

# LM331

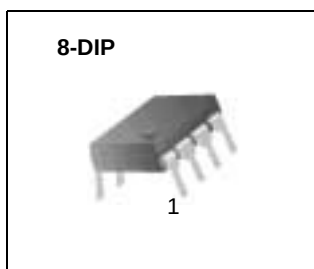
## V-F Converter

### Features

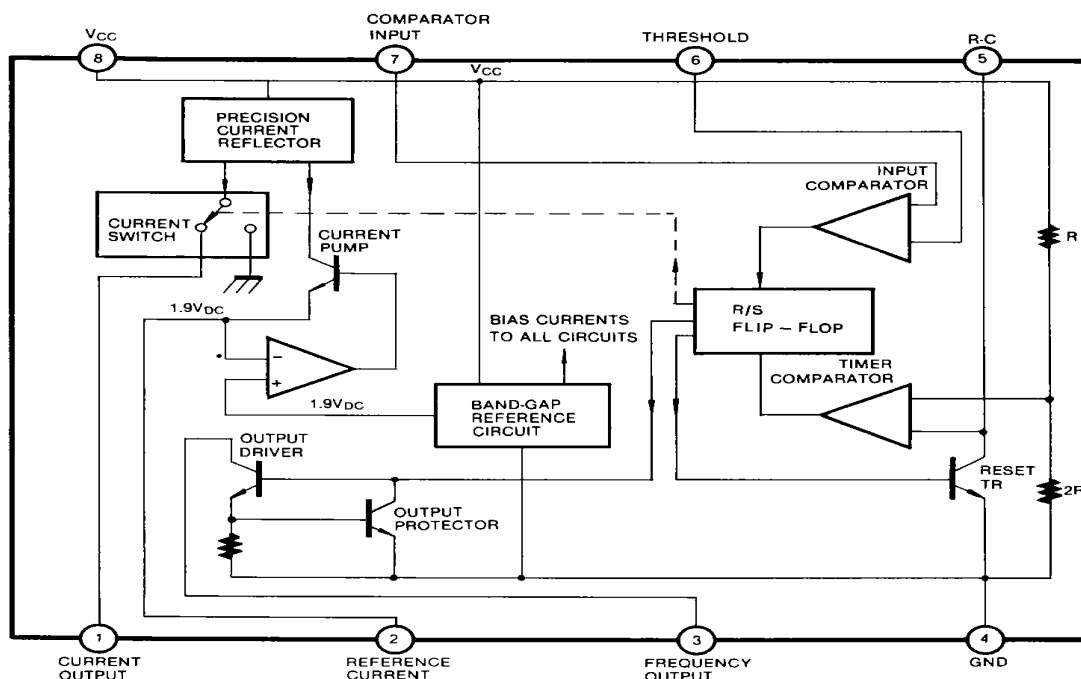
- Guaranteed linearity: 0.01% max.
- Low power dissipation: 15mW at 5V
- Wide range of full scale frequency: 1Hz to 100KHz
- Pulse output compatible with all logic forms
- Wide dynamic range: 100dB min at 10KHz full scale frequency

### Description

This voltage to frequency converter provides the output pulse train at a frequency precisely proportional to the applied input voltage. The LM331 can operate at power supplies as low as 4.0V and be changed output frequency from 1Hz to 100KHz. It is ideally suited for use in simple low cost circuit for analog-to digital conversion, long term integration, linear frequency modulation or demodulation, frequency to voltage conversion, and many other functions.



### Internal Block Diagram

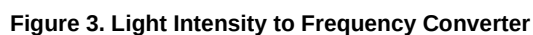


## Absolute Maximum Ratings (T<sub>A</sub> = 25°C)

| Parameter                   | Symbol           | Value                    | Unit |
|-----------------------------|------------------|--------------------------|------|
| Supply Voltage              | V <sub>CC</sub>  | 40                       | V    |
| Input Voltage               | V <sub>I</sub>   | -0.2 ~ + V <sub>CC</sub> | V    |
| Operating Temperature Range | T <sub>OPR</sub> | 0 ~ +70                  | °C   |
| Power Dissipation           | P <sub>D</sub>   | 500                      | mW   |

## Electrical Characteristics

| Parameter                          | Symbol                             | Conditions                                           | Min. | Typ.   | Max.                 | Unit             |
|------------------------------------|------------------------------------|------------------------------------------------------|------|--------|----------------------|------------------|
| VFC Non-Linearity                  | VFCNL                              | 4.5 ≤ V <sub>CC</sub> ≤ 20V                          | -    | ±0.003 | ±0.01                | % Full-Scale     |
| Conversion Accuracy Scale Factor   | ACCUR                              | V <sub>I</sub> = -10V, R <sub>S</sub> = 14KΩ         | 0.90 | 1.00   | 1.10                 | KHz/V            |
| Chang Of Gain With V <sub>CC</sub> | V <sub>CC</sub> ΔG/V <sub>CC</sub> | 4.5V ≤ V <sub>CC</sub> ≤ 10V                         | -    | 0.01   | 0.1                  | % / V            |
|                                    |                                    | 10V ≤ V <sub>CC</sub> ≤ 40V                          | -    | 0.006  | 0.06                 |                  |
| Rated Full - Scale Frequency       | f                                  | V <sub>I</sub> = -10V                                | 10.0 | -      | -                    | KHz              |
| <b>INPUT COMPARATOR</b>            |                                    |                                                      |      |        |                      |                  |
| Offset Voltage                     | V <sub>IO</sub>                    | 0°C ≤ T <sub>A</sub> ≤ +70°C                         | -    | ±3     | ±10                  | mV               |
| Bias Current                       | I <sub>BIAS</sub>                  | -                                                    | -    | -80    | -300                 | nA               |
| Offset Current                     | I <sub>IO</sub>                    | -                                                    | -    | ±8     | ±100                 | nA               |
| Common-Mode Range                  | V <sub>CM</sub>                    | 0°C ≤ T <sub>A</sub> ≤ +70°C                         | -0.2 | -      | V <sub>CC</sub> -2.0 | V                |
| <b>TIMER (PIN 5)</b>               |                                    |                                                      |      |        |                      |                  |
| Timer Threshold Voltage            | V <sub>TH</sub>                    | -                                                    | 0.63 | 0.667  | 0.701                | ×V <sub>CC</sub> |
| Input Bias Current                 | I <sub>BIAS</sub>                  | V <sub>CC</sub> = 15V,<br>0V ≤ V <sub>5</sub> ≤ 9.9V | -    | ±10    | ±100                 | nA               |
|                                    |                                    | V <sub>5</sub> = 10V                                 | -    | 200    | 1000                 | nA               |
| Saturation Voltage                 | V <sub>SAT</sub>                   | I = 5mA                                              | -    | 0.22   | 0.5                  | V                |
| <b>CURRENT SOURCE (PIN 1)</b>      |                                    |                                                      |      |        |                      |                  |
| Output Current                     | I <sub>O</sub>                     | R <sub>S</sub> = 14KΩ, V <sub>1</sub> = 0V           | 116  | 136    | 156                  | μA               |
| Change with Voltage                | ΔI <sub>O</sub> /ΔV <sub>1</sub>   | 0V ≤ V <sub>1</sub> ≤ 10V                            | -    | 0.2    | 1.0                  | μA               |
| Current Source Off Leakage         | I <sub>LKG</sub>                   | -                                                    | -    | 0.02   | 10.0                 | nA               |
| <b>REFERENCE VOLTAGE (PIN 2)</b>   |                                    |                                                      |      |        |                      |                  |
| Reference Voltage                  | V <sub>REF</sub>                   | -                                                    | 1.70 | 1.89   | 2.08                 | V <sub>DC</sub>  |
| Stability vs Temperature           | ST <sub>T</sub>                    | -                                                    | -    | ±60    | -                    | ppm/°C           |
| Stability vs Time, 1000Hours       | ST <sub>T</sub>                    | -                                                    | -    | ±0.1   | -                    | %                |
| <b>LOGIC OUTPUT (Pin 3)</b>        |                                    |                                                      |      |        |                      |                  |
| Saturation Voltage                 | V <sub>SAT</sub>                   | I = 5mA                                              | -    | 0.15   | 0.50                 | V                |
|                                    |                                    | I = 3.2mA                                            | -    | 0.10   | 0.40                 |                  |
| Off Leakage                        | I <sub>LKG</sub>                   | -                                                    | -    | ±0.05  | 1.0                  | μA               |
| <b>SUPPLY CURRENT</b>              |                                    |                                                      |      |        |                      |                  |
| Supply Current                     | I <sub>CC</sub>                    | V <sub>CC</sub> = 5V                                 | 1.5  | 3.0    | 6.0                  | mA               |
|                                    |                                    | V <sub>CC</sub> = 40V                                | 2.0  | 4.0    | 8.0                  |                  |

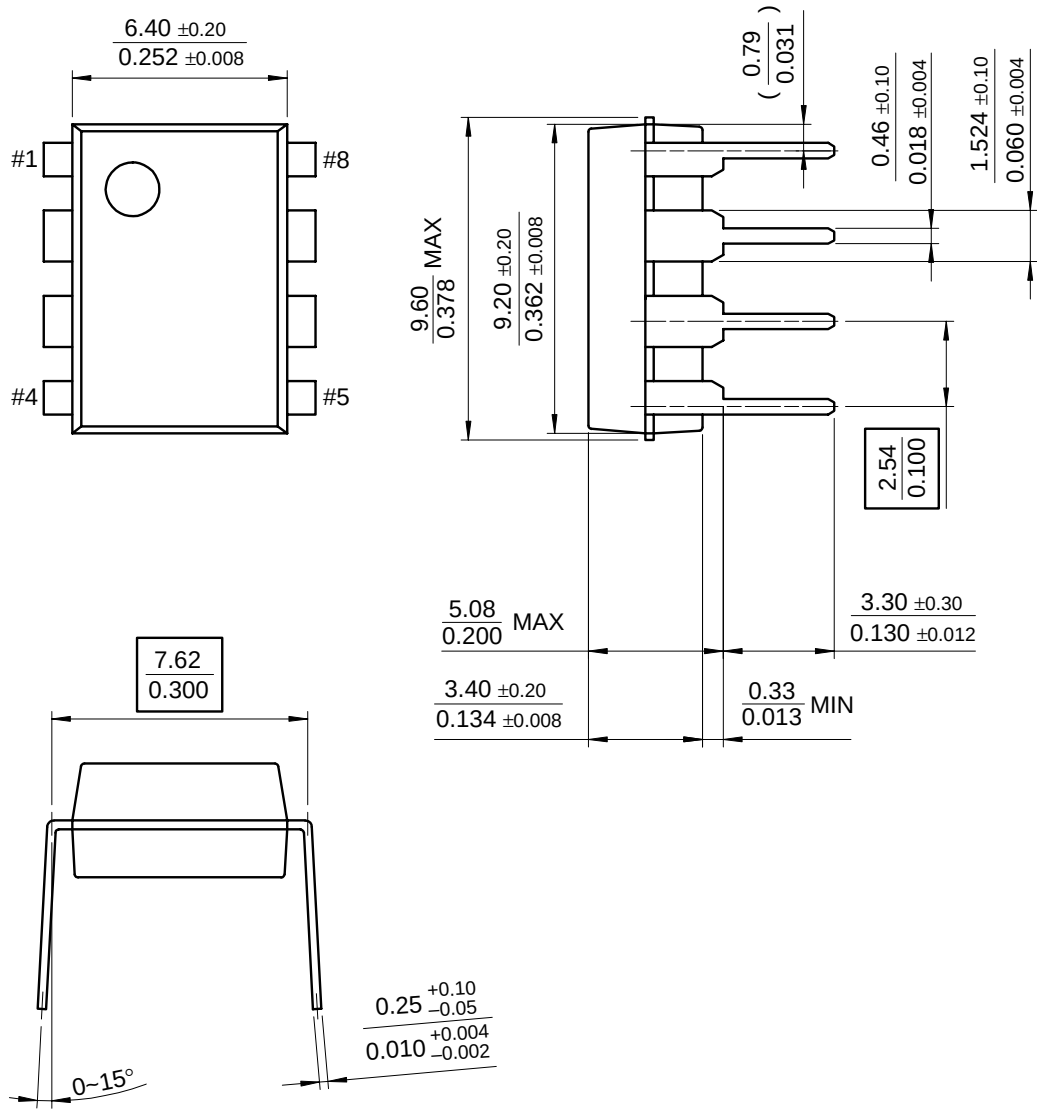


Mechanical Dimensions

Package

Dimensions in millimeters

8-DIP



## Ordering Information

| Product Number | Package | Operating Temperature |
|----------------|---------|-----------------------|
| LM331N         | 8-DIP   | 0 ~ + 70°C            |

**DISCLAIMER**

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

**LIFE SUPPORT POLICY**

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.