

Overview

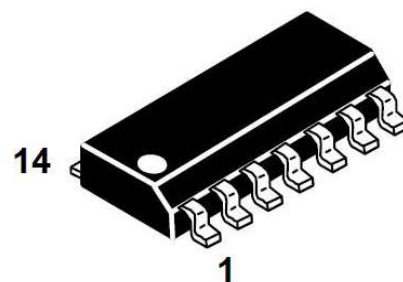
The LM324 consists of four independent low-power differential operational amplifiers, which can operate with single or dual power supplies. It features high open-loop gain, internal frequency compensation, wide common-mode input range, excellent temperature stability and output short-circuit protection.

The device works with supply voltages ranging from 3.0 V to 32 V. Its common-mode input range extends down to the negative supply rail, eliminating the need for external biasing circuitry, and the output voltage range also covers the negative supply voltage. It is widely used in sensor amplifier circuits, DC amplification modules, audio amplifier circuits and general operational amplifier circuits. This product is packaged in a SOP14 package.

Typical Applications

- Sensor signal amplifiers
- DC gain circuits
- Audio amplifiers
- Other general op-amp circuits

Package Outline Drawing

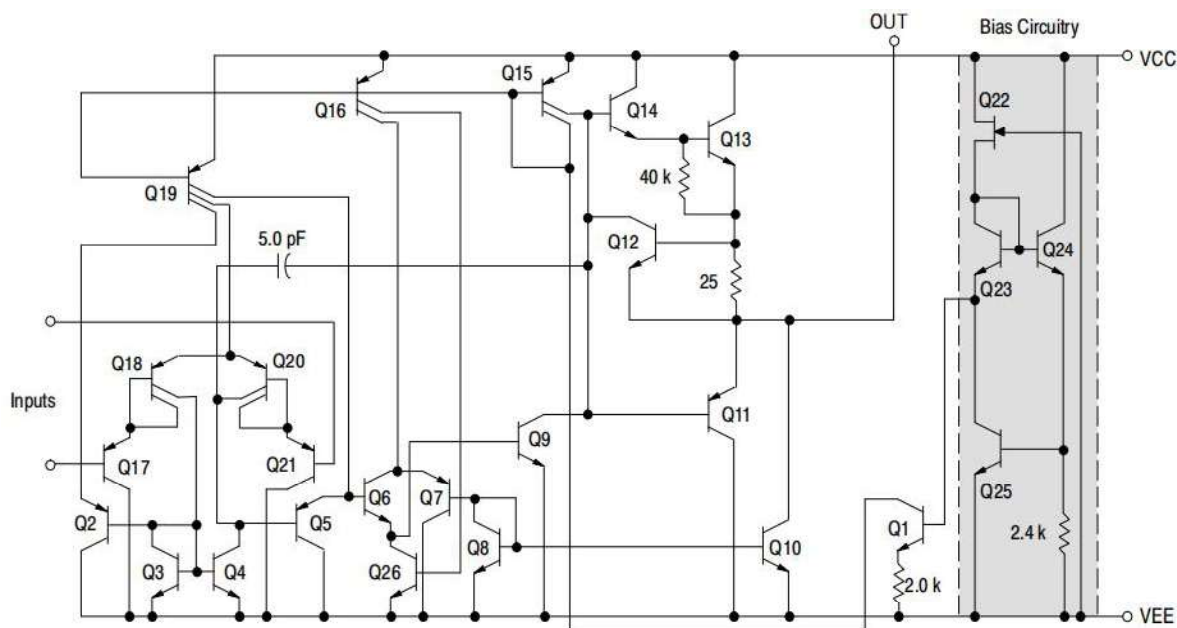


SOP14

Key Features

- Internal frequency compensation
- Output short-circuit protection
- Four independent operational amplifiers integrated on a single chip
- Package: SOP14
- Single supply voltage range: 3 V ~ 32 V
- Dual supply voltage range: +1.5 V ~ ± 16 V
- Unity-gain bandwidth: 1.2 MHz

Functional Block Diagram (Single-Channel Op-Amp)



