

## 1.Description

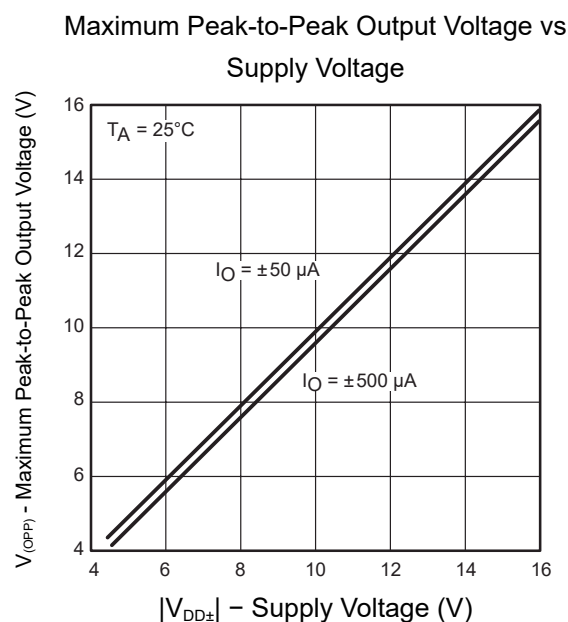
The TLC2272 and TLC2274 are dual and quadruple operational amplifiers. Both devices exhibit rail-to-rail output performance for increased dynamic range in single- or split-supply applications. The TLC2272 and TLC2274 family offers 2 MHz of bandwidth and 3V/ $\mu$ s of slew rate for higher-speed applications. These devices offer comparable AC performance while having better noise, input offset voltage, and power dissipation than existing CMOS operational amplifiers. The TLC2272 and TLC2274 has a noise voltage of 9nV/ $\sqrt{\text{Hz}}$ , two times lower than competitive solutions.

## 3.Applications

- White Goods (Refrigerators, Washing Machines)
- Hand-held Monitoring Systems
- Configuration Control and Print Support
- Transducer Interfaces
- Battery-Powered Applications

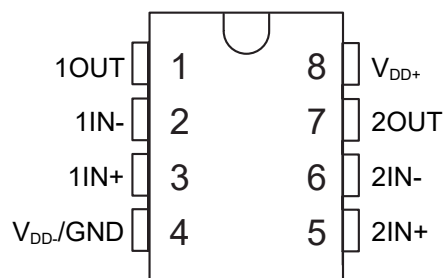
## 2.Features

- Output Swing Includes Both Supply Rails
- Low Noise: 9 nV/ $\sqrt{\text{Hz}}$  Typical at f=1kHz
- Low-Input Bias Current: 1-pA Typical
- Fully-Specified for Both Single-Supply and Split-Supply Operation
- Common-Mode Input Voltage Range Includes Negative Rail
- High-Gain Bandwidth: 2.2-MHz Typical
- High Slew Rate: 3.6-V/ $\mu$ s Typical
- Low Input Offset Voltage: 950  $\mu$ V Maximum at  $T_A=25^\circ\text{C}$

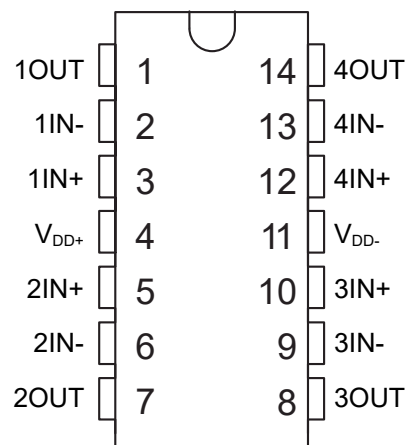




#### 4. Pinning information



**TLC2272**  
**SOP-8**



**TLC2274**  
**SOP-14**



## Pin Functions

| Pin            |                 | Name                 | I/O | Description                    |
|----------------|-----------------|----------------------|-----|--------------------------------|
| TLC2272 (SOP8) | TLC2274 (SOP14) |                      |     |                                |
| 3              | 3               | 1IN+                 | I   | Non-inverting input, Channel 1 |
| 2              | 2               | 1IN-                 | I   | Inverting input, Channel 1     |
| 1              | 1               | 1OUT                 | O   | Output, Channel 1              |
| 5              | 5               | 2IN+                 | I   | Non-inverting input, Channel 2 |
| 6              | 6               | 2IN-                 | I   | Inverting input, Channel 2     |
| 7              | 7               | 2OUT                 | O   | Output, Channel 2              |
| -              | 10              | 3IN+                 | I   | Non-inverting input, Channel 3 |
| -              | 9               | 3IN-                 | I   | Inverting input, Channel 3     |
| -              | 8               | 3OUT                 | O   | Output, Channel 3              |
| -              | 12              | 4IN+                 | I   | Non-inverting input, Channel 4 |
| -              | 13              | 4IN-                 | I   | Inverting input, Channel 4     |
| -              | 14              | 4OUT                 | O   | Output, Channel 4              |
| -              | 4               | V <sub>DD+</sub>     | -   | Positive (highest) supply      |
| 8              | 11              | V <sub>DD-</sub>     | -   | Negative (lowest) supply       |
| -              | -               | V <sub>DD</sub> /GND | -   | Negative (lowest) supply       |
| 4              | -               | NC                   | -   | No Connection                  |



## 5. Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

| Condition                                                           |                | Min             | Max       | Unit |
|---------------------------------------------------------------------|----------------|-----------------|-----------|------|
| Supply voltage, $V_{DD+}$ <sup>(2)</sup>                            |                |                 | 8         | V    |
| $V_{DD-}$ <sup>(2)</sup>                                            |                | -8              |           | V    |
| Differential input voltage, $V_{ID}$ <sup>(3)</sup>                 |                |                 | ±16       | V    |
| Input voltage, $V_I$ (any input) <sup>(2)</sup>                     |                | $V_{DD-} - 0.3$ | $V_{DD+}$ | mA   |
| Input current, $I_I$ (any input)                                    |                |                 | ±5        | mA   |
| Output current, $I_O$                                               |                |                 | ±50       | mA   |
| Total current into $V_{OD+}$                                        |                |                 | ±50       | mA   |
| Total current out of $V_{DD-}$                                      |                |                 | ±50       | mA   |
| Duration of short-circuit current at (or below) 25°C <sup>(4)</sup> |                | Continuous      |           |      |
| Operating free-air temperature range, $T_A$                         | C level parts  | 0               | 70        | °C   |
|                                                                     | I, level parts | -40             | 125       | °C   |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds        | D Package      |                 | 260       | °C   |
| Storage temperature, $T_{STG}$                                      |                | -65             | 150       | °C   |

Notes:

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltage values, except differential voltages, are with respect to the midpoint between  $V_{DD+}$  and  $V_{DD-}$ .

(3) Differential voltages are at  $IN+$  with respect to  $IN-$ . Excessive current will flow if input is brought below  $V_{DD-} - 0.3$  V.

(4) The output may be shorted to either supply. Temperature or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.



## 6.ESD Ratings

| Parameter               |                                                           |                                                     | Symbol      | Value | Units |
|-------------------------|-----------------------------------------------------------|-----------------------------------------------------|-------------|-------|-------|
| Electrostatic discharge | Human-body model (HBM)<br>per AEC Q100-002 <sup>(1)</sup> | Q-grade and M-grade devices in<br>D and PW packages | $V_{(ESD)}$ | ±2000 | V     |
|                         | Charged-device model (CDM)<br>per AEC Q100-011            | Q-grade and M-grade devices in<br>D and PW packages |             | ±1000 | V     |

## 7.Thermal Information

| Parameter                                                   | Symbol               | TLC2272<br>D (SOP)<br>8-PIN | TLC2274<br>D (SOP)<br>14-PIN | Units |
|-------------------------------------------------------------|----------------------|-----------------------------|------------------------------|-------|
| Junction-to-ambient thermal resistance <sup>(2)(3)</sup>    | $R_{\theta JA}$      | 115.6                       | 83.8                         | °C/W  |
| Junction-to-case (top) thermal resistance <sup>(2)(3)</sup> | $R_{\theta JC(top)}$ | 61.8                        | 43.2                         | °C/W  |
| Junction-to-board thermal resistance                        | $R_{\theta JB}$      | 55.9                        | 38.4                         | °C/W  |
| Junction-to-top characterization parameter                  | $\Psi_{JT}$          | 14.3                        | 9.4                          | °C/W  |
| Junction-to-board characterization parameter                | $\Psi_{JB}$          | 55.4                        | 38.1                         | °C/W  |
| Junction-to-case (bottom) thermal resistance                | $R_{\theta JC(bot)}$ | -                           | -                            | °C/W  |

Notes:

(1) Maximum power dissipation is a function of  $T_{J(max)}$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_{J(max)} - T_A) / \theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability



## 8.1 Electrical characteristics (TLC2272, TLC2272A)

at specified free-air temperature,  $V_{DD}=5V$ ;  $T_A=25^\circ C$ , unless otherwise noted.

| Parameter                                           | Symbol           | Conditions                                                                               |                        |                             | Min                       | Typ   | Max  | Units |   |
|-----------------------------------------------------|------------------|------------------------------------------------------------------------------------------|------------------------|-----------------------------|---------------------------|-------|------|-------|---|
| Input offset voltage                                | V <sub>IO</sub>  | V <sub>IC</sub> =0V, V <sub>DD±</sub> =±2.5V<br>V <sub>O</sub> =0V, R <sub>S</sub> =50Ω  | TLC2272                | T <sub>A</sub> =25°C        |                           | 300   | 2500 | μV    |   |
|                                                     |                  |                                                                                          | TLC2272A               |                             |                           | 300   | 950  | μV    |   |
|                                                     |                  |                                                                                          | TLC2272                | Full Range <sup>(1)</sup>   |                           |       | 3000 | μV    |   |
|                                                     |                  |                                                                                          | TLC2272A               |                             |                           |       | 1500 | μV    |   |
| Temperature coefficient of input offset voltage     | α <sub>VIO</sub> | V <sub>IC</sub> =0V, V <sub>DD±</sub> =±2.5 V<br>V <sub>O</sub> =0V, R <sub>S</sub> =50Ω |                        |                             |                           | 1     |      | μV/°C |   |
| Input offset voltage long-term drift <sup>(2)</sup> |                  | V <sub>IC</sub> =0V, V <sub>DD±</sub> =±2.5V<br>V <sub>O</sub> =0V, R <sub>S</sub> =50Ω  |                        |                             |                           | 0.002 |      | μV/mo |   |
| Input offset current                                | I <sub>IO</sub>  | V <sub>IC</sub> =0V, V <sub>DD±</sub> =±2.5V, V <sub>O</sub> =0V, R <sub>S</sub> =50Ω    |                        | T <sub>A</sub> =25°C        |                           | 0.5   | 60   | pA    |   |
| Input bias current                                  | I <sub>IB</sub>  | V <sub>IC</sub> =0V, V <sub>DD±</sub> =±2.5V, V <sub>O</sub> =0V, R <sub>S</sub> =50Ω    |                        | T <sub>A</sub> =25°C        |                           | 1     | 60   | pA    |   |
| Common-mode input voltage                           | V <sub>ICR</sub> | R <sub>S</sub> =50Ω;  V <sub>IO</sub>   ≤ 5mV                                            |                        | T <sub>A</sub> =25°C        | -0.3                      | 2.5   | 4    | V     |   |
|                                                     |                  |                                                                                          |                        | Full Range <sup>(1)</sup>   | 0                         | 2.5   | 3.5  | V     |   |
| High-level output voltage                           | V <sub>OH</sub>  | I <sub>OH</sub> =-20μA                                                                   |                        |                             |                           | 4.99  |      | V     |   |
|                                                     |                  | I <sub>OH</sub> =-200μA                                                                  |                        | T <sub>A</sub> =25°C        | 4.85                      | 4.93  |      | V     |   |
|                                                     |                  |                                                                                          |                        | Full Range <sup>(1)</sup>   | 4.85                      |       |      | V     |   |
|                                                     |                  | I <sub>OH</sub> =-1mA                                                                    |                        | T <sub>A</sub> =25°C        | 4.25                      | 4.65  |      | V     |   |
|                                                     |                  |                                                                                          |                        | Full Range <sup>(1)</sup>   | 4.25                      |       |      | V     |   |
| Low-level output voltage                            | V <sub>OL</sub>  | V <sub>IC</sub> =2.5V                                                                    | I <sub>OL</sub> =50μA  |                             |                           | 0.01  |      | V     |   |
|                                                     |                  |                                                                                          | I <sub>OL</sub> =500μA |                             | T <sub>A</sub> =25°C      |       | 0.09 | 0.15  | V |
|                                                     |                  |                                                                                          |                        |                             | Full Range <sup>(1)</sup> |       |      | 0.15  | V |
|                                                     |                  |                                                                                          | I <sub>OL</sub> =5mA   |                             | T <sub>A</sub> =25°C      |       | 0.9  | 1.5   | V |
|                                                     |                  |                                                                                          |                        |                             | Full Range <sup>(1)</sup> |       |      | 1.5   | V |
| Large-signal differential voltage amplification     | A <sub>VD</sub>  | V <sub>IC</sub> =2.5V, V <sub>O</sub> =1V to 4V;<br>R <sub>L</sub> =10kΩ <sup>(3)</sup>  |                        | T <sub>A</sub> =25°C        | 15                        | 35    |      | V/mV  |   |
|                                                     |                  |                                                                                          |                        | T <sub>A</sub> =0°C to 80°C | 15                        |       |      | V/mV  |   |
|                                                     |                  | V <sub>IC</sub> =2.5V, V <sub>O</sub> =1V to 4V; R <sub>L</sub> =1MΩ <sup>(3)</sup>      |                        |                             |                           | 175   |      | V/mV  |   |



| Parameter                                                             | Symbol    | Conditions                                                                                                                 |                           | Min | Typ       | Max | Units                  |
|-----------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------|---------------------------|-----|-----------|-----|------------------------|
| Differential input resistance                                         | $r_{id}$  |                                                                                                                            |                           |     | $10^{12}$ |     | $\Omega$               |
| Common-mode input resistance                                          | $r_i$     |                                                                                                                            |                           |     | $10^{12}$ |     | $\Omega$               |
| Common-mode input capacitance                                         | $C_i$     | $f=10\text{kHz}$ , P package                                                                                               |                           |     | 8         |     | pF                     |
| Closed-loop output impedance                                          | $Z_o$     | $f=1\text{MHz}$ , $A_v=10$                                                                                                 |                           |     | 140       |     | $\Omega$               |
| Common-mode rejection ratio                                           | CMRR      | $V_{IC}=0\text{V to }2.7\text{V}$ ,<br>$V_O=2.5\text{V}$ , $R_S=50\Omega$                                                  | $T_A=25^\circ\text{C}$    | 70  | 75        |     | dB                     |
|                                                                       |           |                                                                                                                            | Full Range <sup>(1)</sup> | 70  |           |     | dB                     |
| Supply-voltage rejection ratio<br>( $\Delta V_{DD} / \Delta V_{IO}$ ) | $k_{SVR}$ | $V_{DD}=4.4\text{V to }16\text{V}$ ,<br>$V_{IC}=V_{DD}/2$ , no load                                                        | $T_A=25^\circ\text{C}$    | 80  | 95        |     | dB                     |
|                                                                       |           |                                                                                                                            | Full Range <sup>(1)</sup> | 80  |           |     | dB                     |
| Supply current                                                        | $I_{DD}$  | $V_O=2.5\text{V}$ , no load                                                                                                | $T_A=25^\circ\text{C}$    |     | 2.2       | 3   | mA                     |
|                                                                       |           |                                                                                                                            | Full Range <sup>(1)</sup> |     |           | 3   | mA                     |
| Slew rate at unity gain                                               | SR        | $V_O=0.5\text{V to }2.5\text{V}$ , $R_L=10\text{k}\Omega$ <sup>(3)</sup><br>$C_L=100\text{pF}$ <sup>(3)</sup>              | $T_A=25^\circ\text{C}$    | 2.3 | 3.6       |     | V/ $\mu\text{s}$       |
|                                                                       |           |                                                                                                                            | Full Range <sup>(1)</sup> | 1.7 |           |     | V/ $\mu\text{s}$       |
| Equivalent input noise voltage                                        | $V_n$     | $f=10\text{Hz}$                                                                                                            |                           |     | 50        |     | nV/ $\sqrt{\text{Hz}}$ |
|                                                                       |           | $f=1\text{kHz}$                                                                                                            |                           |     | 9         |     | nV/ $\sqrt{\text{Hz}}$ |
| Peak-to-peak equivalent<br>input noise voltage                        | $V_{NPP}$ | $f=0.1\text{Hz to }1\text{Hz}$                                                                                             |                           |     | 1         |     | $\mu\text{V}$          |
|                                                                       |           | $f=0.1\text{Hz to }10\text{Hz}$                                                                                            |                           |     | 1.4       |     | $\mu\text{V}$          |
| Equivalent input noise current                                        | $I_n$     |                                                                                                                            |                           |     | 0.6       |     | fA/ $\sqrt{\text{Hz}}$ |
| Total harmonic distortion+ noise                                      | THD+N     | $V_O=0.5\text{V to }2.5\text{V}$ ,<br>$f=20\text{kHz}$ , $R_L=10\text{k}\Omega$ <sup>(3)</sup>                             | $A_v=1$                   |     | 0.0013    |     | %                      |
|                                                                       |           |                                                                                                                            | $A_v=10$                  |     | 0.004     |     | %                      |
|                                                                       |           |                                                                                                                            | $A_v=100$                 |     | 0.03      |     | %                      |
| Gain-bandwidth product                                                |           | $f=10\text{kHz}$ , $R_L=10\text{k}\Omega$ <sup>(3)</sup> , $C_L=100\text{pF}$ <sup>(3)</sup>                               |                           |     | 2.18      |     | MHz                    |
| Maximum output-swing bandwidth                                        | $B_{OM}$  | $V_{O(PP)}=2\text{V}$ , $A_v=1$ , $R_L=10\text{k}\Omega$ <sup>(3)</sup> , $C_L=100\text{pF}$ <sup>(3)</sup>                |                           |     | 1         |     | MHz                    |
| Settling time                                                         | $t_s$     | $A_v=-1$ , $R_L=10\text{k}\Omega$ <sup>(3)</sup><br>Step= $0.5\text{V to }2.5\text{V}$ , $C_L=100\text{pF}$ <sup>(3)</sup> | To 0.1%                   |     | 1.5       |     | $\mu\text{s}$          |
|                                                                       |           |                                                                                                                            | To 0.01%                  |     | 2.6       |     | $\mu\text{s}$          |
| Phase margin at unity gain                                            | $\phi_m$  | $R_L=10\text{k}\Omega$ <sup>(3)</sup> , $C_L=100\text{pF}$ <sup>(3)</sup>                                                  |                           |     | 50        |     | $^\circ$               |
| Gain margin                                                           |           | $R_L=10\text{k}\Omega$ <sup>(3)</sup> , $C_L=100\text{pF}$ <sup>(3)</sup>                                                  |                           |     | 10        |     | dB                     |



## 9.2 Electrical characteristics (TLC2272, TLC2272A)

at specified free-air temperature,  $V_{DD}=\pm 5V$ ;  $T_A=25^\circ C$ , unless otherwise noted.

| Parameter                                           | Symbol           | Conditions                                                     |                           |                           | Min   | Typ   | Max  | Units |
|-----------------------------------------------------|------------------|----------------------------------------------------------------|---------------------------|---------------------------|-------|-------|------|-------|
| Input offset voltage                                | V <sub>IO</sub>  | V <sub>IC</sub> =0V, V <sub>O</sub> =0V<br>R <sub>S</sub> =50Ω | TLC2272                   | T <sub>A</sub> =25°C      |       | 300   | 2500 | μV    |
|                                                     |                  |                                                                | TLC2272A                  |                           |       | 300   | 950  | μV    |
|                                                     |                  |                                                                | TLC2272                   | Full Range <sup>(1)</sup> |       |       | 3000 | μV    |
|                                                     |                  |                                                                | TLC2272A                  |                           |       |       | 1500 | μV    |
| Temperature coefficient of input offset voltage     | α <sub>VIO</sub> | V <sub>IC</sub> =0V, V <sub>O</sub> =0V<br>R <sub>S</sub> =50Ω |                           |                           |       | 2     |      | μV/°C |
| Input offset voltage long-term drift <sup>(2)</sup> |                  | V <sub>IC</sub> =0V, V <sub>O</sub> =0V<br>R <sub>S</sub> =50Ω |                           |                           |       | 0.002 |      | μV/mo |
| Input offset current                                | I <sub>IO</sub>  | V <sub>IC</sub> =0V, V <sub>O</sub> =0V, R <sub>S</sub> =50Ω   |                           | T <sub>A</sub> =25°C      |       | 0.5   | 60   | pA    |
| Input bias current                                  | I <sub>IB</sub>  | V <sub>IC</sub> =0V, V <sub>O</sub> =0V, R <sub>S</sub> =50Ω   |                           | T <sub>A</sub> =25°C      |       | 1     | 60   | pA    |
| Common-mode input voltage                           | V <sub>ICR</sub> | R <sub>S</sub> =50Ω;  V <sub>IO</sub>   ≤ 5mV                  | T <sub>A</sub> =25°C      | -5.3                      | 0     | 4     | V    |       |
|                                                     |                  |                                                                | Full Range <sup>(1)</sup> | -5                        | 0     | 3.5   | V    |       |
| Maximum positive peak output voltage                | V <sub>OM+</sub> | I <sub>OH</sub> =-20μA                                         |                           |                           |       | 4.99  |      | V     |
|                                                     |                  | I <sub>OH</sub> =-200μA                                        | T <sub>A</sub> =25°C      | 4.85                      | 4.93  |       | V    |       |
|                                                     |                  |                                                                | Full Range <sup>(1)</sup> | 4.85                      |       |       | V    |       |
|                                                     |                  | I <sub>OH</sub> =-1mA                                          | T <sub>A</sub> =25°C      | 4.25                      | 4.65  |       | V    |       |
|                                                     |                  |                                                                | Full Range <sup>(1)</sup> | 4.25                      |       |       | V    |       |
| Maximum negative peak output voltage                | V <sub>OM-</sub> | V <sub>IC</sub> =0V                                            | I <sub>OL</sub> =50μA     |                           |       | -4.99 |      | V     |
|                                                     |                  |                                                                | I <sub>OL</sub> =500μA    | T <sub>A</sub> =25°C      | 4.85  | -4.91 |      | V     |
|                                                     |                  |                                                                |                           | Full Range <sup>(1)</sup> | -4.85 |       |      | V     |
|                                                     |                  |                                                                | I <sub>OL</sub> =5mA      | T <sub>A</sub> =25°C      | -3.5  | -4.1  |      | V     |
|                                                     |                  |                                                                |                           | Full Range <sup>(1)</sup> | -3.5  |       |      | V     |
| Large-signal differential voltage amplification     | A <sub>VD</sub>  | V <sub>O</sub> =±4V, R <sub>L</sub> =10kΩ                      |                           | T <sub>A</sub> =25°C      | 25    | 50    |      | V/mV  |
|                                                     |                  | V <sub>IC</sub> =±4V, R <sub>L</sub> =1MΩ                      |                           |                           |       | 300   |      | V/mV  |



| Parameter                                                                | Symbol           | Conditions                                                               |                           | Min                       | Typ              | Max   | Units  |   |
|--------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------|---------------------------|---------------------------|------------------|-------|--------|---|
| Maximum negative peak output voltage                                     | V <sub>OM-</sub> | V <sub>IC</sub> =0V                                                      | I <sub>OL</sub> =50μA     |                           | -4.99            |       | V      |   |
|                                                                          |                  |                                                                          | I <sub>OL</sub> =500μA    | T <sub>A</sub> =25°C      | -4.85            | -4.91 |        | V |
|                                                                          |                  |                                                                          |                           | Full Range <sup>(1)</sup> | -4.85            |       |        | V |
|                                                                          |                  |                                                                          | I <sub>OL</sub> =5mA      | T <sub>A</sub> =25°C      | -3.5             | -4.1  |        | V |
|                                                                          |                  |                                                                          |                           | Full Range <sup>(1)</sup> | -3.5             |       |        | V |
| Large-signal differential voltage amplification                          | A <sub>VD</sub>  | V <sub>O</sub> =±4V, R <sub>L</sub> =10kΩ                                | T <sub>A</sub> =25°C      | 25                        | 50               |       | V/mV   |   |
|                                                                          |                  | V <sub>IC</sub> =±4V, R <sub>L</sub> =1MΩ                                |                           |                           | 300              |       | V/mV   |   |
| Differential input resistance                                            | r <sub>id</sub>  |                                                                          |                           |                           | 10 <sup>12</sup> |       | Ω      |   |
| Common-mode input resistance                                             | r <sub>i</sub>   |                                                                          |                           |                           | 10 <sup>12</sup> |       | Ω      |   |
| Common-mode input capacitance                                            | C <sub>i</sub>   | f=10kHz, P package                                                       |                           |                           | 8                |       | pF     |   |
| Closed-loop output impedance                                             | Z <sub>O</sub>   | f=1MHz, A <sub>v</sub> =10                                               |                           |                           | 130              |       | Ω      |   |
| Common-mode rejection ratio                                              | CMRR             | V <sub>IC</sub> =-5V to 2.7V,<br>V <sub>O</sub> =0V, R <sub>S</sub> =50Ω | T <sub>A</sub> =25°C      | 75                        | 80               |       | dB     |   |
|                                                                          |                  |                                                                          | Full Range <sup>(1)</sup> | 75                        |                  |       | dB     |   |
| Supply-voltage rejection ratio<br>(ΔV <sub>DD</sub> / ΔV <sub>IO</sub> ) | k <sub>SVR</sub> | V <sub>DD+</sub> =2.2V to ±8V,<br>V <sub>IC</sub> =0V, no load           | T <sub>A</sub> =25°C      | 80                        | 95               |       | dB     |   |
|                                                                          |                  |                                                                          | Full Range <sup>(1)</sup> | 80                        |                  |       | dB     |   |
| Supply current                                                           | I <sub>DD</sub>  | V <sub>O</sub> =0V, no load                                              | T <sub>A</sub> =25°C      |                           | 2.4              | 3     | mA     |   |
|                                                                          |                  |                                                                          | Full Range <sup>(1)</sup> |                           |                  | 3     | mA     |   |
| Slew rate at unity gain                                                  | SR               | V <sub>O</sub> =±2.3V, R <sub>L</sub> =10kΩ<br>C <sub>L</sub> =100pF     | T <sub>A</sub> =25°C      | 2.3                       | 3.6              |       | V/μs   |   |
|                                                                          |                  |                                                                          | Full Range <sup>(1)</sup> | 1.7                       |                  |       | V/μs   |   |
| Equivalent input noise voltage                                           | V <sub>n</sub>   | f=10Hz                                                                   |                           |                           | 50               |       | nV/√Hz |   |
|                                                                          |                  | f=1kHz                                                                   |                           |                           | 9                |       | nV/√Hz |   |



| Parameter                                   | Symbol    | Conditions                                                              |           | Min | Typ    | Max | Units                        |
|---------------------------------------------|-----------|-------------------------------------------------------------------------|-----------|-----|--------|-----|------------------------------|
| Peak-to-peak equivalent input noise voltage | $V_{NPP}$ | $f=0.1\text{Hz to }1\text{Hz}$                                          |           |     | 1      |     | $\mu\text{V}$                |
|                                             |           | $f=0.1\text{Hz to }10\text{Hz}$                                         |           |     | 1.4    |     | $\mu\text{V}$                |
| Equivalent input noise current              | $I_n$     |                                                                         |           |     | 0.6    |     | $\text{fA}/\sqrt{\text{Hz}}$ |
| Total harmonic distortion+ noise            | THD+N     | $V_o=\pm 2.3$<br>$f=20\text{kHz}, R_L=10\text{k}\Omega$                 | $A_v=1$   |     | 0.0011 |     | %                            |
|                                             |           |                                                                         | $A_v=10$  |     | 0.004  |     | %                            |
|                                             |           |                                                                         | $A_v=100$ |     | 0.03   |     | %                            |
| Gain-bandwidth product                      |           | $f=10\text{kHz}, R_L=10\text{k}\Omega, C_L=100\text{pF}$                |           |     | 2.25   |     | MHz                          |
| Maximum output-swing bandwidth              | $B_{OM}$  | $V_{O(PP)}=4.6\text{V}, A_v=1, R_L=10\text{k}\Omega, C_L=100\text{pF}$  |           |     | 0.54   |     | MHz                          |
| Settling time                               | $t_s$     | $A_v=-1, R_L=10\text{k}\Omega$<br>Step=-2.3 to 2.3V, $C_L=100\text{pF}$ | To 0.1%   |     | 1.5    |     | $\mu\text{s}$                |
|                                             |           |                                                                         | To 0.01%  |     | 3.2    |     | $\mu\text{s}$                |
| Phase margin at unity gain                  | $\phi_m$  | $R_L=10\text{k}\Omega, C_L=100\text{pF}$                                |           |     | 52     |     | $^\circ$                     |
| Gain margin                                 |           | $R_L=10\text{k}\Omega, C_L=100\text{pF}$                                |           |     | 10     |     | dB                           |



### 9.3 Electrical characteristics (TLC2274, TLC2274A)

at specified free-air temperature,  $V_{DD}=5V$ ;  $T_A=25^\circ C$ , unless otherwise noted.

| Parameter                                           | Symbol         | Conditions                                                      |                 |                                   | Min  | Typ   | Max  | Units            |
|-----------------------------------------------------|----------------|-----------------------------------------------------------------|-----------------|-----------------------------------|------|-------|------|------------------|
| Input offset voltage                                | $V_{IO}$       | $V_{IC}=0V$ , $V_{DD\pm}=\pm 2.5V$<br>$V_O=0V$ , $R_S=50\Omega$ | TLC2274         | $T_A=25^\circ C$                  |      | 300   | 2500 | $\mu V$          |
|                                                     |                |                                                                 | TLC2274A        |                                   |      | 300   | 950  | $\mu V$          |
|                                                     |                |                                                                 | TLC2274         | Full Range <sup>(1)</sup>         |      |       | 3000 | $\mu V$          |
|                                                     |                |                                                                 | TLC2274A        |                                   |      |       | 1500 | $\mu V$          |
| Temperature coefficient of input offset voltage     | $\alpha_{VIO}$ | $V_{IC}=0V$ , $V_{DD\pm}=\pm 2.5V$<br>$V_O=0V$ , $R_S=50\Omega$ |                 |                                   |      | 2     |      | $\mu V/^\circ C$ |
| Input offset voltage long-term drift <sup>(2)</sup> |                | $V_{IC}=0V$ , $V_{DD\pm}=\pm 2.5V$<br>$V_O=0V$ , $R_S=50\Omega$ |                 |                                   |      | 0.002 |      | $\mu V/mo$       |
| Input offset current                                | $I_{IO}$       | $V_{IC}=0V$ , $V_{DD\pm}=\pm 2.5V$<br>$V_O=0V$ , $R_S=50\Omega$ | All level parts | $T_A=25^\circ C$                  |      | 0.5   | 60   | pA               |
|                                                     |                |                                                                 | C level part    | $T_A=0^\circ C$ to $80^\circ C$   |      |       | 100  | pA               |
|                                                     |                |                                                                 | I level part    | $T_A=-40^\circ C$ to $85^\circ C$ |      |       | 150  | pA               |
| Input bias current                                  | $I_{IB}$       | $V_{IC}=0V$ , $V_{DD\pm}=\pm 2.5V$<br>$V_O=0V$ , $R_S=50\Omega$ | All level parts | $T_A=25^\circ C$                  |      | 1     | 60   | pA               |
|                                                     |                |                                                                 | C level part    | $T_A=0^\circ C$ to $80^\circ C$   |      |       | 100  | pA               |
|                                                     |                |                                                                 | I level part    | $T_A=-40^\circ C$ to $85^\circ C$ |      |       | 150  | pA               |
| Common-mode input voltage                           | $V_{ICR}$      | $R_S=50\Omega$ ; $ V_{IO}  \leq 5mV$                            |                 | $T_A=25^\circ C$                  | -0.3 | 2.5   | 4    | V                |
|                                                     |                |                                                                 |                 | Full Range <sup>(1)</sup>         | 0    | 2.5   | 3.5  | V                |
| High-level output voltage                           | $V_{OH}$       | $I_{OH}=-20\mu A$                                               |                 |                                   |      | 4.99  |      | V                |
|                                                     |                | $I_{OH}=-200\mu A$                                              |                 | $T_A=25^\circ C$                  | 4.85 | 4.93  |      | V                |
|                                                     |                |                                                                 |                 | Full Range <sup>(1)</sup>         | 4.85 |       |      | V                |
|                                                     |                | $I_{OH}=-1mA$                                                   |                 | $T_A=25^\circ C$                  | 4.25 | 4.65  |      | V                |
|                                                     |                |                                                                 |                 | Full Range <sup>(1)</sup>         | 4.25 |       |      | V                |



