Am112/212/312

Compensated, High-Performance Operational Amplifier

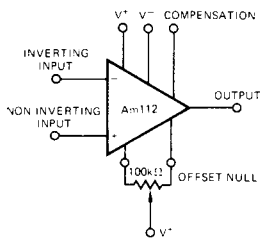
Distinctive Characteristics

- The Am112/212/312 are functionally, electrically, and pin-for-pin equivalents to the National LM112/212/312.
- Low input bias currents: 800pA
- Low input offset currents: 50pA
- Low power consumption: 3mW
- Internal frequency compensation.
- Offset nulling provisions.
- 100% reliability assurance testing in compliance with MIL-STD-883.
- Electrically tested and optically inspected die for assemblers of hybrid products.
- Mixing privileges for obtaining price discounts. Refer to price list.
- Available in metal can, hermetic dual-in-line or hermetic flat packages.

FUNCTIONAL DESCRIPTION

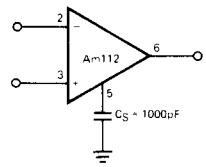
The Am112/212/312 are compensated high-performance operational amplifiers featuring very low offset voltage and input current errors competitive with FET and chopper-stabilized amplifiers. The devices will operate over a supply voltage range of ±2V to ±20V, drawing a typical quiescent current of only 300μA. The Am112/212/312 are internally frequency compensated and provision is made for offset adjustment with a single potentiometer. Overcompensation providing a greater stability margin is possible and the internal protection of the MOS capacitor makes it immune to overvoltage transients.

FUNCTIONAL DIAGRAM



LIC-685

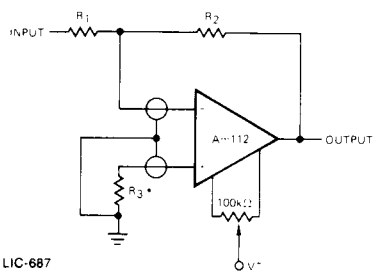
Overcompensation for Greater Stability Margin



LIC-686

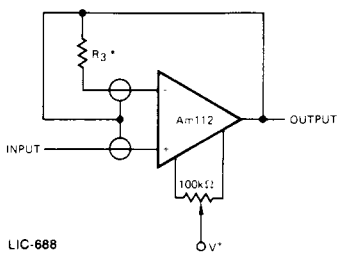
TYPICAL APPLICATIONS

Connection of input guards and offset null



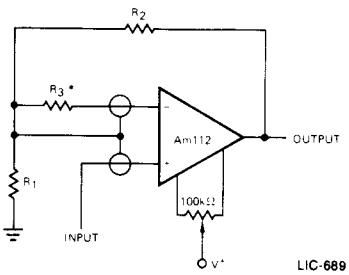
LIC-687

INVERTING AMPLIFIER



LIC-688

FOLLOWER



LIC-689

NON-INVERTING AMPLIFIER

*Use to compensate for large source resistances.

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

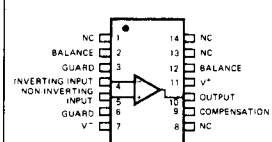
ORDERING INFORMATION

Part Number	Package Type	Temperature Range	Order Number
Am312	DIP	0°C to +70°C	LM312D
	Metal Can	0°C to +70°C	LM312H
	Dice	0°C to +70°C	LD312
Am212	DIP	−25°C to +85°C	LM212D
	Metal Can	−25°C to +85°C	LM212
	Flat Pak	−25°C to +85°C	LM212F
AM112	DIP	−55°C to +125°C	LM112D
	Metal Can	−55°C to +125°C	LM112
	Flat Pak	−55°C to +125°C	LM112F
	Dice	−55°C to +125°C	LD112

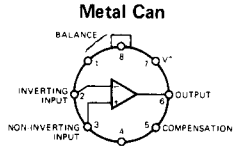
CONNECTION DIAGRAMS

Top Views

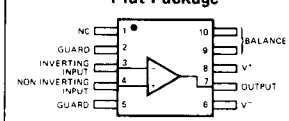
Dual-In-Line



Metal Can



Flat Package



LIC-690

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. Compensation terminal is not brought out on the flat package.

MAXIMUM RATINGS

Supply Voltage	
Am112, 212	±20V
Am312	±18V
Internal Power Dissipation (Note 1)	500mW
Differential Input Current (Note 2)	±10mA
Input Voltage (Note 3)	±15V
Output Short-Circuit Duration	Indefinite
Operating Temperature Range	
Am112	−55°C to +125°C
Am212	−25°C to +85°C
Am312	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 60 sec.)	300°C

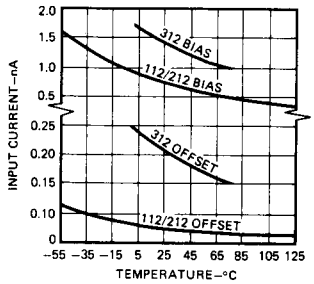
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified) (Note 4)

Parameter (see definitions)	Conditions	Am312 Min.	Am312 Max.	Am112 Am212 Min.	Am112 Am212 Max.	Units
Input Offset Voltage			7.5		2.0	mV
Input Offset Current			1		0.2	nA
Input Bias Current			7		2.0	nA
Input Resistance		10		30		MΩ
Supply Current			0.8		0.6	mA
Large Signal Voltage Gain	V_{OUT} = ±10V, V_S = ±15V R_L > 10kΩ	25		50		V/mV
The Following Specifications Apply Over The Operating Temperature Ranges						
Input Offset Voltage			10		3.0	mV
Average Temperature Coefficient of Input Offset Voltage			30		15	μV/°C
Input Offset Current			1.5		0.4	nA
Average Temperature Coefficient of Input Offset Current			10		2.5	pA/°C
Input Bias Current			10		3.0	nA
Supply Current	T_A = +125°C				0.4	mA
Large Signal Voltage Gain	V_{OUT} = ±10V, V_S = ±15V R_L > 10kΩ	15		25		V/mV
Output Voltage Swing	V_S = ±15V, R_L = 10kΩ	±13		±13		V
Input Voltage Range	V_S = ±15V	±13.5		±13.5		V
Common Mode Rejection Ratio		80		85		dB
Supply Voltage Rejection Ratio		80		80		dB

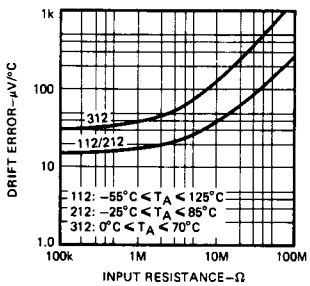
Notes:
1. Derate Metal Can package at 6.8 mW/°C for operation at ambient temperatures above 75°C and the Dual-In-Line package at 9 mW/°C for operation at ambient temperatures above 95°C, and the Flat Package at 5.4 mW/°C for operation at ambient temperatures above 57°C.
2. The inputs are shunted with 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 ±15 V, 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 Am112, Am212 and from ±5 V to ±15 V for the Am312.

