

Quadruple Operational Amplifiers

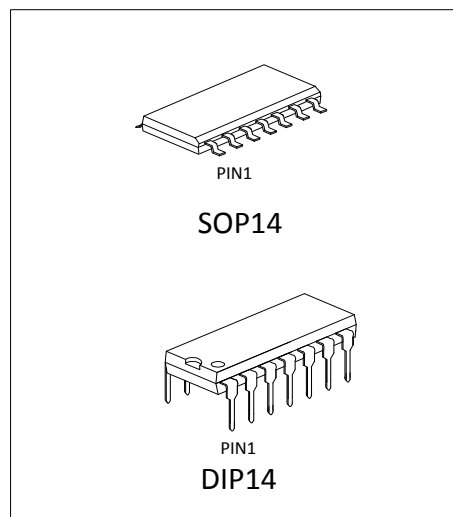
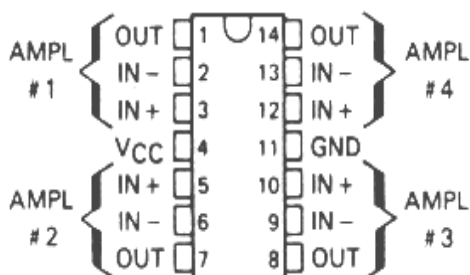
DESCRIPTION

The LM324A 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

PACKAGE INFORMATION



Quadruple Operational Amplifiers
ELECTRICAL CHARACTERISTICS

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

| PARAMETER | TEST CONDITIONS* | | LM324 | | | UNIT |
|--|--|------------------------|---------------------|----------|----------|------------------|
| | | | MIN | TYP | MAX | |
| V_{IO} Input offset voltage | $V_{CC} = 5V$ to MAX, $V_{IC} = V_{ICR}$ min, $V_O = 1.4V$ | 25 °C | | 3 | 7 | mV |
| | | Full temperature range | | | 9 | |
| αV_{IO} Average temperature coefficient of input offset voltage | | Full temperature range | | 7 | | $\mu V/^\circ C$ |
| I_{IO} Input offset current | $V_O = 1.4V$ | 25 °C | | 2 | 50 | nA |
| | | Full temperature range | | | 150 | |
| αI_{IO} Average temperature coefficient of input offset current | | Full temperature range | | 10 | | $\mu A/^\circ C$ |
| I_{IB} Input bias current | $V_O = 1.4V$ | 25 °C | | -20 | -250 | nA |
| | | Full temperature range | | | -500 | |
| V_{ICR} Common-mode input voltage range | $V_{CC} = 5V$ to MAX | 25 °C | 0 to $V_{CC} - 1.5$ | | | V |
| | | Full temperature range | 0 to $V_{CC} - 2$ | | | |
| V_{OH} High-level output voltage | $R_L = 2\text{ k}\Omega$ | 25 °C | $V_{CC} - 1.5$ | | | V |
| | $V_{CC} = \text{MAX}$, $R_L = 2\text{ k}\Omega$ | Full temperature range | 26 | | | |
| | $V_{CC} = \text{MAX}$, $R_L = 10\text{ k}\Omega$ | Full temperature range | 27 | 28 | | |
| V_{OL} Low-level output voltage | $R_L = 10\text{ k}\Omega$ | Full temperature range | | 5 | 20 | mV |
| A_{VD} Large-signal differential voltage amplification | $V_{CC} = 15V$, $V_O = 1V$ to $11V$, $R_L \geq 2\text{ k}\Omega$ | 25 °C | 25 | 100 | | V/mV |
| | | Full temperature range | 15 | | | |
| CMRR Common-mode rejection ratio | $V_{CC} = 5V$ to MAX, $V_{IC} = V_{ICR}$ min | 25 °C | 65 | 80 | | dB |
| k_{SVR} Supply voltage rejection ratio ($\Delta V_{CC}/\Delta V_{IO}$) | $V_{CC} = 5V$ to MAX | 25 °C | 65 | 100 | | dB |
| V_{O1}/V_{O2} Crosstalk attenuation | $f = 1\text{ kHz}$ to 20 kHz | 25 °C | | 120 | | dB |
| I_O Output current | $V_{CC} = 15V$, $V_{ID} = 1V$, $V_O = 0$ | 25 °C | -20 | -30 | | mA |
| | | Full temperature range | -10 | | | |
| | $V_{CC} = 15V$, $V_{ID} = -1V$, $V_O = 15V$ | 25 °C | 10 | 20 | | |
| | | Full temperature range | 5 | | | |
| $V_{ID} = -1V$, $V_O = 200\text{ mV}$ | 25 °C | 12 | 30 | | μA | |
| I_{OS} Short-circuit output current | V_{CC} at $5V$, GND at $-5V$, $V_O = 0$ | 25 °C | | ± 40 | ± 60 | mA |
| I_{CC} Supply current (four amplifiers) | $V_O = 2.5V$, No load | Full temperature range | | 1.5 | 2.4 | mA |
| | $V_{CC} = \text{MAX}$, $V_O = 0.5V_{CC}$, No load | Full temperature range | | 1.1 | 3 | |

