

# MC33272A, MC33274A, NCV33272A, NCV33274A

## Single Supply, High Slew Rate, Low Input Offset Voltage Operational Amplifiers

The MC33272/74 series of monolithic operational amplifiers are quality fabricated with innovative Bipolar design concepts. This dual and quad operational amplifier series incorporates Bipolar inputs along with a patented Zip-R-Trim element for input offset voltage reduction. The MC33272/74 series of operational amplifiers exhibits low input offset voltage and high gain bandwidth product. Dual-doublet frequency compensation is used to increase the slew rate while maintaining low input noise characteristics. Its all NPN output stage exhibits no deadband crossover distortion, large output voltage swing, and an excellent phase and gain margin. It also provides a low open loop high frequency output impedance with symmetrical source and sink AC frequency performance.

### Features

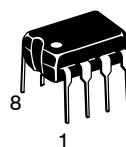
- Input Offset Voltage Trimmed to 100  $\mu$ V (Typ)
- Low Input Bias Current: 300 nA
- Low Input Offset Current: 3.0 nA
- High Input Resistance: 16 M $\Omega$
- Low Noise: 18 nV/ $\sqrt{\text{Hz}}$  @ 1.0 kHz
- High Gain Bandwidth Product: 24 MHz @ 100 kHz
- High Slew Rate: 10 V/ $\mu$ s
- Power Bandwidth: 160 kHz
- Excellent Frequency Stability
- Unity Gain Stable: w/Capacitance Loads to 500 pF
- Large Output Voltage Swing: +14.1 V/ -14.6 V
- Low Total Harmonic Distortion: 0.003%
- Power Supply Drain Current: 2.15 mA per Amplifier
- Single or Split Supply Operation: +3.0 V to +36 V or  $\pm 1.5$  V to  $\pm 18$  V
- ESD Diodes Provide Added Protection to the Inputs
- NCV Prefix for Automotive and Other Applications Requiring Site and Control Changes
- Pb-Free Packages are Available



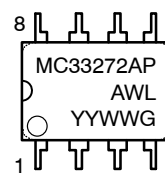
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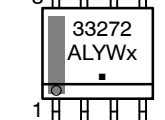
### DUAL MARKING DIAGRAMS



**PDIP-8**  
**P SUFFIX**  
**CASE 626**

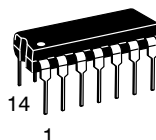


**SOIC-8**  
**D SUFFIX**  
**CASE 751**

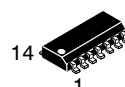
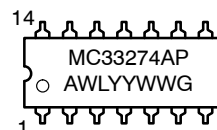


x = A for MC33272AD/DR2  
= N for NCV33272ADR2

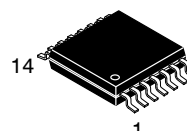
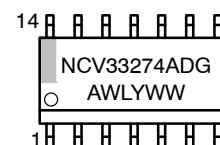
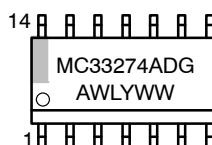
### QUAD



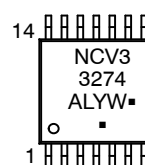
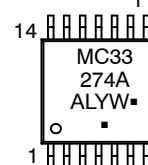
**PDIP-14**  
**P SUFFIX**  
**CASE 646**



**SOIC-14**  
**D SUFFIX**  
**CASE 751A**



**TSSOP-14**  
**DTB SUFFIX**  
**CASE 948G**



A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week  
G or ▪ = Pb-Free Package

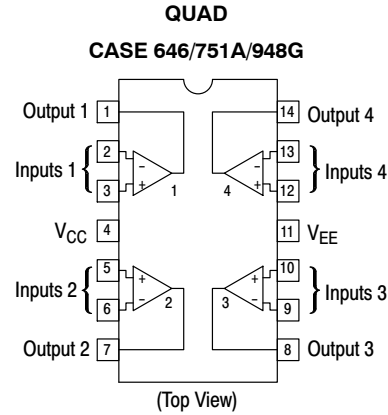
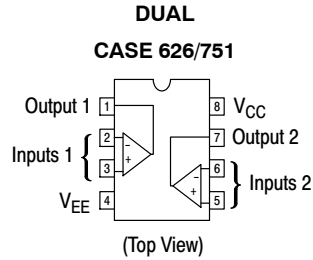
(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 11 of this data sheet.

