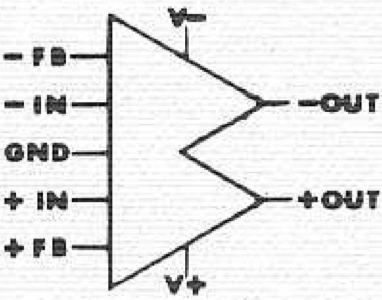
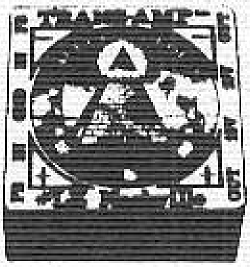
TRANS-AMP™ LZ



BALANCED INPUT AMPLIFIER

DUAL UNBALANCED AMPLIFIER



The Valley People TRANS-AMP LZ is a balanced input amplifying device designed for critical stages in professional audio systems, as well as medical and industrial uses.

Unlike the familiar OP-AMP geometry, the TRANS-AMP LZ is inherently a fully balanced, differential in/differential out device employing symetrically opposed feedback loops. Rather than being returned to the signal input ports, the feedback loops are brought to a pair of internal feedback ports. This results in a pair of input voltage ports configured as a high impedance fully balanced bridging input.

For differential current summing amplifier service, the input signals are brought to the feedback ports, which double as balanced virtual ground current summing points.

Where true balanced inputs are not required, the TRANS-AMP LZ may also be employed as two independent amplifiers, with each half maintaining the extremely low noise and high gain bandwidth characteristics associated with the device. (see applications)

NOISE CONSIDERATIONS

The input circuits of the TRANS-AMP LZ are designed for extremely low noise at very low impedances normally requiring the use of input transformers. (20 ohms to 10 Kohms) The design of the input stage is particularly suited for interface with floating transducers such as microphones, tape heads and phono pickups, due to its inherent ability to effectively cancel the majority of noise currents produced by the input transistors, under such usage.

As can be seen from the Noise Figure VS Source Impedance graph, noise figures under 1 dB can be obtained with sources from 90 ohms to 2 Kohms. The optimum noise impedance is in the region of 300 to 500 ohms, where-in the noise figure is within ¼ dB of theoretical minimum, for floating input sources.

It should be noted that the noise measurements shown have been made with carefully calibrated test equipment correlated to TRUE RMS, and employing 36 dB/Octave filters to represent the true measurement bandwidth of 20 HZ to 20 KHZ.

It should be noted that equivalent input noise of the TRANS-AMP LZ has been optimized at moderate to very high gain configurations. The noise figure increases at low gain settings as the output stages begin to become the predominant noise source. In most applications this effect is of little concern since the absolute output noise is very low, with respect to typical signal levels, at the lower gain settings. (see Output Noise VS Gain Graph.)

For optimum noise performance at low source impedances, the user should be aware that thermal noise generation occurs not only in resistance of the driving source, but also in the resistance at the feedback terminals. This feedback port resistance is taken to mean the parallel combination of all resistors connected to the feedback terminal. The equivalent input noise of a proposed circuit configuration may be determined by considering the source impedance to be the series combination of (A) the resistance at the input terminal(s), and (B) the parallel combination of resistors at the feedback terminal(s). Once the effective source impedance is thus determined, the user may refer to the "Equivalent Input Noise VS Source Impedance" graph to determine E.I.N.

BANDWIDTH AND GAIN

Another unique attribute of the TRANS-AMP LZ configuration is it's ability to vary its open loop gain and bandwidth in proportion to the applied feedback and resultant closed loop gain.

With the feedback loop closed to unity gain, the bandwidth is 5 MHZ. As the closed loop gain is increased, the internal open loop bandwidth increases proportionally in such a manner as to maintain an amplification bandwidth of 5 MHZ. This action continues until a closed loop gain of 40 dB is reached, at which point the effective open loop gain of the device is 500 MHZ. Beyond 40 dB of closed loop gain, the TRANS-AMP LZ behaves as an amplifier having an open loop gain of 500 MHZ. (see Frequency Response VS Gain graph.)

This results, of course, in an amplifier having exceptional stability over a wide range of adjustable gain (unity to 100 dB), and inherently minimal Transient Intermodulation Distortion.

SLEW RATE

The TRANS-AMP LZ exhibits a differential output slew rate in excess of 25 Volts/ microsecond. This results in a full output bandwidth of 180 KHZ for a + 27 dBv (re .775v) output. The THD at 100 KHZ full output is below .05% (100 KHZ is the present limit of our THD measurement capability.)

DISTORTION

Due to the extreme bandwidth stability, TRANS-AMP LZ distortion products are very low and are relatively independant of closed loop gain. (See graph) Both IM and THD are typically in the region under .005% at any output.

LOW FREQUENCY CONSIDERATIONS

The TRANS-AMP LZ is internally AC coupled, with an effective low end open loop bandwidth of .0003 HZ. This results in a closed loop 3 dB point of .3 HZ for 60 dB gain, or 3 HZ for 80 dB gain.

COMMON MODE REJECTION RATIO

In typical circuit configurations, the CMRR of the TRANS-AMP LZ is better than 100 dB in the audio range.

OUTPUT COUPLING CONSIDERATIONS

If the TRANS-AMP LZ is to feed an unbalanced input, it is necessary to differentially couple its two outputs to that unbalanced input in order to realize the full CMRR and PSRR of the device. A suggested method for this interface is shown in "Applications".

STABILITY CONSIDERATIONS

The TRANS-AMP LZ is inherently a highly stable device, in spite of its large gain bandwidth product. There are, however, certain precautions which should be observed in order to maintain that stability in circuit applications.

The first rule, as with any high gain amplifier, is to provide a low impedance to ground for the power supply connections. This may be done by placing capacitors of at least .1 mfd. from the power supply lines to ground, in reasonable proximity (within 6") to the TRANS-AMP LZ. If the user elects to employ series decoupling resistors, their effect on low freq. distortion characteristics should be examined.

A second source of potential instability is the inductive effect which may be exhibited by long cable runs (such as mic cables), at the bridging input terminals. It is suggested that a capacitor be connected directly across the two bridging input terminals, of such a value as to limit the high frequency bandwidth to under 500 KHZ, in such applications. (.002 mfd. or greater for a 150 ohm input) This capacitor will also serve to increase the rejection of unwanted R.F. pickup.

A third source of potential instability is, in certain applications, a capacitive load placed on the outputs of the TRANS-AMP LZ. These outputs are not designed to directly drive long cable runs, and should be buffered for unconditional stability.

