INTERSIL

LM108/A, LM308/A
Low Level Operational Amplifiers

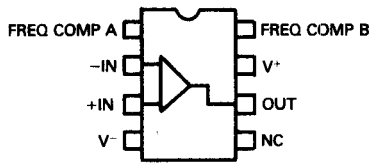
FEATURES

- Input Bias Current – 2 nA max to 7 nA max
- Input Offset Current – 0.2 nA max to 1 nA max
- Input Offset Voltage – 0.5 mV max to 7.5 mV max
- $\Delta Vos/\Delta T$ – 5 $\mu V/°C$ to 30 $\mu V/°C$
- $\Delta Ios/\Delta T$ – 2.5 pA/°C to 10 pA/°C
- Pin for Pin Replacement for 101A/301A

GENERAL DESCRIPTION

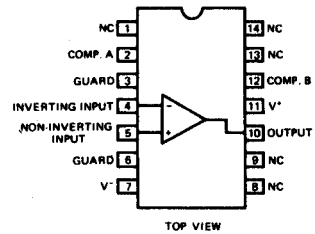
These differential input, precision amplifiers provide low input currents and offset voltages competitive with FET and chopper stabilized amplifiers. They feature low power consumption over a supply voltage range of >2V to ±20V. The amplifiers may be frequency compensated with a single external capacitor. The LM108A and LM308A are high performance selections from the 108/308 amplifier family.

PIN CONFIGURATIONS

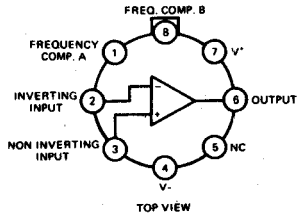


(outline dwg PA)

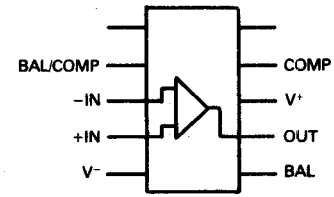
DUAL-IN-LINE PACKAGE



(outline dwg JD)



(outline dwg TO-99)



(outline dwg FB-1)

ORDERING INFORMATION

Part number	TO-99 Can	8 pin MiniDIP	14 pin CERDIP	10 pin Flatpak	Dice
LM108A LM308A	LM108AH* LM308AH	LM308AN	LM108AJ LM308AJ	LM108AF LM308AF	LM108A/D LM308A/D
LM108 LM308	LM108H* LM308H	LM308N	LM108J LM308J	LM108F LM308F	LM108/D LM308/D

*If 883B processing is desired add /883B to order number.

INTERSIL

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	
108, 108A	±20V
308, 308A	±18V
Internal PowerDissipation (Note 1)	
Metal Can (TO-99	500 mW
DIP	500 mW
Differential Input Current (Note 2)	±10 mA
Input Voltage (Note 3)	±15V
Output Short-CircuitDuration	Indefinite
Operating TemperatureRange	
108, 108A	−55°C to +125°C
308, 308A	0°C to +70°C
Storage TemperatureRange	−65°C to +150°C
Lead Temperature (Soldering, 60 sec.)	300°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified) (Note 4)

PARAMETER	CONDITIONS	308			308A			108			108A			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
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 = ±20V								0.3	0.6		0.3	0.6	mA
	V_S = ±15V		0.3	0.8		0.3	0.8							mA
Large Signal Voltage Gain	V_S = ±15V, V_{OUT} = ±10V, $R_L \geq 10\ k\Omega$	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 = ±15V, V_{OUT} = ±10V, $R_L \geq 10\ k\Omega$	15			60			25			40			V/mV
Input Voltage Range	V_S = ±15V	±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 = ±15V, R_L = 10 kΩ	±13	±14		±13	±14		±13	±14		±13	±14		V
Supply Current	T_A = +125°C, V_S = ±20V								0.15	0.4		0.15	0.4	mA

NOTE 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.

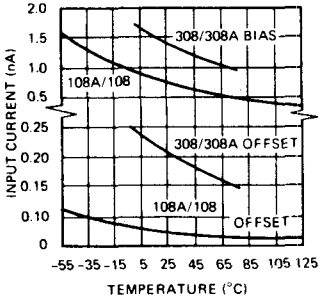
NOTE 2: The inputs are shunted with back-to-back diodes for over-voltage protection. Therefore, excessive current will flow if a differential input voltage in excess of 1V is applied between the inputs unless some limiting resistance is used.

NOTE 3: For supply voltages less than ±15V, the maximum input voltage is equal to the supply voltage.

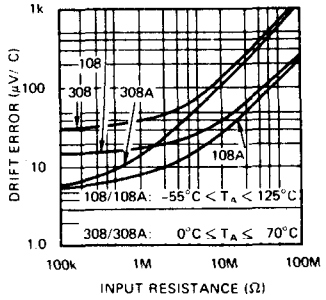
NOTE 4: Unless otherwise specified, these specifications apply for supply voltages from ±5V to ±20V for the 108, and 108A and ±5V to ±15V for the 308 and 308A.

TYPICAL PERFORMANCE CURVES

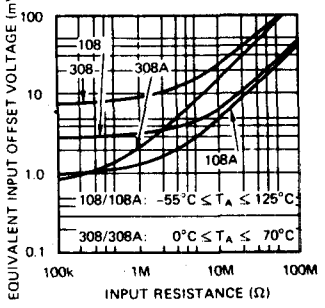
INPUT CURRENTS



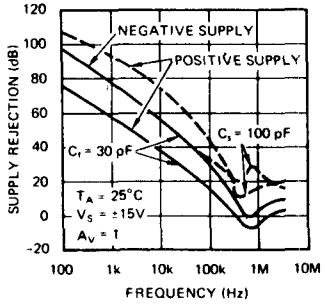
MAXIMUM DRIFT ERROR



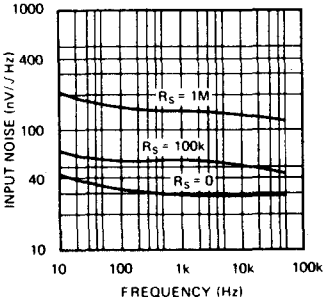
MAXIMUM OFFSET ERROR



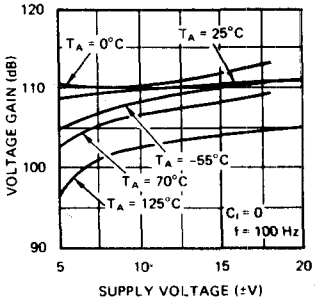
POWER SUPPLY REJECTION



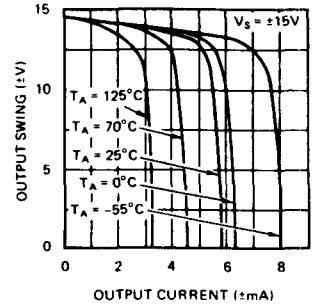
INPUT NOISE VOLTAGE



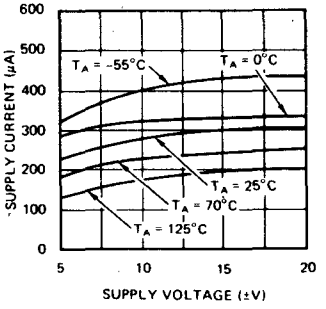
VOLTAGE GAIN



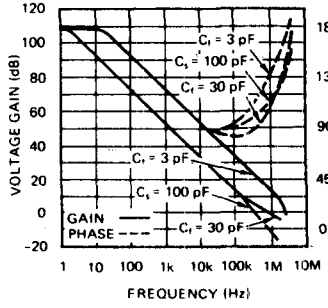
OUTPUT SWING



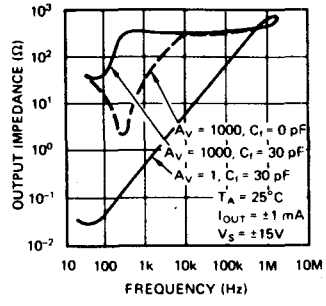
SUPPLY CURRENT



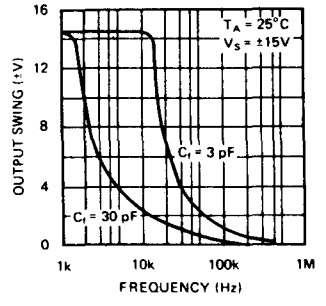
OPEN LOOP
FREQUENCY RESPONSE



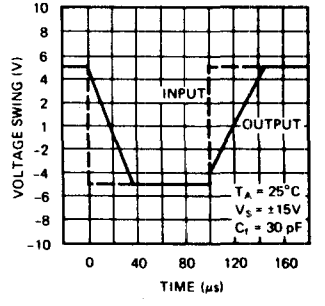
CLOSED LOOP
OUTPUT IMPEDENCE



LARGE SIGNAL
FREQUENCY RESPONSE



VOLTAGE FOLLOWER
PULSE RESPONSE



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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 at 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).

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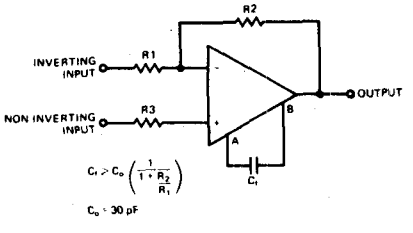
FREQUENCY COMPENSATION CIRCUITS

STANDARD CIRCUIT



ALTERNATE CIRCUIT: IMPROVES REJECTION OF POWER SUPPLY NOISE BY A FACTOR OF TEN.