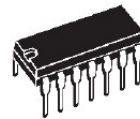


## Description

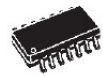
The LM324 consists of four independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies the magnitude of the power supply voltage. Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits.

## Features

- Wide range of supply voltages
- Low supply current drain independent of supply voltage
- Low input biasing current
- Low input offset voltage and offset current
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- DC voltage gain 100 V/ mV Typ
- Internally frequency compensation



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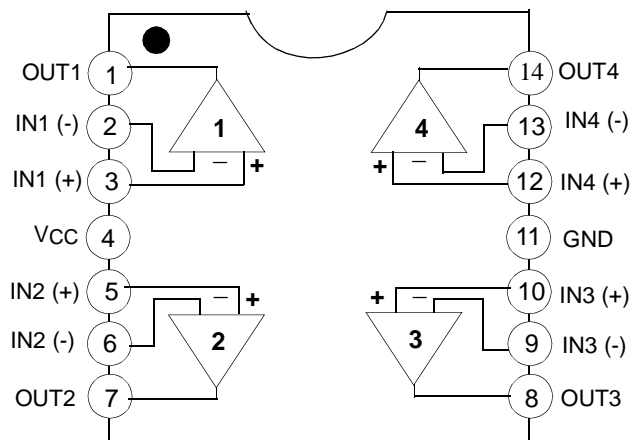


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## Package

## Internal Block Diagram

### PIN CONNECTIONS (top view)



**Electrical Characteristics**

( $V_{CC}=5.0V$ ,  $V_{EE}=GND$ ,  $T_A = 25^{\circ}C$ , unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Input Offset Voltage	$V_{IO}$	$V_{CC}=5V$ to MAX, $V_{IC}=V_{ICR}$ min, $V_O=1.4V$	$25^{\circ}C$		3	7	mV
			Full range			9	
Input Offset Current	$I_{IO}$	$V_O=1.4V$	$25^{\circ}C$		2	50	nA
Input Bias Current	$I_{BIAS}$	$V_O=1.4V$	$25^{\circ}C$		-20	-250	nA
Common-mode input voltage range	$V_{I(R)}$	$V_{CC}=5V$ to MAX	$25^{\circ}C$	0		$V_{CC}-1.5$	V
High-level output voltage	$V_{O(H)}$	$V_{CC}=MAX, R_L=2K\Omega$		26			V
		$V_{CC}=MAX, R_L=10K\Omega$	Full range	27	28		
Low-level output voltage	$V_{O(L)}$	$R_L=10K\Omega$	Full range		5	20	mV
Large-signal differential voltage amplification	$A_{VD}$	$V_{CC}=15V,$	$25^{\circ}C$	25	100		V/mV
		$V_O=1V$ to 11V	Full range	15			
		$R_L=2K\Omega$					
Common-Mode rejection ratio	CMRR	$V_{CC}=15V$ to MAX $V_{IC}=V_{ICR}$ min	$25^{\circ}C$	65	80		dB
$K_{SVR}$ Supply voltage rejection ratio	PSRR	$V_{CC}=5V$ to MAX	$25^{\circ}C$	65	100		dB
Crosstalk attenuation	$V_{O1}/V_{O2}$	$f=1kHz$ to 20kHz	$25^{\circ}C$		120		dB
Output current	$I_O$	$V_{CC}=15V,$ $V_{ID}=1V, V_O=0$	$25^{\circ}C$	-20	-30		mA
			Full range		-10		
		$V_{CC}=15V,$ $V_{ID}=-1V, V_O=0$	$25^{\circ}C$	10	20		
			Full range		5		
		$V_{ID}=-1V, V_O=200mA$	$25^{\circ}C$	12	30		mA
Short-circuit out put current	$I_{OS}$	$V_{CC}$ at 5V, GND at -5V, $V_O=0$	$25^{\circ}C$		+40	+60	mA
Supply current (four amplifiers)	$I_{CC}$	$V_O=2.5V$ , No load	Full range		0.7	1.2	mA
		$V_{CC}=MAX, V_O=0.5V_{CC}$ , No load	Full range		1.1	3	

