

Dual/Quad Micropower, 1MHz C-Load Picoampere Bias Current JFET Input Op Amps

FEATURES

- **Input Bias Current:**
2pA Max (LT1464A)
20pA Max (LT1464, LT1465)
- **Supply Current per Amplifier: 200µA Max**
- Gain Bandwidth Product: 1MHz Typ
- Slew Rate: 0.9V/µs Typ
- Input Common Mode Range Includes Positive Rail
- Unity-Gain Stable for C-Load™ Up to 10nF
- Open-Loop Gain: 1 Million Typ
- Guaranteed Specs with ±5V, ±15V Supplies
- Guaranteed Matching Specifications
- Standard Pinout: SO-8, SO-14 Package

APPLICATIONS

- Battery-Powered Systems
- Photocurrent Amplifiers
- Low Frequency, Micropower Active Filters
- Low Droop Track-and-Hold Circuits

DESCRIPTION

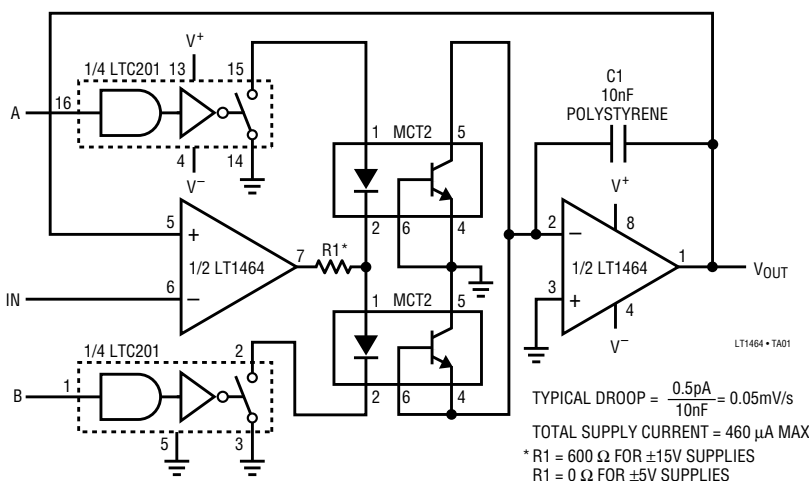
The LT[®]1464 (dual) and LT1465 (quad) are the first micropower op amps (200µA max per amp) to offer picoampere input bias currents (500fA typ) and unity-gain stability for capacitive loads up to 10nF. The output can swing a 10k load to within 1.5V of either supply, just like op amps that require an order of magnitude more supply current. This unique combination of performance makes the LT1464/LT1465 ideal over a wide range of input and output impedances.

In the design and testing of the LT1464/LT1465, particular emphasis has been placed on optimizing performance in the low cost SO-8 (dual) and 14-lead SO (quad) package for ±15V and ±5V supplies. The input common mode range includes the positive rail. Slew rate (0.5V/µs min) and gain bandwidth product (650kHz min) are 100% tested. A full set of matching specifications is also provided.

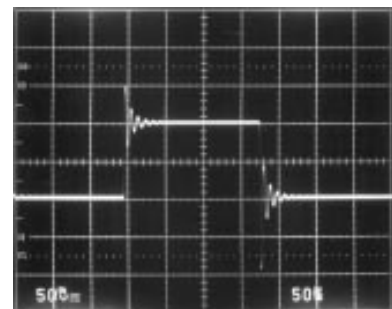
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 C-Load is a trademark of Linear Technology Corporation.

TYPICAL APPLICATION

Micropower Low Droop Track-and-Hold/Peak Detector



Small-Signal Response, C_{LOAD} = 10nF



$A_V = 1$
 $V_S = \pm 5V, \pm 15V$
 $C_L = 10\text{nF}$

1464 • TA02

| FUNCTION | MODE | IN A | IN B | MODE | IN A | IN B |
|------------------------|-------|------|------|-------|------|------|
| Track-and-Hold | Track | 0 | 0 | Hold | 1 | 1 |
| Positive Peak Detector | Reset | 0 | 0 | Store | 0 | 1 |
| Negative Peak Detector | Reset | 0 | 0 | Store | 1 | 0 |

LTC201 switch is open for logic '1'.

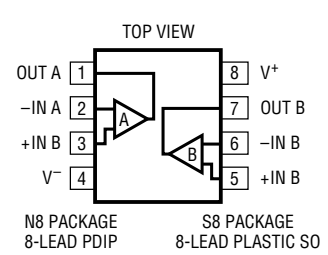
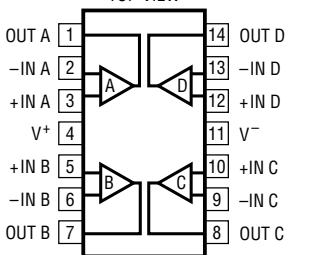
LT1464/LT1465

ABSOLUTE MAXIMUM RATINGS

Supply Voltage $\pm 20V$
 Differential Input Voltage $\pm 40V$
 Input Current 20mA
 Output Short-Circuit Duration Indefinite
 Operating Temperature Range $-40^{\circ}C$ to $85^{\circ}C$

Specified Temperature Range $-40^{\circ}C$ to $85^{\circ}C$
 Maximum Junction Temperature $150^{\circ}C$
 Storage Temperature Range $-65^{\circ}C$ to $150^{\circ}C$
 Lead Temperature (Soldering, 10 sec) $300^{\circ}C$

PACKAGE/ORDER INFORMATION

| | | | |
|---|--|--|----------------------|
|  <p>N8 PACKAGE 8-LEAD PDIP</p> <p>S8 PACKAGE 8-LEAD PLASTIC SO</p> <p>$T_{JMAX} = 150^{\circ}C$, $\theta_{JA} = 130^{\circ}C/W$ (N) $T_{JMAX} = 150^{\circ}C$, $\theta_{JA} = 190^{\circ}C/W$ (S)</p> | ORDER PART NUMBER |  <p>N PACKAGE 14-LEAD PDIP</p> <p>S PACKAGE 14-LEAD PLASTIC SO</p> <p>$T_{JMAX} = 150^{\circ}C$, $\theta_{JA} = 110^{\circ}C/W$ (N) $T_{JMAX} = 150^{\circ}C$, $\theta_{JA} = 150^{\circ}C/W$ (S)</p> | ORDER PART NUMBER |
| | LT1464ACN8 LT1464ACS8 LT1464CN8 LT1464CS8 | | LT1465CN LT1465CS |
| | S8 PART MARKING | | |
| | 1464A 1464 | | |

Consult factory for Industrial and Military grade parts.

