

# LM331

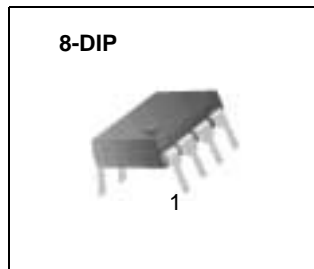
## V-F Converter

### Features

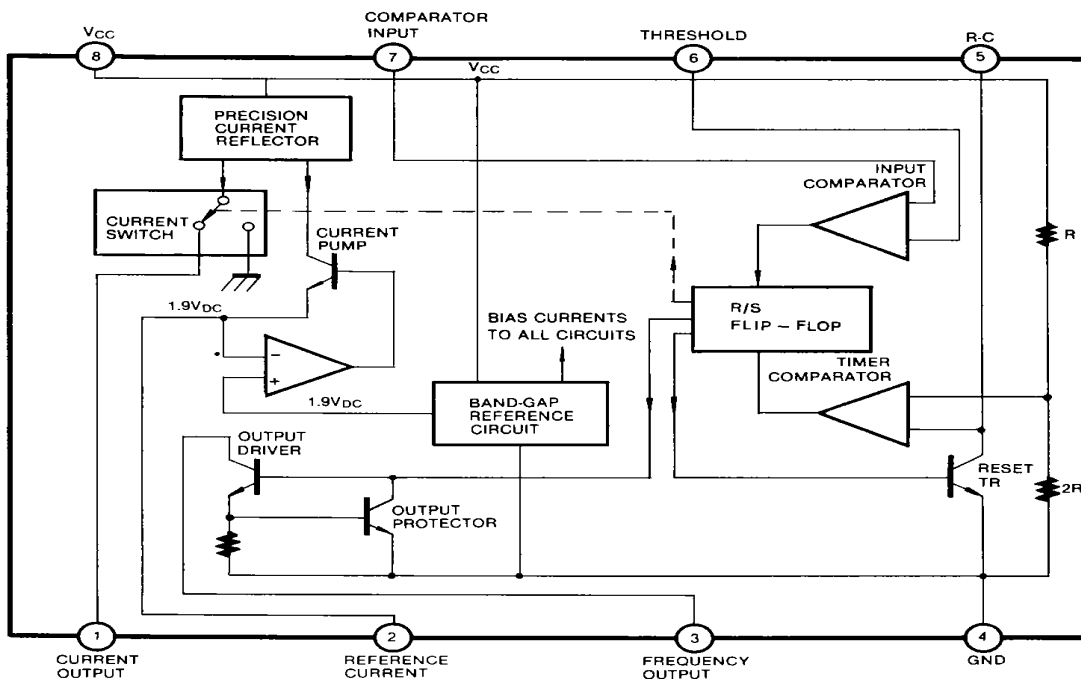
- Guaranteed linearity: 0.01% max.
- Low power dissipation: 15mW at 5V
- Wide range of full scale frequency: 1Hz to 100KHz
- Pulse output compatible with all logic forms
- Wide dynamic range: 100dB min at 10KHz full scale frequency

### 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, 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	

## Typical Applications

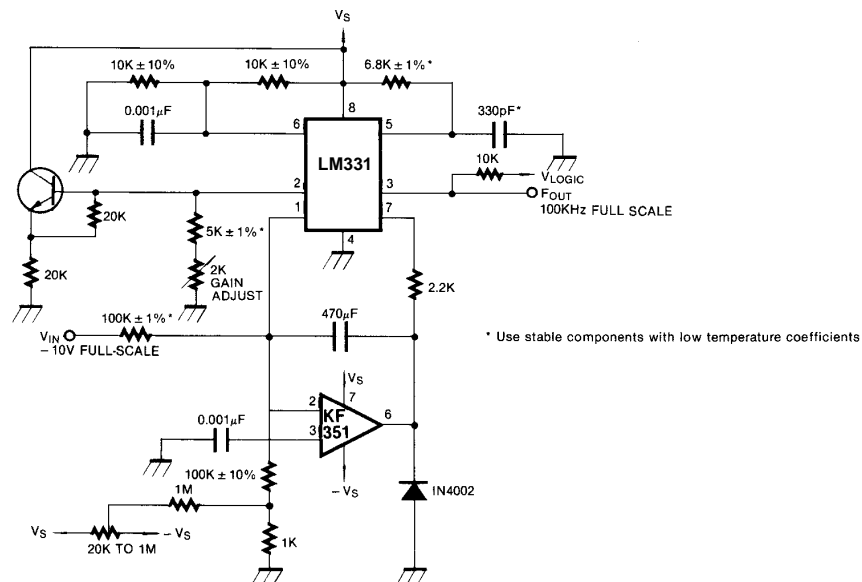


Figure 1. Precision Voltage-to-Frequency Converter, 100KHz Full-Scale

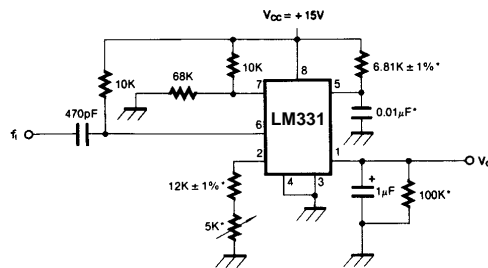


Figure 2. Simple Frequency-to-Voltage Converter, 10KHz Full-Scale

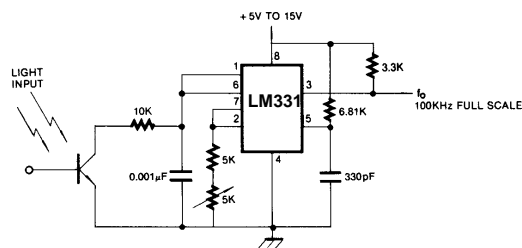


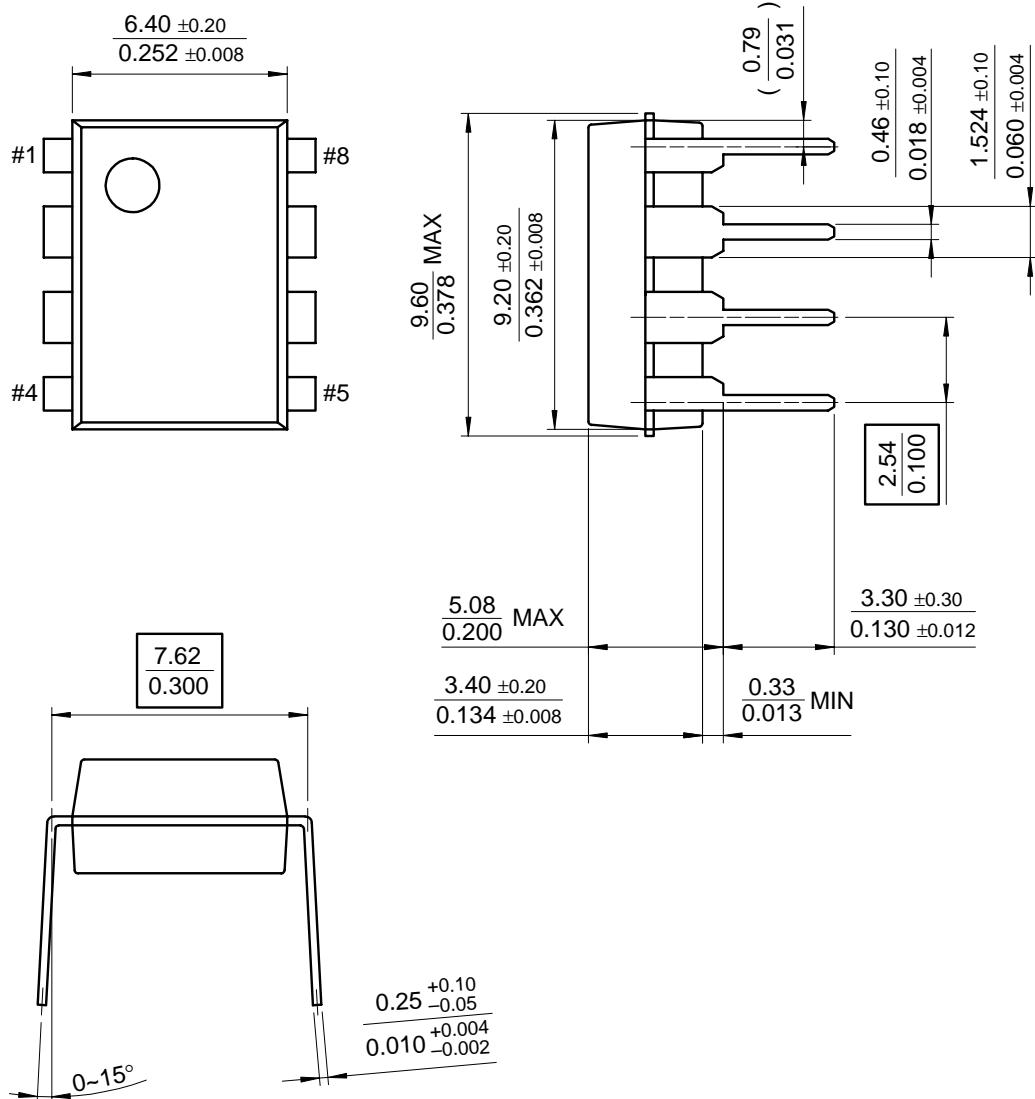
Figure 3. Light Intensity to Frequency Converter

## Mechanical Dimensions

### Package

Dimensions in millimeters

### 8-DIP



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## Ordering Information

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

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