Operational Amplifiers

LM108/LM208 operational amplifiers

general description

The LM108 and LM208 are precision operational amplifiers having specifications a factor of ten better than FET amplifiers over a −55°C to 125°C temperature range. Selected units are available with offset voltages less than 1.0 mV and drifts less than 5 μV/°C, again over the military temperature range. This makes it possible to eliminate offset adjustments, in most cases, and obtain performance approaching chopper stabilized amplifiers.

The devices operate with supply voltages from ±2V to ±20V and have sufficient supply rejection to use unregulated supplies. Although the circuit is interchangeable with and uses the same compensation as the LM101A, an alternate compensation scheme can be used to make it particularly insensitive to power supply noise and to make supply bypass capacitors unnecessary. Outstanding characteristics include:

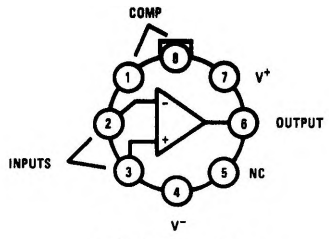
- Maximum input bias current of 3.0 nA over temperature
- Offset current less than 400 pA over temperature
- Supply current of only 300 μA, even in saturation
- Guaranteed drift characteristics

The low current error of the LM108 series makes possible many designs that are not practical with conventional amplifiers. In fact, it operates from 10 MΩ source resistances, introducing less error than devices like the 709 with 10 kΩ sources. Integrators with drifts less than 500 μV/sec and analog time delays in excess of one hour can be made using capacitors no larger than 1 μF.

The LM208 is identical to the LM108, except that the LM208 has its performance guaranteed over a −25°C to 85°C temperature range, instead of −55°C to 125°C.

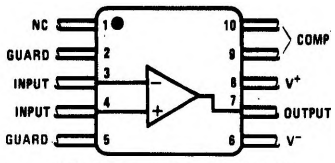
connection diagrams *

Metal Can



NOTE: Pin 4 connected to case.

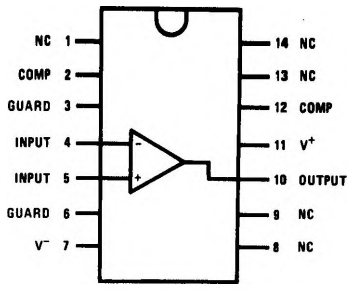
Flat Package



NOTE: Pin 6 connected to bottom of package

TOP VIEW

Dual-In-Line

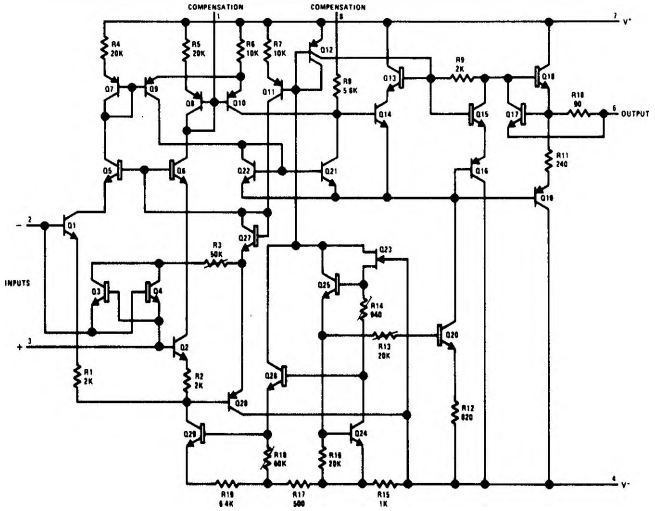


NOTE: Pin 7 connected to bottom of package

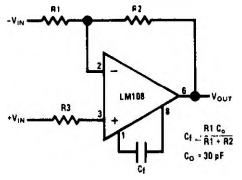
TOP VIEW

*Pin connections shown on schematic diagram are for TO-5 package.

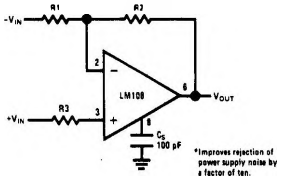
schematic diagram and compensation circuits



Standard Compensation Circuit



Alternate* Frequency Compensation



absolute maximum ratings

Supply Voltage		±20V
Power Dissipation (Note 1)		500 mW
Differential Input Current (Note 2)		±10 mA
Input Voltage (Note 3)		±15V
Output Short-Circuit Duration		Indefinite
Operating Temperature Range	LM108	−55°C to 125°C
	LM208	−25°C to 85°C
Storage Temperature Range		−65°C to 150°C
Lead Temperature (Soldering, 60 sec)		300°C

electrical characteristics (Note 4)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage (Note 5)	$T_A = 25°C$		0.7	2.0	mV
Input Offset Current	$T_A = 25°C$		0.05	0.2	nA
Input Bias Current	$T_A = 25°C$		0.8	2.0	nA
Input Resistance	$T_A = 25°C$	30	70		MΩ
Supply Current	$T_A = 25°C$		0.3	0.6	mA
Large Signal Voltage Gain	$T_A = 25°C$, $V_S = ±15V$ $V_{OUT} = ±10V$, $R_L \geq 10\ k\Omega$	50	300		V/mV
Input Offset Voltage (Note 5)				3.0	mV
Average Temperature Coefficient of Input Offset Voltage (Note 5)			3.0	15	μV/°C
Input Offset Current				0.4	nA
Average Temperature Coefficient of Input Offset Current			0.5	2.5	pA/°C
Input Bias Current				3.0	nA
Supply Current	$T_A = +125°C$		0.15	0.4	mA
Large Signal Voltage Gain	$V_S = ±15V$, $V_{OUT} = ±10V$ $R_L \geq 10\ k\Omega$	25			V/mV
Output Voltage Swing	$V_S = ±15V$, $R_L = 10\ k\Omega$	±13	±14		V
Input Voltage Range	$V_S = ±15V$	±13.5			V
Common Mode Rejection Ratio		85	100		dB
Supply Voltage Rejection Ratio		80	96		dB

Note 1: The maximum junction temperature of the LM108 is 150°C, while that of the LM208 is 100°C. For operating at elevated temperatures, devices in the TO-5 package must be derated based on a thermal resistance of 150°C/W, junction to ambient, or 45°C/W, junction to case. For 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 ten, 0.03-inch-wide, 2-ounce copper conductors. The thermal resistance of the dual-in-line package is 100°C/W, junction to ambient.

Note 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 1V is applied between the inputs unless some limiting resistance is used.

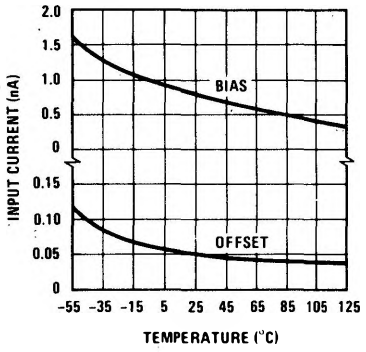
Note 3: For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

Note 4: These specifications apply for $±5V \leq V_S \leq ±20V$ and $-55°C \leq T_A \leq 125°C$, unless otherwise specified. With the LM208, however, all temperature specifications are limited to $-25°C \leq T_A \leq 85°C$.

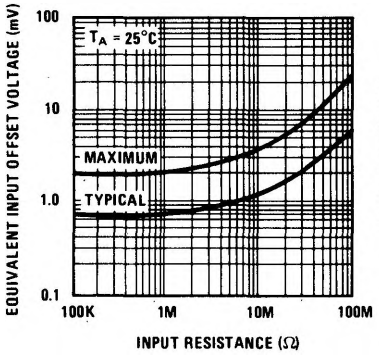
Note 5: The LM108A has a guaranteed offset voltage less than 0.5 mV at 25°C and 1.0 mV for $-55°C \leq T_A \leq 125°C$ and $V_S = ±15V$. The average temperature coefficient of input offset voltage is guaranteed to be less than 5 μV/°C for these same conditions.

typical performance

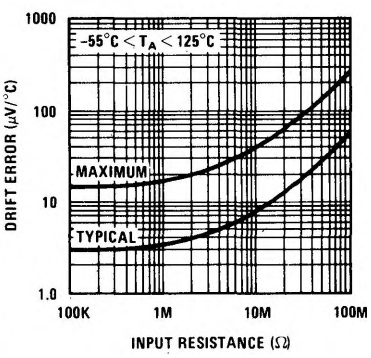
Input Currents



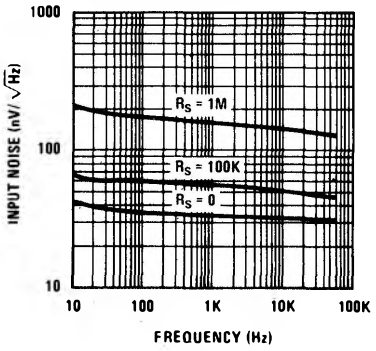
Offset Error



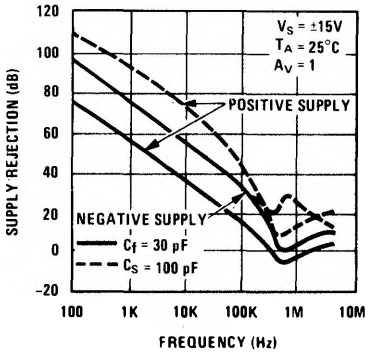
Drift Error



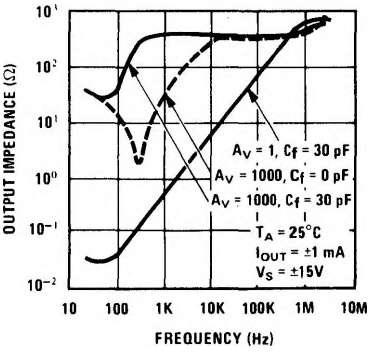
Input Noise Voltage



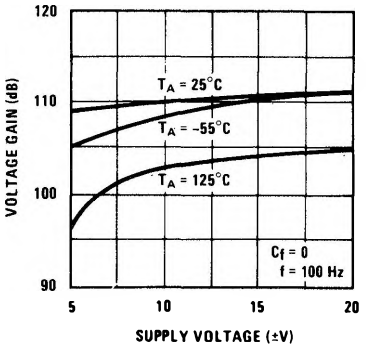
Power Supply Rejection



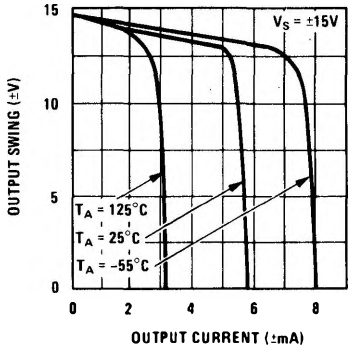
Closed Loop Output Impedance



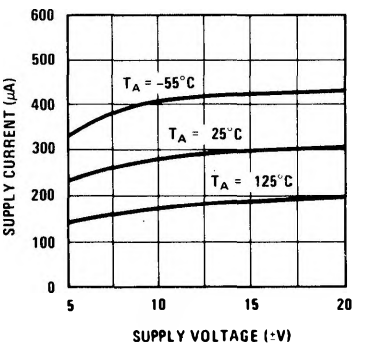
Voltage Gain



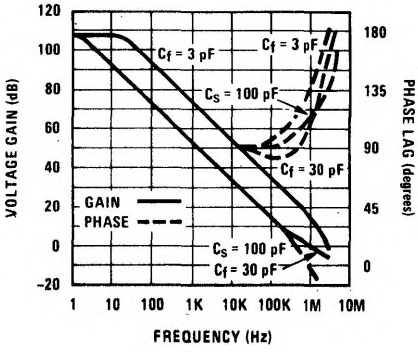
Output Swing



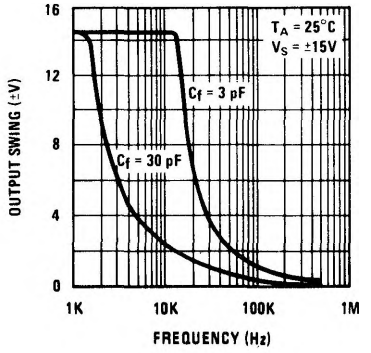
Supply Current



Open Loop Frequency Response



Large Signal Frequency Response



Voltage Follower Pulse Response