# MC33272A, MC33274A, NCV33272A, NCV33274A

## PIN CONNECTIONS



## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage	$V_{CC}$ to $V_{EE}$	+36	V
Input Differential Voltage Range	$V_{IDR}$	Note 1	V
Input Voltage Range	$V_{IR}$	Note 1	V
Output Short Circuit Duration (Note 2)	$t_{SC}$	Indefinite	sec
Maximum Junction Temperature	$T_J$	+150	°C
Storage Temperature	$T_{stg}$	-60 to +150	°C
ESD Protection at Any Pin	$V_{esd}$	2000 200	V
	- Human Body Model - Machine Model		
Maximum Power Dissipation	$P_D$	Note 2	mW
Operating Temperature Range	$T_A$	-40 to +85 -40 to +125	°C
	MC33272A, MC33274A NCV33272A, NCV33274A		

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Either or both input voltages should not exceed  $V_{CC}$  or  $V_{EE}$ .

2. Power dissipation must be considered to ensure maximum junction temperature ( $T_J$ ) is not exceeded (see Figure 2).

# MC33272A, MC33274A, NCV33272A, NCV33274A

## DC ELECTRICAL CHARACTERISTICS ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ , $T_A = 25^\circ\text{C}$ , unless otherwise noted.)

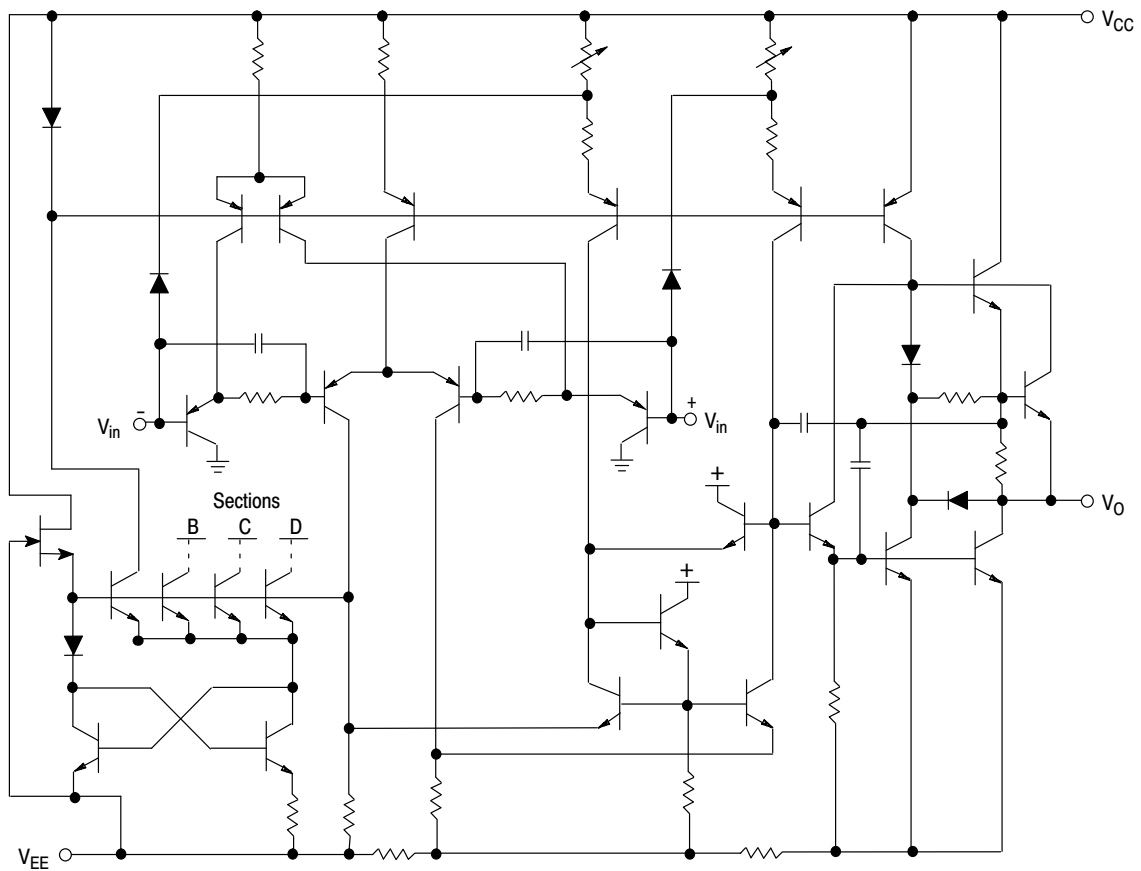
Characteristics	Figure	Symbol	Min	Typ	Max	Unit
Input Offset Voltage ( $R_S = 10\ \Omega$ , $V_{CM} = 0\text{ V}$ , $V_O = 0\text{ V}$ ) ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ ) $T_A = +25^\circ\text{C}$ $T_A = -40^\circ\text{ to }+85^\circ\text{C}$ $T_A = -40^\circ\text{ to }+125^\circ\text{C}$ (NCV33272A) $T_A = -40^\circ\text{ to }+125^\circ\text{C}$ (NCV33274A) ( $V_{CC} = 5.0\text{ V}$ , $V_{EE} = 0$ ) $T_A = +25^\circ\text{C}$	3	$ V_{IO} $	– – – – –	0.1 – – – –	1.0 1.8 2.5 3.5 2.0	mV
Average Temperature Coefficient of Input Offset Voltage $R_S = 10\ \Omega$ , $V_{CM} = 0\text{ V}$ , $V_O = 0\text{ V}$ , $T_A = -40^\circ\text{ to }+125^\circ\text{C}$	3	$\Delta V_{IO}/\Delta T$	–	2.0	–	$\mu\text{V}/^\circ\text{C}$
Input Bias Current ( $V_{CM} = 0\text{ V}$ , $V_O = 0\text{ V}$ ) $T_A = +25^\circ\text{C}$ $T_A = T_{low}\text{ to }T_{high}$	4, 5	$I_{IB}$	– –	300 –	650 800	nA
