

## NTE948 & NTE948SM Integrated Circuit Quad Operational Amplifier

**Description:**

The NTE948 (14-Lead DIP) and NTE948SM (SOIC-14) consists of four independent, high gain, internally compensated, low power operational amplifiers which have been designed to provide functional characteristics identical to those of the familiar 741 operational amplifier.

**Features:**

- Low Supply Current Drain
- Class AB Output Stage – No Crossover Distortion
- Low Input Offset Voltage
- Low Input Offset Current
- Low Input Bias Current
- High Degree of Isolation Between Amplifiers
- Overload Protection for Inputs and Outputs
- Available in 14-Lead DIP (NTE948) and Surface Mount (NTE948SM)

**Absolute Maximum Ratings:**

Supply Voltage, $V_S$ .....	$\pm 18V$
Differential Input Voltage .....	$\pm 36V$
Output Short Circuit Duration (Note 1) .....	Continuous
Power Dissipation ( $T_A = +25^\circ C$ , Note 2), $P_D$ .....	750mW
Maximum Junction Temperature, $T_J$ .....	$+100^\circ C$
Operating Ambient Temperature Range, $T_A$ .....	$0^\circ$ to $+70^\circ C$
Storage Temperature Range, $T_{stg}$ .....	$-65^\circ$ to $+150^\circ C$
Thermal Resistance, Junction-to-Ambient (Note 2), $R_{thJA}$ .....	$100^\circ C/W$

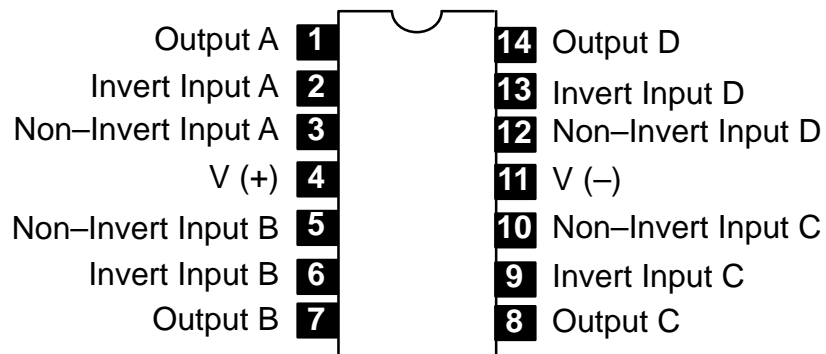
Note 1. Any of the amplifier outputs can be shorted to ground indefinitely; however, more than one should not be simultaneously shorted as the maximum junction temperature will be exceeded.

Note 2. The maximum power dissipation for these devices must be derated at elevated temperatures and is dictated by  $T_{J(MAX)}$ ,  $R_{thJA}$ , and the ambient temperature,  $T_A$ . The maximum available power dissipation at any temperature is  $P_D = (T_{J(MAX)} - T_A)/R_{thJA}$  or the  $25^\circ C$   $P_{D(MAX)}$ , which ever is less.

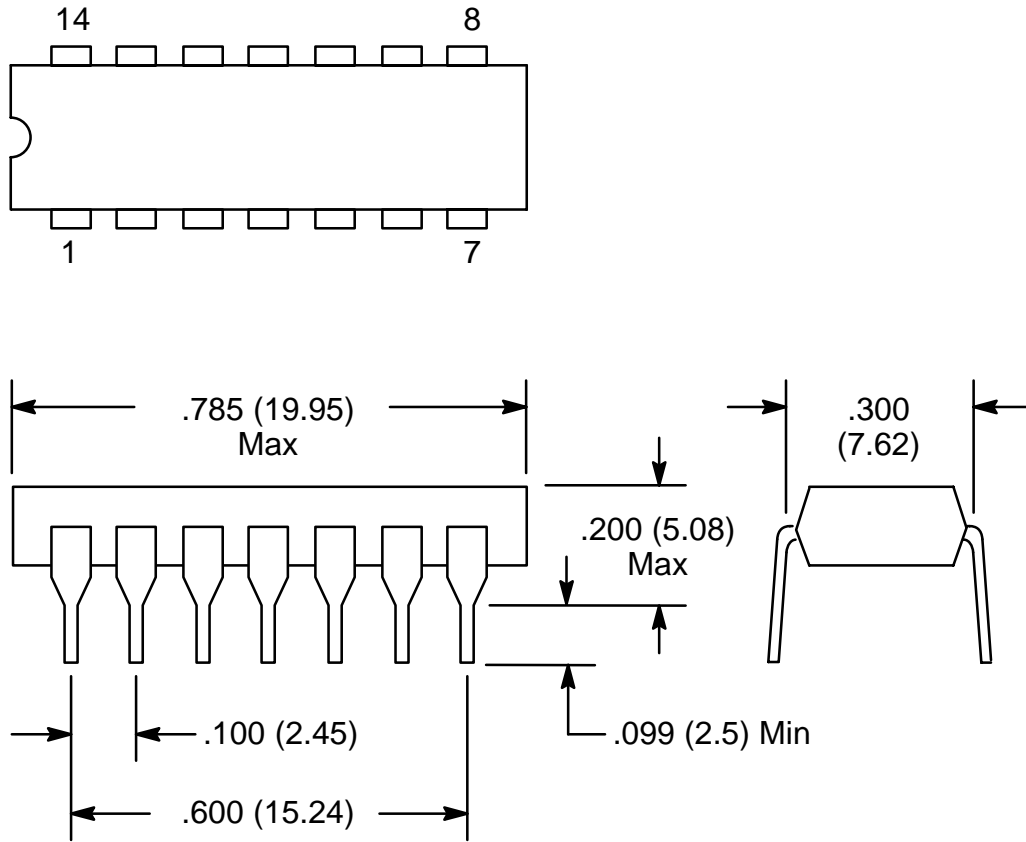
**Electrical Characteristics:** ( $V_S = \pm 15V$ ,  $0^\circ \leq T_A \leq +70^\circ C$  unless otherwise specified)

Parameter	Test Conditions	Min	Typ	Max	Unit
Input Offset Voltage	$T_A = +25^\circ C$ , $R_S \leq 10k\Omega$	–	1.0	6.0	mV
	$R_S \leq 10k\Omega$	–	–	7.5	mV
Input Offset Current	$T_A = +25^\circ C$	–	4	50	nA
		–	–	100	nA
Input Bias Current	$T_A = +25^\circ C$	–	30	200	nA
		–	–	400	nA
Input Resistance	$T_A = +25^\circ C$	0.8	2.5	–	M $\Omega$
Supply Current, All Amplifiers	$T_A = +25^\circ C$ , $V_S = \pm 15V$	–	2.4	4.5	mA
Large Signal Voltage Gain	$T_A = +25^\circ C$ , $V_S = \pm 15V$ , $V_{OUT} = \pm 10V$ , $R_L \geq 2k\Omega$	25	160	–	V/mV
	$V_S = \pm 15V$ , $V_{OUT} = \pm 10V$ , $R_L > 2k\Omega$	–	–	15	V/mV
Amplifier-to-Amplifier Coupling	$T_A = +25^\circ C$ , $f = 1Hz$ to $20kHz$	–	–120	–	dB
Small-Signal Bandwidth	$T_A = +25^\circ C$	–	1.0	–	MHz
Phase Margin	$T_A = +25^\circ C$ , $A_V = 1$	–	60	–	degrees
Slew Rate	$T_A = +25^\circ C$ , $A_V = 1$	–	0.5	–	V/ $\mu s$
Output Short-Circuit Current	$T_A = +25^\circ C$	–	25	–	mA
Output Voltage Swing	$V_S = \pm 15V$ , $R_L = 10k\Omega$	$\pm 12$	$\pm 13$	–	V
	$V_S = \pm 15V$ , $R_L = 2k\Omega$	$\pm 10$	$\pm 12$	–	V
Input Voltage Range	$V_S = \pm 15V$	$\pm 12$	–	–	V
Common-Mode Rejection Ratio	$R_S \leq 10k\Omega$	70	90	–	dB
Supply Voltage Rejection Ratio	$R_S \leq 10k\Omega$ , $\pm 5V \leq V_S \leq \pm 15V$	77	96	–	dB

