

## 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®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.

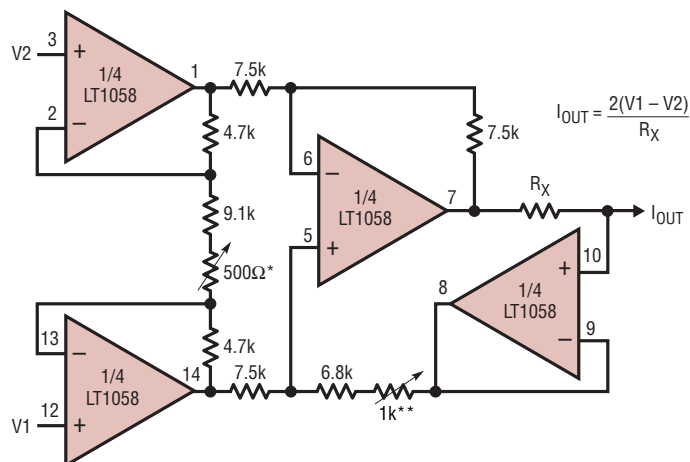
The LT1058 is the lowest offset quad JFET input operational amplifier in the standard 14-pin configuration. It offers significant accuracy improvement over presently available JFET input quad operational amplifiers. The LT1058 can replace four single precision JFET input op amps, while saving board space,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

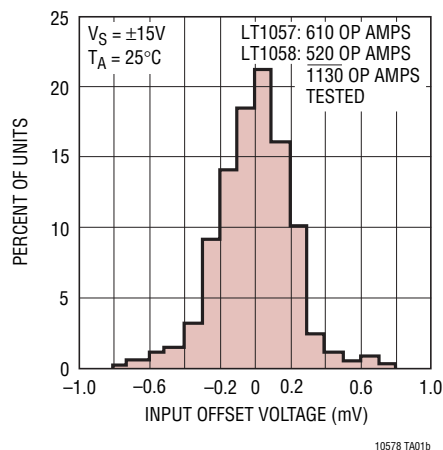


\*GAIN ADJUST

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

10578 TA01

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



# LT1057/LT1058

## ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage .....  $\pm 20\text{V}$   
 Differential Input Voltage .....  $\pm 40\text{V}$   
 Input Voltage .....  $\pm 20\text{V}$   
 Output Short-Circuit Duration ..... Indefinite  
 Storage Temperature Range .....  $-65^{\circ}\text{C}$  to  $150^{\circ}\text{C}$   
 Lead Temperature (Soldering, 10 sec) .....  $300^{\circ}\text{C}$

### Operating Temperature Range

LT1057AM/LT1057M/  
 LT1058AM/LT1058M (**OBSOLETE**) .....  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$   
 LT1057AC/LT1057C/LT1057S  
 LT1058AC/LT1058C/LT1058S .....  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$   
 LT1057I/LT1058I .....  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$

## PACKAGE/ORDER INFORMATION

|                                                                                                                                                                                                                                                                                           |                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                        |                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>TOP VIEW</p> <p>SW PACKAGE<br/>16-LEAD PLASTIC (WIDE) SO<br/><math>T_{JMAX} = 150^{\circ}\text{C}</math>, <math>\theta_{JA} = 90^{\circ}\text{C/W}</math></p>                                                                                                                          | <p>TOP VIEW</p> <p>SW PACKAGE<br/>16-LEAD PLASTIC (WIDE) SO<br/><math>T_{JMAX} = 150^{\circ}\text{C}</math>, <math>\theta_{JA} = 90^{\circ}\text{C/W}</math></p> | <p>TOP VIEW</p> <p>S8 PACKAGE<br/>8-LEAD PLASTIC SO<br/><math>T_{JMAX} = 150^{\circ}\text{C}</math>, <math>\theta_{JA} = 200^{\circ}\text{C/W}</math></p> <p>Please note that the LT1057S8/LT1057IS8 standard surface mount pin-out differs from that of the LT1057 standard CERPDP/DPID 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>TOP VIEW</p> <p>H PACKAGE 8-LEAD METAL CAN</p>                                                                                                                                                                                                                                                      | <p>ORDER PART NUMBER</p> <p>LT1057AMH<br/>LT1057MH<br/>LT1057ACH<br/>LT1057CH</p>                                                                 |
| <p>TOP VIEW</p> <p>N14 PACKAGE<br/>14-LEAD PDIP<br/><math>T_{JMAX} = 125^{\circ}\text{C}</math>, <math>\theta_{JA} = 130^{\circ}\text{C/W}</math></p> <p>J14 PACKAGE 14-LEAD CERPDP<br/><math>T_{JMAX} = 150^{\circ}\text{C}</math>, <math>\theta_{JA} = 100^{\circ}\text{C/W}</math></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>TOP VIEW</p> <p>J8 PACKAGE 8-LEAD CERPDP<br/><math>T_{JMAX} = 150^{\circ}\text{C}</math>, <math>\theta_{JA} = 100^{\circ}\text{C/W}</math></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<br>LT1057 (S8 Package)<br>LT1058                                                   |                                        | 150<br>180                          | 450<br>600 |                                    | 200<br>220<br>250                   | 800<br>1200<br>1000 | $\mu V$<br>$\mu V$<br>$\mu V$    |
| $I_{OS}$  | 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<br>Common Mode $V_{CM} = -11V$ to $8V$<br>Common Mode $V_{CM} = 8V$ to $11V$ |                                        | $10^{12}$<br>$10^{12}$<br>$10^{11}$ |            |                                    | $10^{12}$<br>$10^{12}$<br>$10^{11}$ |                     | $\Omega$<br>$\Omega$<br>$\Omega$ |
|           | Input Capacitance            |                                                                                           |                                        | 4                                   |            |                                    | 4                                   |                     | pF                               |
| $e_n$     | Input Noise Voltage          | 0.1Hz to 10Hz LT1057<br>LT1058                                                            |                                        |                                     | 2.0<br>2.4 |                                    |                                     | 2.1<br>2.5          | $\mu V_{P-P}$<br>$\mu V_{P-P}$   |
| $e_n$     | 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    | $V_O = \pm 10V$ , $R_L = 2k$<br>$V_O = \pm 10V$ , $R_L = 1k$                              | 150<br>120                             | 350<br>250                          |            | 100<br>80                          | 300<br>220                          |                     | V/mV<br>V/mV                     |
|           | Input Voltage Range          |                                                                                           | $\pm 10.5$                             | 14.3<br>-11.5                       |            | $\pm 10.5$                         | 14.3<br>-11.5                       |                     | V<br>V                           |
| CMRR      | Common Mode Rejection Ratio  | LT1057<br>LT1058                                                                          | 86<br>84                               | 100<br>98                           |            | 82<br>80                           | 98<br>96                            |                     | dB<br>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<br>LT1058                                  |     | 0.3<br>0.35        | 2<br>2.5  | mV             |
| $I_{OS}$ | 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<br>0.4<br>0.05 |           | $T\Omega$      |
|          | Input Capacitance                              |                                                   |     | 4                  |           | pF             |
| $e_n$    | Input Noise Voltage                            | 0.1Hz to 10Hz LT1057<br>LT1058                    |     | 2.1<br>2.5         |           | $\mu V_{P-P}$  |
| $e_n$    | 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<br>LT1057IS8<br>LT1057S8<br>LT1058                                                                                       | ●<br>●<br>●<br>●           |                      | 250        | 800       |                    | 330<br>500<br>400<br>400       | 1400<br>2300<br>1900<br>1800     | $\mu V$<br>$\mu V$<br>$\mu V$<br>$\mu V$                                                                             |
|           | Average Temperature Coefficient of Input (Offset Voltage) | LT1057 H/J8 Package<br>N8 Package<br>LT1057S8 (Note 5)<br>LT1057IS8 (Note 5)<br>LT1058 J Package (Note 5)<br>N Package (Note 5) | ●<br>●<br>●<br>●<br>●<br>● |                      | 1.8<br>3   | 7<br>10   |                    | 2.3<br>4<br>4<br>4.5<br>3<br>5 | 12<br>16<br>16<br>16<br>15<br>22 | $\mu V/^\circ C$<br>$\mu V/^\circ C$<br>$\mu V/^\circ C$<br>$\mu V/^\circ C$<br>$\mu V/^\circ C$<br>$\mu V/^\circ C$ |
| $I_{OS}$  | 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                              | $T_A = 70^\circ C$                                                                                                              | ●                          |                      |            | 2.8       |                    |                                | 3.2                              | mA<br>mA                                                                                                             |
|           |                                                           |                                                                                                                                 |                            |                      | 14         |           |                    | 1.5                            |                                  |                                                                                                                      |

# 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         | mV               |
|           |                                                         |                               | LT1058 | ●         | 40         |                  |
| CMRR      | Common Mode Rejection Ratio                             | $V_{CM} = \pm 10.5V$          | LT1057 | ●         | 80         | dB               |
|           |                                                         |                               | LT1058 | ●         | 78         |                  |
| PSRR      | Power Supply Rejection Ratio                            | $V_S = \pm 10V$ to $\pm 18V$  | LT1057 | ●         | 84         | dB               |
|           |                                                         |                               | LT1058 | ●         | 82         |                  |
| $V_{OUT}$ | 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:

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

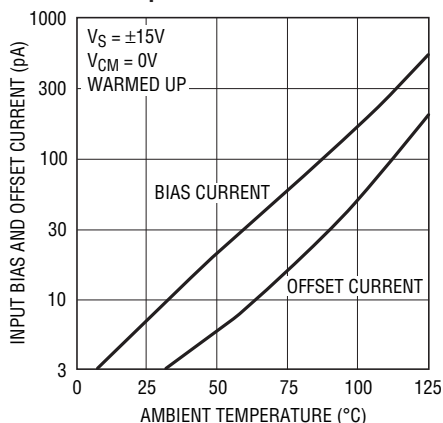
where  $q = 1.6 \cdot 10^{-19}$  coulomb. The noise of source resistors up to 1G swamps the contribution of current noise.

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

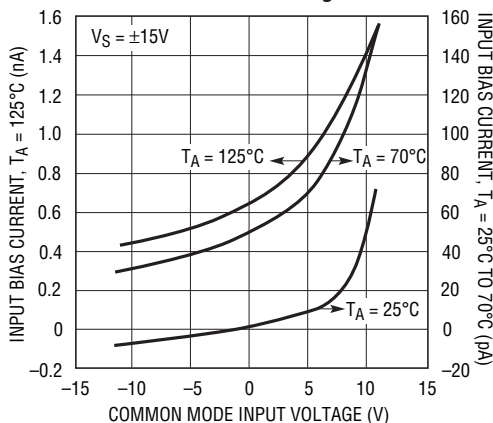
**Note 6:** Gain-bandwidth product is not tested. It is guaranteed by design and by inference from the slew rate measurement.

## TYPICAL PERFORMANCE CHARACTERISTICS

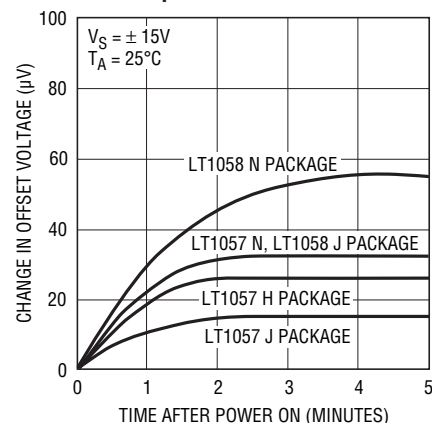
**Input Bias and Offset Currents vs Temperature**



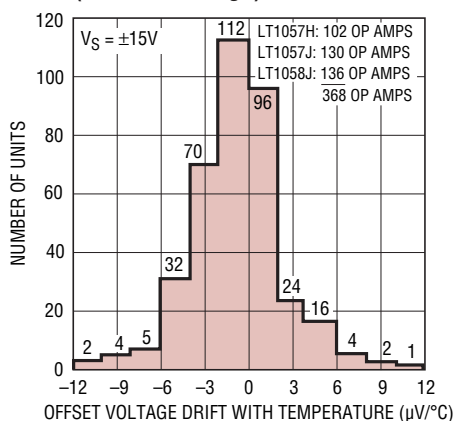
**Input Bias Current Over the Common-Mode Range**



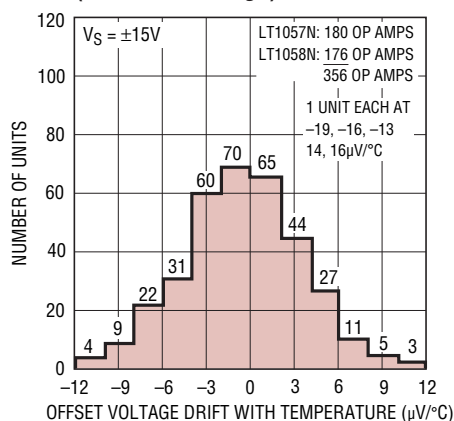
**Warm-Up Drift**



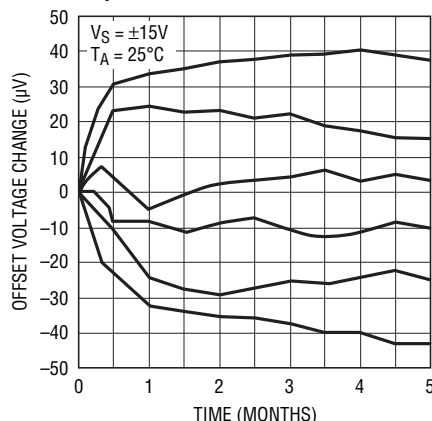
**Distribution of Offset Voltage Drift with Temperature (H and J Package)**



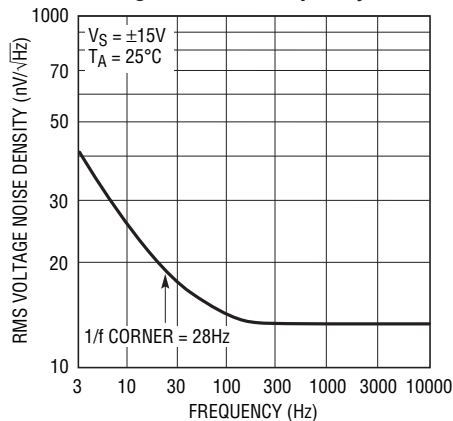
**Distribution of Offset Voltage Drift with Temperature (Plastic N Package)**



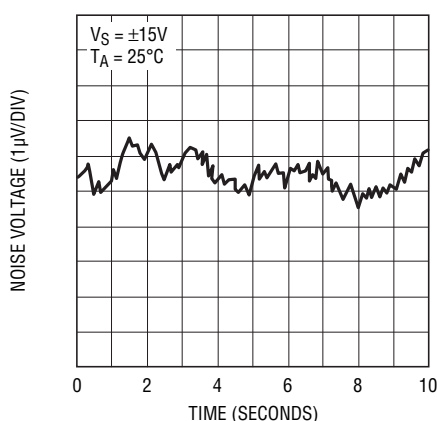
**Long-Term Drift of Representative Units**



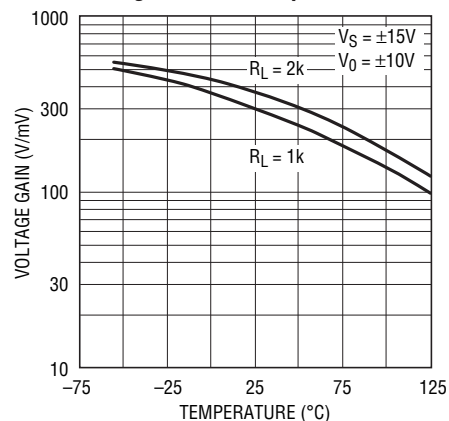
**Voltage Noise vs Frequency**



**0.1Hz to 10Hz Noise**

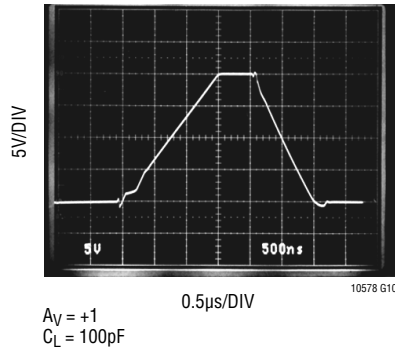


**Voltage Gain vs Temperature**

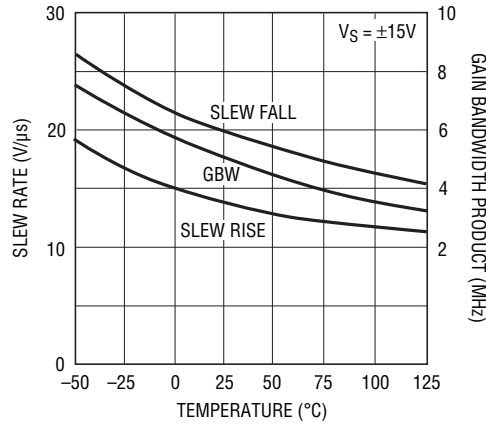


# TYPICAL PERFORMANCE CHARACTERISTICS

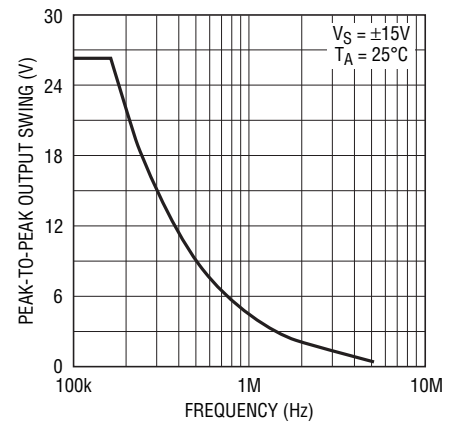
Large-Signal Response



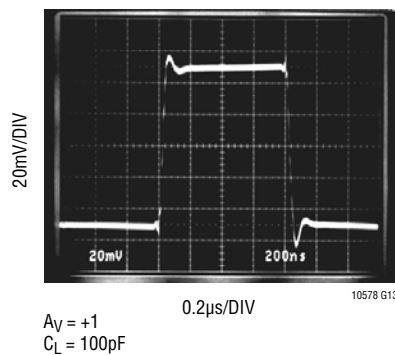
Slew Rate, Gain-Bandwidth Product vs Temperature



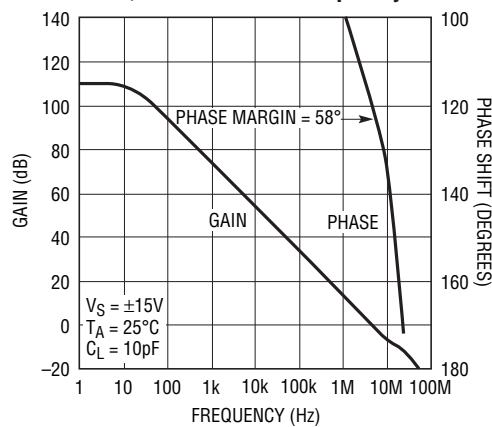
Undistorted Output Swing vs Frequency



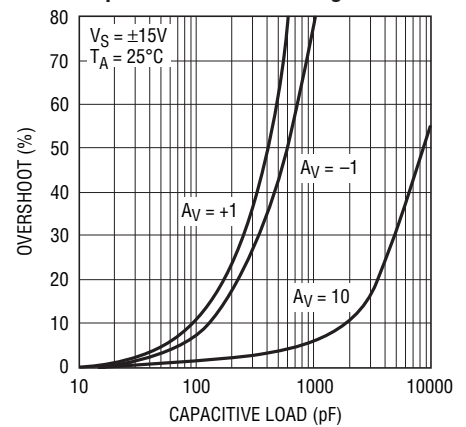
Small-Signal Response



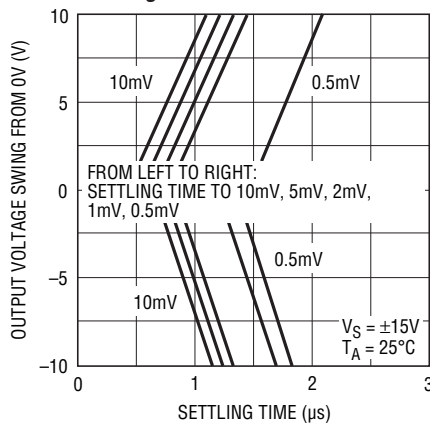
Gain, Phase Shift vs Frequency



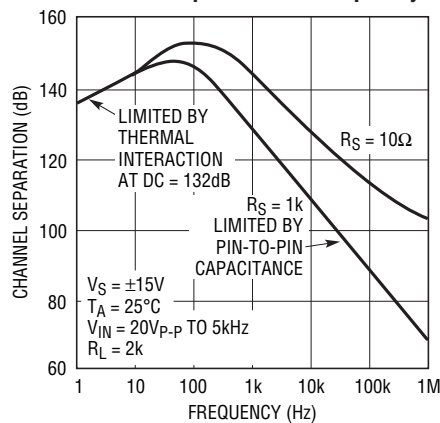
Capacitive Load Handling



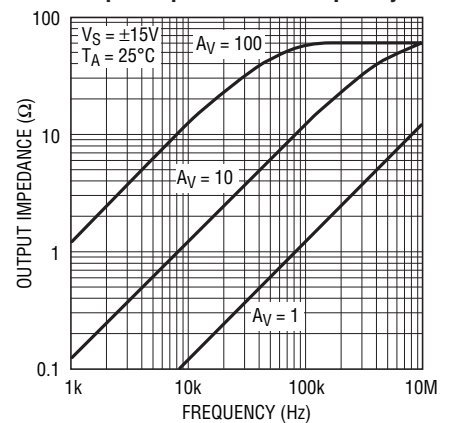
Settling Time



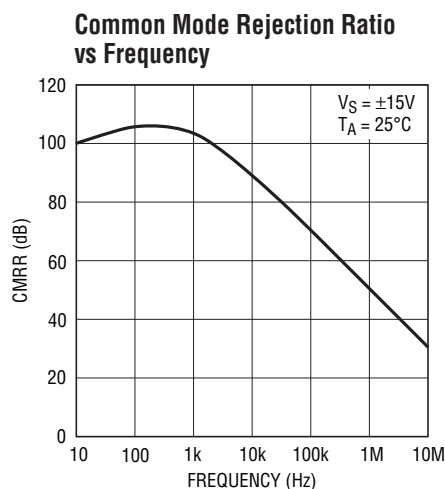
Channel Separation vs Frequency



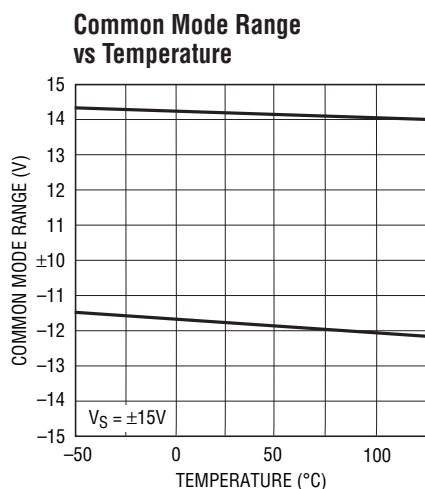
Output Impedance vs Frequency



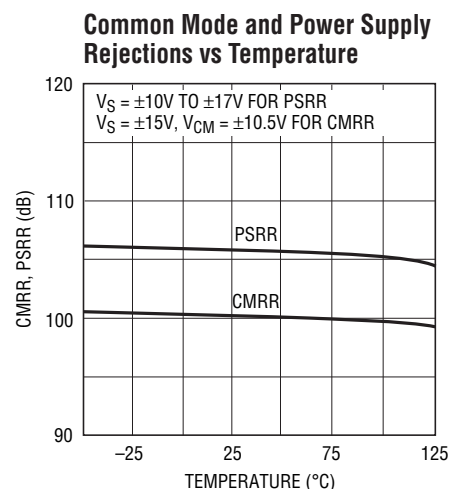
# TYPICAL PERFORMANCE CHARACTERISTICS



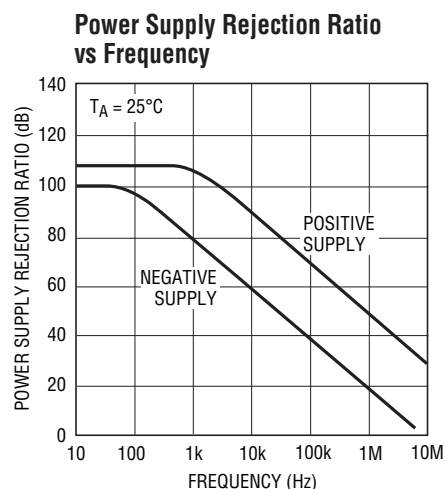
10578 G19



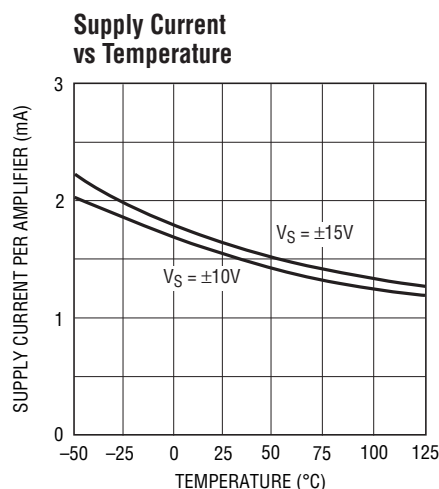
10578 G20



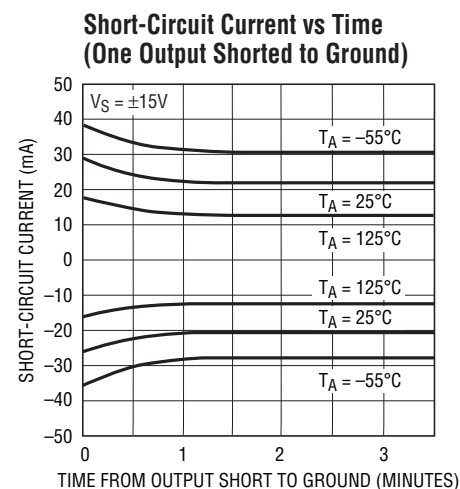
10578 G21



10578 G22



10578 G23



10578 G24

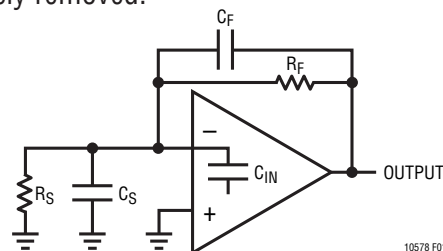
## APPLICATIONS INFORMATION

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 ( $C_{IN} \approx 4pF$ ). 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

10578fd

## 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.

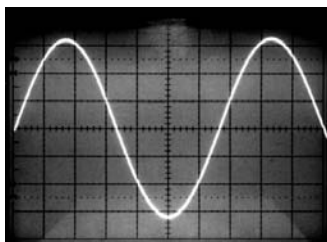
The offset voltage and drift performance are also affected by packaging. In the plastic N package, the molding compound is in direct contact with the chip, exerting pressure on the surface. While NPN input transistors are largely unaffected by this pressure, JFET device drift is degraded. Consequently 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.

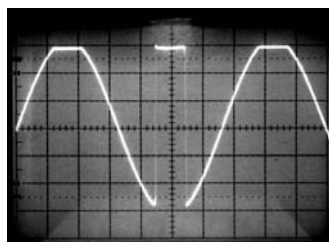
### Phase Reversal Protection

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).

