

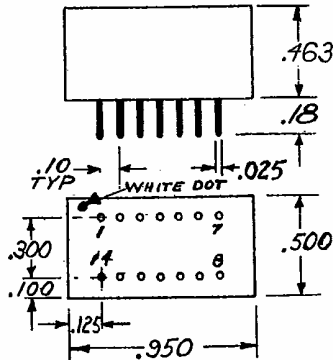


SOLID STATE ELECTRONICS CORPORATION

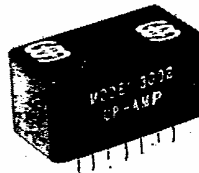
15321 RAYEN STREET,
SEPULVEDA, CALIFORNIA 91343
TELEPHONE: AREA CODE (213)
894-2271

MODEL 3002 SOLID STATE SILICON DIFFERENTIAL OPERATIONAL DC AMPLIFIER

FOR LOW-LEVEL INSTRUMENTATION & BRIDGE APPLICATIONS



THIS UNIT PLUGS INTO A STANDARD
14 PIN DUAL-IN-LINE (DIP) SOCKET,
OR IT CAN BE WIRED OR SOLDERED
DIRECTLY TO A PRINTED WIRING BOARD.



ACTUAL SIZE

ADDITIONAL FEATURES

Completely Solid State Silicon Design
Hybrid Integrated Circuit
DC and AC operation
Differential or Single-Ended Input
Inverted and Non-Inverted Operation
Large Differential Voltage Range

High Gain-Bandwidth Product
Differential Input, Single Ended Output
Versatile, Precise Transfer Functions
High Linearity, Low Distortion, Low Noise
Wide Temperature Range
Solid Encapsulation
Small Size, Light Weight, Rugged

TYPICAL APPLICATIONS

Precision Differential Operational Amplifier For Analog Computers
Thermocouple, Strain Gage and Transducer Bridges
Low Level Instrumentation
Log Period Integrators
Summation, Subtraction, Differentiation

High Performance Voltage Followers
High Input Impedance Isolation Amplifiers
Precision Comparators, Regulators, Simulators
Reference Voltage and Power Supply Regulators
Active Filters

TYPICAL OPERATING CHARACTERISTICS (25°C)

Open-Loop Voltage Gain	20 x 10 ⁶ (146 db)
Common Mode Rejection	100 db
Output Voltage Range (R _L > 10K)	± 14 volts
Output Current Range	± 5 milliamperes
Gain-Bandwidth Product	2 mcps
Differential Input Resistance	300 megohms
Common Mode Input Resistance	1000 megohms
Output Impedance	100 ohms
Frequency Response (Gain = 1000)	10 kcps
Operating Temperature Range	-55°C. to +125°C.
Supply Voltages and Currents	± 15 volts
Supply Currents	To +28 ma, - 17ma
Power Consumption	200 milliwatts

MECHANICAL-ENVIRONMENTAL CHARACTERISTICS

DIMENSIONS:
0.50 x 0.95 x 0.47 inches

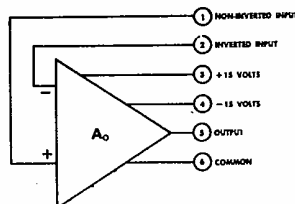
WEIGHT:
Nominal 8 grams.

ENCLOSURE:
Solid epoxy encapsulated plug-in unit

SHOCK:
10,000 G.

VIBRATION:
100 G, zero to 2000 cps.

ACCELERATION:
5,000 G.



CONNECTIONS

0.6 MICROVOLT/°C.
TEMPERATURE DRIFT
5 MICROVOLT/ WEEK
OFFSET VOLTAGE
DRIFT
2 PICOAMP/°C. OFFSET
CURRENT DRIFT
300 MEGOHM INPUT
IMPEDANCE
WIDE COMMON MODE
RANGE

NO FREQUENCY
COMPENSATION
REQUIRED
SHORT CIRCUIT
PROTECTION
ZERO OFFSET VOLTAGE
NULL CAPABILITY
NO LATCH-UP

GENERAL DESCRIPTION

The Model 3002 is a variable high gain, differential input, single-ended output DC operational amplifier suitable for low level instrumentation and bridge input applications. The differential input capability and the extremely high open-loop gain allows versatile utilization of external networks and closed-loop negative feedback to achieve exceptional stability, high linearity and precise predictable transfer functions.

