



# LT1178/LT1179

## ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage .....  $\pm 22\text{V}$   
 Differential Input Voltage .....  $\pm 30\text{V}$   
 Input Voltage ..... Equal to Positive Supply Voltage  
 Input Voltage .....  $5\text{V}$  Below Negative Supply Voltage  
 Output Short-Circuit Duration ..... Indefinite

Operating Temperature Range  
 LT1178I/LT1179I .....  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$   
 LT1178C/LT1178S/LT1179C/LT1179S .....  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$   
 Storage Temperature Range .....  $-65^{\circ}\text{C}$  to  $150^{\circ}\text{C}$   
 Lead Temperature (Soldering, 10 sec.) .....  $300^{\circ}\text{C}$

## PACKAGE/ORDER INFORMATION

|                                                                                                                                                                                                                                                                                                                          |                                                                               |                                                                                                                                                                                                                                                                                                                                                            |                                                                                  |                                                                                                                                                                                                                                                                                                                   |                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| <div><p>TOP VIEW</p><p>OUT A 1 -IN A 2 IN A 3 V- 4 +IN B 5 -IN B 6 OUT B 7 V+ 8</p><p>H PACKAGE<br/>8-LEAD TO-5 METAL CAN</p></div>                                                                                                                                                                                      | <div><p>ORDER PART NUMBER</p><p>LT1178ACH<br/>LT1178CH</p></div>              | <div><p>TOP VIEW</p><p>OUT A 1 -IN A 2 +IN A 3 V- 4 OUT B 7 -IN B 6 -IN B 5 +IN B 8</p><p>N PACKAGE<br/>8-LEAD PDIP</p><p><math>T_{JMAX} = 100^{\circ}\text{C}</math>, <math>\theta_{JA} = 150^{\circ}\text{C/W}</math></p><p>J PACKAGE 8-LEAD CERDIP</p></div>                                                                                            | <div><p>ORDER PART NUMBER</p><p>LT1178ACN8<br/>LT1178CN8<br/>LT1178IN8</p></div> | <div><p>TOP VIEW</p><p>+IN A 1 V- 2 +IN B 3 -IN B 4 OUT B 5 V+ 6 OUT A 7 -IN A 8</p><p>S8 PACKAGE<br/>8-LEAD PLASTIC SO</p><p><math>T_{JMAX} = 150^{\circ}\text{C}</math>, <math>\theta_{JA} = 200^{\circ}\text{C/W}</math></p></div>                                                                             | <div><p>ORDER PART NUMBER</p><p>LT1178S8</p></div> <div><p>PART MARKING</p><p>1178</p></div> |
| <div><p>TOP VIEW</p><p>OUT A 1 -IN A 2 +IN A 3 V+ 4 +IN B 5 -IN B 6 OUT B 7 OUT C 8 -IN C 9 +IN C 10 V- 11 +IN D 12 -IN D 13 OUT D 14</p><p>N PACKAGE<br/>14-LEAD PDIP</p><p><math>T_{JMAX} = 110^{\circ}\text{C}</math>, <math>\theta_{JA} = 130^{\circ}\text{C/W}</math></p><p>J PACKAGE 14-LEAD CERAMIC DIP</p></div> | <div><p>ORDER PART NUMBER</p><p>LT1179ACN<br/>LT1179CN<br/>LT1179IN</p></div> | <div><p>Not Recommended. Use LT1178S8 for New Designs.</p><p>TOP VIEW</p><p>NC 1 OUT A 2 NC 3 -IN A 4 OUT B 5 -IN A 6 +IN A 7 V- 8 -IN B 9 NC 10 +IN B 11 NC 12 -IN B 13 OUT B 14 V+ 15 NC 16 NC</p><p>SW PACKAGE<br/>16-LEAD PLASTIC SO WIDE</p><p><math>T_{JMAX} = 150^{\circ}\text{C}</math>, <math>\theta_{JA} = 90^{\circ}\text{C/W}</math></p></div> | <div><p>ORDER PART NUMBER</p><p>LT1178SW<br/>LT1179SW</p></div>                  | <div><p>TOP VIEW</p><p>OUT A 1 -IN A 2 +IN A 3 V+ 4 +IN B 5 -IN B 6 OUT B 7 OUT C 8 -IN C 9 NC 10 +IN C 11 -IN C 12 +IN D 13 -IN D 14 OUT D 15 NC 16 NC</p><p>SW PACKAGE<br/>16-LEAD PLASTIC SO WIDE</p><p><math>T_{JMAX} = 150^{\circ}\text{C}</math>, <math>\theta_{JA} = 90^{\circ}\text{C/W}</math></p></div> |                                                                                              |

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Consult LTC Marketing for parts specified with wider operating temperature ranges. Please note that the LT1178S8 surface mount pinout differs from that of the LT1178 standard plastic or ceramic dual-in-line packages. For similar performance with standard pinout, see the LT2178.

## ELECTRICAL CHARACTERISTICS $V_S = 5\text{V}$ , $0\text{V}$ ; $V_{CM} = 0.1\text{V}$ , $V_O = 1.4\text{V}$ , $T_A = 25^{\circ}\text{C}$ , unless noted.

| SYMBOL                                     | PARAMETER                                | CONDITIONS (NOTE 2) | LT1178AC/LT1179AC |      |      | LT1178I/C/S/LT1179I/C/S |      |      | UNITS            |
|--------------------------------------------|------------------------------------------|---------------------|-------------------|------|------|-------------------------|------|------|------------------|
|                                            |                                          |                     | MIN               | TYP  | MAX  | MIN                     | TYP  | MAX  |                  |
| $V_{OS}$                                   | Input Offset Voltage                     | LT1178              |                   | 30   | 70   |                         | 40   | 120  | $\mu\text{V}$    |
|                                            |                                          | LT1179              |                   | 35   | 100  |                         | 40   | 150  | $\mu\text{V}$    |
|                                            |                                          | LT1178SW            |                   |      |      |                         | 80   | 450  | $\mu\text{V}$    |
|                                            |                                          | LT1179SW            |                   |      |      |                         | 90   | 600  | $\mu\text{V}$    |
|                                            |                                          | LT1178S8            |                   |      |      |                         | 60   | 180  | $\mu\text{V}$    |
| $\frac{\Delta V_{OS}}{\Delta \text{Time}}$ | Long Term Input Offset Voltage Stability |                     |                   | 0.5  |      |                         | 0.6  |      | $\mu\text{V/Mo}$ |
| $I_{OS}$                                   | Input Offset Current                     |                     |                   | 0.05 | 0.25 |                         | 0.05 | 0.35 | nA               |

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# ELECTRICAL CHARACTERISTICS

$V_S = 5V$ ,  $0V$ ;  $V_{CM} = 0.1V$ ,  $V_O = 1.4V$ ,  $T_A = 25^\circ C$ , unless noted.