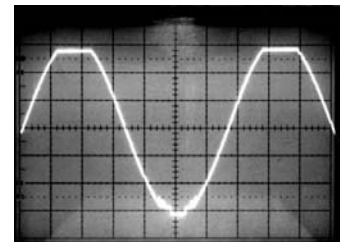
The phase reversal of photo (B) can cause lock-up in servo systems. The LT1057/LT1058 does not phase-reverse due to a unique phase reversal protection circuit.



(A) ±16V Sine Wave Input



(B) LF412A Output



(C) LT1057/LT1058 Output

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

Teflon is a trademark of DuPont.

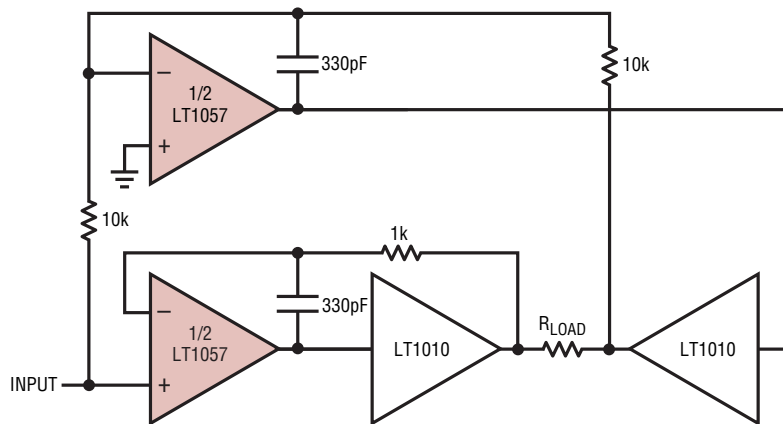
~3dB BANDWIDTH = 350kHz  
 GAIN-BANDWIDTH PRODUCT = 35MHz  
 WIDEBAND NOISE =  $\frac{13\text{nV}/\sqrt{\text{Hz}}}{\sqrt{3}} = 7.5\text{nV}/\sqrt{\text{Hz}}$  REFERRED TO INPUT  
 RMS NOISE DC TO FULL BANDWIDTH = 7 $\mu$ V

–3dB BANDWIDTH = 400kHz  
 GAIN-BANDWIDTH PRODUCT = 400MHz  
 WIDEBAND NOISE = 13nV/√Hz REFERRED TO INPUT

The diagram shows a circuit for common mode suppression. It features two LT1057 op-amp buffers. The first buffer, labeled 'COMMON MODE SUPPRESSION', has its non-inverting input (+) connected to ground and its inverting input (-) connected to a 15pF capacitor and a 100k resistor. The other end of the 100k resistor is connected to the inverting input of the second buffer, labeled 'OSCILLATOR'. The oscillator's non-inverting input (+) is connected to a #327 lamp. The lamp is connected to a crystal (20kHz NT CUT) and a 100Ω resistor. The other end of the 100Ω resistor is connected to a 130Ω resistor, which is then connected to the oscillator's inverting input (-). A 0.01μF capacitor is connected between the oscillator's inverting input and its output. The output of the oscillator is labeled '1VRMS OUT 20kHz 0.005% DISTORTION'.

## TYPICAL APPLICATIONS

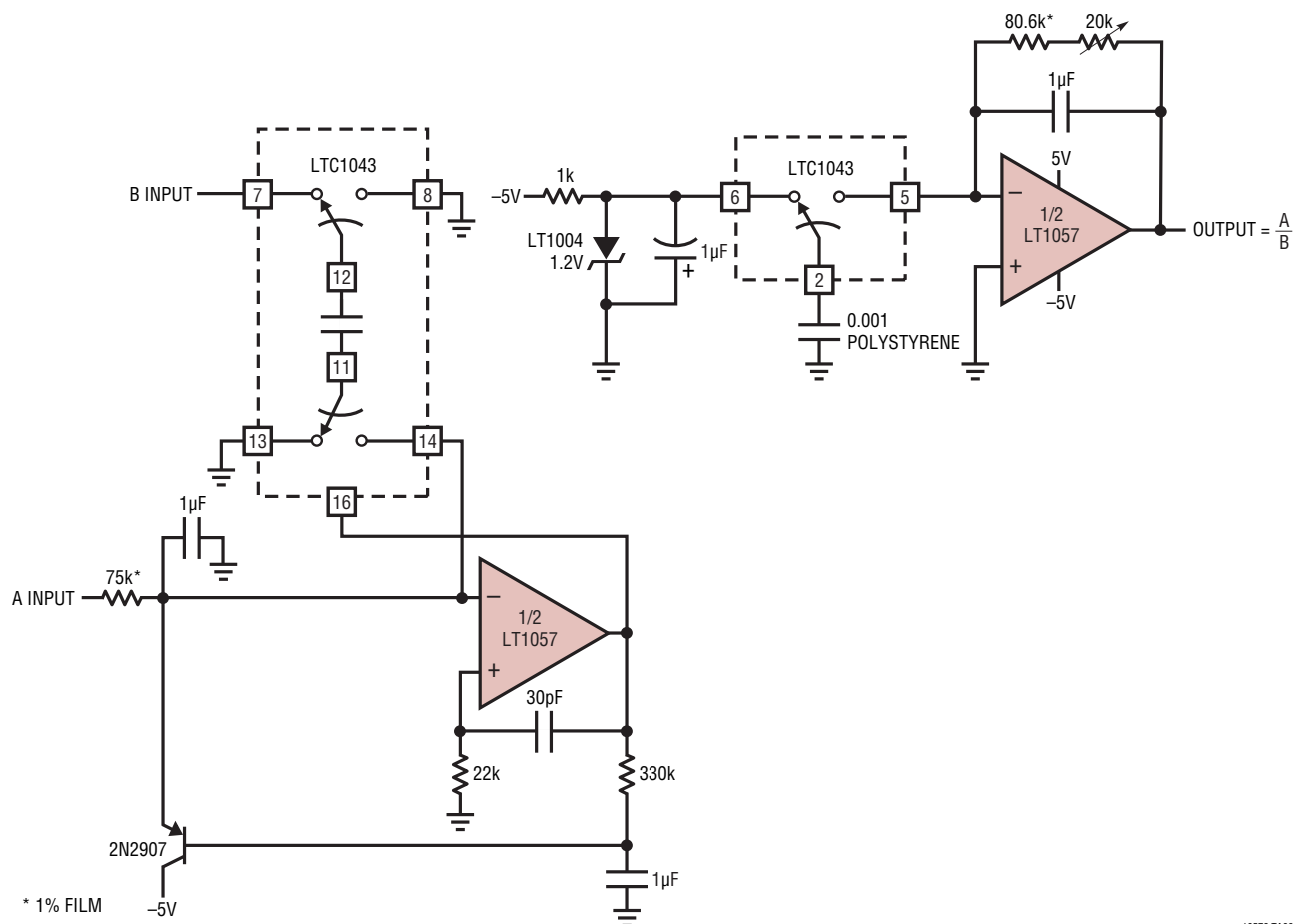
### Fast, Precision Bridge Amplifier



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

10578 TA05

### Analog Divider



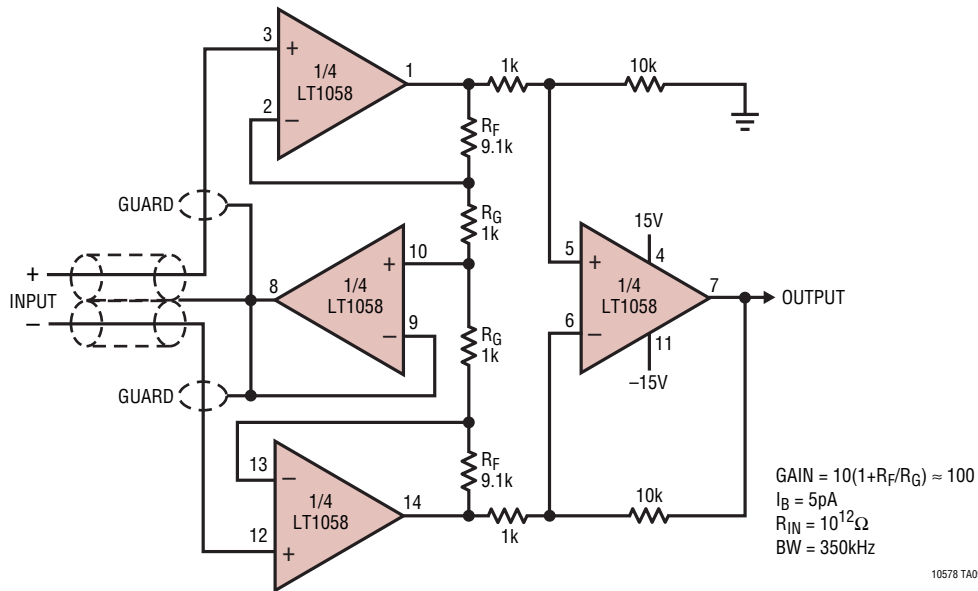
\* 1% FILM

10578 TA06  
 10578fd

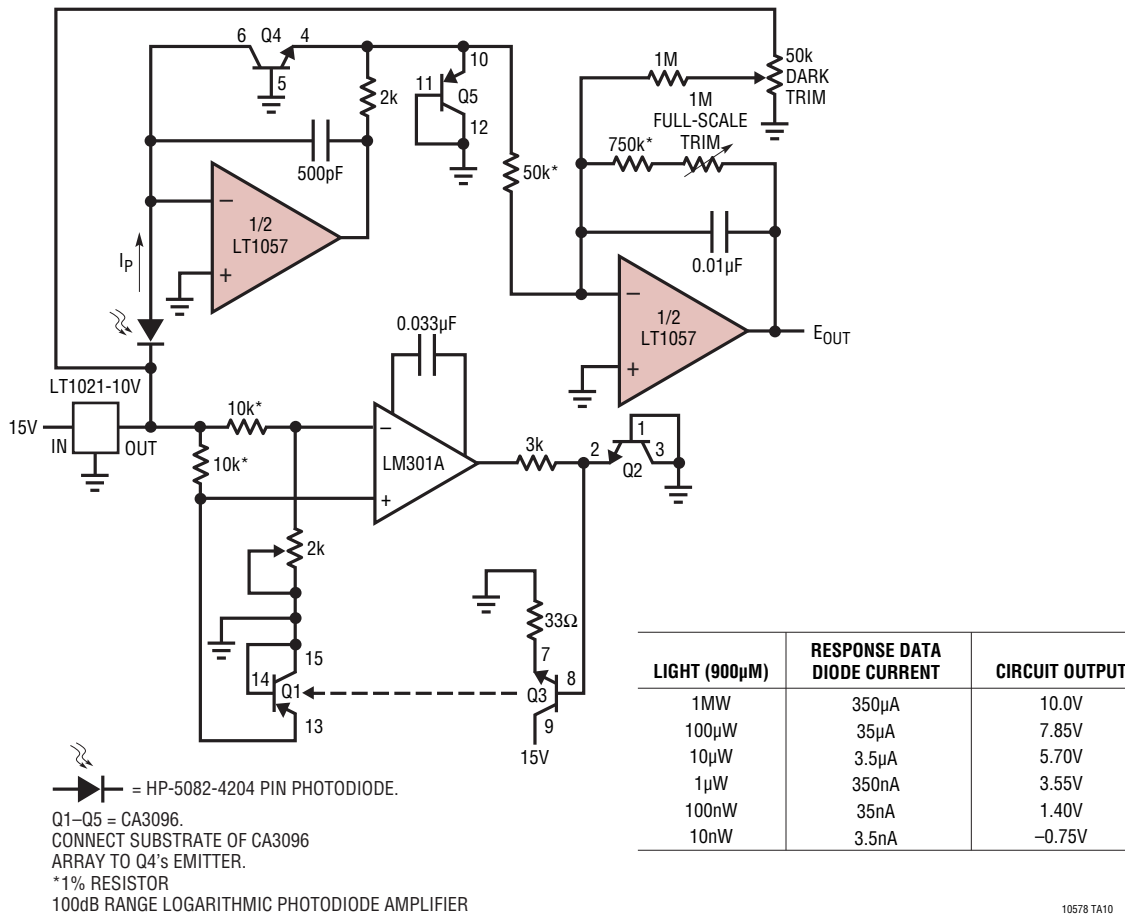
[illegible][illegible]

## TYPICAL APPLICATIONS

Instrumentation Amplifier with Shield Driver

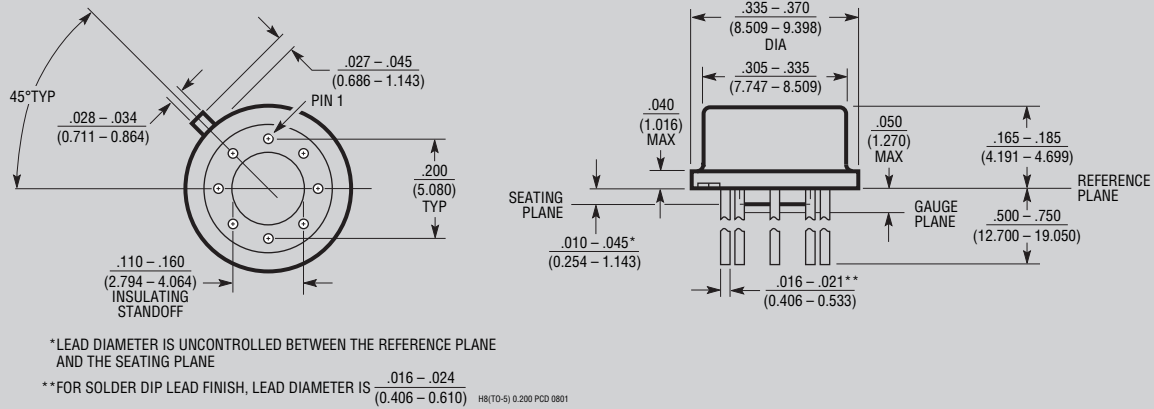


100dB Range Logarithmic Photodiode Amplifier

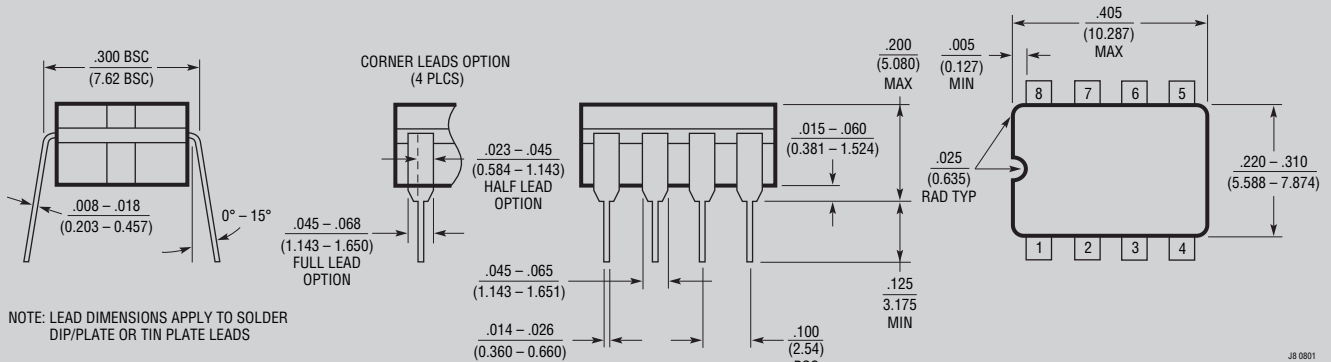


# PACKAGE DESCRIPTION

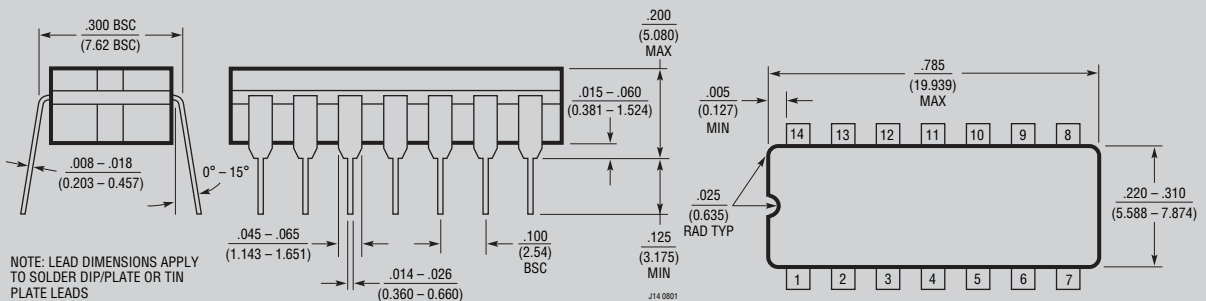
## H Package 8-Lead TO-5 Metal Can (.200 Inch PCD) (Reference LTC DWG # 05-08-1320)



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



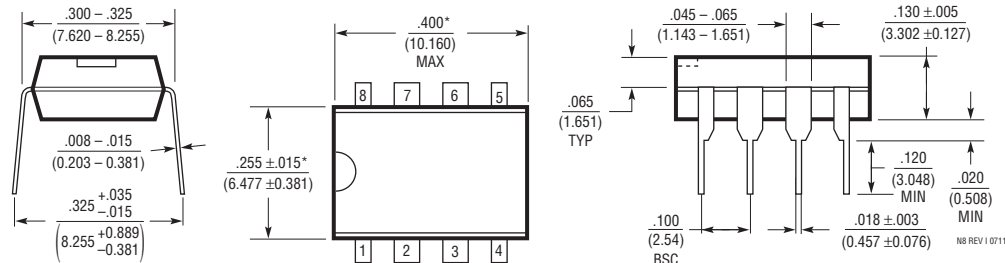
## J Package 14-Lead Cerdip (Narrow .300 Inch, Hermetic) (Reference LTC DWG # 05-08-1110)



## OBSOLETE PACKAGES

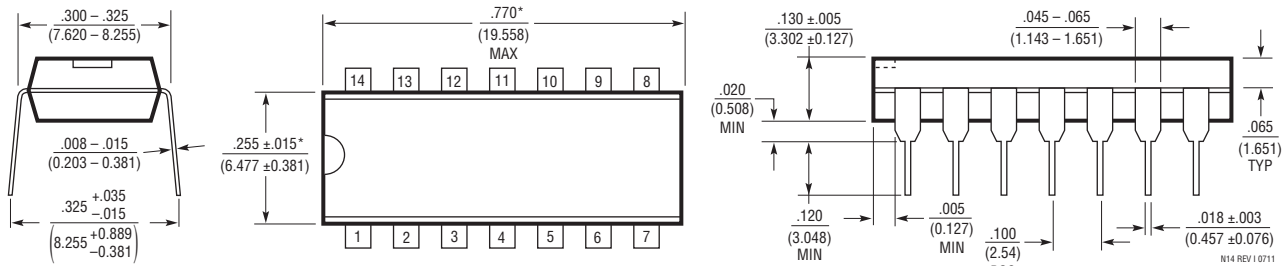
# PACKAGE DESCRIPTION

## N Package 8-Lead PDIP (Narrow .300 Inch) (Reference LTC DWG # 05-08-1510 Rev I)



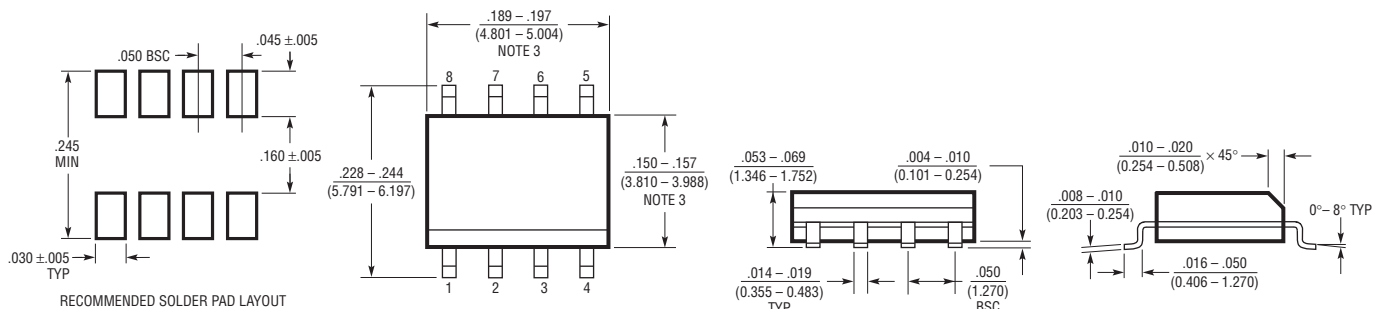
NOTE:  
1. DIMENSIONS ARE  $\frac{\text{INCHES}}{\text{MILLIMETERS}}$   
\*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.  
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

## N Package 14-Lead PDIP (Narrow .300 Inch) (Reference LTC DWG # 05-08-1510 Rev I)



NOTE:  
1. DIMENSIONS ARE  $\frac{\text{INCHES}}{\text{MILLIMETERS}}$   
\*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.  
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

## S8 Package 8-Lead Plastic Small Outline (Narrow .150 Inch) (Reference LTC DWG # 05-08-1610 Rev G)

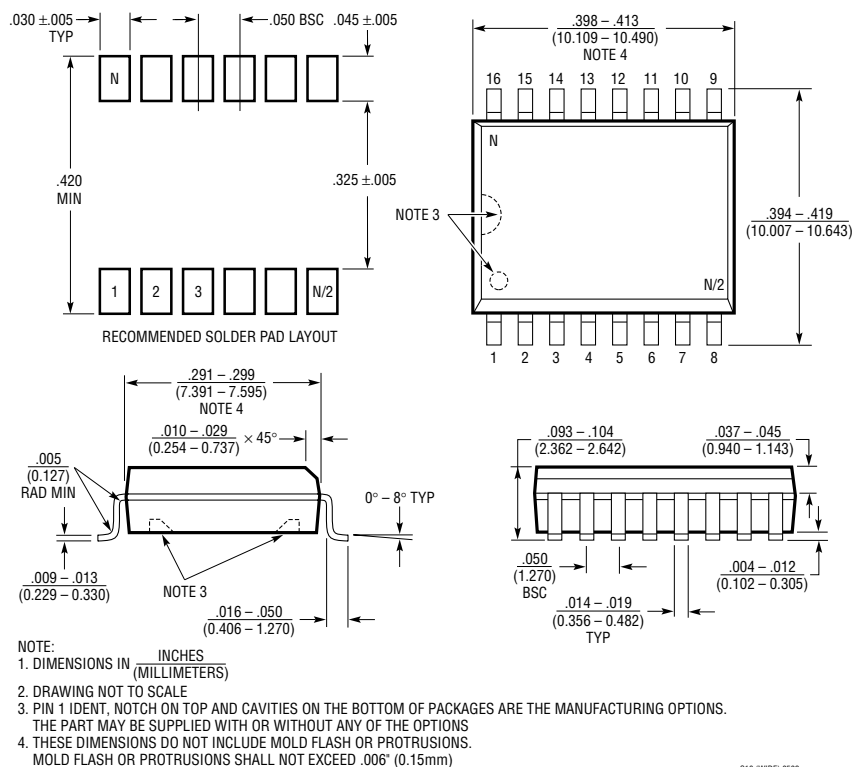


NOTE:  
1. DIMENSIONS IN  $\frac{\text{INCHES}}{\text{MILLIMETERS}}$   
2. DRAWING NOT TO SCALE  
3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.  
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)  
4. PIN 1 CAN BE BEVEL EDGE OR A DIMPLE

S08 REV G 0212

## TYPICAL APPLICATION

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



## RELATED PARTS

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