Input Offset Current ( $V_{CM} = 0\text{ V}$ , $V_O = 0\text{ V}$ ) $T_A = +25^\circ\text{C}$ $T_A = T_{low}\text{ to }T_{high}$		$ I_{IO} $	– –	3.0 –	65 80	nA
Common Mode Input Voltage Range ( $\Delta V_{IO} = 5.0\text{ mV}$ , $V_O = 0\text{ V}$ ) $T_A = +25^\circ\text{C}$	6	$V_{ICR}$	$V_{EE}\text{ to } (V_{CC} - 1.8)$			V
Large Signal Voltage Gain ( $V_O = 0\text{ V to }10\text{ V}$ , $R_L = 2.0\text{ k}\Omega$ ) $T_A = +25^\circ\text{C}$ $T_A = T_{low}\text{ to }T_{high}$	7	$A_{VOL}$	90 86	100 –	– –	dB
Output Voltage Swing ( $V_{ID} = \pm 1.0\text{ V}$ ) ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ ) $R_L = 2.0\text{ k}\Omega$ $R_L = 2.0\text{ k}\Omega$ $R_L = 10\text{ k}\Omega$ $R_L = 10\text{ k}\Omega$ ( $V_{CC} = 5.0\text{ V}$ , $V_{EE} = 0\text{ V}$ ) $R_L = 2.0\text{ k}\Omega$ $R_L = 2.0\text{ k}\Omega$	8, 9, 12     10, 11	$V_{O+}$ $V_{O-}$ $V_{O+}$ $V_{O-}$  $V_{OL}$ $V_{OH}$	13.4 – 13.4 –  – 3.7	13.9 –13.9 14 –14.7  – –	– –13.5 – –14.1  0.2 5.0	V
Common Mode Rejection ( $V_{in} = +13.2\text{ V to }-15\text{ V}$ )	13	CMR	80	100	–	dB
Power Supply Rejection $V_{CC}/V_{EE} = +15\text{ V}/-15\text{ V}$ , $+5.0\text{ V}/-15\text{ V}$ , $+15\text{ V}/-5.0\text{ V}$	14, 15	PSR	80	105	–	dB
Output Short Circuit Current ( $V_{ID} = 1.0\text{ V}$ , Output to Ground) Source Sink	16	$I_{SC}$	+25 –25	+37 –37	– –	mA
Power Supply Current Per Amplifier ( $V_O = 0\text{ V}$ ) ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ ) $T_A = +25^\circ\text{C}$ $T_A = T_{low}\text{ to }T_{high}$ ( $V_{CC} = 5.0\text{ V}$ , $V_{EE} = 0\text{ V}$ ) $T_A = +25^\circ\text{C}$	17	$I_{CC}$	– – –	2.15 – –	2.75 3.0 2.75	mA

3. MC33272A, MC33274A  $T_{low} = -40^\circ\text{C}$   $T_{high} = +85^\circ\text{C}$   
 NCV33272A, NCV33274A  $T_{low} = -40^\circ\text{C}$   $T_{high} = +125^\circ\text{C}$

# MC33272A, MC33274A, NCV33272A, NCV33274A

**AC ELECTRICAL CHARACTERISTICS** ( $V_{CC} = +15\text{ V}$ ,  $V_{EE} = -15\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.)

