ELECTRONICS, INC.
44 FARRAND STREET
BLOOMFIELD, NJ 07003
(973) 748−5089
http://www.nteinc.com

RoHS
2002/95/EC

NTE7236
Integrated Circuit
Quadruple Norton Operational Amplifier
14−Lead DIP Type Package

Description:

The NTE7236 consists of four independent, high−gain frequency−compensated Norton operational amplifiers in a 14−lead DIP type package that are designed specifically to operate from a single supply over a wide range of voltages. Operation from split supplies is also possible. The low supply current drain is essentially independent of the magnitude of the supply voltage. This device provides wide bandwidth and a large output voltage swing.

Features:

- Wide Range of Supply Voltages, Single or Dual Supplies
- Wide Bandwidth
- Large Output Voltage Swing
- Output Short−Circuit Protection
- Internal Frequency Compensation
- Low Input Bias Current

Absolute Maximum Ratings: (T_A = 0° to +70°C unless otherwise specified)

Supply Voltage (Note 1), V_{CC} 36V
Input Current, I_{IN} 20mA
Duration of Output Short Circuit (One Amplifier) to GND at (or Below) +25°C Free−Air Temperature
(Note 2) . . . . Unlimited
Continuous Total Dissipation ($T_A \leq$ +25°C), P_D 1150mW
Derate Above +25°C . . . . 9.2mW/°C
Continuous Total Dissipation (T_A = +70°C), P_D 736mW
Operating Free−Air Temperature Range, T_A . . . . 0° to +70°C
Storage Temperature Range, T_{stg} . . . . −65° to +150°C
Lead Temperature (During Soldering, 1/16” from case, 10sec max), T_L . . . . +260°C

Note 1. All voltage values, except differential voltages, are with respect to the network ground terminal.
Note 2. Short circuits from outputs to V_{CC} can cause excessive heating and eventual destruction.

Recommended Operating Conditions:

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage, Single Supply	V_{CC}		4.5	–	32	V
Supply Voltage, Dual Supply	V_{CC+}		2.2	–	16	V
	V_{CC-}		–2.2	–	–16	V
Input Current	I_{IN}	Note 3	–	–	–1	mA
Operating Free–Air Temperature	T_A		0	–	70	°C

Note 3. Clamp transistors are included to prevent the input voltages from swinging below ground more than approximately –0.3V. The negative input currents that may result from large signal overdrive with capacitance input coupling must be limited externally to values of approximately –1mA. Negative input currents in excess of –4mA causes the output voltage to drop to a low voltage. These values apply for any one of the input terminals. If more than one of the input terminals are simultaneously driven negative, maximum currents are reduced. Common–mode current biasing can be used to prevent negative input voltages.

Electrical Characteristics: (V_{CC} = 15V, T_A = +25°C, Note 4 unless otherwise specified)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Input Bias Current (Inverting Input)	I_{IB}	I_{I+} = 0	T_A = +25°C	–	30	200	nA
			T_A = 0° to +70°C	–	300	–	nA
Mirror Gain		I_{I+} = 20μA to 200μA, T_A = 0° to +70°C, Note 5		0.9	–	1.1	μA/μA
Change in Mirror Gain				–	2%	5%	
Mirror Current		$V_{I+} = V_{I-}$, T_A = 0° to +70°C, Note 5		–	10	500	μA
Large–Signal Differential Voltage Amplification	A_{VD}	V_O = 10V, R_L = 10Ωk, f = 100Hz		1.2	2.8	–	V/mV
Input Resistance (Inverting Input)	r_i			–	1	–	MΩ
Output Resistance	r_o			–	8	–	kΩ
Unity–Gain Bandwidth (Inverting Input)	B_1			–	2.5	–	MHz
Supply Voltage Rejection Ratio ($\Delta V_{CC}/\Delta V_{IO}$)	k_{SVR}			–	70	–	dB
High–Level Output Voltage	V_{OH}	I_{I+} = 0, I_{I-} = 0	R_L = 2kΩ	13.5	–	–	V
			V_{CC} = 30V, No Load	–	29.5	–	V
Low–Level Output Voltage	V_{OL}	I_{I+} = 0, I_{I-} = 10μA, R_L = 2kΩ		–	0.09	0.2	V
Short–Circuit Output Current (Output Internally High)	I_{OS}	I_{I+} = 0, I_{I-} = 0, V_O = 0		–6	–10	–	mA
Pulldown Current				0.5	1.3	–	mA
Low–Level Output Current	I_{OL}	I_{I-}= 5μA, V_{OL} = 1V, Note 6		–	5	–	mA
Supply Current (Four Amplifiers)	I_{CC}			–	6.2	10	mA

Note 4. All characteristics are measured under open–loop conditions with zero common–mode voltage unless otherwise specified.
Note 5. These parameters are measured with the output balanced midway between V_{CC} and GND.
Note 6. The output current–sink capability can be increased fo large–signal conditions by overdriving the inverting input.