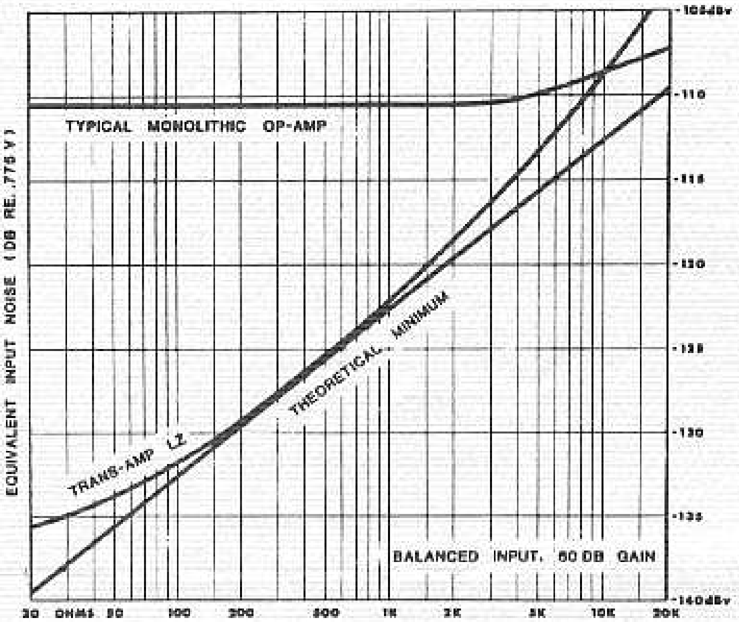
The final stability determining parameter, and the one which requires the most attention from the design engineer, is the value of the feedback resistors externally connected between the output terminals and the feedback terminals. Unlike familiar op-amp configurations, the values of these feedback resistors set the gain/bandwidth parameters of the TRANS-AMP LZ, and must be maintained within defined limits, for unconditional stability. A value of 2.5 K ohm will result in a 500 MHZ effective gain/bandwidth product, and will yield a good stability margin, while satisfying the impedance requirements for optimum noise characteristics, as outlined in the noise considerations section. Lower values will proportionally increase the gain/bandwidth product, while higher values will decrease it. Values below 2 K ohm should not be employed, as they will raise the gain/bandwidth product and decrease the stability margin. The TRANS-AMP LZ will typically go into oscillation at a feedback resistor value of 1600 ohms.

FEEDBACK TERMINAL CONNECTIONS

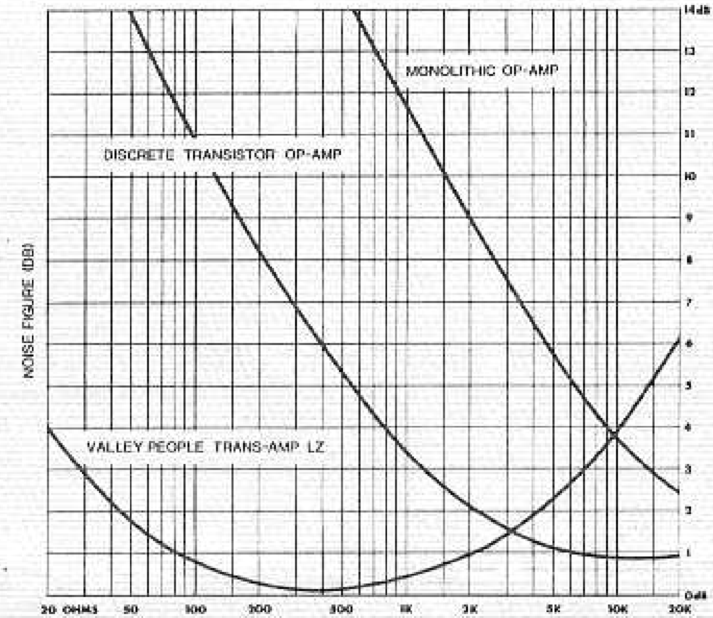
The feedback terminals on the TRANS-AMP LZ will, in most applications have a d.c. potential of around +1 v, with respect to gnd. They may be connected, without blocking capacitors, to each other through any resistance (to establish gain settings in balanced configurations). They may also be connected, via a minimum resistance of 2 K ohms, to the TRANS-AMP LZ outputs or to gnd. When they are to be returned to gnd. through resistances lower than 2 K ohms, blocking capacitors should be placed at the feedback terminals, observing proper polarity. (50 mfd. to 100 mfd. @ 3 V to 6 V is typical for this purpose.)

PHYSICAL

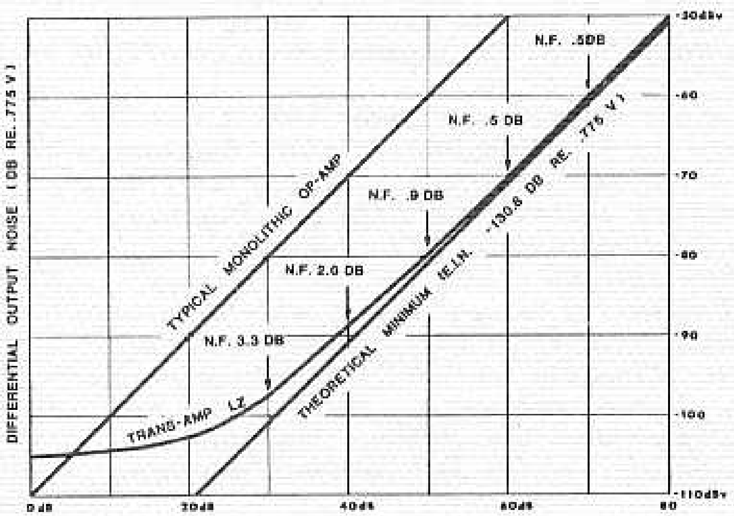
The TRANS-AMP LZ is packaged in a 1.25" X 1.25" X .625" epoxy module. Power requirements are bipolar 15V to 18V at a quiescent current of 10 ma.



EQUIVALENT INPUT NOISE VS. SOURCE IMPEDANCE (TRUE RMS 20HZ-20KHZ)

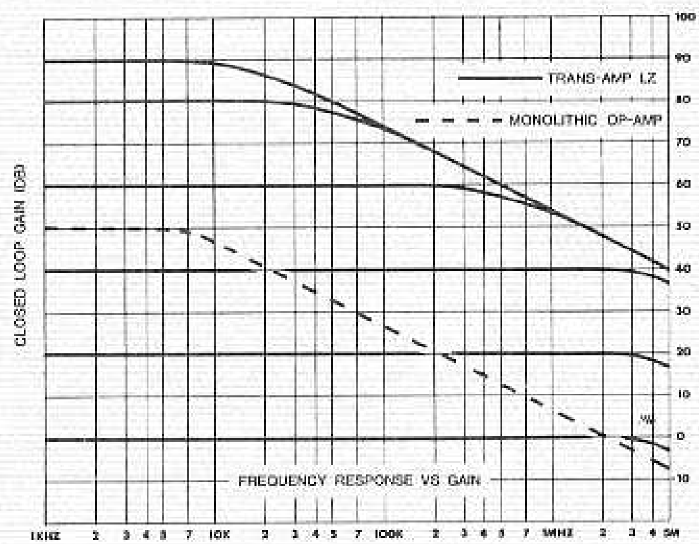


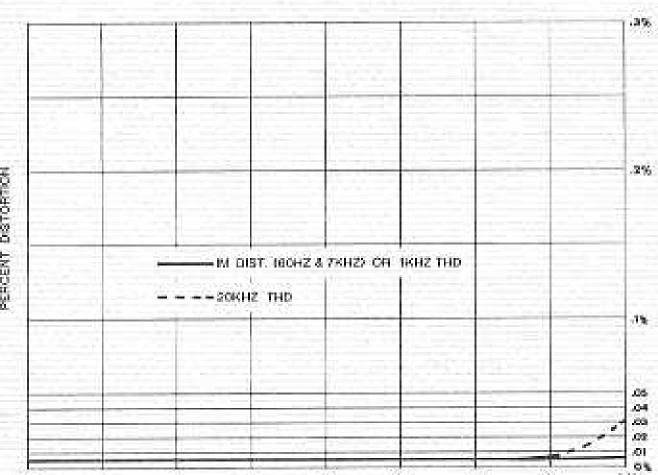
NOISE FIGURE (DB) VS SOURCE IMPEDANCE (OHMS) (TRUE RMS 20HZ-20KHZ)



DIFFERENTIAL OUTPUT NOISE VS. GAIN (TRUE RMS 20HZ-20KHZ)

SOURCE IMPEDANCE 150 OHMS, TRANS-AMP LZ FEEDBACK RESISTORS 2KOHM





TRANS-AMP LZ DISTORTION VS GAIN (+24DBV DIFFERENTIAL OUTPUT) (RE .775VRMS)

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