Characteristics	Figure	Symbol	Min	Typ	Max	Unit
Slew Rate ( $V_{in} = -10\text{ V}$ to $+10\text{ V}$ , $R_L = 2.0\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , $A_V = +1.0\text{ V}$ )	18, 33	SR	8.0	10	–	$\text{V}/\mu\text{s}$
Gain Bandwidth Product ( $f = 100\text{ kHz}$ )	19	GBW	17	24	–	MHz
AC Voltage Gain ( $R_L = 2.0\text{ k}\Omega$ , $V_O = 0\text{ V}$ , $f = 20\text{ kHz}$ )	20, 21, 22	$A_{VO}$	–	65	–	dB
Unity Gain Bandwidth (Open Loop)		BW	–	5.5	–	MHz
Gain Margin ( $R_L = 2.0\text{ k}\Omega$ , $C_L = 0\text{ pF}$ )	23, 24, 26	$A_m$	–	12	–	dB
Phase Margin ( $R_L = 2.0\text{ k}\Omega$ , $C_L = 0\text{ pF}$ )	23, 25, 26	$\phi_m$	–	55	–	Deg
Channel Separation ( $f = 20\text{ Hz}$ to $20\text{ kHz}$ )	27	CS	–	-120	–	dB
Power Bandwidth ( $V_O = 20\text{ V}_{pp}$ , $R_L = 2.0\text{ k}\Omega$ , $\text{THD} \leq 1.0\%$ )		$\text{BW}_P$	–	160	–	kHz
Total Harmonic Distortion ( $R_L = 2.0\text{ k}\Omega$ , $f = 20\text{ Hz}$ to $20\text{ kHz}$ , $V_O = 3.0\text{ V}_{rms}$ , $A_V = +1.0$ )	28	THD	–	0.003	–	%
Open Loop Output Impedance ( $V_O = 0\text{ V}$ , $f = 6.0\text{ MHz}$ )	29	$ Z_O $	–	35	–	$\Omega$
Differential Input Resistance ( $V_{CM} = 0\text{ V}$ )		$R_{in}$	–	16	–	$\text{M}\Omega$
Differential Input Capacitance ( $V_{CM} = 0\text{ V}$ )		$C_{in}$	–	3.0	–	pF
Equivalent Input Noise Voltage ( $R_S = 100\text{ }\Omega$ , $f = 1.0\text{ kHz}$ )	30	$e_n$	–	18	–	$\text{nV}/\sqrt{\text{Hz}}$
Equivalent Input Noise Current ( $f = 1.0\text{ kHz}$ )	31	$i_n$	–	0.5	–	$\text{pA}/\sqrt{\text{Hz}}$

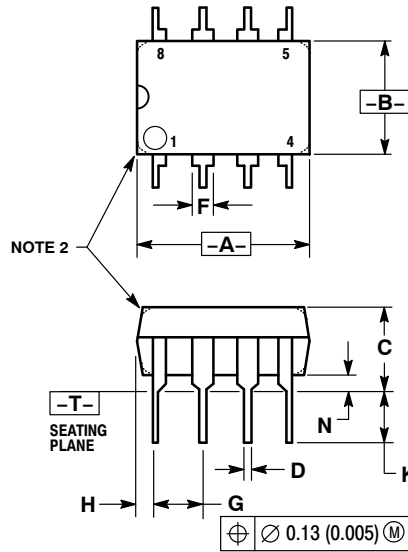


**Figure 1. Equivalent Circuit Schematic**  
(Each Amplifier)

# MC33272A, MC33274A, NCV33272A, NCV33274A

## PACKAGE DIMENSIONS

PDIP-8  
P SUFFIX  
CASE 626-05  
ISSUE L



### NOTES:

1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	---	10°	---	10°
N	0.76	1.01	0.030	0.040

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MC33272A/D