

# LM348/LM248

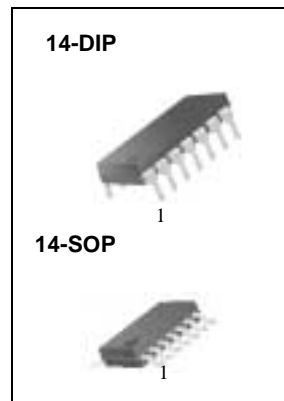
## Quad Operational Amplifier

### Features

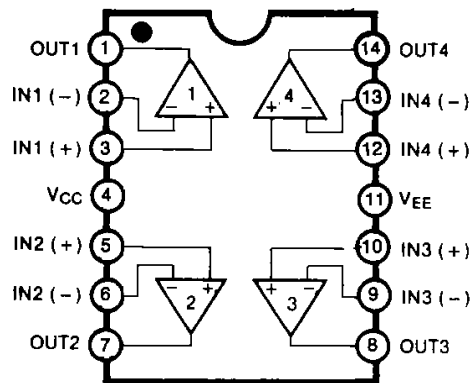
- LM741 OP Amp operating characteristics
- Low supply current drain
- Class AB output stage no crossover distortion
- Pin compatible with the LM324/LM248
- Low input offset voltage : 1mV Typ.
- Low input offset current : 4nA Typ.
- Low input bias current : 30nA Typ.
- Gain bandwidth (unity gain): 1.0MHz Typ.
- High degree of isolation between amplifiers: 120dB
- Overload protection for inputs and outputs

### Description

The LM348/LM248 is a true quad LM741. It 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 LM741 operational amplifier. In addition the total supply current for all four amplifiers is comparable to the supply current of a single LM741 type OP Amp. Other features include input offset currents and input bias current which are much less than those of a standard LM741. Also, excellent isolation between amplifiers has been achieved by independently biasing each amplifier and using layout techniques which minimize thermal coupling.

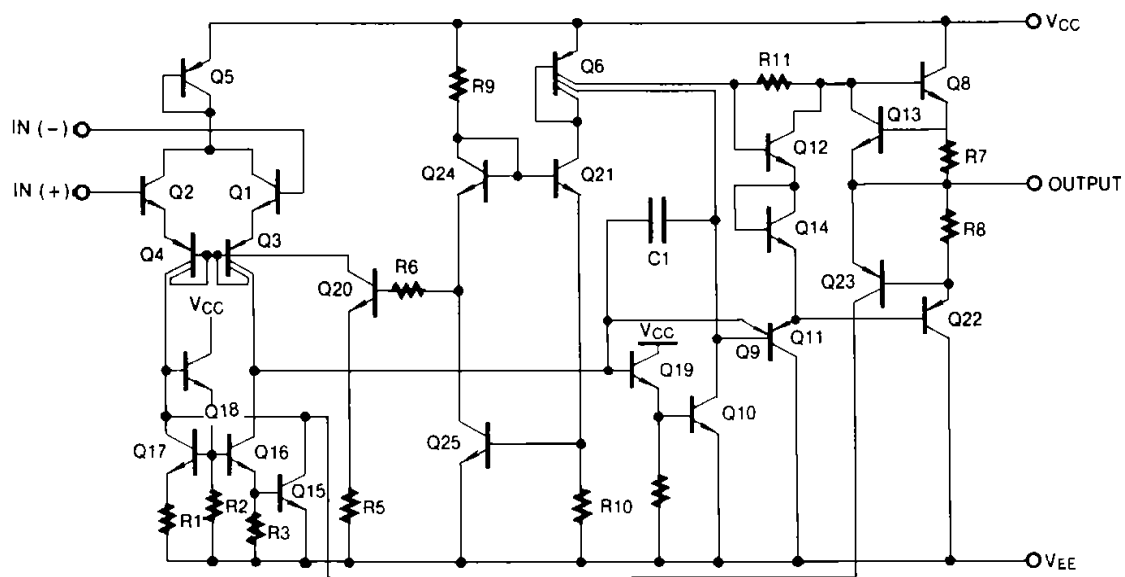


### Internal Block Diagram



## Schematic Diagram

(One Section Only)



## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	VCC	±18	V
Differential Input Voltage	VI(DIFF)	36	V
Input Voltage	VI	±18	V
Output Short Circuit Duration	-	Continuous	-
Operating Temperature LM348 LM248	TOPR	0 ~ +70 -25 ~ +85	°C
Storage Temperature	TSTG	-65 ~ +150	°C

## Electrical Characteristics

(VCC =15V, VEE= -15V, TA=25 °C, unless otherwise specified)

Parameter	Symbol	Conditions	LM248			LM348			Unit	
			Min.	Typ.	Max.	Min.	Typ.	Max.		
Input Offset Voltage	V <sub>IO</sub>	R <sub>S</sub> ≤10KΩ	-	1	6.0	-	1	6.0	mV	
		Note 1	-	-	7.5	-	-	7.5		
Input Offset Current	I <sub>IO</sub>		-	4	50	-	4	50	nA	
		Note 1	-	-	125	-	-	100		
Input Bias Current	I <sub>BIAS</sub>		-	30	200	-	30	200	nA	
		Note 1	-	-	500	-	-	400		
Input Resistance	R <sub>I</sub>	-	0.8	2.5	-	0.8	2.5	-	MΩ	
Supply Current (all Amplifiers)	I <sub>CC</sub>	-	-	2.4	4.5	-	2.4	4.5	mA	
Large Signal Voltage Gain	G <sub>V</sub>	R <sub>L</sub> ≥2KΩ	25	160	-	25	160	-	V/mV	
		Note 1	15	-	-	15	-	-		
Channel Separation	CS	f = 1KHz to 20KHz	-	120	-	-	120	-	dB	
Common Mode Input Voltage Range	V <sub>I(R)</sub>	Note 1	±12	-	-	±12	-	-	V	
Small Signal Bandwidth	BW	G <sub>V</sub> = 1	-	1.0	-	-	1.0	-	MHz	
Phase Margin (Note2)	MPH	G <sub>V</sub> = 1	-	60	-	-	60	-	Degree	
Slew Rate (Note2)	SR	G <sub>V</sub> = 1	-	0.5	-	-	0.5	-	V/μs	
Output Short Circuit Current	I <sub>SC</sub>	-	-	25	-	-	25	-	mA	
Output Voltage Swing	V <sub>O(P-P)</sub>	R <sub>L</sub> ≥10KΩ	Note 1	±12	±13	-	±12	±13	-	V
		R <sub>L</sub> ≥2KΩ		±10	±12	-	±10	±12	-	
Common Mode Rejection Ratio	CMRR	R <sub>S</sub> ≥10KΩ	Note 1	70	90	-	70	90	-	dB
Power Supply Rejection Ratio	PSRR	R <sub>S</sub> ≥10KΩ	Note 1	77	96	-	77	96	-	dB

### Note :

1. LM348: 0 ≤ T<sub>A</sub> ≤ +70 °C , LM248: -25 ≤ T<sub>A</sub> ≤ +85 °C
2. Guaranteed by design.

# Typical Performance Characteristics

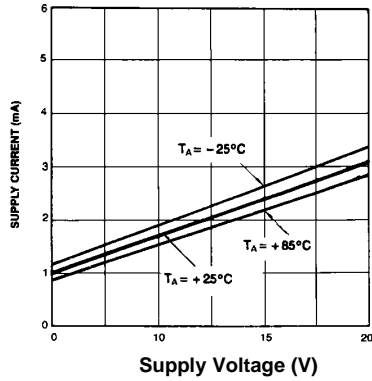


Figure 1. Supply Current vs Supply voltage

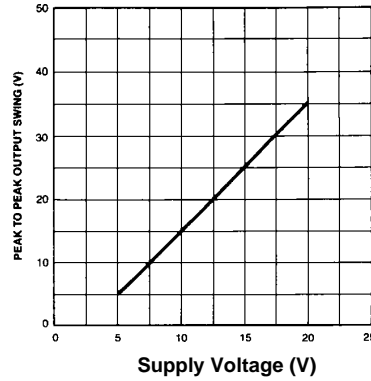


Figure 2. Output Voltage Swing vs Supply voltage

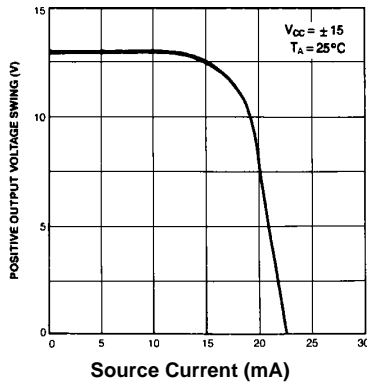


Figure 3. Output voltage swing vs Source Current (mA)

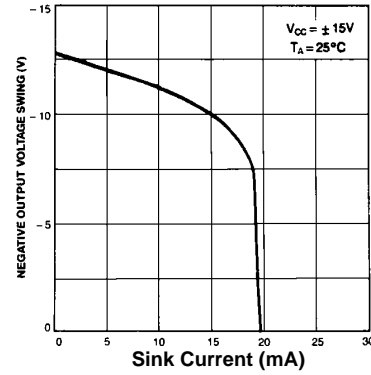


Figure 4. Output voltage swing vs Sink Current (mA)

