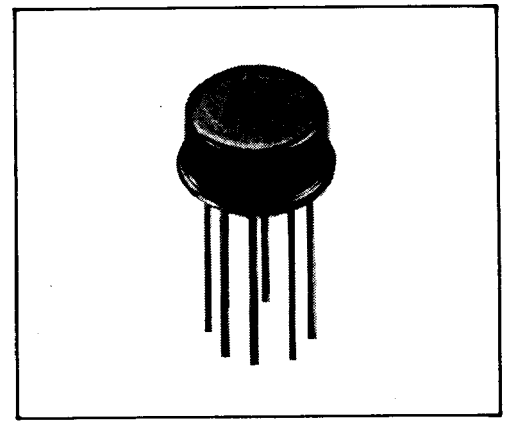
TELEDYNE PHILBRICK

Monolithic Chopper Stabilized Operational Amplifier

1340

The 1340 is an excellent choice for applications that require long term accuracy in thermally unstable environments. Being chopper stabilized, the 1340 does not require initial offset voltage trimming, nor periodic recalibration. This feature is particularly important for circuits operating in remote or inaccessible locations. Using the 1340 in place of general purpose op amps will substantially reduce the system error budget. High common mode rejection, slew rate, and open loop gain ensure fast accurate operation in inverting, noninverting, or differential applications. The 1340 requires only 3 external capacitors for operation. No external trimpots are required. The combination of monolithic construction and chopper stabilization provides exceptionally fast warm-up time and high reliability.



Applications Information

Figure 1 shows the 1340 connected as a differential amplifier. The following recommendations will ensure optimum performance. C1 and C2 should be high quality polystyrene or teflon. C3 can be polystyrene or ceramic. R_1 with R_2 and R_3 with R_4 should be matched to 0.1% for highest CMRR and lowest chopper noise. Also, the maximum source impedance at each input (including R_1 and R_2) should be less than 100kΩ. This is true when the 1340 is connected in inverting, following, or differential configurations. C4 and C5 in combination with R3 and R4 roll-off the input voltage noise (see Figure 2). Select the values of C4 and C5 so the closed loop 3dB frequency ($X_C = R$) gives a noise level 10 to 20dB below the minimum dc voltage change to be resolved. Example: for a noise level of 3μV, f – 3dB is 0.35Hz, as shown in Figure 2. $C \approx 0.006\mu F$. Assume R_1 and $R_2 = 100k\Omega$, and R_3 and $R_4 = 1M\Omega$.

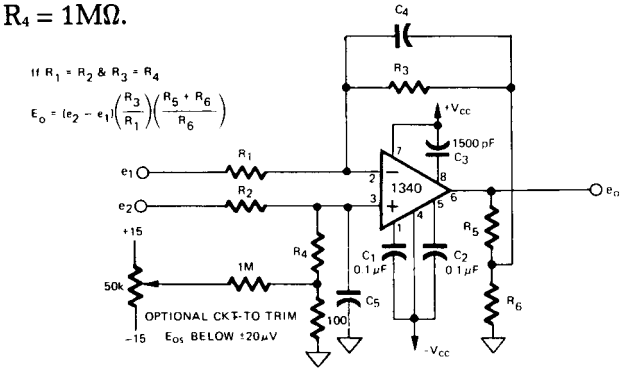


Figure 1. 1340 Connected as Differential Amplifier

FEATURES

- Maximum 80μV Offset Voltage Over Temperature
- 4μV/year Long Term Stability
- 120dB Minimum CMRR
- 120dB Minimum Open Loop Gain
- Full Differential Input

APPLICATIONS

- High Impedance Bridge Circuits
- Ultra Stable Integrators
- Low Drift High Gain Buffers
- Instrumentation Amplifiers
- 16 Bit Voltage DAC's

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SPECIFICATIONS @ +25 °C V_{CC} = ±15 V, unless otherwise noted

	Typical	Guaranteed
OUTPUT RANGE		
Voltage	±12 V	±10 V
Current	---	±7 mA
Impedance	200 Ω	---
VOLTAGE GAIN (dc, open loop)		
Rated Load at +75 °C	175 dB	120 dB
FREQUENCY RESPONSE		
Gain-Bandwidth Product ①	3 MHz	---
Full Power Bandwidth ②	40 kHz	---
Slew Rate ②	2.5 V/μsec	---
Rise Time ③	200 nsec	---
Overshoot ③	20%	---
Chopper Frequency	750 Hz	---
INPUT VOLTAGE RANGE		
Common Mode (dc linear operation)	---	±10 V
Differential (between inputs) abs. max	---	±15 V
Common Mode Rejection Ratio ④	160 dB	120 dB
INPUT IMPEDANCE		
Common Mode	10^{11} Ω	---
Differential	10^{8} Ω	---
INPUT VOLTAGE OFFSET		
Initial @ +25 °C	20 μV	---
@ +75 °C	---	80 μV
Vs Temperature	0.2 μV/°C	---
Vs Power Supply ⑤	160 dB	120 dB
Vs Time	4 μV/year	---
Warm-Up Drift	10 μV	---
INPUT BIAS CURRENT		
Initial @ +25 °C	150 pA	---
@ +75 °C	---	1 nA
Vs Temperature	6 pA/°C	---
OFFSET Current at +25 °C	50 pA	---
at +75 °C	---	500 pA
OFFSET Current vs Temperature	1 pA/°C	---
POWER REQUIREMENTS		
Nominal Supply Voltage	---	±12 to ±20 V
Current Quiescent	3.5 mA	5 mA
Recommended Philbrick Power Supply	2209 (P.C. mounting)	
TEMPERATURE RANGE		
Operating	-55 °C to +125 °C	0 °C to +75 °C
Storage	-65 °C to +150 °C	---
MTBF	150,000 Hrs.	