| SYMBOL    | PARAMETER                                            | CONDITIONS (NOTE 2)                                                                                                                    | LT1178AC/LT1179AC |                                 |                               | LT1178I/C/S/LT1179I/C/S |                                 |          | UNITS                            |
|-----------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------|-------------------------------|-------------------------|---------------------------------|----------|----------------------------------|
|           |                                                      |                                                                                                                                        | MIN               | TYP                             | MAX                           | MIN                     | TYP                             | MAX      |                                  |
| $I_B$     | Input Bias Current                                   |                                                                                                                                        |                   | 3                               | 5                             |                         | 3                               | 6        | nA                               |
| $e_n$     | Input Noise Voltage                                  | 0.1Hz to 10Hz (Note 3)                                                                                                                 |                   | 0.9                             | 2.0                           |                         | 0.9                             |          | $\mu V_{P-P}$                    |
|           | Input Noise Voltage Density                          | $f_0 = 10Hz$ (Note 3)<br>$f_0 = 1000Hz$ (Note 3)                                                                                       |                   | 50<br>49                        | 75<br>65                      |                         | 50<br>49                        |          | $nV/\sqrt{Hz}$<br>$nV/\sqrt{Hz}$ |
| $i_n$     | Input Noise Current                                  | 0.1Hz to 10Hz (Note 3)                                                                                                                 |                   | 1.5                             | 2.5                           |                         | 1.5                             |          | pA <sub>p-p</sub>                |
|           | Input Noise Current Density                          | $f_0 = 10Hz$ (Note 3)<br>$f_0 = 1000Hz$                                                                                                |                   | 0.03<br>0.01                    | 0.07                          |                         | 0.03<br>0.01                    |          | $pA/\sqrt{Hz}$<br>$pA/\sqrt{Hz}$ |
|           | Input Resistance<br>Differential Mode<br>Common Mode | (Note 4)                                                                                                                               | 0.8               | 2.0<br>12                       |                               | 0.6                     | 2.0<br>12                       |          | $G\Omega$<br>$G\Omega$           |
|           | Input Voltage Range                                  |                                                                                                                                        | 3.5<br>0          | 3.9<br>-0.3                     |                               | 3.5<br>0                | 3.9<br>-0.3                     |          | V<br>V                           |
| CMRR      | Common Mode Rejection Ratio                          | $V_{CM} = 0V$ to $3.5V$                                                                                                                | 93                | 103                             |                               | 90                      | 102                             |          | dB                               |
| PSRR      | Power Supply Rejection Ratio                         | $V_S = 2.2V$ to $12V$                                                                                                                  | 94                | 104                             |                               | 92                      | 104                             |          | dB                               |
| $A_{VOL}$ | Large Signal Voltage Gain                            | $V_O = 0.03V$ to $4V$ , No Load (Note 4)<br>$V_O = 0.03V$ to $3.5V$ , $R_L = 50k$                                                      | 140<br>80         | 700<br>200                      |                               | 110<br>70               | 700<br>200                      |          | V/mV<br>V/mV                     |
|           | Maximum Output Voltage Swing                         | Output Low, No Load<br>Output Low, $2k$ to GND<br>Output Low, $I_{SINK} = 100\mu A$<br>Output High, No Load<br>Output High $2k$ to GND |                   | 6.5<br>0.2<br>120<br>4.2<br>3.5 | 9<br>0.6<br>160<br>4.4<br>3.8 |                         | 6.5<br>0.2<br>120<br>4.4<br>3.8 |          | mV<br>mV<br>mV<br>V<br>V         |
| SR        | Slew Rate                                            | $A_V = 1$ , $C_L = 10pF$ (Note 4)                                                                                                      | 0.013             | 0.025                           |                               | 0.013                   | 0.025                           |          | V/ $\mu s$                       |
| GBW       | Gain Bandwidth Product                               | $f_0 \leq 5kHz$                                                                                                                        |                   | 60                              |                               |                         | 60                              |          | kHz                              |
| $I_S$     | Supply Current per Amplifier                         | $V_S = \pm 1.5V$ , $V_O = 0V$                                                                                                          |                   | 13<br>12                        | 18<br>17                      |                         | 14<br>13                        | 21<br>20 | $\mu A$<br>$\mu A$               |
|           | Channel Separation                                   | $\Delta V_{IN} = 3V$ , $R_L = 10k$                                                                                                     |                   | 130                             |                               |                         | 130                             |          | dB                               |
|           | Minimum Supply Voltage                               | (Note 5)                                                                                                                               |                   | 2.0                             | 2.2                           |                         | 2.0                             | 2.2      | V                                |

# ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range of  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$  for I grades,  $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$  for SW grades,  $V_S = 5\text{V}$ ,  $0\text{V}$ ;  $V_{CM} = 0.1\text{V}$ ,  $V_O = 1.4\text{V}$ , unless noted. (Note 7)

| SYMBOL                   | PARAMETER                    | CONDITIONS                                                                                                                |                  | LT1178I/LT1179I |                        |            | LT1178SW/LT1179SW |                        |           | UNITS                          |
|--------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|------------------------|------------|-------------------|------------------------|-----------|--------------------------------|
|                          |                              |                                                                                                                           |                  | MIN             | TYP                    | MAX        | MIN               | TYP                    | MAX       |                                |
| $V_{OS}$                 | Input Offset Voltage         | LT1178<br>LT1179                                                                                                          | ●<br>●           |                 | 80<br>80               | 315<br>345 | 120<br>130        | 650<br>800             |           | $\mu\text{V}$<br>$\mu\text{V}$ |
| $\Delta V_{OS}/\Delta T$ | Input Offset Voltage Drift   | (Note 6)                                                                                                                  | ●                |                 | 0.6                    | 3.0        | 0.8               | 4.5                    |           | $\mu\text{V}/^{\circ}\text{C}$ |
| $I_{OS}$                 | Input Offset Current         |                                                                                                                           | ●                |                 | 0.07                   | 0.7        | 0.06              | 0.50                   |           | nA                             |
| $I_B$                    | Input Bias Current           |                                                                                                                           | ●                |                 | 4                      | 8          | 3                 | 7                      |           | nA                             |
| CMRR                     | Common Mode Rejection Ratio  | $V_{CM} = 0.05\text{V}$ to $3.2\text{V}$ I grade<br>$V_{CM} = 0\text{V}$ to $3.4\text{V}$ S grade                         | ●                | 84              | 98                     |            | 86                | 100                    |           | dB                             |
| PSRR                     | Power Supply Rejection Ratio | $V_S = 3.0\text{V}$ to $12\text{V}$ I grade<br>$V_S = 2.5\text{V}$ to $12\text{V}$ S grade                                | ●                | 86              | 100                    |            | 88                | 102                    |           | dB                             |
| $A_{VOL}$                | Large-Signal Voltage Gain    | $V_O = 0.05\text{V}$ to $4\text{V}$ , No Load (Note 4)<br>$V_O = 0.05\text{V}$ to $3.5\text{V}$ , $R_L = 50\text{k}$      | ●<br>●           | 55<br>35        | 350<br>130             |            | 80<br>45          | 500<br>160             |           | V/mV<br>V/mV                   |
|                          | Maximum Output Voltage Swing | Output Low, No Load<br>Output Low, $I_{SINK} = 100\mu\text{A}$<br>Output High, No Load<br>Output High, $2\text{k}$ to GND | ●<br>●<br>●<br>● |                 | 9<br>160<br>4.2<br>3.7 | 13<br>220  |                   | 8<br>140<br>4.3<br>3.8 | 11<br>190 | mV<br>mV<br>V<br>V             |
| $I_S$                    | Supply Current per Amplifier |                                                                                                                           | ●                |                 | 15                     | 27         | 15                | 24                     |           | $\mu\text{A}$                  |

