

RM747

General Purpose Dual Operational Amplifier

Description

The RM747 integrated circuit is a high gain, operational amplifier internally compensated and constructed on a single silicon chip using an advanced epitaxial process.

The RM747, operates over a temperature range from -55°C to +125°C.

Combining the features of the 741 with the close parameter matching and tracking of a dual device on a monolithic chip results in unique performance characteristics. Excellent channel separation allows the use of the dual device in all single 741 operational amplifier applications providing high packaging density. It is especially well suited for applications in differential-in, differential-out as well as in potentiometric amplifiers and where gain and phase matched channels are mandatory.

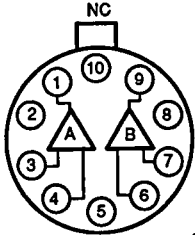
Features

- ◆ Short circuit protection
- ◆ 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

RM747

Connection Information

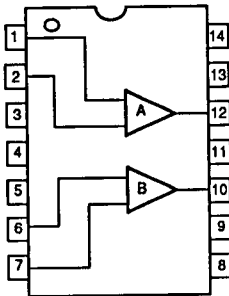
10-Lead TO-100 Metal Can
(Top View)



65-0872

| Pin | Function |
|-----|----------|
| 1 | Output A |
| 2 | $-V_s$ A |
| 3 | -Input A |
| 4 | +Input A |
| 5 | $-V_s$ |
| 6 | +Input B |
| 7 | -Input B |
| 8 | $+V_s$ B |
| 9 | Output B |
| 10 | NC |

14-Lead Dual In-Line Package
(Top View)



65-0873

| Pin | Function |
|-----|-----------------|
| 1 | - Input A |
| 2 | + Input A |
| 3 | V_{cs} Trim A |
| 4 | $-V_s$ |
| 5 | V_{cs} Trim B |
| 6 | +Input B |
| 7 | -Input B |
| 8 | V_{cs} Trim B |
| 9 | $+V_s$ B |
| 10 | Output B |
| 11 | NC |
| 12 | Output A |
| 13 | $+V_s$ A |
| 14 | V_{cs} Trim A |

Ordering Information

| Part Number | Package | Operating Temperature Range |
|-------------|---------|-----------------------------|
| RM747D | D | -55°C to +125°C |
| RM747D/883B | D | -55°C to +125°C |
| RM747T | T | -55°C to +125°C |
| RM747T/883B | T | -55°C to +125°C |

Notes:

883B suffix denotes Mil-Std-883, Level B processing

D = 14-lead ceramic DIP

T = 10-lead metal can TO-100

Absolute Maximum Ratings

Supply Voltage

RM747 ±22V

Differential Input Voltage 30V

Input Voltage¹ ±15V

Output Short-Circuit Duration Indefinite

Storage Temperature

Range -65°C to +150°C

Operating Temperature Range

RM747 -55°C to +125°C

Lead Soldering Temperature

(60 sec) +300°C

Notes:

- For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

Thermal Characteristics

| | 14-Lead Ceramic DIP | 10-Lead TO-100 Metal Can |
|--|---------------------|--------------------------|
| Max. Junction Temp. | +175°C | +175°C |
| Max. P_D $T_A < 50^\circ\text{C}$ | 1042 mW | 658 mW |
| Therm. Res θ_{JC} | 60°C/W | 50°C/W |
| Therm. Res. θ_{JA} | 120°C/W | 190°C/W |
| For $T_A > 50^\circ\text{C}$ Derate at | 8.33 mW/°C | 5.26 mW/°C |

Electrical Characteristics

($V_S = \pm 15\text{V}$ and $T_A = +25^\circ\text{C}$ unless otherwise noted)

| Parameters | Test Conditions | Min | Typ | Max | Units |
|-------------------------------|--|----------|----------|-----|------------------|
| Input Offset Voltage | $R_S \leq 10\text{ k}\Omega$ | | 1.0 | 5.0 | mV |
| Input Offset Current | | | 20 | 200 | nA |
| Input Bias Current | | | 80 | 500 | nA |
| Input Resistance (Diff. Mode) | | 0.3 | 2.0 | | M Ω |
| Large Signal Voltage Gain | $R_L \geq 2\text{ k}\Omega$, $V_{OUT} = \pm 10\text{V}$ | 50 | 200 | | V/mV |
| Output Voltage Swing | $R_L \geq 10\text{ k}\Omega$ | ± 12 | ± 14 | | V |
| | $R_L \geq 2\text{ k}\Omega$ | ± 10 | ± 13 | | |
| Input Voltage Range | | ± 12 | ± 13 | | V |
| Common Mode Rejection Ratio | $R_S \leq 10\text{ k}\Omega$ | 70 | 90 | | dB |
| Power Supply Rejection Ratio | $R_S \leq 10\text{ k}\Omega$ | 76 | 90 | | dB |
| Power Consumption | | | 100 | 170 | mW |
| Transient Response | | | | | |
| Rise Time | $V_{IN} = 20\text{ mV}$, $R_L = 2\text{ k}\Omega$ | | 0.3 | | μS |
| Overshoot | $C_L \leq 100\text{ pF}$ | | 5.0 | | % |
| Slew Rate | $R_L \geq 2\text{ k}\Omega$ | | 0.5 | | V/ μS |
| Channel Separation | $F = 1\text{ kHz}$ | | 98 | | dB |

Linear

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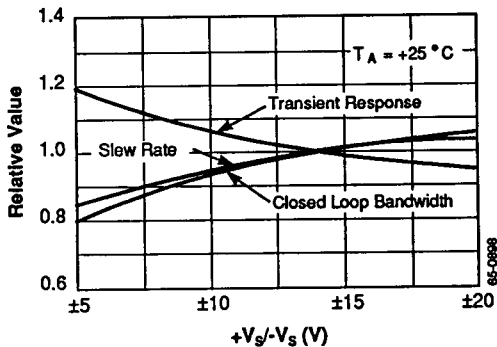
Electrical Characteristics

($V_S = \pm 15V$, $-55^\circ C \leq T_A \leq +125^\circ C$)

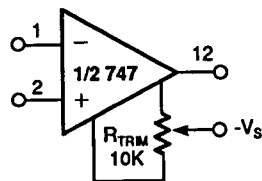
| Parameters | Test Conditions | Min | Typ | Max | Units |
|------------------------------|---|----------|-----|------|-------|
| Input Offset Voltage | $R_S \leq 10 \text{ k}\Omega$ | | | 6.0 | mV |
| Input Offset Current | $T_A = +125^\circ C$, $T_A = +70^\circ C$ | | | 200 | nA |
| | $T_A = -55^\circ C$ | | | 500 | nA |
| | $T_A = 0^\circ C$ | | | | |
| Input Bias Current | $T_A = +125^\circ C$, $T_A = +70^\circ C$ | | | 500 | nA |
| | $T_A = -55^\circ C$, $T_A = 0^\circ C$ | | | 1500 | nA |
| | | | | | |
| Large Signal Voltage Gain | $R_L \geq 2 \text{ k}\Omega$, $V_{OUT} = \pm 10V$ | 25 | | | V/mV |
| Output Voltage Swing | $R_L \geq 10K$ | ± 12 | | | V |
| | $R_L \geq 2 \text{ k}\Omega$ | ± 10 | | | V |
| Common Mode Rejection Ratio | $R_S \leq 10 \text{ k}\Omega$ | 70 | | | dB |
| Power Supply Rejection Ratio | $R_S \leq 10 \text{ k}\Omega$ | 76 | | 150 | dB |
| Power Consumption | $T_A = +125^\circ C$ | | | 150 | mW |
| | $T_A = -55^\circ C$ | | | 200 | mW |
| Input Voltage Range | | ± 12 | | | V |

Typical Performance Characteristics

Frequency Characteristics vs. Supply Voltage



Input Offset Voltage Trim Circuit

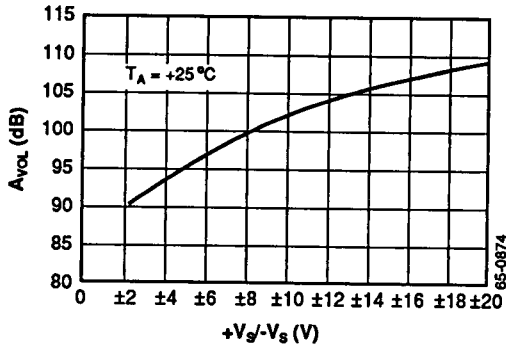


65-0899

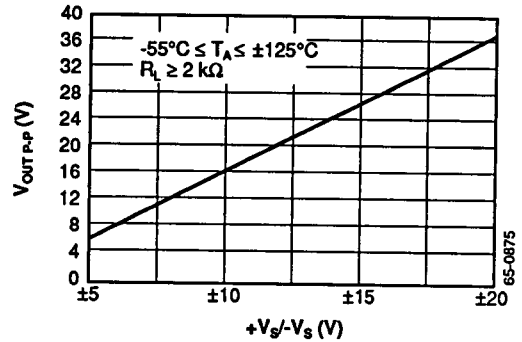
Note: Pin numbers shown are for 14-lead packages

Typical Performance Characteristics (Continued)

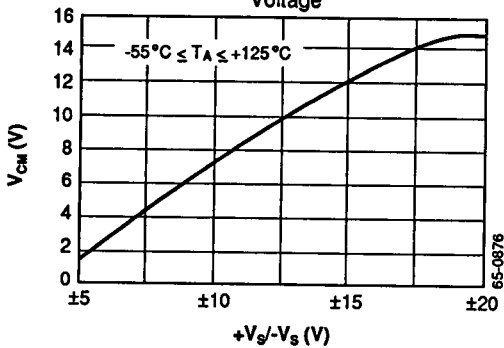
Open Loop Gain vs. Supply Voltage



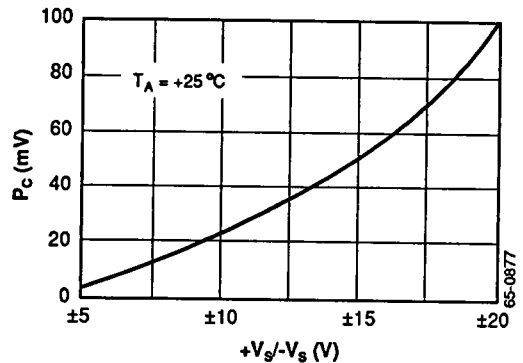
Output Voltage Swing vs. Supply Voltage



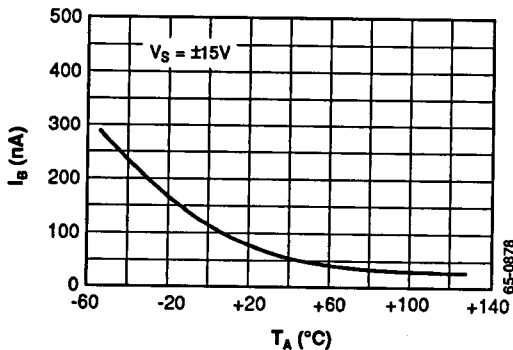
Common Mode Input Range vs. Supply Voltage



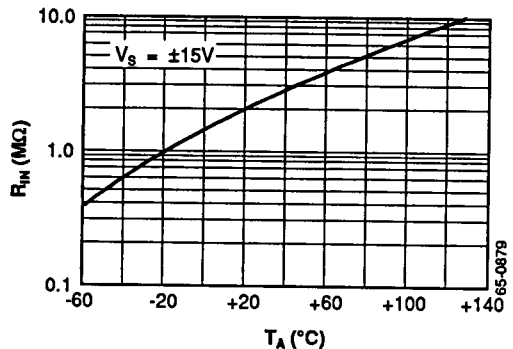
Power Consumption vs. Supply Voltage



Input Bias Current vs. Temperature



Input Resistance vs. Temperature

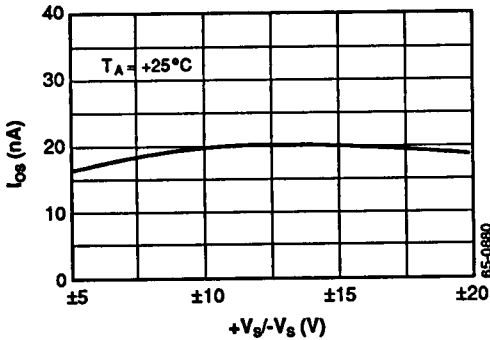


Linear

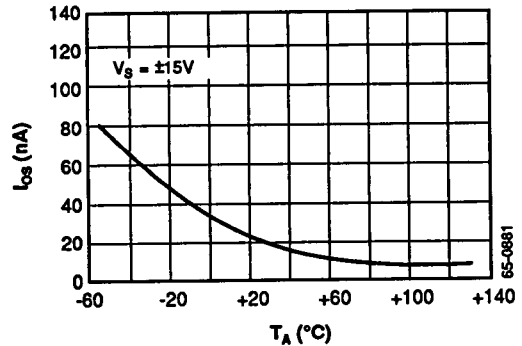
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Typical Performance Characteristics (Continued)

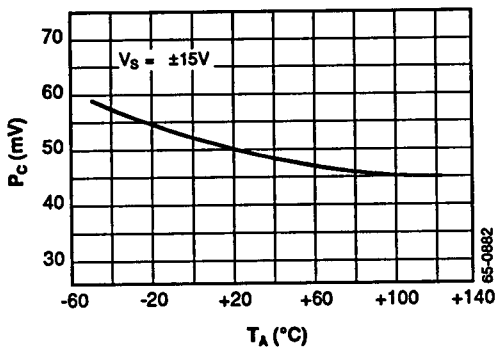
Input Offset Current vs. Supply Voltage



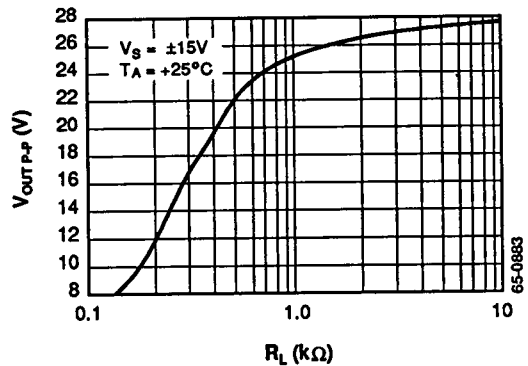
Input Offset Current vs. Temperature



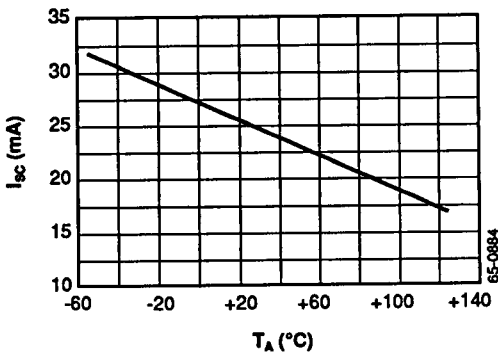
Power Consumption vs. Temperature



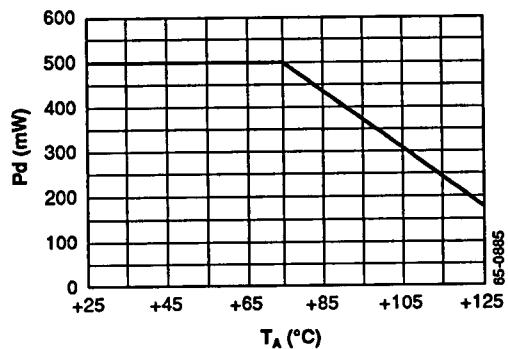
Output Voltage Swing vs. Load Resistance



Short Circuit Current vs. Temperature

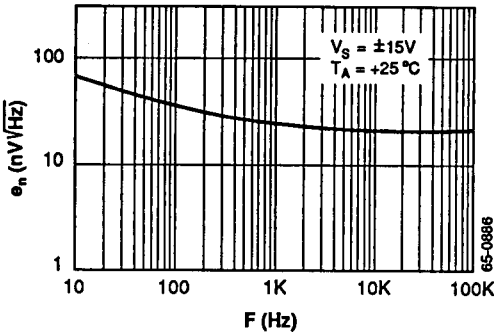


Absolute Maximum Power Dissipation vs. Temperature

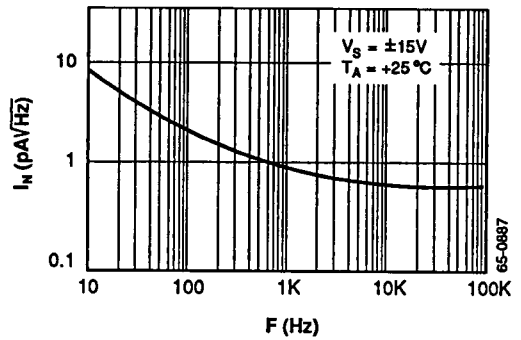


Typical Performance Characteristics (Continued)

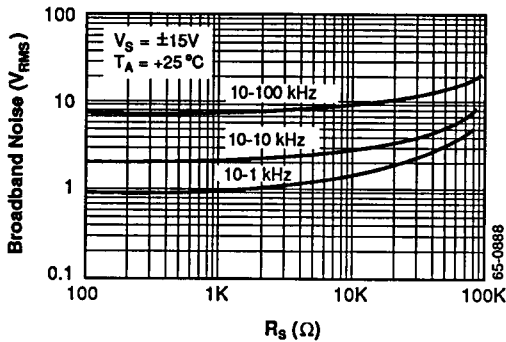
Input Noise Voltage Density vs. Frequency



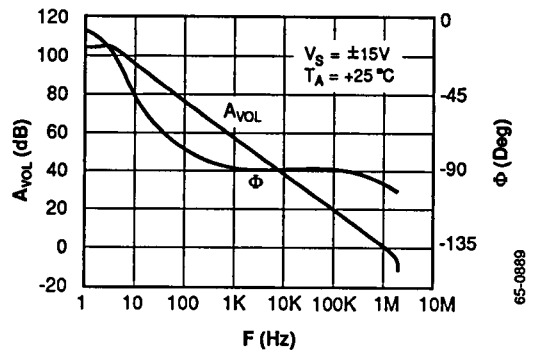
Input Noise Current Density vs. Frequency



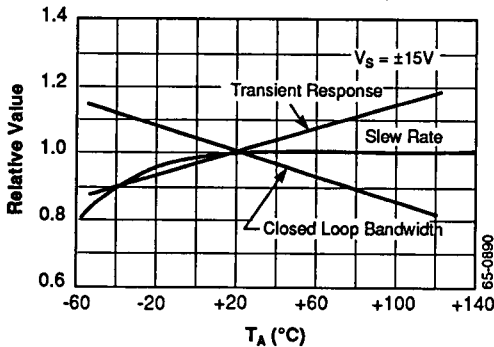
Broadband Noise Referred to Input vs. Source Resistance



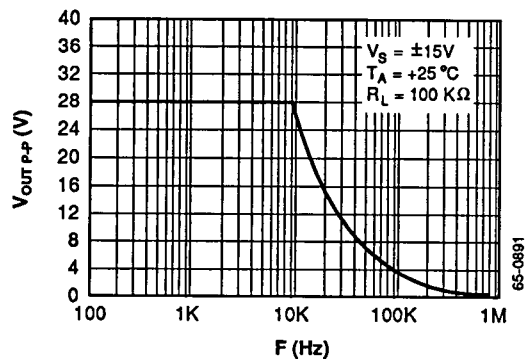
Open Loop Gain, Phase vs. Frequency



Frequency Characteristics vs. Temperature



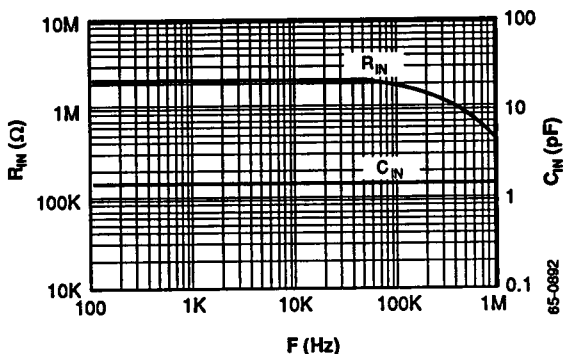
Output Voltage Swing vs. Frequency



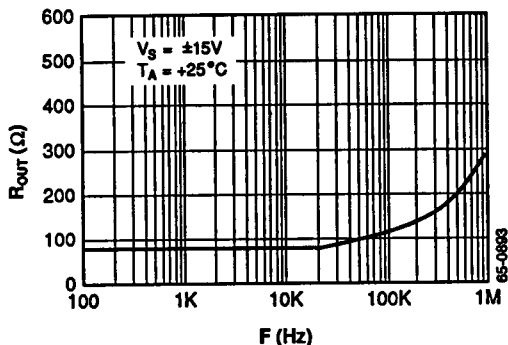
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Typical Performance Characteristics (Continued)

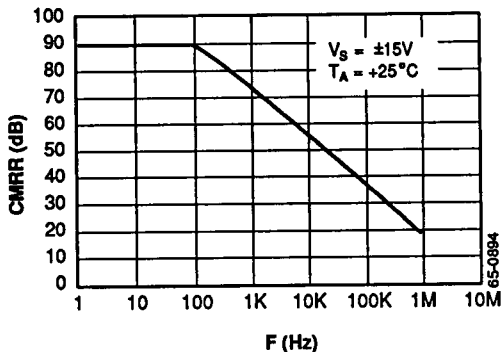
Input Resistance, Capacitance vs. Frequency



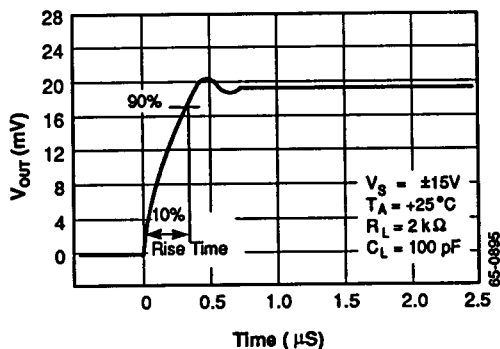
Output Resistance vs. Frequency



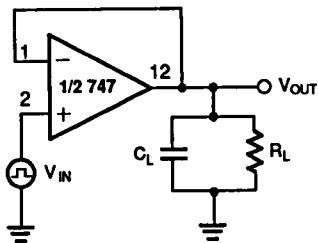
CMRR vs. Frequency



Transient Response Output Voltage vs. Time



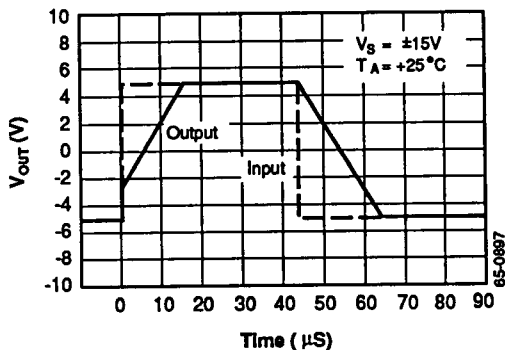
Transient Response Test Circuit



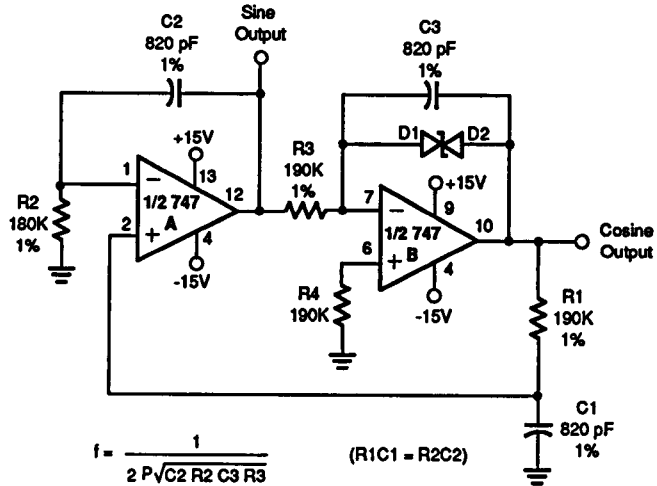
Note: Pin numbers shown are for 14-lead packages

