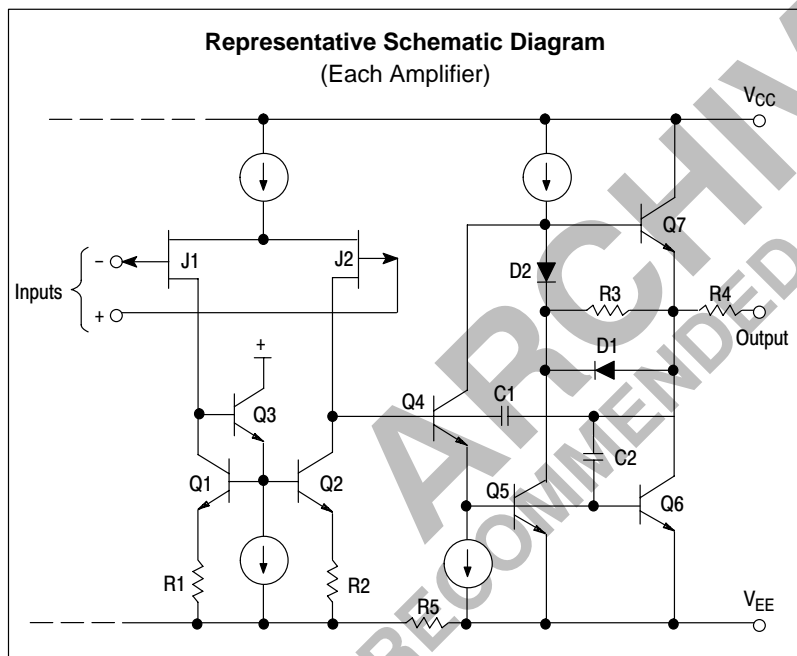


Low Power JFET Input Operational Amplifiers

These JFET input operational amplifiers are designed for low power applications. They feature high input impedance, low input bias current and low input offset current. Advanced design techniques allow for higher slew rates, gain bandwidth products and output swing.

The commercial and vehicular devices are available in Plastic dual in-line and SOIC packages.

- Low Supply Current: 200 μ A/Amplifier
- Low Input Bias Current: 5.0 pA
- High Gain Bandwidth: 2.0 MHz
- High Slew Rate: 6.0 V/ μ s
- High Input Impedance: $10^{12} \Omega$
- Large Output Voltage Swing: ± 14 V
- Output Short Circuit Protection



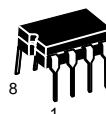
ORDERING INFORMATION

| Op Amp Function | Device | Operating Temperature Range | Package |
|-----------------|------------------------------|--------------------------------|----------------------|
| Dual | TL062CD, ACD TL062CP, ACP | T _A = 0° to +70°C | SO-8 Plastic DIP |
| | TL062VD TL062VP | T _A = -40° to +85°C | SO-8 Plastic DIP |
| Quad | TL064CD, ACD TL064CN, ACN | T _A = 0° to +70°C | SO-14 Plastic DIP |
| | TL064VD TL064VN | T _A = -40° to +85°C | SO-14 Plastic DIP |

TL062 TL064

LOW POWER JFET INPUT OPERATIONAL AMPLIFIERS

SEMICONDUCTOR TECHNICAL DATA



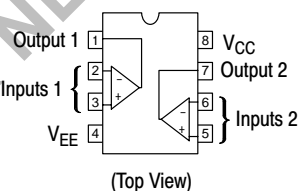
P SUFFIX
PLASTIC PACKAGE
CASE 626



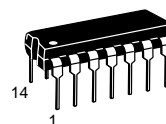
D SUFFIX
PLASTIC PACKAGE
CASE 751
(SO-8)

DUAL

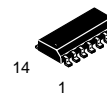
PIN CONNECTIONS



QUAD

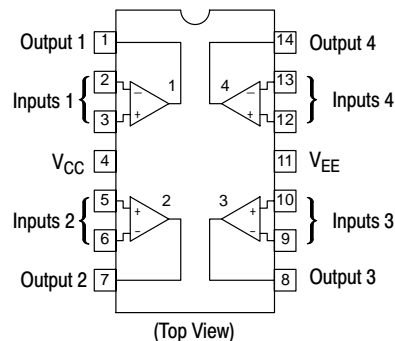


N SUFFIX
PLASTIC PACKAGE
CASE 646



D SUFFIX
PLASTIC PACKAGE
CASE 751A
(SO-14)

PIN CONNECTIONS



TL062 TL064

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|-----------|-------------|--------------------|
| Supply Voltage (from V_{CC} to V_{EE}) | V_S | +36 | V |
| Input Differential Voltage Range (Note 1) | V_{IDR} | ± 30 | V |
| Input Voltage Range (Notes 1 and 2) | V_{IR} | ± 15 | V |
| Output Short Circuit Duration (Note 3) | t_{SC} | Indefinite | sec |
| Operating Junction Temperature | T_J | +150 | $^{\circ}\text{C}$ |
| Storage Temperature Range | T_{stg} | -60 to +150 | $^{\circ}\text{C}$ |

- NOTES:** 1. Differential voltages are at the noninverting input terminal with respect to the inverting input terminal.
 2. The magnitude of the input voltage must never exceed the magnitude of the supply or 15 V, whichever is less.
 3. Power dissipation must be considered to ensure maximum junction temperature (T_J) is not exceeded. (See Figure 1.)