The design is completely solid state and uses only silicon semiconductors and integrated circuits. An active internal low power temperature regulator isolated within a high thermal resistance package, is used to maintain a constant substrate temperature above the highest ambient up to 125°C. This provides very stable DC amplification, thereby replacing complex chopper stabilized amplifiers. Typical stability is 0.6 microvolts per degree C. and 5 microvolts per week, ideal for analog application with thermocouple bridges, strain gage transducers, long time constant integrators, comparators, precision analog computers, analog-to-digital and digital-to-analog converters. A wide common mode voltage range and elimination of "latch-up" make the Model 3002 useful as a voltage follower.

High gain (20 million open-loop, 1000 closed-loop) and a wide range of operating voltages assures excellent performance in integrator, summing amplifier and all feedback applications. Additional features include output short-circuit protection of indefinite duration and no requirement for external frequency compensation. Internal 6db/octave roll-off provides stability in closed-loop applications.

The solid state miniature design assures stable operation through severe modes of shock, vibration and acceleration. Its reliable performance makes it particularly suited for aerospace, military, industrial and medical applications.

ABSOLUTE MAXIMUM RATINGS

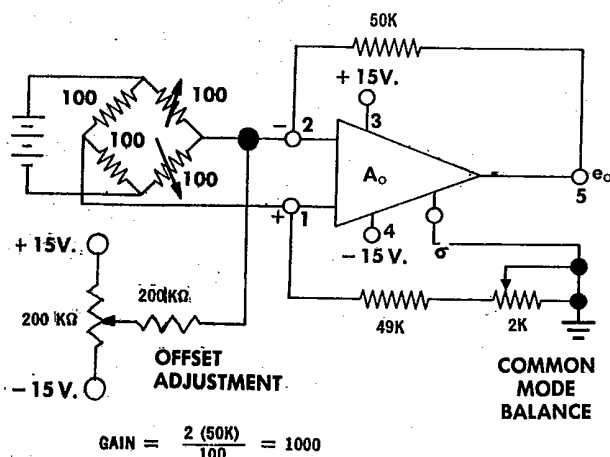
Supply Voltage	±18 Volts
Differential Input Voltage	±10 Volts
Output Current	±5 milliamperes
Common Mode Input Voltage	±15 volts
Differential Input Voltage	±10 volts
Operating Temperature	-55°C. to +125°C.
Storage Temperature	-65°C. to +150°C.
Lead Temperature (Soldering, 60 sec.)	300°C.
Output Short-Circuit Duration	Indefinite
(Ground or Supply, 75°C.)	

TYPICAL ELECTRONIC CHARACTERISTICS AT 25°C.

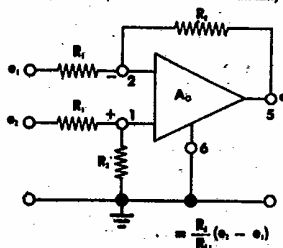
SYMBOL	CHARACTERISTIC	MAGNITUDE	UNITS
A _o	NON-INVERTED OPEN-LOOP VOLTAGE GAIN	20 x 10 ⁶	—
(CMR)	COMMON MODE REJECTION	100	decibels
E _{CM}	COMMON MODE INPUT VOLTAGE RANGE	±15	volts
R _{ID}	DIFFERENTIAL INPUT RESISTANCE	300	megohms
R _{CM}	COMMON MODE INPUT RESISTANCE	1000	megohms
Z _o	OUTPUT IMPEDANCE	100	ohms
E _o	OUTPUT VOLTAGE RANGE (R _L > 2K ohms)	±13	volts
I _o	OUTPUT CURRENT RANGE	±5	milliamps
$\frac{\Delta A}{\Delta T}$	CLOSED-LOOP DC VOLTAGE GAIN STABILITY VS TEMPERATURE CHANGE	A=1000; R _i =50Ω; R _f =50KΩ	.0005%/°C.
$\frac{\Delta A_o}{\Delta V_s}$	OPEN-LOOP DC VOLTAGE GAIN CHANGE VS SUPPLY VOLTAGE CHANGE	ΔV _s = ±3 Volts	0.1%/volt
$\frac{\Delta A}{\Delta V_s}$	CLOSED-LOOP DC VOLTAGE GAIN CHANGE VS SUPPLY VOLTAGE CHANGE	A=1000; R _f =50KΩ; R _i =50Ω	.001%/volt
E _{OF}	OUTPUT VOLTAGE OFFSET, REFERRED TO INPUT (OR DC INPUT VOLTAGE OFFSET)	2 000	microvolts
$\frac{\Delta E_{OF}}{\Delta T}$	OUTPUT VOLTAGE OFFSET CHANGE VS TEMPERATURE CHANGE REFERRED TO INPUT	0.6	microvolts/°C.
$\frac{\Delta E_{OF}}{\Delta V_s}$	OUTPUT VOLTAGE OFFSET CHANGE VS SUPPLY VOLTAGE CHANGE, REFERRED TO INPUT (R _i < 100K ohms)	80	microvolts/volt
I _{OF}	OUTPUT CURRENT OFFSET, REFERRED TO INPUT	3.0	nanoamps
$\frac{\Delta I_{OF}}{\Delta T}$	OUTPUT CURRENT OFFSET CHANGE VS TEMPERATURE CHANGE, REFERRED TO INPUT	2	picoamps/°C.
E _N	OUTPUT NOISE VOLTAGE, REFERRED TO THE INPUT. (BW=10 to 500 cps. R _i < 50 ohms)	3	microvolts rms
E _D	LONG TERM OUTPUT VOLTAGE DRIFT REFERRED TO INPUT (R _i < 50 ohms)	5	microvolts/week
A _o f _c	OPEN-LOOP GAIN-BANDWIDTH PRODUCT	2	megacycle/sec.
f _c (1)	UNITY-GAIN FREQUENCY RESPONSE	20	kilocycles/sec.
f _c (100)	FREQUENCY RESPONSE AT GAIN OF 100	20	kilocycles/sec.
I _b	INPUT BIAS CURRENT	12	nanoamperes
$\frac{\Delta I_b}{\Delta T}$	INPUT BIAS CURRENT CHANGE VS TEMPERATURE CHANGE	15	picoamperes/°C.
t _r	TRANSIENT RESPONSE RISE TIME (UNITY GAIN, 5% OVERSHOOT)	0.3	microseconds
$\frac{\Delta E_o}{\Delta t}$	SLEW RATE (UNITY GAIN)	0.5	volts/microsecond
R _L	LOAD RESISTANCE, MINIMUM RECOMMENDED	2	kilohms
V _s	SUPPLY VOLTAGES	+15 & -15	volts
I _s	NOMINAL SUPPLY CURRENT (each supply)	+28, -17	milliamperes
P _C	POWER CONSUMPTION	200	milliwatts

APPLICATION CIRCUITS

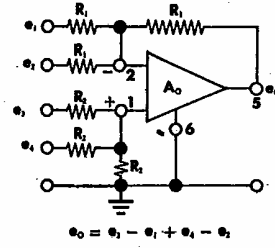
BRIDGE AMPLIFIER



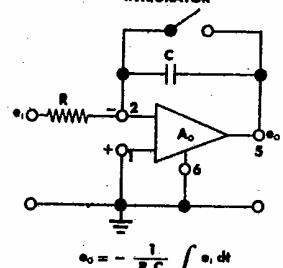
COMPARATOR OR SUBTRACTOR (DIFFERENTIAL AMPLIFIER)



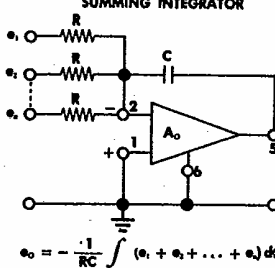
ADDER - SUBTRACTOR



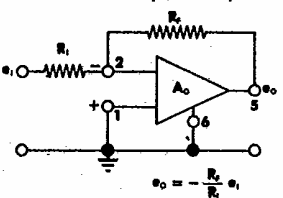
INTEGRATOR



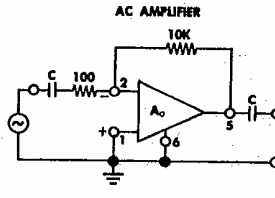
SUMMING INTEGRATOR



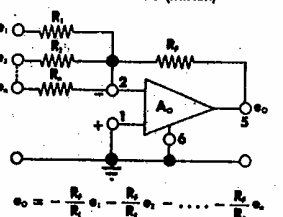
AMPLIFIER (INVERTING)



AC AMPLIFIER



ADDER (MIXER)



VOLTAGE FOLLOWER