Pin Description

Pin Number	Pin Name	I/O	Description	Pinout Diagram
1	1OUT	O	Output of Operational Amplifier Channel 1	
2	1IN-	I	Inverting Input of Amplifier Channel 1	
3	1IN+	I	Non-inverting input of the first operational amplifier	
4	VCC	P	Positive Power Supply	
5	2IN+	I	Non-inverting input of the second operational amplifier	
6	2IN-	I	Inverting Input of the Second Operational Amplifier	
7	2OUT	O	Output of the Second Op-Amp	
8	3OUT	O	Output of the third operational amplifier	
9	3IN-	I	Inverting Input of the Third Operational Amplifier	
10	3IN+	I	Non-inverting input of the third operational amplifier	
11	VEE	P	Negative power supply	
12	4IN+	I	Non-inverting input of the 4th operational amplifier	
13	4IN-	I	Inverting Input of the 4th Operational Amplifier	
14	4OUT	O	Output of the 4th operational amplifier	

Extreme Parameters (Unless otherwise specified, Tamb = 25°C)

Parameter	标识	极限值
Power Supply Voltage	VCC	32 或 ±16V
Differential input voltage	V _{ID}	32V
Input voltage (any input)	V _I	-0.3 ~ VCC
Maximum Operating Junction Temperature	T _J	150°C
Working environment temperature	T _A	-20 ~ +85°C
Storage Temperature	T _S	-65 ~ +150°C
Lead Temperature (Soldering, 10s)	T _W	260°C

Electrical characteristics (unless otherwise specified, VCC = 5V, VEE = GND, Tamb = 25°C)

Parameter	SYMBOL	Test Conditions	Min	Typ	Max	unit
Input Voltage Imbalance	V _{IO}	V _{CC} =5V to 32V, V _{ICM} =V _{ICM(min)} , V _O =1.4V	-	±2	±5	mV
Input unbalanced current	I _{IO}	V _O =1.4V	-	±10	±100	nA
Input bias current	I _B	V _O =1.4V	-	±50	±250	nA
Common-mode input voltage	V _{ICM}	V _{CC} =5V to 32V	V _{EE}		V _{CC} -1.5	V
Open-loop voltage gain	A _{OL}	V _{CC} =15V, V _O =1V to 11V; R _L ≥ 10 kΩ, connected to	-	100	-	V/mV
Common-Mode Rejection Ratio	CMRR	V _{CC} =5V to 32 V V _{EE} , V _{ICM} =V _{ICM(min)}	-	80	-	dB
Power Supply Rejection Ratio	PSRR	V _{CC} =5V to 32V, f=20KHz	-	90	-	dB

Channel Isolation	CS	f=1kHz ~ 20kHz	-	120	-	dB
Output high-level voltage	V_{OH}	$V_{CC}=5V, V_{ID}=1V$	$R_L=2K\Omega$	-	3.5	V
		$V_{CC}=30V, V_{ID}=1V$	$R_L=2K\Omega$	26	-	V
		$V_{CC}=30V, V_{ID}=1V$	$R_L=10K\Omega$	27	28	V
Output low-level voltage	V_{OL}	$V_{CC}=5V, V_{ID}=-1V$	$R_L=10K\Omega$	-	5.0	20 mV
Output Current	I_{source}	$V_{CC}=15V, V_{ID}=1V, V_O=2V$	-20	-35	-	mA
	I_{sink}	$V_{CC}=15V, V_{ID}=-1V, V_O=2V$	10	13	-	mA
Power Supply Operating Current	I_{CC1}	$V_{CC}=5V, V_O=1/2V_{CC}, \text{No load}$	-	0.8	2	mA
	I_{CC2}	$V_{CC}=30V, V_O=1/2V_{CC}, \text{No load}$	-	1.4	3	mA
Gain-bandwidth product	GBWP		-	1.2	-	MHz
Conversion Rate	SR		-	0.5	-	V/uS