\*All characteristics are measured under open loop conditions with zero common-mode input voltage unless otherwise specified. MAX  $V_{CC}$  for testing purposes is 30 V. full range is  $0^{\circ}C$  to  $70^{\circ}C$

## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Power Supply Voltage	V <sub>CC</sub>	± 16 or 32	V
Differential Input Voltage	V <sub>I(DIFF)</sub>	± 32	V
Input Voltage	V <sub>I</sub>	- 0.3 to + 32	V
Output Short Circuit to GND V <sub>CC</sub> 15V(one Amp)	—	Continuous	—
Operating Temperature Range	T <sub>OPR</sub>	0 to + 70	°C
Storage Temperature Range	T <sub>STG</sub>	- 65 to + 150	°C

## Typical Applications Circuit

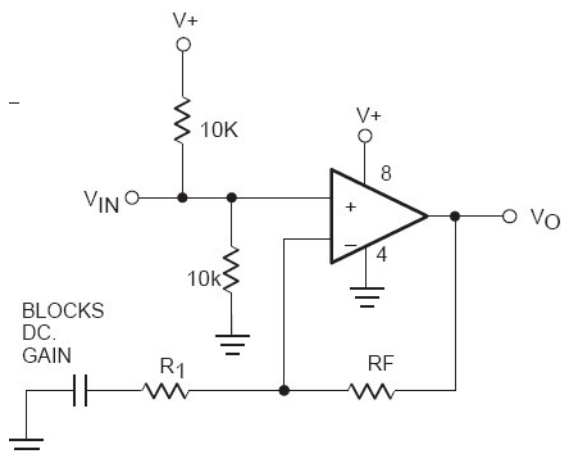
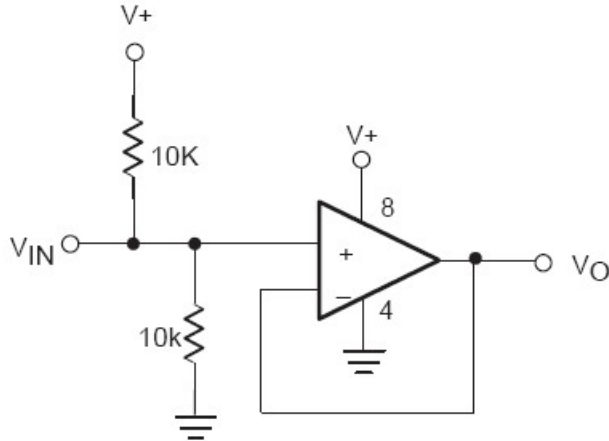
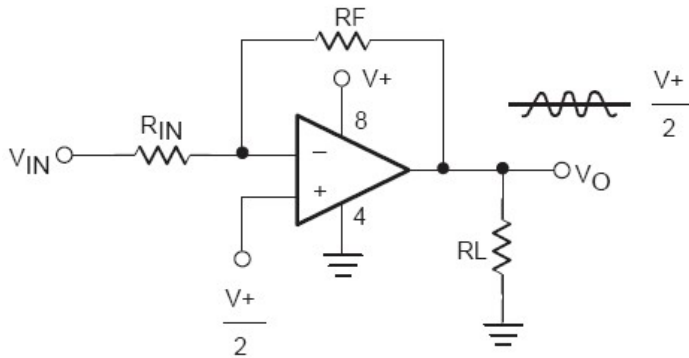


Figure 1. Non-Inverting Amplifier



**Figure 2. Input Biasing Voltage-Follower**



**Figure 3. Single Supply Inverting Amplifier**

## Ordering Information

ORDERING NUMBER	PACKAGE	MARKING
LM324	SOP-14 / DIP-14	LM324

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