

RC4559

Dual High-Gain Operational Amplifier

Features

- Unity gain bandwidth – 4.0 MHz
- Slew rate – 2.0 V/ μ S
- Low noise voltage – 1.4 μ VRMS
- Supply voltage – ± 22 V for RM4559 and ± 18 V for RC4559
- No frequency compensation required
- No latch up
- Large common mode and differential voltage ranges
- Low power consumption
- Parameter tracking over temperature range
- Gain and phase match between amplifiers

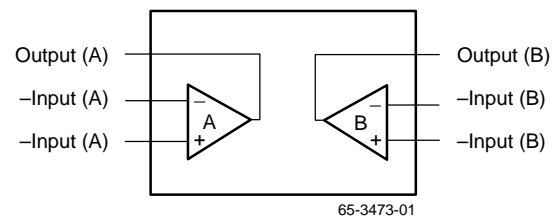
Description

The RC4559 integrated circuit is a high performance dual operational amplifier internally compensated and constructed on a single silicon chip using an advanced epitaxial process.

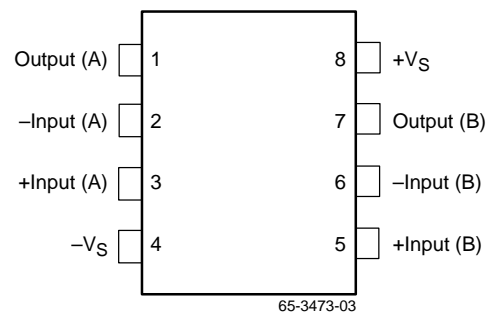
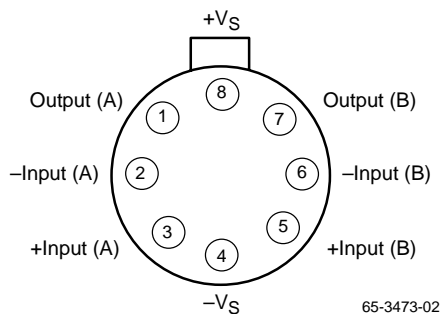
These amplifiers feature improved AC performance which far exceeds that of the 741-type amplifiers. The specially designed low-noise input transistors allow the RC4559 to be used in low-noise signal processing applications such as audio preamplifiers and signal conditioners.

The RC4559 also has more output drive capability than 741-type amplifiers and can be used to drive a 600 Ω load.

Block Diagram



Pin Assignments



Absolute Maximum Ratings

(beyond which the device may be damaged)¹

| Parameter | | Min | Typ | Max | Units |
|--|------------------------------|------------|-----|-----|-------|
| Supply Voltage | RM4559 | | | ±22 | V |
| | RC4559 | | | ±18 | |
| Input Voltage ² | | | | ±15 | V |
| Differential Input Voltage | | | | 30 | V |
| PDTA < 50°C | SOIC | | | 300 | mW |
| | PDIP | | | 468 | |
| | CerDIP | | | 833 | |
| | TO-99 | | | 658 | |
| Junction Temperature | SOIC, PDIP | | | 125 | °C |
| | CerDIP, TO-99 | | | 175 | |
| Operating Temperature | RM4559 | -55 | | 125 | °C |
| | RC4559 | 0 | | 70 | |
| Lead Soldering Temperature | PDIP, CerDIP, TO-99 (60 sec) | | | 300 | °C |
| | SOIC (10 sec) | | | 260 | |
| Output Short Circuit Duration ³ | | Indefinite | | | |

Notes:

1. Functional operation under any of these conditions is NOT implied.
2. For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.
3. Short circuit may be to ground on one op amp only. Rating applies to +75°C ambient temperature.

Matching Characteristics

(V_S = ±15V, T_A = +25°C unless otherwise specified)

| Parameter | Test Conditions | Typ | Units |
|----------------------|-----------------------|------|-------|
| Voltage Gain | R _L ≥ 2 kΩ | ±1.0 | dB |
| Input Bias Current | | ±15 | nA |
| Input Offset Current | | ±7.5 | nA |

Electrical Characteristics

($V_S = \pm 15V$ and $T_A = +25^\circ C$ unless otherwise specified)

| Parameters | Test Conditions | RM4559 | | | RC4559 | | | Units |
|---|--|-----------|----------|-----|-----------|----------|-----|-------------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | $R_S \leq 10k\Omega$ | | 1.0 | 5.0 | | 2.0 | 6.0 | mV |
| Input Offset Current | | | 5.0 | 100 | | 5.0 | 100 | nA |
| Input Bias Current | | | 40 | 250 | | 40 | 250 | nA |
| Input Resistance (Differential Mode) | | 0.3 | 1.0 | | 0.3 | 1.0 | | $M\Omega$ |
| Large Signal Voltage Gain | $R_L \geq 2k\Omega$, $V_{OUT} = \pm 10V$ | 50 | 300 | | 20 | 300 | | V/mV |
| Output Voltage Swing | $R_L \geq 10k\Omega$ | ± 12 | ± 14 | | ± 12 | ± 14 | | V |
| | $R_L \geq 2k\Omega$ | ± 10 | ± 13 | | ± 10 | ± 13 | | |
| | $R_L \geq 600\Omega$ | ± 9.5 | ± 10 | | ± 9.5 | ± 10 | | |
| Input Voltage Range | | ± 12 | ± 13 | | ± 12 | ± 13 | | V |
| Common Mode Rejection Ratio | $R_S \leq 10k\Omega$ | 80 | 100 | | 80 | 100 | | dB |
| Power Supply Rejection Ratio | $R_S \leq 10k\Omega$ | 82 | 100 | | 82 | 100 | | dB |
| Supply Current | $R_L = \infty$ | | 3.3 | 5.6 | | 3.3 | 5.6 | mA |
| Transient Response | | | | | | | | |
| Rise Time | $V_{IN} = 20\text{ mV}$ $R_L = 2k\Omega$ | | 80 | | | 80 | | μS |
| Overshoot | $C_L \leq 100pF$ | | 35 | | | 35 | | % |
| Slew Rate | | 1.5 | 2.0 | | 1.5 | 2.0 | | V/ μS |
| Unity Gain Bandwidth | | 3.0 | 4.0 | | 3.0 | 4.0 | | MHz |
| Power Bandwidth | $V_{OUT} = 20V_{p-p}$ | 24 | 32 | | 24 | 32 | | kHz |
| Input Noise Voltage ¹ | F=20Hz to 20kHz | | 1.4 | 5.0 | | 1.4 | 5.0 | μV_{RMS} |
| Input Noise Current | F=20Hz to 20kHz | | 25 | | | 25 | | pA _{RMS} |
| Channel Separation | Gain = 100, F = 10kHz, $R_S = 1k\Omega$ | | 90 | | | 90 | | dB |
| The following specifications apply for RM = $-55^\circ C \leq T_A \leq +125^\circ C$, RC = $0^\circ \leq T_A \leq +70^\circ C$ | | | | | | | | |
| Input Offset Voltage | $R_S \leq 10k\Omega$ | | | 6.0 | | | 7.5 | mV |
| Input Offset Current | | | | 300 | | | 200 | nA |
| Input Bias Current | | | | 500 | | | 300 | nA |
| Large Signal Voltage Gain | $R_L \geq 2k\Omega$, $V_{OUT} = \pm 10V$ | 25 | | | 15 | | | V/mV |
| Output Voltage Swing | $R_L \geq 2k\Omega$ | ± 10 | | | ± 10 | | | V |
| Supply Current | $R_L = \infty$ | | 4.0 | 6.6 | | 4.0 | 6.6 | mA |

Note:

1. Sample tested only.

Typical Performance Characteristics

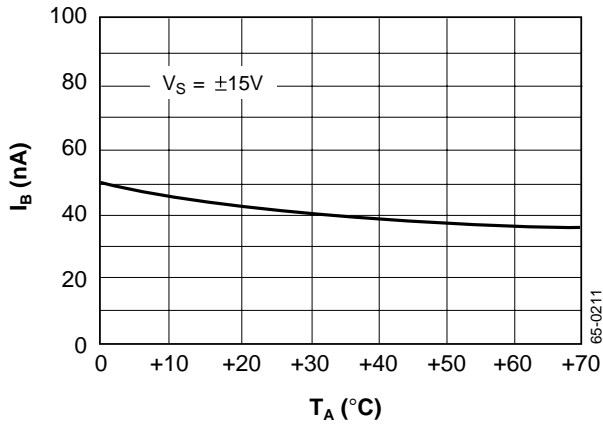


Figure 1. Input Bias Current vs. Temperature

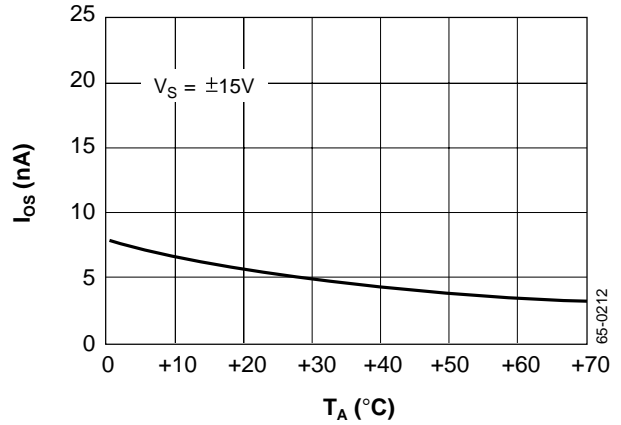


Figure 2. Input Offset Current vs. Temperature

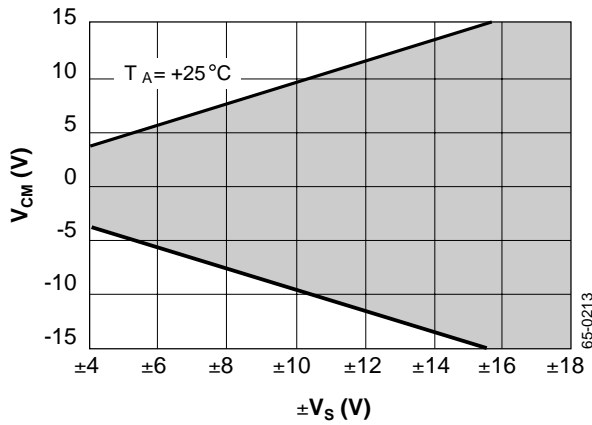


Figure 3. Input Common Mode Voltage Range vs. Supply Voltage

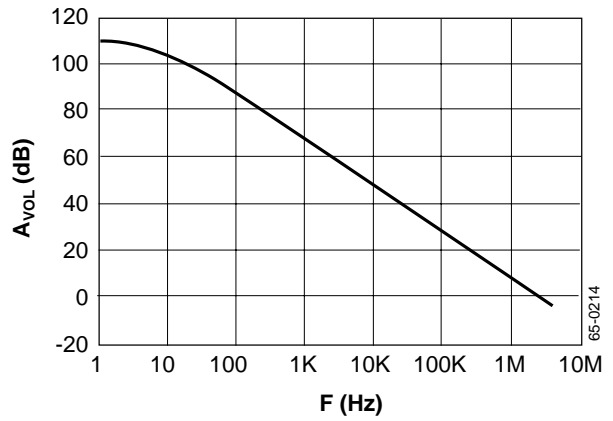


Figure 4. Open Loop Gain Voltage vs. Frequency

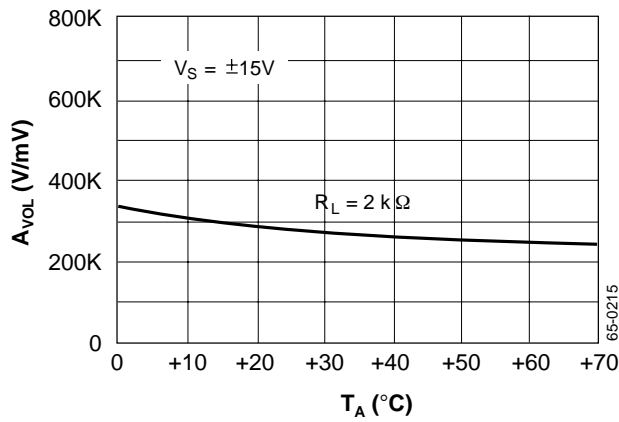


Figure 5. Open Loop Voltage Gain vs. Temperature

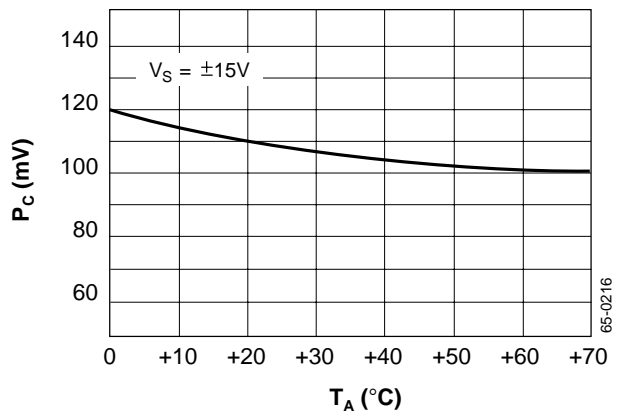


Figure 6. Power Consumption vs. Temperature

Typical Performance Characteristics (continued)

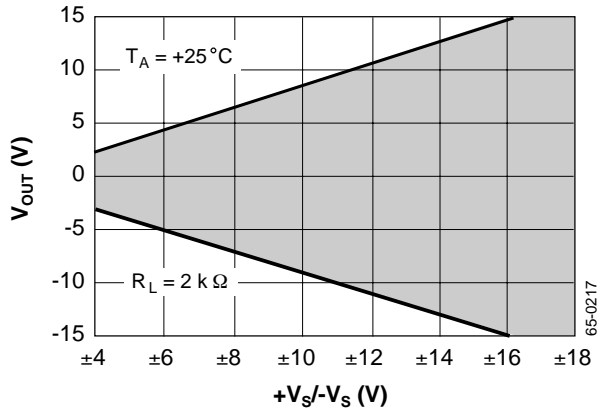


Figure 7. Output Voltage Swing vs. Supply Voltage

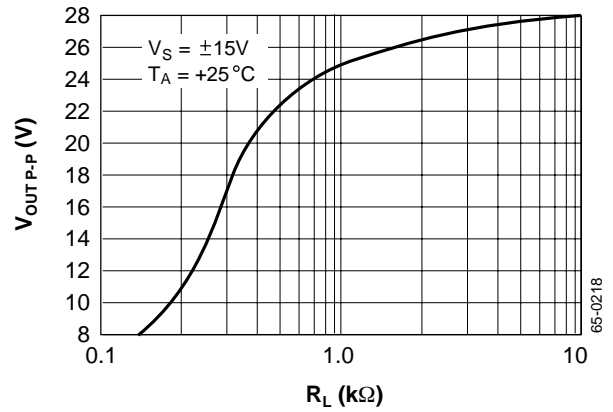


Figure 8. Output Voltage Swing vs. Load Resistance

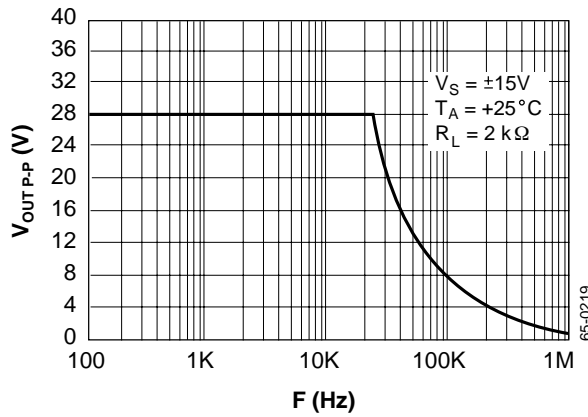


Figure 9. Output Voltage Swing vs. Frequency

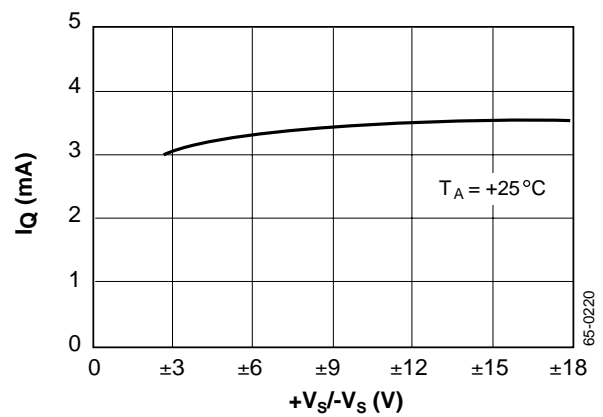


Figure 10. Quiescent Current vs. Supply Voltage

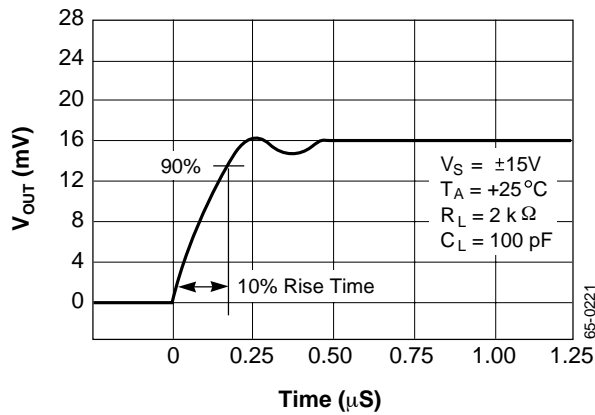


Figure 11. Transient Response Output Voltage vs. Time

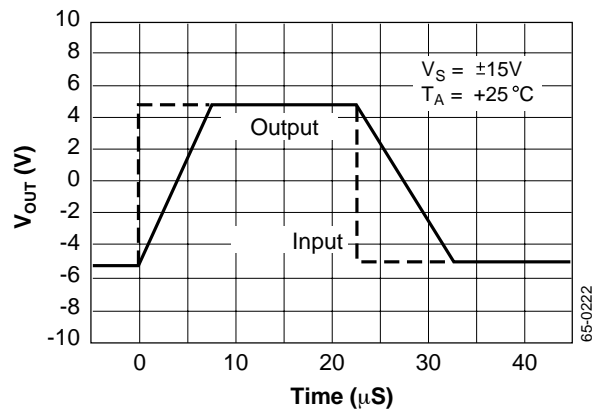


Figure 12. Follower Large Signal Pulse Response Output Voltage vs. Time

Typical Performance Characteristics (continued)

