

### Features

- Supply Range: 2.2V to 5.5V
- Supply Current: 510 $\mu$ A/ch
- Input Offset Voltage: 2.5mV (MAX)
- Gain Bandwidth: 8MHz
- Rail-to-Rail Input and Output
- Slew rate: 6.5V/ $\mu$ s
- Operating Temperature: -40°C ~ +85°C
- Type Package: SOT23-5

### Applications

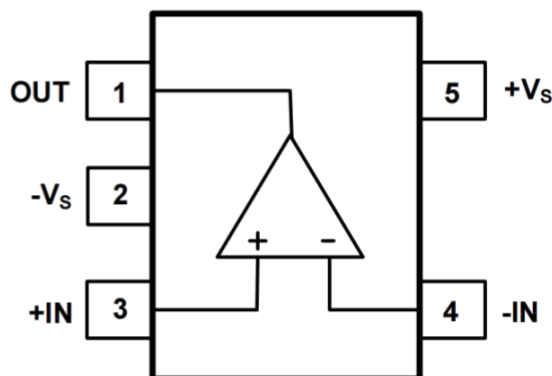
- Temperature Sensors
- Battery-Powered Instruments
- Smoke/Gas/Environment Sensors
- Medical Equipment
- Portable Instruments and Mobile Device
- Active Filters
- Piezo Electrical Transducer Amplifier
- Sensor Interface
- Handheld Test Equipment

### General Description

The families of products offer low voltage operation and rail-to-rail input and output, as well as excellent speed/power consumption ratio, providing an excellent bandwidth (8MHz), a slew rate of 6.5V/ $\mu$ s, and a quiescent current of 510 $\mu$ A/amplifier at 5V. The op-amps are unity gain stable and feature an ultra-low input bias current.

They are designed to provide optimal performance in low-voltage systems. They provide rail-to-rail I/O, and the maximum input offset voltage are 2.5mV for the devices. Their capacitive load capability is also good at low supply voltages.

### Pinout (top view)



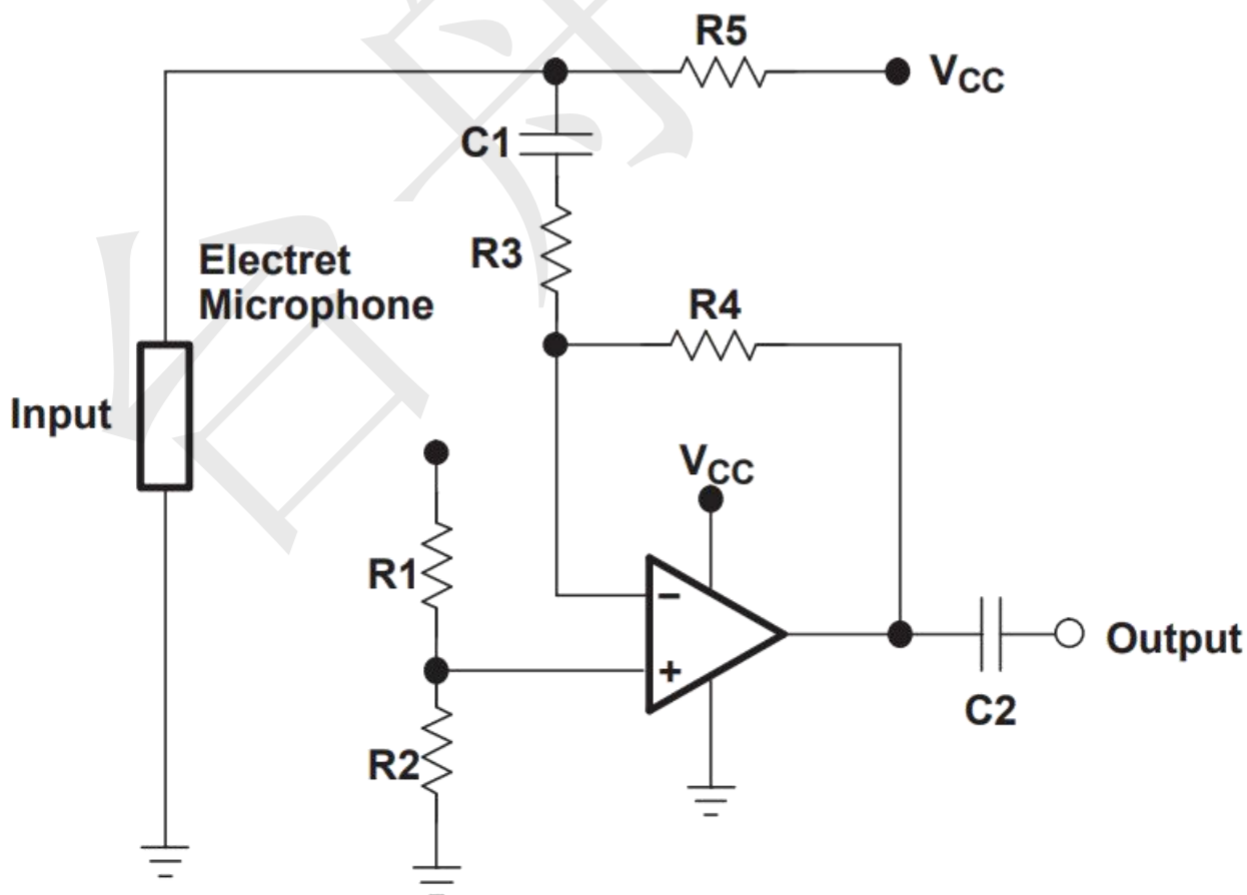
### Pin Configurations

| Pin Number | Pin Name | Pin Function                      |
|------------|----------|-----------------------------------|
| 1          | OUT      | Output                            |
| 2          | -Vs      | Chip Supply Voltage(Negative)/GND |
| 3          | +IN      | In-phase input                    |
| 4          | -IN      | Reverse input                     |
| 5          | +Vs      | Chip Supply Voltage(Positive)/VDD |

### Absolute Maximum Ratings (@TA = +25°C, unless otherwise specified.)

| Condition   |                                       | Rating            | UNIT |
|-------------|---------------------------------------|-------------------|------|
| VDD to GND  | Power Supply Voltage                  | -0.5V~+6V         | V    |
| IN+ or IN-  | Signal Input Terminals Voltage        | GND-0.5V~VDD+0.5V | V    |
| IIN         | Signal Input Terminals Current        | -10 ~ +10         | mA   |
| IOUT        | Signal output Terminals Current       | -200 ~ +200       | mA   |
| IOUT to GND | Output Short-Circuit                  | Continuous        | mA   |
| LT          | Lead Temperature (Soldering, 10 sec.) | 260               | °C   |
| TA          | Operating Temperature Range           | -40      85       | °C   |
| TJ          | Junction Temperature                  | -40      150      | °C   |
| Tstg        | Storage Temperature Range             | -65      150      | °C   |

### Typical Application



### Electrical Characteristics

(At  $T_A = +25^\circ\text{C}$ ,  $V_S = +5\text{V}$ ,  $V_{IN}=V_{OUT}= V_S/2$ , unless otherwise noted.)

| PARAMETER            |                                       | CONDITIONS                          | MIN             | TYP | MAX                  | UNIT             |
|----------------------|---------------------------------------|-------------------------------------|-----------------|-----|----------------------|------------------|
| OFFSET VOLTAGE       |                                       |                                     |                 |     |                      |                  |
| V <sub>OS</sub>      | Input Offset Voltage                  |                                     | -2.5            | 0.8 | 2.5                  | mV               |
| dV <sub>OS</sub> /dT | Input Offset Voltage<br>Average Drift | T <sub>A</sub> = -40°C to 85°C      | --              | 0.6 | --                   | μV/°C            |
| INPUT CURRENT        |                                       |                                     |                 |     |                      |                  |
| I <sub>B</sub>       | Input Bias Current                    |                                     | --              | 10  | --                   | pA               |
| I <sub>OS</sub>      | Input Offset Current                  |                                     | --              | 5   | --                   | pA               |
| NOISE                |                                       |                                     |                 |     |                      |                  |
| V <sub>N</sub>       | Input Voltage Noise                   | f=0.1Hz to 10Hz                     | --              | 4   | --                   | μV <sub>PP</sub> |
| e <sub>n</sub>       | Input Voltage Noise PSD               | f=1kHz                              | --              | 8   | --                   | nV/√Hz           |
| INPUT VOLTAGE        |                                       |                                     |                 |     |                      |                  |
| V <sub>CM</sub>      | Common-Mode Voltage<br>Range          |                                     | V <sub>S-</sub> | --  | V <sub>S+</sub> +0.1 | V                |
| CMRR                 | Common-Mode Rejection<br>Ratio        | V <sub>CM</sub> =0.1V to 4V         | 85              | 95  | --                   | dB               |
| FREQUENCY RESPONSE   |                                       |                                     |                 |     |                      |                  |
| GBW                  | Gain-Bandwidth Product                |                                     | --              | 8   | --                   | MHz              |
| SR                   | Slew Rate                             | G = +1,<br>V <sub>IN</sub> =2V Step | --              | 6   | --                   | V/μs             |
| t <sub>s</sub>       | Settling Time                         | G = +1,<br>V <sub>IN</sub> =2V Step | --              | 0.6 | --                   | μs               |

### Electrical Characteristics

(At  $T_A = +25^\circ\text{C}$ ,  $V_S = +5\text{V}$ ,  $V_{IN}=V_{OUT}= V_S/2$ , unless otherwise noted.)

| PARAMETER    |                              | CONDITIONS                       | MIN | TYP | MAX  | UNIT    |
|--------------|------------------------------|----------------------------------|-----|-----|------|---------|
| OUTPUT       |                              |                                  |     |     |      |         |
| $A_v$        | Open-Loop Voltage Gain       | $V_{OUT}=0.5V$ to $4.8V$         | 95  | 105 | --   | dB      |
| $V_{OH}$     | High output voltage swing    | $R_L=10k\Omega$                  | --  | --  | 5    | mV      |
| $V_{OL}$     | Low output voltage swing     | $R_L=10k\Omega$                  | --  | --  | 5    | mV      |
| $I_{SC}$     | Output Short-Circuit Current | Source Current                   | --  | 26  | --   | mA      |
|              |                              | Sink Current                     | --  | 50  | --   | mA      |
| $C_L^{(1)}$  | Capacitive Load Drive        | $G = +1$ ,<br>$V_{IN}=0.2V$ Step | --  | --  | 1000 | pF      |
| POWER SUPPLY |                              |                                  |     |     |      |         |
| PSRR         | Power-Supply Rejection Ratio | $V_S=2.5V$ to $5.5V$             | 90  | 100 | --   | dB      |
| $V_S$        | Operating Voltage Range      | $I_O=0A$                         | 2.2 | --  | 5.5  | V       |
| $I_Q$        | Quiescent Current/Amplifier  | $I_O=0A$                         | --  | 510 | 600  | $\mu A$ |

**Note 1:** Capacitive load drive means that above a given maximum value, the output waveform will oscillate under the step response.

## TYPICAL CHARACTERISTICS

(At  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 2.5\text{V}$ ,  $V_{IN} = V_{OUT} = V_S/2$ , unless otherwise noted.)