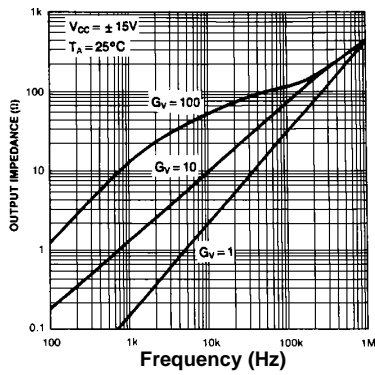


Figure 5. Output Impedance vs Frequency

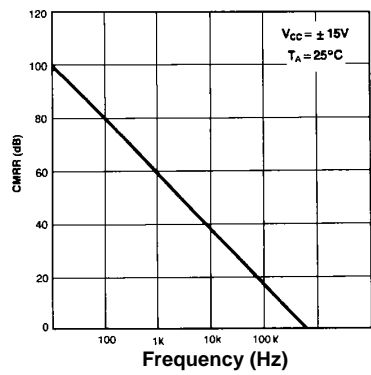


Figure 6. Common-mode Rejection Ratio vs Frequency

## Typical Performance Characteristics (continued)

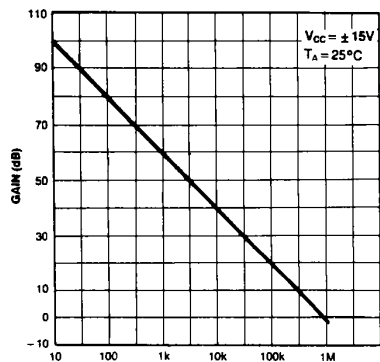


Figure 7. Open Loop Frequency Response

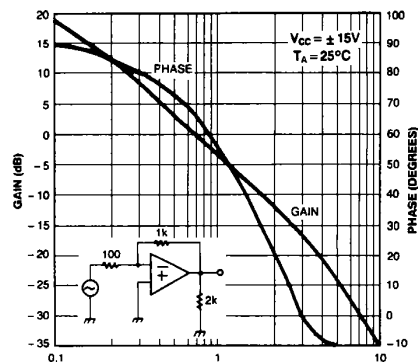


Figure 8. Bode Plot

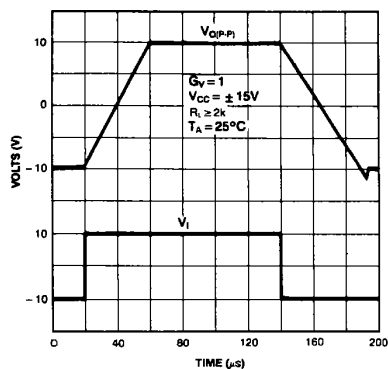


Figure 9. Large Signal Pulse Response

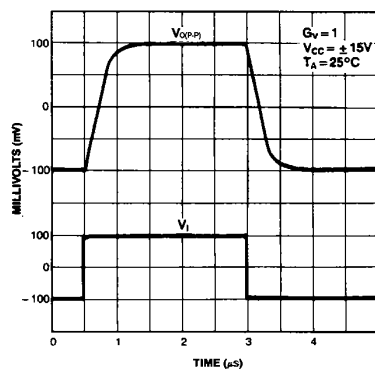


Figure 10. Small Signal Pulse Response