TYPICAL PERFORMANCE CURVES

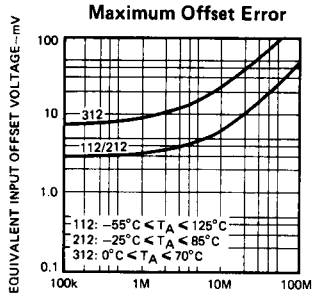
Input Currents



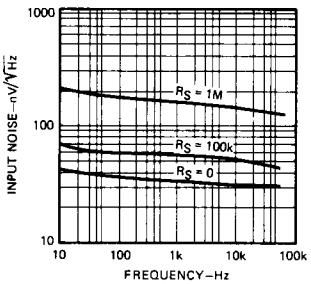
Maximum Drift Error



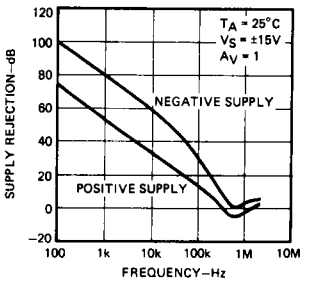
Maximum Offset Error



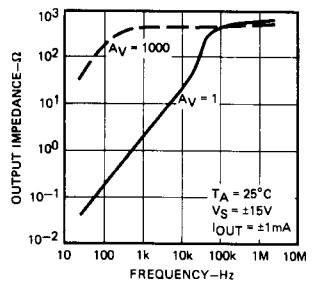
Input Noise Voltage



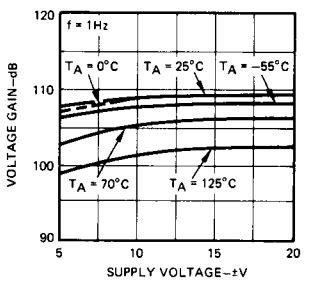
Power Supply Rejection



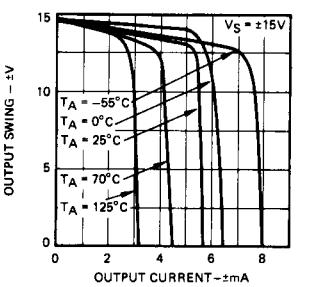
Closed Loop Output Impedance



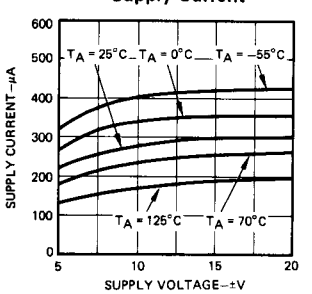
Voltage Gain



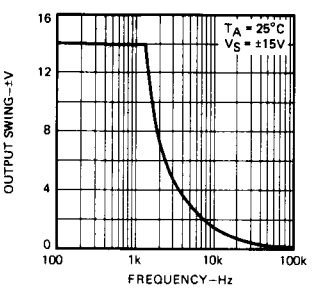
Output Swing



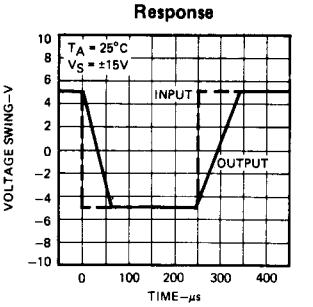
Supply Current



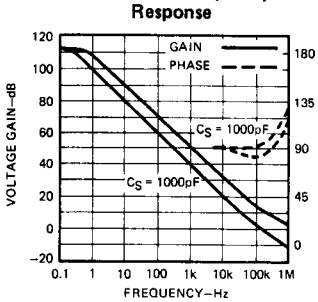
Large Signal Frequency Response



Voltage Follower Pulse Response



Open Loop Frequency Response



LIC-691

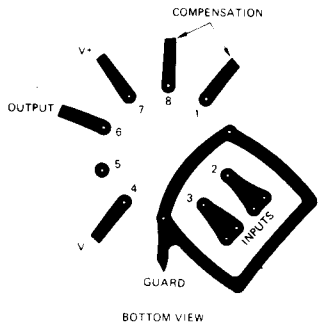
ADDITIONAL APPLICATION INFORMATION

GUARDING

Extra care must be taken in the assembly of printed circuit boards to take full advantage of the low input currents of the 112 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.

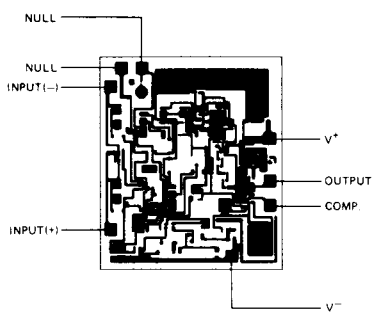
The pin configuration of the dual-in-line package is designed to facilitate guarding, since the pins adjacent to the inputs are not used (this is different from the standard Am741 and Am101A pin configuration.)



Note: Board layout for input Guarding with TO-99 package.

4

Metallization and Pad Layout



62 x 72 Mils