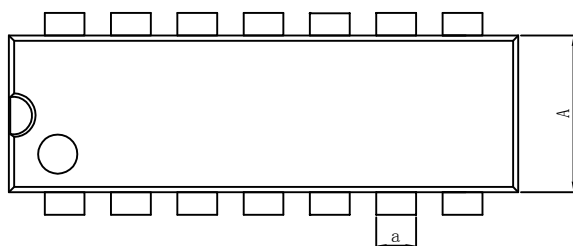
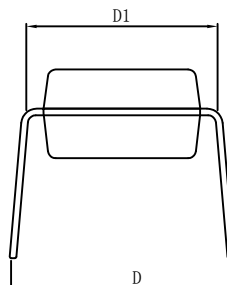
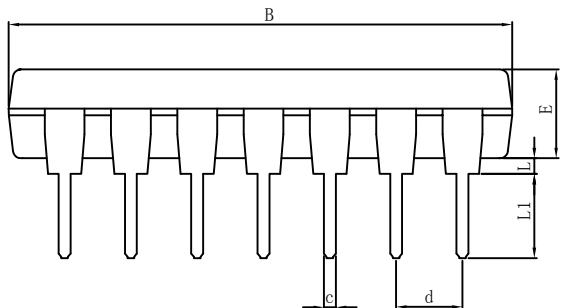
* All characteristics are measured under open loop conditions with zero common-mode input voltage unless otherwise specified.

 "MAX" V_{CC} for testing purposes is 30 V. Operating temperature $-40 - 85^\circ C$.

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PACKAGE

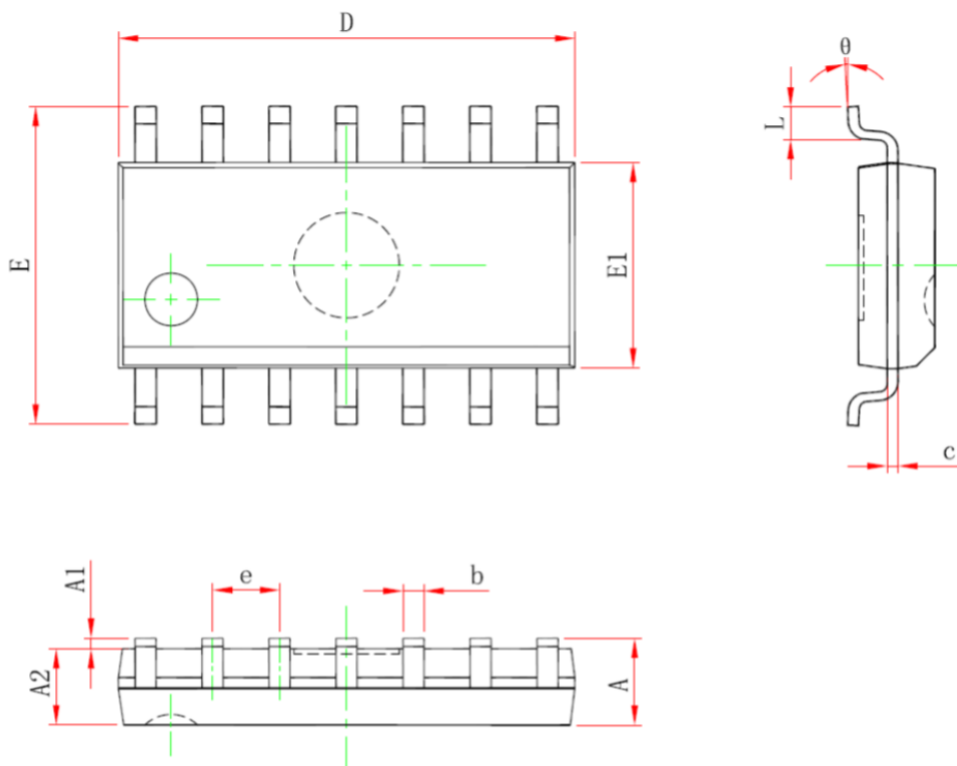
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| UNIT: mm | | | | | | | |
|----------|--------|--------|--------|------|-------|-------|-------|
| DIM. | MIN | TYP | MAX | DIM. | MIN | TYP | MAX |
| A | 6.100 | 6.300 | 6.680 | a | 1.504 | 1.524 | 1.544 |
| B | 18.940 | 19.200 | 19.560 | c | 0.437 | 0.457 | 0.477 |
| D | 8.200 | 8.700 | 9.200 | d | 2.530 | 2.540 | 2.550 |
| D1 | 7.42 | 7.62 | 7.82 | L | 0.500 | - | 0.800 |
| E | 3.100 | 3.300 | 3.550 | L1 | 3.000 | 3.200 | 3.600 |

Quadruple Operational Amplifiers

SOP-14



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | — | 1.750 | — | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.250 | — | 0.049 | — |
| b | 0.310 | 0.510 | 0.012 | 0.020 |
| c | 0.100 | 0.250 | 0.004 | 0.010 |
| D | 8.450 | 8.850 | 0.333 | 0.348 |
| E | 5.800 | 6.200 | 0.228 | 0.244 |
| E1 | 3.800 | 4.000 | 0.150 | 0.157 |
| e | 1.270(BSC) | | 0.050(BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |