

PRODUCT DESCRIPTION

The Analog Devices AD523J, AD523K, and AD523L are the first IC J-FET operational amplifiers to provide sub-picoampere bias current performance comparable to that of discrete component modular products and an order of magnitude improvement over other IC models. Because of its monolithic construction, the cost of the AD523 is significantly below that of modules, and becomes even lower with larger quantity requirements. Its small guarded IC package enables the AD523 to be used in close proximity to the signal source, particularly in probe applications, thus eliminating the need for long interconnections and minimizing pickup and noise.

The AD523 achieves maximum bias currents as low as 0.25 pA under warmed-up operating conditions by combining matched small geometry junction FET chips with a specially designed monolithic thin-film chip in a low leakage TO-99 package. The package, manufactured with high resistivity glass insulation, includes a guard pin connected to the can to allow the user to minimize surface leakage currents, power supply induced noise, and capacitive pickup. The AD523 is fully short circuit protected and offset voltage nullable, and offers maximum input voltage drift of $30 \mu\text{V}/^\circ\text{C}$, minimum CMRR of 80 dB, minimum gain of 40,000, and minimum slew rate of $3 \text{ V}/\mu\text{sec}$. The AD523J, K, and L are specified for operation over the 0°C to $+70^\circ\text{C}$ temperature range. The AD523S is specified over the -55°C to $+125^\circ\text{C}$ temperature range, will be available in the Spring of 1972. *Not Available*

PRODUCT BENEFITS

1. The AD523 provides order-of-magnitude lower bias current than any other high performance IC operational amplifier, and order-of-magnitude faster slew rate than most sub-picoampere modules.
2. The 100-piece price of the AD523 is at least 1/3 to 1/2 that of modular sub-picoampere operational amplifiers.
3. The bias currents of the AD523 are specified as a maximum for either input under fully warmed-up operating conditions. Conventional IC FET op amps specify bias currents as the average of the two input currents and generally do not take into account the self-heating effects of the amplifier, which can quadruple the initial readings.
4. The gain of the AD523 is measured with the offset voltage nulled. Nulling a FET op amp can cause the gain to decrease below its specified limit. The AD523 gain is fully guaranteed with the offset voltage both nulled and unnullled.
5. To maximize the reliability inherent in IC construction, every AD523 is stored for 48 hours at 200°C , temperature cycled from -65°C to $+125^\circ\text{C}$, and receives a high impact shock test. All guaranteed DC parameters are 100% computer tested, including offset voltage drift. AC performance and noise parameters are tested on a sampling basis.

APPLYING THE AD523

The AD523's TO-99 package is specially designed for low bias current performance. The case guard (Pin No. 8) can be used to reduce stray leakage currents that would normally flow from the supply and null pins to the sensitive input pins, and minimize noise caused by supply transients, which are particularly troublesome in sub-picoamp circuits. Pin 8 should be connected to a point which is at the same potential as the signal input to the AD523, thus minimizing voltage drops across the glass insulation. Thus, in inverting circuits Pin 8 should be tied to Pin 3, and in non-inverting circuits Pin 8 should be connected to Pin 2. On the external surface of the header, the pins are surrounded by high resistivity glass to reduce galvanic effects between the pins and the header under high-humidity conditions. Care should be taken to insure that this insulating glass is not crazed when inserting the AD523 into the circuit.

The AD523 is especially designed for the measurement of low-level currents, or small voltages from high impedance sources, in which bias current can be a primary source of error. Applications include.....

- Long term integrators
- Sample-Hold amplifiers
- Electrometer amplifiers
- Current measurements from photo-transducers
- Voltage measurements from pH transducers

AD523J AD523K AD523L

INTEGRATED CIRCUIT ELECTROMETER OPERATIONAL AMPLIFIERS

FEATURES

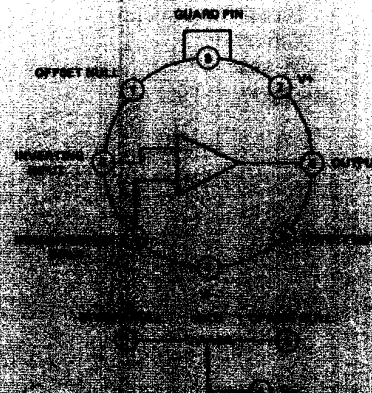
Low Cost: \$14.00 (100's)

Low I_b
1.0pA max (J)
0.5pA max (K)
0.25pA max (L)

Low V_{os} Drift
(100% computer tested)
 $30 \mu\text{V}/^\circ\text{C}$ (K)

High Slew Rate
 $> 3 \text{ V}/\mu\text{sec}$

Small Size (TO-99 can)
Low Leakage Package
Case Guard Pin



ANALOG

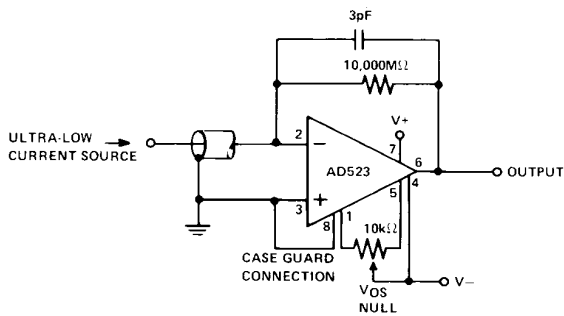
| PARAMETER | AD523J | AD523K | AD523L |
|---|---|---|---|
| OPEN LOOP GAIN $V_{os} \geq 0, R_L = 2k\Omega$ @ $T_A = 0$ to $70^\circ C$ | 20,000 min (50,000 typ) 15,000 min | 40,000 min (75,000 typ) 25,000 min | 40,000 min (75,000 typ) 25,000 min |
| OUTPUT CHARACTERISTICS Voltage @ $R_L = 2k\Omega, T_A = 0$ to $70^\circ C$ | $\pm 10V$ min ($\pm 12V$ typ) | * | * |
| Current, $T_A = 0$ to $70^\circ C$ | $\pm 5mA$ min | * | * |
| Load Capacitance | 1000pF | * | * |
| Short Circuit Current | 25mA | * | * |
| FREQUENCY RESPONSE Unity Gain, Small Signal | 500kHz | * | * |
| Full Power Response | 50kHz | * | * |
| Slew Rate, Unity Gain | 3V/ μsec min (5V/ μsec typ) | * | * |
| INPUT OFFSET VOLTAGE Initial | 50mV max (25mV typ) | 20mV max (10mV typ) | 20mV max (10mV typ) |
| vs. Temp $T_A = 0$ to $70^\circ C$ | 90 $\mu V/^\circ C$ max (25 $\mu V/^\circ C$ typ) | 30 $\mu V/^\circ C$ max (15 $\mu V/^\circ C$ typ) | 60 $\mu V/^\circ C$ max (25 $\mu V/^\circ C$ typ) |
| vs. Supply | 200 $\mu V/V$ max | 100 $\mu V/V$ max | 100 $\mu V/V$ max |
| INPUT BIAS CURRENT Initial, each input, $V_{diff} \leq 4V$ (Note 1) | -1.0pA max (-0.4pA typ) | -0.5pA max (-0.2pA typ) | -0.25pA max (-0.1pA typ) |
| INPUT IMPEDANCE Differential | $10^{12} \parallel 3pF$ | * | * |
| Common Mode | $10^{13} \parallel 3pF$ | * | * |
| INPUT NOISE Voltage, 0.01 to 1Hz | 20 $\mu V p-p$ | * | * |
| 5Hz to 50kHz | 15 $\mu V rms$ | * | * |
| INPUT VOLTAGE RANGE Differential, max safe | $\pm 10V$ | * | * |
| Common Mode Rejection @ $\pm 8V$ $T_A = 0$ to $70^\circ C$ | 70dB min (80dB typ) | 80dB min (90dB typ) | 80dB min (90dB typ) |
| POWER SUPPLY Rated Performance | $\pm 15V$ | * | * |
| Operating | $\pm (5$ to $18)V$ | * | * |
| Current, quiescent | $\pm 7.0mA$ max ($\pm 5.0mA$ typ) | * | * |
| TEMPERATURE RANGE Rated Performance | 0 to $+70^\circ C$ | * | * |
| Operating | -55 to $+125^\circ C$ | * | * |
| Storage | -65 to $+150^\circ C$ | * | * |
| PRICE ** | | | |
| 1 - 24 | \$21.00 | \$25.00 | \$28.00 |
| 25 - 99 | 16.50 | 20.00 | 22.50 |
| 100 - 999 | 14.00 | 16.75 | 18.75 |

NOTE 1: Bias Current specification guaranteed after 5 minutes of operation at $T_A = 25^\circ C$. (For higher ambient temperatures, the current doubles every $+10^\circ C$.)

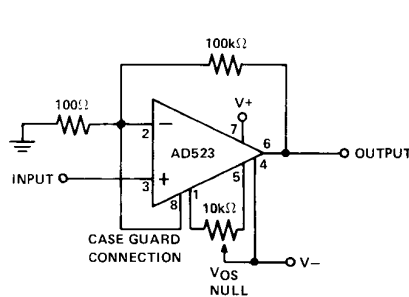
* Specifications same as AD523J.

** Subject to change. Refer to latest Microcircuit Price List.

TYPICAL CIRCUIT APPLICATIONS OF THE AD523

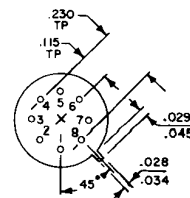
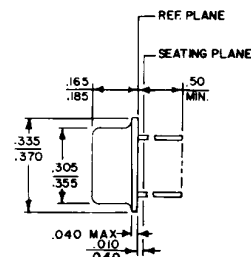


ULTRA LOW CURRENT TO VOLTAGE CONVERTER



ULTRA HIGH INPUT IMPEDANCE NON-INVERTING CIRCUIT

AD523 PACKAGE DIMENSION



MODIFIED TO-99

pkg code "H"