ELECTRICAL CHARACTERISTICS ($V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $T_A = 0^{\circ}$ to $+70^{\circ}\text{C}$, unless otherwise noted.)

| Characteristics | Symbol | TL062AC TL064AC | | | TL062C TL064C | | | Unit |
|---|--------------------------|--------------------|------------|----------|------------------|------------|----------|--------------------------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage ($R_S = 50\ \Omega$, $V_O = 0\text{ V}$) $T_A = 25^{\circ}\text{C}$ $T_A = 0^{\circ}$ to $+70^{\circ}\text{C}$ | V_{IO} | — | 3.0 | 6.0 | — | 3.0 | 15 | mV |
| | | — | — | 7.5 | — | — | 20 | |
| Average Temperature Coefficient for Offset Voltage ($R_S = 50\ \Omega$, $V_O = 0\text{ V}$) | $\Delta V_{IO}/\Delta T$ | — | 10 | — | — | 10 | — | $\mu\text{V}/^{\circ}\text{C}$ |
| Input Offset Current ($V_{CM} = 0\text{ V}$, $V_O = 0\text{ V}$) $T_A = 25^{\circ}\text{C}$ $T_A = 0^{\circ}$ to $+70^{\circ}\text{C}$ | I_{IO} | — | 0.5 | 100 | — | 0.5 | 200 | pA |
| | | — | — | 2.0 | — | — | 2.0 | nA |
| Input Bias Current ($V_{CM} = 0\text{ V}$, $V_O = 0\text{ V}$) $T_A = 25^{\circ}\text{C}$ $T_A = 0^{\circ}$ to $+70^{\circ}\text{C}$ | I_{IB} | — | 3.0 | 200 | — | 3.0 | 200 | pA |
| | | — | — | 2.0 | — | — | 10 | nA |
| Input Common Mode Voltage Range $T_A = 25^{\circ}\text{C}$ | V_{ICR} | — | +14.5 | +11.5 | — | +14.5 | +11 | V |
| | | -11.5 | -12.0 | — | -11 | -12.0 | — | |
| Large Signal Voltage Gain ($R_L = 10\text{ k}\Omega$, $V_O = \pm 10\text{ V}$) $T_A = 25^{\circ}\text{C}$ $T_A = 0^{\circ}$ to $+70^{\circ}\text{C}$ | A_{VOL} | 4.0 | 58 | — | 3.0 | 58 | — | V/mV |
| | | 4.0 | — | — | 3.0 | — | — | |
| Output Voltage Swing ($R_L = 10\text{ k}\Omega$, $V_{ID} = 1.0\text{ V}$) $T_A = 25^{\circ}\text{C}$ | V_{O+} V_{O-} | +10 — | +14 -14 | — -10 | +10 — | +14 -14 | — -10 | V |
| $T_A = 0^{\circ}$ to $+70^{\circ}\text{C}$ | V_{O+} V_{O-} | +10 — | — — | — -10 | +10 — | — — | — -10 | |
| Common Mode Rejection ($R_S = 50\ \Omega$, $V_{CM} = V_{ICR\ min}$, $V_O = 0\text{ V}$, $T_A = 25^{\circ}\text{C}$) | CMR | 80 | 84 | — | 70 | 84 | — | dB |
| Power Supply Rejection ($R_S = 50\ \Omega$, $V_{CM} = 0\text{ V}$, $V_O = 0$, $T_A = 25^{\circ}\text{C}$) | PSR | 80 | 86 | — | 70 | 86 | — | dB |
| Power Supply Current (each amplifier) (No Load, $V_O = 0\text{ V}$, $T_A = 25^{\circ}\text{C}$) | I_D | — | 200 | 250 | — | 200 | 250 | μA |
| Total Power Dissipation (each amplifier) (No Load, $V_O = 0\text{ V}$, $T_A = 25^{\circ}\text{C}$) | P_D | — | 6.0 | 7.5 | — | 6.0 | 7.5 | mW |

TL062 TL064

DC ELECTRICAL CHARACTERISTICS ($V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $T_A = T_{low}$ to T_{high} [Note 4], unless otherwise noted.)

| Characteristics | Symbol | TL062V | | | TL064V | | | Unit |
|--|--|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|------------------------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage ($R_S = 50\ \Omega$, $V_O = 0\text{ V}$) $T_A = 25^\circ\text{C}$ $T_A = T_{low}$ to T_{high} | V_{IO} | — — | 3.0 — | 6.0 9.0 | — — | 3.0 — | 9.0 15 | mV |
| Average Temperature Coefficient for Offset Voltage ($R_S = 50\ \Omega$, $V_O = 0\text{ V}$) | $\Delta V_{IO}/\Delta T$ | — | 10 | — | — | 10 | — | $\mu\text{V}/^\circ\text{C}$ |
| Input Offset Current ($V_{CM} = 0\text{ V}$, $V_O = 0\text{ V}$) $T_A = 25^\circ\text{C}$ $T_A = T_{low}$ to T_{high} | I_{IO} | — — | 5.0 — | 100 20 | — — | 5.0 — | 100 20 | pA nA |
| Input Bias Current ($V_{CM} = 0\text{ V}$, $V_O = 0\text{ V}$) $T_A = 25^\circ\text{C}$ $T_A = T_{low}$ to T_{high} | I_{IB} | — — | 30 — | 200 50 | — — | 30 — | 200 50 | pA nA |
| Input Common Mode Voltage Range ($T_A = 25^\circ\text{C}$) | V_{ICR} | — -11.5 | +14.5 -12.0 | +11.5 — | — -11.5 | +14.5 -12.0 | +11.5 — | V |
| Large Signal Voltage Gain ($R_L = 10\text{ k}\Omega$, $V_O = \pm 10\text{ V}$) $T_A = 25^\circ\text{C}$ $T_A = T_{low}$ to T_{high} | A_{VOL} | 4.0 4.0 | 58 — | — — | 4.0 4.0 | 58 — | — — | V/mV |
| Output Voltage Swing ($R_L = 10\text{ k}\Omega$, $V_{ID} = 1.0\text{ V}$) $T_A = 25^\circ\text{C}$ $T_A = T_{low}$ to T_{high} | V_{O+} V_{O-} V_{O+} V_{O-} | +10 — +10 — | +14 -14 — — | — -10 — -10 | +10 — +10 — | +14 -14 — — | — -10 — -10 | V |
| Common Mode Rejection ($R_S = 50\ \Omega$, $V_{CM} = V_{ICR\ min}$, $V_O = 0$, $T_A = 25^\circ\text{C}$) | CMR | 80 | 84 | — | 80 | 84 | — | dB |
| Power Supply Rejection ($R_S = 50\ \Omega$, $V_{CM} = 0\text{ V}$, $V_O = 0$, $T_A = 25^\circ\text{C}$) | PSR | 80 | 86 | — | 80 | 86 | — | dB |
| Power Supply Current (each amplifier) (No Load, $V_O = 0\text{ V}$, $T_A = 25^\circ\text{C}$) | I_D | — | 200 | 250 | — | 200 | 250 | μA |
| Total Power Dissipation (each amplifier) (No Load, $V_O = 0\text{ V}$, $T_A = 25^\circ\text{C}$) | P_D | — | 6.0 | 7.5 | — | 6.0 | 7.5 | mW |