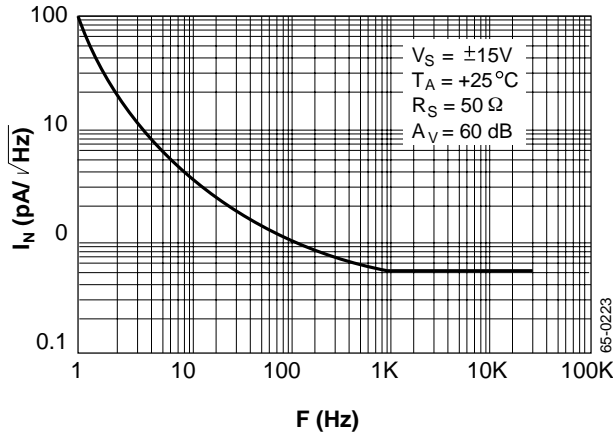


Figure 13. Input Noise Current Density vs. Frequency

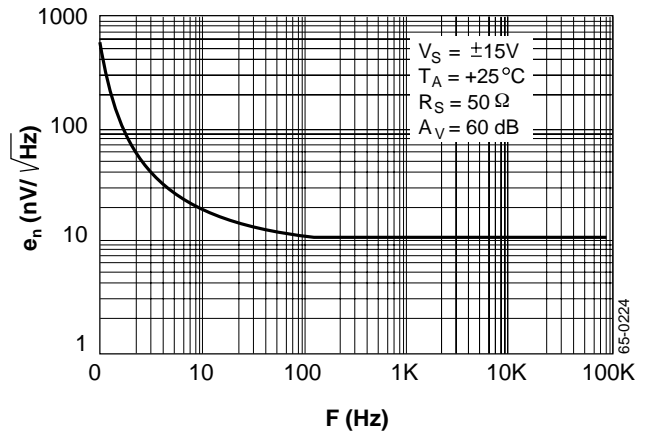


Figure 14. Input Noise Voltage Density vs. Frequency

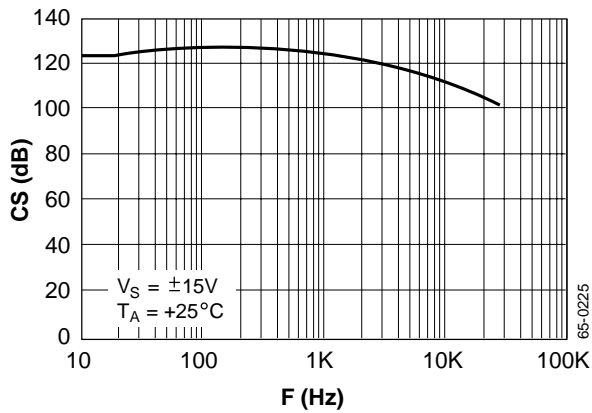


Figure 15. Channel Separation vs. Frequency

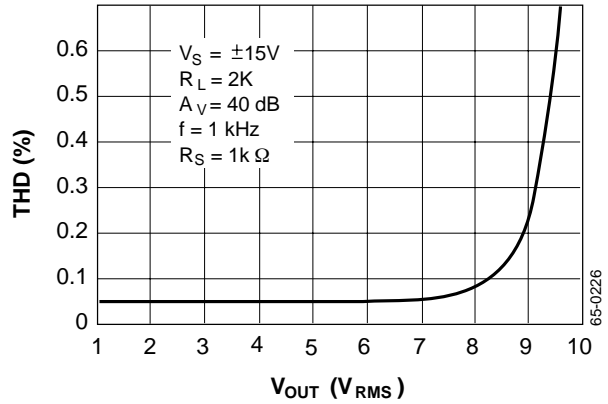


Figure 16. Total Harmonic Distortion vs. Output Voltage

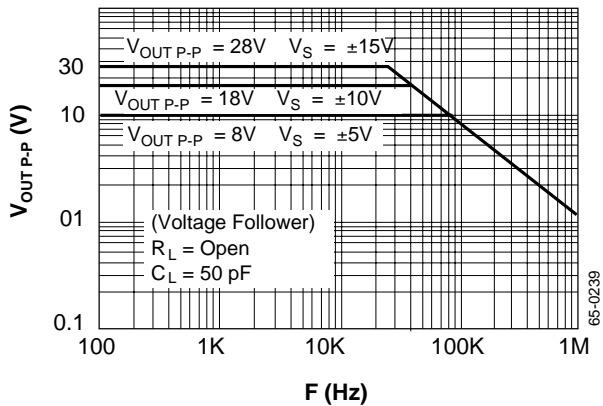


Figure 17. Output Voltage Swing vs. Frequency

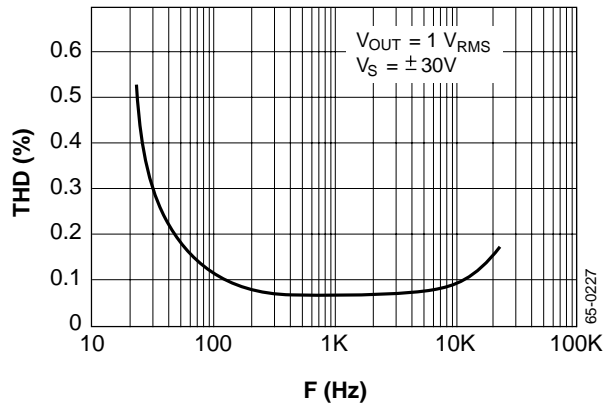


Figure 18. Distortion vs. Frequency

Typical Applications

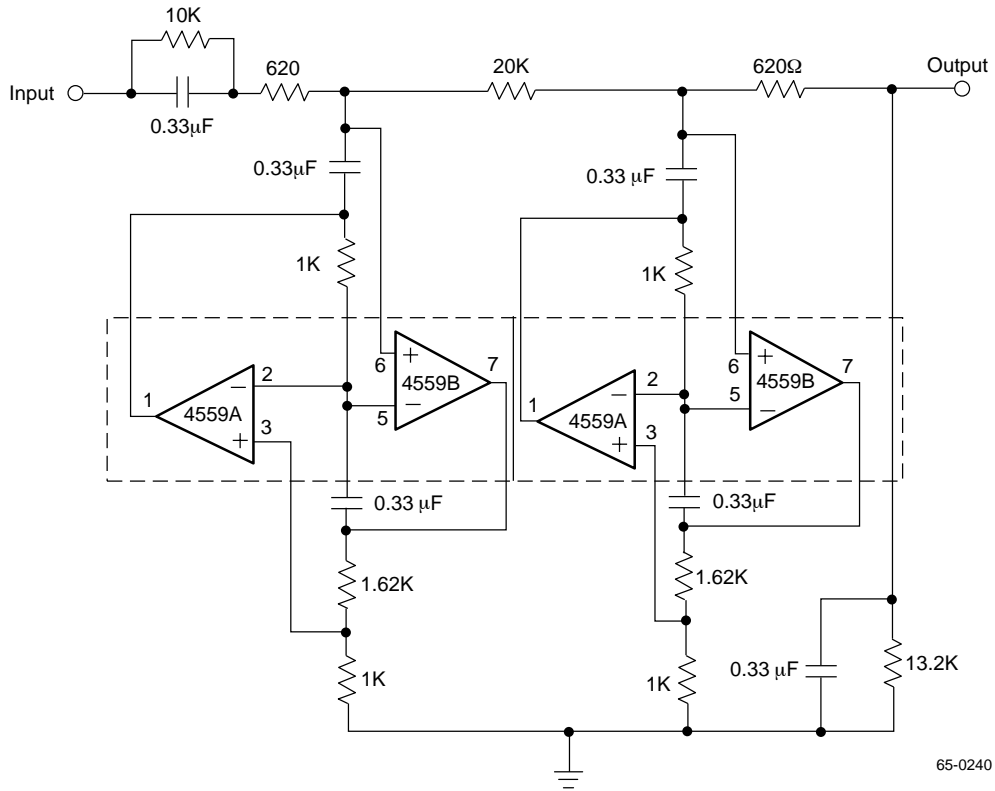


Figure 19. 400Hz Lowpass Butterworth Active Filter

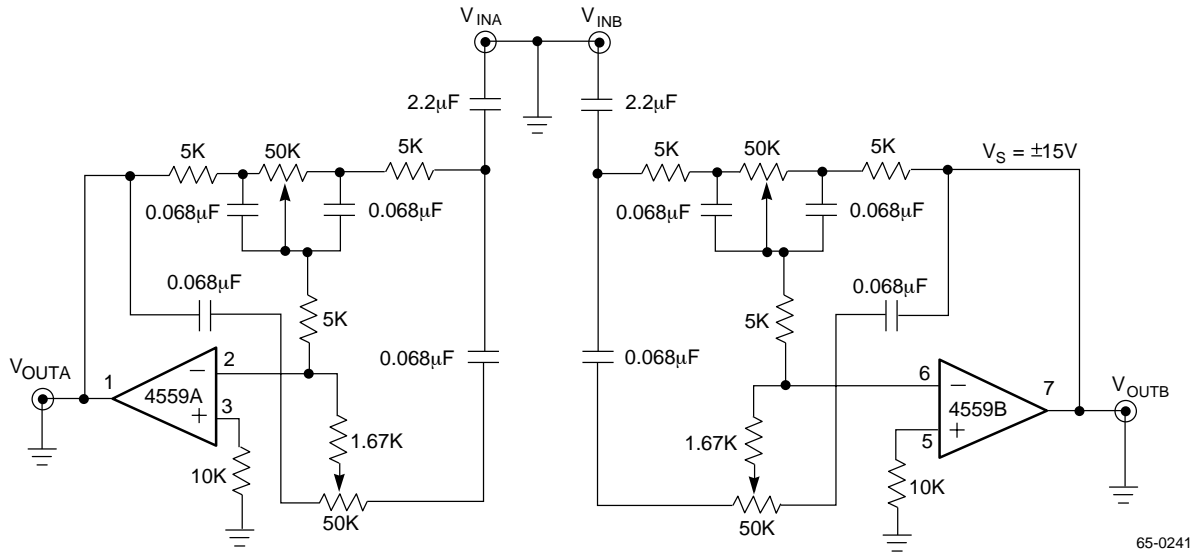


Figure 20. Stereo Tone Control

Typical Applications (continued)

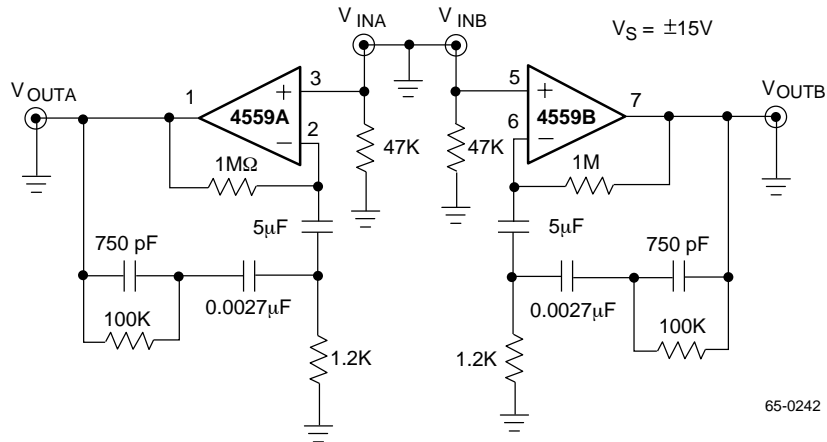


Figure 21. RIAA Preamp

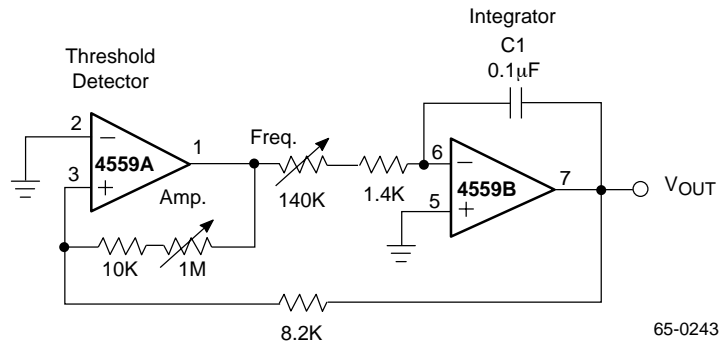


Figure 22. Triangular-Wave Generator

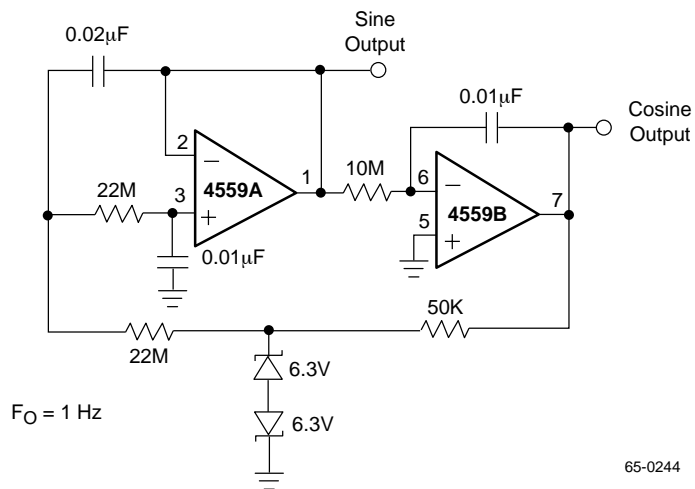
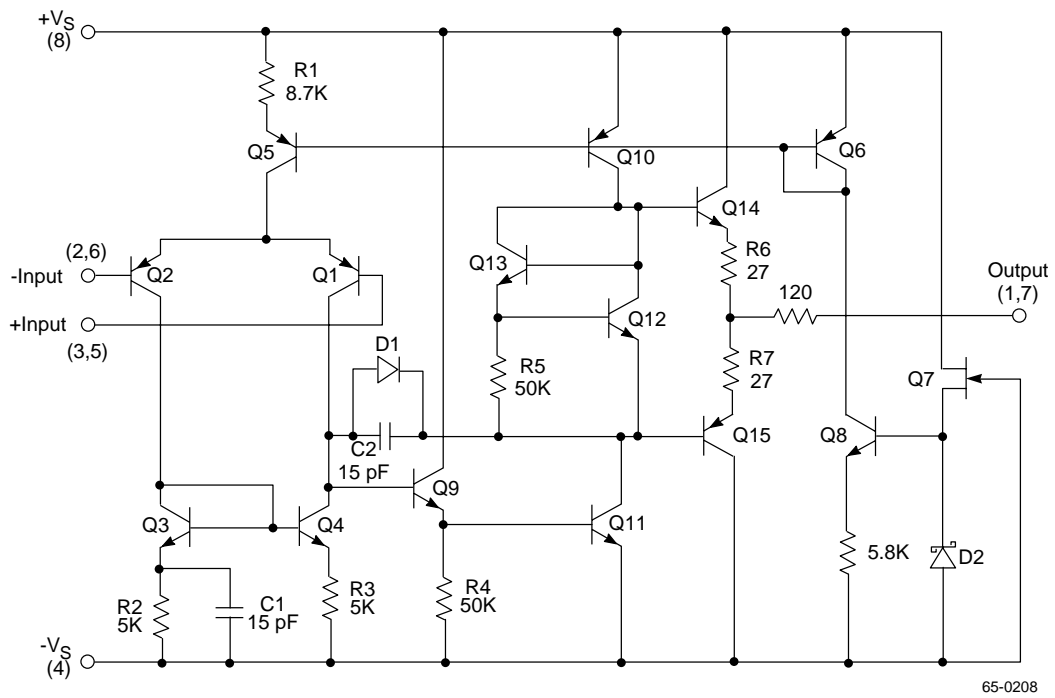


Figure 23. Low Frequency Sine Wave Generator with Quadrature Output

Simplified Schematic Diagram



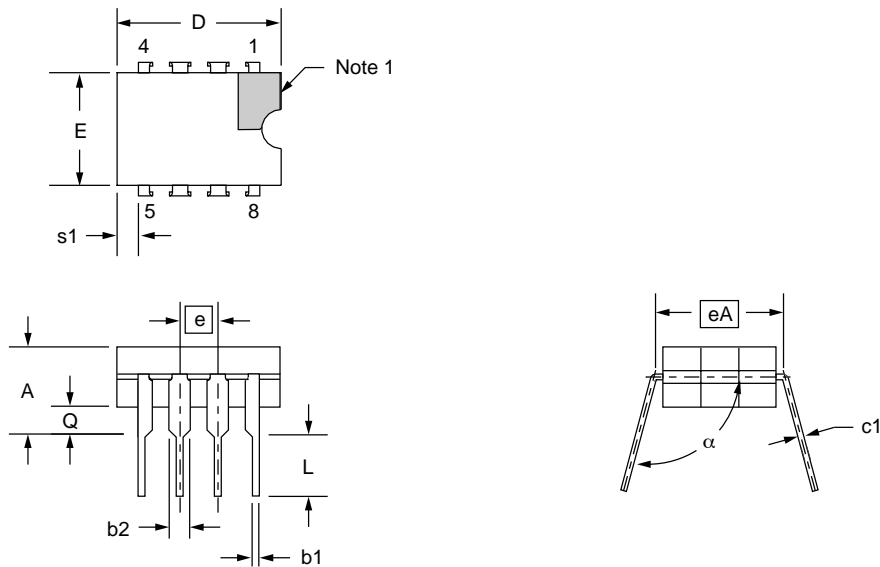
Mechanical Dimensions

8-Lead Ceramic DIP Package

| Symbol | Inches | | Millimeters | | Notes |
|----------|----------|------|-------------|-------|-------|
| | Min. | Max. | Min. | Max. | |
| A | — | .200 | — | 5.08 | |
| b1 | .014 | .023 | .36 | .58 | 8 |
| b2 | .045 | .065 | 1.14 | 1.65 | 2, 8 |
| c1 | .008 | .015 | .20 | .38 | 8 |
| D | — | .405 | — | 10.29 | 4 |
| E | .220 | .310 | 5.59 | 7.87 | 4 |
| e | .100 BSC | | 2.54 BSC | | 5, 9 |
| eA | .300 BSC | | 7.62 BSC | | 7 |
| L | .125 | .200 | 3.18 | 5.08 | |
| Q | .015 | .060 | .38 | 1.52 | 3 |
| s1 | .005 | — | .13 | — | 6 |
| α | 90° | 105° | 90° | 105° | |

Notes:

1. Index area: a notch or a pin one identification mark shall be located adjacent to pin one. The manufacturer's identification shall not be used as pin one identification mark.
2. The minimum limit for dimension "b2" may be .023 (.58mm) for leads number 1, 4, 5 and 8 only.
3. Dimension "Q" shall be measured from the seating plane to the base plane.
4. This dimension allows for off-center lid, meniscus and glass overrun.
5. The basic pin spacing is .100 (2.54mm) between centerlines. Each pin centerline shall be located within ± 0.010 (.25mm) of its exact longitudinal position relative to pins 1 and 8.
6. Applies to all four corners (leads number 1, 4, 5, and 8).
7. "eA" shall be measured at the center of the lead bends or at the centerline of the leads when " α " is 90°.
8. All leads – Increase maximum limit by .003 (.08mm) measured at the center of the flat, when lead finish applied.
9. Six spaces.



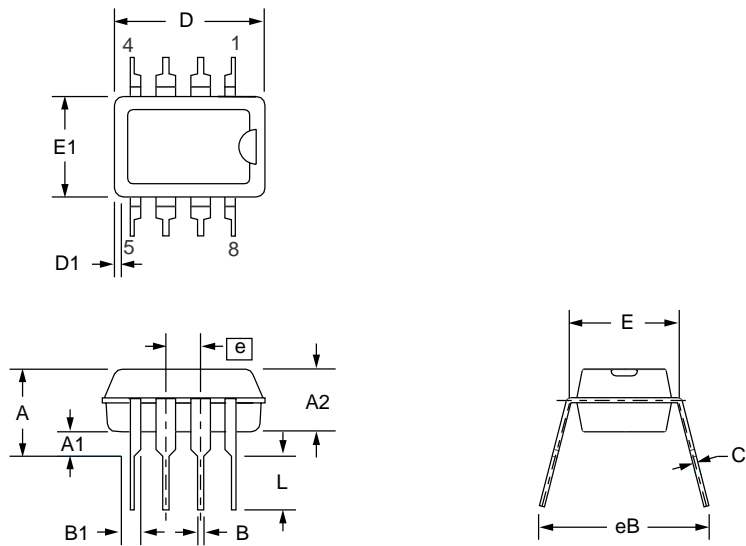
Mechanical Dimensions (continued)

8-Lead Plastic DIP Package

| Symbol | Inches | | Millimeters | | Notes |
|--------|----------|------|-------------|-------|-------|
| | Min. | Max. | Min. | Max. | |
| A | — | .210 | — | 5.33 | |
| A1 | .015 | — | .38 | — | |
| A2 | .115 | .195 | 2.93 | 4.95 | |
| B | .014 | .022 | .36 | .56 | |
| B1 | .045 | .070 | 1.14 | 1.78 | |
| C | .008 | .015 | .20 | .38 | 4 |
| D | .348 | .430 | 8.84 | 10.92 | 2 |
| D1 | .005 | — | .13 | — | |
| E | .300 | .325 | 7.62 | 8.26 | |
| E1 | .240 | .280 | 6.10 | 7.11 | 2 |
| e | .100 BSC | | 2.54 BSC | | |
| eB | — | .430 | — | 10.92 | |
| L | .115 | .160 | 2.92 | 4.06 | |
| N | 8° | | 8° | | 5 |

Notes:

1. Dimensioning and tolerancing per ANSI Y14.5M-1982.
2. "D" and "E1" do not include mold flashing. Mold flash or protrusions shall not exceed .010 inch (0.25mm).
3. Terminal numbers are for reference only.
4. "C" dimension does not include solder finish thickness.
5. Symbol "N" is the maximum number of terminals.



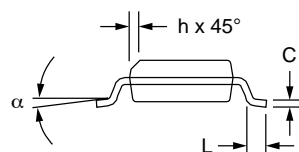
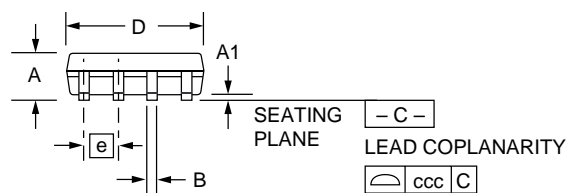
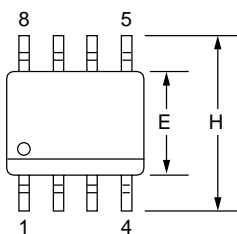
Mechanical Dimensions (continued)

8-Lead SOIC Package

| Symbol | Inches | | Millimeters | | Notes |
|----------|----------|------|-------------|------|-------|
| | Min. | Max. | Min. | Max. | |
| A | .053 | .069 | 1.35 | 1.75 | |
| A1 | .004 | .010 | 0.10 | 0.25 | |
| B | .013 | .020 | 0.33 | 0.51 | |
| C | .008 | .010 | 0.20 | 0.25 | 5 |
| D | .189 | .197 | 4.80 | 5.00 | 2 |
| E | .150 | .158 | 3.81 | 4.01 | 2 |
| e | .050 BSC | | 1.27 BSC | | |
| H | .228 | .244 | 5.79 | 6.20 | |
| h | .010 | .020 | 0.25 | 0.50 | |
| L | .016 | .050 | 0.40 | 1.27 | 3 |
| N | 8 | | 8 | | 6 |
| α | 0° | 8° | 0° | 8° | |
| ccc | — | .004 | — | 0.10 | |

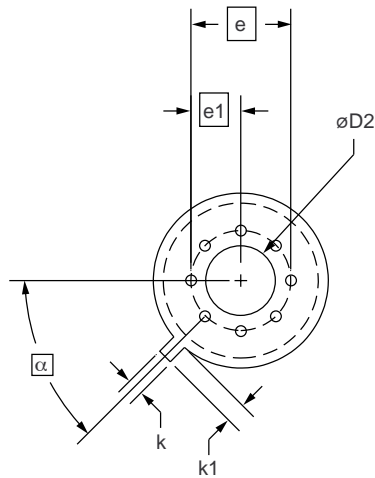
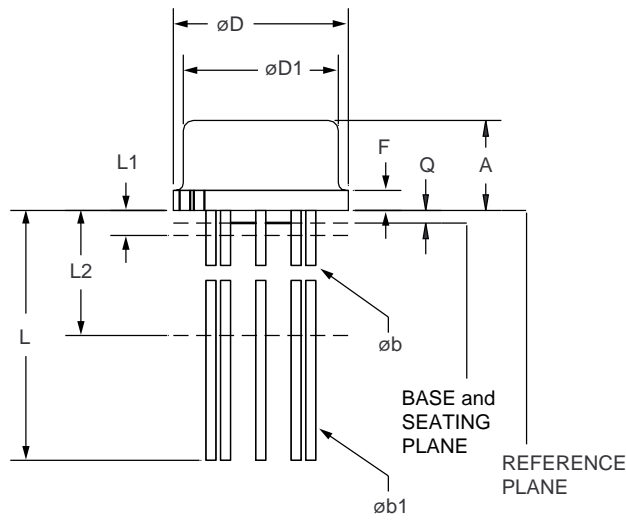
Notes:

1. Dimensioning and tolerancing per ANSI Y14.5M-1982.
2. "D" and "E" do not include mold flash. Mold flash or protrusions shall not exceed .010 inch (0.25mm).
3. "L" is the length of terminal for soldering to a substrate.
4. Terminal numbers are shown for reference only.
5. "C" dimension does not include solder finish thickness.
6. Symbol "N" is the maximum number of terminals.



Mechanical Dimensions (continued)

8-Lead Metal Can IC Header Package



| Symbol | Inches | | Millimeters | | Notes |
|--------|----------|------|-------------|-------|-------|
| | Min. | Max. | Min. | Max. | |
| A | .165 | .185 | 4.19 | 4.70 | |
| øb | .016 | .019 | .41 | .48 | 1, 5 |
| øb1 | .016 | .021 | .41 | .53 | 1, 5 |
| øD | .335 | .375 | 8.51 | 9.52 | |
| øD1 | .305 | .335 | 7.75 | 8.51 | |
| øD2 | .110 | .160 | 2.79 | 4.06 | |
| e | .200 BSC | | 5.08 BSC | | |
| e1 | .100 BSC | | 2.54 BSC | | |
| F | — | .040 | — | 1.02 | |
| k | .027 | .034 | .69 | .86 | |
| k1 | .027 | .045 | .69 | 1.14 | 2 |
| L | .500 | .750 | 12.70 | 19.05 | 1 |
| L1 | — | .050 | — | 1.27 | 1 |
| L2 | .250 | — | 6.35 | — | 1 |
| Q | .010 | .045 | .25 | 1.14 | |
| α | 45° BSC | | 45° BSC | | |

Notes:

1. (All leads) øb applies between L1 & L2. øb1 applies between L2 & .500 (12.70mm) from the reference plane. Diameter is uncontrolled in L1 & beyond .500 (12.70mm) from the reference plane.
2. Measured from the maximum diameter of the product.
3. Leads having a maximum diameter .019 (.48mm) measured in gauging plane, .054 (1.37mm) +.001 (.03mm) -.000 (.00mm) below the reference plane of the product shall be within .007 (.18mm) of their true position relative to a maximum width tab.
4. The product may be measured by direct methods or by gauge.
5. All leads – increase maximum limit by .003 (.08mm) when lead finish is applied.

Ordering Information

| Product Number | Temperature Range | Screening | Package |
|----------------|-------------------|------------|-----------------------|
| RC4559M | 0° to 70°C | Commercial | 8 Pin Wide SOIC |
| RC4559N | 0° to 70°C | Commercial | 8 Pin Plastic DIP |
| RC4559D | 0° to 70°C | Commercial | 8 Pin Ceramic DIP |
| RM4559D | -55°C to +125°C | Commercial | 8 Pin Ceramic DIP |
| RM4559D/883B | -55°C to +125°C | Military | 8 Pin Ceramic DIP |
| RM4559T | -55°C to +125°C | Commercial | 8 Pin TO-99 Metal Can |
| RM4559T/883B | -55°C to +125°C | Military | 8 Pin TO-99 Metal Can |

Note:

1. /883B suffix denotes MIL-STD-883, Par. 1.2.1 compliant device.

LIFE SUPPORT POLICY

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.