

LH2101A/LH2201A/LH2301A

Dual Operational Amplifiers

Distinctive Characteristics

- Low offset voltage
- Low offset current
- Guaranteed drift characteristics
- Offsets guaranteed over entire common mode and supply voltage ranges
- Slew rate of 10V/ μ s as a summing amplifier

FUNCTIONAL DESCRIPTION

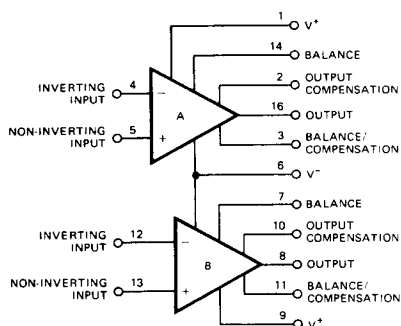
The LH2101A series are differential input, class AB output operational amplifiers. The inputs and outputs are protected against overload and the amplifiers may be frequency compensated with an external 30pF capacitor. The combination of low-input currents, low-offset voltage, low noise, and versatility of compensation classify the LH2101A series amplifiers for low level and general purpose applications.

DESCRIPTION

The LH2101A series of dual operational amplifiers are two LM101A type op amps in a single hermetic package. They are functionally electrically and pin for pin equivalent to the National LH2101A series. Featuring all the same performance characteristics of the single, these duals offer in addition closer thermal tracking, lower weight, reduced insertion cost, and smaller size than two singles.

The LH2101A is specified for operation over the -55°C to $+125^{\circ}\text{C}$ military temperature range. The LH2201A is specified for operation over the -25°C to $+85^{\circ}\text{C}$ temperature range. The LH2301A is specified for operation over the 0°C to $+70^{\circ}\text{C}$ temperature range.

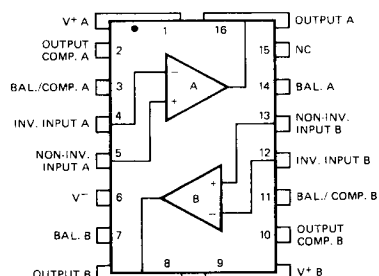
FUNCTIONAL DIAGRAM



LIC-811

CONNECTION DIAGRAMS Top Views

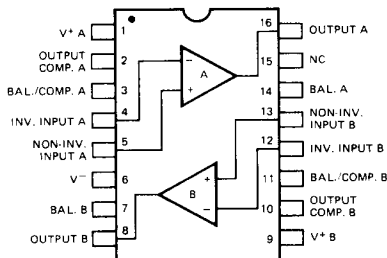
Dual-In-Line



ORDERING INFORMATION

Part Number	Package Type	Temperature Range	Order Number
LH2301A	DIP	0°C to $+70^{\circ}\text{C}$	LH2301AD
	Flat Pak	0°C to $+70^{\circ}\text{C}$	LH2301AF
LH2201A	DIP	-25°C to $+85^{\circ}\text{C}$	LH2201AD
	Flat Pak	-25°C to $+85^{\circ}\text{C}$	LH2201AF
LH2101A	DIP	-55°C to $+125^{\circ}\text{C}$	LH2101AD
	Flat Pak	-55°C to $+125^{\circ}\text{C}$	LH2101AF

Flat Package



Note: Pin 1 is marked for orientation.

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LH2101A/LH2201A/LH2301A**MAXIMUM RATINGS**

Supply Voltage	±22V
LH2101A, LH2201A	±18V
LH2301A	
Internal Power Dissipation (Note 1)	500mW
Differential Input Voltage	±30V
Input Voltage (Note 2)	±15V
Output Short-Circuit Duration	Indefinite
Operating Temperature Range	
LH2101A	-55°C to +125°C
LH2201A	-25°C to +85°C
LH2301A	0°C to +70°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 60 sec.)	300°C

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise specified) (Note 3)

(Each Amplifier)

