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# LA6324N

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## Monolithic Linear IC

# High-Performance

# Quad Operational Amplifier

### Overview

The LA6324 consists of four independent, high-performance, internally phase compensated operational amplifiers that are designed to operate from a single power supply over a wide range of voltages. These four operational amplifiers are packaged in a single package. As in case of conventional general-purpose operational amplifiers, operation from dual power supplies is also possible and the power dissipation is low. It can be applied to various uses in commercial and industrial equipment including all types of transducer amplifiers and DC amplifiers.

### Features

- No phase compensation required
- Wide operating voltage range:  
3.0 V to 30.0 V (single supply)  
 $\pm 1.5$  V to  $\pm 15.0$  V (dual supplies)
- Highly resistant to dielectric breakdown
- Input voltage range includes the neighborhood of GND level and output voltage range  $V_{OUT}$  is from 0 to  $V_{CC} - 1.5$  V.
- Small current dissipation:  
 $I_{CC} = 0.6$  mA typ/ $V_{CC} = +5$  V,  $R_L = \infty$

### Specifications

**Absolute Maximum Ratings** at  $T_a = 25^\circ\text{C}$

| Parameter                   | Symbol       | Conditions | Ratings     | Unit             |
|-----------------------------|--------------|------------|-------------|------------------|
| Maximum Supply voltage      | $V_{CC}$ max |            | 32          | V                |
| Differential input voltage  | $V_{ID}$     |            | 32          | V                |
| Maximum input voltage       | $V_{IN}$ max |            | -0.3 to +32 | V                |
| Allowable power dissipation | $P_d$ max    | LA6324N    | 720         | mW               |
| Operating temperature       | $T_{opr}$    |            | -30 to +85  | $^\circ\text{C}$ |
| Storage temperature         | $T_{stg}$    |            | -55 to +125 | $^\circ\text{C}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

# LA6324N

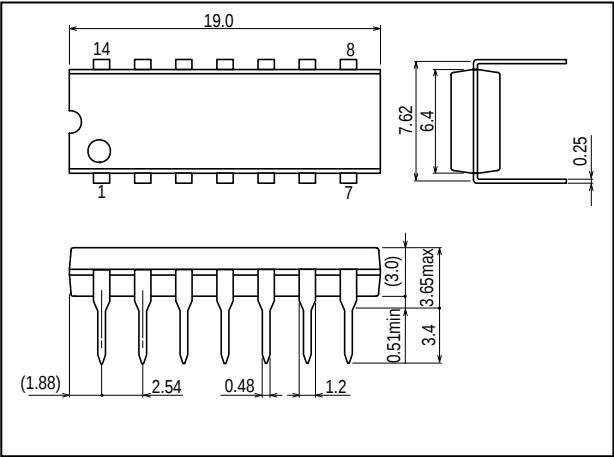
Operating Characteristics at Ta = 25 °C, VCC = +5 V