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

| SYMBOL | PARAMETER | CONDITIONS (Note 1) | LT1464AC | | | LT1464C/LT1465C | | | UNITS |
|-----------|---|---|----------------|-----------|-----------|-----------------|-----------|----------------|----------------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V_{OS} | Input Offset Voltage | $V_S = \pm 5V$ | | 0.4 | 0.8 | | 0.4 | 0.8 | mV |
| | | $V_S = \pm 15V$ | | 0.6 | 2.0 | | 0.6 | 2.0 | mV |
| I_{OS} | Input Offset Current | $V_S = \pm 5V$ | | 0.2 | 1.2 | | | | pA |
| | | $V_S = \pm 15V$ | | 0.5 | 2.0 | | 0.5 | 15 | pA |
| I_B | Input Bias Current | $V_S = \pm 5V$ | | ± 0.4 | ± 2.0 | | | | pA |
| | | $V_S = \pm 15V$ | | ± 0.5 | ± 3.0 | | ± 0.5 | ± 20 | pA |
| e_n | Input Noise Voltage | 0.1Hz to 10Hz | | 2 | | | 2 | | μV_{P-P} |
| | | Input Noise Voltage Density | $f_0 = 10Hz$ | | 33 | | 33 | | nV/\sqrt{Hz} |
| | | | $f_0 = 1000Hz$ | | 24 | | 24 | | nV/\sqrt{Hz} |
| | Input Noise Current Density | $f_0 = 10Hz, 1kHz$ (Note 3) | | 0.4 | | 0.4 | | fA/\sqrt{Hz} | |
| CMRR | Common Mode Rejection Ratio | $V_{CM} = -12.5V$ to $15V$ | 76 | 85 | | 74 | 85 | dB | |
| PSRR | Power Supply Rejection Ratio | $V_S = \pm 2.5V$ to $\pm 20V$ | 81 | 90 | | 78 | 90 | dB | |
| R_{IN} | Input Resistance—Differential Common Mode Common Mode | $V_{CM} = -12.5V$ to $8V$ | | 10^{12} | | | 10^{12} | | Ω |
| | | $V_{CM} = 8V$ to $15V$ | | 10^{12} | | | 10^{12} | | Ω |
| | | | | 0^{11} | | | 10^{11} | | Ω |
| C_{IN} | Input Capacitance | | | 3 | | 3 | | pF | |
| A_{VOL} | Large-Signal Voltage Gain | $V_0 = \pm 10V$, $R_L = 10k$ | 350 | 1000 | | 300 | 900 | | V/mV |
| | | $V_0 = \pm 10V$, $R_L = 2k$ | 150 | 450 | | 150 | 450 | | V/mV |
| | | $V_S = \pm 5V$, $V_0 = \pm 2V$, $R_L = 10k$ | 100 | 250 | | 100 | 250 | | V/mV |
| | | $V_S = \pm 5V$, $V_0 = \pm 1V$, $R_L = 2k$ | 50 | 170 | | 50 | 170 | | V/mV |

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

| SYMBOL | PARAMETER | CONDITIONS (Note 1) | LT1464AC | | | LT1464C/LT1465C | | | UNITS | |
|----------------|--|--|------------|------------|-----|-----------------|------------|-----|------------|---------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | | |
| V_{OUT} | Output Voltage Swing | $R_L = 10k$ | ± 13.5 | ± 13.7 | | ± 13.5 | ± 13.7 | | V | |
| | | $R_L = 2k$ | ± 13.3 | ± 13.5 | | ± 13.3 | ± 13.5 | | V | |
| | | $V_S = \pm 5V$, $R_L = 2k$ | ± 3.5 | ± 3.7 | | ± 3.5 | ± 3.7 | | V | |
| SR | Slew Rate | $R_L = 10k$ (Note 4) | 0.5 | 0.9 | | 0.5 | 0.9 | | V/ μs | |
| GBW | Gain Bandwidth Product | $f = 10kHz$ | 650 | 1000 | | 650 | 1000 | | kHz | |
| I_S | Supply Current per Amplifier | $V_S = \pm 5V$ | | 145 | 200 | | 145 | 200 | | μA |
| | | | | | 135 | 200 | | 135 | 200 | |
| | Channel Separation | $f = 10Hz$, $V_0 = \pm 10V$, $R_L = 10k$ | | 132 | | | 132 | | dB | |
| V_{OS} | Offset Voltage Match (Note 7) | $V_S = \pm 5V$ $V_S = \pm 15V$ | | 0.5 | 1.3 | | 0.5 | 1.3 | | mV |
| | | | | | 0.8 | 3.3 | | 0.8 | 3.3 | |
| ΔI_B^+ | Noninverting Bias Current Match (Note 7) | $V_S = \pm 5V$ $V_S = \pm 15V$ | | 0.4 | 3.0 | | | | | μA |
| | | | | | 0.5 | 4.0 | | 0.5 | 30 | |
| $\Delta CMRR$ | Common Mode Rejection Match | (Notes 5, 7) | 74 | 85 | | 71 | 85 | | dB | |
| $\Delta PSRR$ | Power Supply Rejection Match | (Notes 5, 7) | 78 | 88 | | 74 | 88 | | dB | |

$V_S = \pm 15V$, $V_{CM} = 0V$, $0^\circ C \leq T_A \leq 70^\circ C$, unless otherwise noted.

| SYMBOL | PARAMETER | CONDITIONS (Note 1) | LT1464AC | | | LT1464C/LT1465C | | | UNITS | |
|-------------------------------------|--|---|----------|------------|------------|-----------------|------------|------------|-------|------------------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | | |
| V_{OS} | Input Offset Voltage | $V_S = \pm 5V$ $V_S = \pm 15V$ | ● | 0.5 | 1.4 | | 0.5 | 1.4 | | mV |
| | | | ● | 0.9 | 2.8 | | 0.9 | 2.8 | | mV |
| $\frac{\Delta V_{OS}}{\Delta Temp}$ | Average Input Offset Voltage Drift | (Note 6) | ● | 7 | 20 | | 7 | 20 | | $\mu V/^\circ C$ |
| I_{OS} | Input Offset Current | | ● | 10 | 50 | | 25 | 450 | | μA |
| I_B | Input Bias Current | | ● | 60 | 150 | | 150 | 750 | | μA |
| CMRR | Common Mode Rejection Ratio | $V_{CM} = -12V$ to $15V$ | ● | 75 | 85 | | 73 | 85 | | dB |
| PSRR | Power Supply Rejection Ratio | $V_S = \pm 3V$ to $\pm 20V$ | ● | 80 | 89 | | 77 | 89 | | dB |
| A_{VOL} | Large-Signal Voltage Gain | $V_0 = \pm 10V$, $R_L = 10k$ $V_0 = \pm 10V$, $R_L = 2k$ | ● | 200 | 600 | | 200 | 600 | | V/mV |
| | | | ● | 100 | 350 | | 100 | 350 | | V/mV |
| | | $V_S = \pm 5V$, $V_0 = \pm 2V$, $R_L = 10k$ $V_S = \pm 5V$, $V_0 = \pm 1V$, $R_L = 2k$ | ● | 80 | 200 | | 80 | 200 | | V/mV |
| | | | ● | 45 | 150 | | 45 | 150 | | V/mV |
| V_{OUT} | Output Voltage Swing | $R_L = 10k$ $R_L = 2k$ $V_S = \pm 5V$, $R_L = 2k$ | ● | ± 13.4 | ± 13.6 | | ± 13.4 | ± 13.6 | | V |
| | | | ● | ± 13.2 | ± 13.4 | | ± 13.2 | ± 13.4 | | V |
| | | | ● | ± 3.4 | ± 3.6 | | ± 3.4 | ± 3.6 | | V |
| SR | Slew Rate | $R_L = 10k$ (Note 4) | ● | 0.4 | 0.8 | | 0.4 | 0.8 | | V/ μs |
| GBW | Gain Bandwidth Product | $f = 10kHz$ | ● | 540 | 870 | | 540 | 870 | | kHz |
| I_S | Supply Current per Amplifier | $V_S = \pm 5V$ | ● | 160 | 220 | | 160 | 220 | | μA |
| | | | ● | 150 | 220 | | 150 | 220 | | μA |
| V_{OS} | Offset Voltage Match (Note 7) | $V_S = \pm 5V$ $V_S = \pm 15V$ | ● | 0.7 | 2.0 | | 0.7 | 2.0 | | mV |
| | | | ● | 0.9 | 3.5 | | 0.9 | 3.5 | | mV |
| ΔI_B^+ | Noninverting Bias Current Match (Note 7) | | ● | 5 | 40 | | 35 | 500 | | μA |

