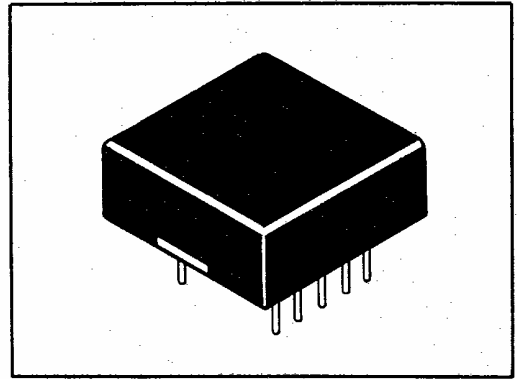


1702

5 Femtoampere Bias Current Operational Amplifier



The 1702, with 5 femtoamp bias current (5×10^{-15} A) maximum, is designed to be used in circuits where extremely low error currents, low current noise, high input impedance, high common mode voltage and high common mode rejection ratio are critical design requirements.

Features include a D.C. open loop gain of 100dB min., common mode voltage range of ± 100 V min., CMRR of 100dB min., and an offset voltage drift of $30\mu\text{V}/^\circ\text{C}$ max. These features are complemented by its small size (1.5 inches square by 0.6 inches high) and epoxy encapsulation for reliability in areas of shock and vibration. The epoxy also forms an isothermal environment for protection against thermal spikes. The unit is totally enclosed by a metal cup for protection against spurious signals from associated circuitry.

Input bias current of the 1702 is measured as the maximum into either input. Therefore, the 1702 can be used for inverting, non-inverting, and differential application. For DC applications where the initial voltage offset may affect performance, an optional 50k Ω pot will zero this voltage. Complete short circuit protection of the input and output circuitry is provided for added reliability.

FEATURES

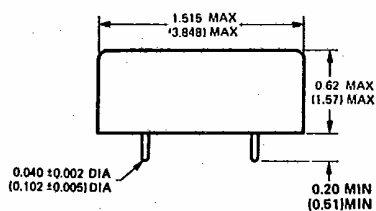
- 2fA Bias Current Typical
- 1fA/ $^\circ\text{C}$ Bias Current T.C., Typical
- $10\mu\text{V}/^\circ\text{C}$ E_{os} T.C.
- 100V Common Mode Voltage @ $V_{cc} = \pm 12$ V.

APPLICATIONS

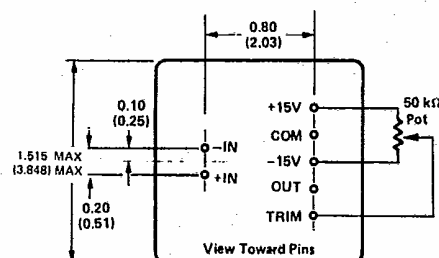
- Electrometers
- Photo-Diode Amplifiers
- pH Meters
- Long Term Integrators
- Charge Amplifiers
- Femto-Ammeters

PACKAGE DIMENSIONS

Dimensions in parentheses are expressed in centimeters.



± 0.01 NON-CUMULATIVE TOLERANCE BETWEEN PINS
 ± 0.02 TOLERANCE FROM CASE EDGE TO CENTER OF PIN



SPECIFICATIONS (+25°C, $V_{CC} = \pm 15V$, unless otherwise indicated.)

PARAMETER	TYPICAL	GUARANTEED
OUTPUT RANGE Voltage (Peak) Current	---	$\pm 10V$ $\pm 5mA$
VOLTAGE GAIN (DC Open Loop) Rated Load	---	100dB
FREQUENCY RESPONSE (Inverting) Small Signal (Unity Gain, Open Loop) Gain @ 5Hz Large Signal Full Output (Undistorted) Large Signal Full Output (Peak to Peak) Slew Rate Max. Capacitive Load Without Instability	500Hz --- --- 50Hz 0.5V/msec 0.1 μF	--- 37dB 20Hz --- --- ---
INPUT VOLTAGE RANGE Common Mode DC Linear Operation (1) Common Mode Fault Differential (Between Inputs) Common Mode Rejection Ratio	--- --- $\pm 300V$ ---	$\pm 100V$ $\pm 200V$ --- 100dB
INPUT VOLTAGE OFFSET Initial (Without External Trim) @ 25°C Zero Adjustment (Optional) Vs. Temperature (Avg. 0° to +70°C)	--- 50k Ω pot ---	$\pm 5mV$ --- $\pm 30\mu V/^{\circ}C$
NOISE Flicker (0.016Hz to 1.6Hz) Midband (1Hz to 100Hz)	7 $\mu Vp-p$ 10 $\mu V(RMS)$	--- ---
INPUT BIAS CURRENT Initial @25°C Vs. Temperature (Avg. 0° to +70°C) Vs. Power Supply	--- 0.001pA/ $^{\circ}C$ 0.0005pA/V	0.005pA 0.002pA/ $^{\circ}C$ ---
INPUT IMPEDANCE Differential Common Mode (Either Input to Common)	$3 \times 10^{11} \Omega 15pF$ 10 ¹⁴ Ω	--- ---
POWER REQUIREMENTS Nominal Supply Voltage Supply Voltage Range Quiescent Current	$\pm 15V$ ± 12 to ± 18 ---	--- --- +13mA, -8mA
TEMPERATURE RANGE Operating (Rated) Operating (Derated) Storage	--- -25°C to +85°C ---	0°C to +70°C --- -55°C to +125°C

NOTE:

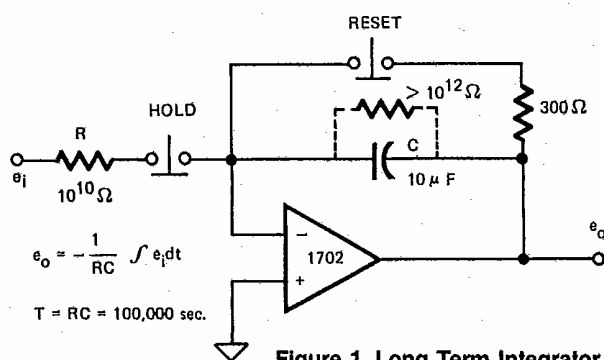
1. The 1702 can operate with $\pm 100V$ of common mode voltage when $V_{CC} = \pm 12V$.

Figure 1. Long Term Integrator

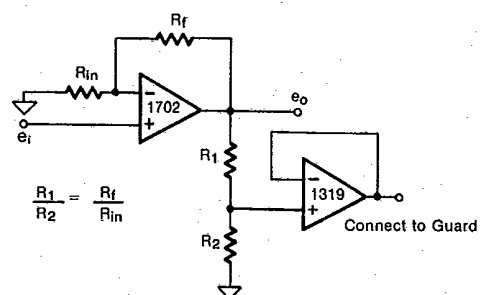


Figure 2. Follower With Gain-Guard Drive

To minimize errors caused by leakage currents, a "foil guard" should be put around the input pins. The guard conductor should be connected to a potential that is very close to or equal to the voltage being applied to the input. In this manner any stray leakage currents will be intercepted before they reach the inputs, and since the guard is at approximately the same potential as the inputs, no leakage currents will be generated.

Connect the guard to ground for inverters or 1 to V_s , to the output for unity gain followers, and to a buffered attenuator (see Figure 2) for follower with gain.

For additional application information, request AN-3.