

## FEATURES

Low offset voltage: 100  $\mu\text{V}$  maximum at  $V_S = 5\text{ V}$

Low input bias current: 1 pA maximum

Single-supply operation: 5 V to 16 V

Low noise: 10 nV/ $\sqrt{\text{Hz}}$

Wide bandwidth: 4 MHz

Unity-gain stable

Small package options

3 mm  $\times$  3 mm 8-lead LFCSP

8-lead MSOP and narrow SOIC

14-lead TSSOP and narrow SOIC

## APPLICATIONS

Sensors

Medical equipment

Consumer audio

Photodiode amplification

ADC drivers

## GENERAL DESCRIPTION

The AD8661/AD8662/AD8664<sup>1</sup> are rail-to-rail output, single-supply amplifiers that use the Analog Devices, Inc., patented DigiTrim<sup>®</sup> trimming technique to achieve low offset voltage.

The AD8661/AD8662/AD8664 series features extended operating ranges, with supply voltages up to 16 V. It also features low input bias current, wide signal bandwidth, and low input voltage and current noise.

The combination of low offset, very low input bias current, and a wide supply range makes these amplifiers useful in a wide variety of applications usually associated with higher priced JFET amplifiers. Systems using high impedance sensors, such as photodiodes, benefit from the combination of low input bias current, low noise, low offset, and wide bandwidth. The wide operating voltage range meets the demands of high performance analog-to-digital converters (ADCs) and digital-to-analog

<sup>1</sup> Protected by U.S. Patents 6,194,962 and 6,696,894.

Rev. E

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## PIN CONFIGURATIONS

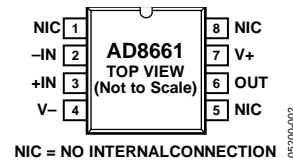


Figure 1. AD8661, 8-Lead SOIC (R-8)



NOTES  
1. NIC = NO INTERNAL CONNECTION.  
2. CONNECT THE EXPOSED PAD TO V<sub>-</sub>.

Figure 2. AD8661, 8-Lead LFCSP (CP-8-13)

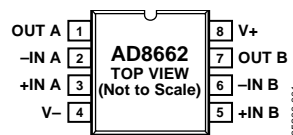


Figure 3. AD8662, 8-Lead SOIC (R-8)

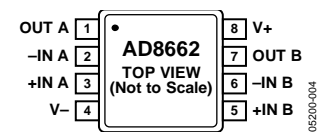


Figure 4. AD8662, 8-Lead MSOP (RM-8)

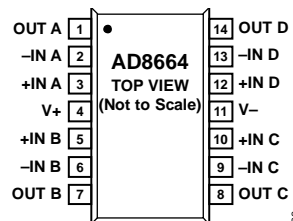


Figure 5. AD8664, 14-Lead SOIC (R-14)

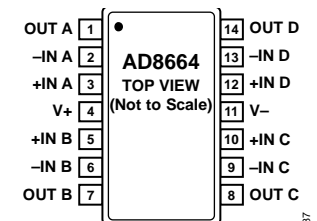


Figure 6. AD8664, 14-Lead TSSOP (RU-14)

converters (DACs). Audio applications and medical monitoring equipment can take advantage of the high input impedance, low voltage, low current noise, and wide bandwidth.

The single AD8661 is available in a narrow 8-lead SOIC package and a very thin, dual lead, 8-lead LFCSP. The AD8661 SOIC package is specified over the extended industrial temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ . The AD8661 LFCSP is specified over the industrial temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . The AD8662 is available in a narrow 8-lead SOIC package and an 8-lead MSOP, both specified over the extended industrial temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ . The AD8664 is available in a narrow 14-lead SOIC package and a 14-lead TSSOP, both with an extended industrial temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

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| <b>REVISION HISTORY</b>  |            |  |           |
| <b>7/2016—Rev. D to Rev. E</b>   |            |  |           |
| Changed CP-8-2 to CP-8-13 .....  | Throughout | <b>3/2006—Rev. A to Rev. B</b>                     |           |
| Changes to Figure 1 and Figure 2.....  | 1          | Added AD8662 .....                                 | Universal |
| Added Patent Note, Note 1.....   | 1          | Added MSOP .....                                   | Universal |
| Updated Outline Dimensions .....   | 13         | Changes to Table 1.....                            | 3         |
| Changes to Ordering Guide .....  | 15         | Changes to Table 2.....                            | 4         |
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| <b>7/2006—Rev. C to Rev. D</b>   |            |  |           |
| Added AD8664 .....   | Universal  | <b>1/2006—Rev. 0 to Rev. A</b>                     |           |
| Added 14-Lead SOIC_N and 14-Lead TSSOP .....                                   | Universal  | Added LFCSP_VD .....                               | Universal |
| Changes to Features.....   | 1          | Changes to Table 1.....                            | 3         |
| Changes to Table 1.....  | 3          | Changes to Table 2.....                            | 4         |
| Changes to Table 2.....  | 4          | Changes to Ordering Guide .....                    | 13        |
| Changes to Table 3.....  | 5          |  |           |
| Changes to Table 4.....  | 6          | <b>9/2005—Revision 0: Initial Version</b>          |           |
| Changes to Table 5 and Table 6.....  | 7          |  |           |
| Changes to Figure 29.....  | 11         |  |           |
| Updated Outline Dimensions .....   | 13         |  |           |
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| <b>5/2006—Rev. B to Rev. C</b>   |            |  |           |
| Changes to Ordering Guide .....  | 13         |  |           |