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

| SYMBOL | PARAMETER | CONDITIONS (Note 1) | | LT1464AC | | | LT1464C/LT1465C | | | UNITS |
|---------------|------------------------------|---------------------|---|----------|-----|-----|-----------------|-----|-----|-------|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $\Delta CMRR$ | Common Mode Rejection Match | (Notes 5, 7) | ● | 73 | 84 | | 70 | 84 | | dB |
| $\Delta PSRR$ | Power Supply Rejection Match | (Notes 5, 7) | ● | 77 | 85 | | 73 | 85 | | dB |

$V_S = \pm 15V$, $V_{CM} = 0V$, $-40^\circ C \leq T_A \leq 85^\circ C$ (Note 2), unless otherwise noted.

| SYMBOL | PARAMETER | CONDITIONS (Note 1) | | LT1464AC | | | LT1464C/LT1465C | | | UNITS | |
|-------------------------------------|--|---|---|------------|------------|-----|-----------------|------------|-----|------------------|------|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | | |
| V_{OS} | Input Offset Voltage | $V_S = \pm 5V$ $V_S = \pm 15V$ | ● | 0.6 | 1.5 | | 0.6 | 1.5 | | mV | |
| | | | ● | 1.0 | 3.0 | | 1.0 | 3.0 | | mV | |
| $\frac{\Delta V_{OS}}{\Delta Temp}$ | Average Input Offset Voltage Drift | (Note 6) | ● | 7 | 20 | | 7 | 20 | | $\mu V/^\circ C$ | |
| I_{OS} | Input Offset Current | | ● | 40 | 150 | | 60 | 700 | | pA | |
| I_B | Input Bias Current | | ● | 200 | 500 | | 300 | 2500 | | pA | |
| CMRR | Common Mode Rejection Ratio | $V_{CM} = -12V$ to $15V$ | ● | 74 | 84 | | 72 | 84 | | dB | |
| PSRR | Power Supply Rejection Ratio | $V_S = \pm 3V$ to $\pm 20V$ | ● | 79 | 88 | | 76 | 88 | | dB | |
| A_{VOL} | Large-Signal Voltage Gain | $V_O = \pm 10V$, $R_L = 10k$ $V_O = \pm 10V$, $R_L = 2k$ | ● | 175 | 400 | | 175 | 400 | | V/mV | |
| | | | ● | 80 | 250 | | 80 | 250 | | V/mV | |
| | | ● | $V_S = \pm 5V$, $V_O = \pm 2V$, $R_L = 10k$ $V_S = \pm 5V$, $V_O = \pm 1V$, $R_L = 2k$ | ● | 70 | 180 | | 70 | 180 | | V/mV |
| | | | | ● | 45 | 140 | | 45 | 140 | | V/mV |
| V_{OUT} | Output Voltage Swing | $R_L = 10k$ $R_L = 2k$ $V_S = \pm 5V$, $R_L = 2k$ | ● | ± 13.2 | ± 13.4 | | ± 13.2 | ± 13.4 | | V | |
| | | | ● | ± 13.0 | ± 13.2 | | ± 13.0 | ± 13.2 | | V | |
| | | | ● | ± 3.2 | ± 3.4 | | ± 3.2 | ± 3.4 | | V | |
| SR | Slew Rate | $R_L = 10k$ (Note 4) | ● | 0.35 | 0.7 | | 0.35 | 0.7 | | V/ μs | |
| GBW | Gain Bandwidth Product | $f = 10kHz$ | ● | 510 | 850 | | 510 | 850 | | kHz | |
| I_S | Supply Current per Amplifier | $V_S = \pm 5V$ | ● | 165 | 230 | | 165 | 230 | | μA | |
| | | | ● | 160 | 230 | | 160 | 230 | | μA | |
| V_{OS} | Offset Voltage Match (Note 7) | $V_S = \pm 5V$ $V_S = \pm 15V$ | ● | 0.8 | 2.5 | | 0.8 | 2.5 | | mV | |
| | | | ● | 1.0 | 4.0 | | 1.0 | 4.0 | | mV | |
| ΔI_B^+ | Noninverting Bias Current Match (Note 7) | | ● | 20 | 100 | | 70 | 800 | | pA | |
| $\Delta CMRR$ | Common Mode Rejection Match | (Notes 5, 7) | ● | 72 | 83 | | 69 | 83 | | dB | |
| $\Delta PSRR$ | Power Supply Rejection Match | (Notes 5, 7) | ● | 76 | 81 | | 73 | 81 | | dB | |

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

Note 1: Typical parameters are defined as 60% yield of parameter distributions of individual amplifiers, i.e., out of 100 LT1465s (or 100 LT1464s) typically 240 op amps (or 120) will be better than the indicated specification.

Note 2: The LT1464 and LT1465 are designed, characterized and expected to meet these extended temperature limits, but are not tested at $-40^\circ C$ and $85^\circ C$. Guaranteed I grade parts are available, consult factory.

Note 3: Current noise is calculated from the formula: $i_n = (2q_i_b)^{1/2}$ where $q = (1.6)(10)^{-19}$ coulomb. The noise of source resistors up to $1G\Omega$ swamps the contribution of current noise.

Note 4: Slew rate is measured in $A_V = -1$; input signal is $\pm 7.5V$, output is measured at $\pm 2.5V$.

Note 5: $\Delta CMRR$ and $\Delta PSRR$ are defined as follows:

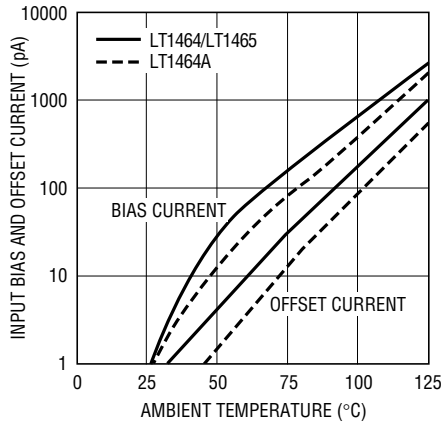
1. CMRR and PSRR are measured in $\mu V/V$ on the individual amplifiers.
2. The difference is calculated between the matching sides in $\mu V/V$.
3. The result is converted to dB.

Note 6: This parameter is not 100% tested.

Note 7: Matching parameters are the difference between amplifiers A and D and between B and C on the LT1465; between the two amplifiers on the LT1464.

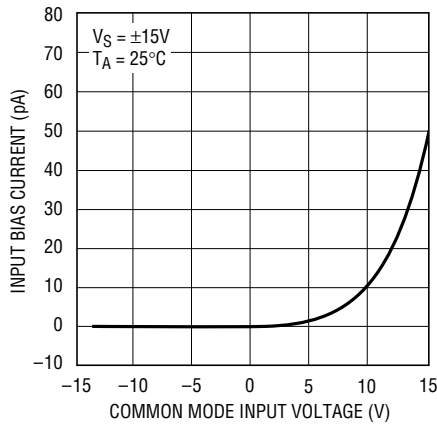
TYPICAL PERFORMANCE CHARACTERISTICS

Input Bias and Offset Current vs Temperature



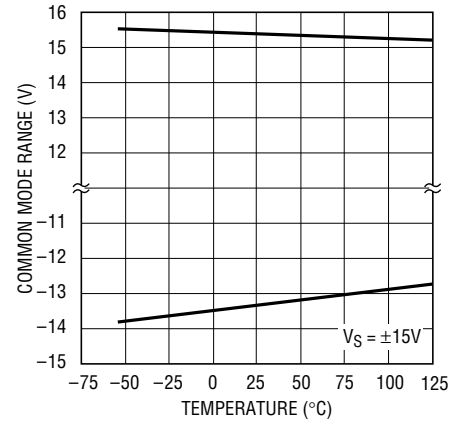
LT1464 • TPC01

Input Bias Current Over the Common Mode Range



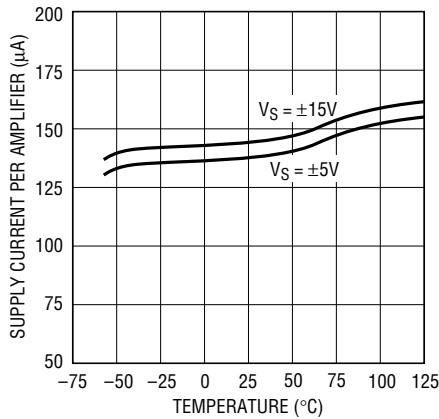
LT1464 • TPC02

Common Mode Range vs Temperature



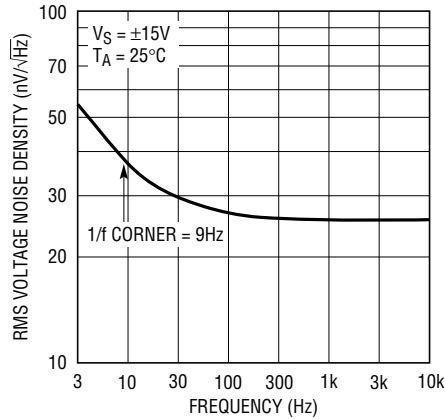
LT1464 • TPC03

Supply Current vs Temperature



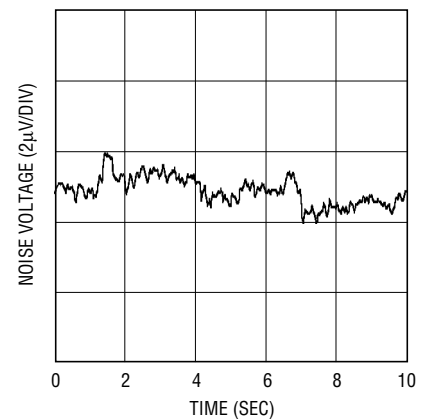
LT1464 • TPC04

Voltage Noise vs Frequency



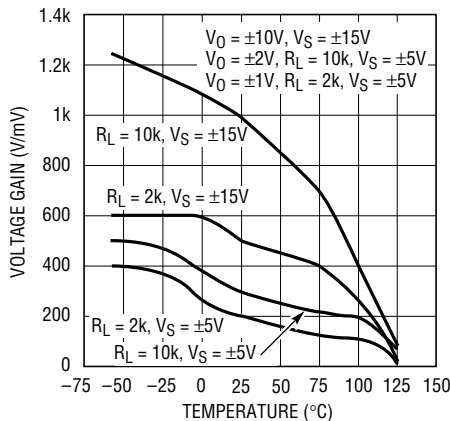
LT1464 • TPC05

0.1Hz to 10Hz Noise



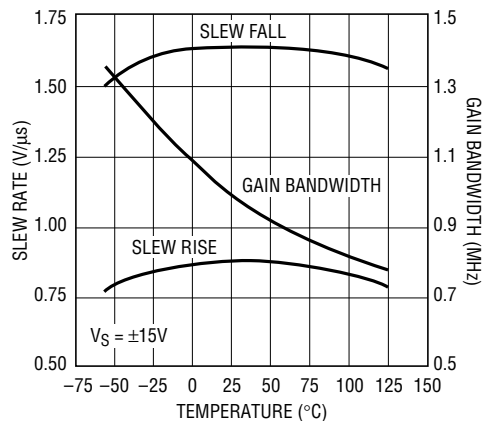
LT1464 • TPC06

Voltage Gain vs Temperature



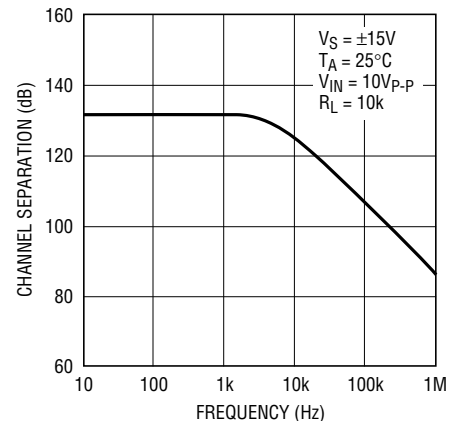
LT1464 • TPC07

Slew Rate, Gain Bandwidth Product vs Temperature



LT1464 • TPC08

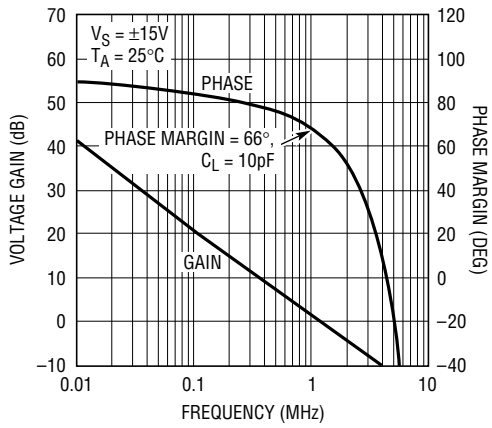
Channel Separation vs Frequency



LT1464 • TPC09

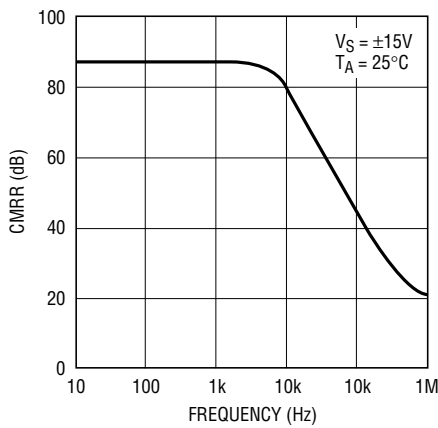
TYPICAL PERFORMANCE CHARACTERISTICS

Gain and Phase vs Frequency



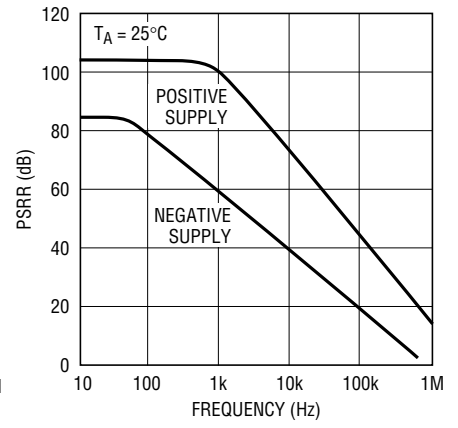
LT1464 • TPC10

Common Mode Rejection Ratio vs Frequency



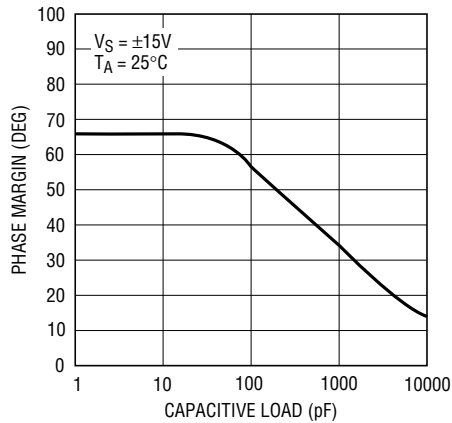
LT1464 • TPC11

Power Supply Rejection Ratio vs Frequency



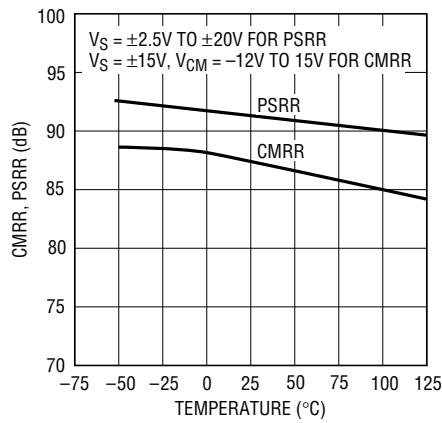
LT1464 • TPC12

Phase Margin vs C_{LOAD}



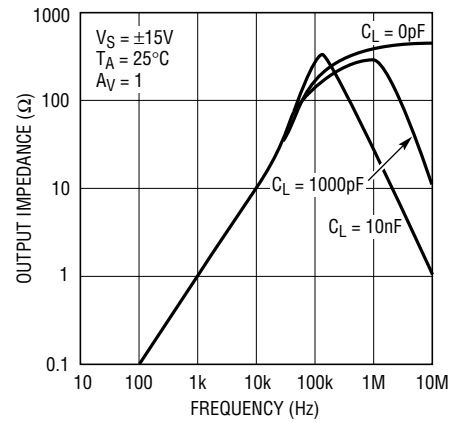
LT1464 • TPC13

Common Mode and Power Supply Rejections vs Temperature



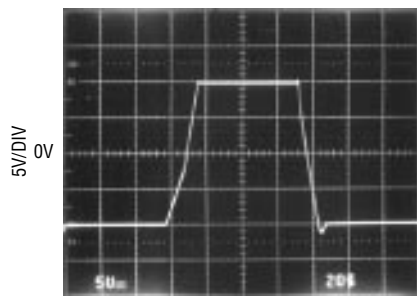
LT1464 • TPC14

Closed-Loop Output Impedance



LT1464 • TPC15

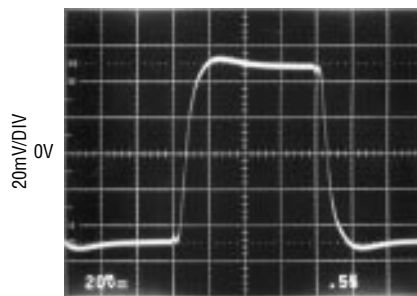
Large-Signal Response, $V_S = \pm 15V$



$A_V = 1$
 $C_L = 10pF$

LT1464 • TPC16

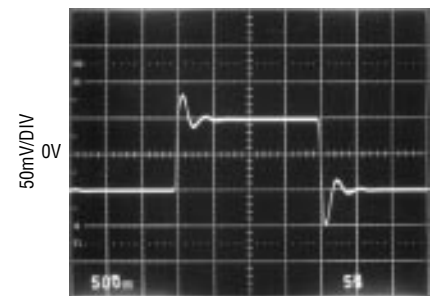
Small-Signal Response, $V_S = \pm 5V, \pm 15V$



$A_V = 1$
 $C_L = 10pF$

LT1464 • TPC17

Small-Signal Response, $V_S = \pm 5V, \pm 15V, C_{LOAD} = 1000pF$



$A_V = 1$
 $C_L = 1000pF$

LT1464 • TPC18

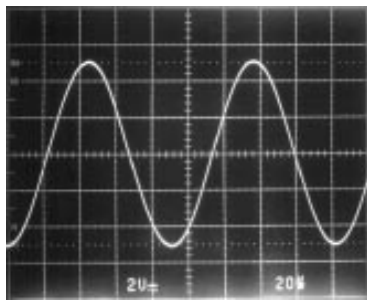
APPLICATIONS INFORMATION

Phase Reversal Protection

Most industry standard JFET input single, dual and quad op amps exhibit phase reversal at the output when the negative common mode limit at the input is exceeded. Common mode range is at a premium at $\pm 5V$ supplies. The Figures show a $\pm 5.2V$ sine wave input (Figure 1a), the response of a competing JFET input op amp in the unity-

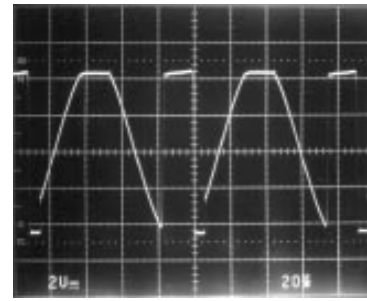
gain follower mode (Figure 1b) and the response of the LT1464/LT1465 (Figure 1c).

