

## QUADRUPLE OPERATIONAL AMPLIFIERS

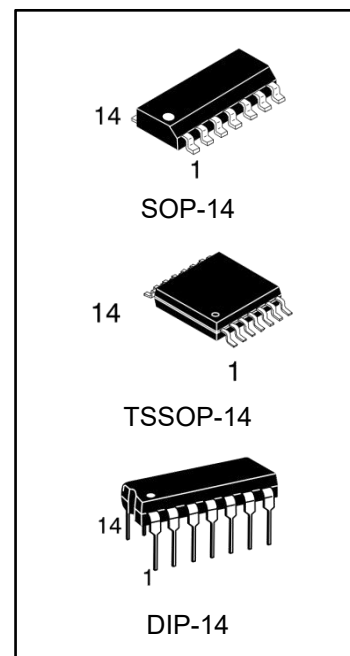
### DESCRIPTION

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 is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits.

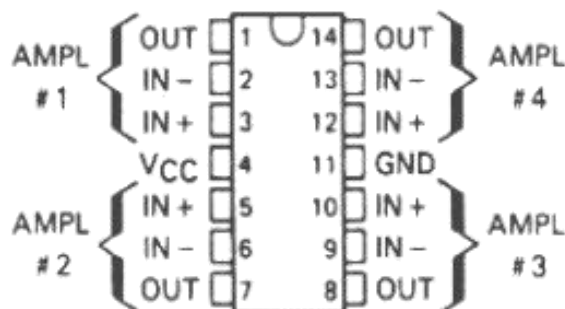
### FEATURES

- 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



### ORDERING INFORMATION

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM324PG	DIP-14	LM324	TUBE	1000pcs/Box
LM324DRG	SOP-14	LM324	REEL	2500pcs/Reel
LM324PWRG	TSSOP-14	LM324	REEL	2500pcs/Reel

**PACKAGE INFORMATION**


DIP-14/SOP-14/TSSOP-14

**ELECTRICAL CHARACTERISTICS**

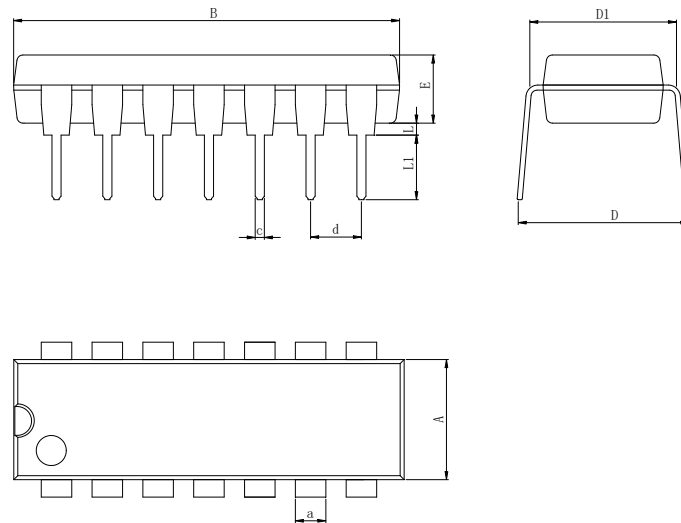
 at specified free-air temperature,  $V_{CC} = 5V$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS*	LM324			UNIT	
		MIN	TYP	MAX		
V <sub>IO</sub> Input offset voltage	V <sub>CC</sub> = 5V to MAX, V <sub>IC</sub> = V <sub>ICRmin</sub> , V <sub>O</sub> = 1.4V	25°C	3	7	mV	
		Full temperature range		9		
$\alpha$ V <sub>IO</sub> Average temperature coefficient of input offset voltage		Full temperature range	7		$\mu V/^\circ C$	
I <sub>IO</sub> Input offset current	V <sub>O</sub> = 1.4V	25°C	2	50	nA	
		Full temperature range		150		
$\alpha$ I <sub>IO</sub> Average temperature coefficient of input offset current		Full temperature range	10		pA/°C	
I <sub>IB</sub> Input bias current	V <sub>O</sub> = 1.4V	25°C	-20	-250	nA	
		Full temperature range		-500		
V <sub>ICR</sub> Common-mode input voltage range	V <sub>CC</sub> = 5V to MAX	25°C	0 to V <sub>CC</sub> - 1.5		V	
		Full temperature range	0 to V <sub>CC</sub> - 2			
V <sub>OH</sub> High-level output voltage	RL = 2 k $\Omega$	25°C	V <sub>CC</sub> - 1.5		V	
	V <sub>CC</sub> = MAX, RL = 2k $\Omega$	Full temperature range	26			
	V <sub>CC</sub> = MAX, RL = 10 k $\Omega$	Full temperature range	27	28		
V <sub>OL</sub> Low-level output voltage	RL = 10 k $\Omega$	Full temperature range		5	20	mV
AVD	V <sub>CC</sub> = 15 V,	25°C	25	100		V/mV