Typical Applications

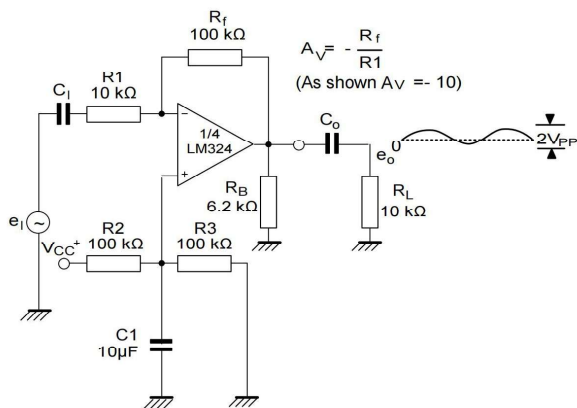


Figure 1: AC-Coupled Inverting Amplifier

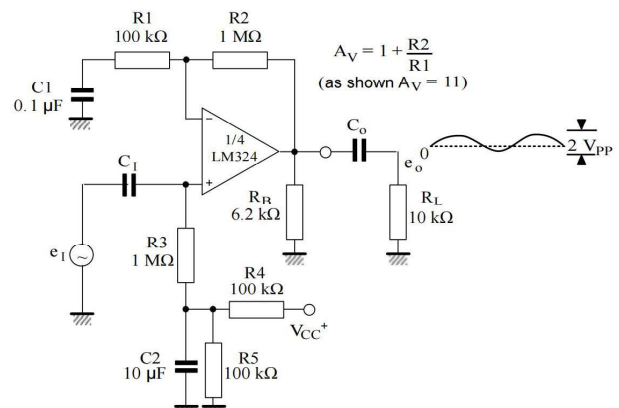


Figure 2: AC-Coupled Non-Inverting Amplifier

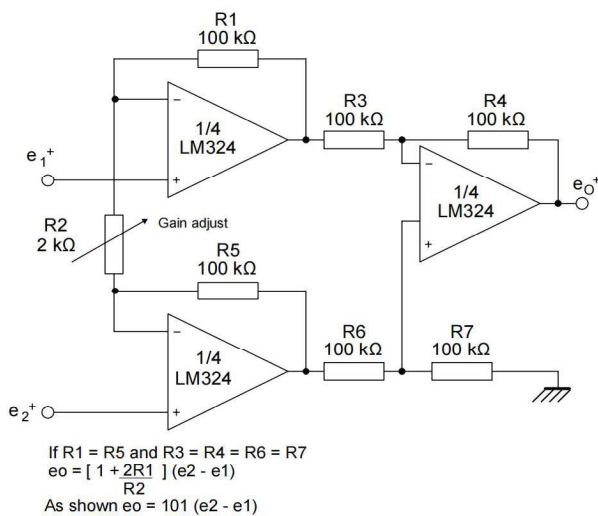


Figure 3: Adjustable Gain DC Instrumentation Amplifier (High Input Impedance)

