



# LH2108/LH2208/LH2308, LH2108A/LH2208A/LH2308A Dual Super Beta Operational Amplifiers

## General Description

The LH2108A/LH2208A/LH2308A and LH2108/LH2208/LH2308 series of dual operational amplifiers are two LM108A or LM108 type op amps in a single hermetic package. Featuring all the same performance characteristics of the single device, these duals also offer closer thermal tracking, lower weight, reduced insertion cost, and smaller size than two single devices. For additional information see the LM108A or LM108 data sheet and National's Linear Application Handbook.

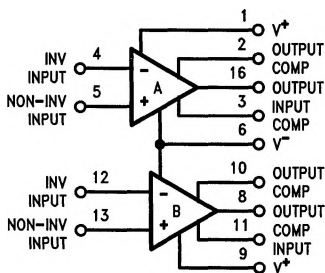
The LH2108A/LH2108 is specified for operation over the -55°C to +125°C military temperature range. The LH2208A/LH2208 is specified for operation over the

-25°C to +85°C temperature range. The LH2308A/LH2308 is specified for operation over the 0°C to +70°C temperature range.

## Features

- Low offset current 50 pA
- Low offset voltage 0.7 mV
- Low offset voltage LH2108A 0.3 mV
- LH2108 0.7 mV
- Wide input voltage range ±15V
- Wide operating supply range ±3V to ±20V

## Connection Diagram

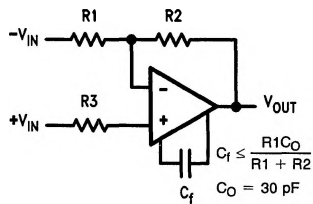


TL/K/10117-1

Order Number LH2108AD, LH2208AD, LH2208AD,  
LH2308AD, LH2108D, LH2208D, or LH2308D  
See NS Package Number D16C

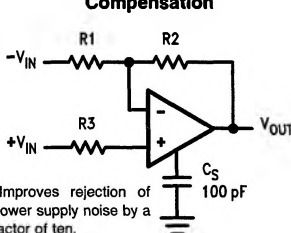
## Auxiliary Circuits

### Standard Compensation Circuit



TL/K/10117-2

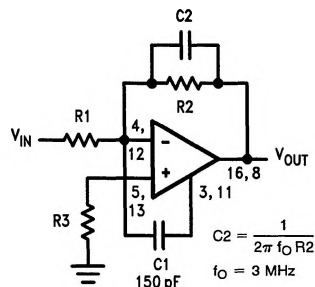
### Alternate\* Frequency Compensation



\*Improves rejection of power supply noise by a factor of ten.

TL/K/10117-3

### Feedback Compensation



TL/K/10117-4

## Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

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	Continuous
Operating Temperature Range	
LH2108A/LH2108	-55°C to +125°C
LH2208A/LH2208	-25°C to +85°C
LH2308A/LH2308	0°C to +70°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec)	300°C

## Electrical Characteristics Each Side (Note 4)

Parameter	Conditions	Limits			Units
		LH2108	LH2208	LH2308	
Input Offset Voltage	$T_A = 25^\circ\text{C}$	2.0	2.0	7.5	mV Max
Input Offset Current	$T_A = 25^\circ\text{C}$	0.2	0.2	1.0	nA Max
Input Bias Current	$T_A = 25^\circ\text{C}$	2.0	2.0	7.0	nA Max
Input Resistance	$T_A = 25^\circ\text{C}$	30	30	10	M $\Omega$ Min
Supply Current	$T_A = 25^\circ\text{C}$	0.6	0.6	0.8	mA Max
Large Signal Voltage Gain	$T_A = 25^\circ\text{C}$ , $V_S = \pm 15\text{V}$ $V_{OUT} = \pm 10\text{V}$ , $R_L > 10\text{ k}\Omega$	50	50	25	V/mV Min
Input Offset Voltage		3.0	3.0	10	mV Max
Average Temperature Coefficient of Input Offset Current		15	15	30	$\mu\text{V}/^\circ\text{C}$ Max
Input Offset Current		0.4	0.4	1.5	nA Max
Average Temperature Coefficient of Input Offset Current		2.5	2.5	10	pA/ $^\circ\text{C}$ Max
Input Bias Current		3.0	3.0	10	nA Max
Supply Current	$T_A = +125^\circ\text{C}$	0.4	0.4		mA Max
Large Signal Voltage Gain	$V_S = \pm 15\text{V}$ , $V_{OUT} = \pm 10\text{V}$ $R_L > 10\text{ k}\Omega$	25	25	15	V/mV Min
Output Voltage Swing	$V_S = \pm 15\text{V}$ , $R_L = 10\text{ k}\Omega$	± 13	± 13	± 13	V Min
Input Voltage Range	$V_S = \pm 15\text{V}$	± 13.5	± 13.5	± 14	V Min
Common Mode Rejection Ratio		85	85	80	dB Min
Supply Voltage Rejection Ratio		80	80	80	dB Min