The phase reversal of Figure 1b can cause lock-up in servo systems. The LT1464/LT1465 does not phase-reverse when the common mode input is anywhere within the supplies.



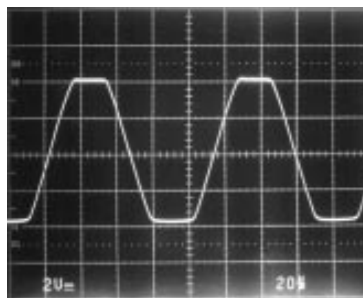
(1a) $\pm 5.2V$ Sine Wave

LT1464 • F01a



(1b) Typical JFET Input Op Amp with $\pm 5V$ Supplies

LT1464 • F01b



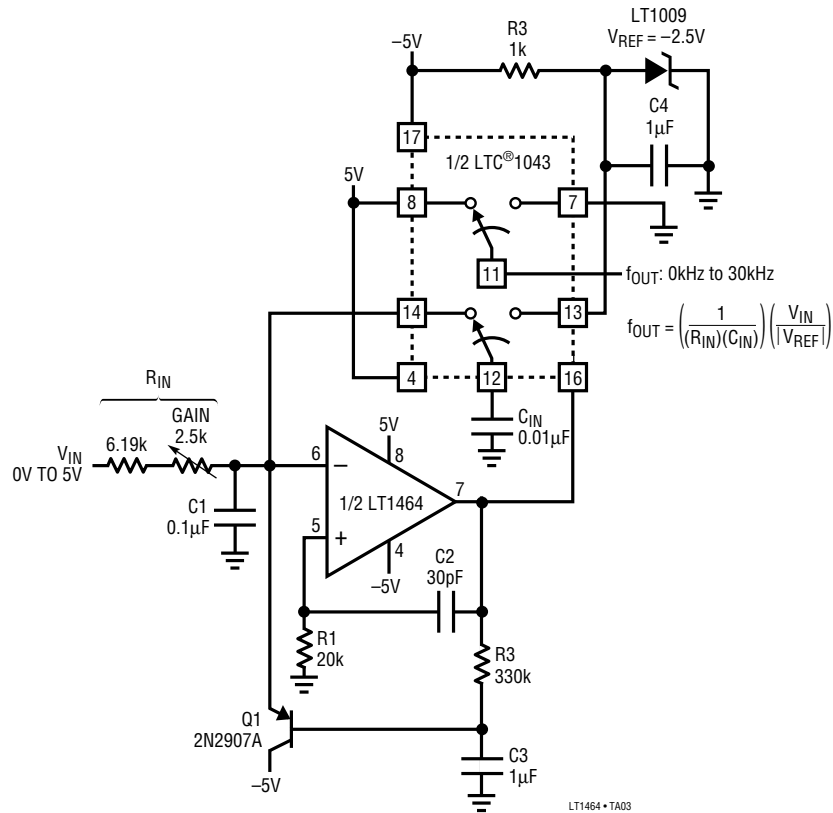
(1c) LT1464/LT1465 Output with $\pm 5V$ Supplies

LT1464 • F01c

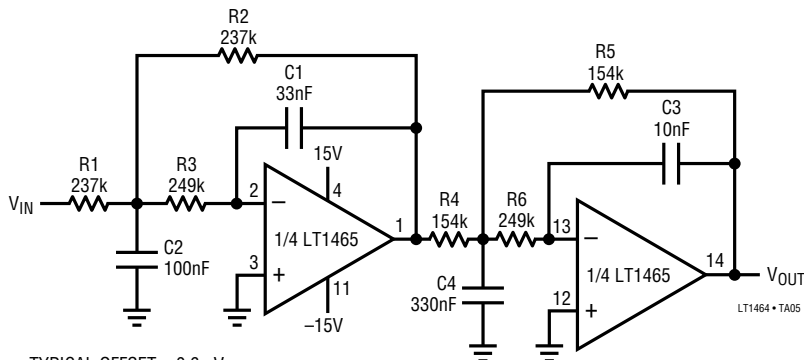
Figure 1. Voltage Follower with Input Exceeding the Common Mode Range ($V_S = \pm 5V$)

TYPICAL APPLICATIONS

Low Voltage 0.016% Voltage to Frequency Converter

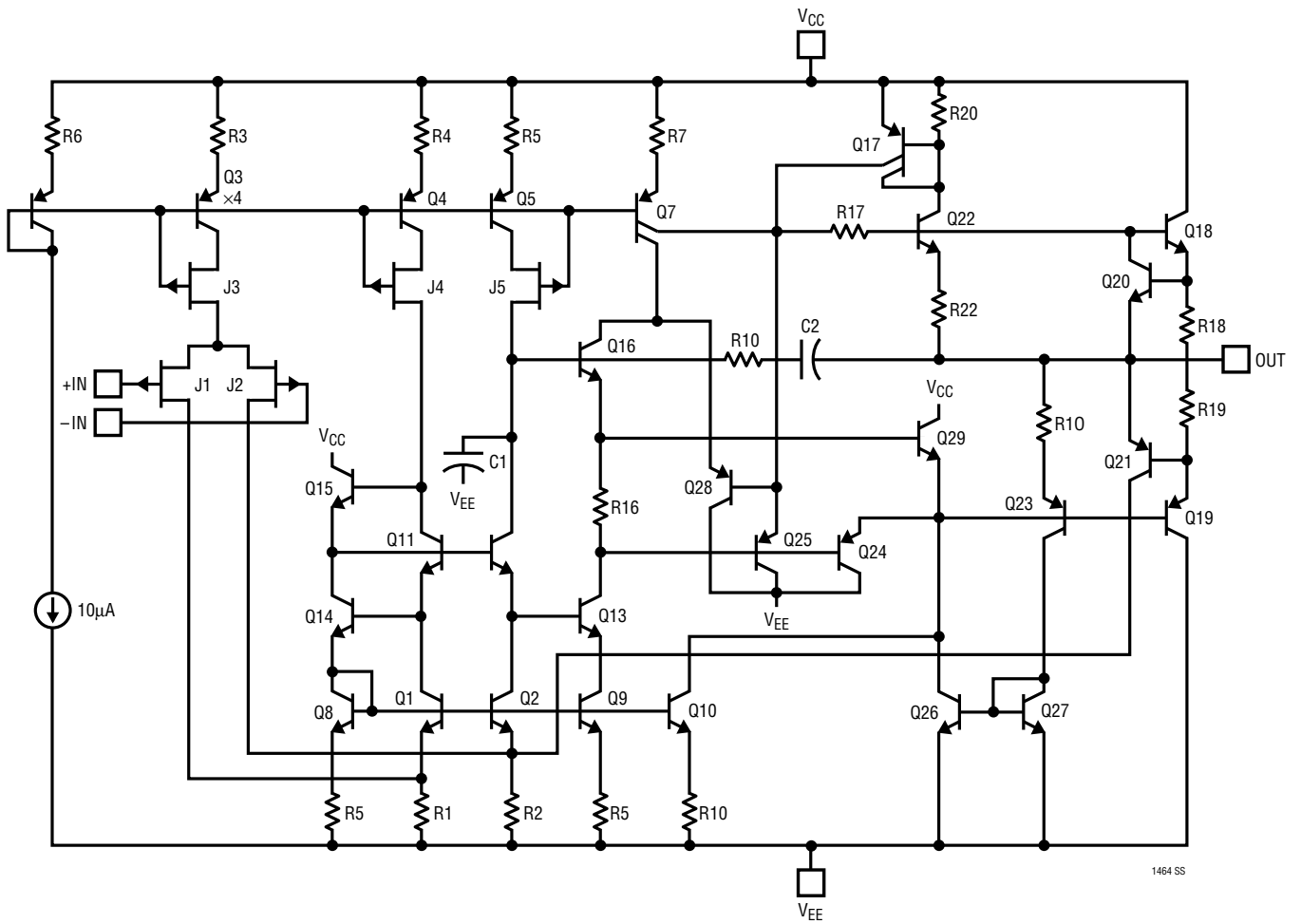


10Hz 4th Order Chebyshev Lowpass Filter (0.01dB Ripple)



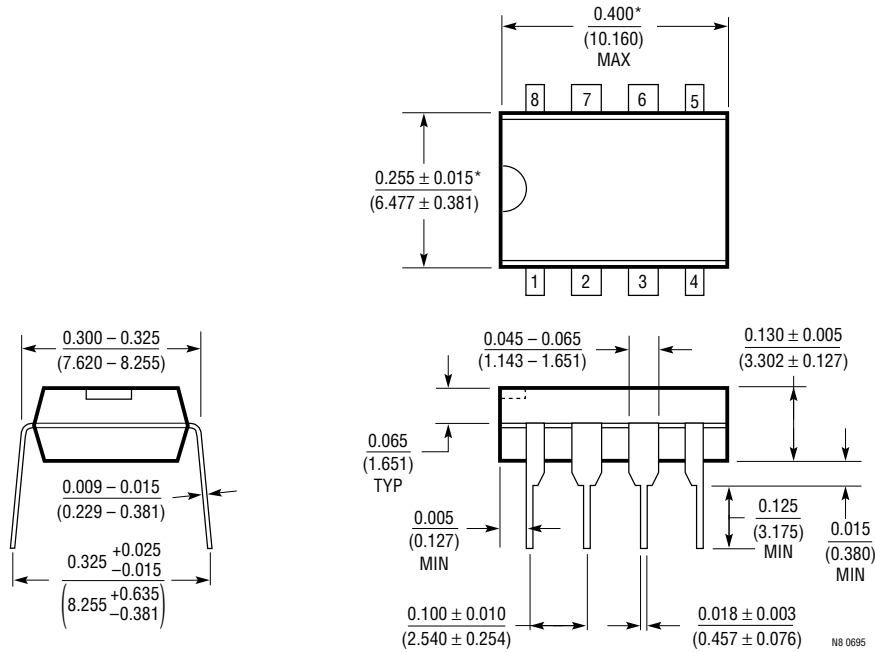
TYPICAL OFFSET = 0.6mV
 1% TOLERANCES
 FOR $V_{IN} = 10V_{P-P}$, $V_{OUT} = -110dB$ AT $f > 300Hz$
 $V_{OUT} = -6dB$ AT $f = 16Hz$
 THE LOW INPUT BIAS CURRENTS ALLOW THE USE OF HIGH RESISTOR VALUES

SIMPLIFIED SCHEMATIC



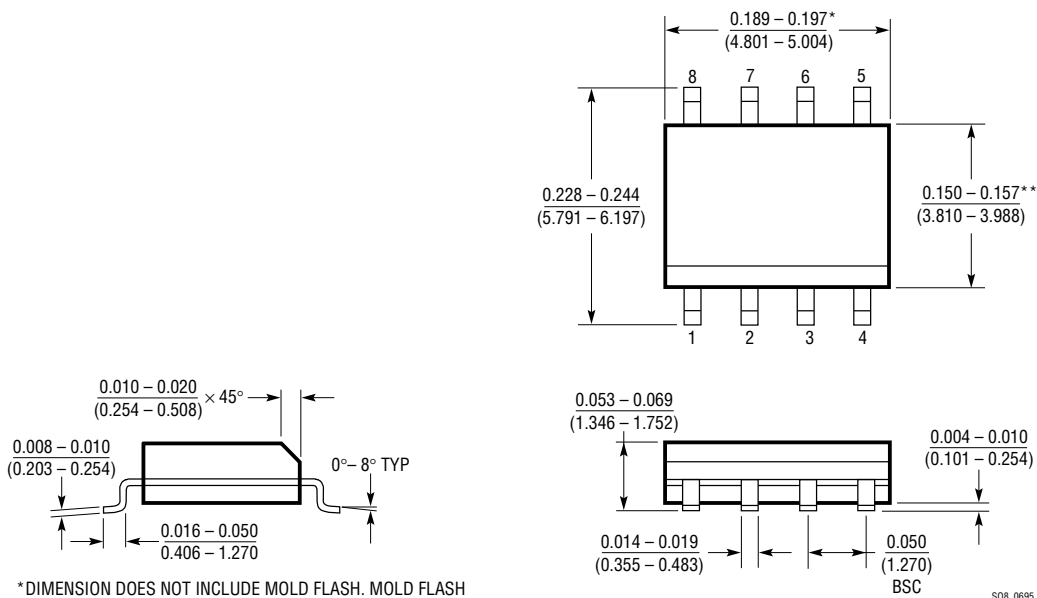
PACKAGE DESCRIPTION Dimensions in inches (millimeters) unless otherwise noted.