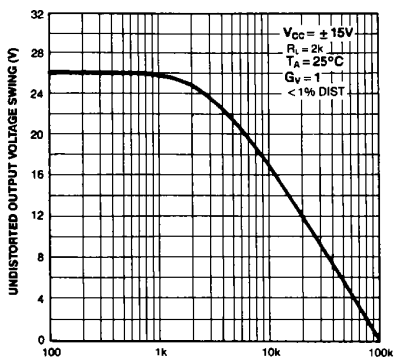


Figure 11. Undistorted Output Voltage Swing vs Frequency

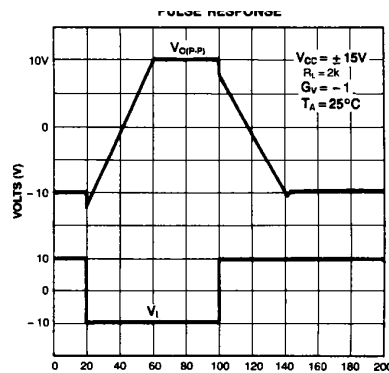


Figure 12. Inverting Large Signal Pulse Response

## Typical Performance Characteristics (continued)

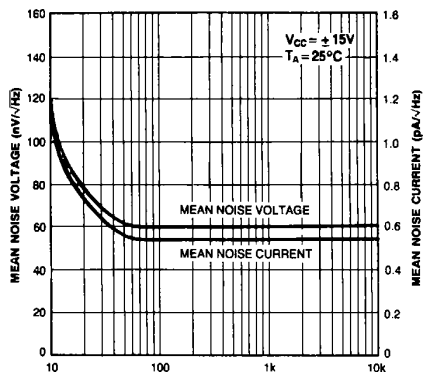


Figure 13. Input Noise Voltage And Noise Current vs Frequency

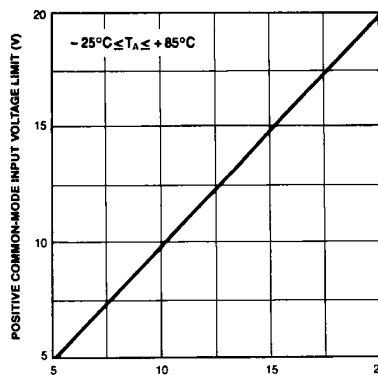


Figure 14. Positive Common Mode Input Voltage Limit vs Positive Supply Voltage

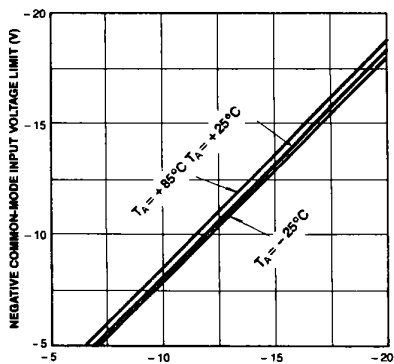
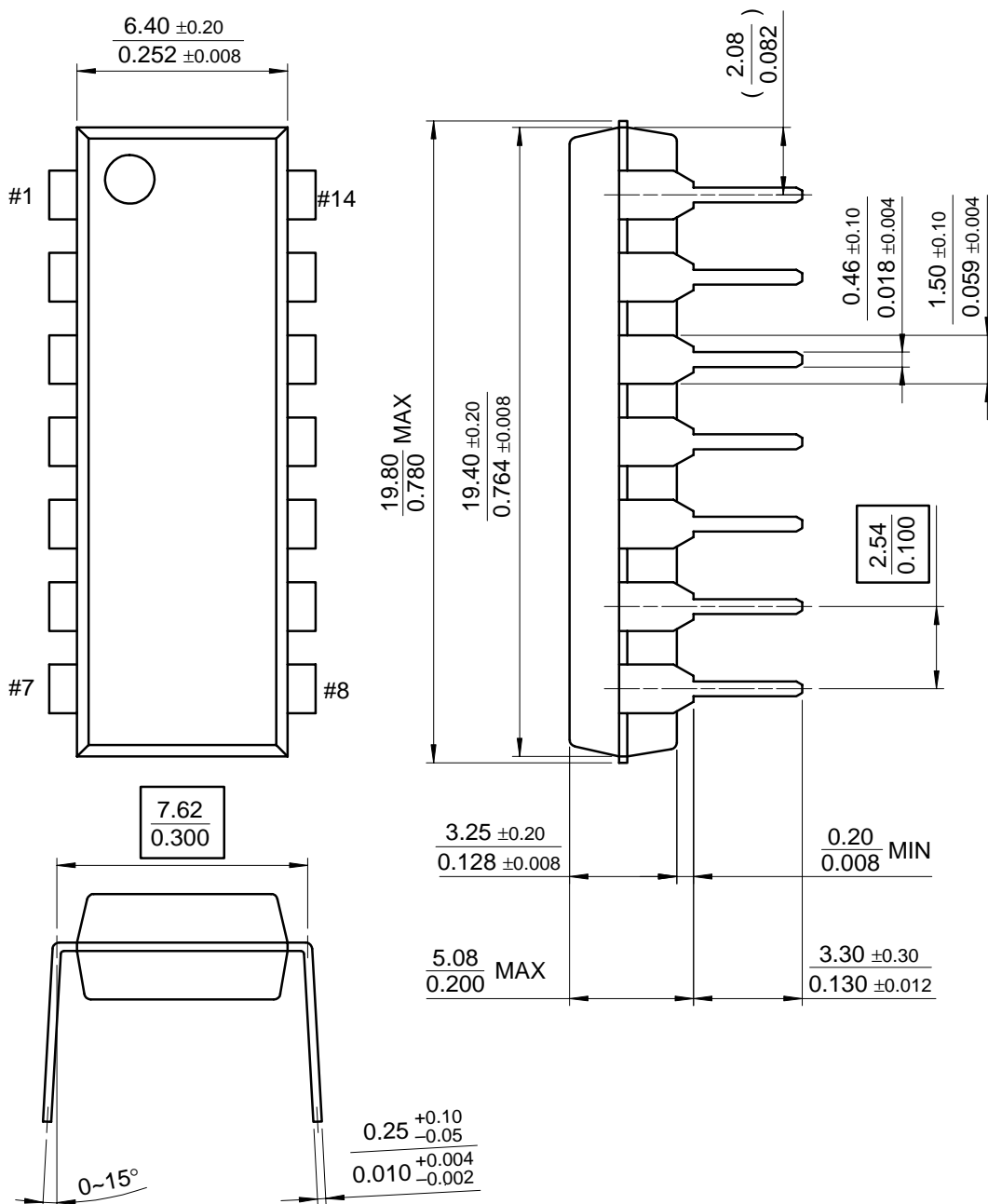


