

Internally Trimmed Precision IC Multiplier

AD632

FEATURES

Pretrimmed to $\pm 0.5\%$ Max 4-Quadrant Error All Inputs (X, Y and Z) Differential, High Impedance for $[(X_1-X_2)(Y_1-Y_2)/10] + Z_2$ Transfer Function Scale-Factor Adjustable to Provide up to X10 Gain Low Noise Design: 90 μ V rms, 10 Hz–10 kHz Low Cost, Monolithic Construction Excellent Long-Term Stability

APPLICATIONS

High Quality Analog Signal Processing
Differential Ratio and Percentage Computations
Algebraic and Trigonometric Function Synthesis
Accurate Voltage Controlled Oscillators and Filters

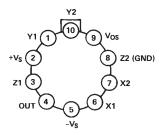
PRODUCT DESCRIPTION

The AD632 is an internally-trimmed monolithic four-quadrant multiplier/divider. The AD632B has a maximum multiplying error of $\pm 0.5\%$ without external trims.

Excellent supply rejection, low temperature coefficients and long term stability of the on-chip thin film resistors and buried zener reference preserve accuracy even under adverse conditions. The simplicity and flexibility of use provide an attractive alternative approach to the solution of complex control functions.

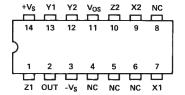
The AD632 is pin-for-pin compatible with the industry standard AD532 with improved specifications and a fully differential high impedance Z-input. The AD632 is capable of providing gains of up to X10, frequently eliminating the need for separate instrumentation amplifiers to precondition the inputs. The AD632 can be effectively employed as a variable gain differential input amplifier with high common-mode rejection. The effectiveness of the variable gain capability is enhanced by the inherent low noise of the AD632: 90 $\mu V\ rms$.

PIN CONFIGURATIONS H-Package TO-100



TOP VIEW

D-Package TO-116



TOP VIEW

PRODUCT HIGHLIGHTS

Guaranteed Performance Over Temperature

The AD632A and AD632B are specified for maximum multiplying errors of $\pm 1.0\%$ and $\pm 0.5\%$ of full scale, respectively at $+25^{\circ}$ C and are rated for operation from -25° C to $+85^{\circ}$ C. Maximum multiplying errors of $\pm 2.0\%$ (AD632S) and $\pm 1.0\%$ (AD632T) are guaranteed over the extended temperature range of -55° C to $+125^{\circ}$ C.

High Reliability

The AD632S and AD632T series are also available with MIL-STD-883 Level B screening and all devices are available in either the hermetically-sealed TO-100 metal can or TO-116 ceramic DIP package.

REV. A

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$\label{eq:AD632-SPECIFICATIONS} \textbf{(@ +25°C, V}_S = \pm 15~\text{V, R} \geq 2~\text{k}\Omega~\text{unless otherwise noted)}$

$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Min Typ Max $\frac{(X_1 - X_2)(Y_1 - Y_2)}{10V} + Z_2$ ± 0.5 ± 1.0 ± 0.01 ± 0.01 ± 0.01 ± 0.1 ± 0.1 ± 0.1 ± 0.1 ± 0.01 ± 0.1 ± 0.01 ± 0.1 ± 0.01 ± 0.1 ± 0.01 ± 15 100 20 20 2 0.8 0.4 1.0 90 ± 11 0.1 30 70	Min Typ Max $\frac{(X_1 - X_2)(Y_1 - Y_2)}{10V} + Z_2$ ± 1.0 ± 2.0 ± 0.25 ± 0.2 ± 0.01 ± 0.4 ± 0.2 ± 0.3 ± 0.01 ± 5 ± 30 50 20 20 20 2 ± 11 0.1 30	±0.5 ±1.0	% % % % % % % % % % % % % % M W W W W W W W W W W W W
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	±0.5 ±1.0 ±0.015 ±0.1 ±0.01 ±0.01 ±0.01 ±0.2 ±0.3 ±0.1 ±0.15 ±0.3 ±0.01±0.1 ±2 ±15 100 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1 30	±1.0 ±2.0 ±0.00 ±0.25 ±0.2 ±0.01 ±0.4 ±0.2 ±0.3 ±0.01 ±5 ±30 500 20 20 2 0.8 0.4 1.0 90 ±11	±0.5 ±1.0 ±0.01 ±0.005 ±0.01 ±0.2 ±0.3 ±0.1 ±0.1 ±0.15 ±0.3 ±0.01 ±0.1 ±2 ±15 300 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	% %/°C % % % % % % mV μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz μV/√Hz mV rm: μV/rms
Total Error¹ (−10 V ≤ X, Y ≤ +10 V) $T_A = Min \text{ to } Max$ Total Error vs. Temperature Scale Factor Error $(SF = 10.000 \text{ V Nominal})^2$ Temperature-Coefficient of Scaling-Voltage Supply Rejection (±15 V ± 1 V) Nonlinearity, X (X = 20 V p-p, Y = 10 V) Nonlinearity, Y (Y = 20 V p-p, X = 10 V) Feedthrough³, X (Y Nulled, X = 20 V p-p 50 Hz) Output Offset Voltage Output Offset Voltage Drift DYNAMICS Small Signal BW, (V _{OUT} = 0.1 rms) 1 % Amplitude Error (C _{LOAD} = 1000 pF) Slew Rate (V _{OUT} 20 p-p) Settling Time (to 1%, ΔV _{OUT} = 20 V) NOISE Noise Spectral-Density SF = 10 V SF = 3 V⁴ Wideband Noise A = 10 Hz to 5 MHz P = 10 Hz to 10 kHz Output Voltage Swing Output Impedance (f ≤ 1 kHz) Output Short Circuit Current (R _L = 0, T _A = Min to Max) Amplifier Open Loop Gain (f = 50 Hz) INPUT AMPLIFIERS (X, Y and Z) ⁵ Signal Voltage Range (Diff. or CM Operating Diff.) Offset Voltage X, Y Offset Voltage X, Y Offset Voltage Drift Z CMRR ±1.0 ±1.0 ±0.02 ±0.02 ±0.01 ±0.04 ±0.01 ±0.01 ±0.01 ±0.01 ±0.01 ±0.01 ±0.01 ±0.01 0.8 SF = 3 V⁴ 0.4 0.8 0.8 0.9 OUTPUT Output Voltage Swing 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.	±0.5 ±1.0 ±0.015 ±0.1 ±0.01 ±0.01 ±0.01 ±0.2 ±0.3 ±0.1 ±0.15 ±0.3 ±0.01±0.1 ±2 ±15 100 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1 30	±1.0 ±2.0 ±0.00 ±0.25 ±0.2 ±0.01 ±0.4 ±0.2 ±0.3 ±0.01 ±5 ±30 500 20 20 2 0.8 0.4 1.0 90 ±11	±0.5 ±1.0 ±0.01 ±0.005 ±0.01 ±0.2 ±0.3 ±0.1 ±0.1 ±0.15 ±0.3 ±0.01 ±0.1 ±2 ±15 300 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	% %/°C % % % % % % mV μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz μV/√Hz mV rm: μV/rms
Total Error¹ (−10 V ≤ X, Y ≤ +10 V) $T_A = Min \text{ to } Max$ Total Error vs. Temperature Scale Factor Error (SF = 10.000 V Nominal)² Temperature-Coefficient of Scaling-Voltage Supply Rejection (±15 V ± 1 V) Nonlinearity, X (X = 20 V p-p, Y = 10 V) Nonlinearity, Y (Y = 20 V p-p, X = 10 V) Feedthrough³, X (Y Nulled, X = 20 V p-p 50 Hz) Feedthrough³, Y (X Nulled, Y = 20 V p-p 50 Hz) Output Offset Voltage Noise Spectral-Density SF = 10 V SF = 3 V⁴ Wideband Noise A = 10 Hz to 5 MHz P = 10 Hz to 10 kHz Output Voltage Swing Output Impedance (f ≤ 1 kHz) Output Short Circuit Current (R _L = 0, T _A = Min to Max) Amplifier Open Loop Gain (f = 50 Hz) NOPUT AMPLIFIERS (X, Y and Z)⁵ Signal Voltage Range (Diff. or CM Operating Diff.) Offset Voltage X, Y Offset Voltage X, Y Offset Voltage Drift Z Offset Voltage Drift Z Offset Voltage Drift Z Offset Voltage Drift X, Y Offset Voltage Drift Z Offset Voltage Drift Z CMRR 60 #1.0 ±1.0 ±1.5 ±0.022 ±0.025 ±0.025 ±0.02 ±0.01 ±0.04 ±0.01 ±0.01 ±0.01 ±0.01 ±0.01 ±0.01 ±0.01 ±0.01 ±0.01 ±0.01 0.8 SF = 30 0.8 0.8 0.8 0.9 ** ** ** ** ** ** ** ** **	±0.5 ±1.0 ±0.015 ±0.1 ±0.01 ±0.01 ±0.01 ±0.2 ±0.3 ±0.1 ±0.15 ±0.3 ±0.01±0.1 ±2 ±15 100 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1 30	±1.0 ±2.0 ±0.00 ±0.25 ±0.2 ±0.01 ±0.4 ±0.2 ±0.3 ±0.01 ±5 ±30 500 20 20 2 0.8 0.4 1.0 90 ±11	±0.5 ±1.0 ±0.01 ±0.005 ±0.01 ±0.2 ±0.3 ±0.1 ±0.1 ±0.15 ±0.3 ±0.01 ±0.1 ±2 ±15 300 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	% %/°C % %/°C % % % % mV μV/°C MHz kHz V/μs μs μV/√Hz μν/√Hz mV rms μV/rms
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	#1.0 ±0.015 ±0.1 #0.01 ±0.01 ±0.2 ±0.3 ±0.1 ±0.1 ±0.15 ±0.3 ±0.01 ±0.1 ±2 ±15 100 1 50 20 2 0.8 0.4 1.0 90 #11 0.1 30	±2.0 ±0.00 ±0.25 ±0.2 ±0.01 ±0.4 ±0.2 ±0.3 ±0.01 ±5 ±30 500 20 20 2 0.8 0.4 1.0 90 ±11	\$\begin{array}{cccccccccccccccccccccccccccccccccccc	% %/°C % % % % % % W μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz μV/√Hz χ/γ ν γ ν γ
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	±0.015 ±0.1 ±0.01 ±0.01 ±0.02 ±0.3 ±0.1 ±0.1 ±0.15 ±0.3 ±0.01 ±0.1 ±2 ±15 100 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1 30	±0.00 ±0.25 ±0.2 ±0.01 ±0.4 ±0.2 ±0.3 ±0.01 ±5 ±30 500 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	\$\frac{\pmu}{\pmu}0.01\$ \$\pmu 0.005\$ \$\pmu 0.01\$ \$\pmu 0.2 \pm 0.3\$ \$\pmu 0.1 \pm 0.1\$ \$\pm 0.15 \pm 0.3\$ \$\pm 0.01 \pm 0.1\$ \$\pm 2 \pm 0.15\$ \$\pm 300\$ 1 50 20 20 2 0.8 0.4 1.0 90 \$\pm 10.1\$	%/°C % %/°C % % % % mV μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz μV/√Hz mV rm: μV/rms
Scale Factor Error $ (SF = 10.000 \text{ V Nominal})^2 $ ± 0.25 Temperature-Coefficient of Scaling-Voltage Supply Rejection $(\pm 15 \text{ V} \pm 1 \text{ V})$ ± 0.01 Nonlinearity, $X (X = 20 \text{ V p-p, } Y = 10 \text{ V})$ Nonlinearity, $Y (Y = 20 \text{ V p-p, } X = 10 \text{ V})$ ± 0.2 Feedthrough ³ , $X (Y \text{ Nulled,}$ $X = 20 \text{ V p-p } 50 \text{ Hz})$ ± 0.3 Feedthrough ³ , $Y (X \text{ Nulled,}$ $Y = 20 \text{ V p-p } 50 \text{ Hz})$ ± 0.01 Output Offset Voltage Drift ± 0.01 ± 0.01 ± 0.01 Output Offset Voltage Drift ± 0.01 ± 0.01 ± 0.01 DYNAMICS Small Signal BW, $(V_{\text{OUT}} = 0.1 \text{ rms})$ ± 0.01 ± 0.01 ± 0.01 ± 0.01 Sew Rate $(V_{\text{OUT}} 20 \text{ p-p})$ ± 0.01 Settling Time (to 1% , $\Delta V_{\text{OUT}} = 20 \text{ V})$ ± 0.01 ± 0.01 NOISE Noise Spectral-Density $SF = 10 \text{ V}$ $SF = 3 \text{ V}^4$ ± 0.4 Wideband Noise $A = 10 \text{ Hz to } 5 \text{ MHz}$ ± 0.4 Wideband Noise $A = 10 \text{ Hz to } 10 \text{ kHz}$ ± 0.01 Output Voltage Swing Output Impedance $(f \le 1 \text{ kHz})$ ± 0.1 Output Short Circuit Current $(R_L = 0, T_A = \text{Min to } \text{Max})$ $Amplifier Open Loop Gain (f = 50 \text{ Hz}) \pm 11 Onlothy TAMPLIFIERS (X, Y \text{ and } Z)^5 Signal Voltage Range (Diff. or CM Operating Diff.) \pm 12 Offset Voltage X, Y Offset Voltage X, Y \pm 5 \pm 20 Offset Voltage Drift X, Y \pm 5 \pm 20 Offset Voltage Drift X, Y \pm 5 \pm 30 \pm 5 \pm 5 \pm 5 \pm 5 Offset Voltage X, Y \pm 5 \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 \pm 20 Offset Voltage Drift X, Y \pm 5 \pm 5 \pm 20 Offset Voltage Drift X, Y \pm 5 \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm 5 Offset Voltage Drift X, Y \pm 5 \pm$	±0.01 ±0.01 ±0.2 ±0.3 ±0.1 ±0.1 ±0.15 ±0.3 ±0.01 ±0.1 ±2 ±15 100 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1 30	±0.2 ±0.01 ±0.4 ±0.2 ±0.3 ±0.01 ±5 ±30 500 20 20 2 0.8 0.4 1.0 90 ±11 0.1	±0.005 ±0.01 ±0.2 ±0.3 ±0.1 ±0.1 ±0.15 ±0.3 ±0.01 ±0.1 ±2 ±15 300 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	%/°C % % % % % mV μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz μV/√Hz mV rm: μV/rms
$\begin{array}{c} \text{Temperature-Coefficient of} \\ \text{Scaling-Voltage} \\ \text{Supply Rejection } (\pm 15 \text{ V} \pm 1 \text{ V}) \\ \text{Nonlinearity, X } (X = 20 \text{ V p-p, Y} = 10 \text{ V}) \\ \text{Nonlinearity, Y } (Y = 20 \text{ V p-p, X} = 10 \text{ V}) \\ \text{Feedthrough}^3, X (Y \text{ Nulled,} \\ X = 20 \text{ V p-p 50 Hz}) \\ \text{Feedthrough}^3, Y (X \text{ Nulled,} \\ Y = 20 \text{ V p-p 50 Hz}) \\ \text{Dutput Offset Voltage} \\ \text{Output Impedance} \\ \text{Output Impedance} \\ \text{Output Short Circuit Current} \\ \text{Output AMPLIFIERS (X, Y and Z)}^5 \\ \text{Signal Voltage Range} \\ \text{Oiffset Voltage Range} \\ \text{Oiff. or CM} \\ \text{Operating Diff.}) \\ \text{Offset Voltage Drift X, Y} \\ \text{Offset Voltage Drift X, Y} \\ \text{Offset Voltage Drift X, Y} \\ \text{Offset Voltage Drift Z} \\ \text{CMRR} \\ \text{60} 80 \\ \\ \text{OOD}$	±0.01 ±0.01 ±0.2 ±0.3 ±0.1 ±0.1 ±0.15 ±0.3 ±0.01 ±0.1 ±2 ±15 100 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1 30	±0.2 ±0.01 ±0.4 ±0.2 ±0.3 ±0.01 ±5 ±30 500 20 20 2 0.8 0.4 1.0 90 ±11 0.1	±0.005 ±0.01 ±0.2 ±0.3 ±0.1 ±0.1 ±0.15 ±0.3 ±0.01 ±0.1 ±2 ±15 300 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	%/°C % % % % mV μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz mV rms μV/rms
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} \pm 0.01 \\ \pm 0.2 \\ \pm 0.3 \\ \pm 0.1 \\ \pm 0.15 \\ \pm 0.3 \end{array} $ $ \begin{array}{c} \pm 0.15 \pm 0.3 \\ \pm 0.01 \pm 0.1 \\ \pm 2 \\ \pm 15 \\ 100 \end{array} $ $ \begin{array}{c} 1 \\ 50 \\ 20 \\ 2 \end{array} $ $ \begin{array}{c} 0.8 \\ 0.4 \\ 1.0 \\ 90 \end{array} $ $ \begin{array}{c} \pm 11 \\ 0.1 \\ 30 \end{array} $	±0.01 ±0.4 ±0.2 ±0.3 ±0.01 ±5 ±30 500 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	\$\begin{array}{c} \pmu 0.01 \\ \pmu 0.2 \\ \pmu 0.3 \\ \pmu 0.1 \\ \pmu 0.15 \pmu 0.3 \\ \pmu 0.01 \\ \pmu 0.15 \\ \pmu 0.3 \\ \pmu 0.01 \\ \pmu 0.1 \end{array}\$	% % % % mV μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz mV rms μV/rms
