

## FEATURES

- 14V/μs Slew Rate: 10V/μs Min
- 5MHz Gain-Bandwidth Product
- Fast Settling Time: 1.3μs to 0.02%
- 150μV Offset Voltage (LT1057): 450μV Max
- 180μV Offset Voltage (LT1058): 600μV Max
- 2μV/°C  $V_{OS}$  Drift: 7μV/°C Max
- 50pA Bias Current at 70°C
- Low Voltage Noise:
  - 13nV/√Hz at 1kHz
  - 26nV/√Hz at 10Hz

## APPLICATIONS

- Precision, High Speed Instrumentation
- Fast, Precision Sample-and-Hold
- Logarithmic Amplifiers
- D/A Output Amplifiers
- Photodiode Amplifiers
- Voltage-to-Frequency Converters
- Frequency-to-Voltage Converters

## DESCRIPTION

The LT<sup>®</sup>1057 is a matched JFET input dual op amp in the industry standard 8-pin configuration, featuring a combination of outstanding high speed and precision specifications. It replaces all the popular bipolar and JFET input dual op amps. In particular, the LT1057 upgrades the performance of systems using the LF412A and OP-215 JFET input duals.

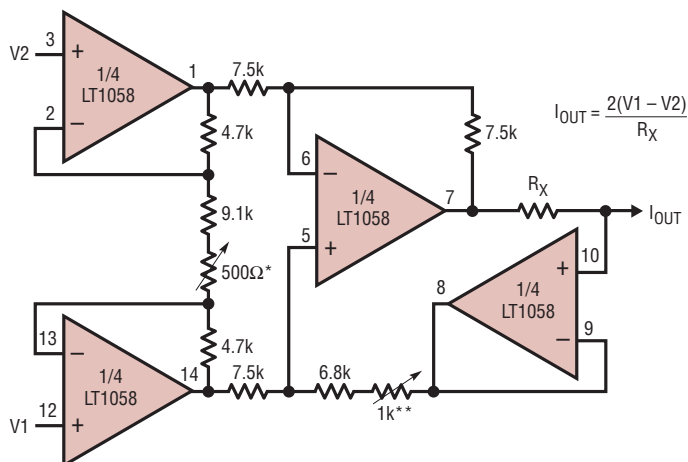
The LT1058 is the lowest offset quad JFET input operational amplifier in the standard 14-pin configuration. It offers significant accuracy improvement over presently available JFET input quad operational amplifiers. The LT1058 can replace four single precision JFET input op amps, while saving board space, power dissipation and cost.

Both the LT1057 and LT1058 are available in the plastic PDIP package and the surface mount SO package.

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## TYPICAL APPLICATION

**Current Output, High Speed, High Input Impedance  
Instrumentation Amplifier**

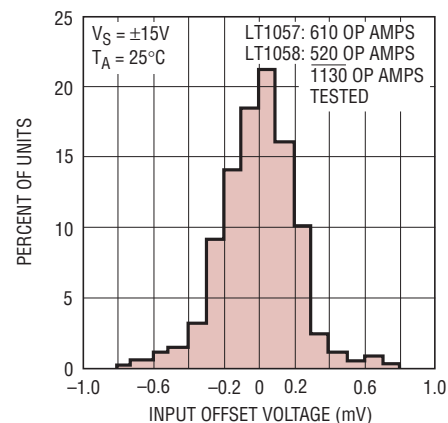


\*GAIN ADJUST

\*\*COMMON MODE REJECTION ADJUST  
BANDWIDTH ≈ 2MHz

10578 TA01

**Distribution of Offset Voltage  
(All Packages, LT1057 and LT1058)**



10578 TA01b

# LT1057/LT1058

## ABSOLUTE MAXIMUM RATINGS (Note 1)

|  |                |
|--|----------------|
| Supply Voltage .....                       | ±20V           |
| Differential Input Voltage.....            | ±40V           |
| Input Voltage.....                         | ±20V           |
| Output Short-Circuit Duration .....        | Indefinite     |
| Storage Temperature Range.....             | -65°C to 150°C |
| Lead Temperature (Soldering, 10 sec) ..... | 300°C          |

### Operating Temperature Range

|  |                               |
|--|-------------------------------|
| LT1057AM/LT1057M/<br>LT1058AM/LT1058M ( <b>OBSOLETE</b> )..... | -55°C to 125°C                |
| LT1057AC/LT1057C/LT1057S<br>LT1058AC/LT1058C/LT1058S.....      | 0°C to 70°C                   |
| LT1057I.....   | -40°C ≤ T <sub>A</sub> ≤ 85°C |

## PACKAGE/ORDER INFORMATION

|   |   |   |   |
|---|---|---|---|
| <p>SW PACKAGE<br/>16-LEAD PLASTIC (WIDE) SO<br/>T<sub>JMAX</sub> = 150°C, θ<sub>JA</sub> = 90°C/W</p>   | <p>SW PACKAGE<br/>16-LEAD PLASTIC (WIDE) SO<br/>T<sub>JMAX</sub> = 150°C, θ<sub>JA</sub> = 90°C/W</p>           | <p>S8 PACKAGE<br/>8-LEAD PLASTIC SO<br/>T<sub>JMAX</sub> = 150°C, θ<sub>JA</sub> = 200°C/W</p> <p>Please note that the LT1057S8/LT1057IS8 standard surface mount pin-out differs from that of the LT1057 standard CERDIP/PDIP packages.</p> | <p>ORDER PART NUMBER</p> <p>LT1057S8<br/>LT1057IS8</p> <p>S8 PART MARKING</p> <p>1057<br/>1057I</p> |
| <p>ORDER PART NUMBER</p> <p>LT1057SW<br/>LT1057ISW</p>  | <p>ORDER PART NUMBER</p> <p>LT1058SW<br/>LT1058ISW</p>  | <p>H PACKAGE 8-LEAD METAL CAN</p>   | <p>ORDER PART NUMBER</p> <p>LT1057AMH<br/>LT1057MH<br/>LT1057ACH<br/>LT1057CH</p>                   |
| <p>N14 PACKAGE<br/>14-LEAD PDIP<br/>T<sub>JMAX</sub> = 125°C, θ<sub>JA</sub> = 130°C/W</p> <p>J14 PACKAGE 14-LEAD CERDIP<br/>T<sub>JMAX</sub> = 150°C, θ<sub>JA</sub> = 100°C/W</p> | <p>ORDER PART NUMBER</p> <p>LT1058ACN<br/>LT1058CN</p> <p>LT1058AMJ<br/>LT1058MJ<br/>LT1058ACJ<br/>LT1058CJ</p> | <p>ORDER PART NUMBER</p> <p>LT1057ACN8<br/>LT1057CN8</p> <p>LT1057ACJ8<br/>LT1057CJ8<br/>LT1057AMJ8<br/>LT1057MJ8</p>   | <p>J8 PACKAGE 8-LEAD CERDIP<br/>T<sub>JMAX</sub> = 150°C, θ<sub>JA</sub> = 100°C/W</p>              |

**Order Options** Tape and Reel: Add #TR

Lead Free: Add #PBF Lead Free Tape and Reel: Add #TRPBF

Lead Free Part Marking: <http://www.linear.com/leadfree/>

Consult LTC Marketing for parts specified with wider operating temperature ranges.

**ELECTRICAL CHARACTERISTICS**  $V_S = \pm 15V$ ,  $T_A = 25^\circ C$ ,  $V_{CM} = 0V$  unless otherwise noted. (Note 2)

| SYMBOL    | PARAMETER                    | CONDITIONS                            | LT1057AM/LT1058AM<br>LT1057AC/LT1058AC |           |          | LT1057M/LT1058M<br>LT1057C/LT1058C |          |                                  | UNITS |
|-----------|------------------------------|---------------------------------------|--|-----------|----------|------------------------------------|----------|----------------------------------|-------|
|           |                              |                                       | MIN                                    | TYP       | MAX      | MIN                                | TYP      | MAX                              |       |
| $V_{OS}$  | Input Offset Voltage         | LT1057                                |  | 150       | 450      | 200                                | 800      | $\mu V$                          |       |
|           |                              | LT1057 (S8 Package)                   |  |           |          | 220                                | 1200     | $\mu V$                          |       |
|           |                              | LT1058                                |  | 180       | 600      | 250                                | 1000     | $\mu V$                          |       |
| $I_{OS}$  | Input Offset Current         | Fully Warmed Up                       |  | 3         | 40       | 4                                  | 50       | pA                               |       |
| $I_B$     | Input Bias Current           | Fully Warmed Up                       |  | $\pm 5$   | $\pm 50$ | $\pm 7$                            | $\pm 75$ | pA                               |       |
|           | Input Resistance             | Differential                          |  | $10^{12}$ |          | $10^{12}$                          |          | $\Omega$                         |       |
|           |                              | Common Mode $V_{CM} = -11V$ to $8V$   |  | $10^{12}$ |          | $10^{12}$                          |          | $\Omega$                         |       |
|           |                              | Common Mode $V_{CM} = 8V$ to $11V$    |  | $10^{11}$ |          | $10^{11}$                          |          | $\Omega$                         |       |
|           | Input Capacitance            |                                       |  | 4         |          | 4                                  |          | pF                               |       |
| $e_n$     | Input Noise Voltage          | 0.1Hz to 10Hz                         | LT1057                                 |           | 2.0      |                                    | 2.1      | $\mu V_{P-P}$                    |       |
|           |                              |                                       | LT1058                                 |           | 2.4      |                                    | 2.5      | $\mu V_{P-P}$                    |       |
| $e_n$     | Input Noise Voltage Density  | $f_0 = 10Hz$<br>$f_0 = 1kHz$ (Note 3) |  | 26<br>13  | 22       | 28<br>14                           | 24       | $nV/\sqrt{Hz}$<br>$nV/\sqrt{Hz}$ |       |
| $i_n$     | Input Noise Current Density  | $f_0 = 10Hz, 1kHz$ (Note 4)           |  | 1.5       | 4        | 1.8                                | 6        | $fA/\sqrt{Hz}$                   |       |
| $A_{VOL}$ | Large-Signal Voltage Gain    | $V_O = \pm 10V, R_L = 2k$             | 150                                    | 350       |          | 100                                | 300      | V/mV                             |       |
|           |                              | $V_O = \pm 10V, R_L = 1k$             | 120                                    | 250       |          | 80                                 | 220      | V/mV                             |       |
|           | Input Voltage Range          |                                       | $\pm 10.5$                             | 14.3      |          | $\pm 10.5$                         | 14.3     | V                                |       |
|           |                              |                                       |  | -11.5     |          |                                    | -11.5    | V                                |       |
| CMRR      | Common Mode Rejection Ratio  |                                       | 86                                     | 100       |          | 82                                 | 98       | dB                               |       |
|           |                              |                                       | 84                                     | 98        |          | 80                                 | 96       | dB                               |       |
| PSRR      | Power Supply Rejection Ratio | $V_S = \pm 10V$ to $\pm 18V$          | 88                                     | 103       |          | 86                                 | 102      | dB                               |       |
| $V_{OUT}$ | Output Voltage Swing         | $R_L = 2k$                            | $\pm 12$                               | $\pm 13$  |          | $\pm 12$                           | $\pm 13$ | V                                |       |
| SR        | Slew Rate                    |                                       | 10                                     | 14        |          | 8                                  | 13       | V/ $\mu s$                       |       |
| GBW       | Gain-Bandwidth Product       | $f = 1MHz$ (Note 6)                   | 3.5                                    | 5         |          | 3                                  | 5        | MHz                              |       |
| $I_S$     | Supply Current Per Amplifier |                                       |  | 1.6       | 2.5      |                                    | 1.7      | 2.8                              | mA    |
|           |                              | Channel Separation                    | DC to 5kHz, $V_{IN} = \pm 10V$         |           | 132      |                                    |          | 130                              | dB    |

**(LT1057/LT1058 SW Package Only),  $V_S = \pm 15V$ ,  $T_A = 25^\circ C$ ,  $V_{CM} = 0V$  unless otherwise noted.**

| SYMBOL   | PARAMETER                                      | CONDITIONS  | MIN    | TYP      | MAX       | UNITS          |
|----------|--|---|--------|----------|-----------|----------------|
| $V_{OS}$ | Input Offset Voltage                           | LT1057  |        | 0.3      | 2         | mV             |
|          |  | LT1058  |        | 0.35     | 2.5       |                |
| $I_{OS}$ | Input Offset Current                           | Fully Warmed Up                                   |        | 5        | 50        | pA             |
| $I_B$    | Input Bias Current                             | Fully Warmed Up                                   |        | $\pm 10$ | $\pm 100$ | pA             |
|          | Input Resistance –Differential<br>–Common Mode | $V_{CM} = -11V$ to $8V$<br>$V_{CM} = 8V$ to $11V$ |        | 0.4      |           | T $\Omega$     |
|          |  |   |        | 0.4      |           |                |
|          |  |   |        | 0.05     |           |                |
|          | Input Capacitance                              |   |        | 4        |           | pF             |
| $e_n$    | Input Noise Voltage                            | 0.1Hz to 10Hz                                     | LT1057 |          | 2.1       | $\mu V_{P-P}$  |
|          |  |   | LT1058 |          | 2.5       |                |
| $e_n$    | Input Noise Voltage Density                    | $f_0 = 10Hz$<br>$f_0 = 1kHz$                      |        | 26<br>13 |           | $nV/\sqrt{Hz}$ |

# LT1057/LT1058

## ELECTRICAL CHARACTERISTICS (LT1057/LT1058 SW Package Only), $V_S = \pm 15V$ , $T_A = 25^\circ C$ , $V_{CM} = 0V$ unless otherwise noted.

| SYMBOL    | PARAMETER                    | CONDITIONS                                  | MIN        | TYP           | MAX | UNITS          |
|-----------|------------------------------|---|------------|---------------|-----|----------------|
| $i_n$     | Input Noise Current Density  | $f_0 = 10\text{Hz}$ , $1\text{kHz}$         |            | 1.8           |     | $fA/\sqrt{Hz}$ |
| $A_{VOL}$ | Large-Signal Voltage Gain    | $V_0 = \pm 10V$<br>$R_L = 2k$<br>$R_L = 1k$ | 100<br>50  | 300<br>220    |     | V/mV           |
|           | Input Voltage Range          |   | $\pm 10.5$ | 14.3<br>-11.5 |     | V              |
| CMRR      | Common Mode Rejection Ratio  | $V_{CM} = \pm 15V$<br>LT1057<br>LT1058      | 82<br>80   | 98<br>98      |     | dB             |
| PSRR      | Power Supply Rejection Ratio | $V_S = \pm 10V$ to $\pm 18V$                | 86         | 102           |     | dB             |
| $V_{OUT}$ | Output Voltage Swing         | $R_L = 2k$                                  | $\pm 12$   | $\pm 13$      |     | V              |
| SR        | Slew Rate                    |   | 8          | 13            |     | V/ $\mu s$     |
| GBW       | Gain-Bandwidth Product       | $f = 1\text{MHz}$ (Note 6)                  | 3          | 5             |     | MHz            |
| $I_S$     | Supply Current Per Amplifier |   |            | 1.7           | 2.8 | mA             |
|           | Channel Separation           | DC to $5\text{kHz}$ , $V_{IN} = \pm 10V$    |            | 130           |     | dB             |

The ● denotes the specifications which apply over the temperature range of  $0^\circ C \leq T_A \leq 70^\circ C$  or  $-40^\circ C \leq T_A \leq 85^\circ C$  (LT1057IS8), otherwise specifications are  $T_A = 25^\circ C$ .  $V_S = \pm 15V$ ,  $V_{CM} = 0V$ , unless noted.

| SYMBOL    | PARAMETER   | CONDITIONS                                 | LT1057AC<br>LT1058AC |          |            | LT1057C<br>LT1058C    |                        |                  | UNITS |
|-----------|---|--|----------------------|----------|------------|-----------------------|------------------------|------------------|-------|
|           |   |  | MIN                  | TYP      | MAX        | MIN                   | TYP                    | MAX              |       |
| $V_{OS}$  | Input Offset Voltage                                      | LT1057                                     | ●                    | 250      | 800        | 330                   | 1400                   | $\mu V$          |       |
|           |   | LT1057IS8                                  | ●                    |          |            | 500                   | 2300                   | $\mu V$          |       |
|           |   | LT1057S8                                   | ●                    |          |            | 400                   | 1900                   | $\mu V$          |       |
|           |   | LT1058                                     | ●                    | 300      | 1200       | 400                   | 1800                   | $\mu V$          |       |
| $V_{OS}$  | Average Temperature Coefficient of Input (Offset Voltage) | LT1057 H/J8 Package                        | ●                    | 1.8      | 7          | 2.3                   | 12                     | $\mu V/^\circ C$ |       |
|           |   | N8 Package                                 | ●                    | 3        | 10         | 4                     | 16                     | $\mu V/^\circ C$ |       |
|           |   | LT1057S8 (Note 5)                          | ●                    |          |            | 4                     | 16                     | $\mu V/^\circ C$ |       |
|           |   | LT1057IS8 (Note 5)                         | ●                    |          |            | 4.5                   | 16                     | $\mu V/^\circ C$ |       |
|           |   | LT1058 J Package (Note 5)                  | ●                    | 2.5      | 10         | 3                     | 15                     | $\mu V/^\circ C$ |       |
|           |   | N Package (Note 5)                         | ●                    | 4        | 15         | 5                     | 22                     | $\mu V/^\circ C$ |       |
| $I_{OS}$  | Input Offset Current                                      | Warmed Up, $T_A = 70^\circ C$<br>LT1057IS8 | ●                    | 18       | 150        | 20<br>35              | 250<br>600             | pA               |       |
| $I_B$     | Input Bias Current  | Warmed Up, $T_A = 70^\circ C$<br>LT1057IS8 | ●                    | $\pm 50$ | $\pm 250$  | $\pm 60$<br>$\pm 100$ | $\pm 350$<br>$\pm 900$ | pA               |       |
| $A_{VOL}$ | Large-Signal Voltage Gain                                 | $V_0 = \pm 10V$ , $R_L = 2k$               | ●                    | 70       | 220        | 50                    | 200                    | V/mV             |       |
| CMRR      | Common Mode Rejection Ratio                               | $V_{CM} = \pm 10.4V$                       | ●                    | 85       | 98         | 80                    | 96                     | dB               |       |
| PSRR      | Power Supply Rejection Ratio                              | $V_S = \pm 10V$ to $\pm 18V$               | ●                    | 87       | 102        | 84                    | 100                    | dB               |       |
| $V_{OUT}$ | Output Voltage Swing                                      | $R_L = 2k$                                 | ●                    | $\pm 12$ | $\pm 12.8$ | $\pm 12$              | $\pm 12.8$             | V                |       |
| $I_S$     | Supply Current Per Amplifier                              |  | ●                    |          | 2.8        |                       | 3.2                    | mA               |       |
|           |   | $T_A = 70^\circ C$                         |                      | 14       |            | 1.5                   |                        | mA               |       |

**ELECTRICAL CHARACTERISTICS** (LT1057/LT1058 SW Package Only). The ● denotes specifications which apply over the temperature range of  $V_S = \pm 15V$ ,  $V_{CM} = 0V$ ,  $0^\circ C \leq T_A \leq 70^\circ C$  (LT1057SW, LT1058SW) or  $-40^\circ C \leq T_A \leq 85^\circ C$  (LT1057ISW, LT1058ISW), unless otherwise noted.

| SYMBOL    | PARAMETER   | CONDITIONS                    | MIN    | TYP       | MAX        | UNITS            |    |
|-----------|---|-------------------------------|--------|-----------|------------|------------------|----|
| $V_{OS}$  | Input Offset Voltage                                    | LT1057                        | ●      | 0.5       | 2.5        | mV               |    |
|           |   | LT1058S                       | ●      | 0.6       | 3.0        |                  |    |
|           |   | LT1058IS                      | ●      | 0.7       | 4.0        |                  |    |
|           | Average Temperature Coefficient of Input Offset Voltage |                               | ●      | 5         |            | $\mu V/^\circ C$ |    |
| $I_{OS}$  | Input Offset Current                                    | Warmed Up, $T_A = 70^\circ C$ |        | 20        | 250        | pA               |    |
|           |   | Warmed Up, $T_A = 85^\circ C$ |        | 35        | 400        |                  |    |
| $I_B$     | Input Bias Current                                      | Warmed Up, $T_A = 70^\circ C$ |        | $\pm 60$  | $\pm 400$  | pA               |    |
|           |   | Warmed Up, $T_A = 85^\circ C$ |        | $\pm 100$ | $\pm 700$  |                  |    |
| $A_{VOL}$ | Large-Signal Voltage Gain                               | $V_O = \pm 10V$ , $R_L = 2k$  | LT1057 | ●         | 50         | 200              | mV |
|           |   |                               | LT1058 | ●         | 40         | 200              |    |
| CMRR      | Common Mode Rejection Ratio                             | $V_{CM} = \pm 10.5V$          | LT1057 | ●         | 80         | 96               | dB |
|           |   |                               | LT1058 | ●         | 78         | 96               |    |
| PSRR      | Power Supply Rejection Ratio                            | $V_S = \pm 10V$ to $\pm 18V$  | LT1057 | ●         | 84         | 100              | dB |
|           |   |                               | LT1058 | ●         | 82         | 100              |    |
| $V_{OUT}$ | Output Voltage Swing                                    | $R_L = 2k$                    | ●      | $\pm 12$  | $\pm 12.8$ | V                |    |

The ● denotes the specifications which apply over the temperature range of  $-55^\circ C \leq T_A \leq 125^\circ C$ ,  $V_S = \pm 15V$ ,  $V_{CM} = 0V$ , unless otherwise noted.

| SYMBOL    | PARAMETER   | CONDITIONS                     | LT1057AM<br>LT1058AM |           |            | LT1057M<br>LT1058M |            |                  | UNITS |
|-----------|---|--------------------------------|----------------------|-----------|------------|--------------------|------------|------------------|-------|
|           |   |                                | MIN                  | TYP       | MAX        | MIN                | TYP        | MAX              |       |
| $V_{OS}$  | Input Offset Voltage                                    | LT1057                         | ●                    | 300       | 1100       | 400                | 2000       | $\mu V$          |       |
|           |   | LT1058                         | ●                    | 380       | 1600       | 550                | 2500       | $\mu V$          |       |
|           | Average Temperature Coefficient of Input Offset Voltage | LT1057                         | ●                    | 2.0       | 7          | 2.5                | 12         | $\mu V/^\circ C$ |       |
|           |   | LT1058 (Note 5)                | ●                    | 2.5       | 10         | 3                  | 15         | $\mu V/^\circ C$ |       |
| $I_{OS}$  | Input Offset Current                                    | Warmed Up, $T_A = 125^\circ C$ |                      | 0.15      | 2          | 0.2                | 3          | nA               |       |
| $I_B$     | Input Bias Current                                      | Warmed Up, $T_A = 125^\circ C$ |                      | $\pm 0.6$ | $\pm 4.5$  | $\pm 0.7$          | $\pm 6$    | nA               |       |
| $A_{VOL}$ | Large-Signal Voltage Gain                               | $V_O = \pm 10V$ , $R_L = 2k$   | ●                    | 40        | 120        | 30                 | 110        | V/mV             |       |
| CMRR      | Common Mode Rejection Ratio                             | $V_{CM} = \pm 10.4V$           | ●                    | 84        | 97         | 80                 | 95         | dB               |       |
| PSRR      | Power Supply Rejection Ratio                            | $V_S = \pm 10V$ to $\pm 17V$   | ●                    | 86        | 100        | 83                 | 98         | dB               |       |
| $V_{OUT}$ | Output Voltage Swing                                    | $R_L = 2k$                     | ●                    | $\pm 12$  | $\pm 12.7$ | $\pm 12$           | $\pm 12.6$ | V                |       |
| $I_S$     | Supply Current Per Amplifier                            | $T_A = 125^\circ C$            |                      | 1.25      | 1.9        | 1.3                | 2.2        | mA               |       |

**Note 1:** Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

**Note 2:** Typical parameters are defined as the 60% yield of distributions of individual amplifiers; (i.e., out of 100 LT1058s or 100 LT1057s, typically 240 op amps, or 120 for the LT1057, will be better than the indicated specification).

**Note 3:** This parameter is tested on a sample basis only.

**Note 4:** Current noise is calculated from the formula:

$$i_n = (2qI_b)^{1/2}$$

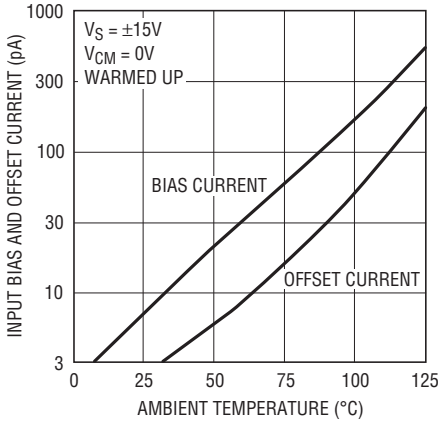
where  $q = 1.6 \cdot 10^{-19}$  coulomb. The noise of source resistors up to 1G swamps the contribution of current noise.

**Note 5:** This parameter is not 100% tested.

**Note 6:** Gain-bandwidth product is not tested. It is guaranteed by design and by inference from the slew rate measurement.

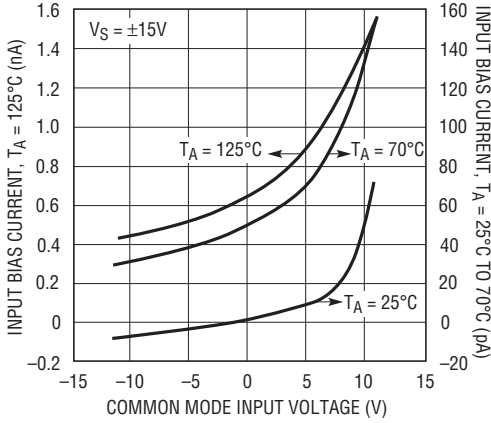
## TYPICAL PERFORMANCE CHARACTERISTICS

### Input Bias and Offset Currents vs Temperature



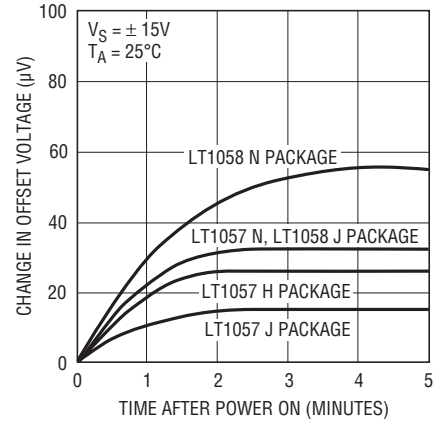
10578 G01

### Input Bias Current Over the Common-Mode Range



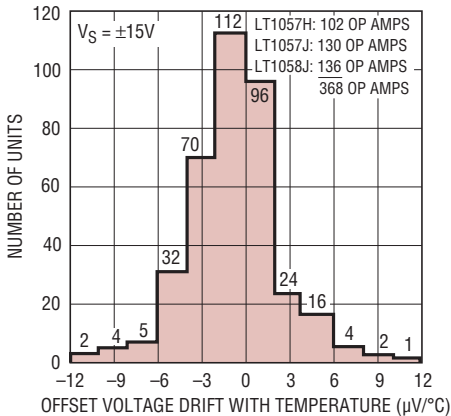
10578 G02

### Warm-Up Drift



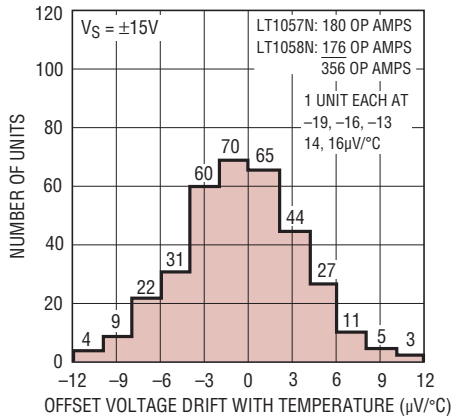
10578 G03

### Distribution of Offset Voltage Drift with Temperature (H and J Package)



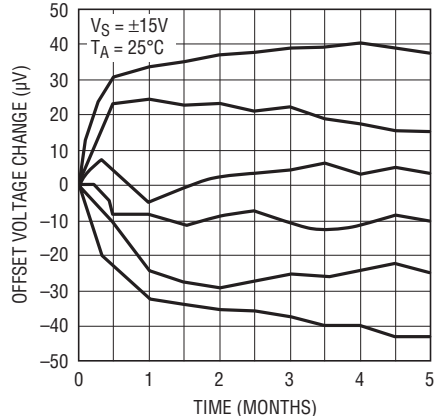
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### Distribution of Offset Voltage Drift with Temperature (Plastic N Package)



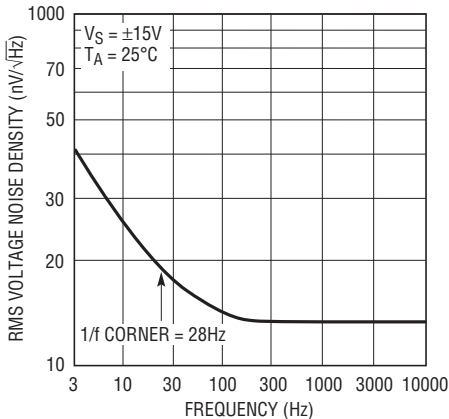
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### Long-Term Drift of Representative Units



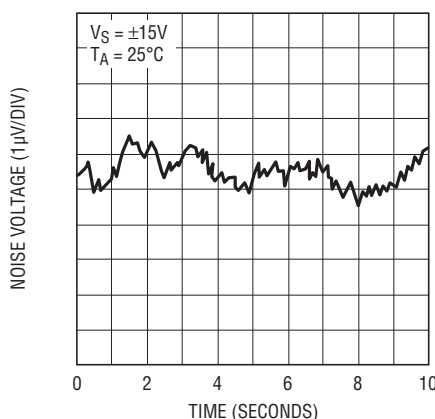
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### Voltage Noise vs Frequency



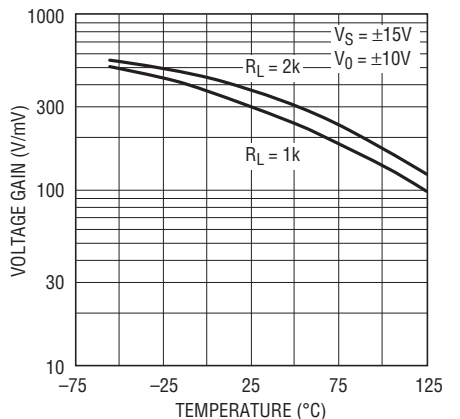
10578 G07

### 0.1Hz to 10Hz Noise



10578 G08

### Voltage Gain vs Temperature

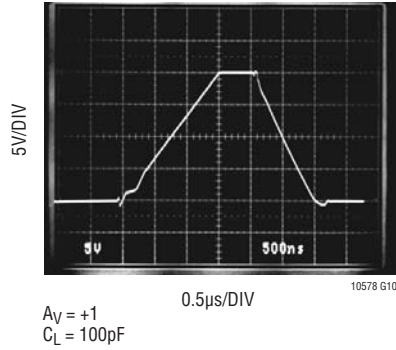


10578 G09

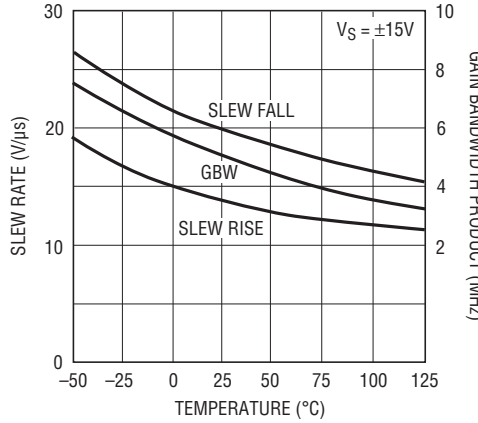
10578fc

# TYPICAL PERFORMANCE CHARACTERISTICS

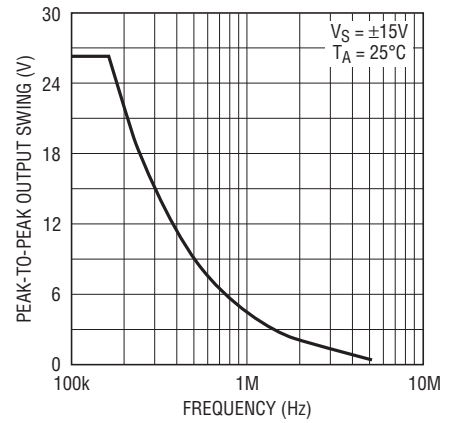
**Large-Signal Response**



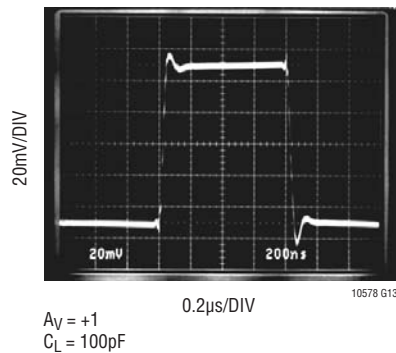
**Slew Rate, Gain-Bandwidth Product vs Temperature**



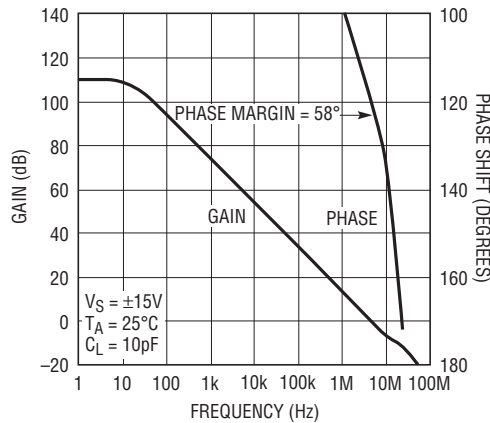
**Undistorted Output Swing vs Frequency**



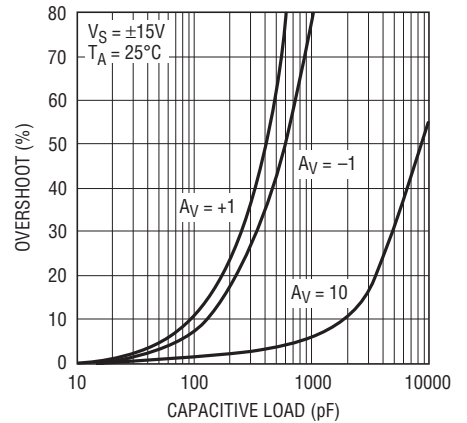
**Small-Signal Response**



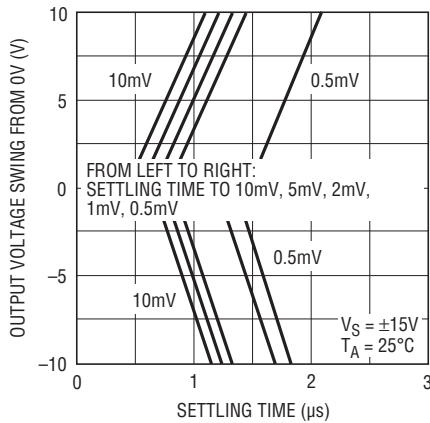
**Gain, Phase Shift vs Frequency**



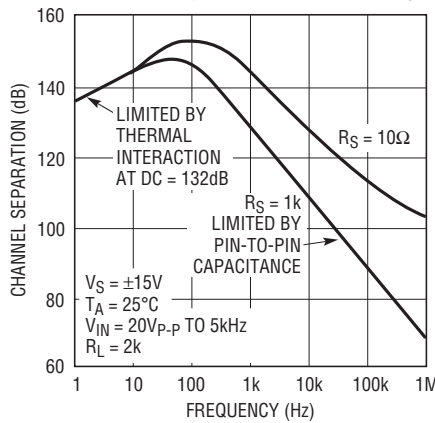
**Capacitive Load Handling**



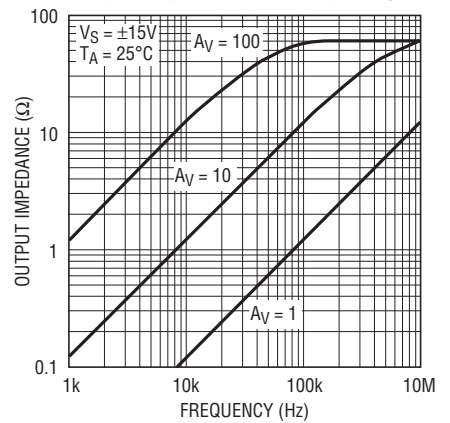
**Settling Time**



**Channel Separation vs Frequency**

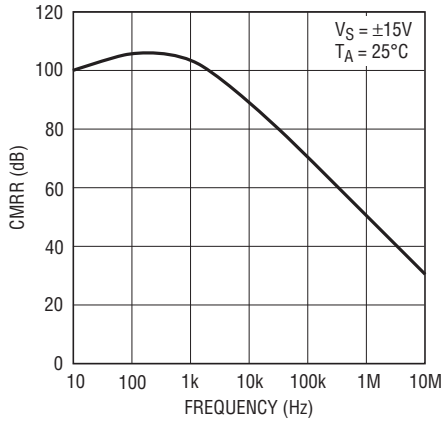


**Output Impedance vs Frequency**



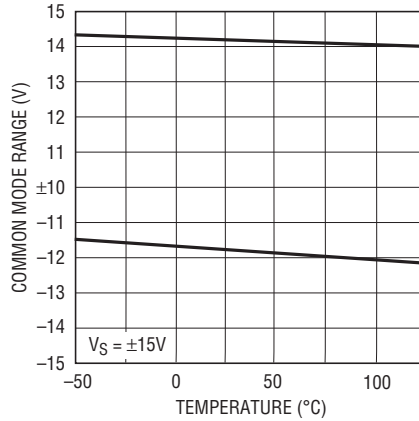
## TYPICAL PERFORMANCE CHARACTERISTICS

**Common Mode Rejection Ratio vs Frequency**



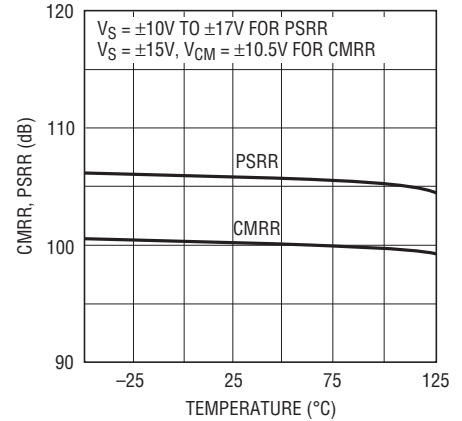
10578 G19

**Common Mode Range vs Temperature**



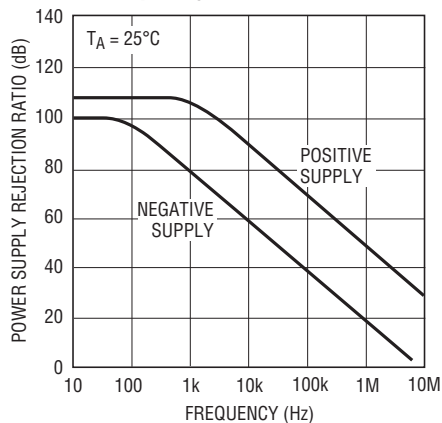
10578 G20

**Common Mode and Power Supply Rejections vs Temperature**



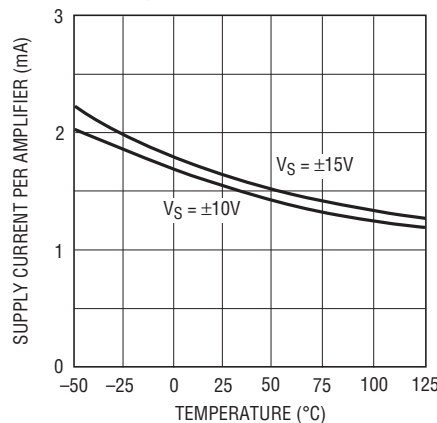
10578 G21

**Power Supply Rejection Ratio vs Frequency**



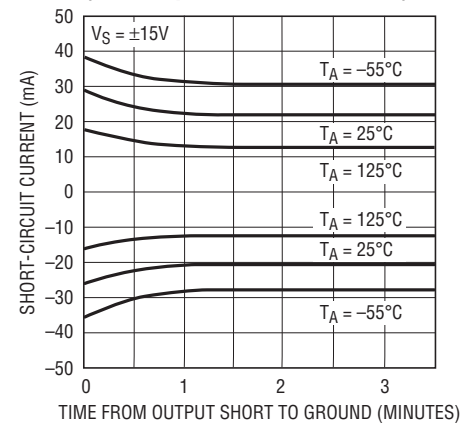
10578 G22

**Supply Current vs Temperature**



10578 G23

**Short-Circuit Current vs Time (One Output Shorted to Ground)**



10578 G24

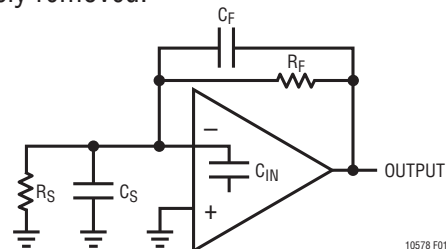
## APPLICATIONS INFORMATION

The LT1057 may be inserted directly in LF353, LF412, LF442, TL072, TL082 and OP-215 sockets. The LT1058 plugs into LF347, LF444, TL074 and TL084 sockets. Of course, all standard dual and quad bipolar op amps can also be replaced by these devices.

### High Speed Operation

When the feedback around the op amp is resistive ( $R_F$ ) a pole will be created with  $R_F$ , the source resistance and capacitance ( $R_S$ ,  $C_S$ ), and the amplifier input capacitance ( $C_{IN} \approx 4\text{pF}$ ). In low closed loop gain configurations and

with  $R_S$  and  $R_F$  in the kilohm range, this pole can create excess phase shift and even oscillation. A small capacitor ( $C_F$ ) in parallel with  $R_F$  eliminates this problem. With  $R_S(C_S + C_{IN}) = R_F C_F$ , the effect of the feedback pole is completely removed.



10578 F01



## APPLICATIONS INFORMATION

Settling time is measured in a test circuit which can be found in the LT1055/LT1056 data sheet and in Application Note 10.

### Achieving Picoampere/Microvolt Performance

In order to realize the picoampere/microvolt level accuracy of the LT1057/LT1058, proper care must be exercised. For example, leakage currents in circuitry external to the op amp can significantly degrade performance. High quality insulation should be used (e.g., Teflon™, Kel-F); cleaning of all insulating surfaces to remove fluxes and other residues will probably be required. Surface coating may be necessary to provide a moisture barrier in high humidity environments.

Board leakage can be minimized by encircling the input circuitry with a guard ring operated at a potential close to that of the inputs; in inverting configurations, the guard ring should be tied to ground, in noninverting connections, to the inverting input. Guarding both sides of the printed circuit board is required. Bulk leakage reduction depends on the guard ring width.

The LT1057/LT1058 have the lowest offset voltage of any dual and quad JFET input op amps available today. However, the offset voltage and its drift with time and temperature are still not as good as on the best bipolar amplifiers (because the transconductance of FETs is considerably lower than that of bipolar transistors). Conversely, this lower transconductance is the main cause of the significantly faster speed performance of FET input op amps.

Offset voltage also changes somewhat with temperature cycling. The AM grades show a typical 40μV hysteresis (50μV on the M grades) when cycled over the -55°C to 125°C temperature range. Temperature cycling from 0°C to 70°C has a negligible (less than 20μV) hysteresis effect.

The offset voltage and drift performance are also affected by packaging. In the plastic N package, the molding compound is in direct contact with the chip, exerting pressure on the surface. While NPN input transistors are largely unaffected by this pressure, JFET device drift is degraded. Consequently for best drift performance, as shown in the Typical Performance Characteristics distribution plots, the J or H packages are recommended.

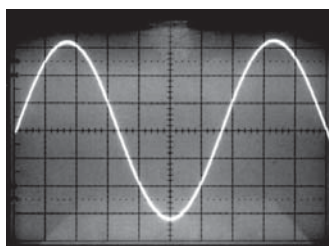
In applications where speed and picoampere bias currents are not necessary, Linear Technology offers the bipolar input, pin compatible LT1013 and LT1014 dual and quad op amps. These devices have significantly better DC specifications than any JFET input device.

### Phase Reversal Protection

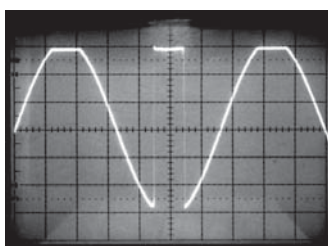
Most industry standard JFET input single, dual and quad op amps (e.g., LF156, LF351, LF353, LF411, LF412, OP-15, OP-16, OP-215, TL084) exhibit phase reversal at the output when the negative common mode limit at the input is exceeded (i.e., below -12V with ±15V supplies). The photos below show a ±16V sine wave input (A), the response of an LF412A in the unity gain follower mode (B), and the response of the LT1057/LT1058 (C).

The phase reversal of photo (B) can cause lock-up in servo systems. The LT1057/LT1058 does not phase-reverse due to a unique phase reversal protection circuit.

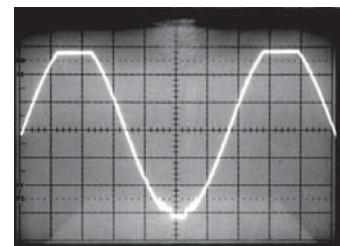
Teflon is a trademark of DuPont.



(A) ±16V Sine Wave Input



(B) LF412A Output

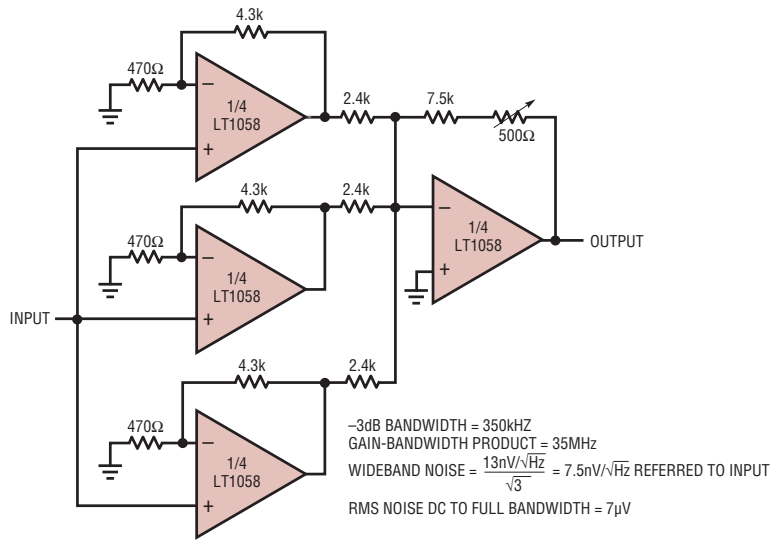


(C) LT1057/LT1058 Output

All Photos 5V/Div Vertical Scale, 50μs/Div Horizontal Scale

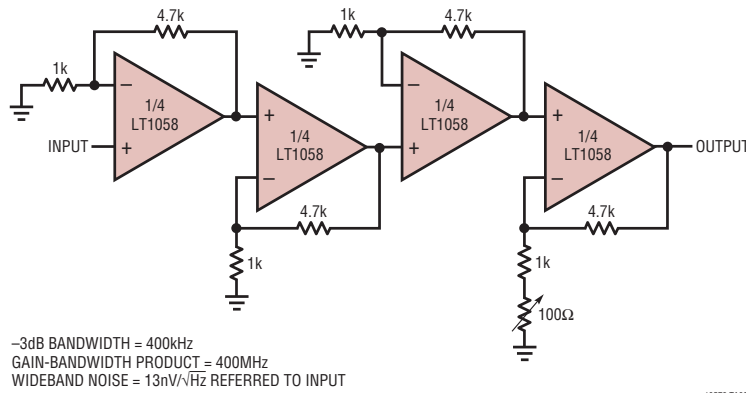
## TYPICAL APPLICATIONS

### Low Noise, Wideband, Gain = 100 Amplifier with High Input Impedance



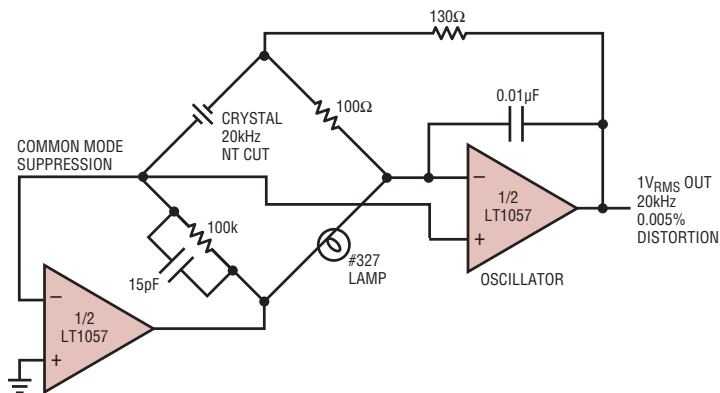
10578 TA02

### Wideband, High Input Impedance, Gain = 1000 Amplifier



10578 TA03

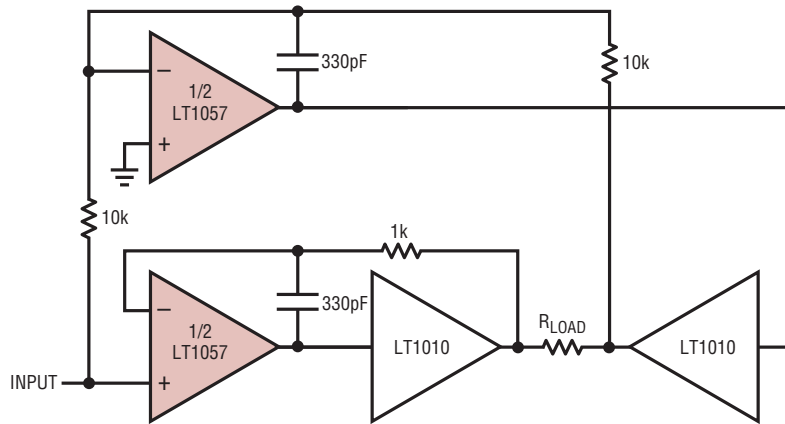
### Low Distortion, Crystal Stabilized Oscillator



10578 TA04

# TYPICAL APPLICATIONS

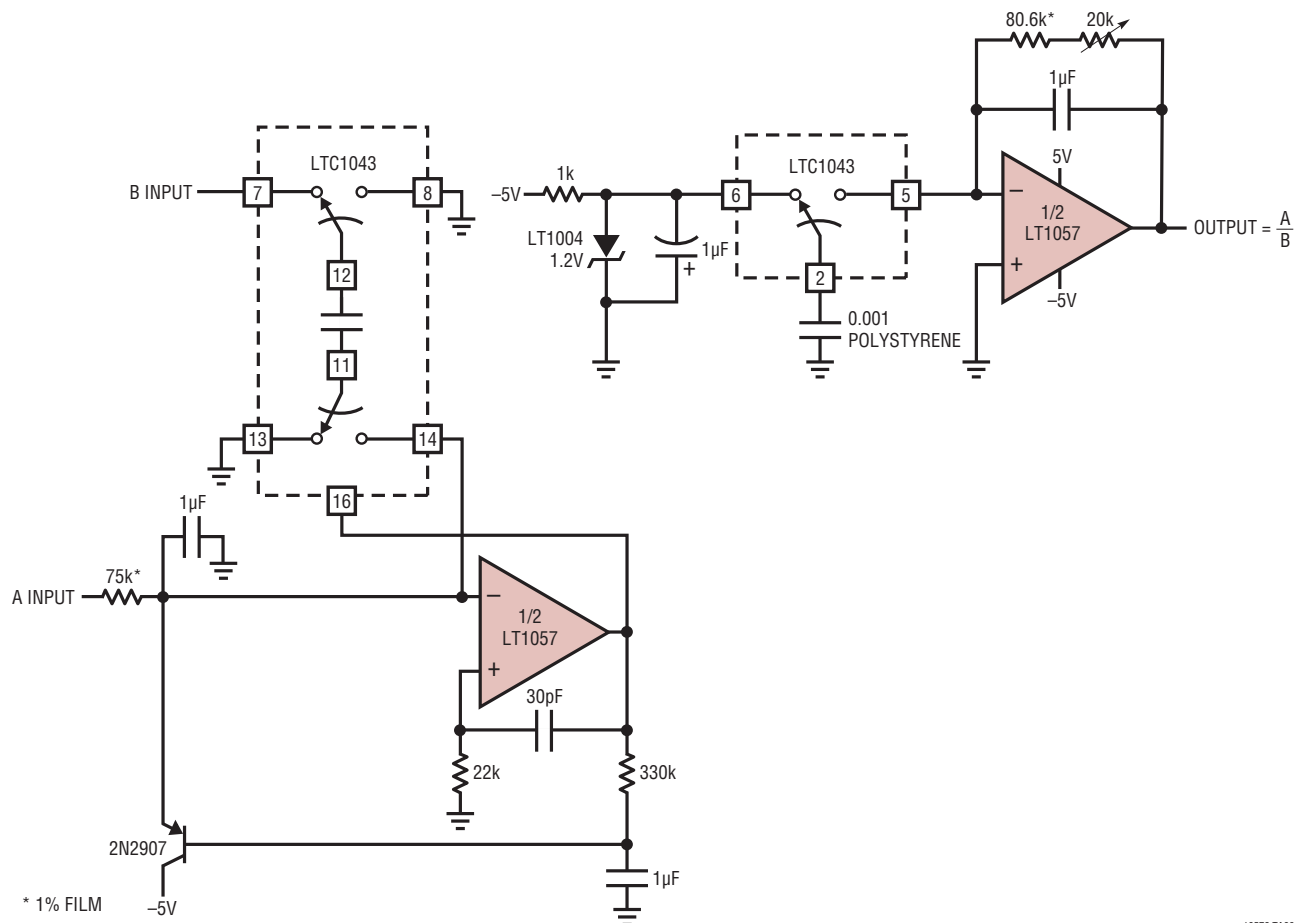
## Fast, Precision Bridge Amplifier



SLEW RATE = 14V/ $\mu$ s  
 OUTPUT CURRENT TO LOAD = 150mA  
 LOAD CAPACITANCE: UP TO 1 $\mu$ F

10578 TA05

## Analog Divider

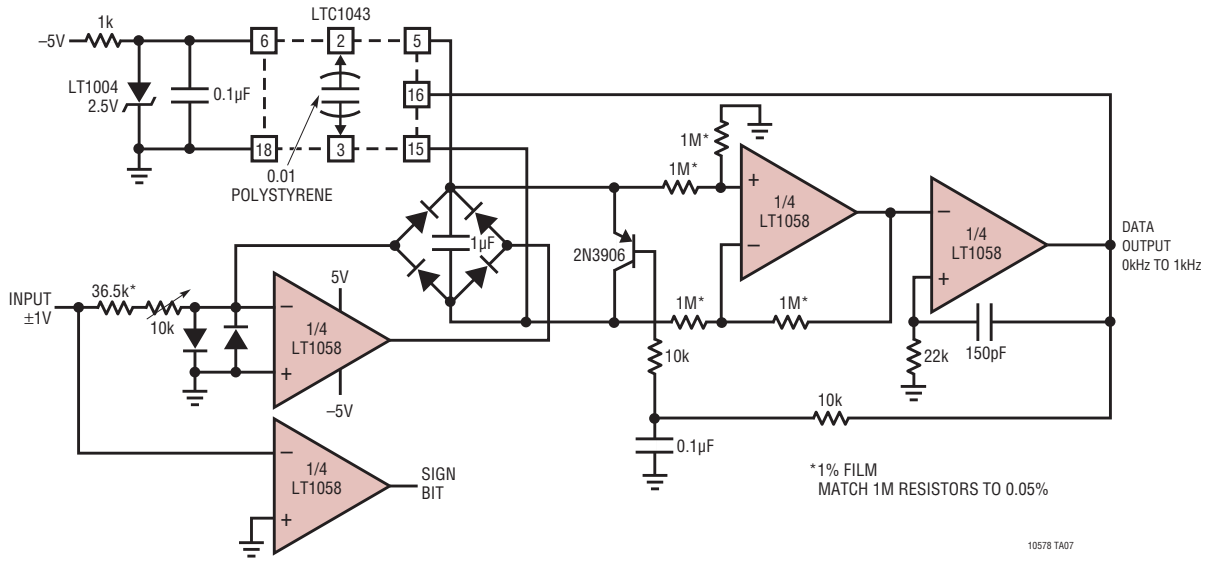


\* 1% FILM

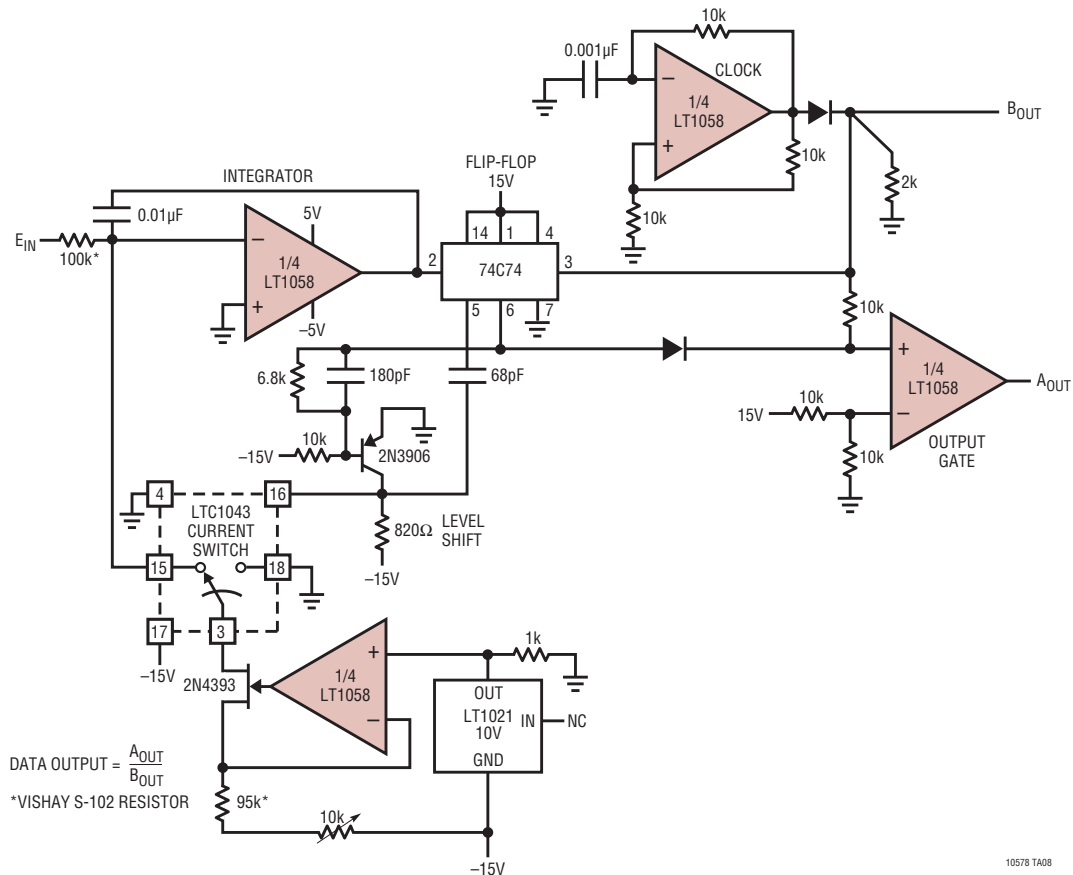
10578 TA06  
 10578fc

## TYPICAL APPLICATIONS

### Bipolar Input (AC) V/F Converter

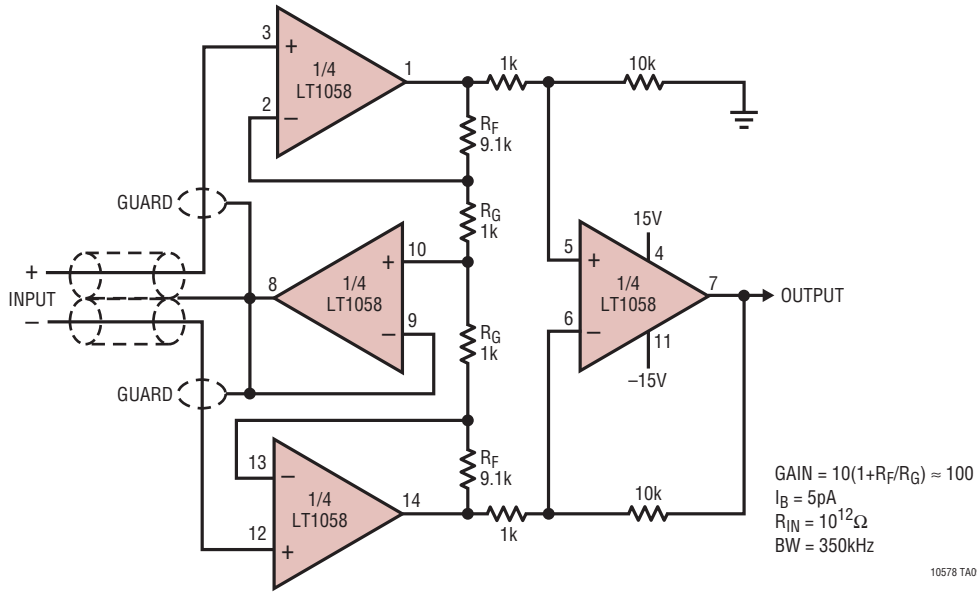


### 12-Bit A/D Converter

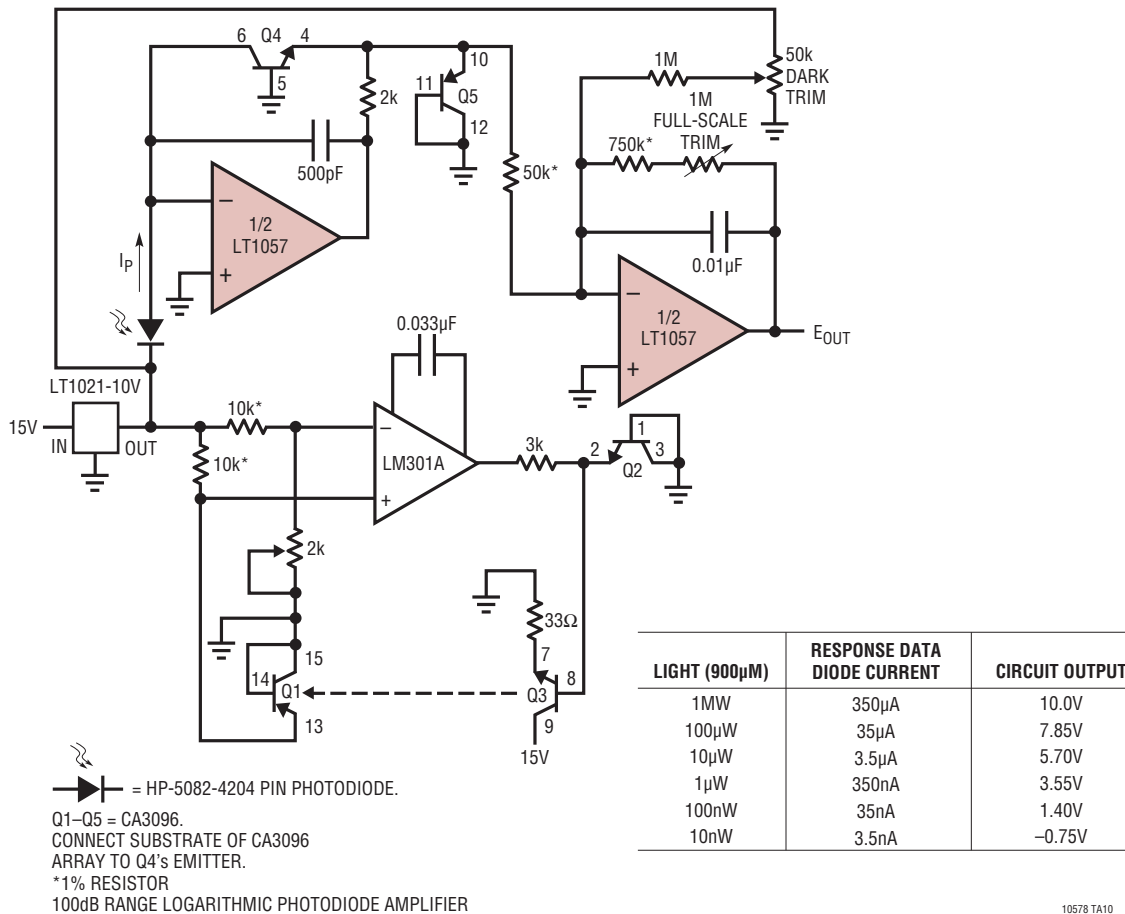


TYPICAL APPLICATIONS

Instrumentation Amplifier with Shield Driver

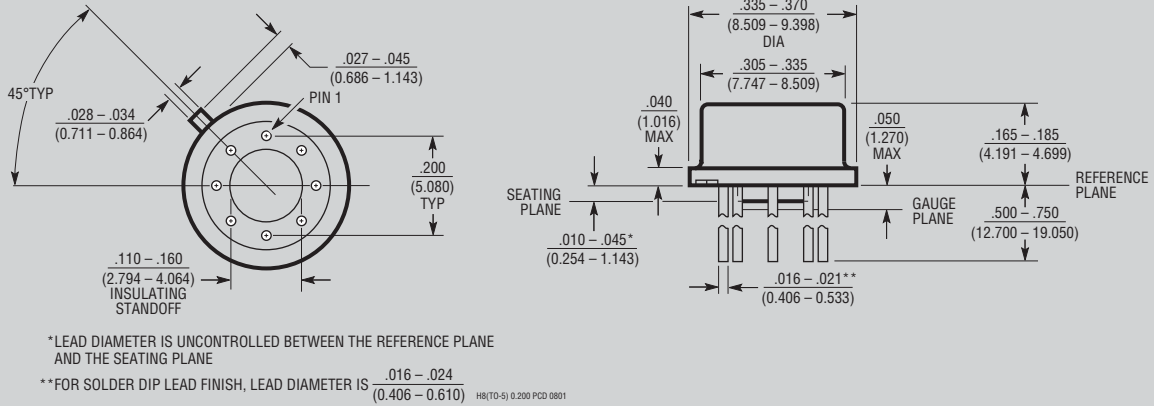


100dB Range Logarithmic Photodiode Amplifier

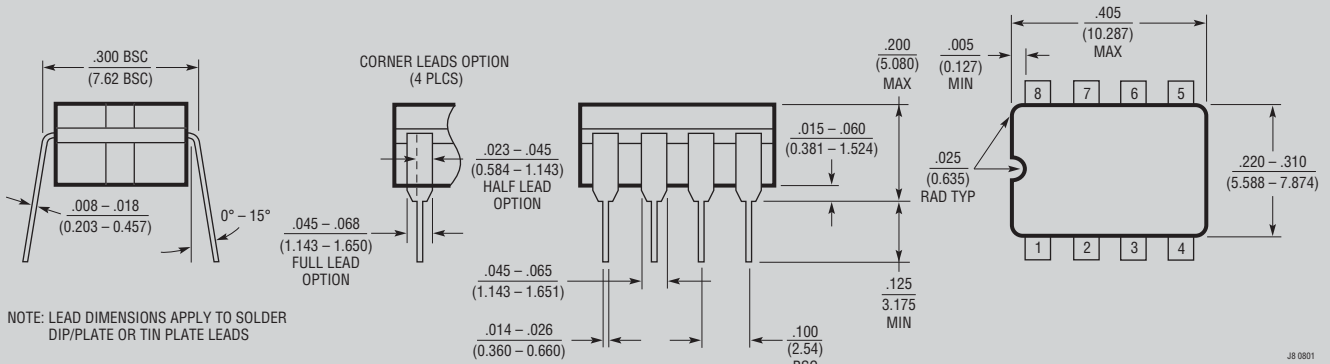


**PACKAGE DESCRIPTION**

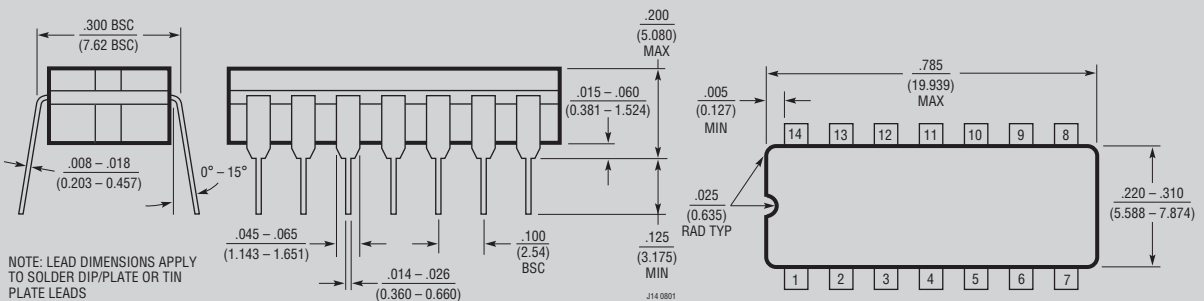
**H Package**  
**8-Lead TO-5 Metal Can (.200 Inch PCD)**  
 (Reference LTC DWG # 05-08-1320)



**J8 Package**  
**8-Lead CERDIP (Narrow .300 Inch, Hermetic)**  
 (Reference LTC DWG # 05-08-1110)



**J Package**  
**14-Lead CERDIP (Narrow .300 Inch, Hermetic)**  
 (Reference LTC DWG # 05-08-1110)

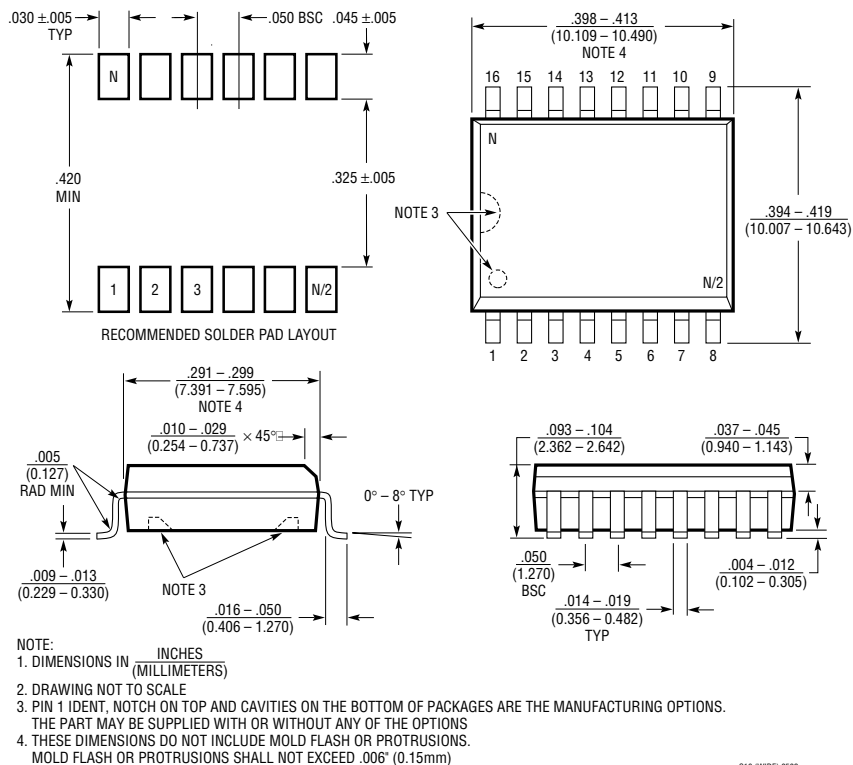


**OBSOLETE PACKAGES**



## TYPICAL APPLICATION

### SW Package 16-Lead Plastic Small Outline (Wide .300 Inch) (Reference LTC DWG # 05-08-1620)



S16 (WIDE) 0502

## RELATED PARTS

| PART NUMBER | DESCRIPTION   | COMMENTS   |
|-------------|---|--|
| LT1055/6    | Precision, High Speed, JFET Input Operational Amplifiers                              | 12V/ $\mu$ s Slew Rate, 5.5MHz Bandwidth                     |
| LT1880      | SOT-23, Rail-to-Rail Output, Picoamp Input Precision Op Amps                          | 150 $\mu$ V Max Offset Voltage, 900pA Max Input Bias Current |
| LT1881/2    | Dual and Quad Rail-to-Rail Output, Picoamp Input Precision Op Amps                    | 50 $\mu$ V Max Offset Voltage, 200pA Max Input Bias Current  |
| LT1884/5    | Dual/Quad Rail-to-Rail Output, Picoamp Input Precision Op Amps                        | 50 $\mu$ V Max Offset Voltage, 400pA Max Input Bias Current  |
| LT6010      | 135 $\mu$ A, 14nV/rtHz, Rail-to-Rail Output, Precision Low Power Op Amp with Shutdown | 35 $\mu$ V Max Offset Voltage, 300pA Max Input Bias Current  |
| LT6011/12   | Dual/Quad 135 $\mu$ A, 14nV/rtHz, Rail-to-Rail Output Precision Low Power Op Amp      | 60 $\mu$ V Max Offset Voltage, 300pA Max Input Bias Current  |
| LTC6078/9   | Micropower Precision, Dual/Quad CMOS Rail-to-Rail Input/Output Amplifiers             | Maximum Offset Drift: 0.7 $\mu$ V/ $^\circ$ C                |
| LTC6241/2   | Dual/Quad 18MHz, Low Noise, Rail-to-Rail CMOS Op Amps                                 | 0.1Hz to 10Hz Noise: 550nVpp                                 |