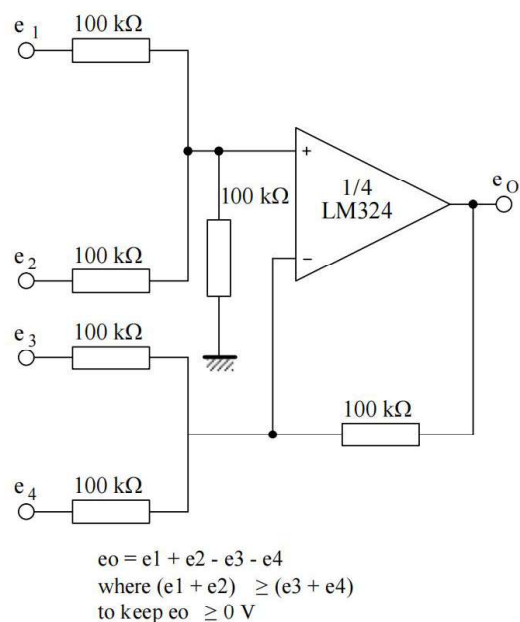


Figure 4: DC Summing Amplifier

Characteristic Curve

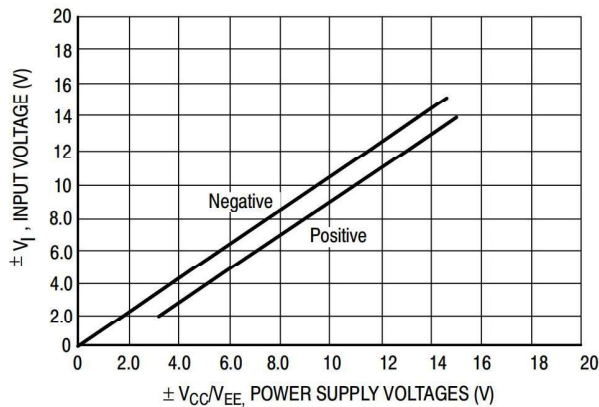


Figure 5: Relationship between input voltage and supply voltage

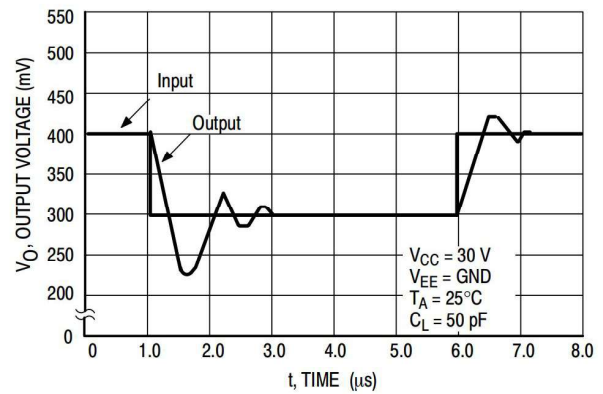


Figure 6: Small-Signal Voltage Follower Pulse Response (Non-Inverting)