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} \pm 0.01 \\ \pm 0.2 \\ \pm 0.3 \\ \pm 0.1 \\ \pm 0.15 \\ \pm 0.3 \end{array} $ $ \begin{array}{c} \pm 0.15 \pm 0.3 \\ \pm 0.01 \pm 0.1 \\ \pm 2 \\ \pm 15 \\ 100 \end{array} $ $ \begin{array}{c} 1 \\ 50 \\ 20 \\ 2 \end{array} $ $ \begin{array}{c} 0.8 \\ 0.4 \\ 1.0 \\ 90 \end{array} $ $ \begin{array}{c} \pm 11 \\ 0.1 \\ 30 \end{array} $	±0.01 ±0.4 ±0.2 ±0.3 ±0.01 ±5 ±30 500 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	\$\begin{array}{c} \pmu 0.01 \\ \pmu 0.2 \\ \pmu 0.3 \\ \pmu 0.1 \\ \pmu 0.15 \pmu 0.3 \\ \pmu 0.01 \\ \pmu 0.15 \\ \pmu 0.3 \\ \pmu 0.01 \\ \pmu 0.1 \end{array}\$	% % % % mV μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz mV rms μV/rms
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \pm 0.2 & \pm 0.3 \\ \pm 0.1 & \pm 0.1 \\ \\ \pm 0.15 & \pm 0.3 \\ \\ \pm 0.01 & \pm 0.1 \\ \\ \pm 2 & \pm 15 \\ 100 \\ \\ \\ 1 \\ 50 \\ 20 \\ 2 \\ \\ \\ 2 \\ \\ \\ 0.8 \\ 0.4 \\ 1 & .0 \\ 90 \\ \\ \\ \\ \pm 11 \\ 0.1 \\ 30 \\ \end{array}$	±0.4 ±0.2 ±0.3 ±0.01 ±5 ±30 500 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	\$\begin{array}{cccccccccccccccccccccccccccccccccccc	% % % mV μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz μV/√Hz πV rm: μV/rms
Nonlinearity, Y (Y = 20 V p-p, X = 10 V) Feedthrough ³ , X (Y Nulled, X = 20 V p-p 50 Hz) Feedthrough ³ , Y (X Nulled, Y = 20 V p-p 50 Hz) Output Offset Voltage Output Offset Voltage Drift DYNAMICS Small Signal BW, (V _{OUT} = 0.1 rms) 1% Amplitude Error (C _{LOAD} = 1000 pF) Slew Rate (V _{OUT} 20 p-p) Settling Time (to 1%, Δ V _{OUT} = 20 V) NOISE Noise Spectral-Density SF = 10 V SF = 3 V ⁴ Wideband Noise A = 10 Hz to 5 MHz P = 10 Hz to 10 kHz OUTPUT Output Voltage Swing Output Impedance (f \leq 1 kHz) Output Impedance (f \leq 1 kHz) Output Short Circuit Current (R _L = 0, T _A = Min to Max) Amplifier Open Loop Gain (f = 50 Hz) INPUT AMPLIFIERS (X, Y and Z) ⁵ Signal Voltage Range (Diff. or CM Operating Diff.) Offset Voltage Z, Y Offset Voltage Z Offset Voltage Drift Z, Y Offset Voltage Drift Z CMRR 60 80	$\begin{array}{c} \pm 0.1 & \pm 0.1 \\ \pm 0.15 \pm 0.3 \\ \pm 0.01 \pm 0.1 \\ \pm 2 & \pm 15 \\ 100 \\ \\ \\ 1 \\ 50 \\ 20 \\ 2 \\ \\ \\ \\ 0.8 \\ 0.4 \\ 1 .0 \\ 90 \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	±0.2 ±0.3 ±0.01 ±5 ±30 500 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	$\begin{array}{c} \pm 0.1 & \pm 0.1 \\ \pm 0.15 \pm 0.3 \\ \pm 0.01 \pm 0.1 \\ \pm 2 & \pm 15 \\ \hline 300 \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	% % mV μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz mV rm: μV/rms
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} \pm 0.15 \pm 0.3 \\ \pm 0.01 \pm 0.1 \\ \pm 2 \\ \pm 15 \\ 100 \end{array} $ $ \begin{array}{c} 1 \\ 50 \\ 20 \\ 2 \end{array} $ $ \begin{array}{c} 0.8 \\ 0.4 \\ 1.0 \\ 90 \end{array} $ $ \begin{array}{c} \pm 11 \\ 0.1 \\ 30 \end{array} $	±0.3 ±0.01 ±5 ±30 500 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	$ \begin{array}{c} \pm 0.15 \pm 0.3 \\ \pm 0.01 \pm 0.1 \\ \pm 2 \pm 15 \\ \hline 300 \end{array} $ $ \begin{array}{c} 1 \\ 50 \\ 20 \\ 2 \end{array} $ $ \begin{array}{c} 0.8 \\ 0.4 \\ 1.0 \\ 90 \end{array} $ $ \pm 11 \\ 0.1 $	% mV μV/°C MHz kHz V/μs μs μV/√Hz μV/√Hz μV/√Hz mV rm: μV/rms
$\begin{array}{c} X=20 \text{ V p-p } 50 \text{ Hz}) \\ \text{Feedthrough}^3, Y (X \text{ Nulled,} \\ Y=20 \text{ V p-p } 50 \text{ Hz}) \\ \text{Output Offset Voltage} \\ \text{Output Offset Voltage Drift} \\ \\ \hline DYNAMICS \\ \text{Small Signal BW, } (V_{\text{OUT}}=0.1 \text{ rms}) \\ 1''_{\text{A}} \text{ Amplitude Error } (C_{\text{LOAD}}=1000 \text{ pF}) \\ \text{Slew Rate } (V_{\text{OUT}} 20 \text{ p-p}) \\ \text{Settling Time } (\text{to } 1\%, \Delta V_{\text{OUT}}=20 \text{ V}) \\ \hline \\ \text{NOISE} \\ \text{Noise Spectral-Density SF}=10 \text{ V} \\ \text{SF}=3 \text{ V}^4 \\ \text{Wideband Noise A}=10 \text{ Hz to } 5 \text{ MHz} \\ \text{P}=10 \text{ Hz to } 10 \text{ kHz} \\ \hline \\ \text{Output Voltage Swing} \\ \text{Output Impedance } (f \leq 1 \text{ kHz}) \\ \text{Output Short Circuit Current} \\ (R_L=0, T_A=\text{Min to Max}) \\ \text{Amplifier Open Loop Gain } (f=50 \text{ Hz}) \\ \hline \\ \text{INPUT AMPLIFIERS } (X, Y \text{ and } Z)^5 \\ \text{Signal Voltage Range } (\text{Diff. or CM} \\ \text{Operating Diff.}) \\ \text{Offset Voltage Z} \\ \text{Offset Voltage Z} \\ \text{Offset Voltage Drift Z} \\ \text{CMRR} \\ \hline \\ \begin{array}{c} \pm 0.3 \\ \pm 0.01 \\ \pm 0.01 \\ \pm 0.01 \\ \pm 0.1 \\ \hline \end{array}$	$ \begin{array}{c} \pm 0.01 \pm 0.1 \\ \pm 2 \\ 100 \end{array} $ $ \begin{array}{c} 1 \\ 50 \\ 20 \\ 2 \end{array} $ $ \begin{array}{c} 0.8 \\ 0.4 \\ 1.0 \\ 90 \end{array} $ $ \pm 11 \\ 0.1 \\ 30 $	±0.01 ±5 ±30 500 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{tabular}{lll} $\%$ & mV \\ $\mu V/^\circ C$ \\ \hline MHz & kHz \\ $V/\mu s$ & μs \\ \hline $\mu V/\sqrt{Hz}$ & $\mu V/\sqrt{Hz}$ & mV rms & $\mu V/rms$ \\ \hline V & & V \\ \hline \end{tabular}$
Feedthrough 3 , Y (X Nulled, Y = 20 V p-p 50 Hz) ± 0.01 Output Offset Voltage Output Offset Voltage Drift 200 DYNAMICS Small Signal BW, (V _{OUT} = 0.1 rms) 1 1% Amplitude Error (C _{LOAD} = 1000 pF) 50 Slew Rate (V _{OUT} 20 p-p) 20 Settling Time (to 1%, Δ V _{OUT} = 20 V) 2 NOISE Noise Spectral-Density SF = 10 V SF = 3 V 4 0.4 Wideband Noise A = 10 Hz to 5 MHz P = 10 Hz to 10 kHz 90 OUTPUT Output Voltage Swing Output Impedance (f \leq 1 kHz) Output Short Circuit Current (R _L = 0, T _A = Min to Max) Amplifier Open Loop Gain (f = 50 Hz) 70 INPUT AMPLIFIERS (X, Y and Z) 5 Signal Voltage Range (Diff. or CM Operating Diff.) ± 12 Offset Voltage X, Y ± 5 ± 20 Offset Voltage Z ± 5 ± 30 Offset Voltage Drift Z, CMRR ± 0.01	\$\frac{\pmath{\pm}}\pmath{\\not}\qani\trigk{\pmath{\pmath{\pmath{\qani\trigket{\pmath{\	±5 ±30 500 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	1 50 20 2 2 0.8 0.4 1.0 90 ±11 0.1	$\begin{array}{c} mV \\ \mu V/^{\circ}C \\ \\ MHz \\ kHz \\ V/\mu s \\ \mu s \\ \\ \mu V/\sqrt{Hz} \\ \mu V/\sqrt{Hz} \\ mV rm \\ \mu V/rms \\ \\ V \\ \end{array}$
Output Offset Voltage Output Offset Voltage Drift 200 DYNAMICS Small Signal BW, $(V_{OUT} = 0.1 \text{ rms})$ 1 1% Amplitude Error $(C_{LOAD} = 1000 \text{ pF})$ 50 Slew Rate $(V_{OUT} 20 \text{ p-p})$ 20 Settling Time (to 1%, $\Delta V_{OUT} = 20 \text{ V})$ 2 NOISE Noise Spectral-Density SF = 10 V 0.4 Wideband Noise A = 10 Hz to 5 MHz 90 OUTPUT Output Voltage Swing Output Impedance ($f \le 1 \text{ kHz}$) 0.1 Output Short Circuit Current ($R_L = 0$, $T_A = \text{Min to Max}$) 30 Amplifier Open Loop Gain ($f = 50 \text{ Hz}$) 70 INPUT AMPLIFIERS (X, Y and Z) ⁵ Signal Voltage Range (Diff. or CM 0perating Diff.) 212 Offset Voltage X, Y 0ffset Voltage Z 0ffset Voltage Drift X, Y 100 Offset Voltage Drift Z 200 CMRR 60 80	\$\frac{\pmath{\pm}}\pmath{\\not}\qani\trigk{\pmath{\pmath{\pmath{\qani\trigket{\pmath{\	±5 ±30 500 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	1 50 20 2 2 0.8 0.4 1.0 90 ±11 0.1	$\begin{array}{c} mV \\ \mu V/^{\circ}C \\ \\ MHz \\ kHz \\ V/\mu s \\ \mu s \\ \\ \mu V/\sqrt{Hz} \\ \mu V/\sqrt{Hz} \\ mV \\ rms \\ \mu V/rms \\ \\ V \\ \end{array}$
Output Offset Voltage Drift 200 DYNAMICS Small Signal BW, $(V_{OUT} = 0.1 \text{ rms})$ 1 1% Amplitude Error $(C_{LOAD} = 1000 \text{ pF})$ 50 Slew Rate $(V_{OUT} 20 \text{ p-p})$ 20 Settling Time (to 1% , $\Delta V_{OUT} = 20 \text{ V})$ 2 NOISE Noise Spectral-Density SF = 10 V 0.8 SF = 3 V^4 0.4 Wideband Noise A = 10 Hz to 5 MHz 90 OUTPUT Output Voltage Swing Output Impedance ($f \le 1 \text{ kHz}$) 0.1 Output Short Circuit Current $(R_L = 0, T_A = \text{Min to Max})$ 30 Amplifier Open Loop Gain ($f = 50 \text{ Hz}$) 70 INPUT AMPLIFIERS (X, Y and Z) ⁵ Signal Voltage Range (Diff. or CM 212 Offset Voltage X, Y 25 Offset Voltage Drift X, Y 100 Offset Voltage Z 200 CMRR 260 60 80	100 1 50 20 20 2 0.8 0.4 1.0 90 ±11 0.1 30	500 1 50 20 20 2 0.8 0.4 1.0 90 ±11 0.1	300 1 50 20 2 0.8 0.4 1.0 90 ±11 0.1	$\begin{array}{c} \mu V/^{\circ}C \\ \\ MHz \\ kHz \\ V/\mu s \\ \mu s \\ \\ \mu V/\sqrt{Hz} \\ \mu V/\sqrt{Hz} \\ m V rms \\ \mu V/rms \\ \\ V \end{array}$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1 50 20 2 2 0.8 0.4 1.0 90 ±11 0.1	1 50 20 2 2 0.8 0.4 1.0 90	1 50 20 2 2 0.8 0.4 1.0 90	MHz kHz V/μs μs μV/√Hz μV/√Hz mV rms μV/rms
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	50 20 2 2 0.8 0.4 1.0 90 ±11 0.1	50 20 2 0.8 0.4 1.0 90 ±11	50 20 2 0.8 0.4 1.0 90 ±11	kHz V/ μ s μ s $\mu V/\sqrt{Hz}$ $\mu V/\sqrt{Hz}$ $\mu V/\sqrt{Hz}$ $\mu V/\sqrt{Hz}$ $\mu V/rms$
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	50 20 2 2 0.8 0.4 1.0 90 ±11 0.1	50 20 2 0.8 0.4 1.0 90 ±11	50 20 2 0.8 0.4 1.0 90 ±11	kHz V/μs μs μV/√Hz μV/√Hz mV rms μV/rms
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	20 2 0.8 0.4 1.0 90 ±11 0.1	20 2 0.8 0.4 1.0 90 ±11	20 2 0.8 0.4 1.0 90 ±11	V/μs μs μV/√Hz μV/√Hz mV rms μV/rms
Settling Time (to 1%, $\Delta V_{OUT} = 20 \text{ V})$ NOISE Noise Spectral-Density SF = 10 V 0.8 SF = 3 V ⁴ 0.4 Wideband Noise A = 10 Hz to 5 MHz 1.0 P = 10 Hz to 10 kHz 90 OUTPUT Output Voltage Swing ±11 Output Impedance (f ≤ 1 kHz) 0.1 Output Short Circuit Current 30 (R _L = 0, T _A = Min to Max) 30 Amplifier Open Loop Gain (f = 50 Hz) 70 INPUT AMPLIFIERS (X, Y and Z) ⁵ Signal Voltage Range (Diff. or CM ±10 Operating Diff.) ±12 Offset Voltage X, Y ±5 ±20 Offset Voltage Drift X, Y 100 Offset Voltage Drift Z 200 CMRR 60 80	2 0.8 0.4 1.0 90 ±11 0.1 30	2 0.8 0.4 1.0 90 ±11 0.1	2 0.8 0.4 1.0 90 ±11 0.1	$\begin{array}{c} \mu s \\ \mu V/\sqrt{Hz} \\ \mu V/\sqrt{Hz} \\ \mu V/\sqrt{Hz} \\ m V \ rms \\ \mu V/rms \\ \end{array}$
NOISE Noise Spectral-Density SF = 10 V SF = 3 V ⁴ Wideband Noise A = 10 Hz to 5 MHz P = 10 Hz to 10 kHz OUTPUT Output Voltage Swing Output Impedance ($f \le 1$ kHz) Output Short Circuit Current ($R_L = 0$, $T_A = Min$ to Max) Amplifier Open Loop Gain ($f = 50$ Hz) INPUT AMPLIFIERS (X, Y and Z) ⁵ Signal Voltage Range (Diff. or CM Operating Diff.) Offset Voltage X, Y Offset Voltage Z Offset Voltage Drift X, Y Offset Voltage Drift Z CMRR 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.	0.8 0.4 1.0 90 ±11 0.1	0.8 0.4 1.0 90 ±11 0.1	0.8 0.4 1.0 90 ±11 0.1	μV/√Hz μV/√Hz mV rms μV/rms
Noise Spectral-Density SF = 10 V $SF = 3 V^4$ 0.4 Wideband Noise A = 10 Hz to 5 MHz P = 10 Hz to 10 kHz 90 OUTPUT Output Voltage Swing Output Impedance ($f \le 1$ kHz) 0.1 Output Short Circuit Current ($R_L = 0$, $T_A = Min$ to Max) 30 Amplifier Open Loop Gain ($f = 50$ Hz) 70 INPUT AMPLIFIERS (X, Y and Z) ⁵ Signal Voltage Range (Diff. or CM Operating Diff.) ± 12 Offset Voltage X, Y ± 5 ± 20 Offset Voltage Z ± 5 ± 30 Offset Voltage Drift Z ± 5 ± 20 CMRR ± 60 80	0.4 1.0 90 ±11 0.1	0.4 1.0 90 ±11 0.1	0.4 1.0 90 ±11 0.1	μV/√Hz mV rms μV/rms
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.4 1.0 90 ±11 0.1	0.4 1.0 90 ±11 0.1	0.4 1.0 90 ±11 0.1	μV/√Hz mV rms μV/rms
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.0 90 ±11 0.1 30	1.0 90 ±11 0.1	1.0 90 ±11 0.1	mV rms μV/rms
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	90 ±11 0.1 30	90 ±11 0.1	90 ±11 0.1	μV/rms V
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	±11 0.1 30	±11 0.1	±11 0.1	V
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.1	0.1	0.1	1 '
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.1	0.1	0.1	1 '
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	30			32
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		30	30	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	70			mA
Signal Voltage Range (Diff. or CM ± 10 Operating Diff.) ± 12 Offset Voltage X, Y ± 5 ± 20 Offset Voltage Drift X, Y 100 Offset Voltage Z ± 5 ± 30 Offset Voltage Drift Z 200 CMRR 60 80		70	70	dB
Signal Voltage Range (Diff. or CM ± 10 Operating Diff.) ± 12 Offset Voltage X, Y ± 5 ± 20 Offset Voltage Drift X, Y 100 Offset Voltage Z ± 5 ± 30 Offset Voltage Drift Z 200 CMRR 60 80				
Operating Diff.) ±12 Offset Voltage X, Y ±5 ±20 Offset Voltage Drift X, Y 100 ±5 ±30 Offset Voltage Drift Z 200 200 60 80	±10	±10	±10	V
Offset Voltage Drift X, Y 100 Offset Voltage Z ± 5 ± 30 Offset Voltage Drift Z 200 CMRR 60 80	±12	±12	±12	V
Offset Voltage Z Offset Voltage Drift Z CMRR	±2 ±10	±5 ±20	±2 ±10	mV
Offset Voltage Drift Z CMRR 200 60 80	50	100	150	μV/°C
CMRR 60 80	±2 ±15	±5 ±30	±2 ±15	mV
	100	500	300	μV/°C
Kine Current 0.8 2.0	70 90 0.8 2.0	60 80 0.8 2.0	70 90 0.8 2.0	dB μA
Bias Current 0.8 2.0 Offset Current 0.1	0.8 2.0 0. I	0.8 2.0	0.8 2.0	μΑ
Differential Resistance 10	10	1 0	10	MΩ
DIVIDER PERFORMANCE	-			
Transfer Function $(X_1 > X_2)$ $10V \frac{(Z_2 - Z_1)}{(X_1 - X_2)} + Y_1$	$10V\frac{(Z_2-Z_1)}{(X_1-X_2)}+Y_1$	$10V\frac{(Z_2-Z_1)}{(X_1-X_2)}+Y_1$	$10V\frac{(Z_2-Z_1)}{(X_1-X_2)}+Y_1$	
Total Error ¹ $(X_1 - X_2)$	$(X_1 - X_2)$	$(X_1 - X_2)$	$(X_1 - X_2)$	
$(X = 10 \text{ V}, -10 \text{ V} \le Z \le +10 \text{ V})$ ± 0.75	±0.35	±0.75	±0.35	%
$(X = 1 \text{ V}, -1 \text{ V} \le Z \le +1 \text{ V})$ ± 2.0	±1.0	±2.0	±1.0	%
$(0.1 \text{ V} \le \text{X} \le 10 \text{ V}, -10 \text{ V} \le \text{Z} \le 10 \text{ V})$ ± 2.5	±1.0	±2.5	±1.0	%
SQUARER PERFORMANCE	-	-	-	
Transfer Function $\frac{(X_1 - X_2)^2}{10V} + Z_2$	$\frac{(X_1-X_2)^2}{10X_1}+Z_2$	$\frac{(X_1 - X_2)^2}{10 V} + Z_2$ ± 0.6	$\frac{(X_1 - X_2)^2}{10 V} + Z_2$ ± 0.3	
Total Error (-10 V \leq X \leq 10 V) ± 0.6		+0.6	±0.3	%
SQUARE-ROOTER PERFORMANCE	$\frac{(X_1 - X_2)^2}{10 V} + Z_2$ ± 0.3			
Transfer Function, $(Z_1 \le Z_2)$ $\sqrt{10V(Z_2 - Z_1) + X_2}$	±0.3	20.0		1
Total Error ¹ (1 V \leq Z \leq 10 V) $ \begin{array}{c} \sqrt{10V(Z_2-Z_1)+X_2} \\ \pm 1.0 \end{array} $	$ \begin{array}{c} 10V \\ \pm 0.3 \end{array} $ $ \sqrt{10V(Z_2 - Z_1) + X_2} $	$\sqrt{10V(Z_2 - Z_1) + X_2}$	$\sqrt{10 V(Z_2 - Z_1) + X_2}$	

-2- REV. A

		AD632	A		AD632	В		AD632	S		AD63	2T	
Model	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Units
POWER SUPPLY SPECIFICATIONS													
Supply Voltage													
Rated Performance		±15			±15			±15			±15		V
Operating	±8		±18	±8		±18	±8		±22	±8		±22	V
Supply Current													
Quiescent		4	6		4	6		4	6		4	6	mA

NOTES

All min and max specifications are guaranteed.

Specifications shown in **boldface** are tested on all production units at final electrical test. Results from those tests are used to calculate outgoing quality levels. Specifications subject to change without notice.

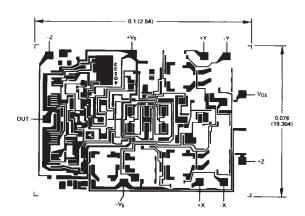
ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option*	
AD632AD	−25°C to +85°C	Side Brazed Ceramic DIP	D-14	
AD632BD	−25°C to +85°C	Side Brazed Ceramic DIP	D-14	
AD632AH	−25°C to +85°C	Header	H-10A	
AD632BH	−25°C to +85°C	Header	H-10A	
AD632SD	−55°C to +125°C	Side Brazed Ceramic DIP	D-14	
AD632SD/833B	−55°C to +125°C	Side Brazed Ceramic DIP	D-14	
AD632TD	−55°C to +125°C	Side Brazed Ceramic DIP	D-14	
AD632TD/883B	−55°C to +125°C	Side Brazed Ceramic DIP	D-14	
AD632SH	−55°C to +125°C	Header	H-10A	
AD632SH/883B	−55°C to +125°C	Header	H-10A	
AD632TH	−55°C to +125°C	Header	H-10A	
AD632TH/883B	−55°C to +125°C	Header	H-10A	

^{*}For outline information see Package Information section.

CHIP DIMENSIONS AND PAD LAYOUT

Dimensions shown in inches and (mm). (Contact factory for latest dimensions.)



For further information, consult factory.

Thermal Characteristics

Thermal Resistance	$\theta_{\rm JC}$ = 25°C/W for H-10A
	$\theta_{JA} = 150^{\circ} \text{C/W for H-10A}$
	$\theta_{IC} = 25^{\circ}$ C/W for D-14
	$\theta_{JA} = 95^{\circ}\text{C/W for D-14}$

REV. A -3-

 $^{^1}Figures$ given are percent of full-scale, $\pm 10~V$ (i.e., 0.01% = 1 mV).