Operating Characteristics: (V_{CC} = ±15V, T_A = +25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Slew Rate at Unity gain	SR					
Low–to–High Output		V_O = 10V, C_L = 100pF, R_L = 2kΩ	–	0.5	–	V/μs
High–to–Low Output			–	20	–	V/μs

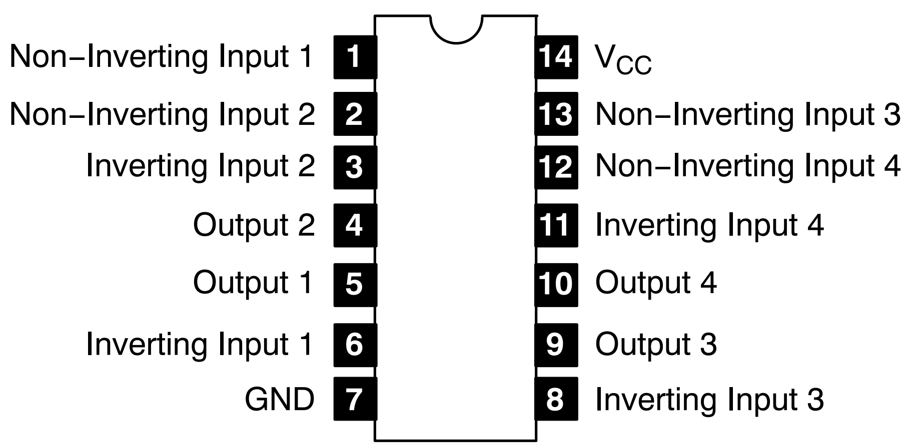
Application Information:

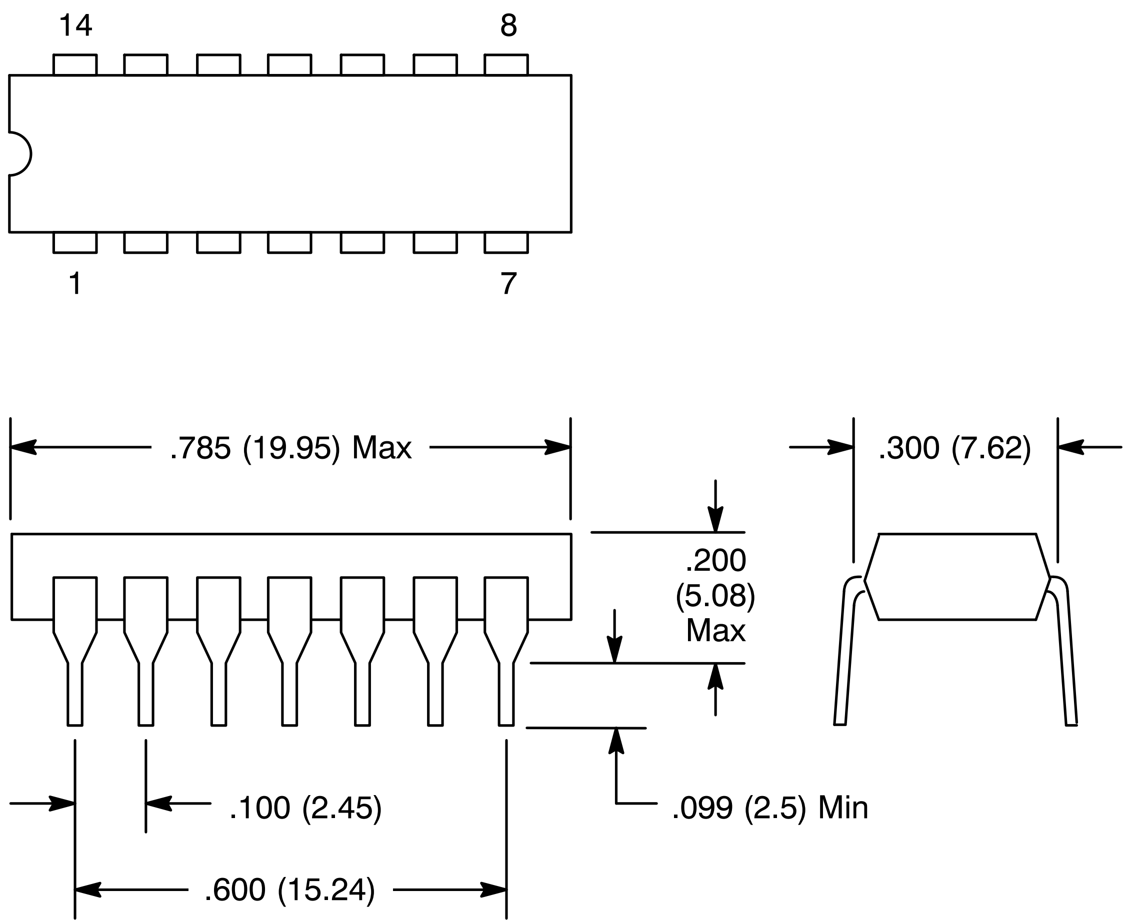
Norton (or current−differencing) amplifiers can be used in most standard general purpose operational amplifier applications. Performance as a DC amplifier in a single−power−supply mode is not as precise as a standard integrated circuit operational amplifier operating from dual supplies. Operation of the amplifier can best be understood by noting that input currents are differenced at the inverting input terminal and this current then flows through the external feedback resistor to produce the output voltage. Common−mode current biasing is generally useful to allow operating with signal levels near (or even below) ground.

Internal transistors clamp negative input voltages at approximately −0.3V but the magnitude of current flow has to be limited by the external input network. For operation at high temperature, this limit should be approximately −100μA.

Noise immunity of a Norton amplifier is less than that of standard bipolar amplifiers. Circuit layout is more critical since coupling from the output to the non−inverting input can cause oscillations. care must also be exercised when driving either input from a low−impedance source. A limiting resistor should be placed in series with the input lead to limit the peak input current. Current up to 20mA will not damage the device, but the current mirror on the non−inverting input will saturate and cause a loss of mirror gain at higher current levels, especially at high operating temperatures.

Pin Connection Diagram





14
8
1
7
.785 (19.95) Max
.300 (7.62)
.200
(5.08)
Max
.100 (2.45)
.099 (2.5) Min
.600 (15.24)