Parameter (see definitions)	Conditions	LH2301A			LH2101A LH2201A			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage	$R_S \leq 50\text{k}\Omega$		2.0	7.5		0.7	2.0	mV
Input Offset Current			3.0	50		1.5	10	nA
Input Bias Current			70	250		30	75	nA
Input Resistance		0.5	2.0		1.5	4.0		M Ω
Supply Current (Total Both Amplifiers)	$V_S = \pm 20\text{V}$					3.6	6.0	mA
	$V_S = \pm 15\text{V}$		3.6	6.0				
Large Signal Voltage Gain	$V_S = \pm 15\text{V}$, $V_{OUT} = \pm 10\text{V}$, $R_L > 2\text{k}\Omega$	25	160		50	160		V/mV
Slew Rate	$V_S = \pm 20\text{V}$, $A_V = +1$		0.5			0.5		V/ μs
The Following Specifications Apply Over The Operating Temperature Ranges								
Input Offset Voltage	$R_S \leq 50\text{k}\Omega$			10			3.0	mV
Input Offset Current				70			20	nA
Average Temperature Coefficient of Input Offset Voltage	$T_A(\text{MIN}) \leq T_A \leq T_A(\text{MAX})$		6.0	30		3.0	15	$\mu\text{V}/^\circ\text{C}$
Average Temperature Coefficient of Input Offset Current	$25^\circ\text{C} \leq T_A \leq T_A(\text{MAX})$		0.01	0.3		0.01	0.1	nA/ $^\circ\text{C}$
	$T_A(\text{MIN}) \leq T_A \leq 25^\circ\text{C}$		0.02	0.6		0.02	0.2	
Input Bias Current				300			100	nA
Large Signal Voltage Gain	$V_S = \pm 15\text{V}$, $V_{OUT} = \pm 10\text{V}$, $R_L > 2\text{k}\Omega$	25			25			V/mV
Input Voltage Range	$V_S = \pm 20\text{V}$ $V_S = \pm 15\text{V}$	+15, -12			± 15			Volts
Common Mode Rejection Ratio	$R_S \leq 50\text{k}\Omega$	70	90		80	96		dB
Supply Voltage Rejection Ratio	$R_S \leq 50\text{k}\Omega$	70	96		80	96		dB
Output Voltage Swing	$V_S = \pm 15\text{V}$, $R_L = 10\text{k}\Omega$	± 12	± 14		± 12	± 14		Volts
	$R_L = 2\text{k}\Omega$	± 10	± 13		± 10	± 13		
Supply Current (Total Both Amplifiers)	$T_A = +125^\circ\text{C}$, $V_S = \pm 20\text{V}$					2.4	5.0	mA

Notes: 1. The maximum junction temperature of the LH2101A is 150°C , while that of the LH2201A and LH2301A is 100°C . For operating temperatures, devices in 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 0.03-inch-wide, 2-ounce copper conductors. The thermal resistance of the dual-in-line package is 100°C/W , junction to ambient.

2. For supply voltages less than $\pm 15\text{V}$, the absolute maximum input voltage is equal to the supply voltage.

3. These specifications apply for $\pm 5\text{V} \leq V_S \leq \pm 20\text{V}$ and $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$, unless otherwise specified. With the LH2201A, however, all temperature specifications are limited to $-25^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$. For the LH2301A these specifications apply for $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$, $\pm 5\text{V}$ and $\leq V_S \leq \pm 15\text{V}$. Supply current and input voltage range are specified as $V_S = \pm 5\text{V}$ for the LH2301A. $C_1 = 30\text{pF}$ unless otherwise specified.

FREQUENCY COMPENSATION CIRCUITS

Single Pole Compensation

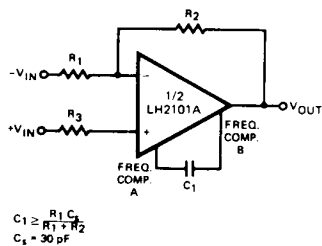


Figure 1

Two Pole Compensation

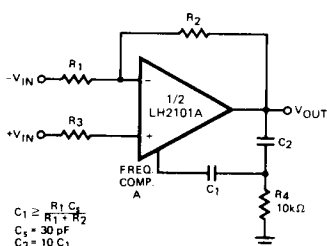


Figure 2

Feedforward Compensation

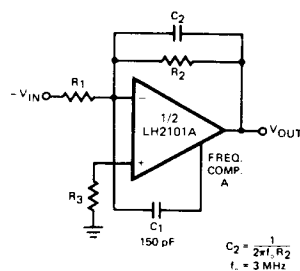


Figure 3

LIC-813

LIC-814

LIC-815

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

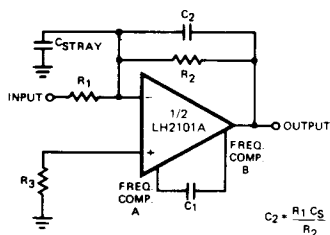


Figure 4

LIC-816

Isolating Large Capacitive Loads

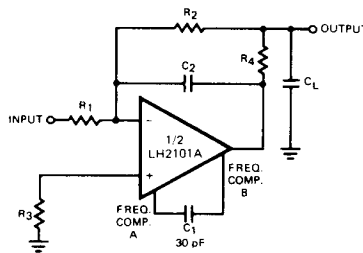
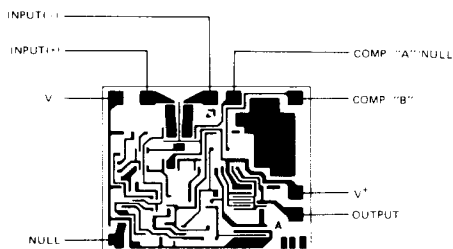


Figure 5

LIC-817

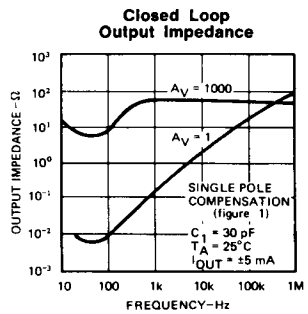
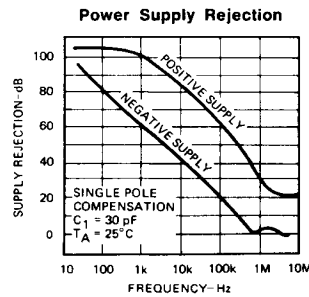
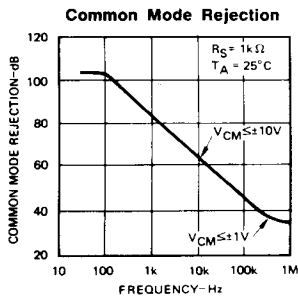
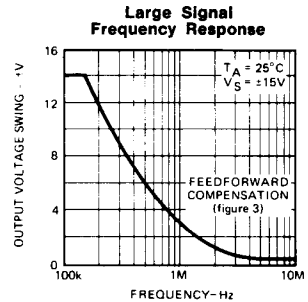
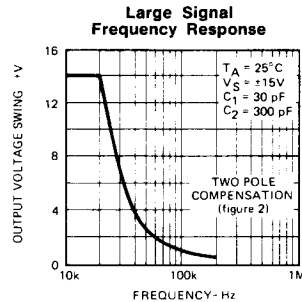
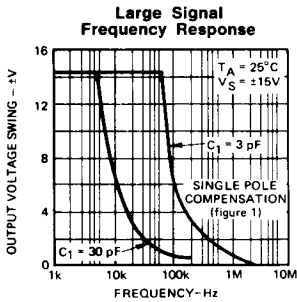
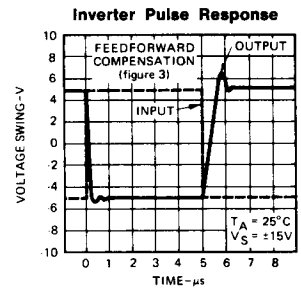
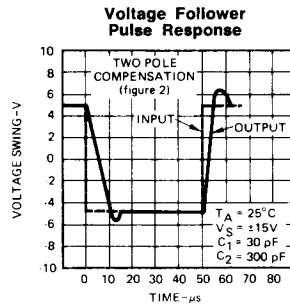
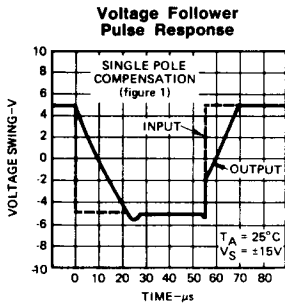
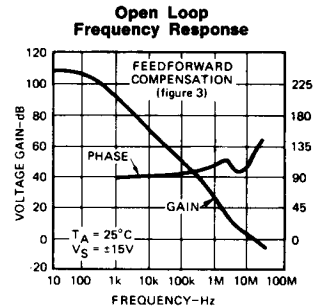
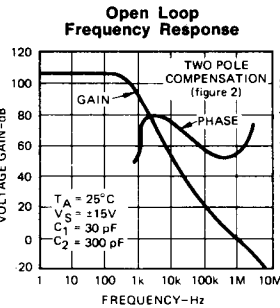
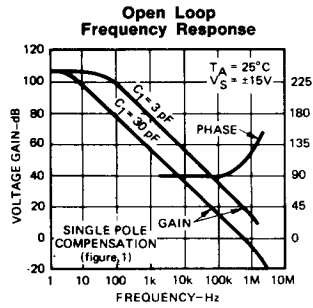
The values given for the frequency compensation capacitor guarantee stability only for source resistances less than $10 \text{ k}\Omega$, stray capacitances on the summing junction less than 5 pF and capacitive loads smaller than 100 pF . If any of these conditions is not met, it is necessary to use 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.