## Electrical Characteristics Each Side (Note 4)

Parameter	Conditions	Limits			Units
		LH2108A	LH2208A	LH2308A	
Input Offset Voltage	$T_A = 25^\circ\text{C}$	0.5	0.5	0.5	mV Max
Input Offset Current	$T_A = 25^\circ\text{C}$	0.2	0.2	1.0	nA Max
Input Bias Current	$T_A = 25^\circ\text{C}$	2.0	2.0	7.0	nA Max
Input Resistance	$T_A = 25^\circ\text{C}$	30	30	10	M $\Omega$ Min
Supply Current	$T_A = 25^\circ\text{C}$	0.6	0.6	0.8	mA Max
Large Signal Voltage Gain	$T_A = 25^\circ\text{C}$ , $V_S = \pm 15\text{V}$ $V_{OUT} = \pm 10\text{V}$ , $R_L > 10\text{ k}\Omega$	80	80	80	V/mV Min

**Electrical Characteristics** Each Side (Note 4) (Continued)

Parameter	Conditions	Limits			Units
		LH2108A	LH2208A	LH2308A	
Input Offset Voltage		1.0	1.0	0.73	mV Max
Average Temperature Coefficient of Input Offset Voltage		5	5	5	$\mu\text{V}/^\circ\text{C}$ Max
Input Offset Current		0.4	0.4	1.5	nA Max
Average Temperature Coefficient of Input Offset Current		2.5	2.5	10	$\text{pA}/^\circ\text{C}$ Max
Input Bias Current		3.0	3.0	10	nA Max
Supply Current	$T_A = +125^\circ\text{C}$	0.4	0.4		mA Max
Large Signal Voltage Gain	$V_S = \pm 15\text{V}$ , $V_{\text{OUT}} = \pm 10\text{V}$ $R_L > 10\text{ k}\Omega$	40	40	60	V/mV Min
Output Voltage Swing	$V_S = \pm 15\text{V}$ , $R_L = 10\text{ k}\Omega$	$\pm 13$	$\pm 13$	$\pm 13$	V Min
Input Voltage Range	$V_S = \pm 15\text{V}$	$\pm 13.5$	$\pm 13.5$	$\pm 14$	V Min
Common Mode Rejection Ratio		96	96	96	dB Min
Supply Voltage Rejection Ratio		96	96	96	dB Min

**Note 1:** The maximum junction temperature of the LH2108A/LH2108 is  $150^\circ\text{C}$ , while that of the LH2208A/LH2208 is  $100^\circ\text{C}$  and that of the LH2308A/LH2308 is  $85^\circ\text{C}$ . For operating devices in the flat package at elevated temperatures, the derating is based on a thermal resistance of  $185^\circ\text{C}/\text{W}$  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  $100^\circ\text{C}/\text{W}$ , 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  $\pm 15\text{V}$ , the absolute maximum input voltage is equal to the supply voltage.

**Note 4:** 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 LH2208A/LH2208, however, all temperature specifications are limited to  $-25^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$  and with the LH2308A/LH2308 for  $\pm 5\text{V} \leq V_S \leq 15\text{V}$  and  $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ .