Am1501

Dual Operational Amplifiers

Distinctive Characteristics

- Low offset voltage
- Low offset current
- Guaranteed drift characteristics
- Offsets guaranteed over entire common mode and supply voltage ranges
- Slew rate of 10V/μs as a summing amplifier

FUNCTIONAL DESCRIPTION

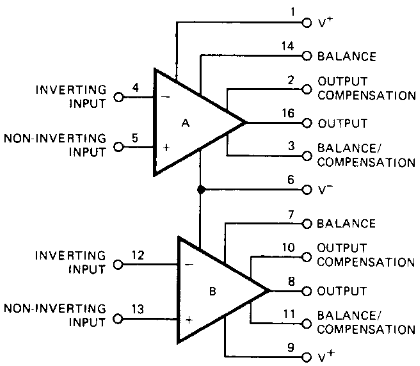
The Am1501 series are differential input, class AB output operational amplifiers. The inputs and outputs are protected against overload and the amplifiers may be frequency compensated with an external 30pF capacitor. The combination of low-input currents, low-offset voltage, low noise, and versatility of compensation classify the Am1501 series amplifiers for low level and general purpose applications.

DESCRIPTION

The Am1501 series of dual operational amplifiers are two LM101A type op amps in a single hermetic package. They are functionally, electrically and pin-for-pin equivalent to the National LH2101A series. Featuring all the same performance characteristics of the single, these duals offer in addition closer thermal tracking, lower weight, reduced insertion cost, and smaller size than two singles.

The Am1501M is specified for operation over the –55°C to +125°C military temperature range. The Am1501L is specified for operation over the –25°C to +85°C temperature range. The Am1501C is specified for operation over the 0°C to +70°C temperature range.

FUNCTIONAL DIAGRAM



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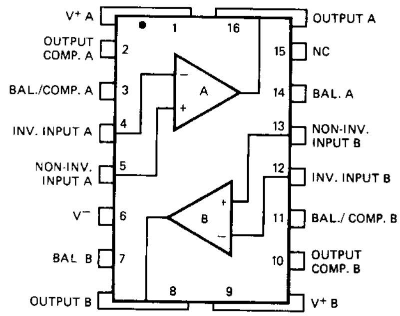
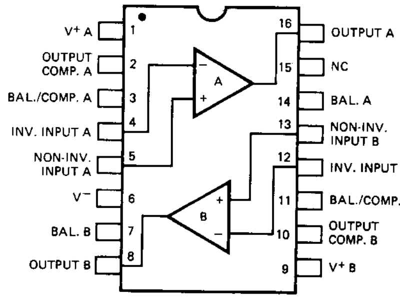
CONNECTION DIAGRAMS

Top Views

Dual-In-Line



Flat Package



Note: Pin 1 is marked for orientation.

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ORDERING INFORMATION

Part Number	Package Type	Temperature Range	Order Number
Am1501C	Hermetic Dip	0°C to +70°C	AM1501DC
	Flat Pak	0°C to +70°C	AM1501FC
Am1501L	Hermetic Dip	–25°C to +85°C	AM1501DL
	Flat Pak	–25°C to +85°C	AM1501FL
Am1501M	Hermetic Dip	–55°C to +125°C	AM1501DM
	Flat Pak	–55°C to +125°C	AM1501FM

MAXIMUM RATINGS

Supply Voltage	
Am1501M, Am1501L	±22V
Am1501C	±18V
Internal Power Dissipation (Note 1)	500mW
Differential Input Voltage	±30V
Input Voltage (Note 2)	±15V
Output Short-Circuit Duration	Indefinite
Operating Temperature Range	
Am1501M	−55°C to +125°C
Am1501L	−25°C to + 85°C
Am1501C	0°C to + 85°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 60 sec.)	300°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified) (Note 3)
(EACH AMPLIFIER)

Parameter (see definitions)	Conditions	Am1501C Min.	Am1501C Typ.	Am1501C Max.	Am1501M Am1501L Min.	Am1501M Am1501L Typ.	Am1501M Am1501L Max.	Units
Input Offset Voltage	$R_S \leq 50k\Omega$		2.0	7.5		0.7	2.0	mV
Input Offset Current			3.0	50		1.5	10	nA
Input Bias Current			70	250		30	75	nA
Input Resistance		0.5	2.0		1.5	4.0		MΩ
Supply Current (Total Both Amplifiers)	$V_S = \pm 20V$					3.6	6.0	mA
	$V_S = \pm 15V$		3.6	6.0				mA
Large Signal Voltage Gain	$V_S = \pm 15V$, $V_{OUT} = \pm 10V$, $R_L > 2.0k\Omega$	25	160		50	160		V/mV
Slew Rate	$V_S = \pm 20V$, $A_V = +1.0$		0.5			0.5		V/μs
The Following Specifications Apply Over The Operating Temperature Ranges								
Input Offset Voltage	$R_S \leq 50k\Omega$			10			3.0	mV
Input Offset Current				70			20	nA
Average Temperature Coefficient of Input Offset Voltage	$T_{A(min.)} \leq T_A \leq T_{A(max.)}$		6.0	30		3.0	15	μV/°C
Average Temperature Coefficient of Input Offset Current	$25°C \leq T_A \leq T_{A(max.)}$		0.01	0.3		0.01	0.1	nA/°C
	$T_{A(min.)} \leq T_A \leq 25°C$		0.02	0.6		0.02	0.2	nA/°C
Input Bias Current				300			100	nA
Large Signal Voltage Gain	$V_S = \pm 15V$, $V_{OUT} = \pm 10V$, $R_L > 2.0k\Omega$	25			25			V/mV
Input Voltage Range	$V_S = \pm 20V$				±15			V
	$V_S = \pm 15V$	+15,−12						V
Common Mode Rejection Ratio	$R_S \leq 50k\Omega$	70	90		80	96		dB
Supply Voltage Rejection Ratio	$R_S \leq 50k\Omega$	70	96		80	96		dB
Output Voltage Swing	$V_S = \pm 15V$, $R_L = 10k\Omega$	±12	±14		±12	±14		V
	$R_L = 2.0k\Omega$	±10	±13		±10	±13		V
Supply Current (Total Both Amplifiers)	$T_A = +125°C$, $V_S = \pm 20V$					2.4	5.0	mA

Notes: 1. The maximum junction temperature of the Am1501M is 150°C, while that of the Am1501L and Am1501C is 100°C. For operating temperatures, devices in the flat package, the derating is based on a thermal resistance of 185°C/W when mounted on a 1/16-inch-thick epoxy glass board with 0.03-inch-wide, 2-ounce copper conductors. The thermal resistance of the dual-in-line package is 100°C/W, junction to ambient.

2. For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

3. These specifications apply for $\pm 5V \leq V_S \leq \pm 20V$ and $-55°C \leq T_A \leq +125°C$, unless otherwise specified. With the Am1501L, however, all temperature specifications are limited to $-25°C \leq T_A \leq +85°C$. For the Am1501C these specifications apply for $0°C \leq T_A \leq +70°C$, $\pm 5V$ and $\leq V_S \leq \pm 15V$. Supply current and input voltage range are specified as $V_S = \pm 15V$ for the Am1501C. C_1 = 30pF unless otherwise specified.

FREQUENCY COMPENSATION CIRCUITS

Single Pole Compensation

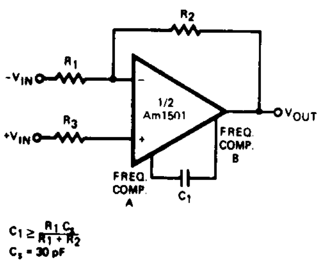

Figure 1

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Two Pole Compensation

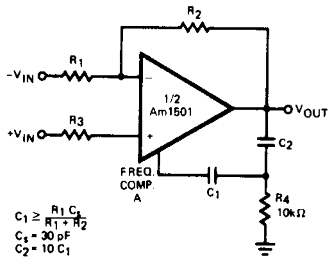

Figure 2

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Feedforward Compensation

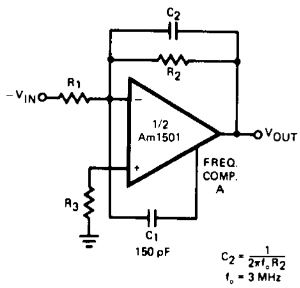

Figure 3

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Power supplies should be bypassed to ground at one point, minimum, on each card. More bypass points should be considered for five or more amplifiers on a single card. For applications using feed-forward compensation, the power supply leads of each amplifier should be bypassed with low inductance capacitors.

Compensating for Stray Input Capacitance/Large Feedback Resistance

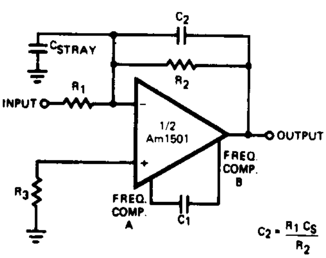

Figure 4

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Isolating Large Capacitive Loads

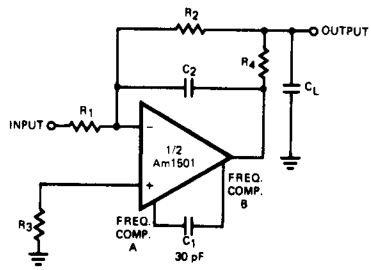

Figure 5

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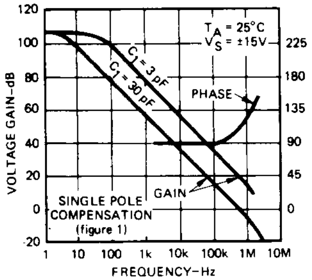
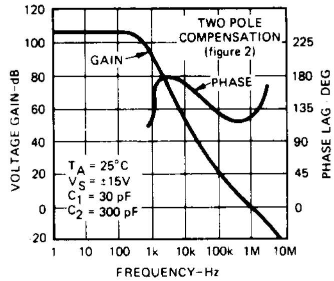
The values given for the frequency compensation capacitor guarantee stability only for source resistances less than 10kΩ, stray capacitances on the summing junction less than 5pF and capacitive loads smaller than 100pF. If any of these conditions is not met, it is necessary to use a larger compensation capacitor. Alternately, lead capacitors can be used in the feedback network to negate the effect of stray capacitance and large feedback resistors, or an RC network can be added to isolate capacitive loads.

PERFORMANCE CURVES (Note 3)

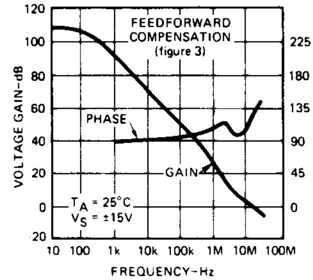
Open Loop Frequency Response



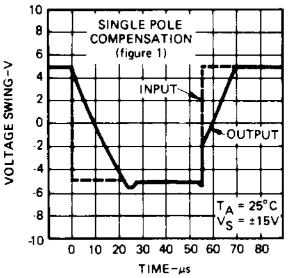
Open Loop Frequency Response



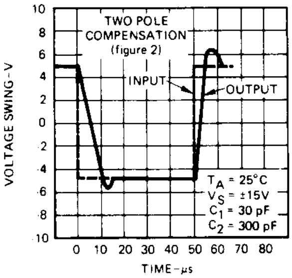
Open Loop Frequency Response



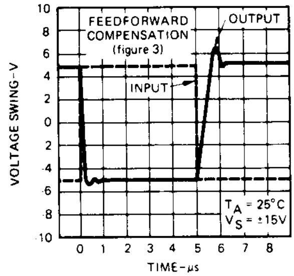
Voltage Follower Pulse Response



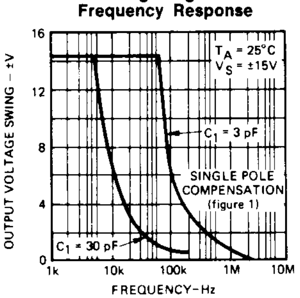
Voltage Follower Pulse Response



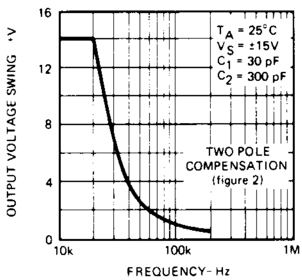
Inverter Pulse Response



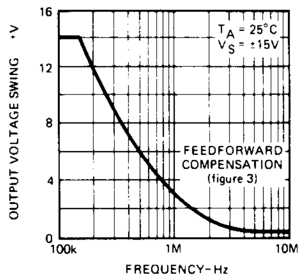
Large Signal Frequency Response



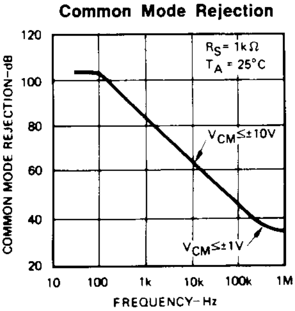
Large Signal Frequency Response



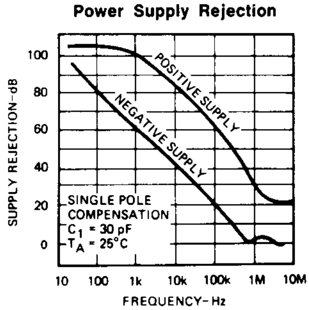
Large Signal Frequency Response



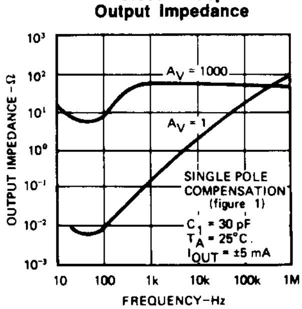
Common Mode Rejection



Power Supply Rejection



Closed Loop Output Impedance



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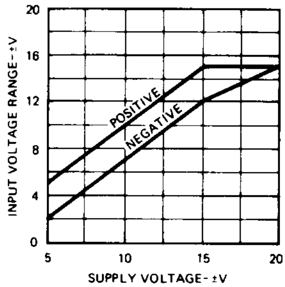
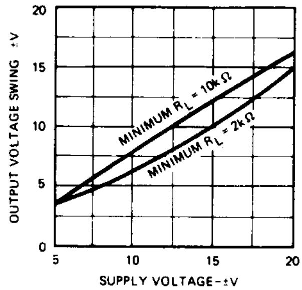
GUARANTEED PERFORMANCE CURVES (Note 3)

(Curves apply over the Operating Temperature Ranges)

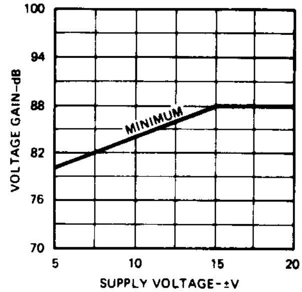
Input Voltage Range



Output Swing

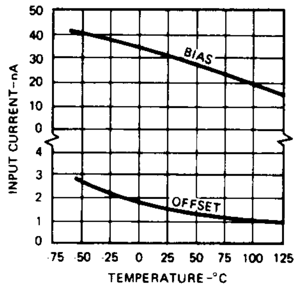


Voltage Gain

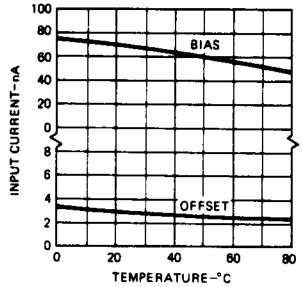


PERFORMANCE CURVES (Note 3)

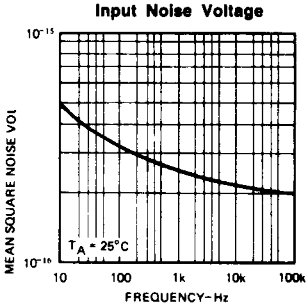
Input Current – Am1501M, L



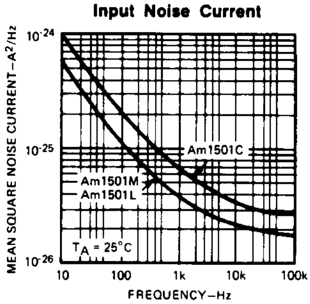
Input Current – Am1501C



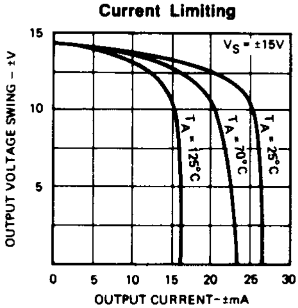
Input Noise Voltage



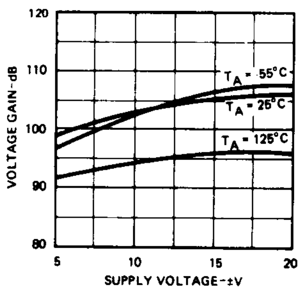
Input Noise Current



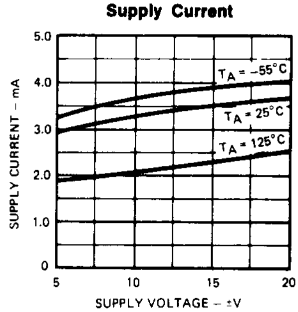
Current Limiting



Voltage Gain



Supply Current



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