65-0896

Follower Large Signal Pulse Response Output Voltage vs. Time

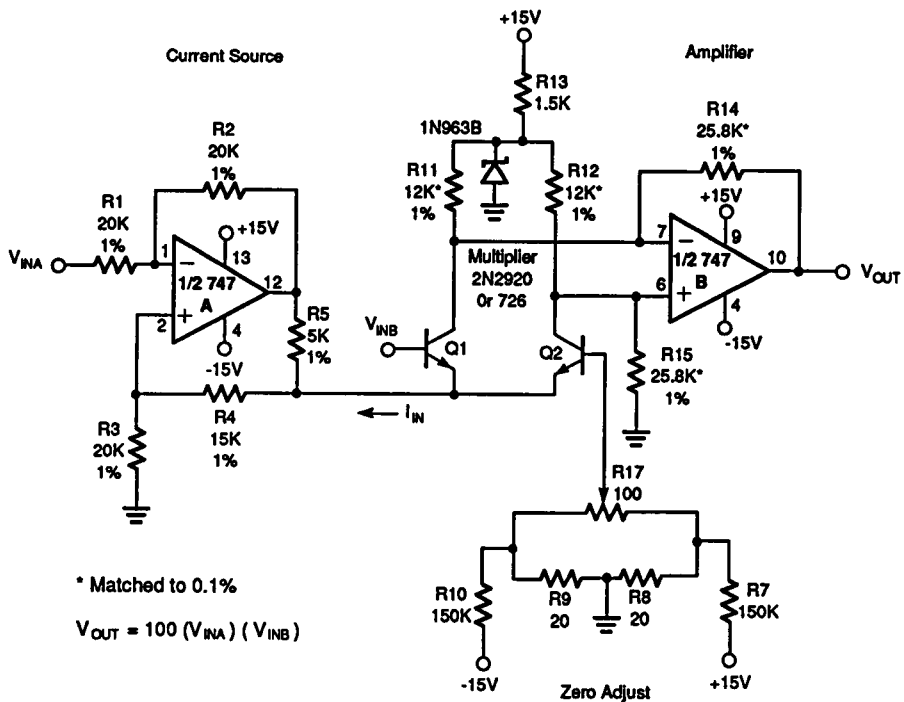


Typical Applications



65-0901

Quadrature Oscillator



Note: Pin numbers shown are for 14-lead packages

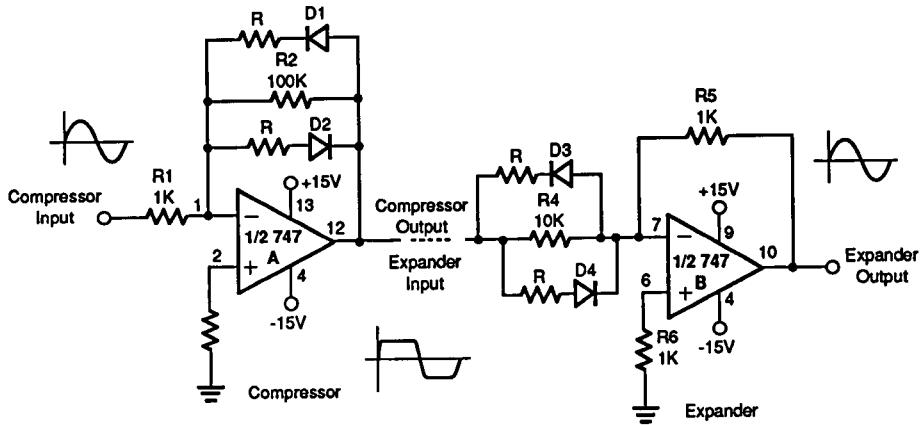
65-0902

Analog Multiplier

Linear

RM747

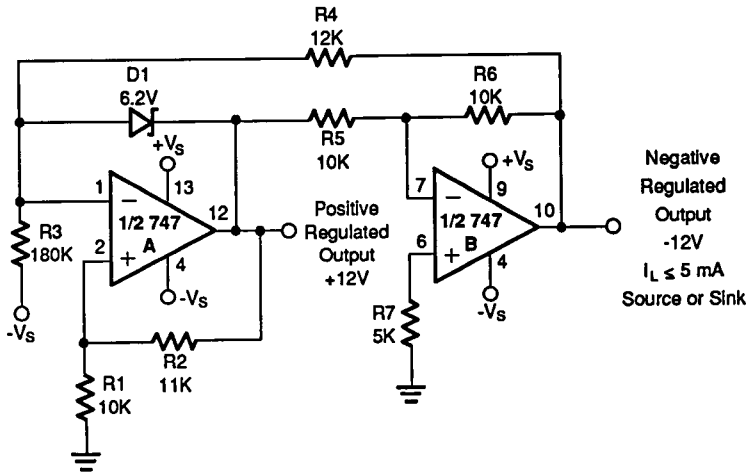
Typical Applications (Continued)



Maximum compressor expansion ratio = $R1/R$ ($10\text{ k}\Omega > R \geq 0$)
 Note: Diodes D1 through D4 are matched FD6666 or equivalent

65-0903

Compressor/Expander Amplifiers



$$\text{Positive Output} = V_{D1} \times \frac{R1 + R2}{R2}$$

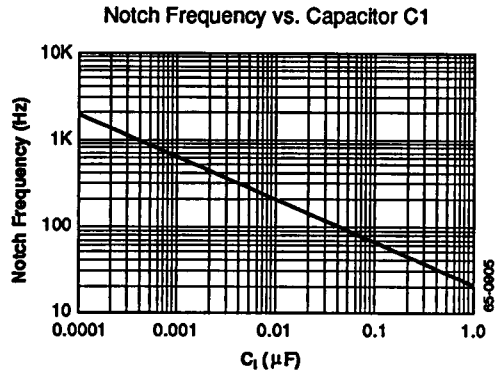
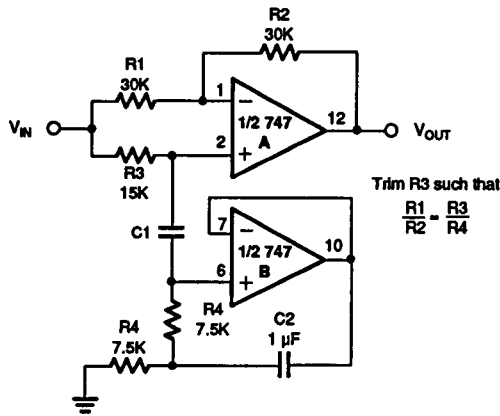
$$\text{Negative Output} = - \text{Positive Output} \times \frac{R6}{R5}$$

65-0904

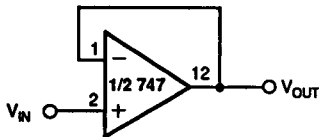
Note: Pin numbers shown are for 14-lead packages.

Tracking Positive and Negative Voltage References

Typical Applications (Continued)



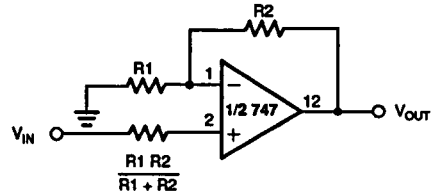
Notch Filter Using the 747 as a Gyrator



$R_{IN} = 400 \text{ M}\Omega$
 $C_{IN} = 1 \text{ pF}$
 $R_{OUT} \leq 1 \Omega$
 $BW = 1 \text{ MHz}$

65-0906

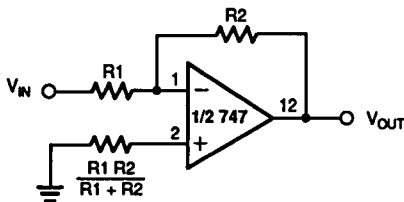
Unity Gain Voltage Follower



| Gain | R1 | R2 | B.W. | RIN |
|------|--------|---------|---------|--------|
| 10 | 1 kΩ | 9 kΩ | 100 kHz | 400 MΩ |
| 100 | 100 kΩ | 9.9 kΩ | 10 kHz | 280 MΩ |
| 1000 | 100 kΩ | 99.9 kΩ | 1 kHz | 80 MΩ |

65-0907

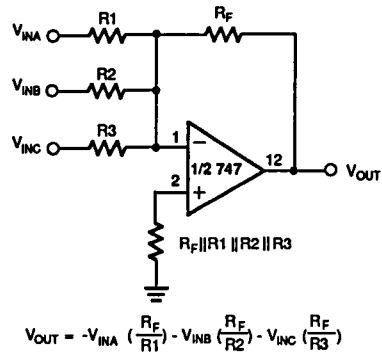
Non-Inverting Amplifier



| Gain | R1 | R2 | B.W. | RIN |
|------|--------|--------|---------|-------|
| 1 | 10 kΩ | 10 kΩ | 1 MHz | 10 kΩ |
| 10 | 1 kΩ | 10 kΩ | 100 kHz | 1 kΩ |
| 100 | 1 kΩ | 100 kΩ | 10 kHz | 1 kΩ |
| 1000 | 100 kΩ | 100 kΩ | 1 kHz | 100Ω |

65-0908

Inverting Amplifier



Note: Pin numbers shown are for 14-lead packages

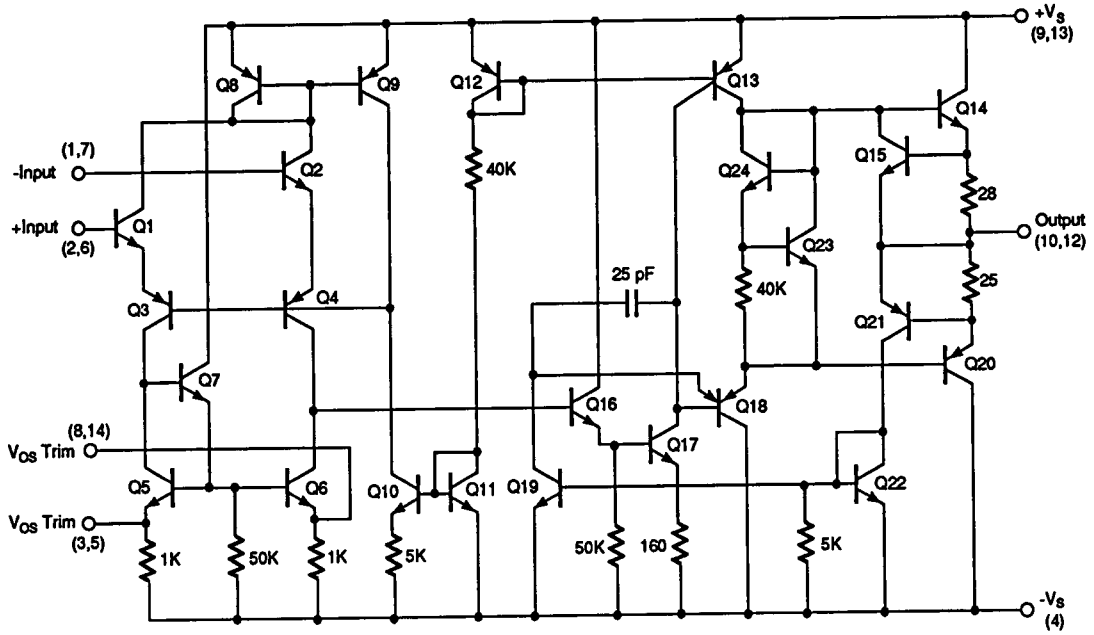
65-0909

Weighted Averaging Amplifier

Linear

RM747

Schematic Diagram (1/2 Shown)



Note: Pin numbers shown are for 14-lead packages

65-0871