N8 Package
8-Lead PDIP (Narrow 0.300)
 (LTC DWG # 05-08-1510)



*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
 MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH (0.254mm)

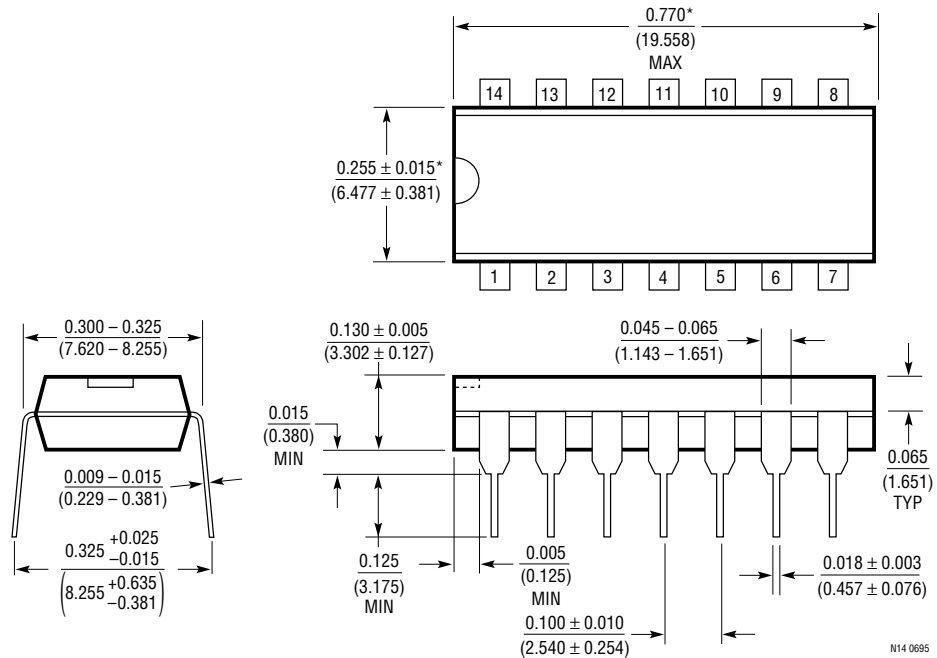
S8 Package
8-Lead Plastic Small Outline (Narrow 0.150)
 (LTC DWG # 05-08-1610)



*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE
 **DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

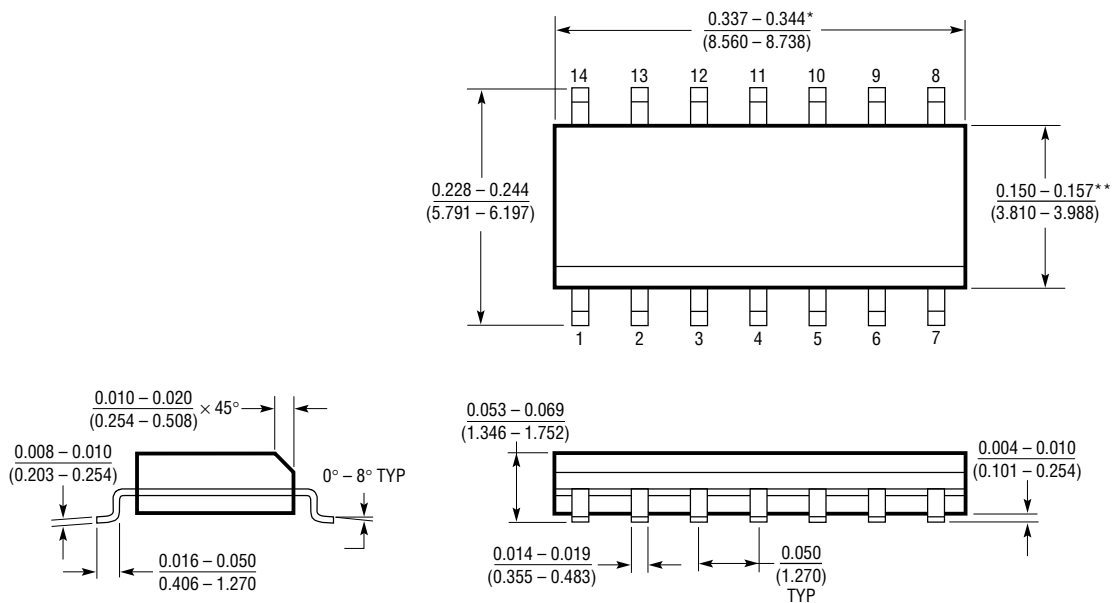
PACKAGE DESCRIPTION Dimensions in inches (millimeters) unless otherwise noted.

N Package
14-Lead PDIP (Narrow 0.300)
 (LTC DWG # 05-08-1510)



*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
 MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH (0.254mm)

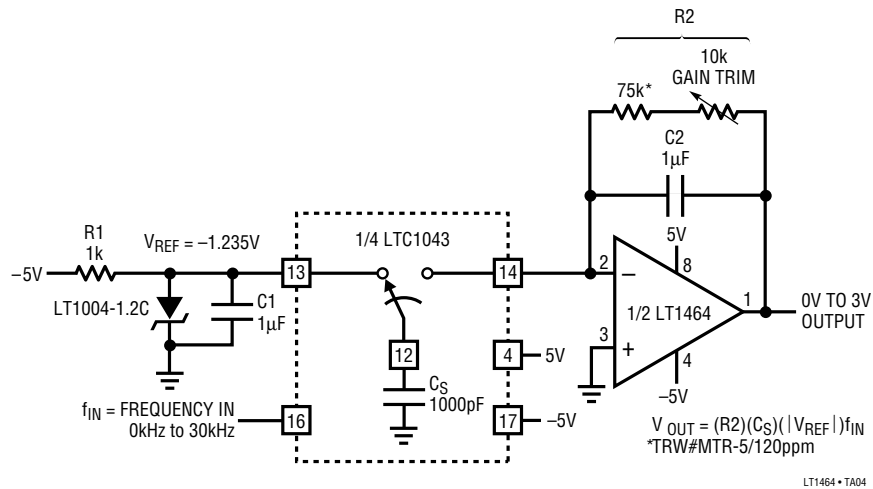
S Package
14-Lead Plastic Small Outline (Narrow 0.150)
 (LTC DWG # 05-08-1610)



*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE
 **DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

TYPICAL APPLICATION

Low Voltage 0.027% Frequency to Voltage Converter



RELATED PARTS

| PART NUMBER | DESCRIPTION | COMMENTS |
|---------------|---|---|
| LT1057 | Dual JFET Input Precision, High Speed Op Amp | Fast Settling Time, 14V/µs Slew Rate, 5MHz GBW, 450µV V_{OS} (Max), 50pA I_{OS} (Max) |
| LT1113 | Dual Low Noise, Precision, JFET Input Op Amp | 6nV/√Hz Input Noise Voltage Density, 480pA I_B , 6.3MHz GBW |
| LT1169 | Dual Low Noise, Picoampere Bias Current, JFET Input Op Amp | 20pA I_B , 8nV/√Hz e_n , 5.3MHz GBW, 1.5pF Input Capacitance |
| LT1457 | Dual Precision JFET Input Op Amp C-Load | Drives 10,000pF Capacitive Load, 450µV V_{OS} (Max), 4µV/°C Drift |
| LT1462/LT1463 | Dual/Quad Micropower, C-Load Picoampere Bias Current JFET Input Op Amps | 28µA Supply Current Per Amplifiers Drives 10µF Capacitive Load, 175kHz GBW |