

## FEATURES

- *Guaranteed 150 $\mu$ V max. Offset Voltage*
- *Guaranteed 1.8 $\mu$ V/ $^{\circ}$ C max. Offset Voltage Drift with Temperature*
- *Excellent 2.0 $\mu$ V/Month max. Long Term Stability*
- *Guaranteed 0.65 $\mu$ Vp-p max. Noise*
- *Guaranteed 7nA max. Input Bias Current*

## APPLICATIONS

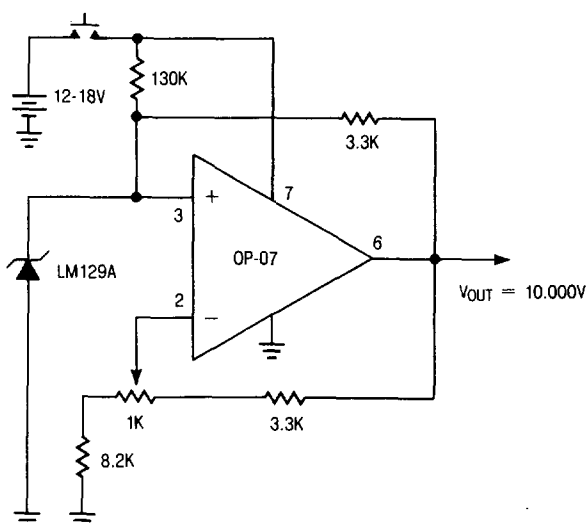
- Thermocouple Amplifiers
- Strain Gauge Amplifiers
- Low Level Signal Processing
- Medical Instrumentation

## DESCRIPTION

The OP-07 offers excellent performance in applications requiring low offset voltage, low drift with time and temperature and very low noise. Linear's OP-07 is interchangeable with many of the precision op amp device types. The OP-07 also offers a wide input voltage range, high common-mode rejection and low input bias current. These features result in optimum performance for small signal level and low frequency applications. Use of advanced design, processing and testing techniques make Linear's OP-07 a superior choice over similar products. A buffered reference application is shown below. For single op amp applications requiring higher performance in the SO package, see the LT1001CS8.

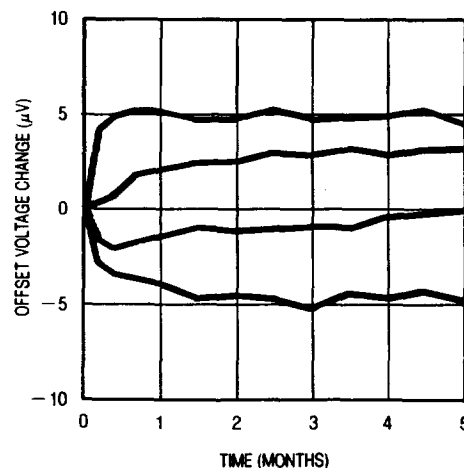
**2**

**Precision Buffered Single Supply Reference**



The OP-07 contributes less than 5% of the total drift with temperature, noise and long term drift of the reference application.

**Long Term Stability of Four Representative Units**



## ABSOLUTE MAXIMUM RATINGS

|                                             |                                  |
|---------------------------------------------|----------------------------------|
| Supply Voltage .....                        | $\pm 22V$                        |
| Differential Input Voltage .....            | $\pm 30V$                        |
| Input Voltage Equal to Supply Voltage       |                                  |
| Output Short Circuit Duration .....         | Indefinite                       |
| Operating Temperature Range .....           | $0^{\circ}C$ to $70^{\circ}C$    |
| Storage Temperature Range                   |                                  |
| All Devices .....                           | $-65^{\circ}C$ to $150^{\circ}C$ |
| Lead Temperature (Soldering, 10 sec.) ..... | $300^{\circ}C$                   |

## PACKAGE/ORDER INFORMATION

|                                                  |                   |
|--------------------------------------------------|-------------------|
| <p>TOP VIEW</p> <p>S8 PACKAGE<br/>PLASTIC SO</p> | ORDER PART NUMBER |
|                                                  | OP-07CS8          |
|                                                  | PART MARKING      |
|                                                  | OP07CS8           |