| Parameter                       | Symbol               | Conditions                                          | Test circuit | Ratings |         |                | Unit |
|---------------------------------|----------------------|-----------------------------------------------------|--------------|---------|---------|----------------|------|
|                                 |                      |                                                     |              | min     | typ     | max            |      |
| Input offset voltage            | $V_{IO}$             |                                                     | 1            |         | $\pm 2$ | $\pm 7$        | mV   |
| Input offset current            | $I_{IO}$             | $I_{IN}(+) / I_{IN}(-)$                             | 2            |         | $\pm 5$ | $\pm 50$       | nA   |
| Input bias current              | $I_B$                | $I_{IN}(+) / I_{IN}(-)$                             | 3            |         | 45      | 250            | nA   |
| Common-mode input voltage range | $V_{ICM}$            |                                                     | 4            | 0       |         | $V_{CC} - 1.5$ | V    |
| Common-mode rejection ratio     | CMR                  |                                                     | 4            | 65      | 80      |                | dB   |
| Voltage gain                    | VG                   | $V_{CC} = 15 \text{ V}, R_L \geq 2 \text{ k}\Omega$ | 5            | 25      | 100     |                | V/mV |
| Output voltage range            | $V_{OUT}$            |                                                     |              | 0       |         | $V_{CC} - 1.5$ | V    |
| Supply voltage rejection ratio  | SVR                  |                                                     | 6            | 65      | 100     |                | dB   |
| Channel separation              | CS                   | $f = 1 \text{ k to } 20 \text{ kHz}$                | 7            |         | 120     |                | dB   |
| Current drain                   | $I_{CC}$             |                                                     | 8            |         | 0.6     | 2              | mA   |
|                                 | $I_{CC}$             | $V_{CC} = 30 \text{ V}$                             | 8            |         | 1.5     | 3              | mA   |
| Output current (Source)         | $I_O \text{ source}$ | $V_{IN}^+ = 1 \text{ V}, V_{IN}^- = 0 \text{ V}$    | 9            | 20      | 40      |                | mA   |
| Output current (Sink)           | $I_O \text{ sink}$   | $V_{IN}^+ = 0 \text{ V}, V_{IN}^- = 1 \text{ V}$    | 10           | 10      | 20      |                | mA   |

## Package Dimensions

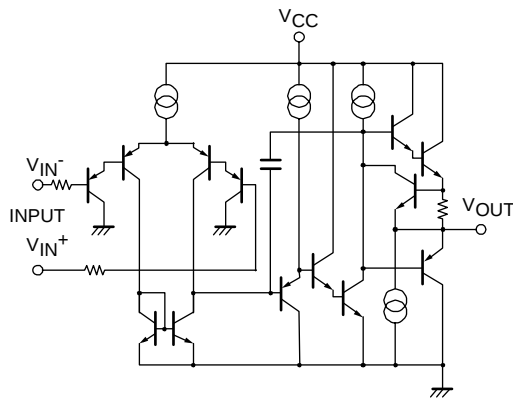
unit : mm

3003B [LA6324N]



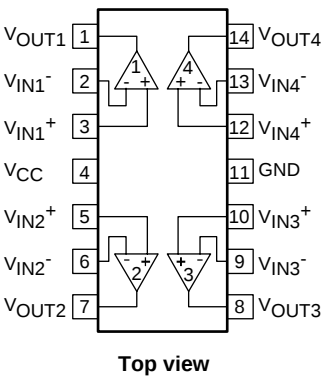
## Equivalent Circuit

(1 unit)



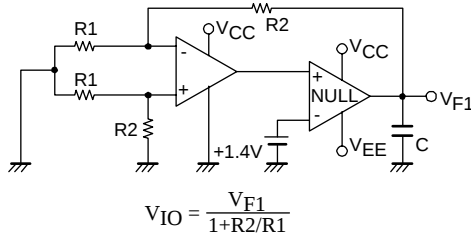
## Pin Assignment

(LA6324N)

