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NTE995 & NTE995M Integrated Circuit Frequency-to-Voltage Converter

Description:

The NTE995 (14-Lead DIP) and NTE995M (8-Lead DIP) are monolithic frequency to voltage converters with a high gain OP amp/comparator designed to operate a relay, lamp, or other load when the input frequency reaches or exceeds a selected rate. The tachometer uses a charge pump technique and offers frequency doubling for low ripple, full input protection, and its output swings to GND for a zero frequency input.

Advantages:

- Output Swing to GND for Zero Frequency Input
- Easy to Use: $V_{OUT} = f_{IN} \times V_{CC} \times R1 \times C1$
- Only One RC Network Provides Frequency Doubling
- Zener Regulator On Chip Allows Accurate and Stable Frequency to Voltage or Current Conversion

Features:

- Ground Referenced Tachometer Input Interfaces Directly with Variable Reluctance Magnetic Pickups
- OP Amp/Comparator has Floating Transistor Output
- 50mA Sink or Source to Operate Relays, Solenoids, Meters, or LEDs
- Frequency Doubling for Low Ripple
- Tachometer has Built-In Hysteresis with Either Differential Input or Ground Referenced Input
- Built-In Zener Diode
- $\pm 0.3\%$ Linearity Typical
- Ground Referenced Tachometer is Fully Protected from damage Due to Swings Above V_{CC} and Below GND

Applications:

- Over/Under Speed Sensing
- Frequency to Voltage Conversion (Tachometer)
- Speedometers
- Breaker Point Dwell Meters
- Hand-Held Tachometer
- Speed Governors
- Cruise Control
- Automotive Door Lock Control
- Clutch Control
- Horn Control
- Touch or Sound Switches

Absolute Maximum Ratings:

Supply Voltage, V_{CC}	28V
Supply Current (Zener Options)	25mA
Collector Voltage	28V
Differential Input Voltage	
Tachometer	28V
OP Amp/Comparator	28V
Input Voltage Range	
Tachometer	
NTE995M	$\pm 28V$
NTE955	0.0V to +28V
OP Amp/Comparator	0.0V to +28V
Power Dissipation (Note 1), P_D	
NTE995M	1200mW
NTE995	1580mW
Operating Temperature Range, T_{opr}	-40° to $+85^\circ C$
Storage Temperature Range, T_{stg}	-65° to $+150^\circ C$
Lead Temperature, T_L	
NTE995, NTE995M (During Soldering, 10sec)	$+260^\circ C$
NTE995M	
(Vapor Phase, 60sec)	$+215^\circ C$
(Infrared, 15sec)	$+220^\circ C$

Note 1. For operation in ambient temperatures above $25^\circ C$, the device must be derated based on a $+150^\circ C$ maximum junction temperature and a thermal resistance of $+101^\circ C/W$ junction to ambient for the NTE995M, and $+79^\circ C/W$ junction to ambient for the NTE995.

Electrical Characteristics: ($V_{CC} = 12V$, $T_A = +25^\circ C$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Tachometer						
Input Thresholds		$V_{IN} = 250mV_{P-P}$ @ 1kHz, Note 2	± 10	± 25	± 40	mV
Hysteresis		$V_{IN} = 250mV_{P-P}$ @ 1kHz, Note 2	-	30	-	mV
Offset Voltage		$V_{IN} = 250mV_{P-P}$ @ 1kHz, Note 2	-	3.5	10	mV
NTE995						
NTE995M				5.0	15	mV
Input Bias Current		$V_{IN} = \pm 50mV$	-	0.1	1.0	μA
Output Voltage (High Level, Pin2)	V_{OH}	$V_{IN} = +125mV$, Note 3	-	8.3	-	V
Output Voltage (Low Level, Pin2)	V_{OL}	$V_{IN} = -125mV$, Note 3	-	2.3	-	V
Output Current	I_2, I_3	$V_2 = V_3 = 6V$, Note 4	140	180	240	μA
Leakage Current	I_3	$I_2 = 0, V_3 = 0$	-	-	0.1	μA
Gain Constant	K	Note 3	0.9	1.0	1.1	
Linearity		$f_{IN} = 1kHz, 5kHz, 10kHz$, Note 5	-1.0	0.3	+1.0	%

Note 2. Hysteresis is the sum $+V_{TH} - (-V_{TH})$, offset voltage is their difference.

Note 3. V_{OH} is equal to $\frac{3}{4} \times V_{CC} - 1 V_{BE}$, V_{OL} is equal to $\frac{1}{4} \times V_{CC} - 1 V_{BE}$ therefore $V_{OH} - V_{OL} = V_{CC}/2$. The difference, $V_{OH} - V_{OL}$, and the mirror gain, I_2/I_3 , are two factors that cause the tachometer gain constant to vary from 1.0.

Note 4. Be sure when choosing the time constant $R1 \times C1$ that $R1$ is such that the maximum anticipated output voltage at Pin3 can be reached with $I_3 \times R1$. The maximum value for $R1$ is limited by the output resistance of Pin3 which is greater than $10M\Omega$ typically.

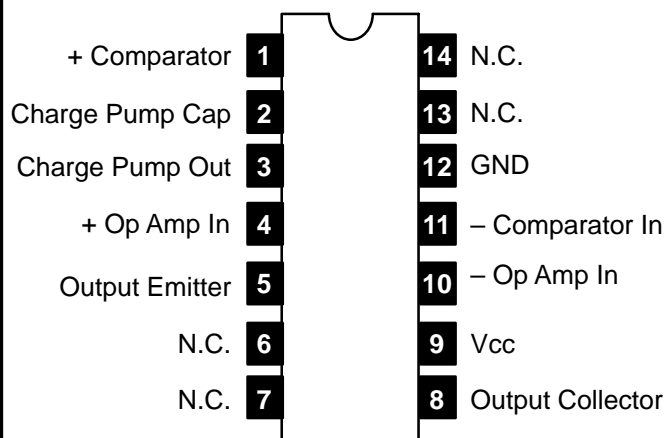
Note 5. Nonlinearity is defined as the deviation of V_{OUT} (@ Pin3) for $f_{IN} = 5kHz$ from a straight line defined by the V_{OUT} @ 1kHz and V_{OUT} @ 10kHz. $C1 = 1000pF$, $R1 = 68k$ and $C2 = 0.22mFd$.

Electrical Characteristics (Cont'd): ($V_{CC} = 12V$, $T_A = +25^\circ C$ unless otherwise specified)

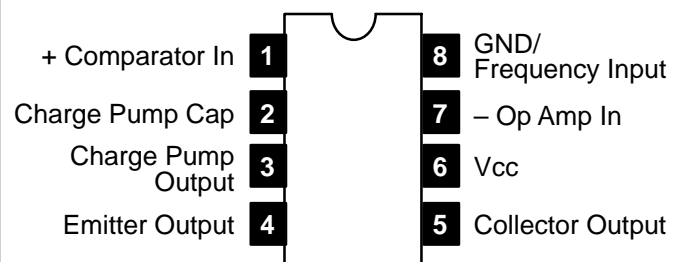
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OP Amp/Comparator						
	V_{OS}	$V_{IN} = 6V$	–	3	10	mV
	I_{BIAS}	$V_{IN} = 6V$	–	50	500	nA
Input Common-Mode Voltage			0	–	$V_{CC}-1.5V$	V
Voltage Gain			–	200	–	V/mV
Output Sink Current		$V_C = 1.0$	40	50	–	mA
Output Source Current		$V_E = V_{CC} - 2.0$	–	10	–	mA
Saturation Voltage		$I_{SINK} = 5mA$	–	0.1	0.5	V
		$I_{SINK} = 20mA$	–	–	1.0	V
		$I_{SINK} = 50mA$	–	1.0	1.5	V
Zener Regulator						
Regulator Voltage		$R_{DROP} = 470\Omega$	–	7.56	–	V
Series Resistance			–	10.5	15.0	Ω
Temperature Stability			–	+1	–	mV/ $^\circ C$
Total Supply Current			–	3.8	6.0	mA

Pin Connection Diagram

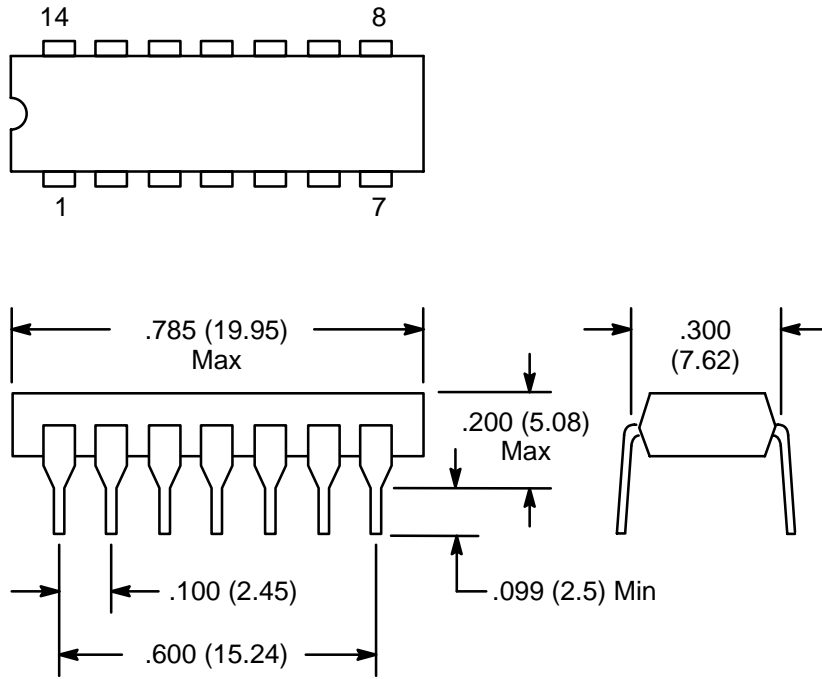
NTE995



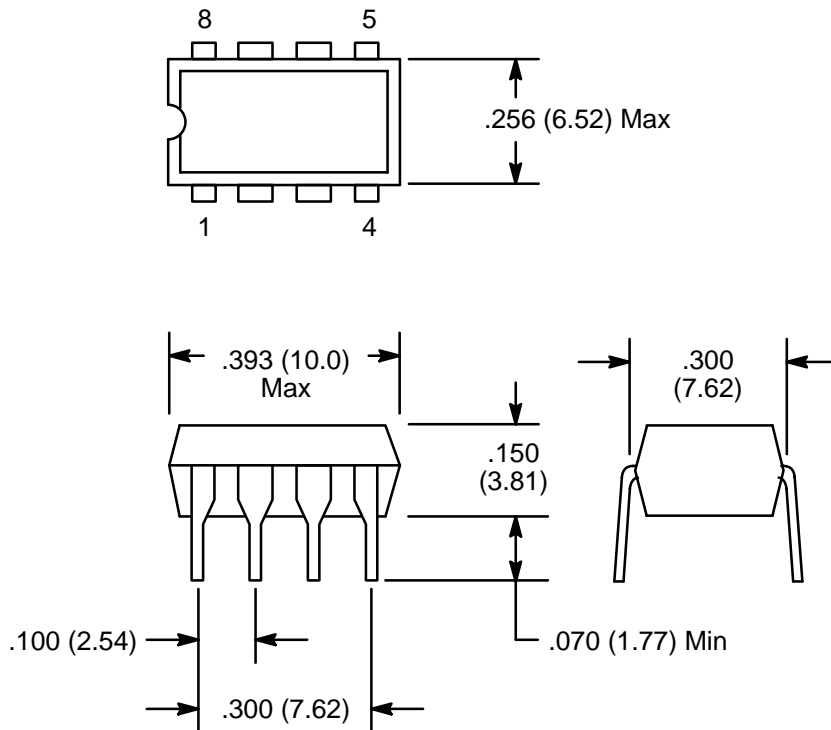
NTE995M



NTE995



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