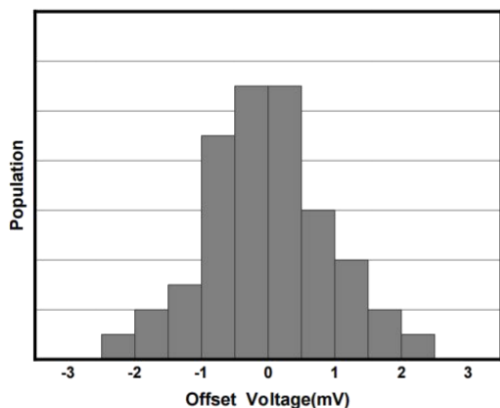


Figure 2. Offset Voltage Production Distribution

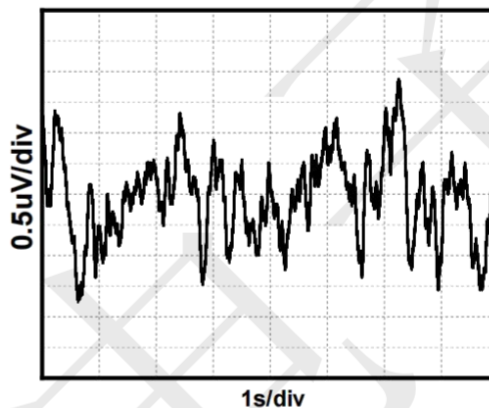


Figure 3. 0.1Hz to 10Hz Noise

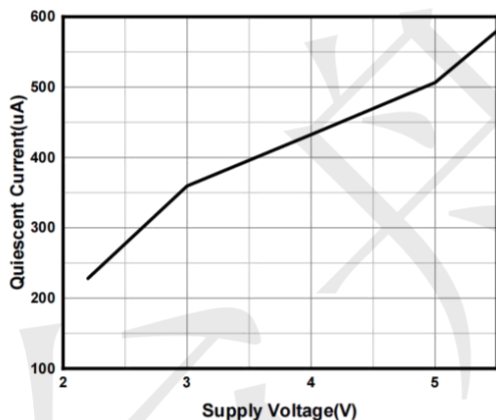


Figure 4. Quiescent Current vs Supply Voltage

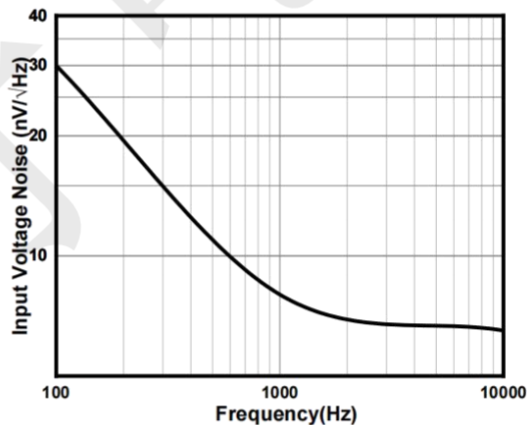