ELECTRICAL CHARACTERISTICS  $V_S = \pm 15V$ ,  $T_A = 25^{\circ}C$ , unless otherwise noted.

| SYMBOL                                     | PARAMETER                                | CONDITIONS                                                                                            | OP-07CS8                 |                                        |           | UNITS                 |
|--------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------|----------------------------------------|-----------|-----------------------|
|                                            |                                          |                                                                                                       | MIN                      | TYP                                    | MAX       |                       |
| $V_{OS}$                                   | Input Offset Voltage                     | (Note 1)                                                                                              |                          | 60                                     | 150       | $\mu V$               |
| $\frac{\Delta V_{OS}}{\Delta \text{Time}}$ | Long Term Input Offset Voltage Stability | (Notes 2 and 3)                                                                                       |                          | 0.4                                    | 2.0       | $\mu V/\text{Month}$  |
| $I_{OS}$                                   | Input Offset Current                     |                                                                                                       |                          | 0.8                                    | 6.0       | nA                    |
| $I_B$                                      | Input Bias Current                       |                                                                                                       |                          | $\pm 1.8$                              | $\pm 7.0$ | nA                    |
| $e_n$                                      | Input Noise Voltage                      | 0.1Hz to 10Hz (Note 2)                                                                                |                          | 0.35                                   | 0.65      | $\mu V_{p-p}$         |
|                                            | Input Noise Voltage Density              | $f_0 = 10\text{Hz}$                                                                                   |                          | 10.5                                   | 20.0      | $nV/\sqrt{\text{Hz}}$ |
|                                            |                                          | $f_0 = 100\text{Hz}$ (Note 2)                                                                         |                          | 10.2                                   | 13.5      | $nV/\sqrt{\text{Hz}}$ |
|                                            |                                          | $f_0 = 1000\text{Hz}$                                                                                 |                          | 9.8                                    | 11.5      | $nV/\sqrt{\text{Hz}}$ |
| $I_n$                                      | Input Noise Current                      | 0.1Hz to 10Hz (Note 2)                                                                                |                          | 15                                     | 35        | $pA_{p-p}$            |
|                                            | Input Noise Current Density              | $f_0 = 10\text{Hz}$                                                                                   |                          | 0.32                                   | 0.90      | $pA/\sqrt{\text{Hz}}$ |
|                                            |                                          | $f_0 = 100\text{Hz}$ (Note 2)                                                                         |                          | 0.15                                   | 0.27      | $pA/\sqrt{\text{Hz}}$ |
|                                            |                                          | $f_0 = 1000\text{Hz}$                                                                                 |                          | 0.13                                   | 0.18      | $pA/\sqrt{\text{Hz}}$ |
| $R_{in}$                                   | Input Resistance Differential Mode       | (Note 4)                                                                                              | 8                        | 33                                     |           | M $\Omega$            |
|                                            | Input Resistance Common-Mode             |                                                                                                       |                          | 120                                    |           | G $\Omega$            |
|                                            | Input Voltage Range                      |                                                                                                       | $\pm 13.0$               | $\pm 14.0$                             |           | V                     |
| CMRR                                       | Common-Mode Rejection Ratio              | $V_{CM} = \pm 13V$                                                                                    | 100                      | 120                                    |           | dB                    |
| PSRR                                       | Power Supply Rejection Ratio             | $V_S = \pm 3V$ to $\pm 18V$                                                                           | 90                       | 104                                    |           | dB                    |
| $A_{VOL}$                                  | Large Signal Voltage Gain                | $R_L = 2k\Omega$ , $V_O = \pm 10V$<br>$R_L = 500\Omega$ , $V_O = \pm 0.5V$<br>$V_S = \pm 3V$ (Note 4) | 120<br>100               | 400<br>400                             |           | $V/mV$<br>$V/mV$      |
| $V_O$                                      | Maximum Output Voltage Swing             | $R_L = 10k\Omega$<br>$R_L \geq 2k\Omega$<br>$R_L \geq 1k\Omega$                                       | $\pm 12.5$<br>$\pm 11.5$ | $\pm 13.0$<br>$\pm 12.8$<br>$\pm 12.0$ |           | V<br>V<br>V           |
| SR                                         | Slewing Rate                             | $R_L \geq 2k\Omega$ (Note 2)                                                                          | 0.1                      | 0.25                                   |           | $V/\mu s$             |
| GBW                                        | Closed Loop Bandwidth                    | $A_{VOL} = +1$ (Note 2)                                                                               | 0.4                      | 0.6                                    |           | MHz                   |
| $Z_o$                                      | Open Loop Output Impedance               | $V_O = 0$ , $I_O = 0$ , $f = 10\text{Hz}$                                                             |                          | 60                                     |           | $\Omega$              |
| $P_d$                                      | Power Dissipation                        | $V_S = \pm 15V$<br>$V_S = \pm 3V$                                                                     |                          | 80<br>4                                | 150<br>8  | mW<br>mW              |
|                                            | Offset Adjustment Range                  | Null Pot = $20k\Omega$                                                                                |                          | $\pm 4$                                |           | mV                    |

**ELECTRICAL CHARACTERISTICS**  $V_S = \pm 15V$ ,  $0^\circ C \leq T_A \leq 70^\circ C$ , unless otherwise noted.

| SYMBOL                              | PARAMETER                                                                         | CONDITIONS                            |   | OP-07CS8   |            |            | UNITS                                |
|-------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------|---|------------|------------|------------|--------------------------------------|
|                                     |                                                                                   |                                       |   | MIN        | TYP        | MAX        |                                      |
| $V_{OS}$                            | Input Offset Voltage                                                              |                                       | ● |            | 85         | 250        | $\mu V$                              |
| $\frac{\Delta V_{OS}}{\Delta Temp}$ | Average Input Offset Voltage Drift<br>Without External Trim<br>With External Trim | Null Pot = 20k $\Omega$ (Note 2)      | ● |            | 0.5<br>0.4 | 1.8<br>1.6 | $\mu V/^\circ C$<br>$\mu V/^\circ C$ |
| $I_{OS}$                            | Input Offset Current                                                              |                                       | ● |            | 1.6        | 8.0        | nA                                   |
| $\frac{\Delta I_{OS}}{\Delta Temp}$ | Average Input Offset Current Drift                                                | (Note 2)                              | ● |            | 12         | 50         | pA/°C                                |
| $I_B$                               | Input Bias Current                                                                |                                       | ● |            | $\pm 2.2$  | $\pm 9.0$  | nA                                   |
| $\frac{\Delta I_B}{\Delta Temp}$    | Average Input Bias Current Drift                                                  | (Note 2)                              | ● |            | 18         | 50         | pA/°C                                |
|                                     | Input Voltage Range                                                               |                                       | ● | $\pm 13.0$ | $\pm 13.5$ |            | V                                    |
| CMRR                                | Common-Mode Rejection Ratio                                                       | $V_{CM} = \pm 13V$                    | ● | 97         | 120        |            | dB                                   |
| PSRR                                | Power Supply Rejection Ratio                                                      | $V_S = \pm 3V$ to $\pm 18V$           | ● | 86         | 100        |            | dB                                   |
| $A_{VOL}$                           | Large Signal Voltage Gain                                                         | $R_L \geq 2k\Omega$ , $V_O = \pm 10V$ | ● | 100        | 400        |            | V/mV                                 |
| $V_{OUT}$                           | Output Voltage Swing                                                              | $R_L \geq 2k\Omega$                   | ● | $\pm 11.0$ | $\pm 12.6$ |            | V                                    |

The ● denotes specifications which apply over the full operating temperature range.

**Note 1:** Offset voltage is measured with high speed test equipment, approximately 1 second after power is applied.

**Note 2:** This parameter is tested on a sample basis only.

**Note 3:** Long Term Input Offset Voltage Stability refers to the averaged trend line of  $V_{OS}$  versus Time over extended periods after the first 30 days of operation. Excluding the initial hour of operation, changes in  $V_{OS}$  during the first 30 operating days are typically 2.5 $\mu V$ .

**Note 4:** This parameter is guaranteed by design.