

## Features

- Supply Range: 2.7V to 5.5V
- Low Offset Voltage: 1 $\mu$ V(TYP)
- Input Offset Drift: 0.005 $\mu$ V/ $^{\circ}$ C
- Gain Bandwidth: 10MHz
- Rail-to-Rail Input and Output
- High Slew rate: 5V/ $\mu$ s
- Operating Temperature: -40 $^{\circ}$ C ~ +125 $^{\circ}$ C
- Type Package:SOP-8

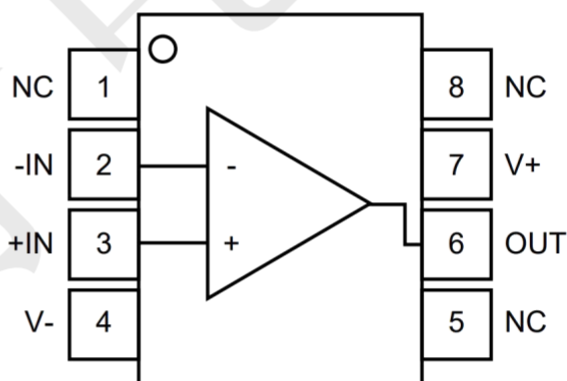
## Applications

- Temperature Sensors
- Battery-Powered Instruments
- Smoke/Gas/Environment Sensors
- Medical Equipment
- Portable Instruments and Mobile Device
- Active Filters
- Piezo Electrical Transducer Amplifier
- Sensor Interface
- Handheld Test Equipment

## General Description

The is Of CMOS operational amplifiers use auto-zero techniques to simultaneously provide very low offset voltage (5 $\mu$ V max) and near-zero drift over time and temperature. This family of amplifiers has ultra low noise, offset and power. This miniature, high-precision operational amplifiers offset high input impedance and rail-to-rail input and rail-to-rail output swing. With high gain-bandwidth product of 10MHz and slew rate of 5V/ $\mu$ s. Single or dual supplies as low as +2.7V( $\pm$ 1.35V) and up to +5.5V ( $\pm$ 2.75V) may be used.

## Pinout (top view)



## Pin Configurations

| Pin Number | Pin Name | Pin Function                      |
|------------|----------|-----------------------------------|
| 1          | NC       | Not connection                    |
| 2          | -IN      | Reverse input                     |
| 3          | +IN      | In-phase input                    |
| 4          | V-       | Chip Supply Voltage(Negative)/GND |
| 5          | NC       | Not connection                    |
| 6          | OUT      | Output                            |
| 7          | V+       | Chip Supply Voltage(Positive)/VDD |
| 8          | NC       | Not connection                    |

## Absolute Maximum Ratings

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

| PARAMETER                                 | MIN         | MAX         | UNIT |
|-------------------------------------------|-------------|-------------|------|
| Supply Voltage, $V_s=(V^+) - (V^-)$       | --          | 6           | V    |
| Input Terminal Voltage <sup>(2)</sup>     | $(V^-)-0.5$ | $(V^+)+0.5$ | V    |
| Input Terminal Current <sup>(2)</sup>     | -10         | +10         | mA   |
| Signal Output Current                     | -35         | +35         | mA   |
| Maximum Junction Temperature              | --          | +150        | °C   |
| Storage Temperature Range                 | -65         | +150        | °C   |
| Electrostatic discharge (HBM) $V_{(ESD)}$ | $\pm 2000$  |             | V    |

**Note 1:** Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

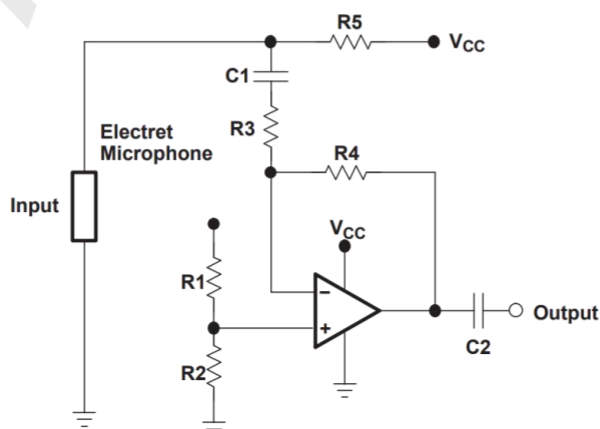
**Note 2:** Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.5V beyond the supply rails should be current-limited to 10mA or less.

## Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

| PARAMETER                           |               | MIN        | TYP | MAX        | UNIT |
|-------------------------------------|---------------|------------|-----|------------|------|
| Supply Voltage, $V_s=(V^+) - (V^-)$ | Signal-supply | 2.7        | --  | 5.5        | V    |
|                                     | Dual-supply   | $\pm 1.35$ | --  | $\pm 2.75$ | V    |
| Operating Temperature Range         |               | -40        | +25 | +125       | °C   |

## Typical Application



## Electrical Characteristics

(At  $T_A=+25^{\circ}\text{C}$ ,  $V_S=5\text{V}$ ,  $R_L=10\text{k}\Omega$  connected to  $V_S/2$ , and  $V_{OUT}=V_S/2$ , unless otherwise noted.)

| PARAMETER                          | SYMBOL       | CONDITIONS                                                  | MIN      | TYP      | MAX      | UNIT                           |
|------------------------------------|--------------|-------------------------------------------------------------|----------|----------|----------|--------------------------------|
| <b>POWER SUPPLY</b>                |              |                                                             |          |          |          |                                |
| Operating Voltage Range            | $V_S$        |                                                             | 2.7      | --       | 5.5      | V                              |
| Quiescent Current/Amplifier        | $I_Q$        |                                                             | --       | 700      | --       | $\mu\text{A}$                  |
| Power-Supply Rejection Ratio       | PSRR         | $V_S=2.7\text{V}$ to $5.5\text{V}$ , $V_{CM}=0\text{V}$     | 110      | 130      | --       | dB                             |
| <b>INPUT</b>                       |              |                                                             |          |          |          |                                |
| Input Offset Voltage               | $V_{OS}$     | $V_{CM}=V_S/2$                                              | --       | $\pm 1$  | $\pm 5$  | $\mu\text{V}$                  |
| Input Offset Voltage Average Drift | $dV_{OS}/dT$ |                                                             | --       | 0.005    | --       | $\mu\text{V}/^{\circ}\text{C}$ |
| Input Bias Current                 | $I_B$        | $V_{CM}=V_S/2$                                              | --       | $\pm 50$ | --       | pA                             |
| Input Offset Current               | $I_{OS}$     | $V_{CM}=V_S/2$                                              | --       | $\pm 10$ | --       | pA                             |
| Common-Mode Voltage Range          | $V_{CM}$     |                                                             | (V-)-0.1 |          | (V+)+0.1 | V                              |
| Common-Mode Rejection Ratio        | CMRR         | $(V-)-0.1\text{V} < V_{CM} < (V+)+0.1\text{V}$              | 110      | 130      | --       | dB                             |
| Input Differential Capacitance     |              |                                                             | --       | 1        | --       | pF                             |
| Input Common Capacitance           |              |                                                             | --       | 5        | --       | pF                             |
| <b>OUTPUT</b>                      |              |                                                             |          |          |          |                                |
| Open-Loop Voltage Gain             | $A_{OL}$     | $R_L=10\text{k}\Omega$ , $V_O=0.3\text{V}$ to $4.7\text{V}$ | 110      | 130      | --       | dB                             |
| Output Voltage High                | $V_{OH}$     | $R_L=100\text{k}\Omega$ to GND                              | 4.99     | 4.998    | --       | V                              |
|                                    |              | $R_L=10\text{k}\Omega$ to GND                               | 4.95     | 4.98     | --       | V                              |
| Output Voltage Low                 | $V_{OL}$     | $R_L=100\text{k}\Omega$ to V+                               | --       | 1        | 10       | mV                             |
|                                    |              | $R_L=10\text{k}\Omega$ to V+                                | --       | 10       | 30       | mV                             |
| Short-Circuit Current              | $I_{OUT}$    |                                                             | --       | 35       | --       | mA                             |
| <b>FREQUENCY RESPONSE</b>          |              |                                                             |          |          |          |                                |
| Slew Rate                          | SR           | $G=+1$                                                      | --       | 5        | --       | V/ $\mu\text{s}$               |
| Gain-Bandwidth Product             | GBW          |                                                             | --       | 10       | --       | MHz                            |
| Overload Recovery Time             |              |                                                             | --       | 1        | --       | $\mu\text{s}$                  |
| <b>NOISE</b>                       |              |                                                             |          |          |          |                                |
| Input Voltage Noise                | $e_{n-p-p}$  | $f=0.01\text{Hz}$ to $10\text{Hz}$                          | --       | 0.75     | --       | $\mu\text{Vpp}$                |
|                                    |              | $f=0.01\text{Hz}$ to $1\text{Hz}$                           | --       | 0.22     | --       | $\mu\text{Vpp}$                |
| Input Voltage Noise Density        | $e_n$        | $f=1\text{KHz}$                                             | --       | 35       | --       | nV/Hz                          |

## TYPICAL CHARACTERISTICS

(At  $T_A=+25^{\circ}\text{C}$ ,  $V_S=5\text{V}$ ,  $R_L = 10\text{k}\Omega$  connected to  $V_S/2$ ,  $V_{OUT}=V_S/2$ , unless otherwise noted.)