① At closed loop Gain, A_{CL}, of 10
② E_{out} = ±10 V
③ E_{out} = 200 mV, A_{CL} = 1
④ E_{CM} = ±5 V
⑤ ΔV_{CC} = ±5 V, A_{CL} = 1

The input circuits of these units are protected to ±Vcc. Output circuits are short-circuit protected to ground.

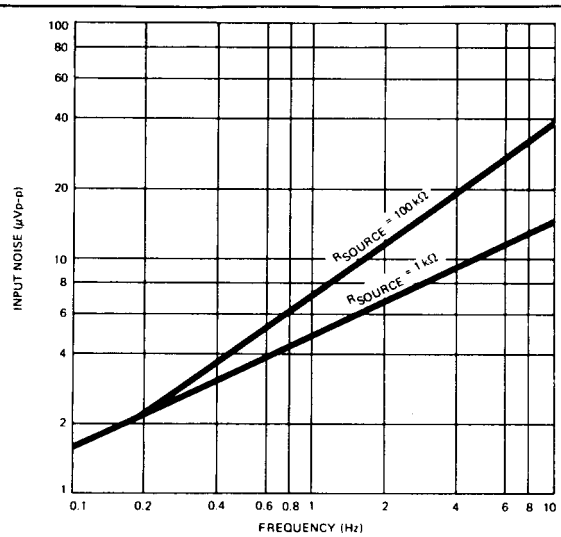


Figure 2. Equivalent Input Noise vs Closed Loop Bandwidth vs Source Impedance

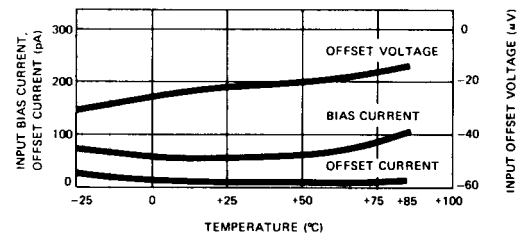
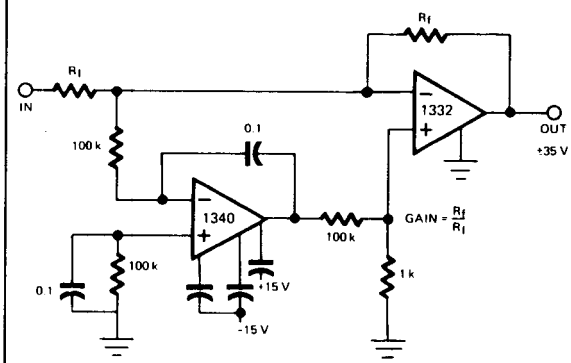
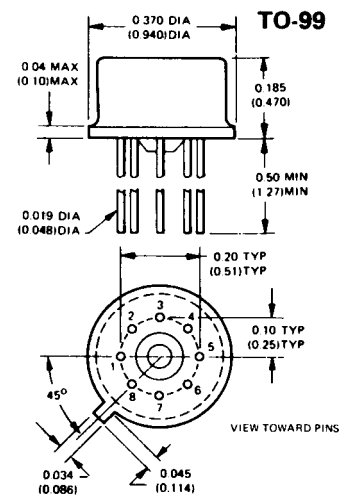


Figure 3. Typical Input Characteristics vs Temperature

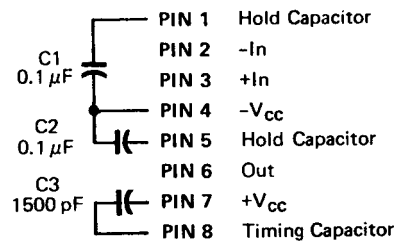


FAST, LOW NOISE, CHOPPER STABILIZED AMPLIFIER
NOTE: ±35 V OUT
INPUT NOISE 5 μV P-P (0 to 1 kHz) 5 V/μSEC SLEW

Figure 4. Fast, Low Noise, Chopper Stabilized Amplifier



DIMENSIONS IN PARANTHESES ARE EXPRESSED IN CENTIMETERS.



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