## SPECIFICATIONS

## AD8661/AD8662/AD8664 ELECTRICAL CHARACTERISTICS—SOIC, MSOP, AND TSSOP

$V_S = 5.0\text{ V}$ ,  $V_{CM} = V_S/2$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

Table 1.

| Parameter                     | Symbol     | Test Conditions/Comments  | Min  | Typ      | Max  | Unit                         |
|-------------------------------|------------|---|------|----------|------|------------------------------|
| <b>INPUT CHARACTERISTICS</b>  |            |   |      |          |      |                              |
| Offset Voltage                | $V_{OS}$   | $V_{CM} = V_S/2$  |      | 30       | 100  | $\mu\text{V}$                |
| AD8661                        |            | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$                   |      |          | 1000 | $\mu\text{V}$                |
| AD8661                        |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  |      |          | 1400 | $\mu\text{V}$                |
| AD8662                        |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  |      |          | 1000 | $\mu\text{V}$                |
| AD8664                        |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  |      |          | 1200 | $\mu\text{V}$                |
| Input Bias Current            | $I_B$      |   |      | 0.3      | 1    | $\text{pA}$                  |
|                               |            | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$                   |      |          | 50   | $\text{pA}$                  |
|                               |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  |      |          | 300  | $\text{pA}$                  |
| Input Offset Current          | $I_{OS}$   |   |      | 0.2      | 0.5  | $\text{pA}$                  |
|                               |            | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$                   |      |          | 20   | $\text{pA}$                  |
|                               |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  |      |          | 75   | $\text{pA}$                  |
| Input Voltage Range           |            |   | -0.1 |          | +3.0 | $\text{V}$                   |
| Common-Mode Rejection Ratio   | CMRR       | $V_{CM} = -0.1\text{ V to }+3.0\text{ V}$                       | 85   | 100      |      | $\text{dB}$                  |
|                               |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  |      | 80       | 100  |                              |
| Large Signal Voltage Gain     | $A_{VO}$   | $R_L = 2\text{ k}\Omega$ , $V_O = 0.5\text{ V to }4.5\text{ V}$ | 100  | 220      |      | $\text{V/mV}$                |
| Offset Voltage Drift          | $TCV_{OS}$ |   |      |          |      |                              |
| AD8661                        |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  |      | 3        | 10   | $\mu\text{V}/^\circ\text{C}$ |
| AD8662, AD8664                |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  |      | 2        | 9    | $\mu\text{V}/^\circ\text{C}$ |
| <b>OUTPUT CHARACTERISTICS</b> |            |   |      |          |      |                              |
| Output Voltage High           | $V_{OH}$   | $I_L = 1\text{ mA}$   | 4.85 | 4.93     |      | $\text{V}$                   |
|                               |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  | 4.80 |          |      | $\text{V}$                   |
| Output Voltage Low            | $V_{OL}$   | $I_L = 1\text{ mA}$   |      | 50       | 100  | $\text{mV}$                  |
|                               |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  |      |          | 110  | $\text{mV}$                  |
| Short-Circuit Current         | $I_{SC}$   |   |      | $\pm 19$ |      | $\text{mA}$                  |
| Closed-Loop Output Impedance  | $Z_{OUT}$  | $f = 1\text{ MHz}$ , $A_V = 1$                                  |      | 50       |      | $\Omega$                     |
| <b>POWER SUPPLY</b>           |            |   |      |          |      |                              |
| Supply Current per Amplifier  | $I_{SY}$   | $V_O = V_S/2$   |      | 1.15     | 1.40 | $\text{mA}$                  |
|                               |            | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                  |      |          | 2.0  | $\text{mA}$                  |
| <b>DYNAMIC PERFORMANCE</b>    |            |   |      |          |      |                              |
| Slew Rate                     | SR         | $R_L = 2\text{ k}\Omega$  |      | 3.5      |      | $\text{V}/\mu\text{s}$       |
| Gain Bandwidth Product        | GBP        |   |      | 4        |      | $\text{MHz}$                 |
| Phase Margin                  | $\Phi_O$   |   |      | 65       |      | Degrees                      |
| <b>NOISE PERFORMANCE</b>      |            |   |      |          |      |                              |
| Peak-to-Peak Noise            | $e_n$ p-p  | $f = 0.1\text{ Hz to }10\text{ Hz}$                             |      | 2.5      |      | $\mu\text{V p-p}$            |
| Voltage Noise Density         | $e_n$      | $f = 1\text{ kHz}$  |      | 12       |      | $\text{nV}/\sqrt{\text{Hz}}$ |
|                               |            | $f = 10\text{ kHz}$   |      | 10       |      | $\text{nV}/\sqrt{\text{Hz}}$ |
| Current Noise Density         | $i_n$      | $f = 1\text{ kHz}$  |      | 0.1      |      | $\text{pA}/\sqrt{\text{Hz}}$ |

## AD8661/AD8662/AD8664 ELECTRICAL CHARACTERISTICS—SOIC, MSOP, AND TSSOP

$V_S = 16.0\text{ V}$ ,  $V_{CM} = V_S/2$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

Table 2.

| Parameter                    | Symbol           | Test Conditions/Comments  | Min   | Typ       | Max   | Unit                         |
|------------------------------|------------------|---|-------|-----------|-------|------------------------------|
| INPUT CHARACTERISTICS        |                  |   |       |           |       |                              |
| Offset Voltage               | $V_{OS}$         | $V_{CM} = V_S/2$  |       | 50        | 160   | $\mu\text{V}$                |
| AD8661                       |                  | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$                     |       |           | 1000  | $\mu\text{V}$                |
| AD8661                       |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    |       |           | 1400  | $\mu\text{V}$                |
| AD8662                       |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    |       |           | 1000  | $\mu\text{V}$                |
| AD8664                       |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    |       |           | 1200  | $\mu\text{V}$                |
| Input Bias Current           | $I_B$            |   |       | 0.3       | 1     | $\text{pA}$                  |
|                              |                  | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$                     |       |           | 50    | $\text{pA}$                  |
|                              |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    |       |           | 300   | $\text{pA}$                  |
| Input Offset Current         | $I_{OS}$         |   |       | 0.2       | 0.5   | $\text{pA}$                  |
|                              |                  | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$                     |       |           | 20    | $\text{pA}$                  |
|                              |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    |       |           | 75    | $\text{pA}$                  |
| Input Voltage Range          |                  |   | -0.1  |           | +14.0 | $\text{V}$                   |
| Common-Mode Rejection Ratio  | CMRR             | $V_{CM} = -0.1\text{ V to } +14.0\text{ V}$                       | 90    | 110       |       | $\text{dB}$                  |
|                              |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    | 90    | 110       |       | $\text{dB}$                  |
| Large Signal Voltage Gain    | $A_{VO}$         | $R_L = 2\text{ k}\Omega$ , $V_O = 0.5\text{ V to } 15.5\text{ V}$ | 200   | 360       |       | $\text{V/mV}$                |
| Offset Voltage Drift         | $TCV_{OS}$       |   |       |           |       |                              |
| AD8661                       |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    |       | 3         | 10    | $\mu\text{V}/^\circ\text{C}$ |
| AD8662, AD8664               |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    |       | 2         | 9     | $\mu\text{V}/^\circ\text{C}$ |
| OUTPUT CHARACTERISTICS       |                  |   |       |           |       |                              |
| Output Voltage High          | $V_{OH}$         | $I_L = 1\text{ mA}$   | 15.93 | 15.97     |       | $\text{V}$                   |
|                              |                  | $I_L = 10\text{ mA}$  | 15.60 | 15.70     |       | $\text{V}$                   |
|                              |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    | 15.50 |           |       | $\text{V}$                   |
| Output Voltage Low           | $V_{OL}$         | $I_L = 1\text{ mA}$   |       | 24        | 50    | $\text{mV}$                  |
|                              |                  | $I_L = 10\text{ mA}$  |       | 190       | 300   | $\text{mV}$                  |
|                              |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    |       |           | 350   | $\text{mV}$                  |
| Short-Circuit Current        | $I_{SC}$         |   |       | $\pm 140$ |       | $\text{mA}$                  |
| Closed-Loop Output Impedance | $Z_{OUT}$        | $f = 1\text{ MHz}$ , $A_V = 1$                                    |       | 45        |       | $\Omega$                     |
| POWER SUPPLY                 |                  |   |       |           |       |                              |
| Power Supply Rejection Ratio | PSRR             | $V_S = 5\text{ V to } 16\text{ V}$                                | 95    | 110       |       | $\text{dB}$                  |
|                              |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    | 95    | 115       |       | $\text{dB}$                  |
| Supply Current per Amplifier | $I_{SY}$         | $V_O = V_S/2$   |       | 1.25      | 1.55  | $\text{mA}$                  |
|                              |                  | $-40^\circ\text{C} < T_A < +125^\circ\text{C}$                    |       |           | 2.1   | $\text{mA}$                  |
| DYNAMIC PERFORMANCE          |                  |   |       |           |       |                              |
| Slew Rate                    | SR               | $R_L = 2\text{ k}\Omega$  |       | 3.5       |       | $\text{V}/\mu\text{s}$       |
| Gain Bandwidth Product       | GBP              |   |       | 4         |       | $\text{MHz}$                 |
| Phase Margin                 | $\Phi_O$         |   |       | 65        |       | Degrees                      |
| NOISE PERFORMANCE            |                  |   |       |           |       |                              |
| Peak-to-Peak Noise           | $e_n\text{ p-p}$ | $f = 0.1\text{ Hz to } 10\text{ Hz}$                              |       | 2.5       |       | $\mu\text{V p-p}$            |
| Voltage Noise Density        | $e_n$            | $f = 1\text{ kHz}$  |       | 12        |       | $\text{nV}/\sqrt{\text{Hz}}$ |
|                              |                  | $f = 10\text{ kHz}$   |       | 10        |       | $\text{nV}/\sqrt{\text{Hz}}$ |
| Current Noise Density        | $i_n$            | $f = 1\text{ kHz}$  |       | 0.1       |       | $\text{pA}/\sqrt{\text{Hz}}$ |

