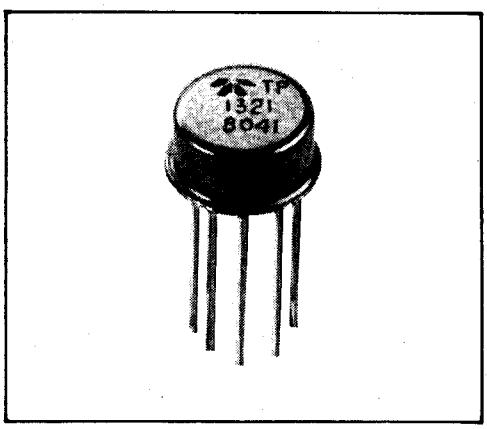
TELEDYNE PHILBRICK

Monolithic High Slew Rate Operational Amplifiers

1321
1322

The 1321 and 1322 are TO-99 packaged high speed op amps that are second to none in their combination of low cost, high frequency, high speed, and precision performance. Each has been optimized for a particular set of applications. These are true differential input amplifiers with stable 6dB per octave gain vs. frequency plots from maximum open loop gain to closed loop gains between 3 and 10. The 1321 should be used for precision settling to 0.01%, for high frequency precision closed loop gain, or for applications requiring low bias current. The 1322 should be used when its 120V/μsec slew rate or 1.6MHz full power frequency (both @ ± 10V into 500Ω) is required.



Applications Information

As with all high frequency devices, optimum performance from the 1321 and 1322 demands care in lead length, bypassing, and stray capacity. When operating at closed loop gains of less than 10, compensation techniques may be required at the bandwidth control pin (pin 8) for stable operation. They are mandatory with closed loop gains below 3. Most applications operating at a gain of less than 10 are stabilized by connecting a 20pF capacitor between pin 8 and ground. The effect on the amplifier's Bode plot of the stabilizing capacitor is shown in Figure 2. When gains greater than 10 are used, care should be taken to minimize stray capacity to pin 8. When maximum speed/frequency response is required, pin 8 should be cut off close to the TO-99 case. When optimum time response and settling time are required at gains less than 10, the amplifier must be "fooled" and operated at a gain greater than 10 at high frequency as shown in Figure 1.

These amplifiers will usually operate better with a 50pF load capacitor and 5 to 20pF in parallel with the feedback resistor. Short, individual lines should be run from the power supply to $\pm V_{CC}$ and to circuit power common. In addition, $\pm V_{CC}$ pins should be bypassed to common at the device with 1μF tantalum capacitors in parallel with 0.01μF ceramic discs.

FEATURES

- Low Cost
- High Slew Rate
  1321 35V/μsec
  1322 120V/μsec
- Fast Settling to ±0.01%
- 100dB CMRR
- Low Power Consumption
- −55°C to +125°C Operation

APPLICATIONS

- Fast Buffer/Followers
- Current to Voltage Converters
- Video Amplifiers
- Differential Amplifiers
- Line Drivers

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SPECIFICATIONS (at 25 °C, V_{CC} = ±15 V, R_L = 2K, unless otherwise indicated).