| Parameter                                                                | Symbol           | Conditions                                                                                                |                           | Min                           | Typ  | Max              | Units |        |
|--------------------------------------------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------|------|------------------|-------|--------|
| Low-level output voltage                                                 | V <sub>OL</sub>  | V <sub>IC</sub> =2.5V                                                                                     | I <sub>OL</sub> =50μA     |                               | 0.01 |                  | V     |        |
|                                                                          |                  |                                                                                                           | I <sub>OL</sub> =500μA    | T <sub>A</sub> =25°C          |      | 0.09             | 0.15  | V      |
|                                                                          |                  |                                                                                                           |                           | Full Range <sup>(1)</sup>     |      |                  | 0.15  | V      |
|                                                                          |                  |                                                                                                           | I <sub>OL</sub> =5mA      | T <sub>A</sub> =25°C          |      | 0.9              | 1.5   | V      |
|                                                                          |                  |                                                                                                           |                           | Full Range <sup>(1)</sup>     |      |                  | 1.5   | V      |
| Large-signal differential voltage amplification                          | A <sub>VD</sub>  | V <sub>IC</sub> =2.5V,<br>V <sub>O</sub> =1V to 4V;<br>R <sub>L</sub> =10kΩ <sup>(3)</sup>                | C level part              | T <sub>A</sub> =25°C          | 15   | 35               |       | V/mV   |
|                                                                          |                  |                                                                                                           |                           | T <sub>A</sub> =0°C to 80°C   | 15   |                  |       | V/mV   |
|                                                                          |                  |                                                                                                           | I level part              | T <sub>A</sub> =25°C          | 15   | 35               |       | V/mV   |
|                                                                          |                  |                                                                                                           |                           | T <sub>A</sub> =-40°C to 85°C | 15   |                  |       | V/mV   |
|                                                                          |                  | V <sub>IC</sub> =2.5V, V <sub>O</sub> =1V to 4V; R <sub>L</sub> =1MΩ <sup>(3)</sup>                       |                           |                               |      | 175              |       | V/mV   |
| Differential input resistance                                            | r <sub>id</sub>  |                                                                                                           |                           |                               |      | 10 <sup>12</sup> |       | Ω      |
| Common-mode input resistance                                             | r <sub>i</sub>   |                                                                                                           |                           |                               |      | 10 <sup>12</sup> |       | Ω      |
| Common-mode input capacitance                                            | C <sub>i</sub>   | f=10kHz, P package                                                                                        |                           |                               |      | 8                |       | pF     |
| Closed-loop output impedance                                             | Z <sub>O</sub>   | f=1MHz, A <sub>V</sub> =10                                                                                |                           |                               |      | 140              |       | Ω      |
| Common-mode rejection ratio                                              | CMRR             | V <sub>IC</sub> =0V to 2.7V,<br>V <sub>O</sub> =2.5V, R <sub>S</sub> =50Ω                                 | T <sub>A</sub> =25°C      | 70                            | 75   |                  | dB    |        |
|                                                                          |                  |                                                                                                           | Full Range <sup>(1)</sup> | 70                            |      |                  | dB    |        |
| Supply-voltage rejection ratio<br>(ΔV <sub>DD</sub> / ΔV <sub>IO</sub> ) | k <sub>SVR</sub> | V <sub>DD</sub> =4.4V to 16V,<br>V <sub>IC</sub> =V <sub>DD</sub> /2, no load                             | T <sub>A</sub> =25°C      | 80                            | 95   |                  | dB    |        |
|                                                                          |                  |                                                                                                           | Full Range <sup>(1)</sup> | 80                            |      |                  | dB    |        |
| Supply current                                                           | I <sub>DD</sub>  | V <sub>O</sub> =2.5V, no load                                                                             | T <sub>A</sub> =25°C      |                               | 4.4  | 6                | mA    |        |
|                                                                          |                  |                                                                                                           | Full Range <sup>(1)</sup> |                               |      | 6                | mA    |        |
| Slew rate at unity gain                                                  | SR               | V <sub>O</sub> =0.5V to 2.5V, R <sub>L</sub> =10kΩ <sup>(3)</sup><br>C <sub>L</sub> =100pF <sup>(3)</sup> | T <sub>A</sub> =25°C      | 2.3                           | 3.6  |                  | V/μs  |        |
|                                                                          |                  |                                                                                                           | Full Range <sup>(1)</sup> | 1.7                           |      |                  | V/μs  |        |
| Equivalent input noise voltage                                           | V <sub>n</sub>   | f=10Hz                                                                                                    |                           |                               |      | 50               |       | nV/√Hz |
|                                                                          |                  | f=1kHz                                                                                                    |                           |                               |      | 9                |       | nV/√Hz |



| Parameter                                   | Symbol    | Conditions                                                                                               |           | Min | Typ    | Max | Units                        |
|---------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------|-----------|-----|--------|-----|------------------------------|
| Peak-to-peak equivalent input noise voltage | $V_{NPP}$ | $f=0.1\text{Hz to }1\text{Hz}$                                                                           |           |     | 1      |     | $\mu\text{V}$                |
|                                             |           | $f=0.1\text{Hz to }10\text{Hz}$                                                                          |           |     | 1.4    |     | $\mu\text{V}$                |
| Equivalent input noise current              | $I_n$     |                                                                                                          |           |     | 0.6    |     | $\text{fA}/\sqrt{\text{Hz}}$ |
| Total harmonic distortion+ noise            | THD+N     | $V_O=0.5\text{V to }2.5\text{V},$<br>$f=20\text{kHz}, R_L=10\text{k}\Omega^{(3)}$                        | $A_V=1$   |     | 0.0013 |     | %                            |
|                                             |           |                                                                                                          | $A_V=10$  |     | 0.004  |     | %                            |
|                                             |           |                                                                                                          | $A_V=100$ |     | 0.03   |     | %                            |
| Gain-bandwidth product                      |           | $f=10\text{kHz}, R_L=10\text{k}\Omega^{(3)}, C_L=100\text{pF}^{(3)}$                                     |           |     | 2.18   |     | MHz                          |
| Maximum output-swing bandwidth              | $B_{OM}$  | $V_{O(PP)}=2\text{V}, A_V=1, R_L=10\text{k}\Omega^{(3)}, C_L=100\text{pF}^{(3)}$                         |           |     | 1      |     | MHz                          |
| Settling time                               | $t_s$     | $A_V=-1, R_L=10\text{k}\Omega^{(3)}$<br>$\text{Step}=0.5\text{V to }2.5\text{V}, C_L=100\text{pF}^{(3)}$ | To 0.1%   |     | 1.5    |     | $\mu\text{s}$                |
|                                             |           |                                                                                                          | To 0.01%  |     | 2.6    |     | $\mu\text{s}$                |
| Phase margin at unity gain                  | $\phi_m$  | $R_L=10\text{k}\Omega^{(3)}, C_L=100\text{pF}^{(3)}$                                                     |           |     | 50     |     | °                            |
| Gain margin                                 |           | $R_L=10\text{k}\Omega^{(3)}, C_L=100\text{pF}^{(3)}$                                                     |           |     | 10     |     | dB                           |



## 9.4 Electrical characteristics (TLC2274, TLC2274A)

at specified free-air temperature,  $V_{DD}=\pm 5V$ ;  $T_A=25^\circ C$ , unless otherwise noted.

| Parameter                                           | Symbol           | Conditions                                                     |                        |                           | Min   | Typ   | Max  | Units |
|-----------------------------------------------------|------------------|----------------------------------------------------------------|------------------------|---------------------------|-------|-------|------|-------|
| Input offset voltage                                | V <sub>IO</sub>  | V <sub>IC</sub> =0V, V <sub>O</sub> =0V<br>R <sub>S</sub> =50Ω | TLC2274                | T <sub>A</sub> =25°C      |       | 300   | 2500 | μV    |
|                                                     |                  |                                                                | TLC2274A               |                           |       | 300   | 950  | μV    |
|                                                     |                  |                                                                | TLC2242                | Full Range <sup>(1)</sup> |       |       | 3000 | μV    |
|                                                     |                  |                                                                | TLC2274A               |                           |       |       | 1500 | μV    |
| Temperature coefficient of input offset voltage     | α <sub>VIO</sub> | V <sub>IC</sub> =0V, V <sub>O</sub> =0V<br>R <sub>S</sub> =50Ω |                        |                           |       | 2     |      | μV/°C |
| Input offset voltage long-term drift <sup>(2)</sup> |                  | V <sub>IC</sub> =0V, V <sub>O</sub> =0V<br>R <sub>S</sub> =50Ω |                        |                           |       | 0.002 |      | μV/mo |
| Input offset current                                | I <sub>IO</sub>  | V <sub>IC</sub> =0V, V <sub>O</sub> =0V, R <sub>S</sub> =50Ω   |                        | T <sub>A</sub> =25°C      |       | 0.5   | 60   | pA    |
| Input bias current                                  | I <sub>IB</sub>  | V <sub>IC</sub> =0V, V <sub>O</sub> =0V, R <sub>S</sub> =50Ω   |                        | T <sub>A</sub> =25°C      |       | 1     | 60   | pA    |
| Common-mode input voltage                           | V <sub>ICR</sub> | R <sub>S</sub> =50Ω;  V <sub>IO</sub>   ≤ 5mV                  |                        | T <sub>A</sub> =25°C      | -5.3  | 0     | 4    | V     |
|                                                     |                  |                                                                |                        | Full Range <sup>(1)</sup> | -5    | 0     | 3.5  | V     |
| Maximum positive peak output voltage                | V <sub>OM+</sub> | I <sub>OH</sub> =-20μA                                         |                        |                           |       | 4.99  |      | V     |
|                                                     |                  | I <sub>OH</sub> =-200μA                                        |                        | T <sub>A</sub> =25°C      | 4.85  | 4.93  |      | V     |
|                                                     |                  |                                                                |                        | Full Range <sup>(1)</sup> | 4.85  |       |      | V     |
|                                                     |                  | I <sub>OH</sub> =-1mA                                          |                        | T <sub>A</sub> =25°C      | 4.25  | 4.65  |      | V     |
|                                                     |                  |                                                                |                        | Full Range <sup>(1)</sup> | 4.25  |       |      | V     |
| Maximum negative peak output voltage                | V <sub>OM-</sub> | V <sub>IC</sub> =0V                                            | I <sub>OL</sub> =50μA  |                           |       | -4.99 |      | V     |
|                                                     |                  |                                                                | I <sub>OL</sub> =500μA | T <sub>A</sub> =25°C      | -4.85 | -4.91 |      | V     |
|                                                     |                  |                                                                |                        | Full Range <sup>(1)</sup> | -4.85 |       |      | V     |
|                                                     |                  |                                                                | I <sub>OL</sub> =5mA   | T <sub>A</sub> =25°C      | -3.5  | -4.1  |      | V     |
|                                                     |                  |                                                                |                        | Full Range <sup>(1)</sup> | -3.5  |       |      | V     |
| Large-signal differential voltage amplification     | A <sub>VD</sub>  | V <sub>O</sub> =±4V, R <sub>L</sub> =10kΩ                      |                        | T <sub>A</sub> =25°C      | 25    | 50    |      | V/mV  |
|                                                     |                  | V <sub>IC</sub> =±4V, R <sub>L</sub> =1MΩ                      |                        |                           |       | 300   |      | V/mV  |



| Parameter                                                             | Symbol    | Conditions                                            |                           | Min                                | Typ       | Max   | Units           |
|-----------------------------------------------------------------------|-----------|-------------------------------------------------------|---------------------------|------------------------------------|-----------|-------|-----------------|
| Maximum negative peak output voltage                                  | $V_{OM-}$ | $V_{IC}=0V$                                           | $I_{OL}=50\mu A$          |                                    | -4.99     |       | V               |
|                                                                       |           |                                                       | $I_{OL}=500\mu A$         | $T_A=25^\circ C$                   | -4.85     | -4.91 | V               |
|                                                                       |           |                                                       |                           | Full Range <sup>(1)</sup>          | -4.85     |       | V               |
|                                                                       |           |                                                       | $I_{OL}=5mA$              | $T_A=25^\circ C$                   | -3.5      | -4.1  | V               |
|                                                                       |           |                                                       |                           | Full Range <sup>(1)</sup>          | -3.5      |       | V               |
| Large-signal differential voltage amplification                       | $A_{VD}$  | $V_O=\pm 4V, R_L=10k\Omega$                           | C level part              | $T_A=25^\circ C$                   | 25        | 50    | V/mV            |
|                                                                       |           |                                                       |                           | $T_A=0^\circ C$ to $80^\circ C$    | 25        |       | V/mV            |
|                                                                       |           |                                                       | I level part              | $T_A=25^\circ C$                   | 25        | 50    | V/mV            |
|                                                                       |           |                                                       |                           | $T_A=-40^\circ C$ to $85^\circ C$  | 25        |       | V/mV            |
|                                                                       |           |                                                       | Q level part              | $T_A=25^\circ C$                   | 20        | 50    | V/mV            |
|                                                                       |           |                                                       |                           | $T_A=-40^\circ C$ to $125^\circ C$ | 20        |       | V/mV            |
|                                                                       |           |                                                       | M level part              | $T_A=25^\circ C$                   | 20        | 50    | V/mV            |
|                                                                       |           |                                                       |                           | $T_A=-55^\circ C$ to $125^\circ C$ | 20        |       | V/mV            |
|                                                                       |           | $V_{IC}=\pm 4V, R_L=1M\Omega$                         |                           |                                    | 300       |       | V/mV            |
| Differential input resistance                                         | $r_{id}$  |                                                       |                           |                                    | $10^{12}$ |       | $\Omega$        |
| Common-mode input resistance                                          | $r_i$     |                                                       |                           |                                    | $10^{12}$ |       | $\Omega$        |
| Common-mode input capacitance                                         | $C_i$     | $f=10kHz$ , P package                                 |                           |                                    | 8         |       | pF              |
| Closed-loop output impedance                                          | $Z_O$     | $f=1MHz$ , $A_v=10$                                   |                           |                                    | 130       |       | $\Omega$        |
| Common-mode rejection ratio                                           | CMRR      | $V_{IC}=-5V$ to $2.7V$ ,<br>$V_O=0V$ , $R_S=50\Omega$ | $T_A=25^\circ C$          | 75                                 | 80        |       | dB              |
|                                                                       |           |                                                       | Full Range <sup>(1)</sup> | 75                                 |           |       | dB              |
| Supply-voltage rejection ratio<br>( $\Delta V_{DD} / \Delta V_{IO}$ ) | $k_{SVR}$ | $V_{DD+}=2.2V$ to $\pm 8V$ ,<br>$V_{IC}=0V$ , no load | $T_A=25^\circ C$          | 80                                 | 95        |       | dB              |
|                                                                       |           |                                                       | Full Range <sup>(1)</sup> | 80                                 |           |       | dB              |
| Supply current                                                        | $I_{DD}$  | $V_O=0V$ , no load                                    | $T_A=25^\circ C$          |                                    | 4.8       | 6     | mA              |
|                                                                       |           |                                                       | Full Range <sup>(1)</sup> |                                    |           | 6     | mA              |
| Slew rate at unity gain                                               | SR        | $V_O=\pm 2.3V$ , $R_L=10k\Omega$<br>$C_L=100pF$       | $T_A=25^\circ C$          | 2.3                                | 3.6       |       | V/ $\mu s$      |
|                                                                       |           |                                                       | Full Range <sup>(1)</sup> | 1.7                                |           |       | V/ $\mu s$      |
| Equivalent input noise voltage                                        | $V_n$     | $f=10Hz$                                              |                           |                                    | 50        |       | nV/ $\sqrt{Hz}$ |
|                                                                       |           | $f=1kHz$                                              |                           |                                    | 9         |       | nV/ $\sqrt{Hz}$ |



| Parameter                                   | Symbol    | Conditions                                                              |           | Min | Typ    | Max | Units                        |
|---------------------------------------------|-----------|-------------------------------------------------------------------------|-----------|-----|--------|-----|------------------------------|
| Peak-to-peak equivalent input noise voltage | $V_{NPP}$ | $f=0.1\text{Hz to }1\text{Hz}$                                          |           |     | 1      |     | $\mu\text{V}$                |
|                                             |           | $f=0.1\text{Hz to }10\text{Hz}$                                         |           |     | 1.4    |     | $\mu\text{V}$                |
| Equivalent input noise current              | $I_n$     |                                                                         |           |     | 0.6    |     | $\text{fA}/\sqrt{\text{Hz}}$ |
| Total harmonic distortion+ noise            | THD+N     | $V_o=\pm 2.3$<br>$f=20\text{kHz}, R_L=10\text{k}\Omega$                 | $A_v=1$   |     | 0.0011 |     | %                            |
|                                             |           |                                                                         | $A_v=10$  |     | 0.004  |     | %                            |
|                                             |           |                                                                         | $A_v=100$ |     | 0.03   |     | %                            |
| Gain-bandwidth product                      |           | $f=10\text{kHz}, R_L=10\text{k}\Omega, C_L=100\text{pF}$                |           |     | 2.25   |     | MHz                          |
| Maximum output-swing bandwidth              | $B_{OM}$  | $V_{O(PP)}=4.6\text{V}, A_v=1, R_L=10\text{k}\Omega, C_L=100\text{pF}$  |           |     | 0.54   |     | MHz                          |
| Settling time                               | $t_s$     | $A_v=-1, R_L=10\text{k}\Omega$<br>Step=-2.3 to 2.3V, $C_L=100\text{pF}$ | To 0.1%   |     | 1.5    |     | $\mu\text{s}$                |
|                                             |           |                                                                         | To 0.01%  |     | 3.2    |     | $\mu\text{s}$                |
| Phase margin at unity gain                  | $\phi_m$  | $R_L=10\text{k}\Omega, C_L=100\text{pF}$                                |           |     | 52     |     | $^\circ$                     |
| Gain margin                                 |           | $R_L=10\text{k}\Omega, C_L=100\text{pF}$                                |           |     | 10     |     | dB                           |

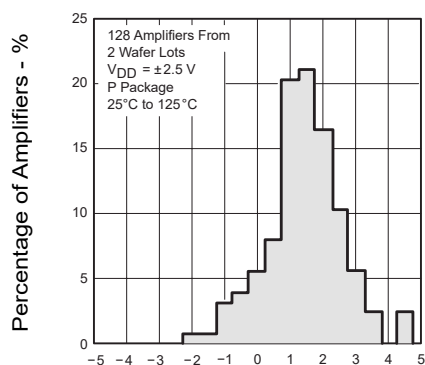


11.1 Typical Characteristic

|                                                        |                                                        |
|--------------------------------------------------------|--------------------------------------------------------|
|                                                        |                                                        |
| Figure 1: Distribution of TLC2272 Input Offset Voltage | Figure 2: Distribution of TLC2272 Input Offset Voltage |
|                                                        |                                                        |
| Figure 3: Distribution of TLC2274 Input Offset Voltage | Figure 4: Distribution of TLC2274 Input Offset Voltage |
|                                                        |                                                        |
| Figure 5: Input Offset Voltage vs Common-Mode Voltage  | Figure 6: Input Offset Voltage vs Common-Mode Voltage  |

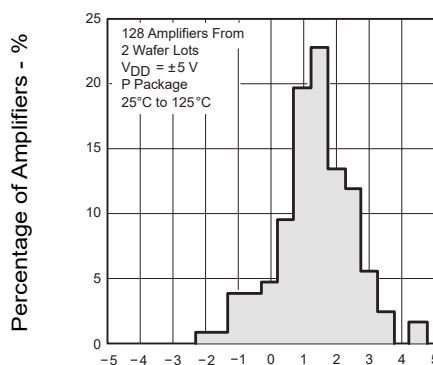


## 11.2 Typical Characteristic



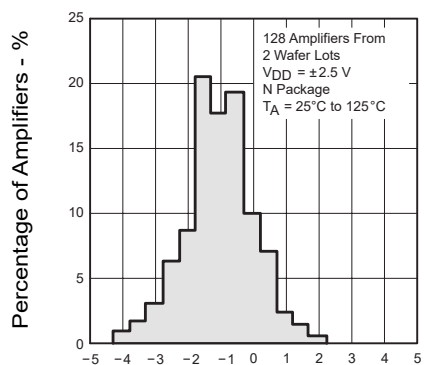
$\alpha V_{IO}$ , Temperature Coefficient ( $\mu V/^{\circ}C$ )

Figure 7: Distribution of TLC2272 vs Input Offset Voltage Temperature Coefficient



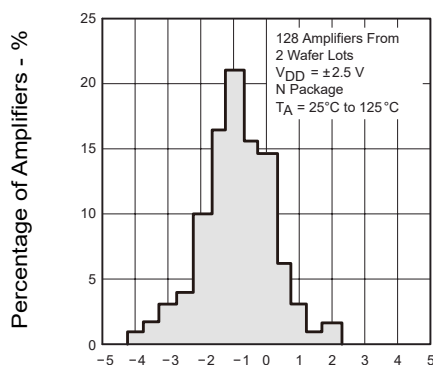
$\alpha V_{IO}$ , Temperature Coefficient ( $\mu V/^{\circ}C$ )

Figure 8: Distribution of TLC2272 vs Input Offset Voltage Temperature Coefficient



$\alpha V_{IO}$ , Temperature Coefficient ( $\mu V/^{\circ}C$ )

Figure 9: Distribution of TLC2274 vs Input Offset Voltage Temperature Coefficient



$\alpha V_{IO}$ , Temperature Coefficient ( $\mu V/^{\circ}C$ )

Figure 10: Distribution of TLC2274 vs Input Offset Voltage Temperature Coefficient

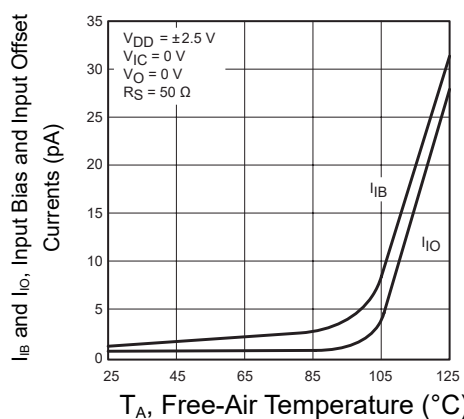


Figure 11: Input Bias and Input Offset Current vs Free-Air Temperature

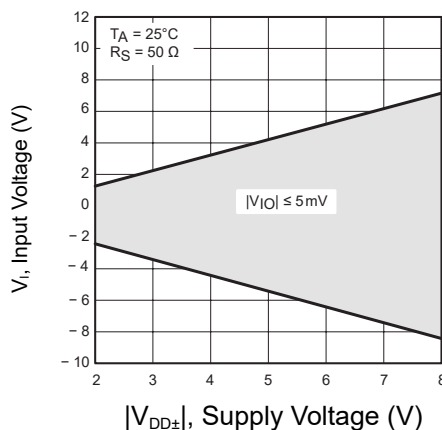


Figure 12: Input Voltage vs Supply Voltage



### 11.3 Typical Characteristic

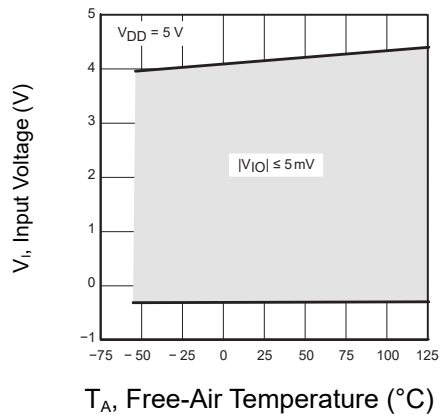


Figure 13: Input Voltage vs Free-Air Temperature

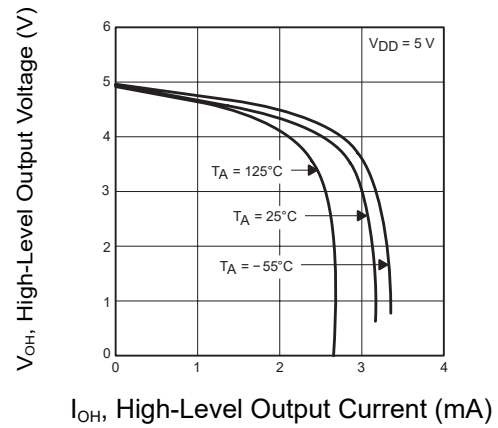


Figure 14: High-Level Output Voltage vs High-Level Output Current

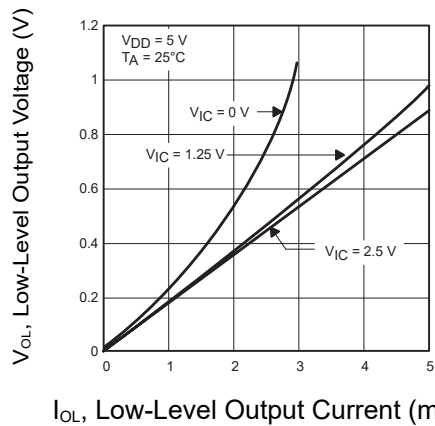


Figure 15: Low-Level Output Voltage vs Low-Level Output Current

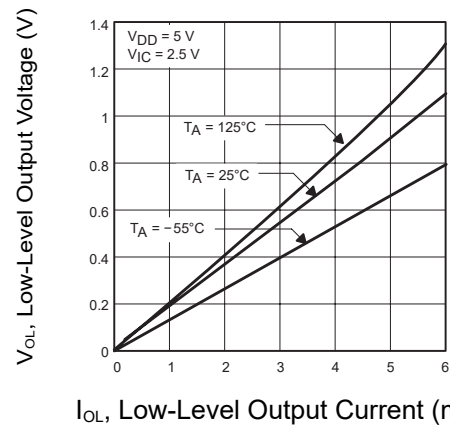


Figure 16: Low-Level Output Voltage vs Low-Level Output Current

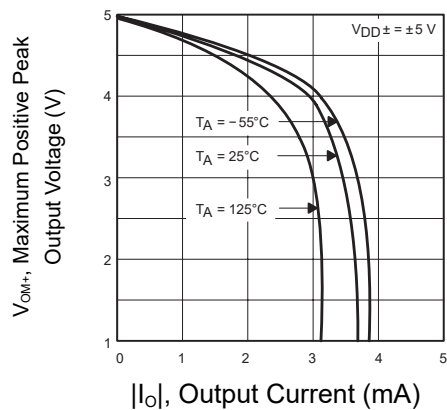


Figure 17: Maximum Positive Peak Output Voltage vs Output Current

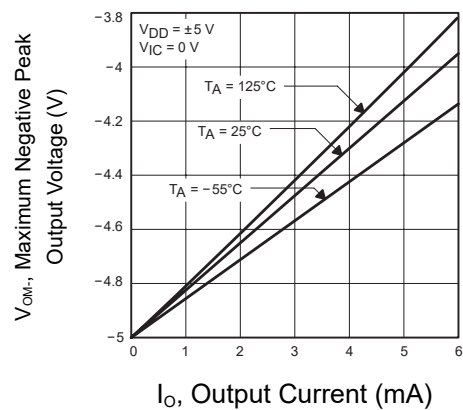


Figure 18: Maximum Negative Peak Output Voltage vs Output Current



## 11.4 Typical Characteristic

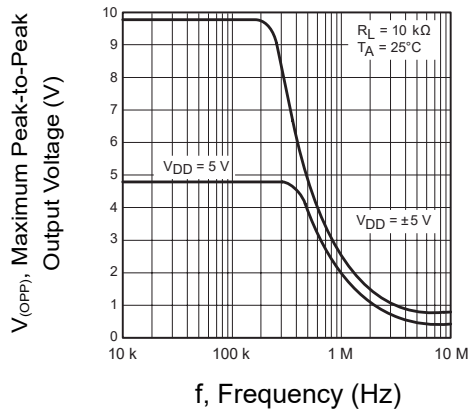


Figure 19: Maximum Peak-to-Peak Output Voltage vs Frequency

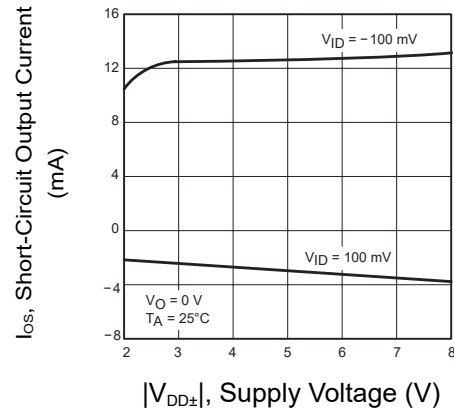


Figure 20: Short-Circuit Output Current vs Supply Voltage

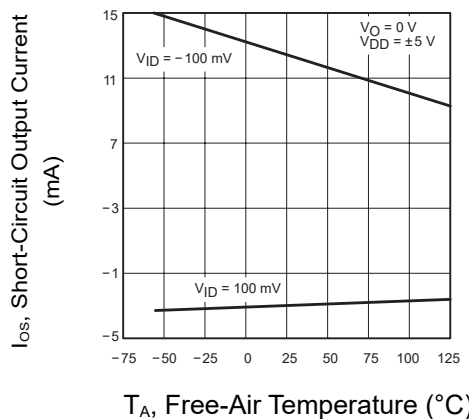


Figure 21: Short-Circuit Output Current vs Free-Air Temperature

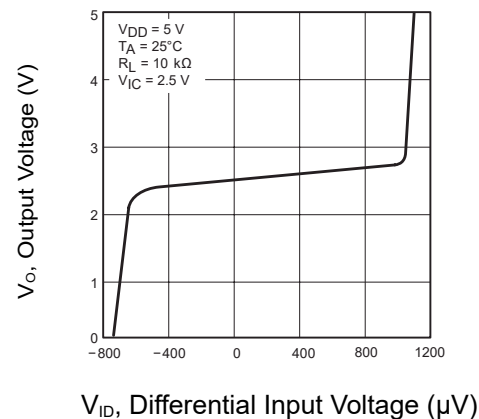


Figure 22: Output Voltage vs Differential Input Voltage

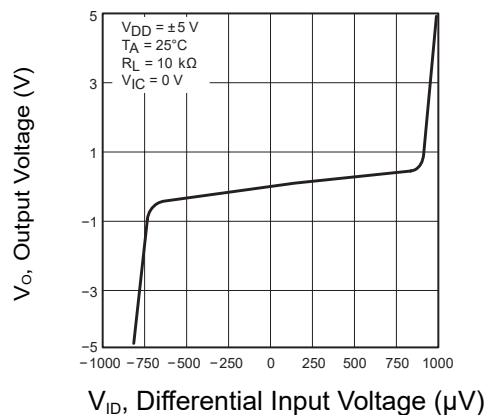


Figure 23: Output Voltage vs Differential Input Voltage

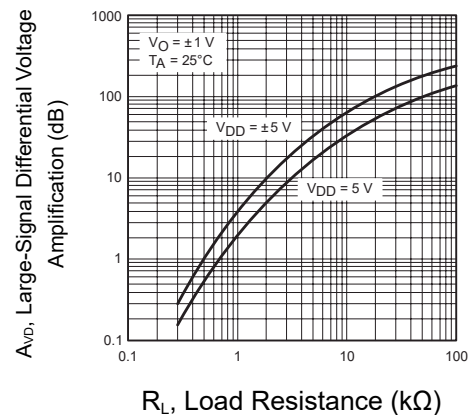


Figure 24: Large-Signal Differential Voltage Amplification vs Load Resistance



## 11.5 Typical Characteristic

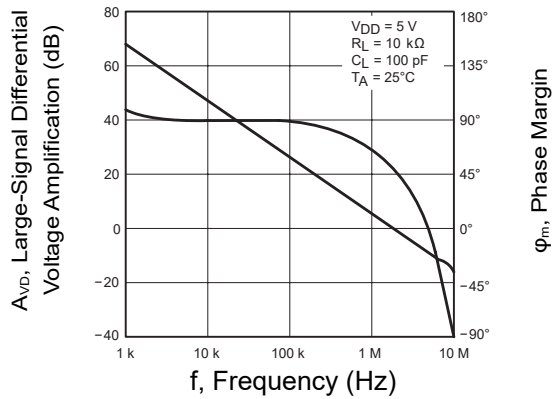


Figure 25: Large-Signal Differential Voltage Amplification and Phase Margin vs Frequency

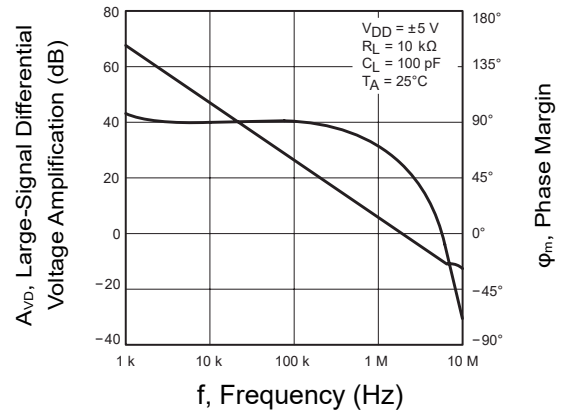


Figure 26: Large-Signal Differential Voltage Amplification and Phase Margin vs Frequency

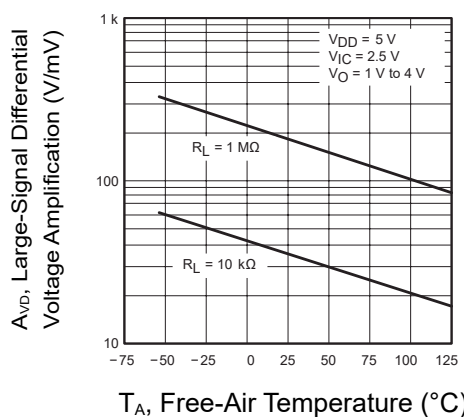


Figure 27: Large-Signal Differential Voltage Amplification vs Free-Air Temperature

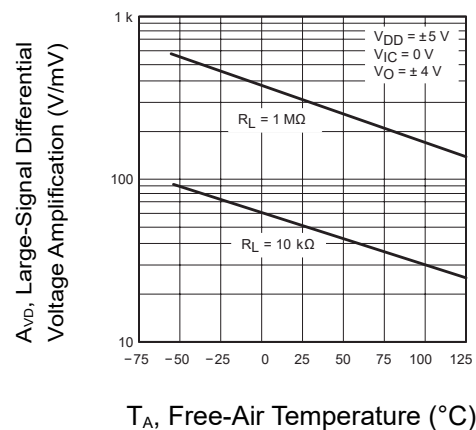


Figure 28: Large-Signal Differential Voltage Amplification vs Free-Air Temperature

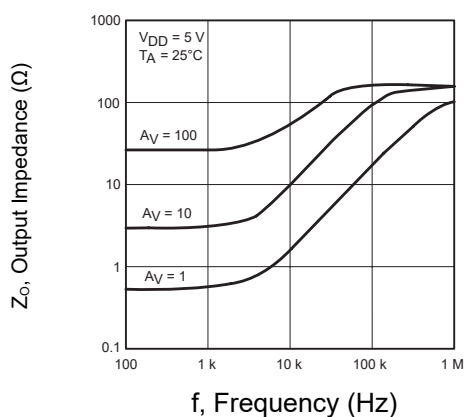


Figure 29: Output Impedance vs Frequency

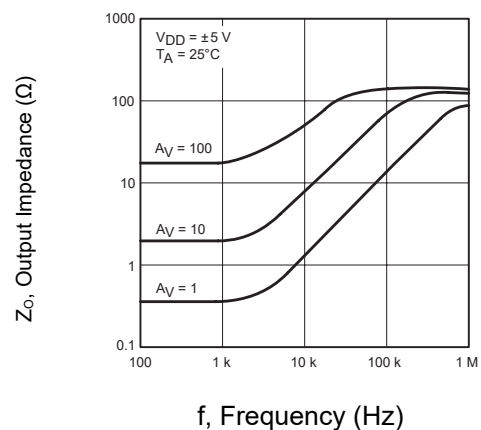


Figure 30: Output Impedance vs Frequency



## 11.6 Typical Characteristic

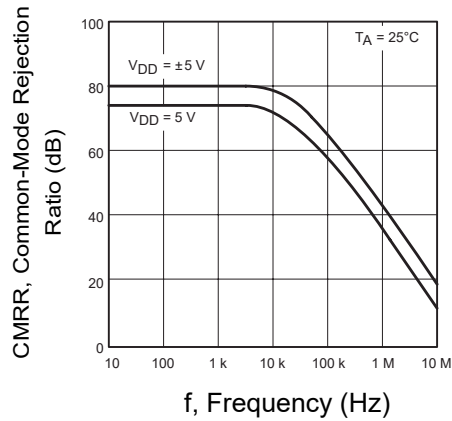


Figure 31: Common-Mode Rejection Ratio vs Frequency

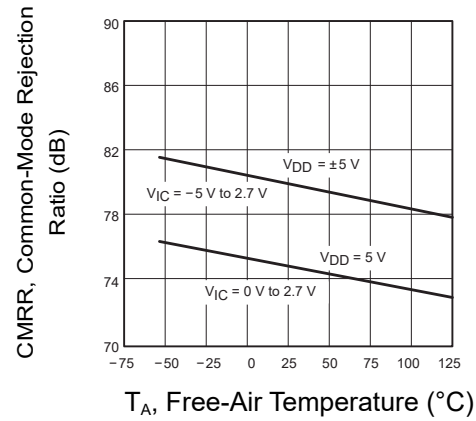


Figure 32: Common-Mode Rejection Ratio vs Free-Air Temperature

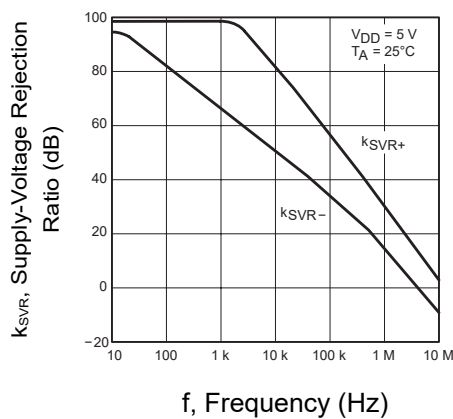


Figure 33: Supply-Voltage Rejection Ratio vs Frequency

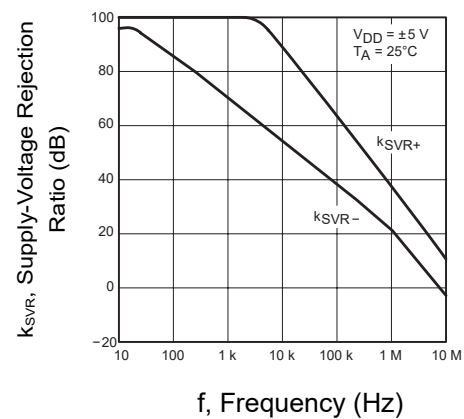


Figure 34: Supply-Voltage Rejection Ratio vs Frequency

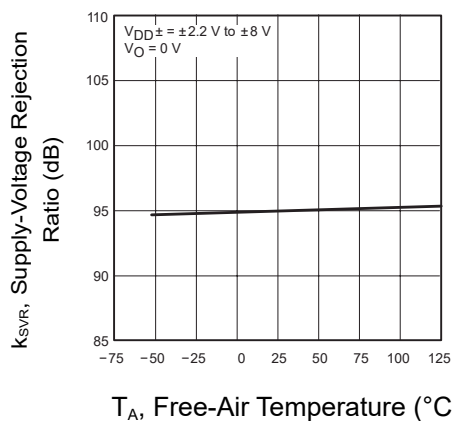


Figure 35: Supply-Voltage Rejection Ratio vs Free-Air Temperature

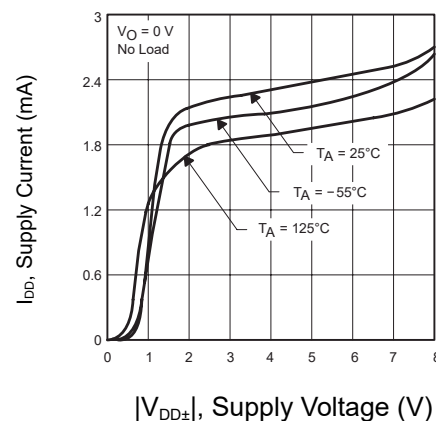


Figure 36: TLC2272 Supply Current vs Supply Voltage



## 11.7 Typical Characteristic

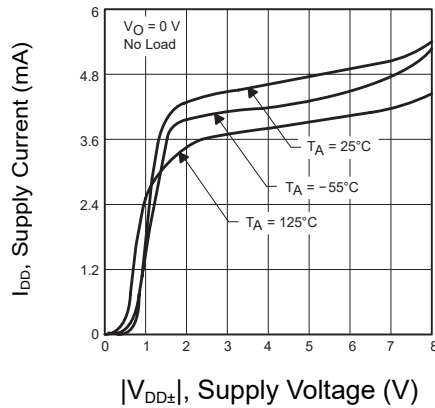


Figure 37: TLC2274 Supply Current vs Supply Voltage

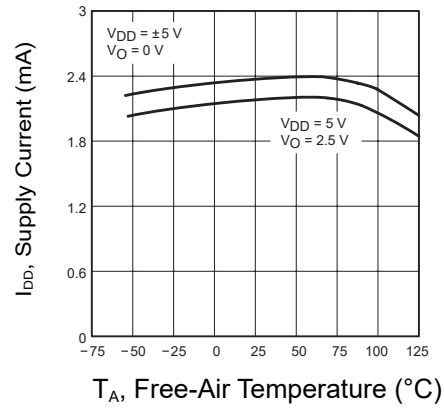


Figure 38: TLC2272 Supply Current vs Free-Air Temperature

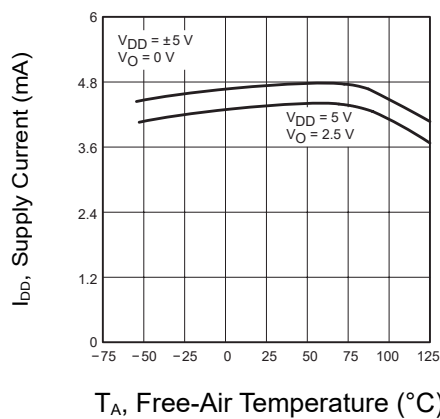


Figure 39: TLC2274 Supply Current vs Free-Air Temperature

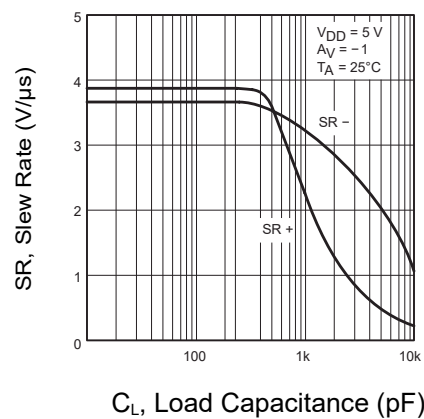


Figure 40: Slew Rate vs Load Capacitance

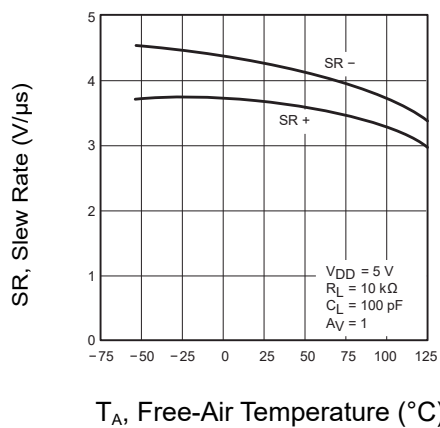


Figure 41: Slew Rate vs Free-Air Temperature

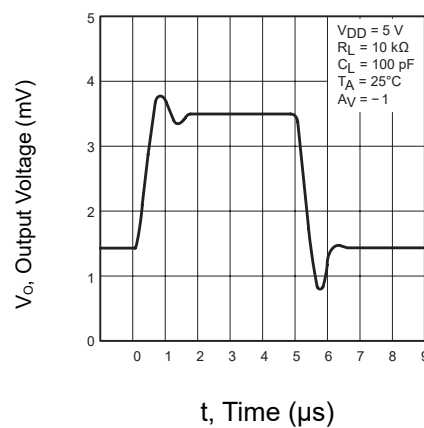
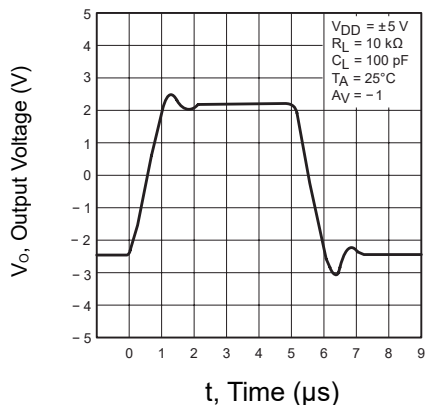
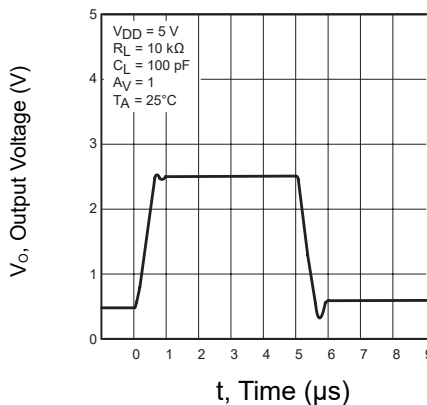
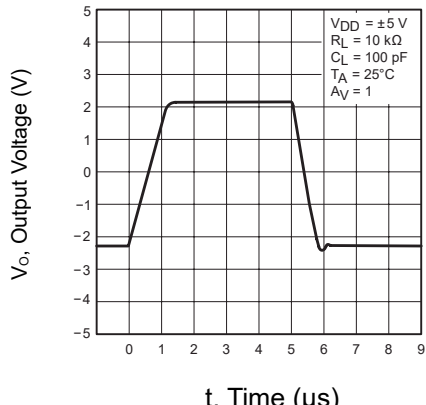
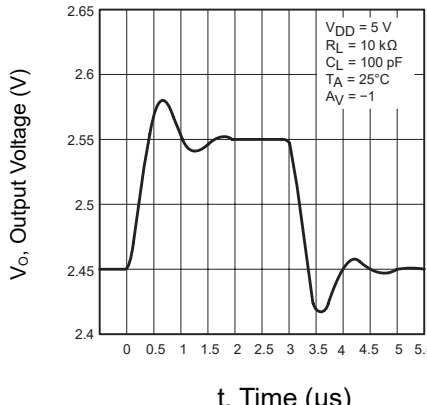
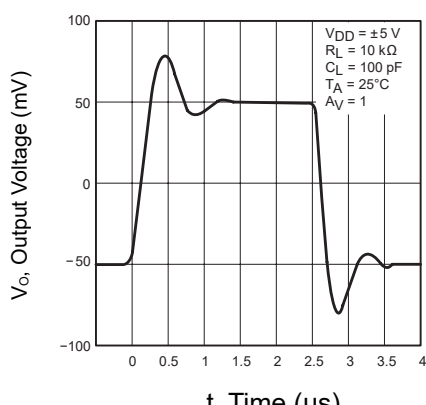
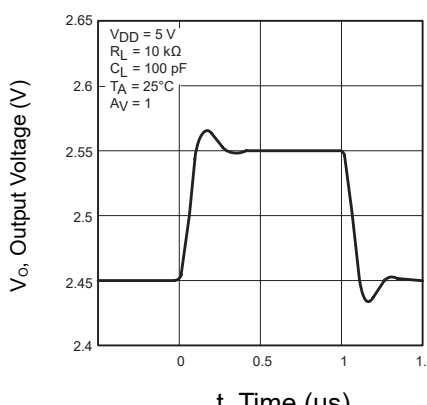


Figure 42: Inverting Large-Signal Pulse Response



11.8 Typical Characteristic

|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|    |    |
| Figure 43: Inverting Large-Signal Pulse Response                                    | Figure 44: Voltage-Follower Large-Signal Pulse Response                              |
|   |   |
| Figure 45: Voltage-Follower Large-Signal Pulse Response                             | Figure 46: Inverting Small-Signal Pulse Response                                     |
|  |  |
| Figure 47: Inverting Small-Signal Pulse Response                                    | Figure 48: Voltage-Follower Small-Signal Pulse Response                              |



## 11.9 Typical Characteristic

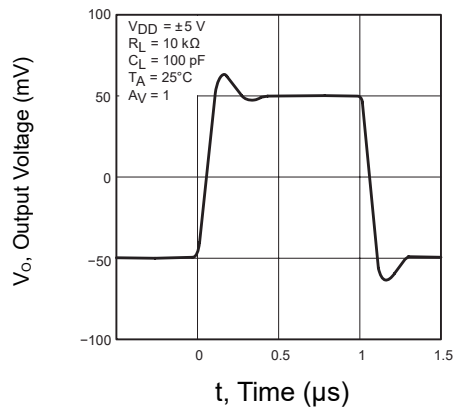


Figure 49: Voltage-Follower Small-Signal Pulse Response

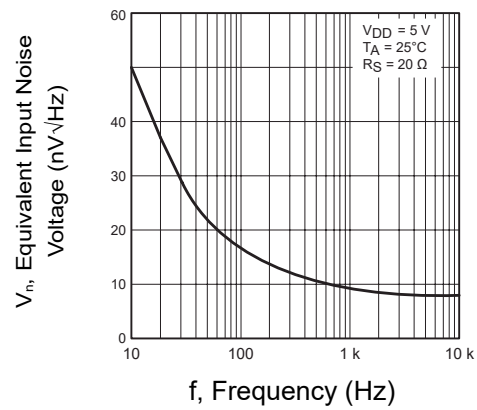


Figure 50: Equivalent Input Noise Voltage vs Frequency

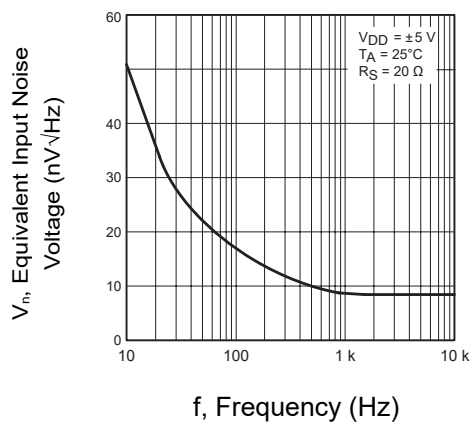


Figure 51: Equivalent Input Noise Voltage vs Frequency

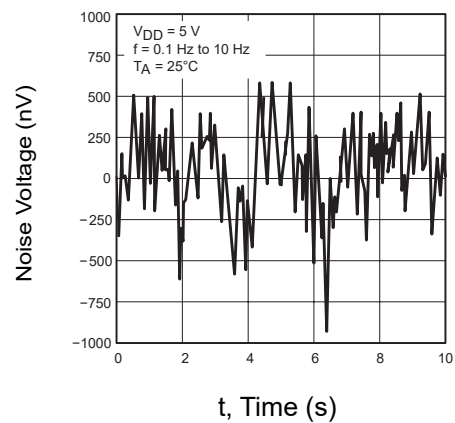


Figure 52: Noise Voltage Over a 10 Second Period

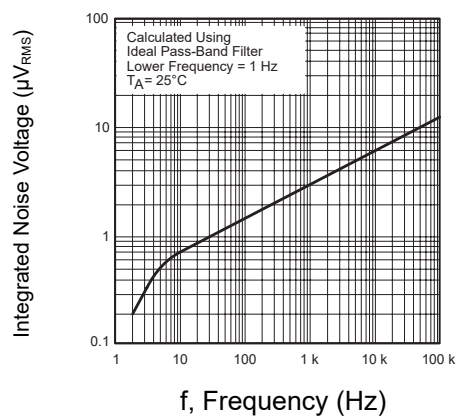


Figure 53: Integrated Noise Voltage vs Frequency

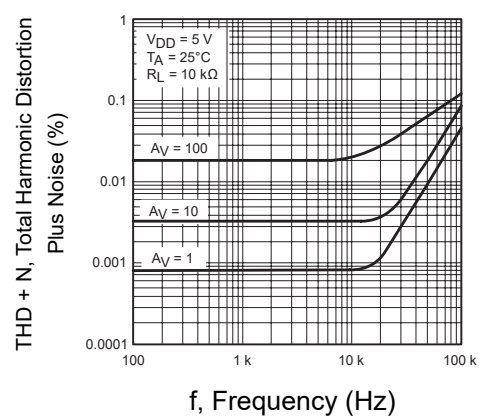


Figure 54: Total Harmonic Distortion + Noise vs Frequency

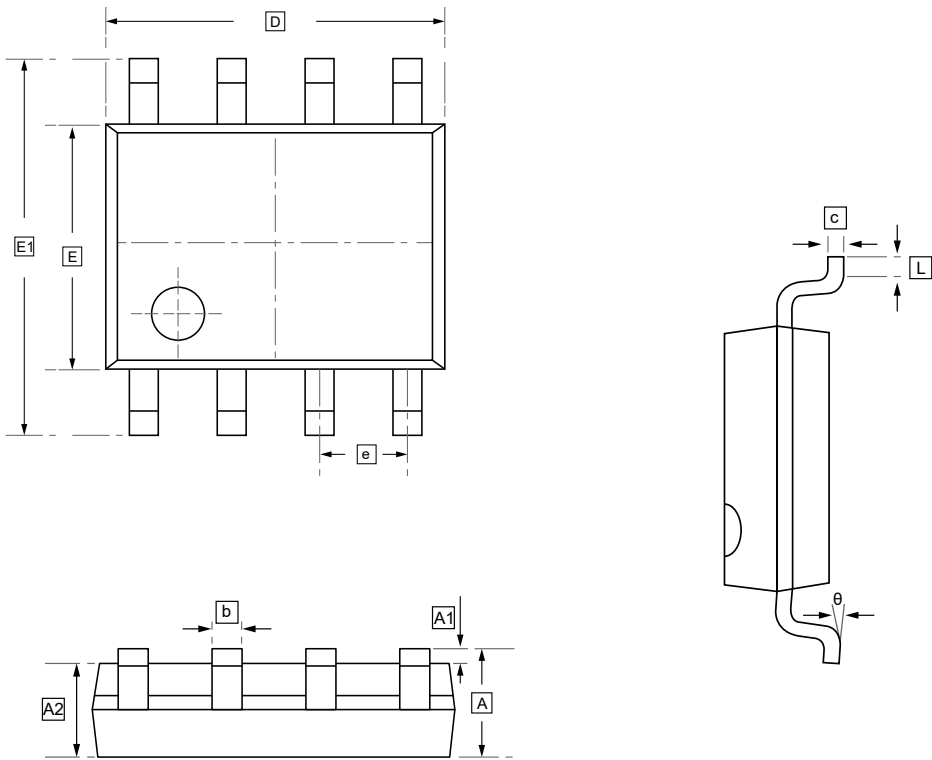


11.10 Typical Characteristic

|                                                     |                                                           |
|-----------------------------------------------------|-----------------------------------------------------------|
|                                                     |                                                           |
| Figure 55: Gain-Bandwidth Product vs Supply Voltage | Figure 56: Gain-Bandwidth Product vs Free-Air Temperature |
|                                                     |                                                           |
| Figure 57: Phase Margin vs Load Capacitance         | Figure 58: Gain Margin vs Load Capacitance                |



12.1 SOP-8 Package Outline Dimensions

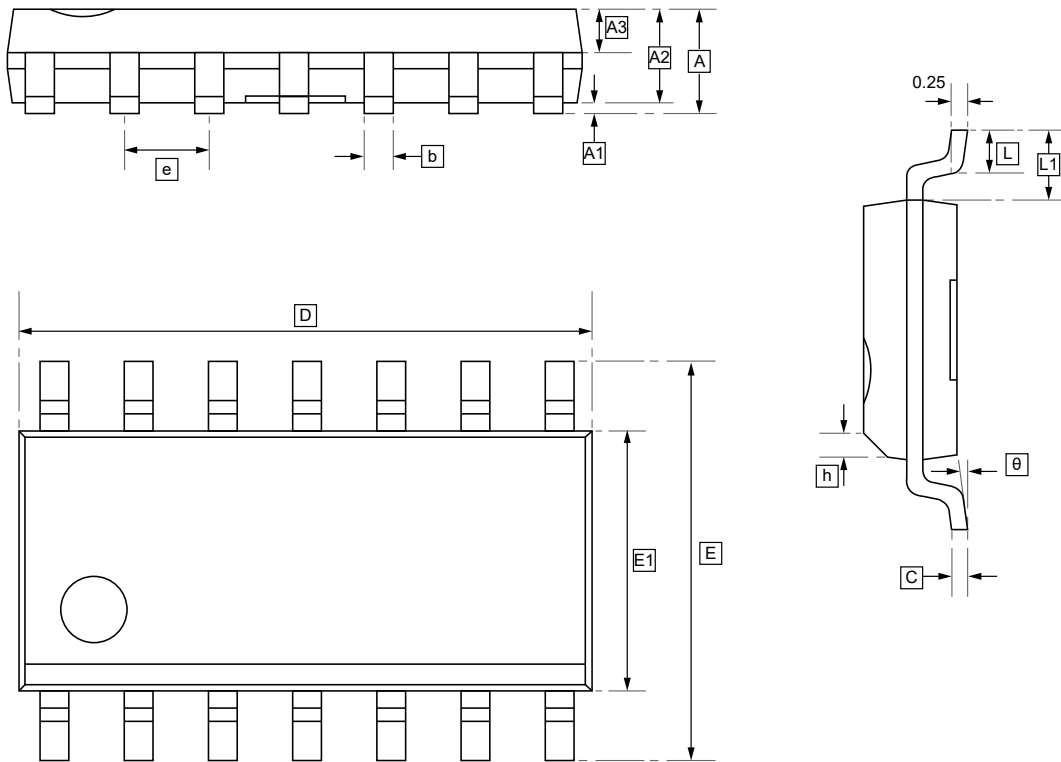


DIMENSIONS (mm are the original dimensions)

| Symbol | A     | A1    | A2    | b     | c     | D     | E     | E1    | e     | L     | θ  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|
| Min    | 1.350 | 0.000 | 1.350 | 0.330 | 0.170 | 4.700 | 3.800 | 5.800 | 1.270 | 0.400 | 0° |
| Max    | 1.750 | 0.100 | 1.550 | 0.510 | 0.250 | 5.100 | 4.000 | 6.200 | BSC   | 1.270 | 8° |



12.2 SOP-14 Package Outline Dimensions



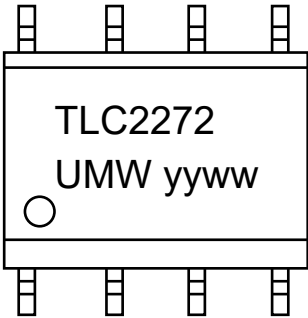
DIMENSIONS (mm are the original dimensions)

| Symbol | A    | A1   | A2   | A3   | b     | C    | D    | E    | E1   | e    | h    | L    |
|--------|------|------|------|------|-------|------|------|------|------|------|------|------|
| Min    | -    | 0.05 | 1.35 | 0.65 | 0.203 | 0.17 | 8.45 | 5.80 | 3.80 | 1.24 | 0.25 | 0.40 |
| Max    | 1.75 | 0.25 | 1.55 | 0.75 | 0.305 | 0.25 | 8.85 | 6.20 | 4.00 | 1.30 | 0.50 | 0.80 |

| Symbol | L1   | θ  |
|--------|------|----|
| Min    | 1.00 | 0° |
| Max    | 1.10 | 8° |



13.Ordering Information



yy: Year Code  
ww: Week Code

| Order Code      | Marking | Package | Base QTY | Delivery Mode |
|-----------------|---------|---------|----------|---------------|
| UMW TLC2272ACDR | TLC2272 | SOP-8   | 2500     | Tape and reel |
| UMW TLC2272AIDR | TLC2272 | SOP-8   | 2500     | Tape and reel |
| UMW TLC2272CDR  | TLC2272 | SOP-8   | 2500     | Tape and reel |
| UMW TLC2272IDR  | TLC2272 | SOP-8   | 2500     | Tape and reel |
| UMW TLC2274ACDR | TLC2274 | SOP-14  | 2500     | Tape and reel |
| UMW TLC2274AIDR | TLC2274 | SOP-14  | 2500     | Tape and reel |
| UMW TLC2274CDR  | TLC2274 | SOP-14  | 2500     | Tape and reel |
| UMW TLC2274IDR  | TLC2274 | SOP-14  | 2500     | Tape and reel |



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