**AD8661 ELECTRICAL CHARACTERISTICS—LFCSP ONLY**

$V_S = 5.0\text{ V}$ ,  $V_{CM} = V_S/2$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

Table 3.

| Parameter                     | Symbol           | Test Conditions/Comments   | Min  | Typ      | Max  | Unit  |
|-------------------------------|------------------|--|------|----------|------|---|
| <b>INPUT CHARACTERISTICS</b>  |                  |  |      |          |      |   |
| Offset Voltage                | $V_{OS}$         | $V_{CM} = V_S/2$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$                          |      | 50       | 300  | $\mu\text{V}$                                 |
| Input Bias Current            | $I_B$            | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$  |      | 0.3      | 1    | $\text{pA}$                                   |
| Input Offset Current          | $I_{OS}$         | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$  |      | 0.2      | 0.5  | $\text{pA}$                                   |
| Input Voltage Range           |                  | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$  |      |          | 20   | $\text{pA}$                                   |
| Common-Mode Rejection Ratio   | CMRR             | $V_{CM} = -0.1\text{ V to }+3.0\text{ V}$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$ | -0.1 | 85       | 100  | $\text{dB}$                                   |
| Large Signal Voltage Gain     | $A_{VO}$         | $R_L = 2\text{ k}\Omega$ , $V_O = 0.5\text{ V to }4.5\text{ V}$                            | 80   | 100      |      | $\text{dB}$                                   |
| Offset Voltage Drift          | $TCV_{OS}$       | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$  | 100  | 240      | 17   | $\text{V/mV}$<br>$\mu\text{V}/^\circ\text{C}$ |
| <b>OUTPUT CHARACTERISTICS</b> |                  |  |      |          |      |   |
| Output Voltage High           | $V_{OH}$         | $I_L = 1\text{ mA}$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$                       | 4.85 | 4.93     |      | $\text{V}$                                    |
| Output Voltage Low            | $V_{OL}$         | $I_L = 1\text{ mA}$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$                       | 4.80 | 50       | 100  | $\text{V}$<br>$\text{mV}$                     |
| Short-Circuit Current         | $I_{SC}$         |  |      | $\pm 19$ | 120  | $\text{mV}$<br>$\text{mA}$                    |
| Closed-Loop Output Impedance  | $Z_{OUT}$        | $f = 1\text{ MHz}$ , $A_V = 1$   |      | 65       |      | $\Omega$                                      |
| <b>POWER SUPPLY</b>           |                  |  |      |          |      |   |
| Supply Current per Amplifier  | $I_{SY}$         | $V_O = V_S/2$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$                             |      | 1.15     | 1.40 | $\text{mA}$                                   |
|                               |                  |  |      |          | 1.8  | $\text{mA}$                                   |
| <b>DYNAMIC PERFORMANCE</b>    |                  |  |      |          |      |   |
| Slew Rate                     | SR               | $R_L = 2\text{ k}\Omega$   |      | 3.5      |      | $\text{V}/\mu\text{s}$                        |
| Gain Bandwidth Product        | GBP              |  |      | 4        |      | $\text{MHz}$                                  |
| Phase Margin                  | $\Phi_O$         |  |      | 65       |      | Degrees                                       |
| <b>NOISE PERFORMANCE</b>      |                  |  |      |          |      |   |
| Peak-to-Peak Noise            | $e_n\text{ p-p}$ | $f = 0.1\text{ Hz to }10\text{ Hz}$  |      | 2.5      |      | $\mu\text{V p-p}$                             |
| Voltage Noise Density         | $e_n$            | $f = 1\text{ kHz}$   |      | 12       |      | $\text{nV}/\sqrt{\text{Hz}}$                  |
|                               |                  | $f = 10\text{ kHz}$  |      | 10       |      | $\text{nV}/\sqrt{\text{Hz}}$                  |
| Current Noise Density         | $i_n$            | $f = 1\text{ kHz}$   |      | 0.1      |      | $\text{pA}/\sqrt{\text{Hz}}$                  |

**AD8661 ELECTRICAL CHARACTERISTICS—LFCSP ONLY**

$V_S = 16.0\text{ V}$ ,  $V_{CM} = V_S/2$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

Table 4.