Figure 5. Input Voltage Noise Spectral Density

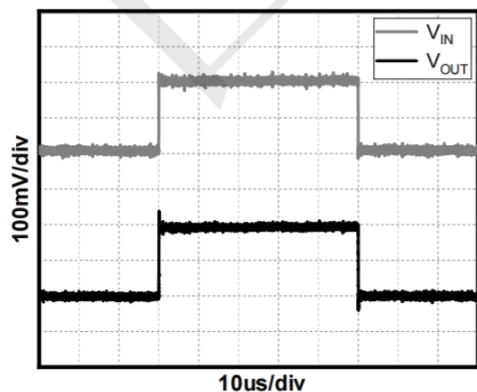


Figure 6. Small-Signal Step Response

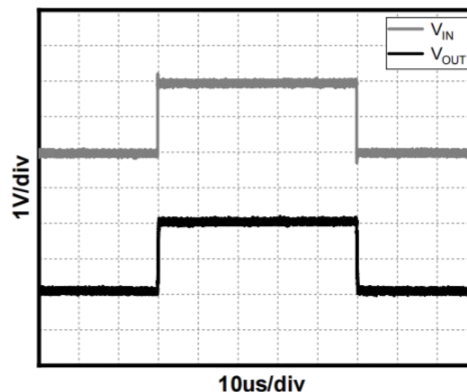
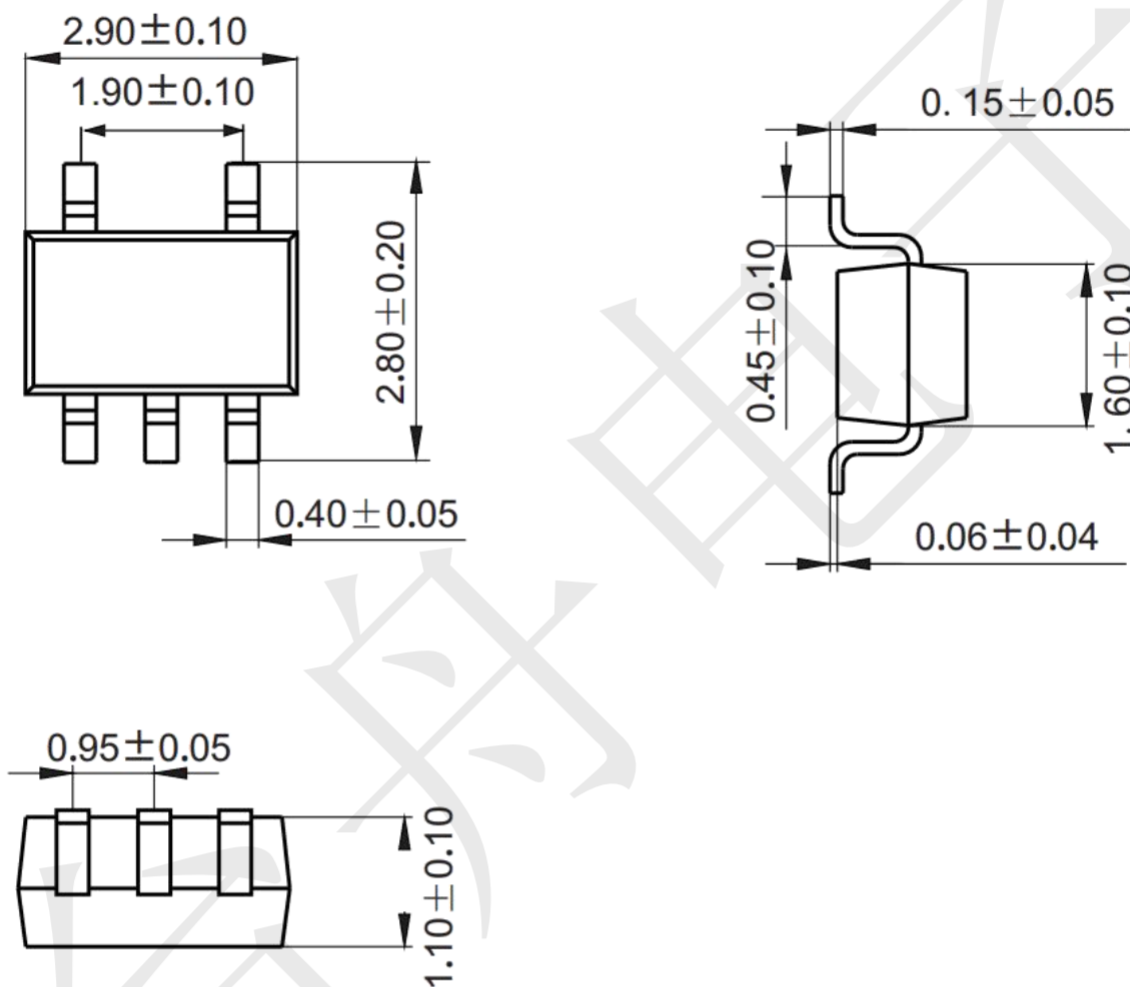


Figure 7. Large-Signal Step Response

**Package informantion (Unit: mm)**

SOT23-5



**Mounting Pad Layout (Unit: mm)**

