T-79-06-10

LM108A/LH2108A Precision Operational Amplifiers

Features

- Low input bias current — 2nA
- Low input offset current — 200pA
- Low input offset voltage — 500μV
- Low input offset drift — 5μV/°C
- Wide supply range — ±3V to ±20V
- Low supply current — 0.6mA
- High PSRR — 96dB
- High CMRR — 96dB
- Mil-Std-883B available

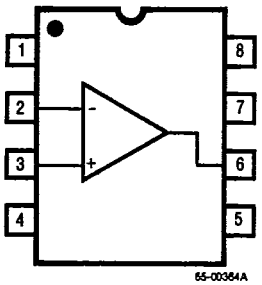
Description

These operational amplifiers feature low input bias current combined with the advantages of bipolar transistor construction; input offset voltages and currents are kept low over a wide range of temperature and supply voltage. Raytheon's superbeta bipolar manufacturing process includes extra treatment at epitaxial growth to ensure low input voltage noise.

The LH2108 consists of two LM108 ICs in one 16-lead DIP. The "A" versions meet tighter electrical specifications than the plain versions. All types are available with 883B military screening.

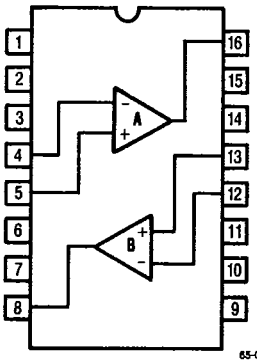
Connection Information (Top Views)

8-Lead DIP



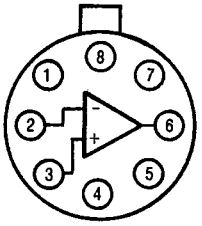
65-00364A

16-Lead DIP



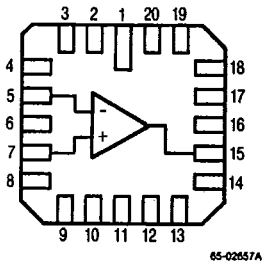
65-02658A

TO-99 Can



65-00363A

20-Pad LCC



65-02657A

Pin	Function
1	Comp
2	-Input
3	+Input
4	$-V_s$
5	NC
6	Output
7	$+V_s$
8	Comp

Pin	Function
1	$+V_s$ (A)
2	Comp (A)
3	Comp (A)
4	-Input (A)
5	+Input (A)
6	$-V_s$
7	NC
8	Output (B)

Pin	Function
9	$+V_s$ (B)
10	Comp (B)
11	Comp (B)
12	-Input (B)
13	+Input (B)
14	NC
15	NC
16	Output (A)

Pin	Function
1	Comp
2	-Input
3	+Input
4	$-V_s$
5	NC
6	Output
7	$+V_s$
8	Comp

Pin	Function
1	NC
2	Comp
3	NC
4	NC
5	-Input
6	NC
7	+Input
8	NC
9	NC
10	$-V_s$

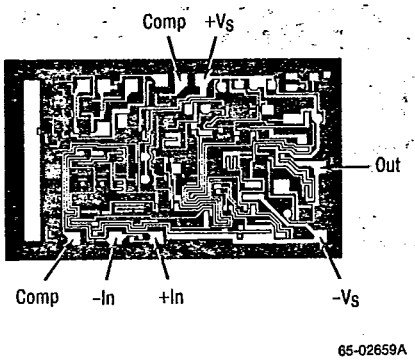
Pin	Function
11	NC
12	NC
13	NC
14	NC
15	Output
16	NC
17	$+V_s$
18	NC
19	NC
20	Comp

Ordering Information

Part Number	Package	Operating Temperature Range
LM108L	L	-55°C to +125°C
LM108AL	L	-55°C to +125°C
LM108D	D	-55°C to +125°C
LM108AD	D	-55°C to +125°C
LM108T	T	-55°C to +125°C
LM108AT	T	-55°C to +125°C
LH2108D	D	-55°C to +125°C
LH2108AD/883B	D	-55°C to +125°C

Notes:
/883B suffix denotes Mil-Std-883, Level B processing
D = 16 lead ceramic DIP (LH2108)
D = 8-lead ceramic DIP (LM108)
T = 8-lead metal can TO-99
L = 20-pad leadless chip carrier
Contact a Raytheon sales office or representative for ordering information on special package/temperature range combinations.

Mask Pattern



Die Size: 104 x 61 mils
Min. Pad Dimensions: 4 x 4 mils

Absolute Maximum Ratings

Supply Voltage ..... ±20V
Differential Input Current* ..... ±10 mA
Input Voltage** ..... ±15V
Output Short Circuit ..... Continuous
Operating Temperature Range ..... -55°C to +125°C
Storage Temperature Range ..... -65°C to +150°C
Lead Soldering Temperature (60 sec) ..... +300°C

*The inputs are shunted with back-to-back diodes for overvoltage protection. Therefore, if a differential input voltage in excess of 1V is applied between the inputs, excessive current will flow, unless some limiting resistance is provided.
**For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

Thermal Characteristics

	8-Lead TO-99 Metal Can	8-Lead Ceramic DIP	16-Lead Ceramic DIP	20-Lead LCC
Max. Junction Temp.	175°C	175°C	175°C	175°C
Max. P_D T_A <50°C	658 mW	833 mW	1042 mW	925 mW
Therm. Res θ_{JC}	50°C/W	45°C/W	60°C/W	37°C/W
Therm. Res. θ_{JA}	190°C/W	150°C/W	120°C/W	105°C/W
For T_A >50°C Derate at	5.26 mW/°C	8.33 mW/°C	8.38 mW/°C	7.0 mW/°C

Electrical Characteristics ($\pm 5V \leq V_S \leq \pm 20V$ and $T_A = +25°C$ unless otherwise noted

Parameters	Test Conditions	LM108A/LH2108A			LM108/LH2108			Units
		Min	Typ	Max	Min	Tp	Max	
Input Offset Voltage			0.3	0.5		0.7	2.0	mV
Input Offset Current			0.05	0.2		0.05	0.2	nA
Input Bias Current			0.8	2.0		0.8	2.0	nA
Input Resistance[1]		30	70		30	70		MΩ
Large Signal Voltage Gain	$V_S = \pm 15V$, $V_{OUT} = \pm 10V$, $R_L \geq 10\ k\Omega$	80	300		50	300		V/mV
Supply Current	Each Amplifier		0.3	0.6		0.3	0.6	mA

Electrical Characteristics ($\pm 5V \leq V_S \leq \pm 20V$; $-55°C \leq T_A \leq +125°C$ unless otherwise noted)

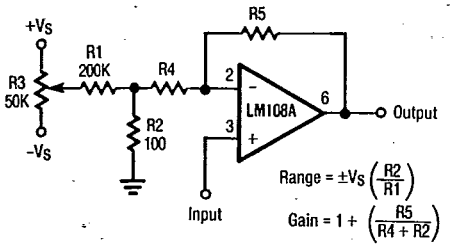
Parameters	Test Conditions	LM108A/LH2108A			LM108/LH2108			Units
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage			0.4	1.0		1.0	3.0	mV
Average Input Offset Voltage Drift[2]			1.0	5.0		3.0	1.5	µV/°C
Input Offset Current			0.1	0.4		0.1	0.4	nA
Average Input Offset Current Drift[2]			0.5	2.5		0.5	2.5	pA/°C
Input Bias Current			1.0	3.0		1.0	3.0	nA
Large Signal Voltage Gain	$V_S = \pm 15V$, $V_O = \pm 10V$, $R_L \geq 10\ k\Omega$	40	200		25	200		V/mV
Output Voltage Swing	$R_L \geq 10\ k\Omega$ $V_S = \pm 20V$	±16	±18		±16	±18		V
Input Voltage Range	$V_S = \pm 15V$	±13.5			±13.5			V
Common Mode Rejection Ratio	$V_{CM} = \pm 13.5$ $V_S = \pm 15V$	96	110		85	100		dB
Power Supply Rejection Ratio	$V_S = \pm 5V$ to $\pm 20V$	96	110		80	96		dB
Supply Current	Each Amplifier			0.6			0.6	mA

Notes: 1. Guaranteed by input bias current specification.
2. Sample tested

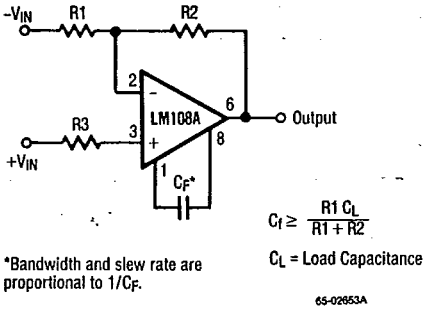
Typical Applications

The LM108 series has very low input offset and bias currents; the user is cautioned that printed circuit board leakages can produce significant errors, especially at high board temperatures. Careful attention to board layout and cleaning procedure is required to achieve the LM108A's rated performance. It is suggested that board leakage be minimized by encircling the input pins with a guard ring maintained at a potential close to that of the inputs. The guard ring should be driven by a low impedance source such as an amplifier's output or ground.

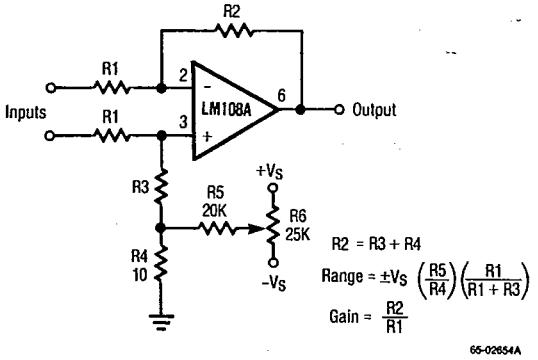
Offset Adjustment for Non-Inverting Amplifiers



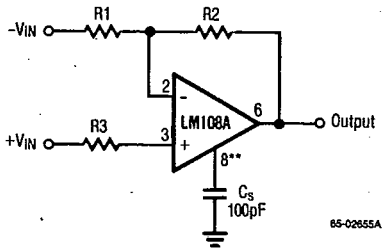
Standard Compensation Circuit



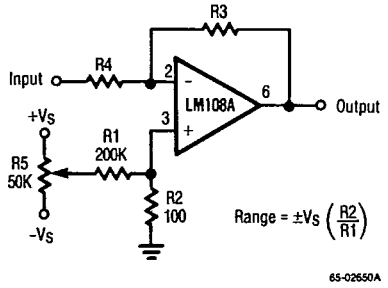
Offset Adjustment for Differential Amplifiers



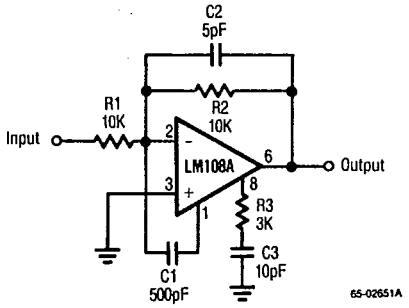
Alternate* Frequency Compensation



Offset Adjustment for Inverting Amplifiers



Feedforward Compensation



Schematic Diagram