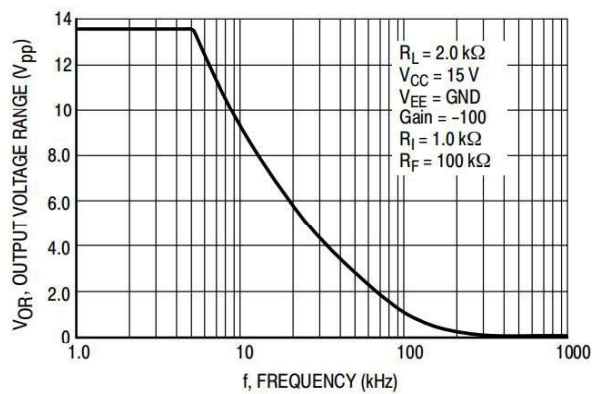


Figure 7: Large-Signal Frequency Response

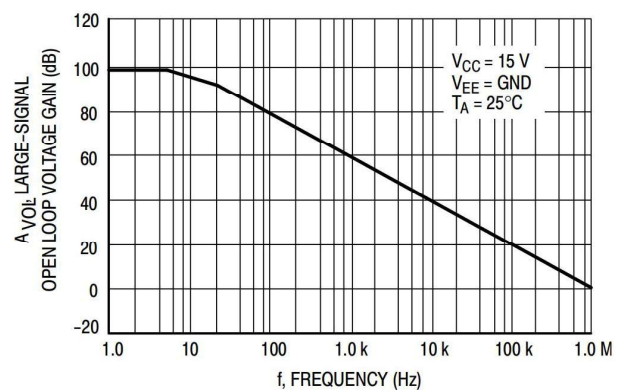


Figure 8: Relationship Between Open-Loop Gain and Frequency

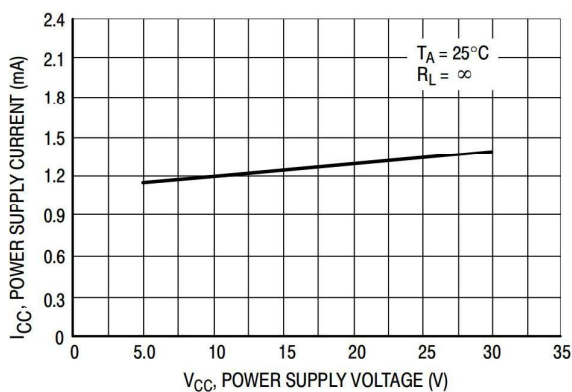


Figure 9: Relationship between Supply Current and Supply Voltage

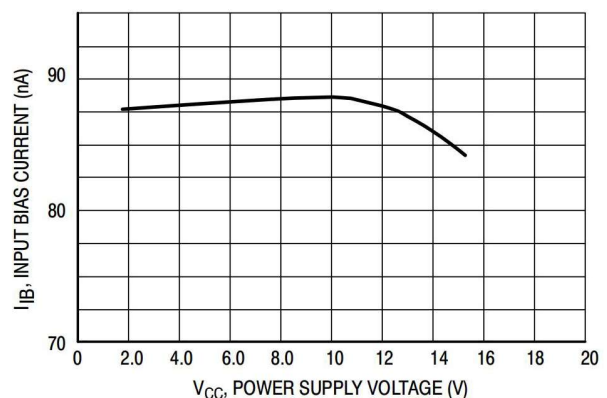
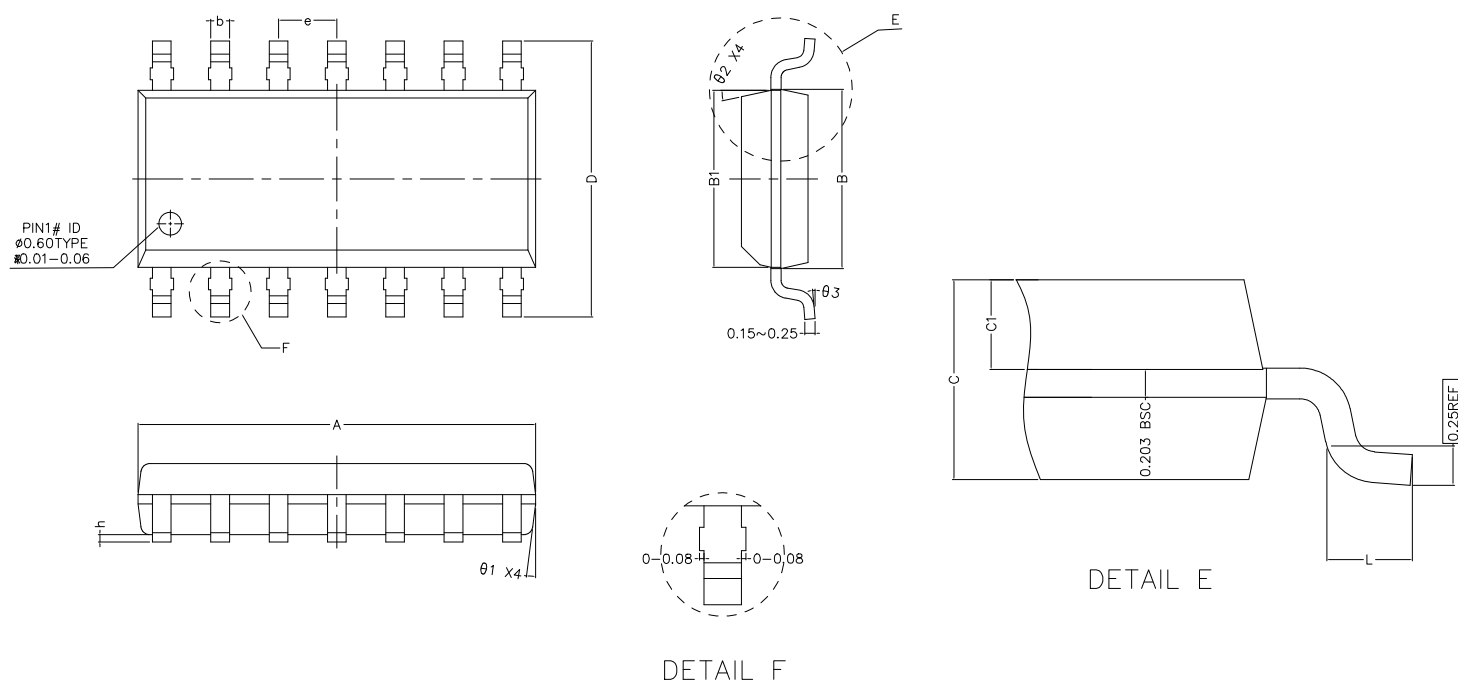


Figure 10: Relationship Between Input Bias Current and Supply Voltage

Encapsulation Information (SOP14):



COMMON DIMENSIONS (UNITS OF MEASURE IS mm)			
	MIN	NORMAL	MAX
A	8.500	8.600	8.700
B	3.800	3.900	4.000
B1	3.750	3.850	3.950
C	1.300	1.400	1.500
C1	0.600	0.650	0.700
D	5.800	6.000	6.200
L	0.450	0.600	0.750
b	0.350	0.400	0.450
h	0.050	0.100	0.250
e	1.270TYPE		
θ_1	12° TYPE		
θ_2	12° TYPE		
θ_3	0° ~ 8°		

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