The ● denotes specifications which apply over the full operating temperature range of  $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$ ,  $V_S = 5\text{V}$ ,  $0\text{V}$ ,  $V_{CM} = 0.1\text{V}$ ,  $V_O = 1.4\text{V}$ , unless noted.

| SYMBOL                   | PARAMETER                    | CONDITIONS                                                                                                                |                  | LT1178AC/LT1179AC |                        |            | LT1178C/S8/LT1179C |                        |           | UNITS                                                            |
|--------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------------|-------------------|------------------------|------------|--------------------|------------------------|-----------|------------------------------------------------------------------|
|                          |                              |                                                                                                                           |                  | MIN               | TYP                    | MAX        | MIN                | TYP                    | MAX       |                                                                  |
| $V_{OS}$                 | Input Offset Voltage         | LT1178<br>LT1178S8<br>LT1179                                                                                              | ●<br>●<br>●      |                   | 50<br>60               | 170<br>200 | 65<br>85<br>70     | 250<br>350<br>290      |           | $\mu\text{V}$<br>$\mu\text{V}$<br>$\mu\text{V}$                  |
| $\Delta V_{OS}/\Delta T$ | Input Offset Voltage Drift   | (Note 6)<br>LT1178S8                                                                                                      | ●<br>●           |                   | 0.5                    | 2.2        | 0.6<br>0.6         | 3.0<br>3.5             |           | $\mu\text{V}/^{\circ}\text{C}$<br>$\mu\text{V}/^{\circ}\text{C}$ |
| $I_{OS}$                 | Input Offset Current         |                                                                                                                           | ●                |                   | 0.06                   | 0.35       | 0.06               | 0.50                   |           | nA                                                               |
| $I_B$                    | Input Bias Current           |                                                                                                                           | ●                |                   | 3                      | 6          | 3                  | 7                      |           | nA                                                               |
| CMRR                     | Common Mode Rejection Ratio  | $V_{CM} = 0\text{V}$ to $3.4\text{V}$                                                                                     | ●                | 90                | 101                    |            | 86                 | 100                    |           | dB                                                               |
| PSRR                     | Power Supply Rejection Ratio | $V_S = 2.5\text{V}$ to $12\text{V}$                                                                                       | ●                | 90                | 102                    |            | 88                 | 102                    |           | dB                                                               |
| $A_{VOL}$                | Large-Signal Voltage Gain    | $V_O = 0.05\text{V}$ to $4\text{V}$ , No Load (Note 4)<br>$V_O = 0.05\text{V}$ to $3.5\text{V}$ , $R_L = 50\text{k}$      | ●<br>●           | 105<br>55         | 500<br>160             |            | 80<br>45           | 500<br>160             |           | V/mV<br>V/mV                                                     |
|                          | Maximum Output Voltage Swing | Output Low, No Load<br>Output Low, $I_{SINK} = 100\mu\text{A}$<br>Output High, No Load<br>Output High, $2\text{k}$ to GND | ●<br>●<br>●<br>● |                   | 8<br>140<br>4.3<br>3.8 | 11<br>190  |                    | 8<br>140<br>4.3<br>3.8 | 11<br>190 | mV<br>mV<br>V<br>V                                               |
| $I_S$                    | Supply Current per Amplifier |                                                                                                                           | ●                |                   | 14                     | 21         | 15                 | 24                     |           | $\mu\text{A}$                                                    |

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

| SYMBOL    | PARAMETER                    | CONDITIONS                                                 | LT1178AC/LT1179AC        |                          |      | LT1178I/C/S/LT1179I/C/S  |                          |                           | UNITS                                    |
|-----------|------------------------------|------------------------------------------------------------|--------------------------|--------------------------|------|--------------------------|--------------------------|---------------------------|------------------------------------------|
|           |                              |                                                            | MIN                      | TYP                      | MAX  | MIN                      | TYP                      | MAX                       |                                          |
| $V_{OS}$  | Input Offset Voltage         | LT1178SW<br>LT1179SW<br>LT1178S8                           |                          | 80                       | 350  |                          | 100<br>150<br>160<br>120 | 480<br>900<br>1050<br>350 | $\mu V$<br>$\mu V$<br>$\mu V$<br>$\mu V$ |
| $I_{OS}$  | Input Offset Current         |                                                            |                          | 0.05                     | 0.25 |                          | 0.05                     | 0.35                      | nA                                       |
| $I_B$     | Input Bias Current           |                                                            |                          | 3                        | 5    |                          | 3                        | 6                         | nA                                       |
|           | Input Voltage Range          |                                                            | 13.5<br>-15.0            | 13.9<br>-15.3            |      | 13.5<br>-15.0            | 13.9<br>-15.3            |                           | V<br>V                                   |
| CMRR      | Common Mode Rejection Ratio  | $V_{CM} = 13.5V, -15V$                                     | 97                       | 106                      |      | 94                       | 106                      |                           | dB                                       |
| PSRR      | Power Supply Rejection Ratio | $V_S = 5V, 0V$ to $\pm 18V$                                | 96                       | 112                      |      | 94                       | 112                      |                           | dB                                       |
| $A_{VOL}$ | Large-Signal Voltage Gain    | $V_O = \pm 10V$ , $R_L = 50k$<br>$V_O = \pm 10V$ , No Load | 300<br>600               | 1200<br>2500             |      | 250<br>400               | 1000<br>2500             |                           | V/mV<br>V/mV                             |
| $V_{OUT}$ | Maximum Output Voltage Swing | $R_L = 50k$<br>$R_L = 2k$                                  | $\pm 13.0$<br>$\pm 11.0$ | $\pm 14.2$<br>$\pm 12.7$ |      | $\pm 13.0$<br>$\pm 11.0$ | $\pm 14.2$<br>$\pm 12.7$ |                           | V<br>V                                   |
| SR        | Slew Rate                    | $A_V = 1$                                                  | 0.02                     | 0.04                     |      | 0.02                     | 0.04                     |                           | V/ $\mu s$                               |
| GBW       | Gain Bandwidth Product       | $f_0 \leq 5kHz$                                            |                          | 85                       |      |                          | 85                       |                           | kHz                                      |
| $I_S$     | Supply Current per Amplifier |                                                            |                          | 16                       | 21   |                          | 17                       | 25                        | $\mu A$                                  |

The ● denotes specifications which apply over the full operating temperature range of  $-40^\circ C \leq T_A \leq 85^\circ C$  for I grades,  $0^\circ C \leq T_A \leq 70^\circ C$  for SW grades,  $V_S = \pm 15V$ , unless noted.

| SYMBOL                   | PARAMETER                    | CONDITIONS                    |        | LT1178I/LT1179I |            |            | LT1178SW/LT1179SW |            |              | UNITS              |
|--------------------------|------------------------------|-------------------------------|--------|-----------------|------------|------------|-------------------|------------|--------------|--------------------|
|                          |                              |                               |        | MIN             | TYP        | MAX        | MIN               | TYP        | MAX          |                    |
| $V_{OS}$                 | Input Offset Voltage         | LT1178<br>LT1179              | ●<br>● |                 | 130<br>130 | 740<br>740 |                   | 190<br>200 | 1150<br>1300 | $\mu V$<br>$\mu V$ |
| $\Delta V_{OS}/\Delta T$ | Input Offset Voltage Drift   | (Note 6)                      | ●      |                 | 0.7        | 4.0        |                   | 0.9        | 5.5          | $\mu V/^\circ C$   |
| $I_{OS}$                 | Input Offset Current         |                               | ●      |                 | 0.07       | 0.7        |                   | 0.06       | 0.35         | nA                 |
| $I_B$                    | Input Bias Current           |                               | ●      |                 | 4          | 8          |                   | 3          | 7            | nA                 |
| $A_{VOL}$                | Large-Signal Voltage Gain    | $V_O = \pm 10V$ , $R_L = 50k$ | ●      |                 | 100        | 500        |                   | 150        | 750          | V/mV               |
| CMRR                     | Common Mode Rejection Ratio  | $V_{CM} = 13V, -14.9V$        | ●      |                 | 88         | 103        |                   | 91         | 104          | dB                 |
| PSRR                     | Power Supply Rejection Ratio | $V_S = 5V, 0V$ to $\pm 18V$   | ●      |                 | 88         | 109        |                   | 91         | 110          | dB                 |
|                          | Maximum Output Voltage Swing | $R_L = 5k$                    | ●      |                 | $\pm 11.0$ | $\pm 13.5$ |                   | $\pm 11.0$ | $\pm 13.5$   | V                  |
| $I_S$                    | Supply Current per Amplifier |                               | ●      |                 | 19         | 30         |                   | 18         | 28           | $\mu A$            |

## ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range of  $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$ ,  $V_S = \pm 15\text{V}$ , unless noted.

The ● denotes specifications which apply over the full operating temperature range of  $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$ ,  $V_S = \pm 15\text{V}$ , unless noted.

| SYMBOL                   | PARAMETER                    | CONDITIONS                                          |   | LT1178AC/LT1179AC |            |      | LT1178C/S8/LT1179C |            |      | UNITS                          |
|--------------------------|------------------------------|-----------------------------------------------------|---|-------------------|------------|------|--------------------|------------|------|--------------------------------|
|                          |                              |                                                     |   | MIN               | TYP        | MAX  | MIN                | TYP        | MAX  |                                |
| $V_{OS}$                 | Input Offset Voltage         | LT1178S8                                            | ● |                   | 100        | 480  |                    | 130        | 660  | $\mu\text{V}$                  |
|                          |                              |                                                     | ● |                   |            |      |                    | 150        | 540  | $\mu\text{V}$                  |
| $\Delta V_{OS}/\Delta T$ | Input Offset Voltage Drift   | (Note 6)<br>LT1178S8                                | ● |                   | 0.6        | 2.8  |                    | 0.7        | 4.0  | $\mu\text{V}/^{\circ}\text{C}$ |
|                          |                              |                                                     | ● |                   |            |      |                    | 0.7        | 3.8  | $\mu\text{V}/^{\circ}\text{C}$ |
| $I_{OS}$                 | Input Offset Current         |                                                     | ● |                   | 0.06       | 0.35 |                    | 0.06       | 0.35 | nA                             |
| $I_B$                    | Input Bias Current           |                                                     | ● |                   | 3          | 6    |                    | 3          | 7    | nA                             |
| $A_{VOL}$                | Large-Signal Voltage Gain    | $V_O = \pm 10\text{V}$ , $R_L = 50\text{k}$         | ● | 200               | 800        |      | 150                | 750        |      | V/mV                           |
| CMRR                     | Common Mode Rejection Ratio  | $V_{CM} = 13\text{V}$ , $-15\text{V}$               | ● | 94                | 104        |      | 91                 | 104        |      | dB                             |
| PSRR                     | Power Supply Rejection Ratio | $V_S = 5\text{V}$ , $0\text{V}$ to $\pm 18\text{V}$ | ● | 93                | 110        |      | 91                 | 110        |      | dB                             |
|                          | Maximum Output Voltage Swing | $R_L = 5\text{k}$                                   | ● | $\pm 11.0$        | $\pm 13.6$ |      | $\pm 11.0$         | $\pm 13.6$ |      | V                              |
| $I_S$                    | Supply Current per Amplifier |                                                     | ● |                   | 17         | 24   |                    | 18         | 28   | $\mu\text{A}$                  |

**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

**Note 2:** Typical parameters are defined as the 60% yield of parameter distributions of individual amplifiers; (i.e., out of 100 LT1179s, or 100 LT1178s, typically 240 op amps, or 120, will be better than the indicated specification).

**Note 3:** This parameter is tested on a sample basis only. All noise parameters are tested with  $V_S = \pm 2.5$ ,  $V_O = 0\text{V}$ .

**Note 4:** This parameter is guaranteed by design and is not tested.

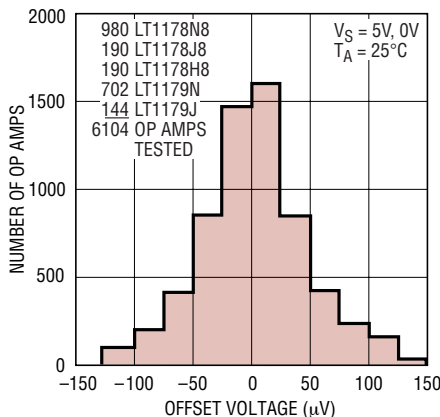
**Note 5:** Power supply rejection ratio is measured at the minimum supply voltage. The op amps actually work at 1.7V supply but with a typical offset skew of  $-300\mu\text{V}$ .

**Note 6:** This parameter is not 100% tested.

**Note 7:** During testing at  $-40^{\circ}\text{C}$ , the 5V power supply turn on-time is less than 0.5 seconds.

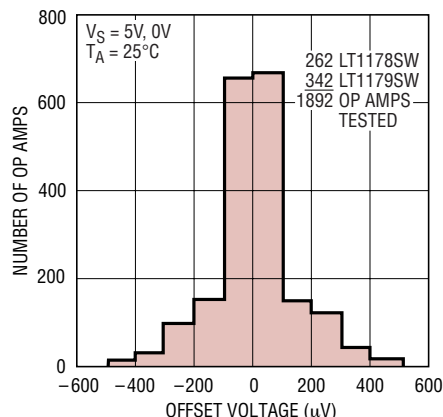
## TYPICAL PERFORMANCE CHARACTERISTICS

Input Offset Voltage Distribution  
N, J, H Package



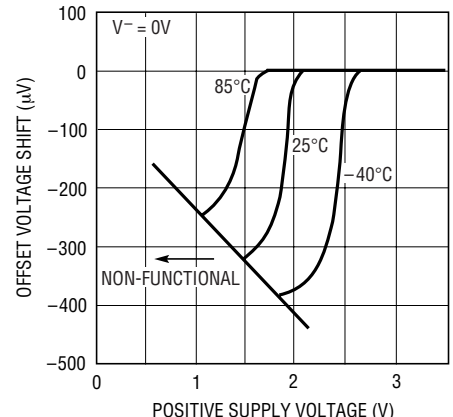
LT1178/LT1179 • TP001

Input Offset Voltage Distribution  
Surface Mount Package



LT1178/LT1179 • TP002

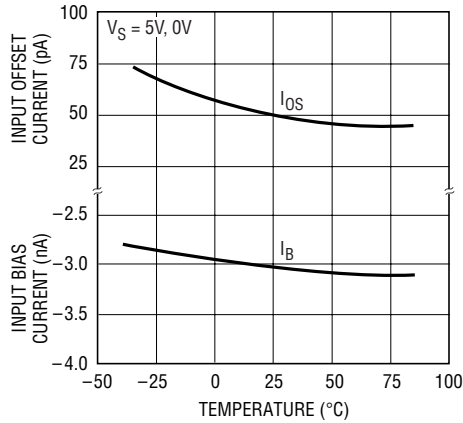
Minimum Supply Voltage



LT1178/LT1179 • TP003

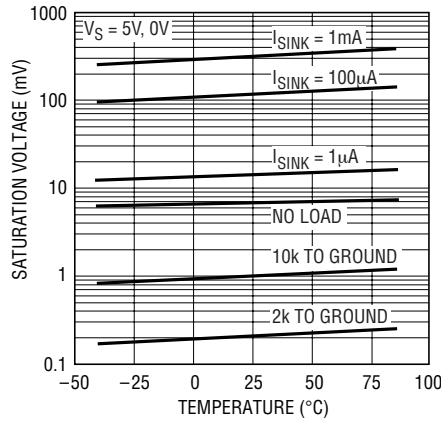
# TYPICAL PERFORMANCE CHARACTERISTICS

**Input Bias and Offset Currents vs Temperature**



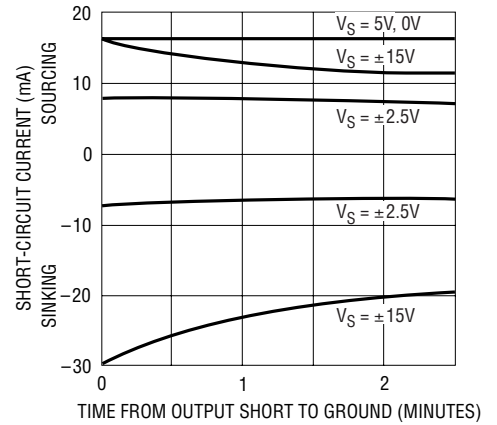
LT1178/LT1179 • TPC04

**Output Saturation vs Temperature vs Sink Current**



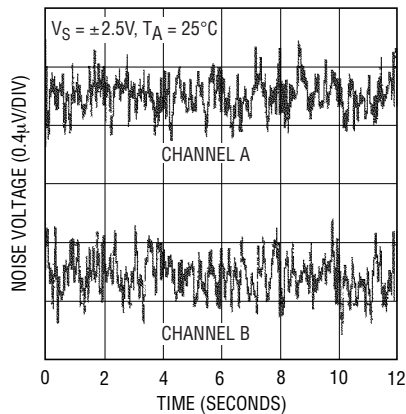
LT1178/LT1179 • TPC05

**Short-Circuit Current**



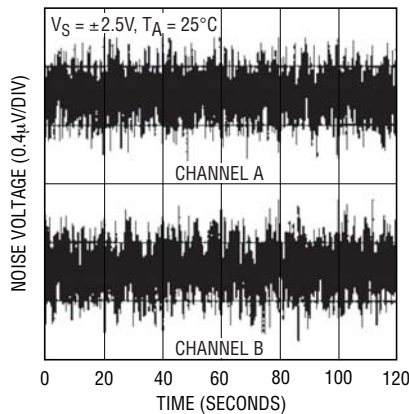
LT1178/LT1179 • TPC06

**0.1Hz to 10Hz Noise**



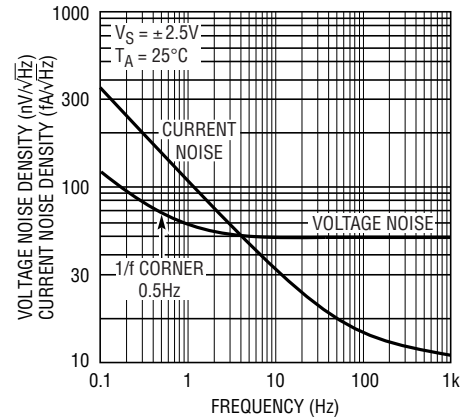
LT1178/LT1179 • TPC07

**0.01Hz to 10Hz Noise**



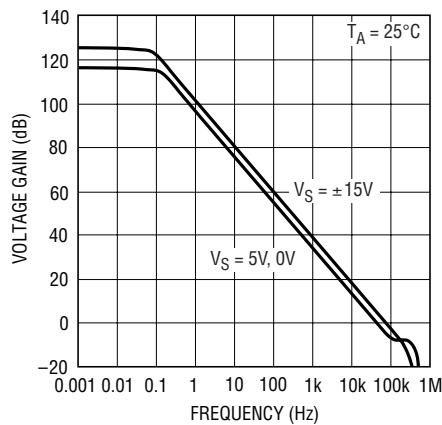
LT1178/LT1179 • TPC08

**Noise Spectrum**



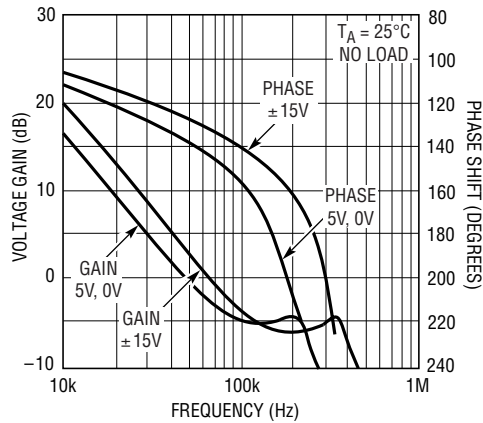
LT1178/LT1179 • TPC09

**Voltage Gain vs Frequency**



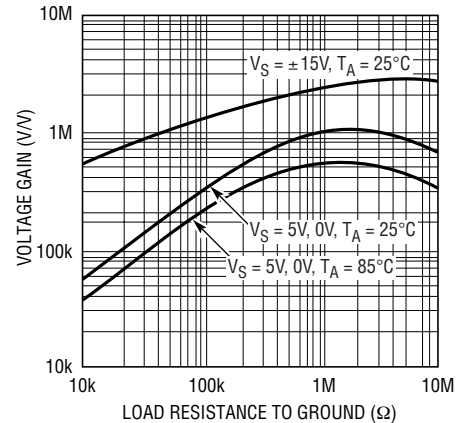
LT1178/LT1179 • TPC10

**Gain, Phase vs Frequency**



LT1178/LT1179 • TPC11

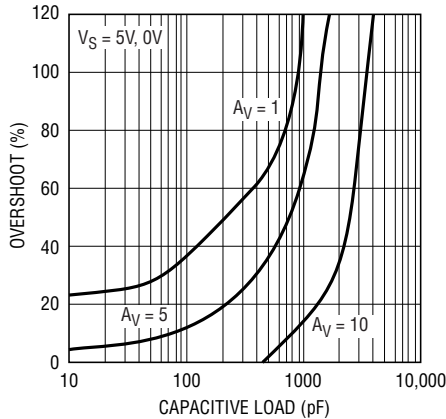
**Voltage Gain vs Load Resistance**



LT1178/LT1179 • TPC12

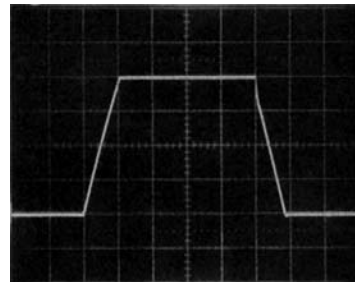
## TYPICAL PERFORMANCE CHARACTERISTICS

Capacitive Load Handling



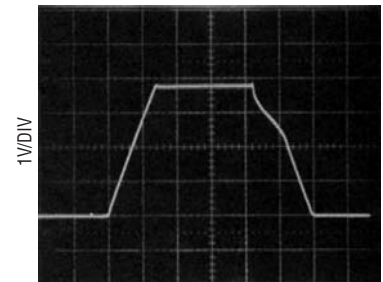
LT1178/LT1179 • TPC13

Large-Signal Transient Response  
 $V_S = \pm 15V$



$A_V = 1$   
 $C_L = 12pF$

Large-Signal Transient Response  
 $V_S = 5V, 0V$



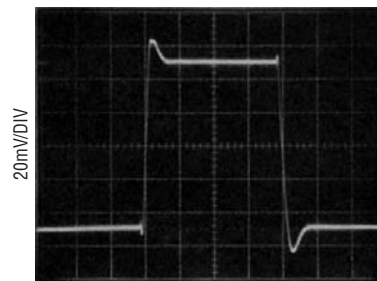
$A_V = 1$   
 $C_L = 12pF$   
INPUT PULSE = 0V TO 3.8V

Small-Signal Transient Response  
 $V_S = \pm 2.5V$



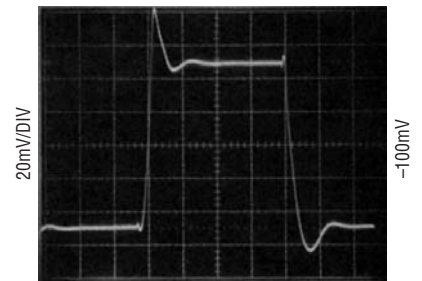
$A_V = 1$   
 $C_L = 12pF$

Small-Signal Transient Response  
 $V_S = \pm 15V$



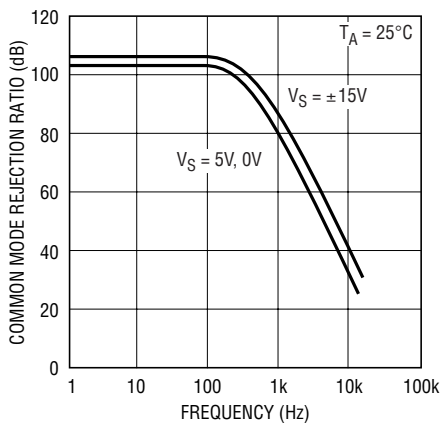
$A_V = 1$   
 $C_L = 12pF$

Small-Signal Transient Response  
 $V_S = 5V, 0V$



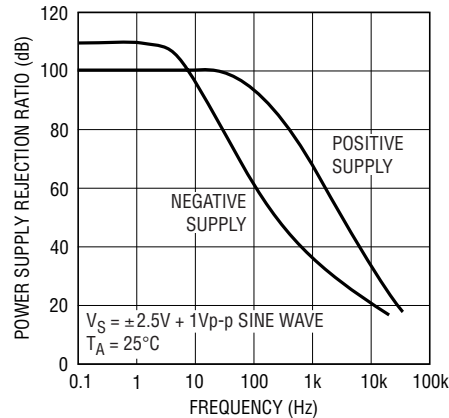
$A_V = 1$   
 $C_L = 12pF$   
INPUT 50 TO 150mV

Common Mode Rejection Ratio vs Frequency



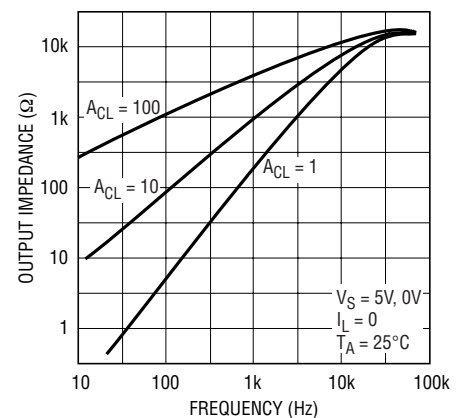
LT1178/LT1179 • TPC19

Power Supply Rejection Ratio vs Frequency



LT1188/LT1189 • TPC20

Closed Loop Output Impedance



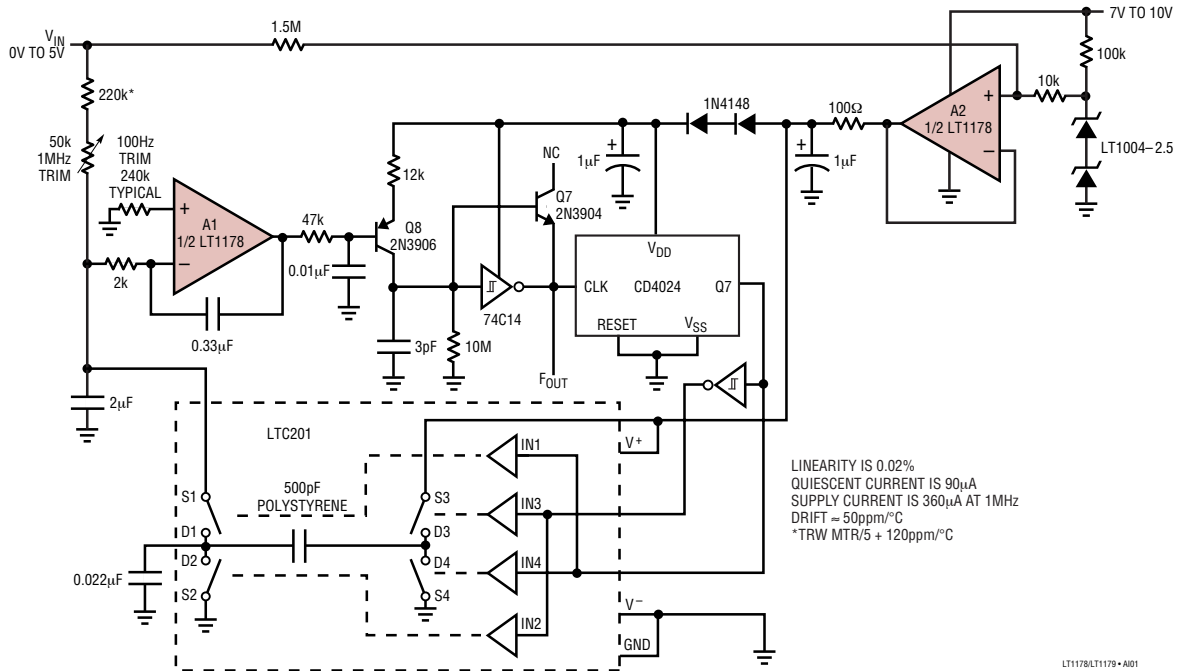
LT1178/LT1179 • TPC21

## APPLICATIONS INFORMATION

Please see the LT1078/LT1079 data sheet for applications information. All comments relating to specifications, single

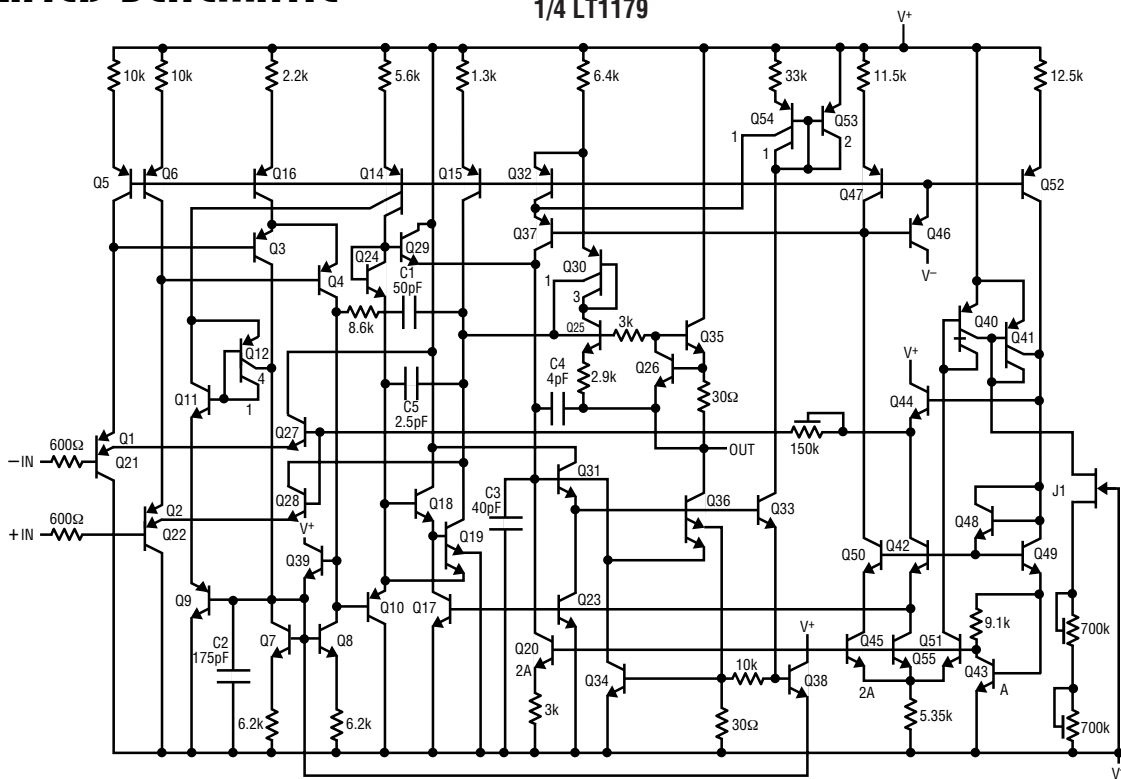
supply operation and phase reversal protection are directly applicable to the LT1178/LT1179.

### Micropower 100Hz to 1MHz V-to-F Converter



## SIMPLIFIED SCHEMATIC

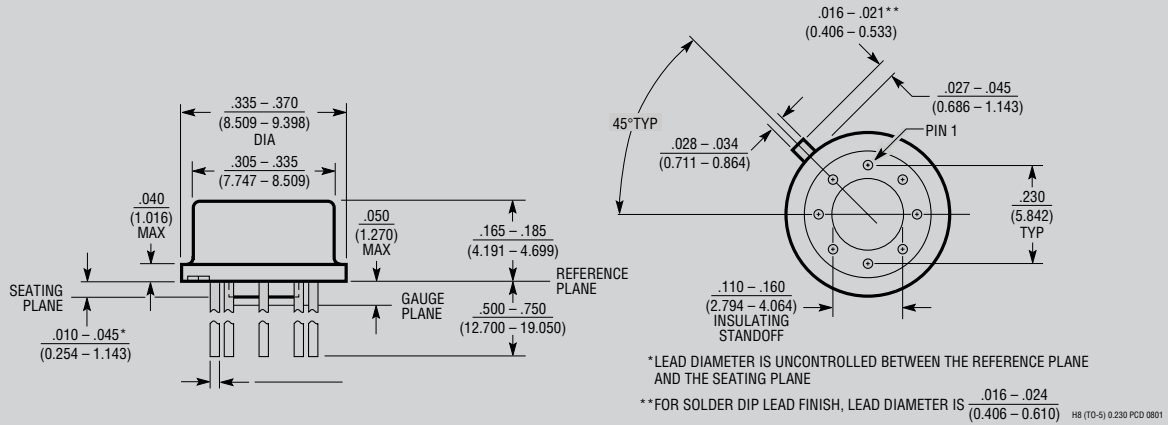
1/2 LT1178  
1/4 LT1179



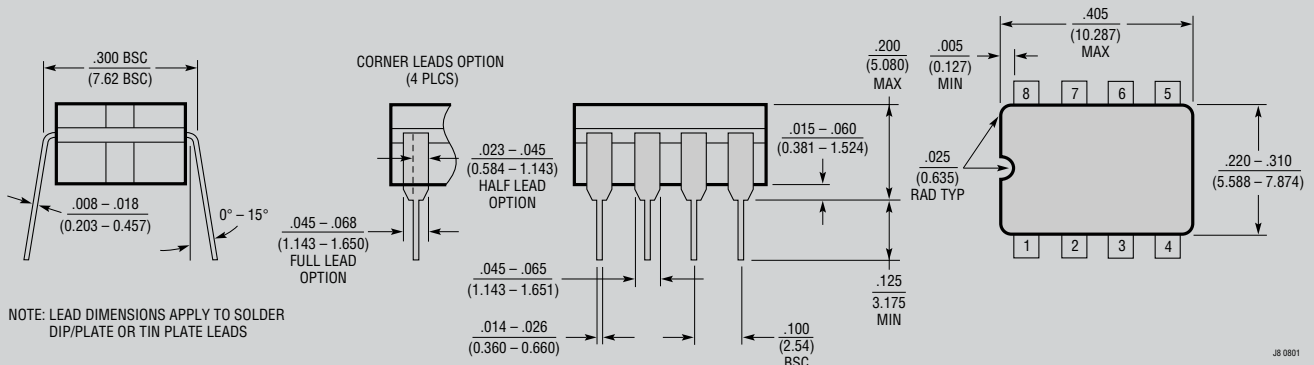
11789fb

## PACKAGE DESCRIPTION

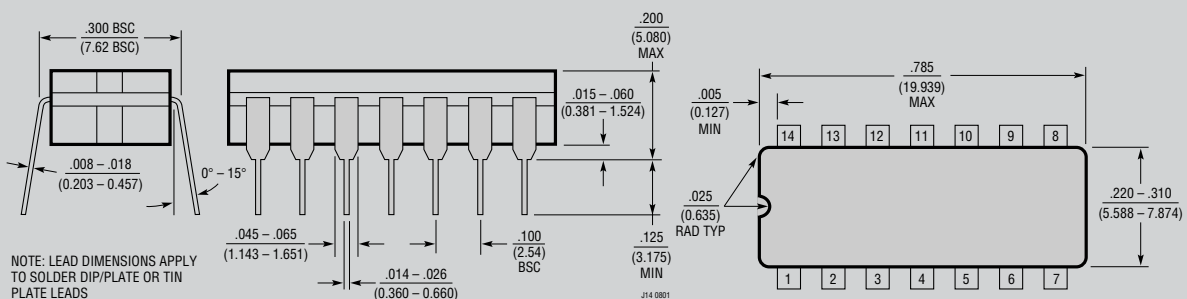
**H Package**  
**8-Lead TO-5 Metal Can (.230 Inch PCD)**  
 (Reference LTC DWG # 05-08-1321)



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



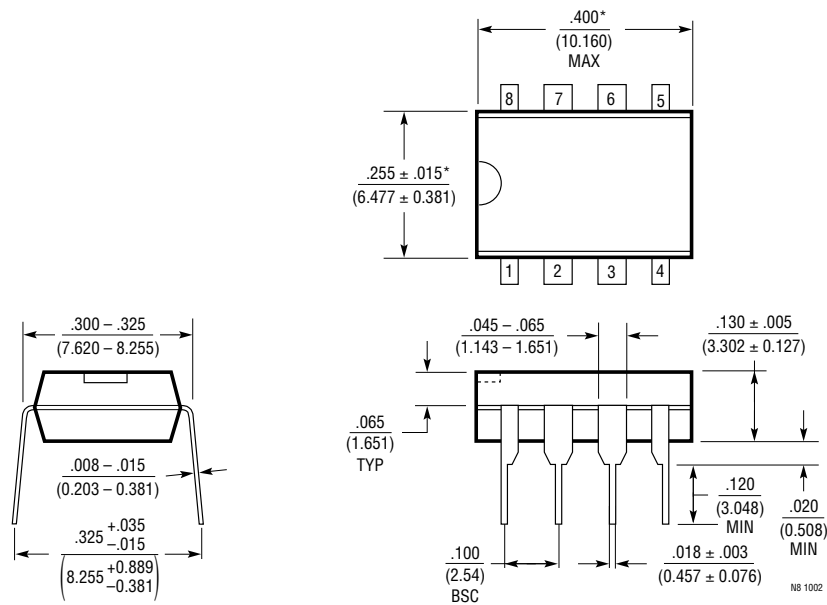
**J Package**  
**14-Lead Cerdip (Narrow .300 Inch, Hermetic)**  
 (Reference LTC DWG # 05-08-1110)



## OBSOLETE PACKAGES

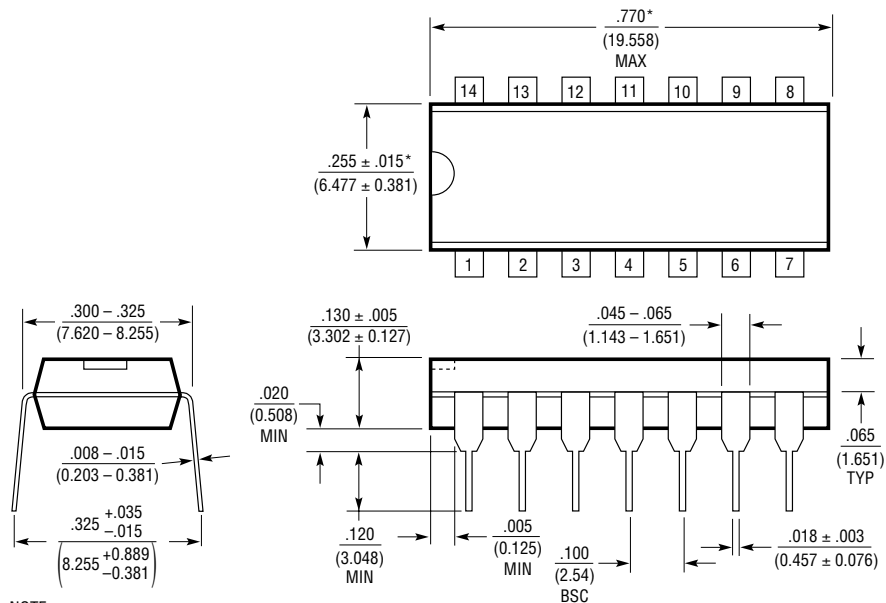
# PACKAGE DESCRIPTION

## N8 Package 8-Lead PDIP (Narrow .300 Inch) (Reference LTC DWG # 05-08-1510)



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)

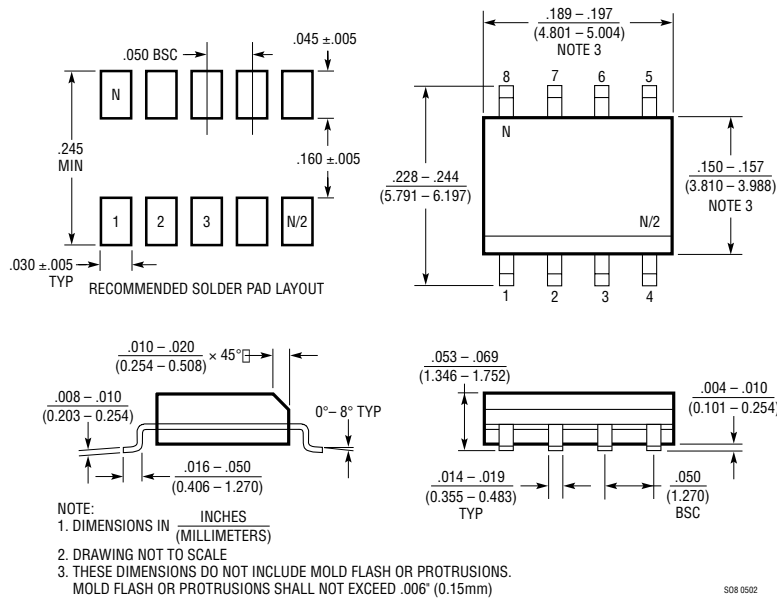
## N Package 14-Lead PDIP (Narrow .300 Inch) (Reference LTC DWG # 05-08-1510)



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)

# PACKAGE DESCRIPTION

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



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