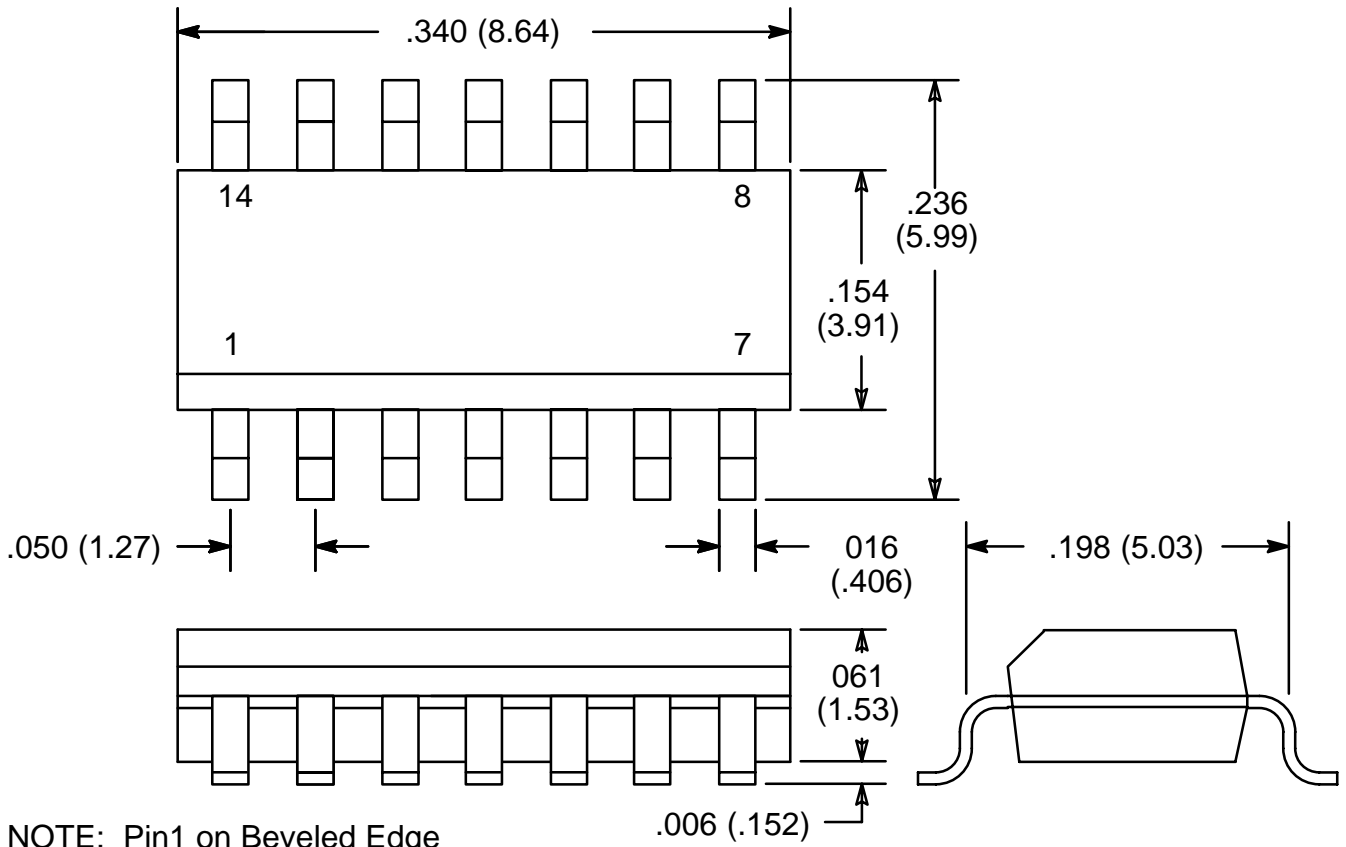
**Pin Connection Diagram**



NTE948



NTE948SM



NOTE: Pin1 on Beveled Edge