NOTE: 4. $T_{low} = -40^\circ\text{C}$ $T_{high} = +85^\circ\text{C}$ for TL062,4V

AC ELECTRICAL CHARACTERISTICS ($V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $T_A = +25^\circ\text{C}$, unless otherwise noted.)

| Characteristics | Symbol | Min | Typ | Max | Unit |
|---|--------|--------|------------|--------|------------------------|
| Slew Rate ($V_{in} = -10\text{ V}$ to $+10\text{ V}$, $R_L = 10\text{ k}\Omega$, $C_L = 100\text{ pF}$, $A_V = +1.0$) | SR | 2.0 | 6.0 | — | V/ μs |
| Rise Time ($V_{in} = 20\text{ mV}$, $R_L = 10\text{ k}\Omega$, $C_L = 100\text{ pF}$, $A_V = +1.0$) | t_r | — | 0.1 | — | μs |
| Overshoot ($V_{in} = 20\text{ mV}$, $R_L = 10\text{ k}\Omega$, $C_L = 100\text{ pF}$, $A_V = +1.0$) | OS | — | 10 | — | % |
| Settling Time ($V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $A_V = -1.0$, $R_L = 10\text{ k}\Omega$, $V_O = 0\text{ V}$ to $+10\text{ V}$ step) | t_s | — — | 1.6 2.2 | — — | μs |
| Gain Bandwidth Product ($f = 200\text{ kHz}$) | GBW | — | 2.0 | — | MHz |
| Equivalent Input Noise ($R_S = 100\ \Omega$, $f = 1.0\text{ kHz}$) | e_n | — | 47 | — | nV/ $\sqrt{\text{Hz}}$ |
| Input Resistance | R_i | — | 10^{12} | — | Ω |
| Channel Separation ($f = 10\text{ kHz}$) | CS | — | 120 | — | dB |

Figure 1. Maximum Power Dissipation versus Temperature for Package Variations

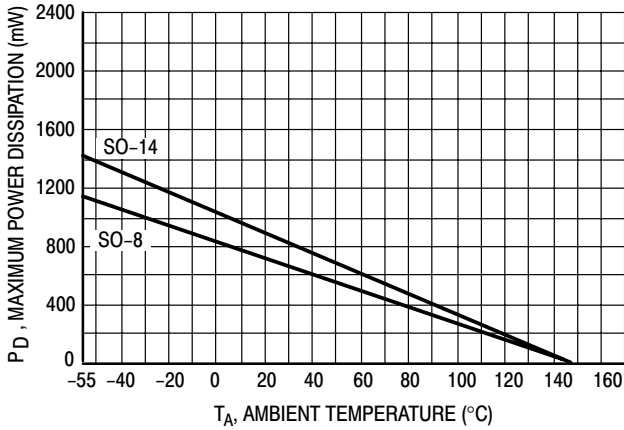


Figure 2. Output Voltage Swing versus Supply Voltage

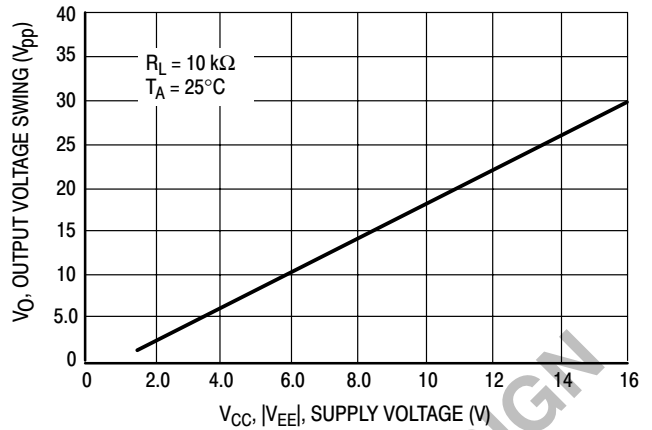


Figure 3. Output Voltage Swing versus Temperature

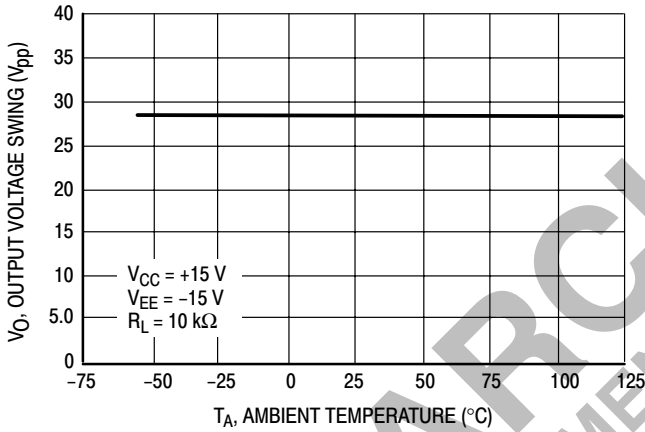


Figure 4. Output Voltage Swing versus Load Resistance

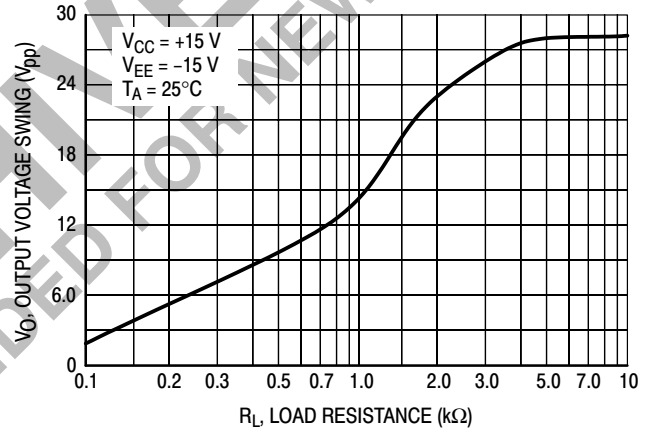


Figure 5. Output Voltage Swing versus Frequency

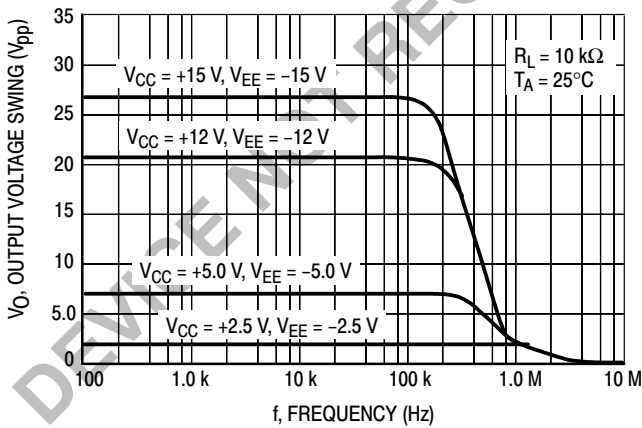


Figure 6. Large Signal Voltage Gain versus Temperature

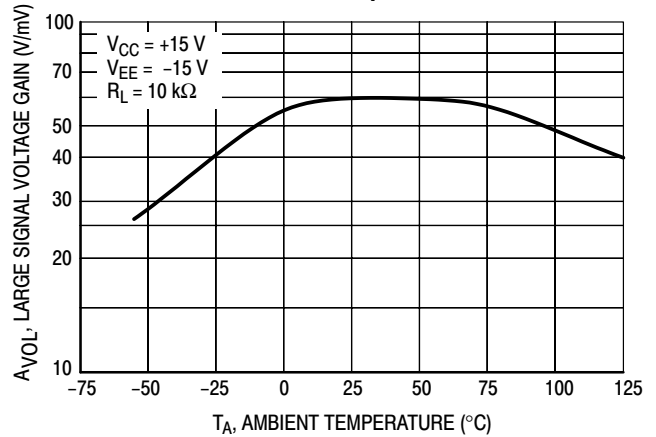


Figure 7. Open Loop Voltage Gain and Phase versus Frequency

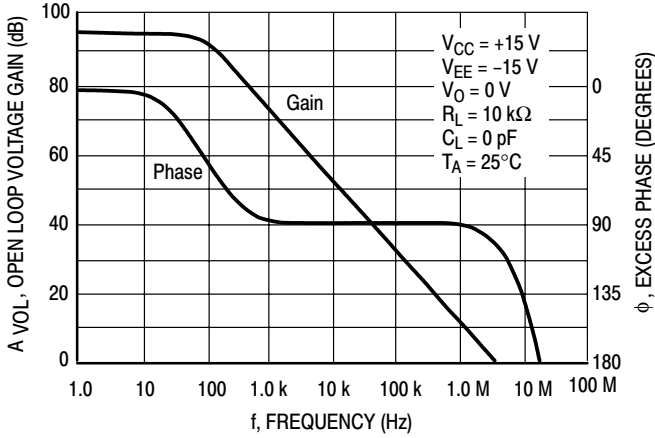