| Parameter                     | Symbol           | Test Conditions/Comments   | Min                     | Typ            | Max         | Unit   |
|-------------------------------|------------------|--|-------------------------|----------------|-------------|--|
| <b>INPUT CHARACTERISTICS</b>  |                  |  |                         |                |             |  |
| Offset Voltage                | $V_{OS}$         | $V_{CM} = V_S/2$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$                            |                         | 50             | 300         | $\mu\text{V}$                                    |
| Input Bias Current            | $I_B$            | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$  |                         | 0.3            | 1           | $\mu\text{A}$                                    |
| Input Offset Current          | $I_{OS}$         | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$  |                         | 0.2            | 0.5         | $\mu\text{A}$                                    |
| Input Voltage Range           |                  |  | -0.1                    |                | +14.0       | V  |
| Common-Mode Rejection Ratio   | CMRR             | $V_{CM} = -0.1\text{ V to }+14.0\text{ V}$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$  | 90                      | 110            |             | dB   |
| Large Signal Voltage Gain     | $A_{VO}$         | $R_L = 2\text{ k}\Omega$ , $V_O = 0.5\text{ V to }15.5\text{ V}$                             | 200                     | 420            |             | V/mV   |
| Offset Voltage Drift          | $TCV_{OS}$       | $-40^\circ\text{C} < T_A < +85^\circ\text{C}$  |                         | 4              | 17          | $\mu\text{V}/^\circ\text{C}$                     |
| <b>OUTPUT CHARACTERISTICS</b> |                  |  |                         |                |             |  |
| Output Voltage High           | $V_{OH}$         | $I_L = 1\text{ mA}$<br>$I_L = 10\text{ mA}$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$ | 15.95<br>15.60<br>15.50 | 15.97<br>15.70 |             | V<br>V<br>V                                      |
| Output Voltage Low            | $V_{OL}$         | $I_L = 1\text{ mA}$<br>$I_L = 10\text{ mA}$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$ |                         | 24<br>210      | 50<br>350   | mV<br>mV<br>mV                                   |
| Short-Circuit Current         | $I_{SC}$         |  |                         | $\pm 140$      |             | mA   |
| Closed-Loop Output Impedance  | $Z_{OUT}$        | $f = 1\text{ MHz}$ , $A_V = 1$   |                         | 45             |             | $\Omega$   |
| <b>POWER SUPPLY</b>           |                  |  |                         |                |             |  |
| Power Supply Rejection Ratio  | PSRR             | $V_S = 5\text{ V to }16\text{ V}$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$           | 95<br>95                | 110<br>115     |             | dB<br>dB   |
| Supply Current per Amplifier  | $I_{SY}$         | $V_O = V_S/2$<br>$-40^\circ\text{C} < T_A < +85^\circ\text{C}$                               |                         | 1.25           | 1.55<br>1.9 | mA<br>mA   |
| <b>DYNAMIC PERFORMANCE</b>    |                  |  |                         |                |             |  |
| Slew Rate                     | SR               | $R_L = 2\text{ k}\Omega$   |                         | 3.5            |             | V/ $\mu\text{s}$                                 |
| Gain Bandwidth Product        | GBP              |  |                         | 4              |             | MHz  |
| Phase Margin                  | $\Phi_O$         |  |                         | 65             |             | Degrees  |
| <b>NOISE PERFORMANCE</b>      |                  |  |                         |                |             |  |
| Peak-to-Peak Noise            | $e_n\text{ p-p}$ | $f = 0.1\text{ Hz to }10\text{ Hz}$  |                         | 2.5            |             | $\mu\text{V p-p}$                                |
| Voltage Noise Density         | $e_n$            | $f = 1\text{ kHz}$<br>$f = 10\text{ kHz}$  |                         | 12<br>10       |             | nV/ $\sqrt{\text{Hz}}$<br>nV/ $\sqrt{\text{Hz}}$ |
| Current Noise Density         | $i_n$            | $f = 1\text{ kHz}$   |                         | 0.1            |             | pA/ $\sqrt{\text{Hz}}$                           |

## ABSOLUTE MAXIMUM RATINGS

Table 5.

| Parameter                            | Rating          |
|--------------------------------------|-----------------|
| Supply Voltage                       | 18V             |
| Input Voltage                        | -0.1 V to $V_S$ |
| Differential Input Voltage           | 18V             |
| Output Short-Circuit Duration to GND | Indefinite      |
| Storage Temperature Range            | -60°C to +150°C |
| Operating Temperature Range          |                 |
| R-8, RM-8, R-14, and RU-14           | -40°C to +125°C |
| CP-8-13                              | -40°C to +85°C  |
| Junction Temperature Range           | -65°C to +150°C |
| Lead Temperature, Soldering (60 sec) | 300°C           |

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

## THERMAL RESISTANCE

$\theta_{JA}$  is specified for the worst-case conditions, that is, a device soldered in a circuit board for surface-mount packages.

Table 6. Thermal Resistance

| Package Type  | $\theta_{JA}$   | $\theta_{JC}$   | Unit |
|---------------|-----------------|-----------------|------|
| 8-Lead SOIC   | 121             | 43              | °C/W |
| 8-Lead LFCSP  | 75 <sup>1</sup> | 18 <sup>1</sup> | °C/W |
| 8-Lead MSOP   | 142             | 44              | °C/W |
| 14-Lead SOIC  | 88.2            | 56.3            | °C/W |
| 14-Lead TSSOP | 114             | 23.3            | °C/W |

<sup>1</sup> Exposed pad soldered to application board.

## ESD CAUTION



**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

TYPICAL PERFORMANCE CHARACTERISTICS



Figure 7. Input Offset Voltage Distribution

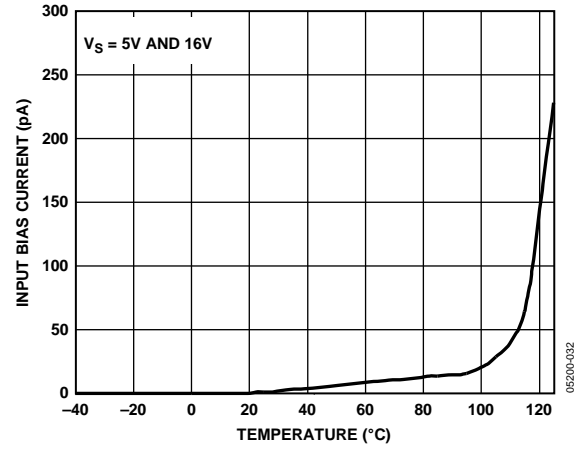


Figure 10. Input Bias Current vs. Temperature

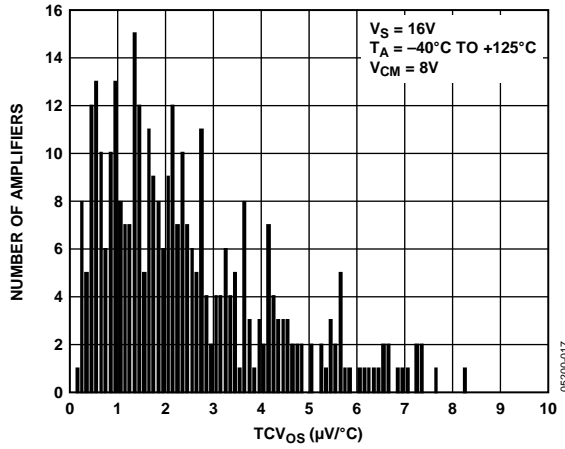


Figure 8. Offset Voltage Drift Distribution

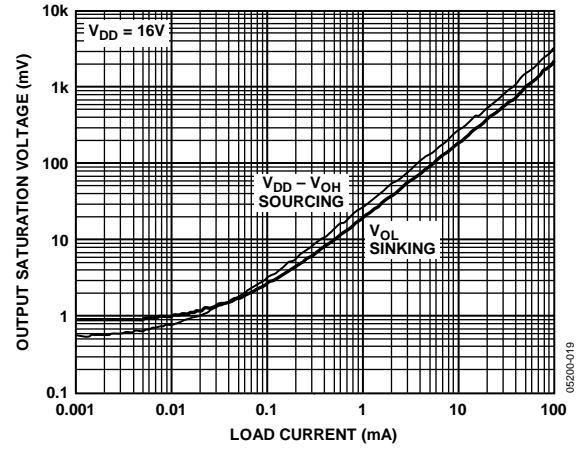


Figure 11. Output Swing Saturation Voltage vs. Load Current

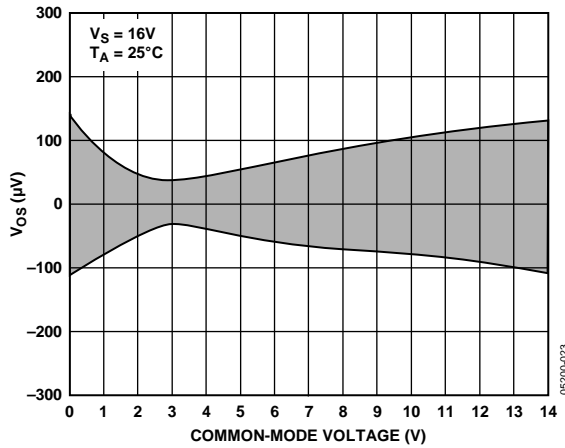


Figure 9. Input Offset Voltage vs. Common-Mode Voltage

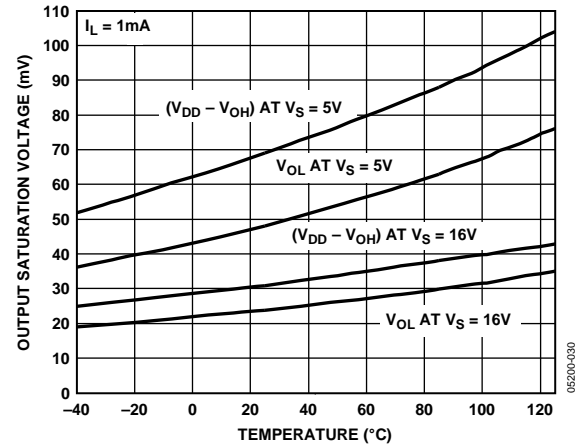


Figure 12. Output Swing Saturation Voltage vs. Temperature,  $I_L = 1 \text{ mA}$





Figure 13. Output Swing Saturation Voltage vs. Temperature,  $I_L = 10\text{ mA}$



Figure 16. CMRR vs. Frequency



Figure 14. Open-Loop Gain and Phase Shift vs. Frequency



Figure 17. PSRR vs. Frequency



Figure 15. Closed-Loop Output Impedance vs. Frequency



Figure 18. Small Signal Overshoot vs. Load Capacitance



Figure 19. Supply Current vs. Temperature



Figure 22. Small Signal Transient Response



Figure 20. Supply Current vs. Supply Voltage (Dual-Supply Configuration),  $T_A = 25^\circ\text{C}$



Figure 23. Large Signal Transient Response



Figure 21. 0.1 Hz to 10 Hz Input Voltage Noise



Figure 24. Positive Overload Recovery



Figure 25. Negative Overload Recovery

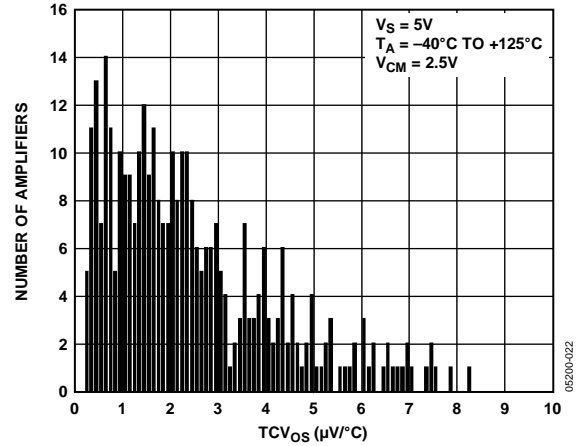


Figure 28. Offset Voltage Drift Distribution



Figure 26. Voltage Noise Density vs. Frequency

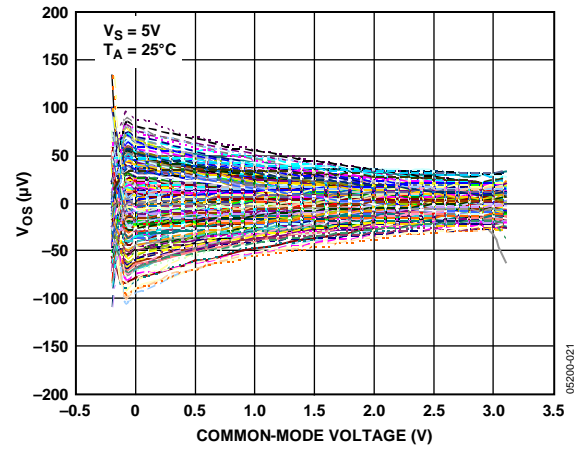


Figure 29. Input Offset Voltage vs. Common-Mode Voltage



Figure 27. Input Offset Voltage Distribution

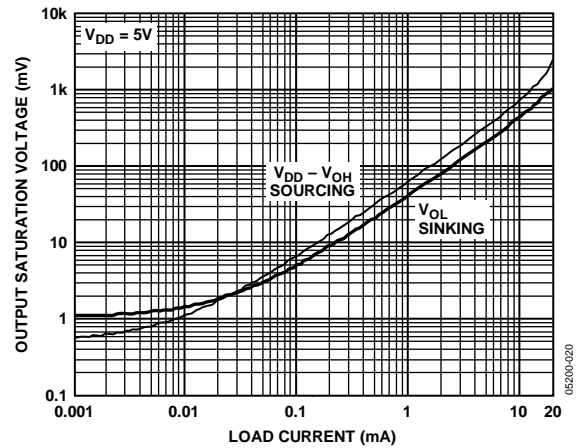


Figure 30. Output Swing Saturation Voltage vs. Load Current



Figure 31. Closed-Loop Output Impedance vs. Frequency

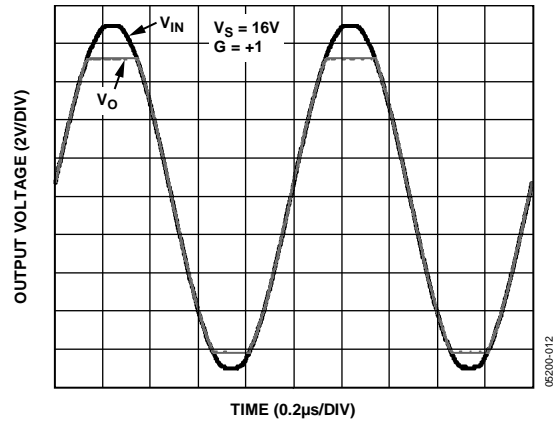


Figure 33. No Phase Reversal



Figure 32. Large Signal Transient Response

OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MS-012-A  
 CONTROLLING DIMENSIONS ARE IN MILLIMETERS; INCH DIMENSIONS  
 (IN PARENTHESES) ARE ROUNDED-OFF MILLIMETER EQUIVALENTS FOR  
 REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN.

060506-A

Figure 34. 8-Lead Small Outline Package [SOIC\_N]  
 Narrow Body  
 (R-8)

Dimensions shown in millimeters and (inches)



FOR PROPER CONNECTION OF  
 THE EXPOSED PAD, REFER TO  
 THE PIN CONFIGURATION AND  
 FUNCTION DESCRIPTIONS  
 SECTION OF THIS DATA SHEET.

COMPLIANT TO JEDEC STANDARDS MO-229-WEED-4

Figure 35. 8-Lead Lead Frame Chip Scale Package [LFCSP]  
 3 mm x 3 mm Body and 0.75 mm Package Height  
 (CP-8-13)

Dimensions shown in millimeters

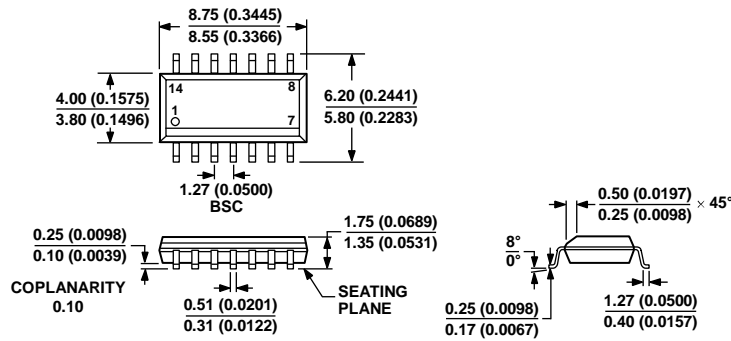
05-11-2016-A



COMPLIANT TO JEDEC STANDARDS MO-187-AA

Figure 36. 8-Lead Mini Small Outline Package [MSOP] (RM-8)

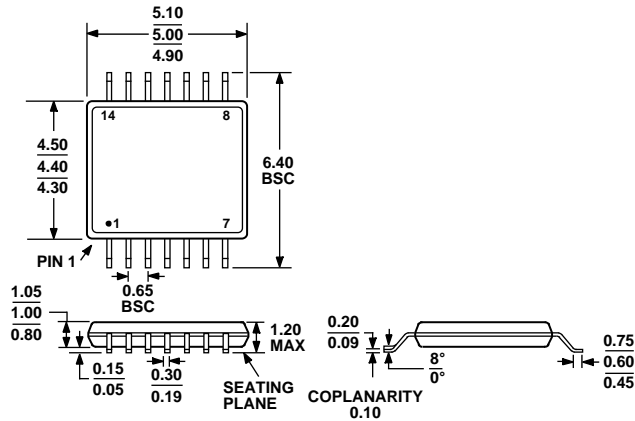
Dimensions shown in millimeters



COMPLIANT TO JEDEC STANDARDS MS-012-AB  
CONTROLLING DIMENSIONS ARE IN MILLIMETERS; INCH DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF MILLIMETER EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN.

Figure 37. 14-Lead Standard Small Outline Package [SOIC\_N] Narrow Body (R-14)

Dimensions shown in millimeters and (inches)



COMPLIANT TO JEDEC STANDARDS MO-153-AB-1

Figure 38. 14-Lead Thin Shrink Small Outline Package [TSSOP] (RU-14)

Dimensions shown in millimeters

## ORDERING GUIDE

| Model <sup>1</sup> | Temperature Range | Package Description                               | Package Option | Branding |
|--------------------|-------------------|---|----------------|----------|
| AD8661ARZ          | −40°C to +125°C   | 8-Lead Small Outline Package [SOIC_N]             | R-8            |          |
| AD8661ARZ-REEL     | −40°C to +125°C   | 8-Lead Small Outline Package [SOIC_N]             | R-8            |          |
| AD8661ARZ-REEL7    | −40°C to +125°C   | 8-Lead Small Outline Package [SOIC_N]             | R-8            |          |
| AD8661ACPZ-R2      | −40°C to +85°C    | 8-Lead Lead Frame Chip Scale Package [LFCSP]      | CP-8-13        | AOM      |
| AD8661ACPZ-REEL7   | −40°C to +85°C    | 8-Lead Lead Frame Chip Scale Package [LFCSP]      | CP-8-13        | AOM      |
| AD8662ARZ          | −40°C to +125°C   | 8-Lead Small Outline Package [SOIC_N]             | R-8            |          |
| AD8662ARZ-REEL     | −40°C to +125°C   | 8-Lead Small Outline Package [SOIC_N]             | R-8            |          |
| AD8662ARZ-REEL7    | −40°C to +125°C   | 8-Lead Small Outline Package [SOIC_N]             | R-8            |          |
| AD8662ARMZ         | −40°C to +125°C   | 8-Lead Mini Small Outline Package [MSOP]          | RM-8           | A10      |
| AD8662ARMZ-REEL    | −40°C to +125°C   | 8-Lead Mini Small Outline Package [MSOP]          | RM-8           | A10      |
| AD8664ARZ          | −40°C to +125°C   | 14-Lead Standard Small Outline Package [SOIC_N]   | R-14           |          |
| AD8664ARZ-REEL     | −40°C to +125°C   | 14-Lead Standard Small Outline Package [SOIC_N]   | R-14           |          |
| AD8664ARZ-REEL7    | −40°C to +125°C   | 14-Lead Standard Small Outline Package [SOIC_N]   | R-14           |          |
| AD8664ARUZ         | −40°C to +125°C   | 14-Lead Thin Shrink Small Outline Package [TSSOP] | RU-14          |          |
| AD8664ARUZ-REEL    | −40°C to +125°C   | 14-Lead Thin Shrink Small Outline Package [TSSOP] | RU-14          |          |

<sup>1</sup> Z = RoHS Compliant Part.

**NOTES**