Metallization and Pad Layout



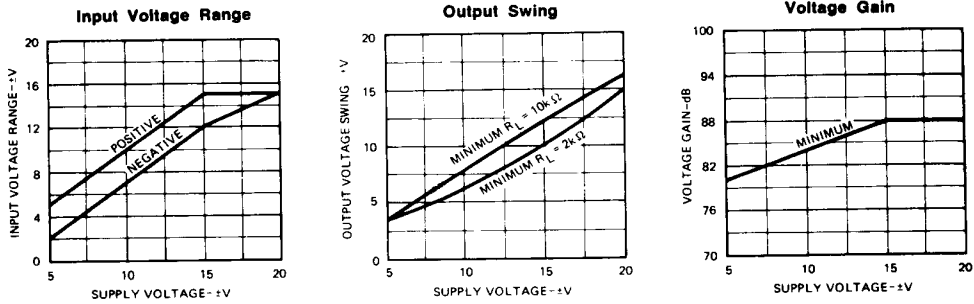
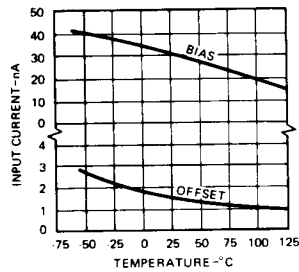
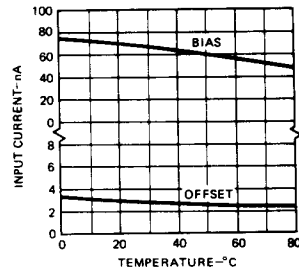
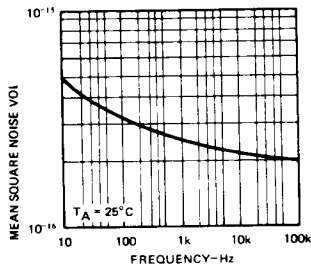
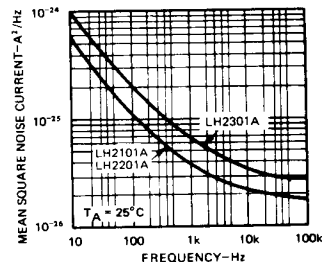
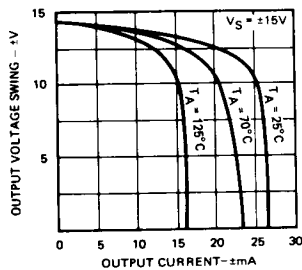
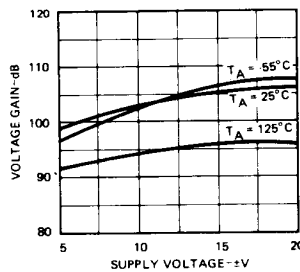
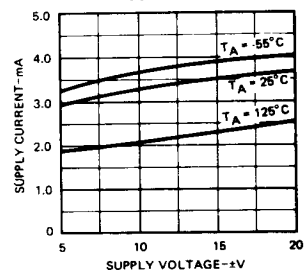
49 X 56 Mils

PERFORMANCE CURVES (Note 3)



GUARANTEED PERFORMANCE CURVES (Note 3)

(Curves apply over the Operating Temperature Ranges)

**PERFORMANCE CURVES (Note 3)****Input Current - LH2101A, LH2201A****Input Current - LH2301A****Input Noise Voltage****Input Noise Current****Current Limiting****Voltage Gain****Supply Current**

LIC-819