Figure 15. Negative Common-mode Input Voltage Limit vs Negative Supply Voltage

# Mechanical Dimensions

## Package

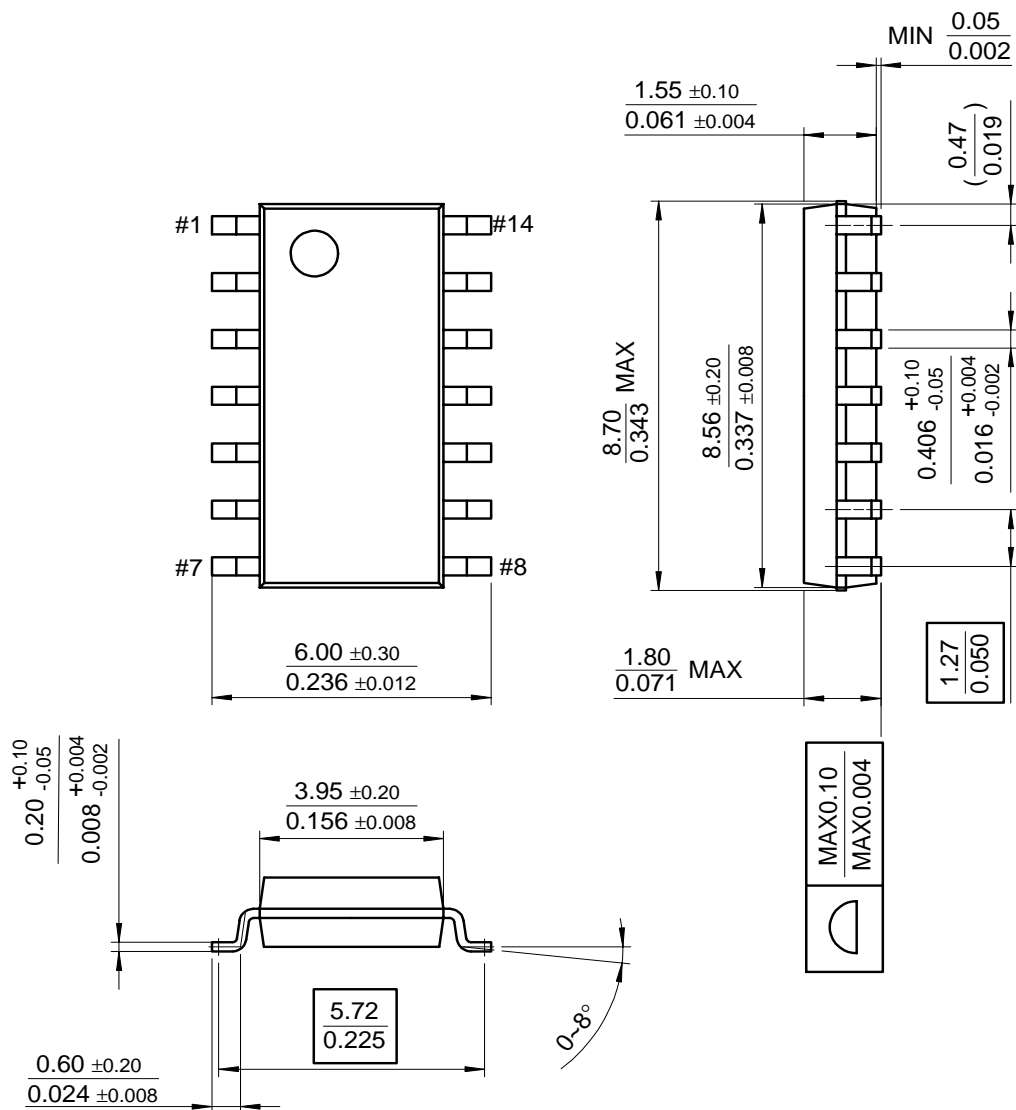
### 14-DIP



# Mechanical Dimensions

## Package

### 14-SOP





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## Ordering Information

Product Number	Package	Operating Temperature
LM348N	14-DIP	0 ~ + 70°C
LM348M	14-SOP	
LM248N	14-DIP	-25 ~ + 85°C
LM248M	14-SOP	

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.