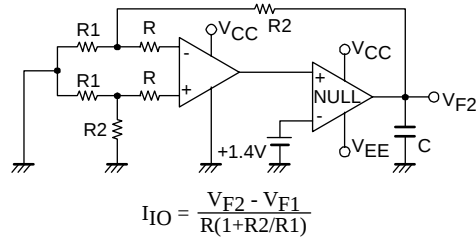


## Test Circuit

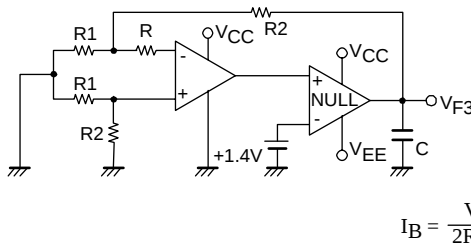
### 1. Input offset voltage $V_{IO}$



### 2. Input offset current $I_{IO}$

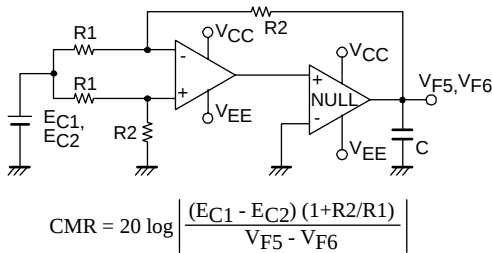


### 3. Input bias current $I_B$

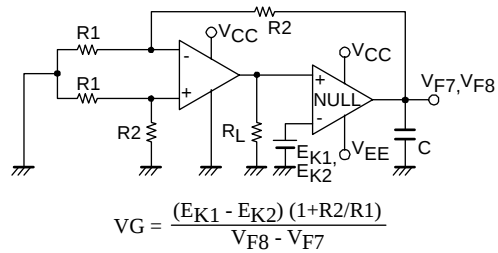


### 4. Common-mode rejection ratio CMR

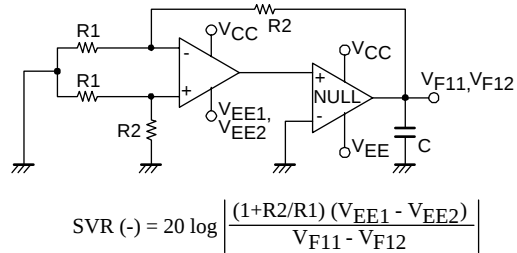
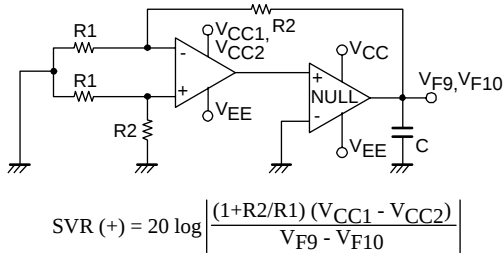
Common-mode input voltage range  $V_{ICM}$



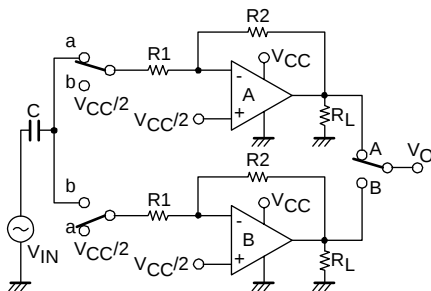
### 5. Voltage gain $V_G$



### 6. Supply voltage rejection ratio SVR



### 7. Channel separation CS



$$SW: a$$

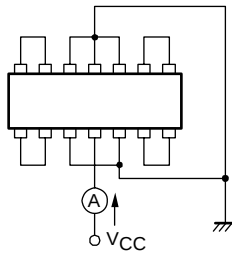
$$CS (A \rightarrow B) = 20 \log \frac{R2 V_{OA}}{R1 V_{OB}}$$

$$SW: b$$

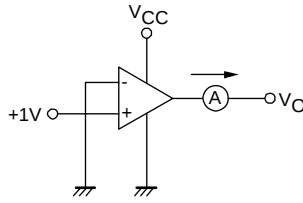
$$CS (B \rightarrow A) = 20 \log \frac{R2 V_{OB}}{R1 V_{OA}}$$

These apply also to other channels.

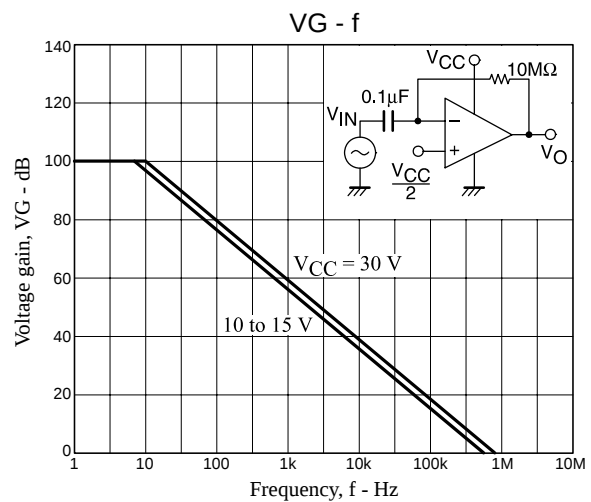
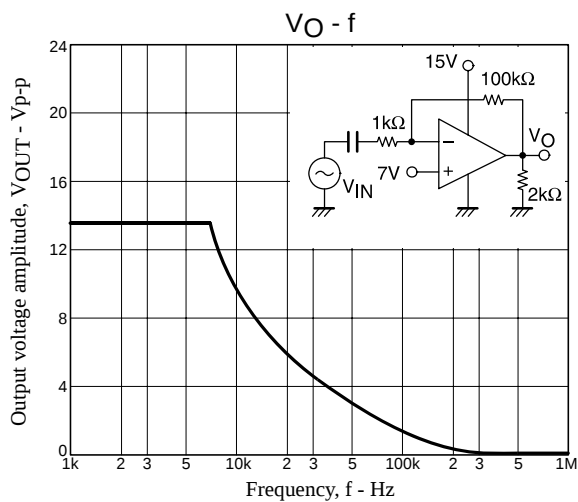
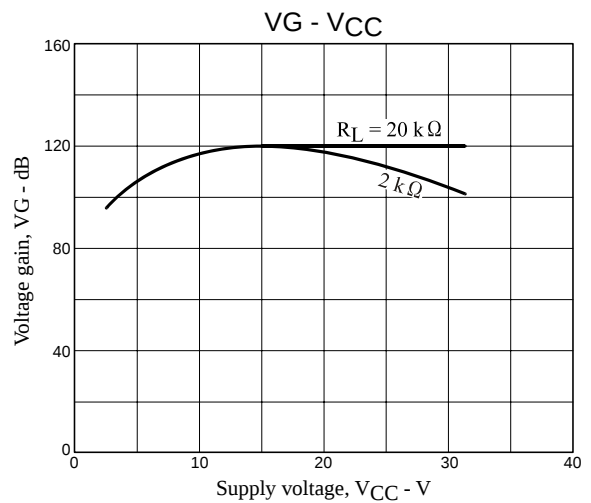
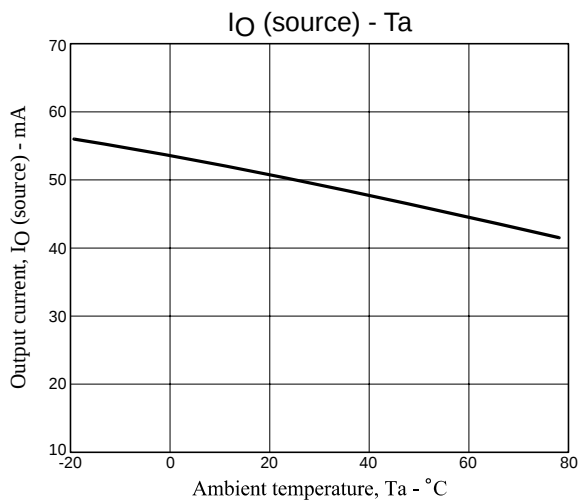
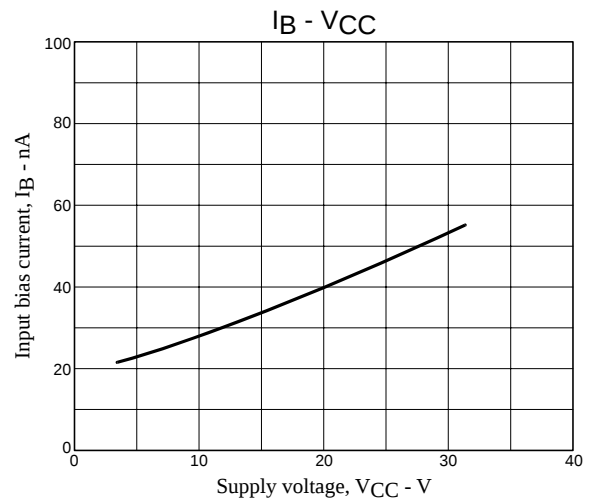
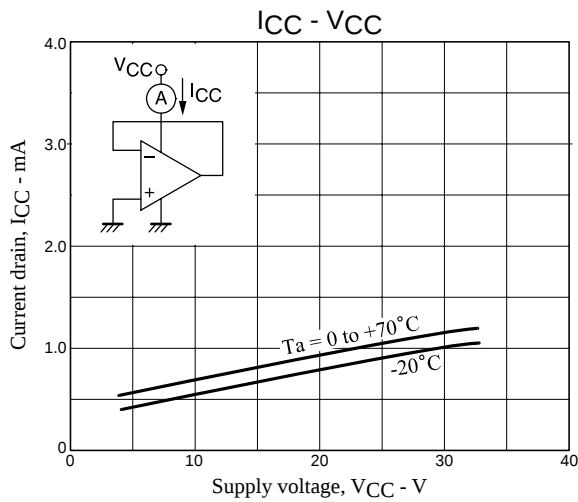
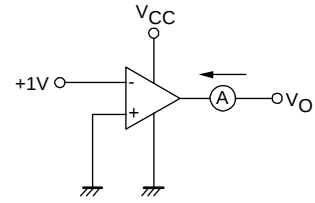
8. Current drain  $I_{CC}$