Figure 8. Supply Current per Amplifier versus Supply Voltage

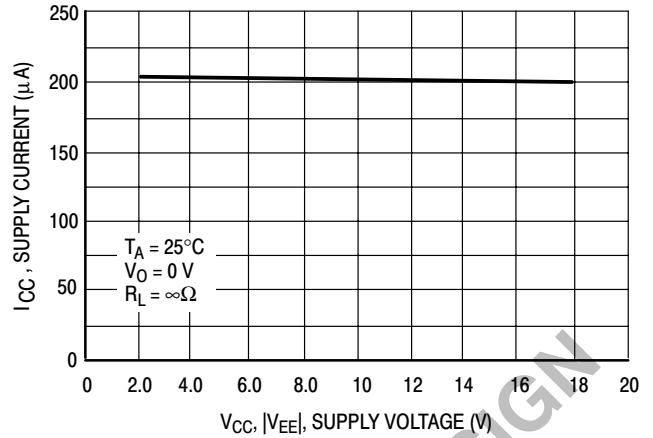


Figure 9. Supply Current per Amplifier versus Temperature

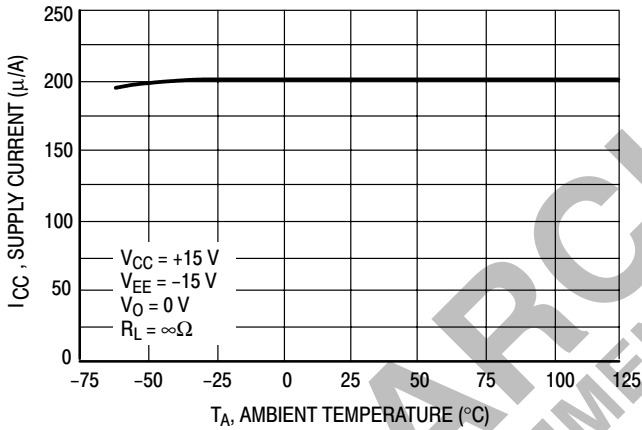


Figure 10. Total Power Dissipation versus Temperature

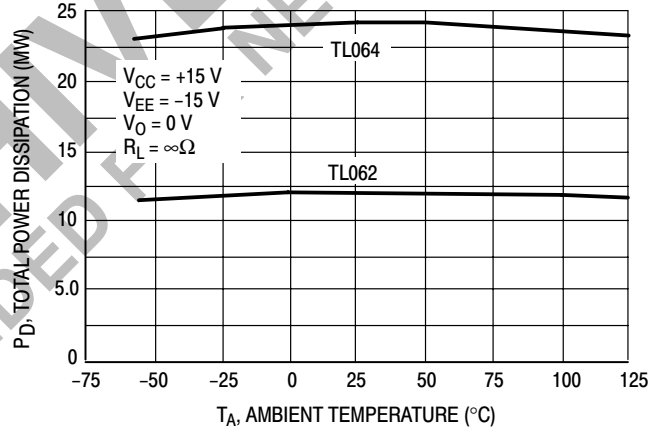


Figure 11. Common Mode Rejection versus Temperature

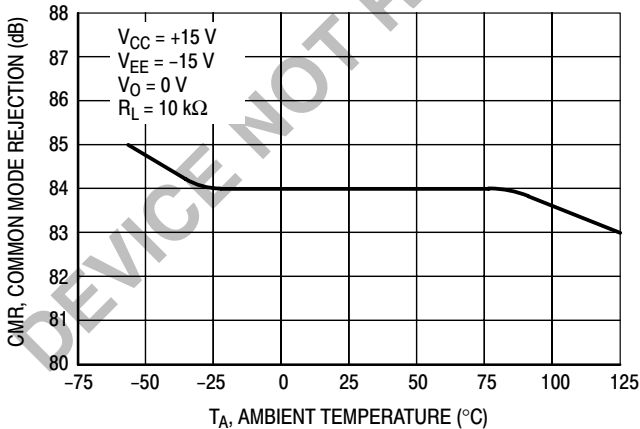


Figure 12. Common Mode Rejection versus Frequency

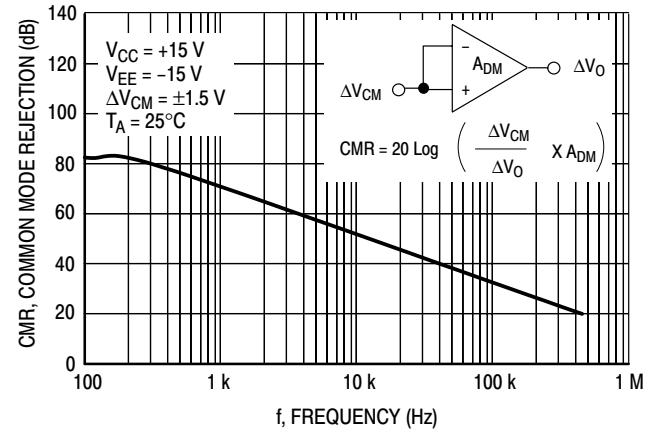


Figure 13. Power Supply Rejection versus Frequency

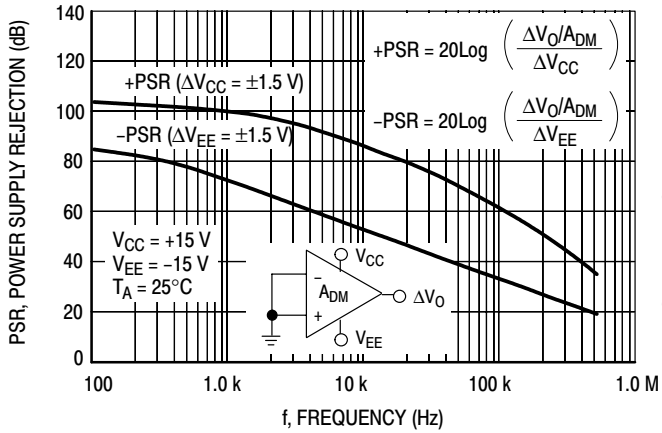


Figure 14. Normalized Gain Bandwidth Product, Slew Rate and Phase Margin versus Temperature

