Am108/208/308•Am108A/208A/308A

Operational Amplifiers

Description: The 108, 208, 308, 108A, 208A and 308A monolithic operational amplifiers are functionally, electrically and pin-for-pin equivalents to the National LM108, LM208, LM308, LM108A, LM208A and LM308A. They are available in the hermetic TO-99 metal can, dual-in-line, and flat packages.

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

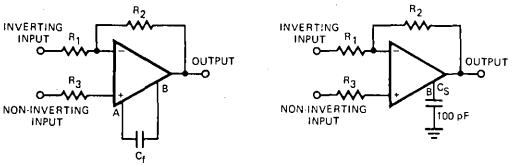
Electrically tested and optically inspected dice for the assemblers of hybrid products.

FUNCTIONAL DESCRIPTION

These differential input, precision amplifiers provide low input current and offset voltage competitive with FET and chopper stabilized amplifiers. They feature low power consumption over a supply voltage range of ±2V to ±20V. The amplifiers may be frequency compensated with a single external capacitor and are pin-for-pin interchangeable with the 101A/201A/301A. The 108A, 208A, and 308A are high performance selections from the 108/208/308 amplifier family.

FUNCTIONAL DIAGRAM

Frequency Compensation Circuits

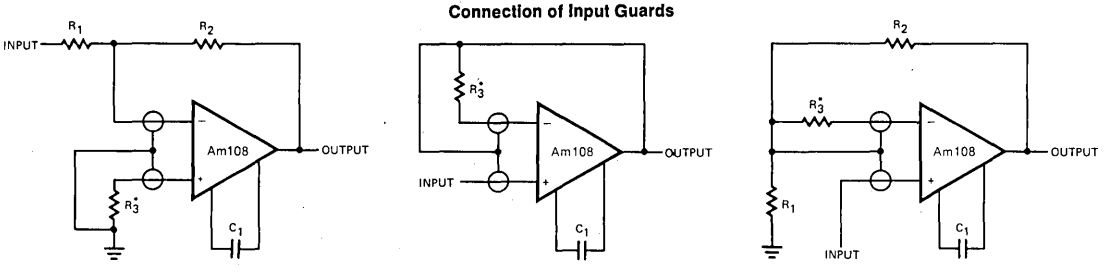


$$C_f \geq C_o\left(\frac{1}{1+\frac{R_2}{R_1}}\right)$$

C_o = 30 pF

APPLICATIONS

Connection of Input Guards



* Use to compensate for large source resistances.

NOTE: $\frac{R_1 R_2}{R_1 + R_2}$ Must be LOW impedance

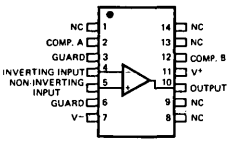
ORDERING INFORMATION

Part Number	Package Type	Temperature Range	Order Number
Am308	Hermetic DIP	0°C to +70°C	LM308D
	TO-99	0°C to +70°C	LM308H
	Molded DIP	0°C to +70°C	LM308N
	Dice	0°C to +70°C	LD308
Am308A	Hermetic DIP	0°C to +70°C	LM308AD
	TO-99	0°C to +70°C	LM308AH
	Molded DIP	0°C to +70°C	LM308AN
	Dice	0°C to +70°C	LD308A
Am208	Hermetic DIP	-25°C to +85°C	LM208D
	TO-99	-25°C to +85°C	LM208H
Am208A	Hermetic DIP	-25°C to +85°C	LM208AD
	TO-99	-25°C to +85°C	LM208AH
Am108	Hermetic DIP	-55°C to +125°C	LM108D
	TO-99	-55°C to +125°C	LM108H
	Dice	-55°C to +125°C	LD108
Am108A	Hermetic DIP	-55°C to +125°C	LM108AD
	TO-99	-55°C to +125°C	LM108AH
	Dice	-55°C to +125°C	LD108A

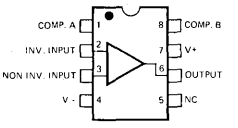
CONNECTION DIAGRAMS

Top Views

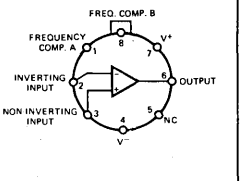
Dual-In-Line



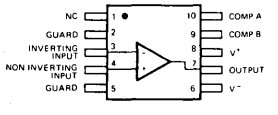
Dual-In-Line



Metal Can



Flat Package



NOTES:

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

(2) On DIP, pin 7 is connected to bottom of package.

(3) On Flat Package, pin 6 is connected to bottom of package.

MAXIMUM RATINGS

Supply Voltage Am108, 208, 108A, 208A, Am308, 308A	 ±20 V ±18 V
Internal Power Dissipation (Note 1)	500 mW
Differential Input Current (Note 2)	±10 mA
Input Voltage (Note 3)	±15 V
Output Short-Circuit Duration	Indefinite
Operating Temperature Range Am108, 108A Am208, 208A Am308, 308A	 −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 4)

Parameter (see definitions)	Conditions	Am308 Min.	Am308 Typ.	Am308 Max.	Am308A Min.	Am308A Typ.	Am308A Max.	Am108 Am208 Min.	Am108 Am208 Typ.	Am108 Am208 Max.	Am108A Am208A Min.	Am108A Am208A Typ.	Am108A Am208A Max.	Units
Input Offset Voltage			2.0	7.5		0.3	0.5		0.7	2.0		0.3	0.5	mV
Input Offset Current			0.2	1.0		0.2	1.0		0.05	0.2		0.05	0.2	nA
Input Bias Current			1.5	7		1.5	7		0.8	2.0		0.8	2.0	nA
Input Resistance		10	40		10	40		30	70		30	70		MΩ
Supply Current	V_S = ±20 V V_S = ±15 V		0.3	0.8		0.3	0.8		0.3	0.6		0.3	0.6	mA
Large Signal Voltage Gain	V_S = ±15 V, V_{OUT} = ±10 V, $R_L \geq 10$ kΩ	25	300		80	300		50	300		80	300		V/mV
The Following Specifications Apply Over The Operating Temperature Ranges														
Input Offset Voltage				10			0.73			3.0			1.0	mV
Input Offset Current				1.5			1.5			0.4			0.4	nA
Average Temperature Coefficient of Input Offset Voltage			6.0	30		1.0	5.0		3.0	15		1.0	5.0	μV/°C
Average Temperature Coefficient of Input Offset Current			2	10		2.0	10		0.5	2.5		0.5	2.5	pA/°C
Input Bias Current				10			10			3.0			3.0	nA
Large Signal Voltage Gain	V_S = ±15 V, V_{OUT} = ±10 V, $R_L \geq 10$ kΩ	15			60			25			40			V/mV
Input Voltage Range	V_S = ±15 V	±13.5			±13.5			±13.5			±13.5			V
Common Mode Rejection Ratio		80	100		96	110		85	100		96	110		dB
Supply Voltage Rejection Ratio		80	96		96	110		80	96		96	110		dB
Output Voltage Swing	V_S = ±15 V, R_L = 10 kΩ,	±13	±14		±13	±14		±13	±14		±13	±14		V
Supply Current	V_S = ±20 V V_S = ±15 V		0.6	1.0		0.6	0.8		0.15	0.4		0.15	0.4	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.
2. The inputs are shunted with back-to-back diodes for overvoltage protection. Therefore, excessive current will flow if a differential input voltage in excess of 1 V is applied between the inputs unless some limiting resistance is used.
3. For supply voltages less than ±15V, the maximum input voltage is equal to the supply voltage.
4. Unless otherwise specified, these specifications apply for supply voltages from ±5 V to ±20 V for the 108, 208, 108A and 208A and from ±5 V to ±15 V for the 308 and 308A.

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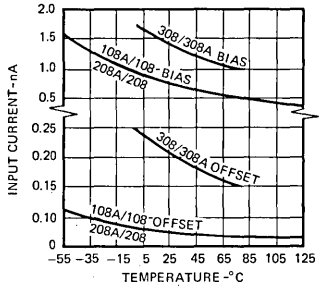
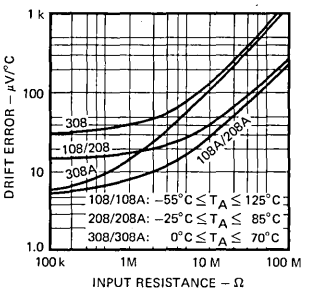
TYPICAL PERFORMANCE CURVES

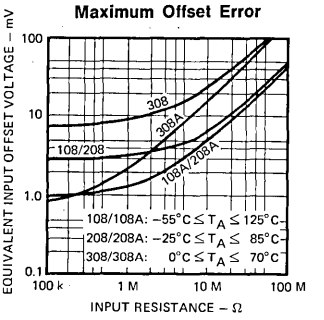
Input Currents



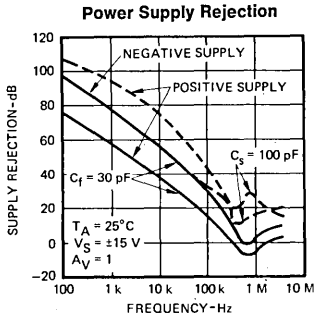
Maximum Drift Error



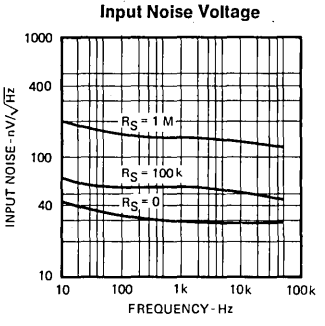
Maximum Offset Error



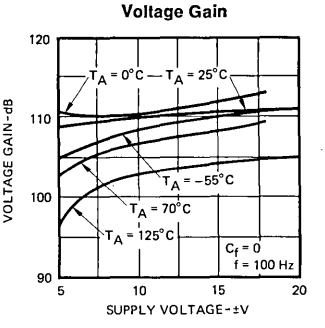
Power Supply Rejection



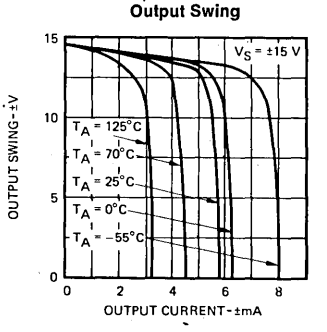
Input Noise Voltage



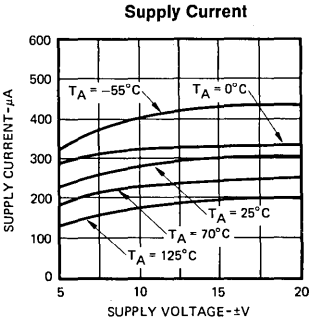
Voltage Gain



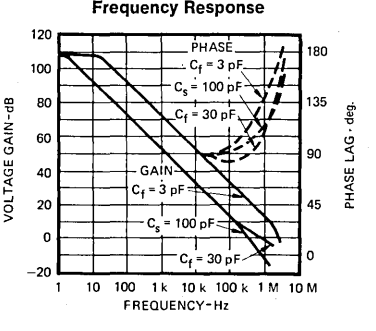
Output Swing



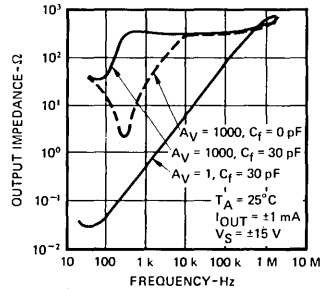
Supply Current



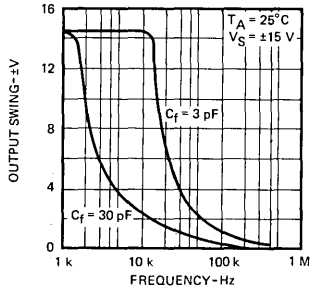
Open Loop Frequency Response



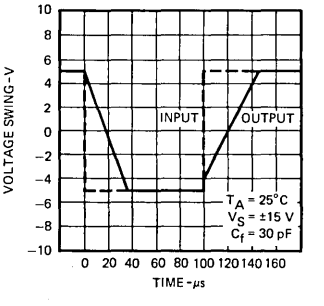
Closed Loop Output Impedance



Large Signal Frequency Response



Voltage Follower Pulse Response



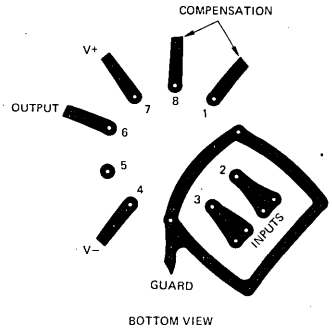
ADDITIONAL APPLICATION INFORMATION

GUARDING

Extra care must be taken in the assembly of printed circuit boards to take full advantage of the low input currents of the 108 amplifier. Boards must be thoroughly cleaned with TCE or alcohol and blown dry with compressed air. After cleaning, the boards should be coated with epoxy or silicone rubber to prevent contamination.

Even with properly cleaned and coated boards, leakage currents may cause trouble at 125°C, particularly since the input pins are adjacent to pins that are at supply potentials. This leakage can be significantly reduced by using guarding to lower the voltage difference between the inputs and adjacent metal runs. Input guarding of the 8-lead TO-99 package is accomplished by using a 10-lead pin circle, with the leads of the device formed so that the holes adjacent to the inputs are empty when it is inserted in the board. The guard, which is a conductive ring surrounding the inputs, is connected to a low-impedance point that is at approximately the same voltage as the inputs. Leakage currents from high-voltage pins are then absorbed by the guard.

The pin configuration of the dual-in-line package is designed to facilitate guarding, since the pins adjacent to the inputs are not used (this is different from the standard 741 and 101A pin configuration.)



Board layout for Input Guarding with TO-99 package.

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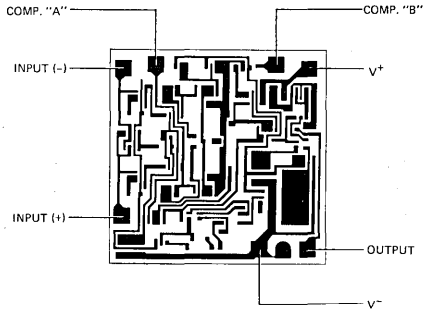
Metallization and Pad Layout



56 x 56 Mils