TELEDYNE PHILBRICK

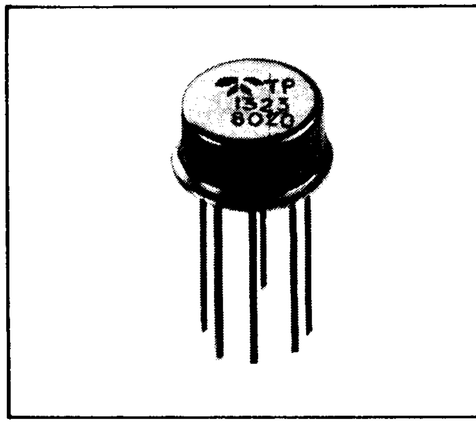
Monolithic High Performance Operational Amplifiers

1323 1332

These bipolar amplifiers provide the solutions to problems which cannot be solved with the typical 741. Each has had one or more specifications optimized to provide such capabilities as low drift, high output voltage swing, high speed, etc. The 1323 emphasizes open loop gain, slew rate, and low power supply range (down to ± 5.5V). The 1332 emphasizes output voltage range (± 35V with ± 40V supplies), offset drift, and wide power supply range (± 10V to ± 40V).

The 1332 is completely 741 pin compatible (including the 10kΩ optional offset trim pot connection). The 1323 is 741 pin compatible only when no external trim is required. If an initial offset less than ± 5mV is required, the 1323 is trimmed with a 1MΩ potentiometer between pins 1 and 8, with the wiper to $+V_{CC}$. It should also be noted that pin 4 ($-V_{CC}$) of the 1323 is connected to the case (see outline and base drawing).

Both devices have a low initial offset voltage, the worst case (1332) being ± 6mV. The quiescent power supply current of the 1323 is guaranteed to be less than ± 80μA. However, the unit can drive ± 10mA into a 1kΩ load at 25kHz. It thus can be used to configure a battery powered precision power amplifier (approximately 200mW out). When operating under load, quiescent current increases as a function of differential input voltage as shown in Figure 7. Its high stable gain and common mode rejection also make it ideal for battery powered instrumentation amplifiers.



FEATURES

- Low Cost
- Monolithic Construction
- ± 35V Output (1332)
- ± 1mV Offset (1323)
- 126dB Gain (1323)
- 20V/μsec Slew Rate (1323)
- Low Power

APPLICATIONS

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

TELEDYNE PHILBRICK Allied Drive @ Rte. 128, Dedham, Massachusetts 02026
Tel: (617) 329-1600, TWX: (710) 348-6726, Tlx: 92-4439

SPECIFICATIONS (T_A = +25°C, ±V_{CC} = ±15V unless otherwise indicated).

	1323 Typical	1323 Guaranteed	1332 Typical	1332 Guaranteed
OUTPUT RANGE				
Voltage	±13V	±12V	±37V	±35V (2)
Current	±20mA	±10mA	±12mA	±10mA
VOLTAGE GAIN (dc Open Loop)				
Rated Load	126dB	106dB	106dB	100dB
FREQUENCY/TIME RESPONSE				
Small Signal (Unity Gain, Open Loop)	700kHz		4MHz	
Max Sine Power Out (3 to 5% Distortion)	25kHz		25kHz	
Slew Rate	20V/μsec	10V/μsec	5V/μsec	
Settling Time to ±0.1% (Step Input)	10μsec		7μsec	
INPUT VOLTAGE RANGE				
Common Mode (dc Linear Operation)	±12V	±11V	±40V	±35 V
Common Mode Fault	±V_{CC}		±V_{CC}	
Differential (Between Inputs)	+V_{CC} − (−V_{CC})		+V_{CC} − (−V_{CC})	
Common Mode Rejection Ratio	106dB	80dB	100dB	74dB
INPUT OFFSET VOLTAGE				
Initial (without external trim)	±1mV	±5mV	±2mV	±6mV
Zero Adjustment (Optional)		1MΩ pot		10kΩ pot
Vs. Temperature (Avg. 0 to +70°C)	±30μV/°C		±15μV/°C	±20μV/°C
Vs. Power Supply	±10μV/V	±100μV/V	±30μV/V	±200μV/V
INPUT BIAS CURRENT				
Initial	±5nA	±40nA	±5nA	±30nA
Vs. Temperature (Avg. 0 to +70°C)	±0.1nA/°C		±0.1nA/°C	±0.4nA/°C
Offset Current	±10nA		±10nA	±30nA
Offset vs. Temperature (Avg. 0 to +70°C)	±0.5nA/°C		±0.5nA/°C	
INPUT IMPEDANCE				
Differential	2MΩ	200kΩ	200MΩ	
Common Mode			1000MΩ	
NOISE (Referred to Input)				
Wideband (10Hz to 10kHz)	10μV rms		10μV rms	
POWER REQUIREMENTS				
Voltage Range (Volts)	±5.5 to ±20	±12 to ±18	±8 to ±45	±10 to ±40
Current: Quiescent	±70μA	±80μA (1)	±3.2mA	±4.5mA
TEMPERATURE RANGE				
Operating		0 to +75°C		0 to +75°C
Storage		−65 to +150°C		−65°C to +150°C

Notes: 1. When inputs are less than 5mV apart. When inputs are more than 50mV apart, quiescent current is ±3mA Typical.
2. @V_{CC} = ±40V

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

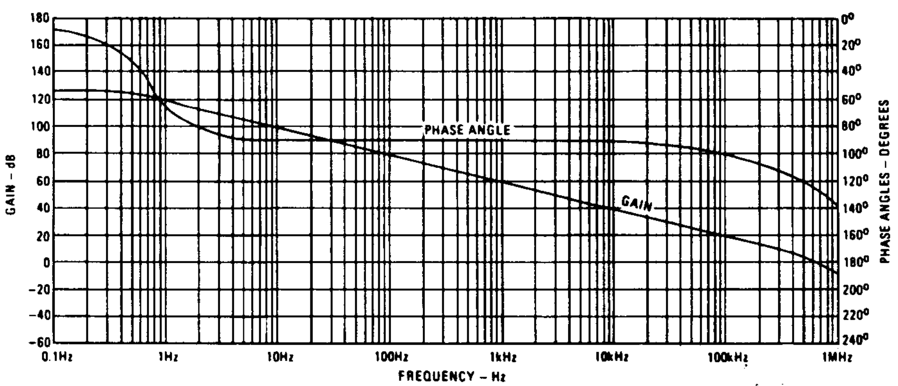
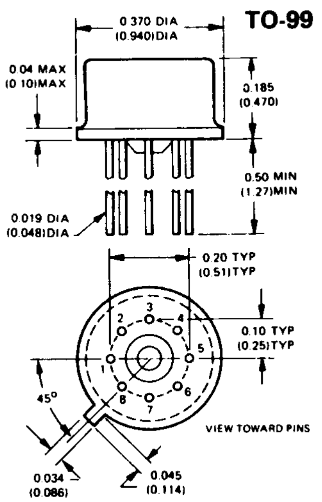


Figure 1. Phase-Frequency for Model 1323



DIMENSIONS IN PARENTHESES ARE EXPRESSED IN CENTIMETERS

MODEL 1332

1 Offset Adj.
2 -In
3 +In
4 $-V_{CC}$
5 Offset Adj.
6 Output
7 $+V_{CC}$
8 NC *

Optional Eos Trim 10 KΩ

*Bandwidth Control on Model 1332

MODEL 1323

1 Offset Adj.
2 -In
3 +In
4 $-V_{CC}$ & Case
5 NC
6 Output
7 $+V_{CC}$
8 Offset Adj.

Optional Eos Trim 1 MΩ

APPLICATIONS

Each of these differential amplifiers can be used in any of the thousands of circuits, simple or complex, cute or conventional, which have been developed over the past 30 years. Illustrated below are several applications in which advantage is taken of unique device capabilities.

Bipolar Variable Voltage Source

Figure 2 shows a 1323 connected as a low cost ±5 V @ 20 mA voltage source which could be battery powered (10 penlite cells) to provide a floating reference voltage operating at a quiescent current of less than 500 μA (using a 250 μA, LVA zener). The single potentiometer varies the output from minus 5V, through zero to plus 5V.

If a 1332 is substituted for the 1323, V_{CC} changed to ±40 V and resistors and zener changed accordingly, a ±35 V @ 10 mA voltage source results. To provide ±10 V out with ±15 V power supplies, the 1323 may be used.

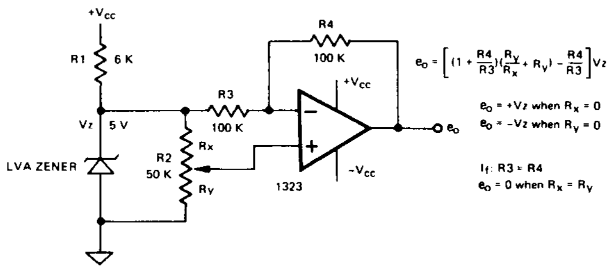


Figure 2. Precision Battery-Powered Variable Voltage Source ±5V @ 20 mA

Instrumentation Amplifier

Figure 3 illustrates three 1323 amplifiers being used in the classic Instrumentation amplifier configuration to provide high differential input impedance and high CMRR with the capability to set gain with one resistor R_g. For best results the R3R4 pairs are matched to the basic accuracy required. This amplifier will draw less than 250 μA yet have the current and speed to drive galvanometers.

If the input signal is imposed on a high Common Mode voltage (between ±15 and ±40 V) replace A1 and A2 with 1332's operating at $\pm V_{CC}$ greater than the CMV. For high voltage out, replace A3 with a 1332 and operate with voltage gain.

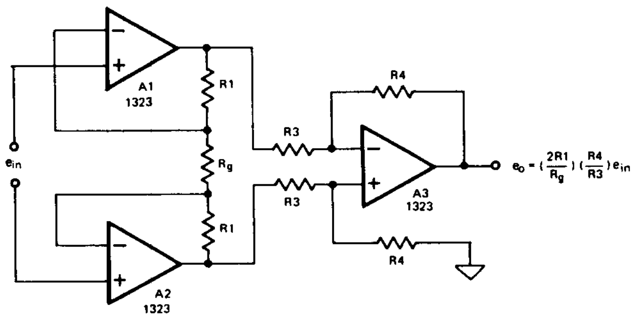


Figure 3. Micropower (<250 μA) Instrumentation Amplifier

Single Supply Operation

Figure 4 shows a 1332 operating as an inverter from a single supply. This will allow a 1332 to operate from 48 V aircraft or vessel power, or the 1321 could operate from a single 6 V battery and the 1323 from a 12 V battery.

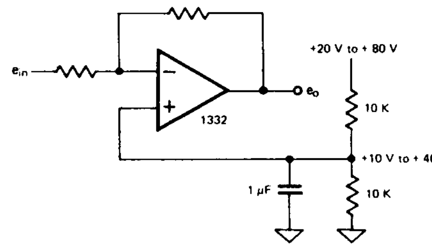


Figure 4. 1332 Single Supply Operation

Model 1332

Figures 5 and 6 show that the 1332, operating with a ±40 V power supply, can drive ±35 V into 2.7 kΩ at 25 kHz. Under maximum load conditions, the output can be short circuited to common without danger, as the output is limited by a chip temperature sensing circuit.

If it is desired to decrease bandwidth, capacity may be added between pin 8 and common. Figure 8 shows the effect of this capacity.