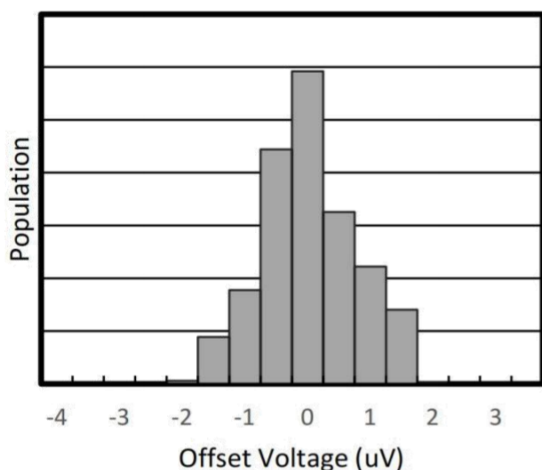


Figure 1. Offset Voltage Production Distribution

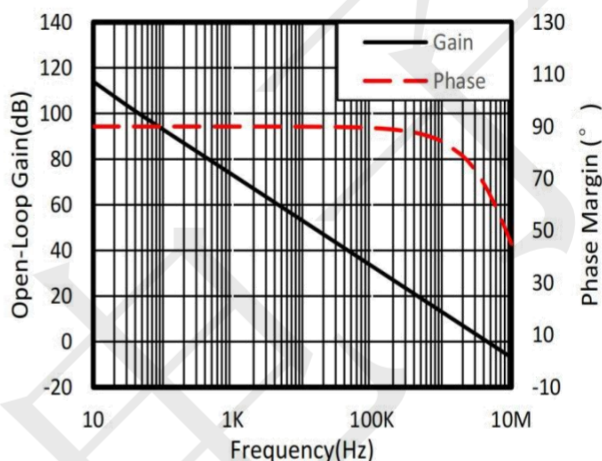


Figure 2. Open-Loop Gain And Phase vs Frequency

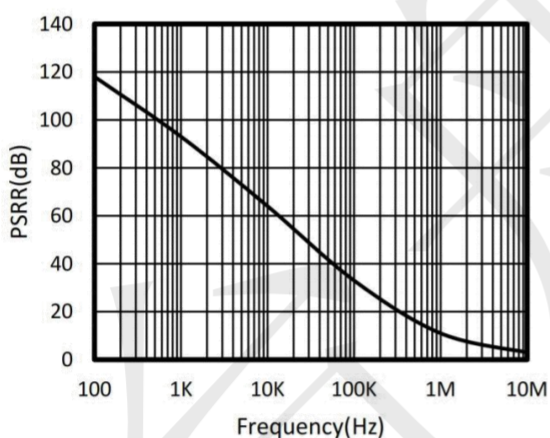


Figure 3. Power-Supply Rejection Ratio vs Frequency

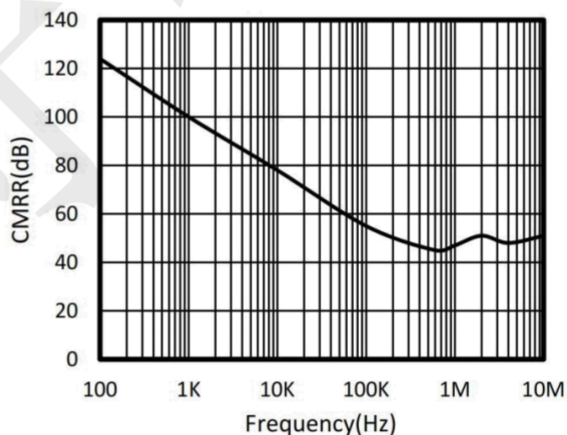


Figure 4. Common-Mode Rejection Ratio vs Frequency

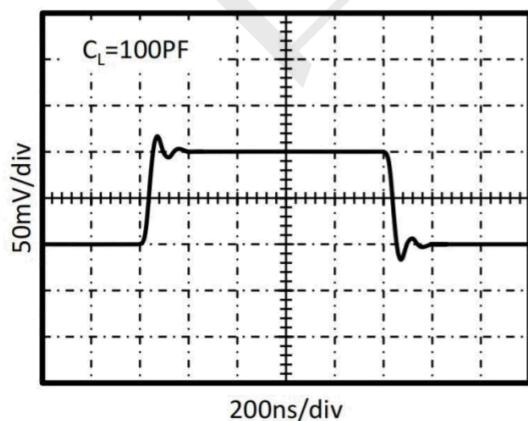


Figure 5. Small-Signal Step Response

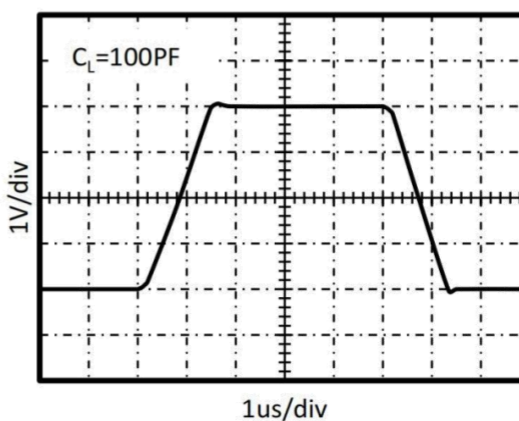
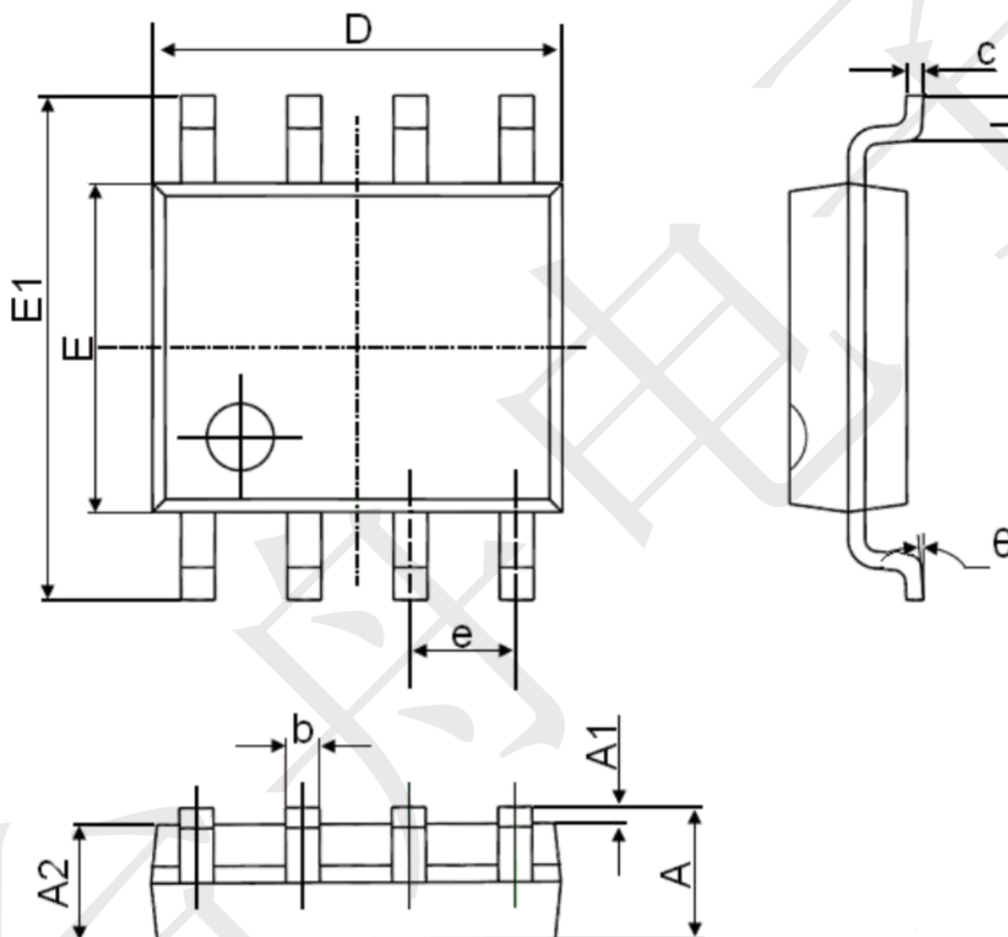


Figure 6. Large-Signal Step Response

**Package information (Unit: mm)**

**SOP-8**



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 1.350                     | 1.750 | 0.053                | 0.069 |
| A1     | 0.100                     | 0.250 | 0.004                | 0.010 |
| A2     | 1.350                     | 1.550 | 0.053                | 0.061 |
| b      | 0.330                     | 0.510 | 0.013                | 0.020 |
| c      | 0.170                     | 0.250 | 0.006                | 0.010 |
| D      | 4.700                     | 5.100 | 0.185                | 0.200 |
| E      | 3.800                     | 4.000 | 0.150                | 0.157 |
| E1     | 5.800                     | 6.200 | 0.228                | 0.244 |
| e      | 1.270(BSC)                |       | 0.050(BSC)           |       |
| L      | 0.400                     | 1.270 | 0.016                | 0.050 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |