Am101A/201A/301A

Operational Amplifiers

Description: The Am101A, Am201A and Am301A monolithic operational amplifiers are functionally, electrically and pin-for-pin equivalent to the National LM101A, LM201A, and LM301A. They are available in the hermetic TO-99 metal can, dual-in-line, and flat packages.

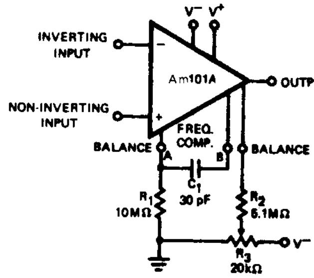
Distinctive Characteristics: 100% reliability ssurance testing including high-temperature bake, temperature cycling, centrifuge and fine leak hermeticity testing in compliance with MIL-STD-883.

Electrically tested and optically inspected dice for the assemblers of hybrid products.

FUNCTIONAL DESCRIPTION

The Am101A/Am201A/Am301A 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 Am101A/Am201A/Am301A amplifiers for low level and general purpose applications.

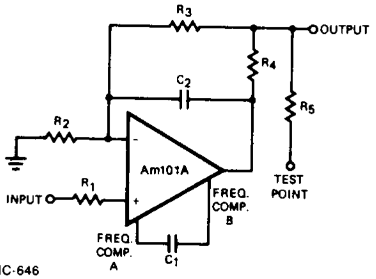
FUNCTIONAL DIAGRAM



LIC-645

APPLICATIONS

INPUT/OUTPUT OVERLOAD PROTECTION



LIC-646

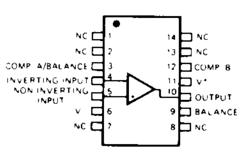
If an input is driven from a low-impedance source, a series resistor, R, should be used to limit the peak instantaneous output current of the source to less than 100 mA. A large capacitor (>0.1μF) is equivalent to a low-source impedance and should be protected against by an isolation resistor.
The amplifier output is protected against damage from shorts to ground or to the power supplies by device design. Protection of the output from voltages exceeding the specified operating power supplies can be obtained by isolating the output via limiting resistors R_4 or R_5.
The power supplies must never become reversed, even under transient conditions. Reverse voltages as low as 1 volt can cause damage through excessive current. This hazard can be reduced by using clamp diodes of high peak current rating connected to the device supply lines.

ORDERING INFORMATION

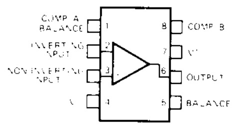
Part Number	Package Type	Temperature Range	Order Number
Am301A	DIP	0°C to +70°C	LM301AD
	Metal Can	0°C to +70°C	LM301AH
	Molded DIP	0°C to +70°C	LM301AN
	Dice	0°C to +70°C	LD301A
Am201A	DIP	−25°C to +85°C	LM201AD
	Metal Can	−25°C to +85°C	LM201AH
	Flat Pak	−25°C to +85°C	Lm201AF
Am101A	DIP	−55°C to +125°C	LM101AD
	Metal Can	−55°C to +125°C	LM101AH
	Flat Pak	−55°C to +125°C	LM101AF
	Dice	−55°C to +125°C	LD101A

CONNECTION DIAGRAM
Top Views

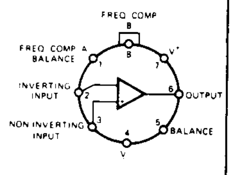
Dual-In-Line



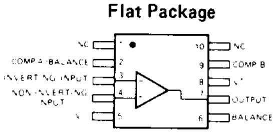
Dual-In-Line



Metal Can



Flat Package



LIC-647

NOTES:

(1) On Metal Can, pin 4 is connected to case.

(2) On DIP, pin 8 is connected to bottom of package.

(3) On Flat Package, pin 5 is connected to bottom of package.

MAXIMUM RATINGS

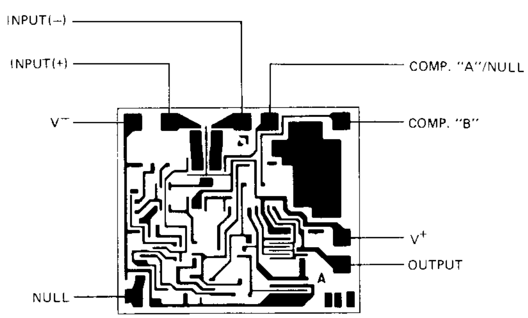
Supply Voltage Am101A, 201A Am301A	 ±22V ±18V
Internal Power Dissipation (Note 1)	500 mW
Differential Input Voltage	±30V
Input Voltage (Note 2)	±15V
Output Short-Circuit Duration	Indefinite
Operating Temperature Range Am101A Am201A Am301A	 −55°C to +125°C −25°C to +85°C 0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 60 sec.)	300°C

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

Parameter (see definitions)	Conditions	Am301A Min	Am301A Typ	Am301A Max	Am101A Am201A Min	Am101A Am201A Typ	Am101A Am201A Max	Units
Input Offset Voltage	$R_S \leq 50\ k\Omega$		2.0	7.5		0.7	2.0	mV
Input Offset Current			3	50		1.5	10	nA
Input Bias Current			70	250		30	75	nA
Input Resistance		0.5	2		1.5	4		MΩ
Supply Current	$V_S = \pm 20V$ $V_S = \pm 15V$		 1.8	 3.0		1.8	3.0	mA mA
Large Signal Voltage Gain	$V_S = \pm 15\ V$, $V_{OUT} = \pm 10\ V$, $R_L > 2\ k\Omega$	25	160		50	160		V/mV
Slew Rate	$V_S = \pm 20V$, $A_V = +1$		0.5			0.5		V/μs
The Following Specifications Apply Over The Operating Temperature Ranges								
Input Offset Voltage	$R_S \leq 50\ k\Omega$			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	$25°C \leq T_A \leq T_{A\ (max)}$ $T_{A\ (min)} \leq T_A \leq 25°C$		0.01 0.02	0.3 0.6		0.01 0.02	0.1 0.2	nA/°C nA/°C
Input Bias Current				300			100	nA
Large Signal Voltage Gain	$V_S = \pm 15\ V$, $V_{OUT} = \pm 10\ V$, $R_L > 2\ k\Omega$	25			25			V/mV
Input Voltage Range	$V_S = \pm 20\ V$ $V_S = \pm 15\ V$	 +15, −12			±15			V V
Common Mode Rejection Ratio	$R_S \leq 50\ k\Omega$	70	90		80	96		dB
Supply Voltage Rejection Ratio	$R_S \leq 50\ k\Omega$	70	96		80	96		dB
Output Voltage Swing	$V_S = \pm 15V$, $R_L = 10\ k\Omega$, $R_L = 2\ k\Omega$,	±12 ±10	±14 ±13		±12 ±10	±14 ±13		V V
Supply Current	$T_A = +125°C$ $V_S = \pm 20\ V$					1.2	2.5	mA

Notes:
1. Derate Metal Can package at 6.8 mW/°C for operation at ambient temperatures above 75°C and the Dual In-Line package at 9 mW/°C for operation at ambient temperatures above 95°C, and the Flat Package at 5.4 mW/°C for operation at ambient temperatures above 57°C.
2. For supply voltages less than ±15 V, the maximum input voltage is equal to the supply voltage.
3. Unless otherwise specified, these specifications apply for supply voltages from ±5 V to ±20 V for the 101A and 201A, and from ±5 V to ±15 V for the 301A

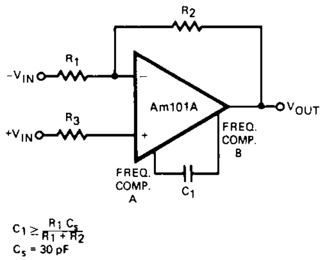
Metallization and Pad Layout



49 X 56 Mils

FREQUENCY COMPENSATION CIRCUITS

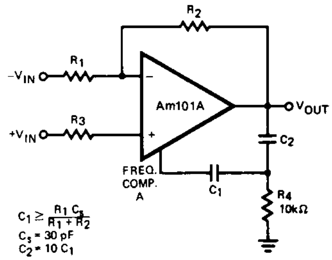
Single Pole Compensation



LIC-648

Figure 1

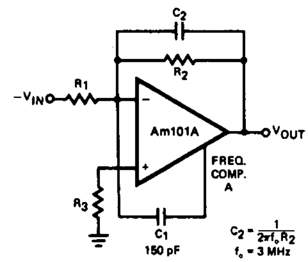
Two Pole Compensation



LIC-649

Figure 2

Feedforward Compensation

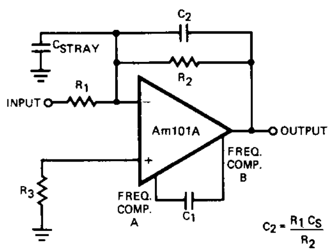


LIC-650

Figure 3

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.

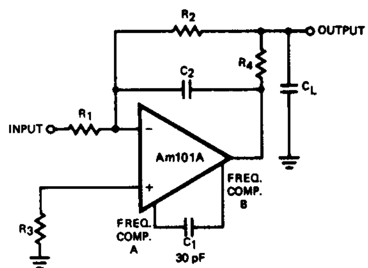
Compensating for Stray Input Capacitance/Large Feedback Resistance



LIC-651

Figure 4

Isolating Large Capacitive Loads



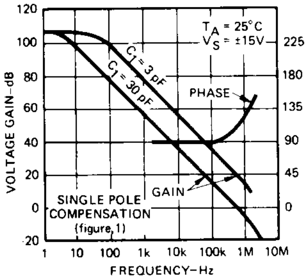
LIC-652

Figure 5

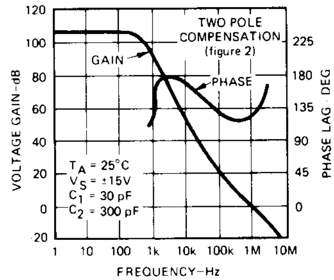
The values given for the frequency compensation capacitor guarantee stability only for source resistances less than 10kΩ, stray capacitances on the summing junction less than 5pF and capacitive loads smaller than 100pF. If any of these conditions is not met, it is necessary to use a larger compensation 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 8)

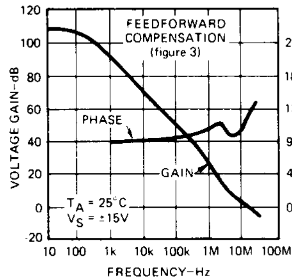
Open Loop Frequency Response



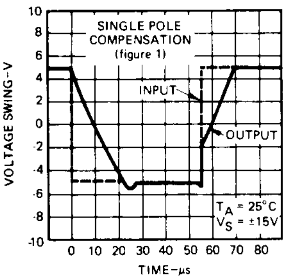
Open Loop Frequency Response



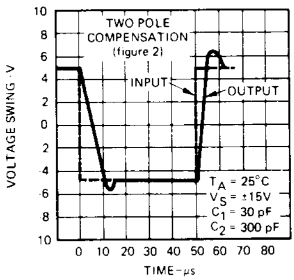
Open Loop Frequency Response



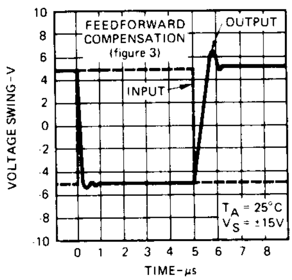
Voltage Follower Pulse Response



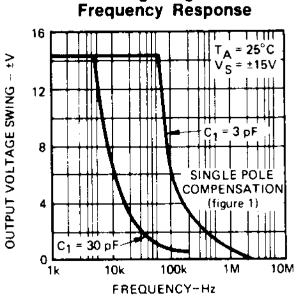
Voltage Follower Pulse Response



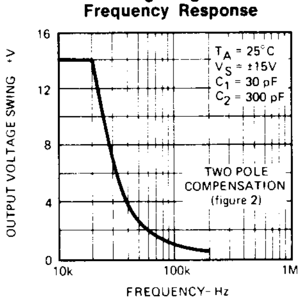
Inverter Pulse Response



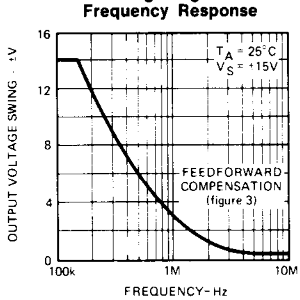
Large Signal Frequency Response



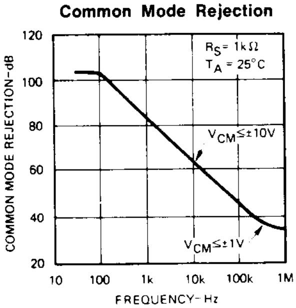
Large Signal Frequency Response



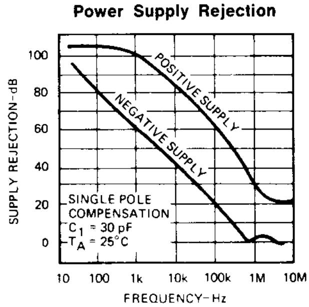
Large Signal Frequency Response



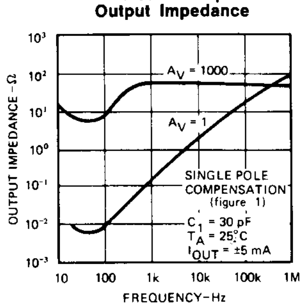
Common Mode Rejection



Power Supply Rejection



Closed Loop Output Impedance

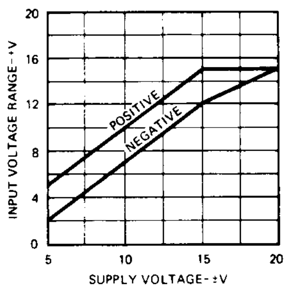


LIC-653

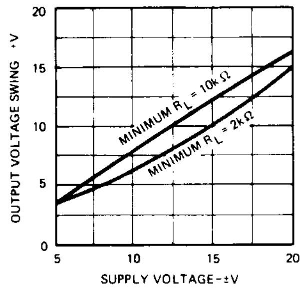
GUARANTEED PERFORMANCE CURVES (Note 3)

(Curves apply over the Operating Temperature Ranges)

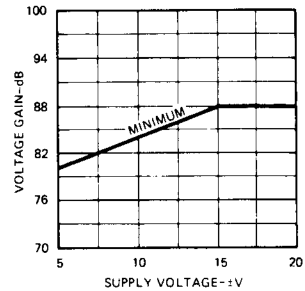
Input Voltage Range



Output Swing

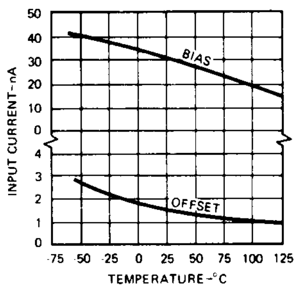


Voltage Gain

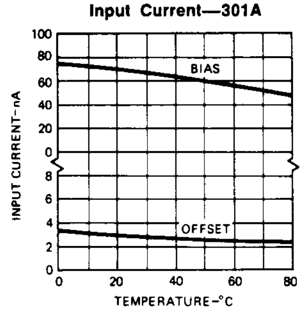


PERFORMANCE CURVES (Note 3)

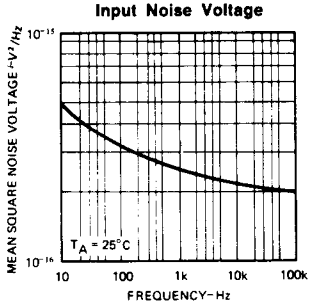
Input Current—101A, 201A



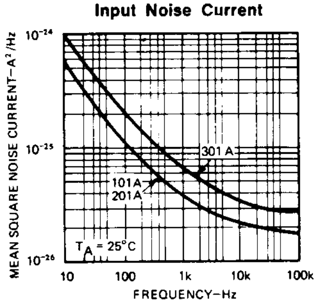
Input Current—301A



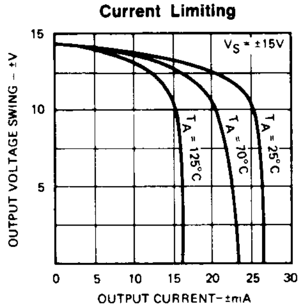
Input Noise Voltage



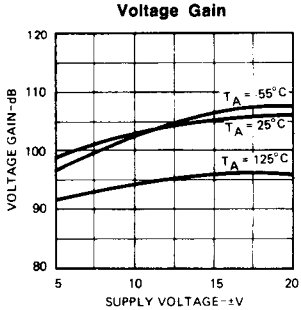
Input Noise Current



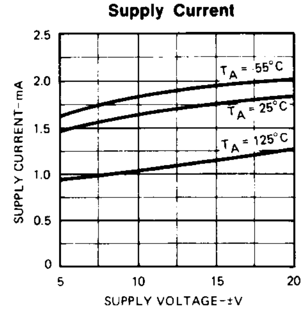
Current Limiting



Voltage Gain



Supply Current



LIC-654

4