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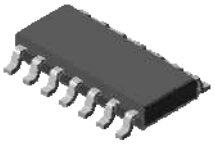
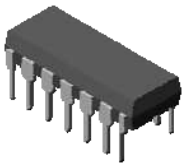
Low Power Quad OP AMP SN324/P



SOP-14



DIP-14

Description

The SN324/P is quad operational amplifiers with true differential inputs. They have several distinct advantages over standard operational amplifier types in single supply applications.

The quad amplifier can operate at supply voltages as low as 3.0 V or as high as 32V, The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications.

The output voltage range also includes the negative power supply voltage.

Application

◈ Transducer amplifier

◈ DC gain blocks

◈ Conventional operational amplifiers

ORDERING INFORMATION

Product	Marking	Package
SN324	SN324	SOP-14
SN324P	SN324P	DIP-14

▲ **Marking Information**

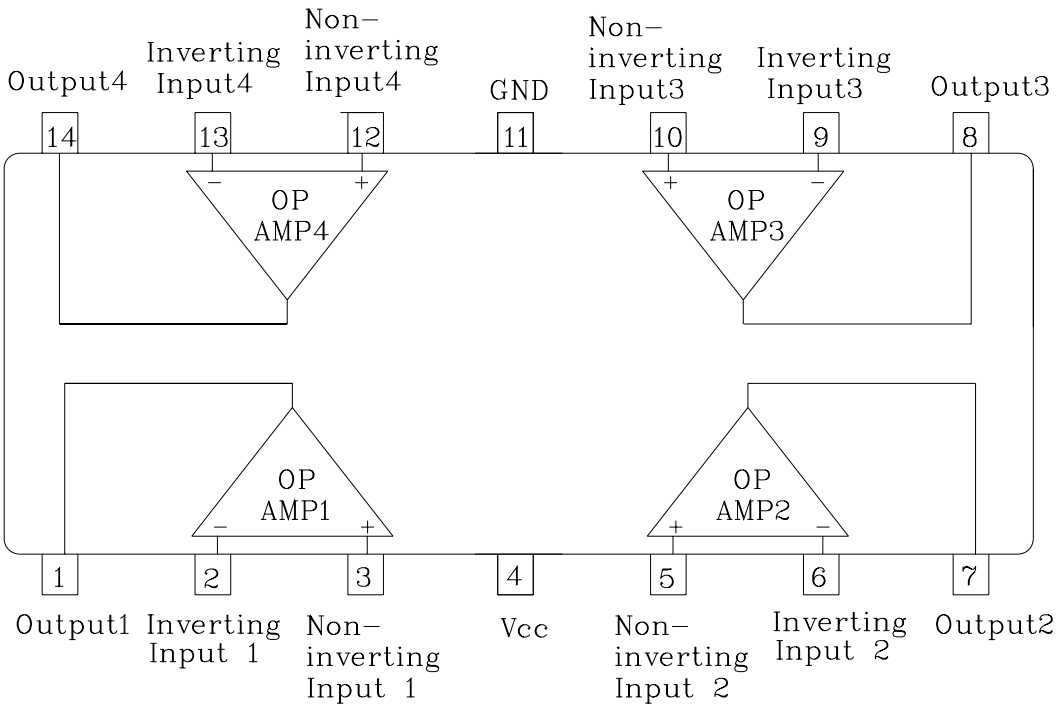
① Device Code

② Year & Week Code

Features and Benefits

◈ Short Circuited Protected Outputs
◈ True Differential Input Stage
◈ Single Supply Operation: 3.0 V to 32 V
◈ Low Input Bias Currents: 100 nA Maximum
◈ Common Mode Range Extends to Negative Supply

◈ Internal Block Diagram



◈ Pin Description

No	Symbol	I/O	Description
1	Output1	O	OP-Amp1's Output
2	IN1(-)	I	OP-Amp1's Inverting Input
3	IN1(+)	I	OP-Amp1's Non- Inverting Input
4	V_{CC}	PWR	V_{CC} for Dual Operational Amplifier
5	IN2(+)	I	OP-Amp2's Non- Inverting Input
6	IN2(-)	I	OP-Amp2's Inverting Input
7	Output2	O	OP-Amp2's Output
8	Output3	O	OP-Amp3's Output
9	IN3(-)	I	OP-Amp3's Inverting Input
10	IN3(+)	I	OP-Amp3's Non- Inverting Input
11	GND	GND	Ground
12	IN4(+)	I	OP-Amp4's Non- Inverting Input
13	IN4(-)	I	OP-Amp4's Inverting Input
14	Output4	O	OP-Amp4's Output

Absolute maximum ratings

Characteristic	Symbol		Ratings	Unit
Supply voltage	V_{CC}		36 or ±18	V
Differential input voltage	V_{IND}		36	V
Input voltage	V_{IN}		-0.3 ~ +36	V
Power Dissipation	P_D	SOP-14	800	mW
		DIP-14	1300	mW
Operating temperature	T_{opr}		-40 ~ +85	°C
Storage temperature	T_{stg}		-55 ~ 150	°C

Electrical Characteristics

(Unless otherwise specified. V_{CC} = 5V, V_{EE} = GND and 0 °C ≤ Ta ≤ +70 °C)

Characteristic	Symbol	Test Condition		Min.	Typ.	Max.	Unit
Input offset voltage	V_{IOS}	V_{CC} = 5~30V Rg = 0Ω		-	2	7	mV
Input offset current	I_{IOS}	-		-	5	30	nA
Input bias current	I_{IB}	-		-	45	150	nA
Input common mode voltage range	V_{ICR}	V_{CC} = 30V, Ta=25°C		0	-	V_{CC} –1.5	V
Supply current	I_{CC}	R_L = ∞, All Channel		-	0.7	1.2	mA
Large signal voltage gain	G_V	V_{CC} = 15V R_L ≥ 2 KΩ		86	100	-	dB
Output voltage swing	V_{OH}	V_{CC} = 30V	R_L=2 KΩ	26	-	-	V
			R_L=10 KΩ	27	28	-	
	V_{OL}	V_{CC} =5V, R_L ≤10 KΩ		-	5	20	mV
Common mode rejection ratio	CMRR	V_{CC}=5V~15V, V_{IC}=V_{IVRMIN} Ta=25°C		65	85	-	dB
Power supply rejection ratio	PSRR	V_{CC}=5V~15V, Ta=25 °C		65	100	-	dB
Output source current	I_{O+}	V_{CC} = 15V V_{IN+} = 1V, V_{IN-} = 0V	Ta=25°C	20	40	-	mA
				10	-	-	
Output sink current	I_{O-}	V_{CC} = 15V V_{IN+} = 0V, V_{IN-} = 1V	Ta=25°C	10	20	-	mA
				5	-	-	
		V_{OUT} = 200mV, Ta=25°C V_{IN+}= 0V, V_{IN-}= 1V, V_{CC}= 15V		12	45	-	µA

Electrical Characteristic Curves

Fig. 1 I_{CC}-V_{CC}

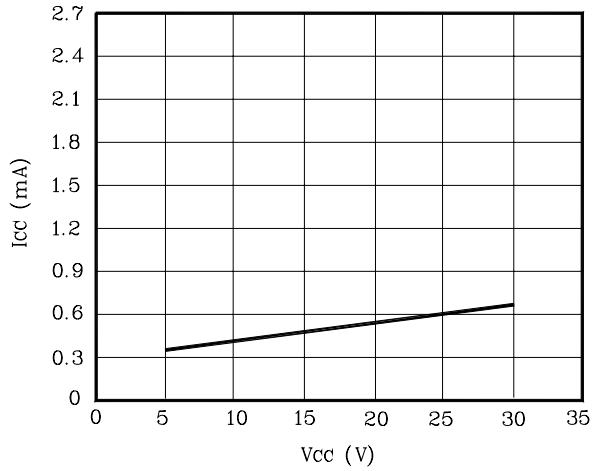


Fig. 2 I_{IB}-V_{CC}

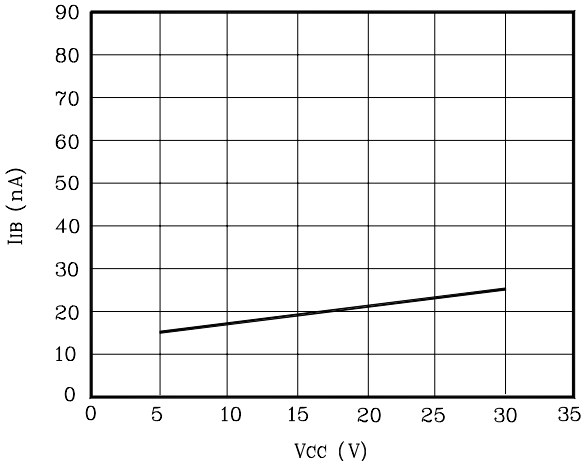


Fig. 3 V_{IOS}-T_a

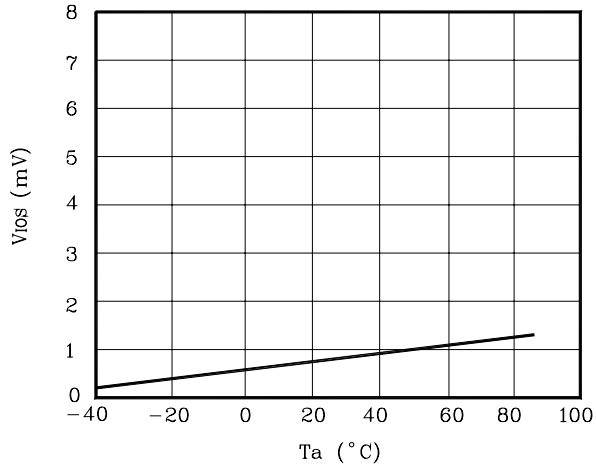


Fig. 4 I_O-T_a

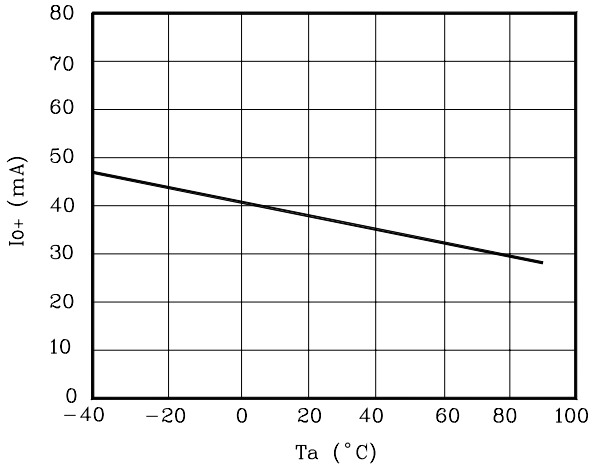


Fig. 5 CMRR-f

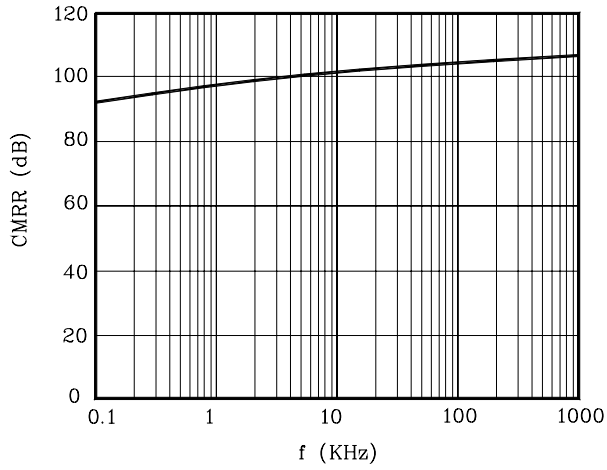
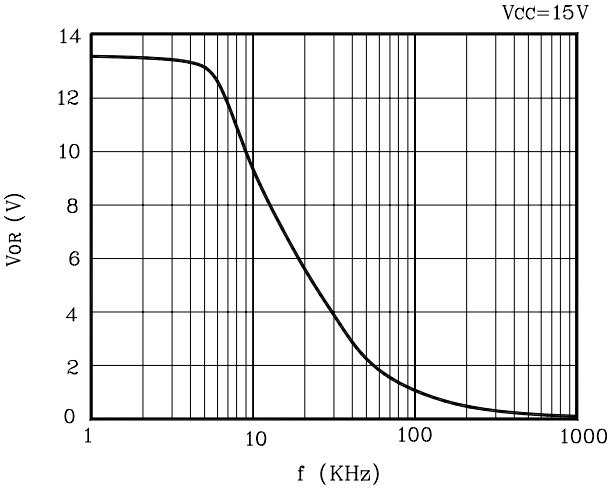
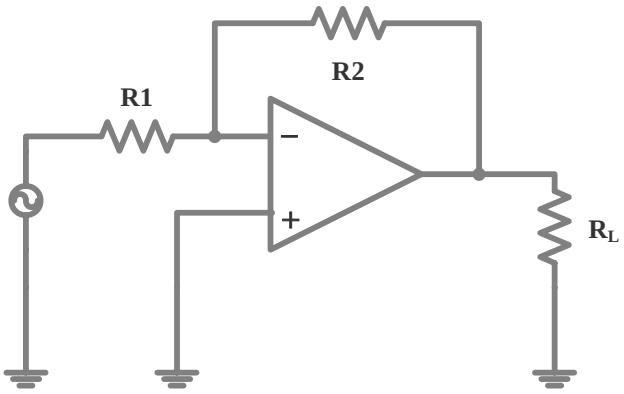


Fig. 6 V_{OR}-f

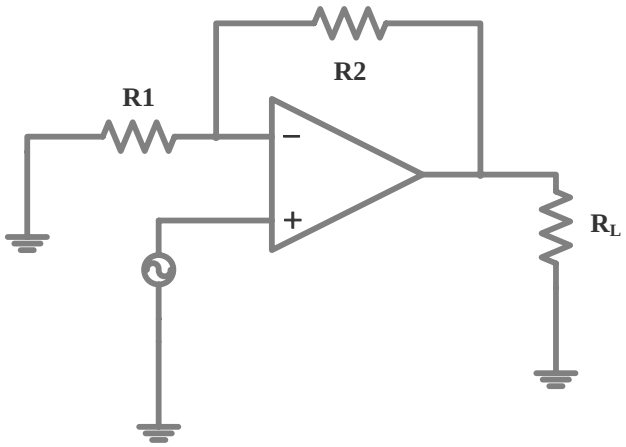


Typical Applications

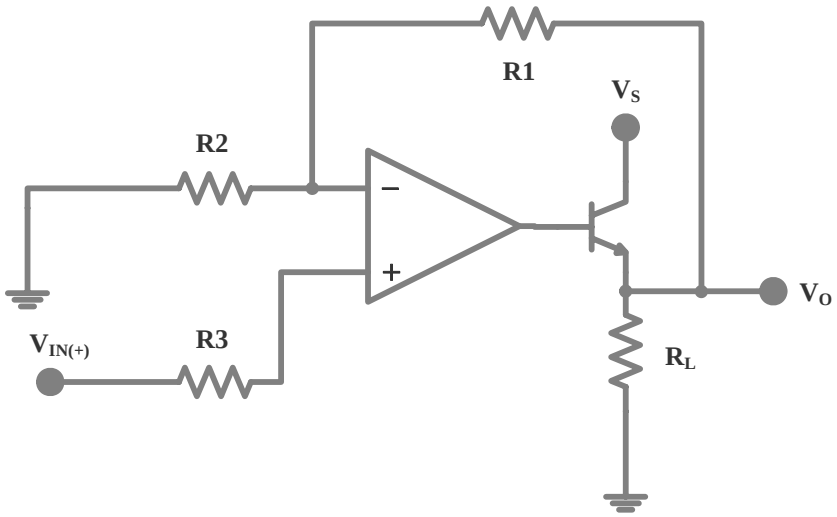
Inverting Amplifier



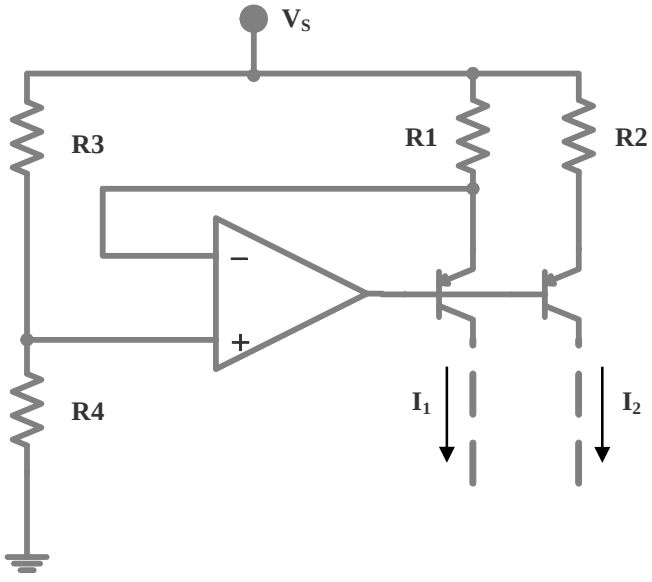
Non-inverting Amplifier



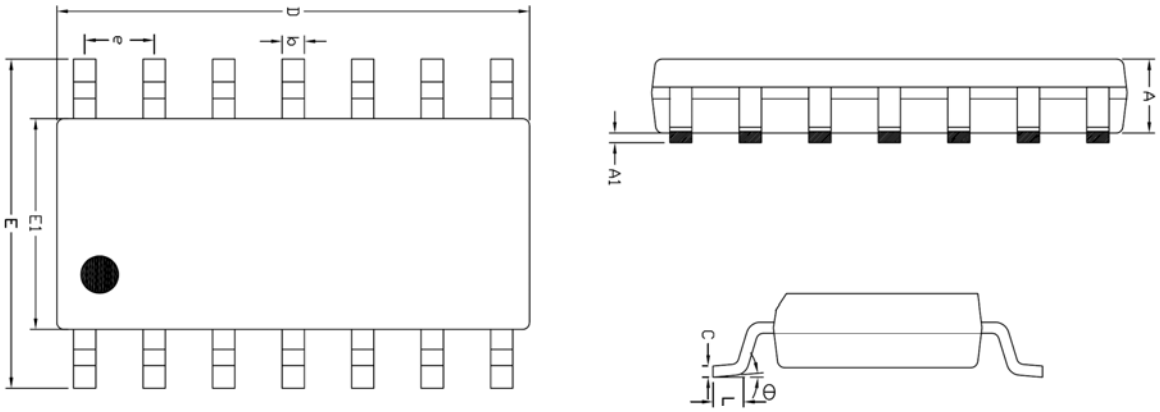
Power Amplifier



Fixed Current Sources

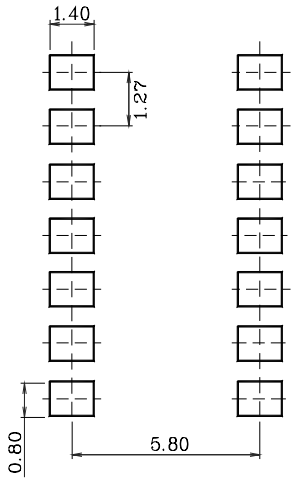


Outline Dimension (Unit : mm)

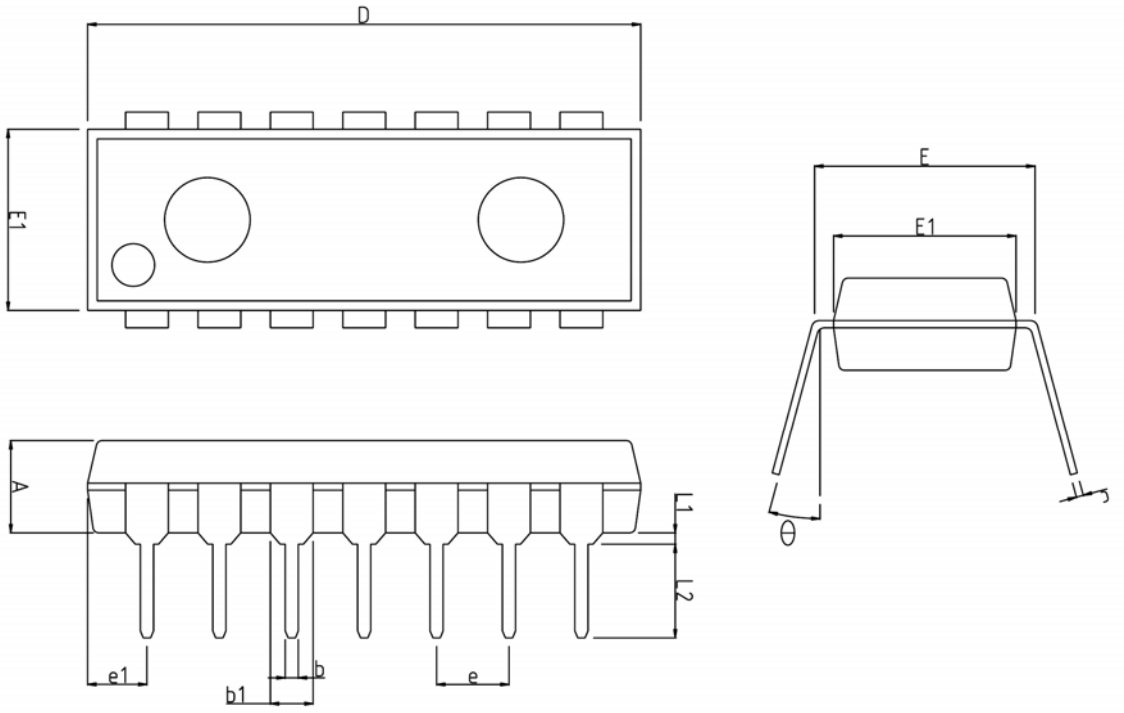


SYMBOL	MILLIMETER(mm)			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	1.245	–	1.445	
A1	0.125	0.175	0.275	
b	0.320	0.420	0.520	
c	0.170	0.220	0.270	
D	8.536	8.636	8.736	
E	5.870	6.020	6.170	
E1	3.761	3.861	3.961	
e	1.270 BSC			
L	0.462	0.562	0.662	
θ	0 °	–	8 °	

※ Recommend PCB solder land (Unit : mm)



Outline Dimension (Unit : mm)



SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	3.05	3.25	3.45	
b	0.36	0.46	0.56	
b1	1.40	1.50	1.60	
c	0.20	0.25	0.35	
D	19.20	19.40	19.60	
E	7.37	7.62	7.87	
E1	6.20	6.40	6.60	
e	2.54 TYP			
e1	2.08 TYP			
L1	0.20	–	–	
L2	3.00	3.30	3.60	
θ	0°	–	15°	

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