 $^{^2\}mbox{May}$ be reduced to 3 V using external resistor between $-\mbox{V}_S$ and SF.

³Irreducible component due to nonlinearity: excludes effect of offsets.

⁴Using external resistor adjusted to give SF = 3 V.

⁵See functional block diagram for definition of sections.

AD632

Typical Performance Curves

(typical @ $+25^{\circ}$ C with $\pm V_S = 15 \text{ V}$)

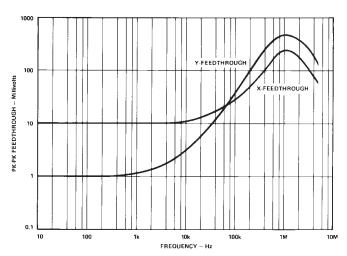


Figure 1. AC Feedthrough vs. Frequency

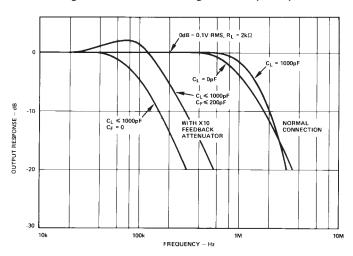


Figure 2. Frequency Response as a Multiplier

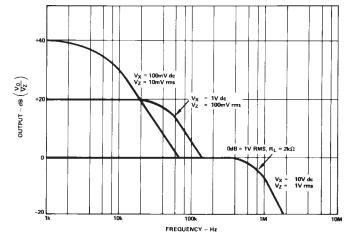


Figure 3. Frequency Response vs. Divider Denominator Input Voltage

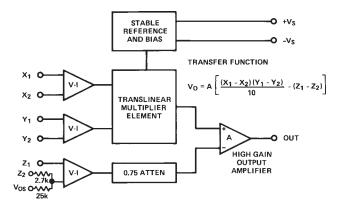


Figure 4. AD632 Functional Block Diagram

OPERATION AS A MULTIPLIER

Figure 5 shows the basic connection for multiplication. Note that the circuit will meet all specifications without trimming.

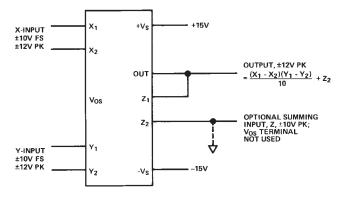


Figure 5. Basic Multiplier Connection

In some cases the user may wish to reduce ac feedthrough to a minimum (as in a suppressed carrier modulator) by applying an external trim voltage (±30 mV range required) to the X or Y input. Curve 1 shows the typical ac feedthrough with this adjustment mode. Note that the feedthrough of the Y input is a factor of 10 lower than that of the X input and should be used in applications where null suppression is critical.

The Z_2 terminal of the AD632 may be used to sum an additional signal into the output. In this mode the output amplifier behaves as a voltage follower with a 1 MHz small signal bandwidth and a 20 V/µs slew rate. This terminal should always be referenced to the ground point of the driven system, particularly if this is remote. Likewise the differential inputs should be referenced to their respective signal common potentials to realize the full accuracy of the AD632.

A much lower scaling voltage can be achieved without any reduction of input signal range using a feedback attenuator as shown in Figure 6. In this example, the scale is such that $V_{\rm OUT}$ = XY, so that the circuit can exhibit a maximum gain of 10. This connection results in a reduction of bandwidth to about 80 kHz without the peaking capacitor $C_{\rm F}$. In addition, the output offset voltage is increased by a factor of 10 making external adjustments necessary in some applications.

Feedback attenuation also retains the capability for adding a signal to the output. Signals may be applied to the Z terminal, where they are amplified by -10, or to the common ground connection where they are amplified by -1. Input signals may also be applied to the lower end of the 2.7 k Ω resistor, giving a gain of +9.

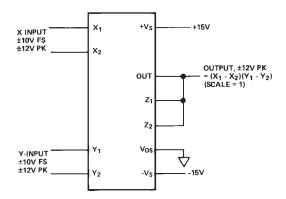


Figure 6. Connections for Scale-Factor of Unity

OPERATION AS A DIVIDER

Figure 7 shows the connection required for division. Unlike earlier products, the AD632 provides differential operation on both numerator and denominator, allowing the ratio of two floating variables to be generated. Further flexibility results from access to a high impedance summing input to Y_1 . As with all dividers based on the use of a multiplier in a feedback loop, the bandwidth is proportional to the denominator magnitude, as shown in Figure 3.

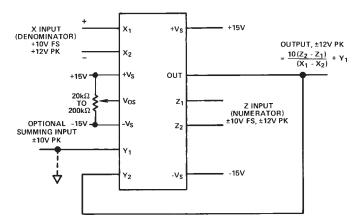


Figure 7. Basic Divider Connection

Without additional trimming, the accuracy of the AD632B is sufficient to maintain a 1% error over a 10 V to 1 V denominator range (The AD535 is functionally equivalent to the AD632 and has guaranteed performance in the divider and square-rooter configurations and is recommended for such applications).

This range may be extended to 100:1 by simply reducing the X offset with an externally generated trim voltage (range required is ± 3.5 mV max) applied to the unused X input. To trim, apply a ramp of +100 mV to +V at 100 Hz to both X_1 and Z_1 (if X_2 is used for offset adjustment, otherwise reverse the signal polarity) and adjust the trim voltage to minimize the variation in the output.*

Since the output will be near +10 V, it should be ac-coupled for this adjustment. The increase in noise level and reduction in bandwidth preclude operation much beyond a ratio of 100 to 1.

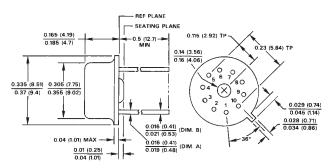
REV. A -5-

^{*}See the AD535 data sheet for more details.

OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

H-Package TO-100



D-Package TO-116