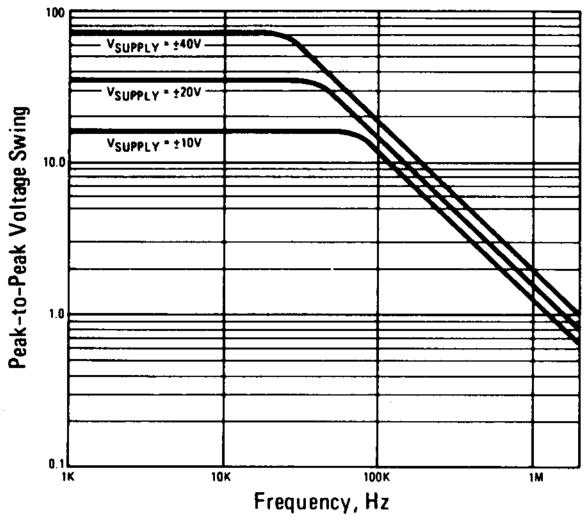


Figure 5. Output Voltage Swing vs Frequency at 25°C Model 1332

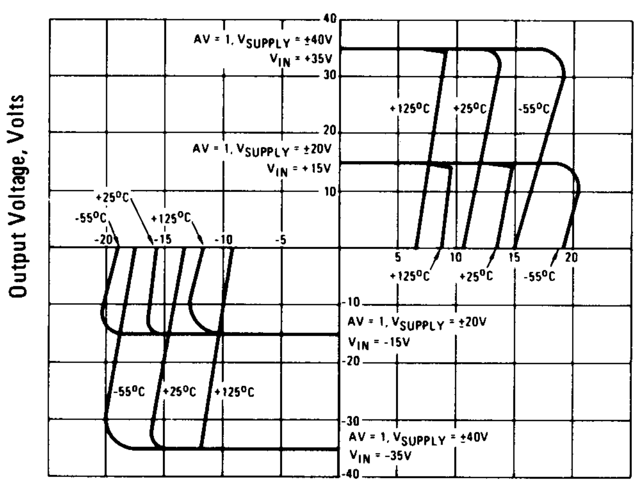


Figure 6. Output Current Characteristic of Model 1332

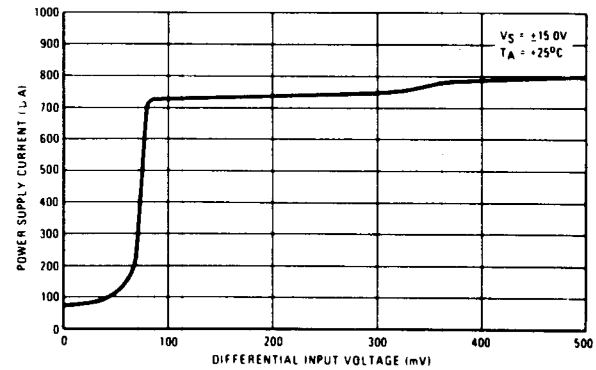


Figure 7. Supply Current vs Diff. Input Voltage for Model 1323

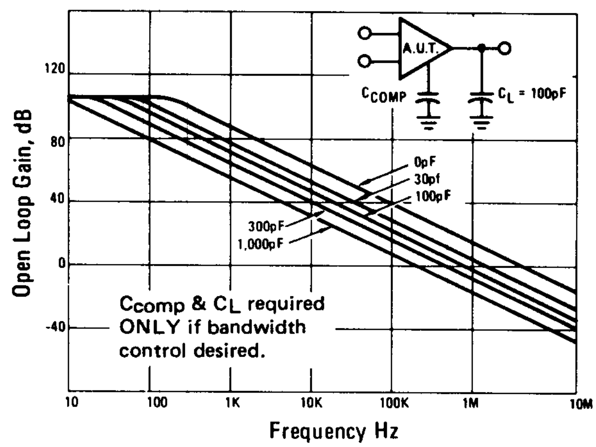


Figure 8. Gain vs Frequency vs Bandwidth Control Pin Capacity for Model 1332.

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