	1321		1322	
	Typical	**Guaranteed**	**Typical**	**Guaranteed**
OUTPUT RANGE (R_L = 1K)				
Voltage	±12 V	±10 V	±12 V	±10 V
Current	±20 mA	±10 mA	±20 mA	±10 mA
VOLTAGE GAIN (dc Open Loop)	100 dB	98 dB	84 dB	76 dB
FREQUENCY RESPONSE (Inverting)				
Gain-Bandwidth Product	100 MHz ① ③	----	20 MHz ①	
Max Peak to Peak Out (Triangle Wave)	600 kHz ④	320 kHz	1.6 MHz ③	1.2 MHz
Slew Rate	35 V/μsec ④	20 V/μsec	120 V/μsec	80 V/μsec
Settling Time 0.1%	400 nsec	----	200 nsec	----
Settling Time 0.01%	1.0 μsec	----	3.0 μsec	----
INPUT VOLTAGE RANGE				
Common Mode (dc Linear Operation)	±12 V	±11 V	±12 V	±10 V
Differential (between inputs)	±12 V	----	±15 V	----
Common Mode Rejection Ratio (dc)	100 dB	----	90 dB	----
INPUT OFFSET VOLTAGE				
Initial (without External Trim)	±3 mV	±5 mV	±5 mV	±10 mV
Zero Adjustment (Optional)	----	100 kΩ pot	----	20 kΩ pot
Vs. Temperature	30 μV/°C	----	30 μV/°C	----
Vs. Power Supply	30 μV/V	----	30 μV/V	----
INPUT BIAS CURRENT				
Initial at 25 °C	±5 nA	±25 nA	100 nA	250 nA
Offset (Tracking)	5 nA	25 nA	20 nA	50 nA
Offset vs. Temperature	±0.5 nA/°C	±0.8 nA/°C	±0.1 nA/°C	±0.5 nA/°C
INPUT IMPEDANCE				
Differential	300 MΩ	40 MΩ	100 MΩ	40 MΩ
Common Mode (either Input to Common)	1000 MΩ	----	1000 MΩ	----
NOISE (Referred to Input)				
Voltage rms				
Flicker (0.016 Hz to 1.6 Hz)	4 μV (p/p)	----	----	----
Midband (1.6 Hz to 160 Hz)	0.6 μV (rms)	----	----	----
Highband (160 Hz to 16 kHz)	0.8 μV (rms)	----	----	----
Wideband (10 Hz to 10 kHz)	1 μV (rms)	----	1 μV (rms)	----
POWER REQUIREMENTS				
Voltage Range	±8 V to ±22 V	----	±8 V to +20 V	----
Current: Quiescent	±3 mA	±4 mA	±4 mA	±6 mA
TEMPERATURE RANGE				
Operating (°C)	----	0 to +75	----	0 to +75
Operating (1321-01 · 1322-01) (°C)	----	-55 to +125	----	-55 to +125
Storage (°C)	----	-65 to +150	----	-65 to +150

① G x BW @ A = 10
③ @ A_{cl} = 1, f_t = 10 MHz (Typical)
④ $A_{cl} \geq 3$
④ $A_{cl} \geq 5$

The input circuits of these units are protected to ±V_{CC}. Output circuits are short-circuit protected to ground.

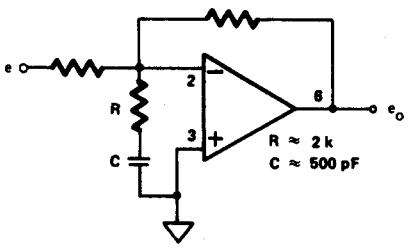
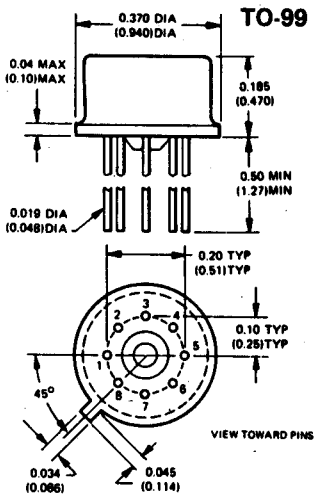
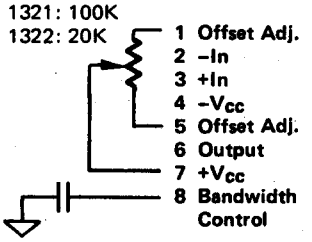


Figure 1. Optional Stabilizing Scheme (for unity gain stability at high speed)



DIMENSIONS IN PARENTHESES ARE EXPRESSED IN CENTIMETERS

Optional
E_{OS} Trim
1321: 100K
1322: 20K



20 pF stabilizing capacitor for closed loop gains less than 10

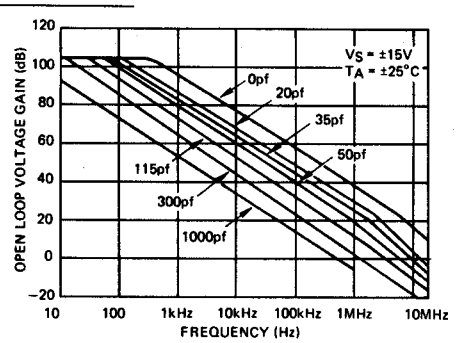


Figure 2A. Bode Plot 1321

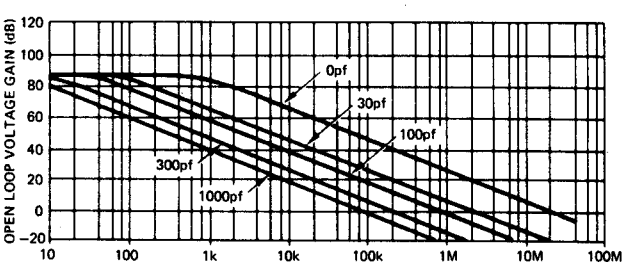


Figure 2B. Bode Plot 1322

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