L . This will normally charge V_x up to a higher level than V_1 . At the end of the timing period, the current i will turn OFF, and the timer will reset itself.

Now there is no current flowing from pin 1, and the capacitor C_L will be gradually discharged by R_L until V_x falls to the level of V_1 . Then the comparator will trigger the timer and start another cycle.

The current flowing into C_L is exactly $i_{ave} = i \times (1.1 \times R_t C_t) \times f$, and the current flowing out of C_L is exactly $V_x / R_L = V_{in} / R_L$. If V_{in} is doubled, the frequency will double to maintain this balance. Even a simple V-to-F converter can provide a frequency precisely proportional to its input voltage over a wide range of frequencies.



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FIGURE 2. Simplified Block Diagram of Stand-Alone Voltage-to-Frequency Converter and External Components