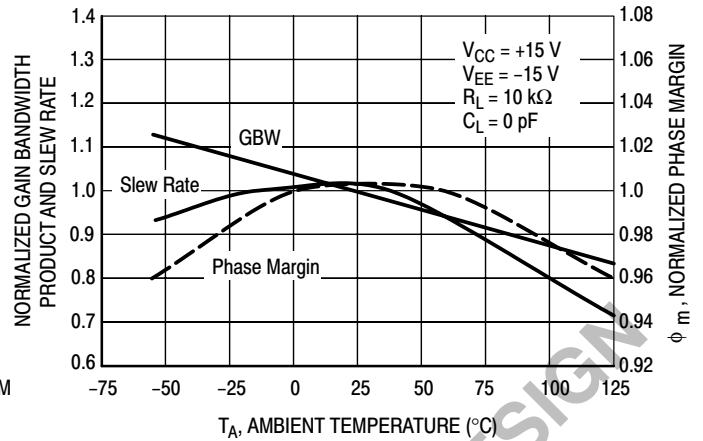


Figure 15. Input Bias Current versus Temperature

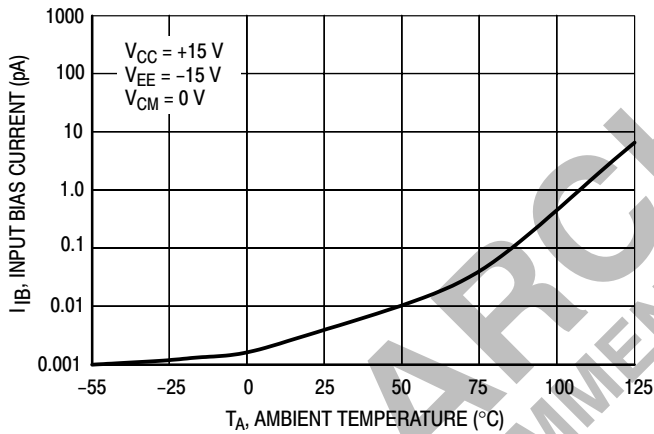


Figure 16. Input Noise Voltage versus Frequency

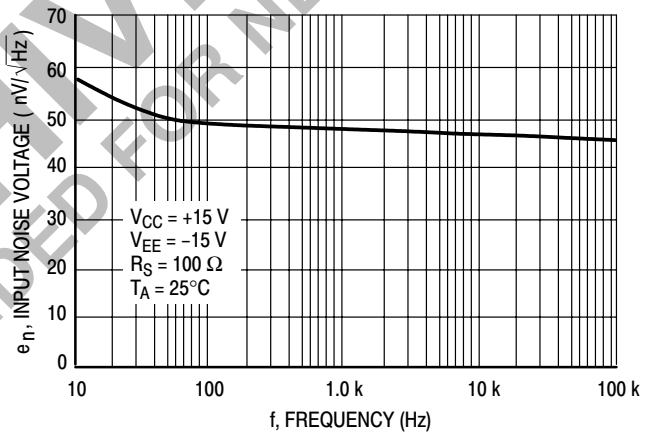


Figure 17. Small Signal Response

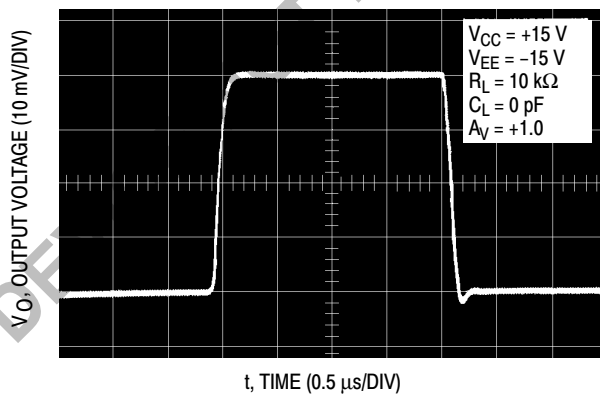
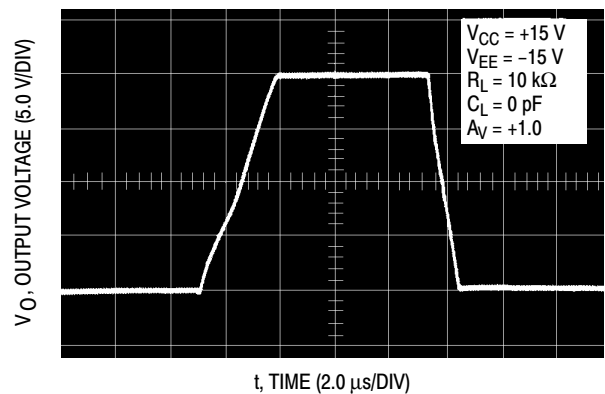


Figure 18. Large Signal Response



TL062 TL064

Figure 19. AC Amplifier

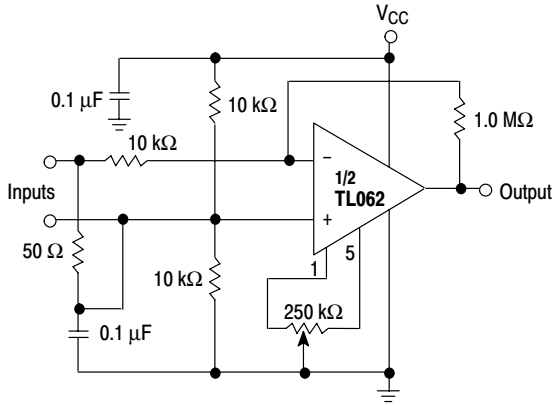


Figure 20. High-Q Notch Filter

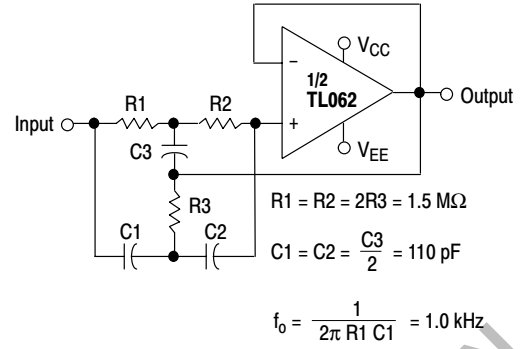


Figure 21. Instrumentation Amplifier

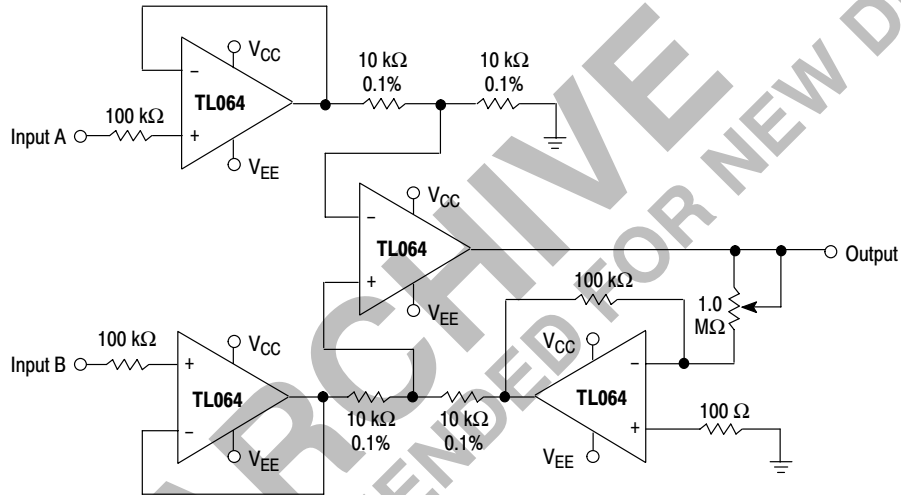


Figure 22. 0.5 Hz Square-Wave Oscillator

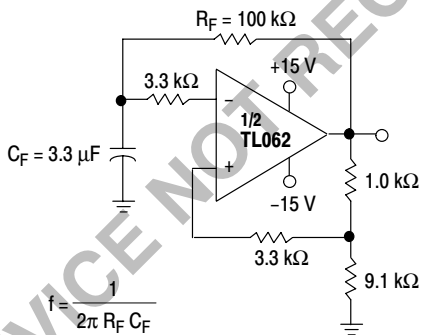
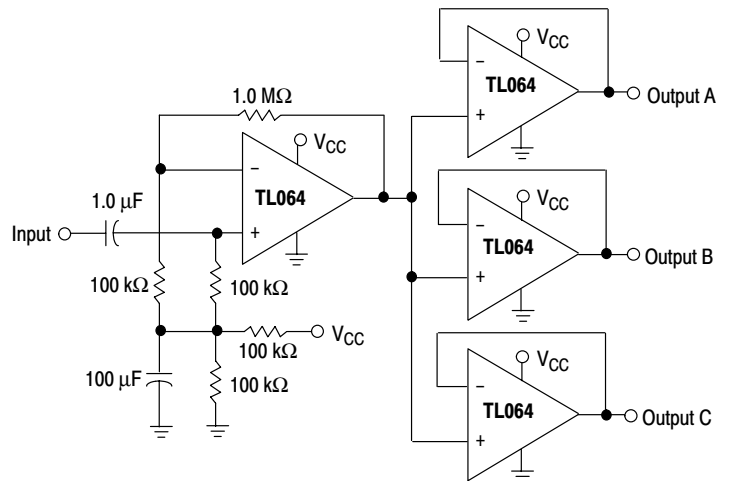


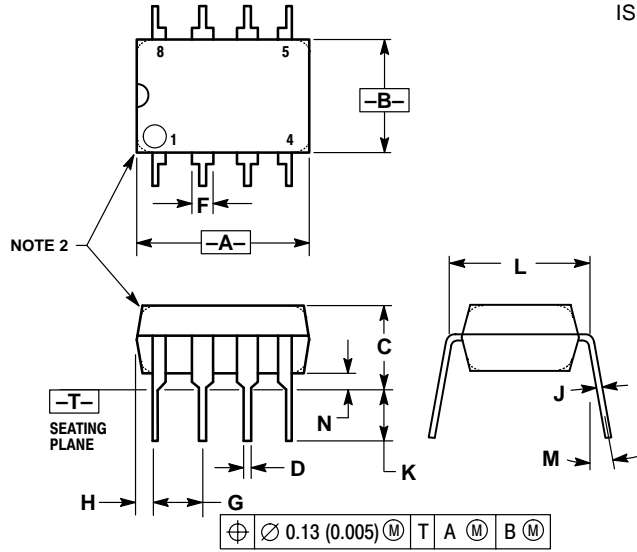
Figure 23. Audio Distribution Amplifier



TL062 TL064

OUTLINE DIMENSIONS

P SUFFIX PLASTIC PACKAGE CASE 626-05 ISSUE K

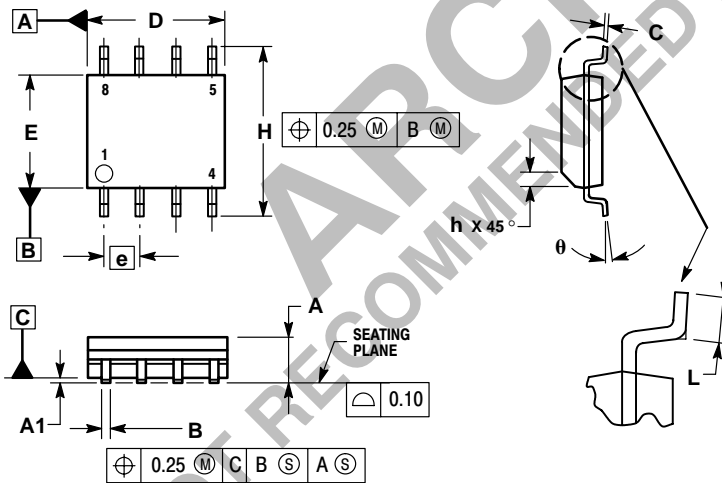


NOTES:

1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 9.40 | 10.16 | 0.370 | 0.400 |
| B | 6.10 | 6.60 | 0.240 | 0.260 |
| C | 3.94 | 4.45 | 0.155 | 0.175 |
| D | 0.38 | 0.51 | 0.015 | 0.020 |
| F | 1.02 | 1.78 | 0.040 | 0.070 |
| G | 2.54 BSC | | 0.100 BSC | |
| H | 0.76 | 1.27 | 0.030 | 0.050 |
| J | 0.20 | 0.30 | 0.008 | 0.012 |
| K | 2.92 | 3.43 | 0.115 | 0.135 |
| L | 7.62 BSC | | 0.300 BSC | |
| M | --- | 10° | --- | 10° |
| N | 0.76 | 1.01 | 0.030 | 0.040 |

D SUFFIX PLASTIC PACKAGE CASE 751-05 (SO-8) ISSUE R



NOTES:

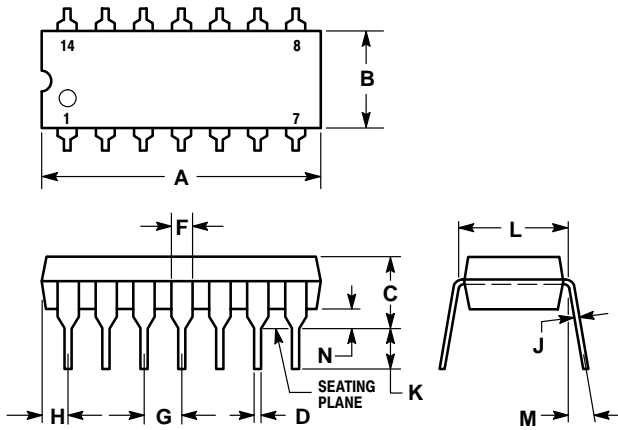
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | |
|----------|-------------|------|
| | MIN | MAX |
| A | 1.35 | 1.75 |
| A1 | 0.10 | 0.25 |
| B | 0.35 | 0.49 |
| C | 0.18 | 0.25 |
| D | 4.80 | 5.00 |
| E | 3.80 | 4.00 |
| e | 1.27 BSC | |
| H | 5.80 | 6.20 |
| h | 0.25 | 0.50 |
| L | 0.40 | 1.25 |
| θ | 0° | 7° |

TL062 TL064

OUTLINE DIMENSIONS

N SUFFIX PLASTIC PACKAGE CASE 646-06 ISSUE L

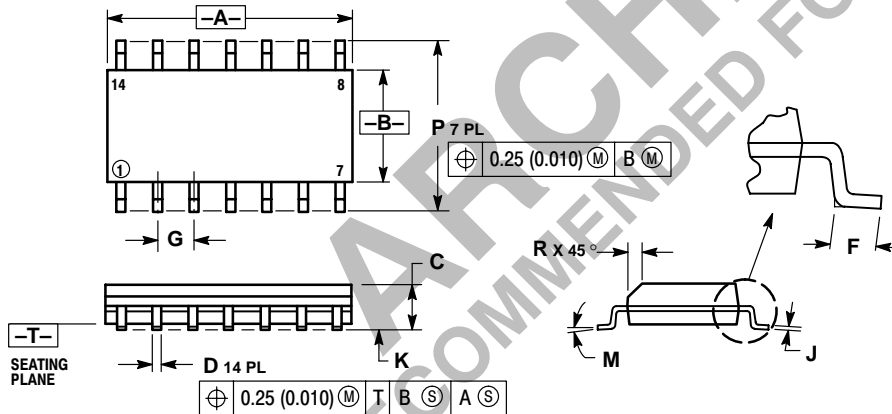


NOTES:

- LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
- DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
- DIMENSION B DOES NOT INCLUDE MOLD FLASH.
- ROUNDED CORNERS OPTIONAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.715 | 0.770 | 18.16 | 19.56 |
| B | 0.240 | 0.260 | 6.10 | 6.60 |
| C | 0.145 | 0.185 | 3.69 | 4.69 |
| D | 0.015 | 0.021 | 0.38 | 0.53 |
| F | 0.040 | 0.070 | 1.02 | 1.78 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.052 | 0.095 | 1.32 | 2.41 |
| J | 0.008 | 0.015 | 0.20 | 0.38 |
| K | 0.115 | 0.135 | 2.92 | 3.43 |
| L | 0.300 BSC | | 7.62 BSC | |
| M | 0° | 10° | 0° | 10° |
| N | 0.015 | 0.039 | 0.39 | 1.01 |

D SUFFIX PLASTIC PACKAGE CASE 751A-03 (SO-14) ISSUE F



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
- MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
- DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 8.55 | 8.75 | 0.337 | 0.344 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.25 | 0.016 | 0.049 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.19 | 0.25 | 0.008 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 0° | 7° | 0° | 7° |
| P | 5.80 | 6.20 | 0.228 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |


TL062 TL064
NOTES

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DEVICE NOT RECOMMENDED FOR NEW DESIGN

TL062 TL064
NOTES

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