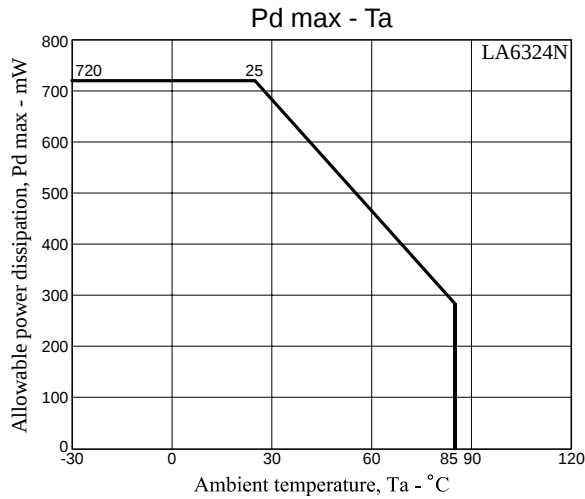


9. Output current  $I_O$  source



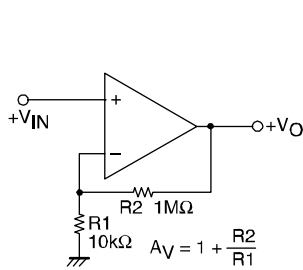
10. Output current  $I_O$  sink



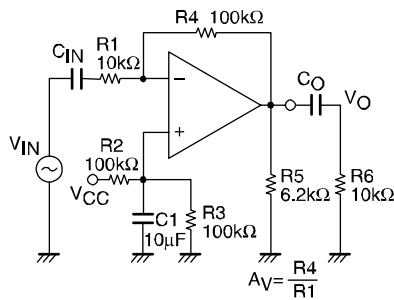


## Sample Application Circuits

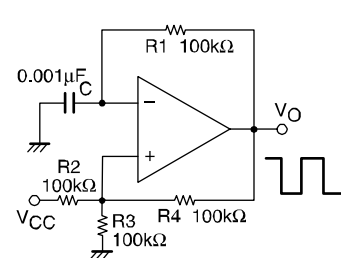
Noninverting DC amplifier



Rectangular wave oscillator



Inverting AC amplifier



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