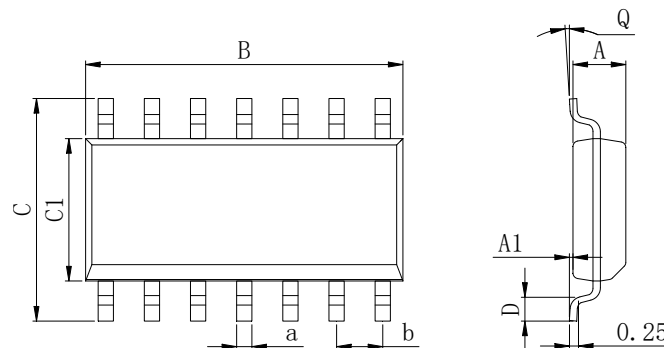
Large-signal differential voltage amplification	$V_o=1V$ to $11V$ , $R_L \geq 2k\Omega$	Full temperature range	15			
CMRR Common-mode rejection ratio	$V_{cc} = 5V$ to MAX, $V_{IC} = V_{ICR}$ min	$25^\circ C$	65	80		dB
kSVR Supply voltage rejection ratio ( $\Delta V_{cc}/\Delta V_{IO}$ )	$V_{cc} = 5V$ to MAX	$25^\circ C$	65	100		dB
$V_{o1}/V_{o2}$ Crosstalk attenuation	$f=1kHz$ to $20kHz$	$25^\circ C$		120		dB
IO Output current	$V_{cc} = 15V$ , $V_{ID}=1V, V_o=0$	$25^\circ C$	-20	-30		mA
		Full temperature range	-10			
	$V_{cc} = 15V$ , $V_{ID} = -1V, V_o=15V$	$25^\circ C$	10	20		mA
		Full temperature range	5			
	$V_{ID} = -1V$ , $V_o = 200mV$	$25^\circ C$	12	30		$\mu A$
$I_{os}$ Short-circuit output current	$V_{cc}$ at $5V$ , GND at $-5V, V_o=0$	$25^\circ C$		$\pm 40$	$\pm 60$	mA
$I_{cc}$ Supply current (four amplifiers)	$V_o = 2.5V$ , No load	Full temperature range		1.5	2.4	mA
	$V_{cc} = MAX$ , $V_o = 0.5V_{cc}$ , No load	Full temperature range		1.1	3	

\* All characteristics are measured under open loop conditions with zero common-mode input voltage unless otherwise specified.

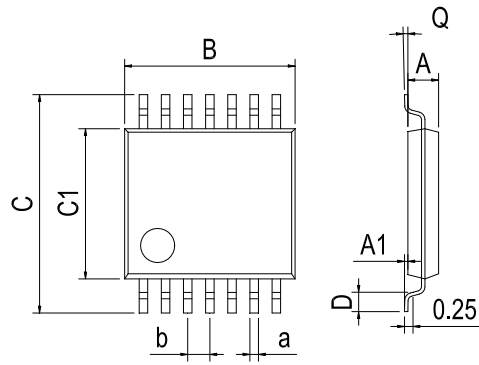
"MAX"  $V_{cc}$  for testing purposes is  $30V$ . Operating temperature  $-40 \sim 85^\circ C$ , MAX Junction temperature  $+125^\circ C$ .

**PHYSICAL DIMENSIONS**
**DIP-14**

**Dimensions In Millimeters(DIP-14)**

Symbol:	A	B	D	D1	E	L	L1	a	c	d
<b>Min:</b>	6.10	18.94	8.10	7.42	3.10	0.50	3.00	1.50	0.40	2.54 BSC
<b>Max:</b>	6.68	19.56	10.9	7.82	3.55	0.70	3.60	1.55	0.50	

**SOP-14**

**Dimensions In Millimeters(SOP-14)**

Symbol:	A	A1	B	C	C1	D	Q	a	b
<b>Min:</b>	1.35	0.05	8.55	5.80	3.80	0.40	0°	0.35	1.27 BSC
<b>Max:</b>	1.55	0.20	8.75	6.20	4.00	0.80	8°	0.45	

**TSSOP-14**

**Dimensions In Millimeters(TSSOP-14)**

Symbol:	A	A1	B	C	C1	D	Q	a	b
<b>Min:</b>	0.85	0.05	4.90	6.20	4.30	0.40	0°	0.20	0.65 BSC
<b>Max:</b>	0.95	0.20	5.10	6.60	4.50	0.80	8°	0.25	

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**REVISION HISTORY**

DATE	REVISION	PAGE
2019-10-5	New	1-7
2023-8-29	Update encapsulation type、 Updated DIP-14 dimension	1、 4

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