LM108A/LH2108A

Precision Operational Amplifiers

Features

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

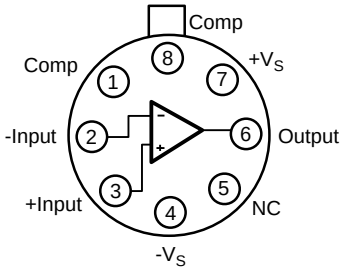
Description

The LM108A operational amplifiers features 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. Fairchild Semiconductor's superbeta bipolar manufacturing process includes extra treatment at epitaxial growth to ensure low input voltage noise.

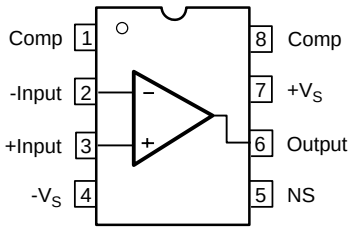
The LH2108 consists of two LM108 ICs in one 16-lead DIP. The "A" versions meet tighter electrical specifications than the plain versions. All types are available with 883B military screening.

Pin Assignments

8-Lead Metal Can
(Top View)



8-Lead DIP
(Top View)



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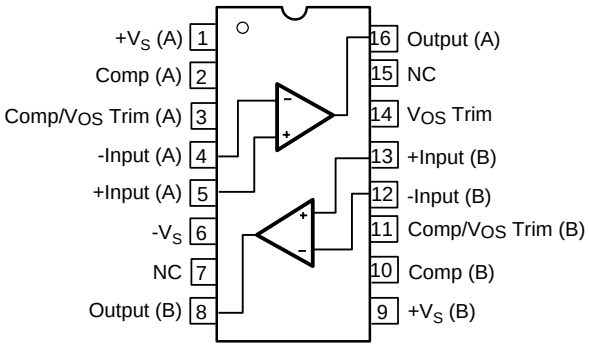
16-Lead DIP
(Top View)



65-108A-02

Absolute Maximum Ratings

Parameter	Min.	Max.	Units
Supply Voltage		±20	V
Differential Input Current[1]		±10	mA
Input Voltage[2]		±15	V
Output Short-Circuit Duration[2]	Continuous		
Operating Temperature Range	-55	+125	°C
Storage Temperature Range	-65	+150	°C
Lead Soldering Temperature (60 seconds)		+300	°C

Notes:

1. 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.
2. For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

Thermal Characteristics

Parameter	8-Lead Metal Can	8-Lead Ceramic DIP	16-Lead Ceramic DIP
Maximum Junction Temperature	+175°C	+175°C	+175°C
Max. $P_D T_A < 50°C$	658 mW	833 mW	1042 mW
Thermal Resistance, θ_{JC}	50°C/W	45°C/W	60°C/W
Thermal Resistance, θ_{JA}	190°C/W	150°C/W	120°C/W
For $T_A > 50°C$ Derate at	5.26 mW/°C	8.33 mW/°C	8.38 mW/°C

Electrical Characteristics

±5V, ≤ V_S ≤ ±20V and T_A ≤ +25°C unless otherwise noted

Parameters	Test Conditlons	LM108A/LH2108A			LM108/LH2108			Units
		Min.	Typ.	Max.	Min.	Typ.	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 Resistance1		30	70		30	70		MΩ
Large Signal Voltage Gain	V_S = ±15V, V_{OUT} ±10V, R_L ≥ 10KΩ	80	300		50	300		V/mV
Supply Current	Each Amplifier		0.3	0.6		0.3	0.6	mA
±5V, ≤ V_S ≤ ±20V; -55°C ≤ T_A ≤ +25°C unless otherwise noted								
Input Offset Voltage			0.4	1.0		1.0	3.0	mV
Avg. Input Offset Voltage Drift[2]			1.0	5.0		3.0	15	μV/°C
Input Offset Current			0.1	0.4		0.1	0.4	nA
Avg. lnput 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 = ±15V, V_{OUT} = ±10V, R_L ≥ 10 KΩ	40	200		25	200		V/mV
Output Voltage Swing	R_L ≥ 10 KΩ, V_S = ±20V	±16	±18		±16	±18		V
Input Voltage Range	V_S = ±15V	±13.5			±13.5			V
Common Mode Rejection Ratio	V_{CM} = ±13.5V, V_S = ±15V	96	110		85	100		dB
Power Supply Rejection Ratio	V_S = ±15V	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.

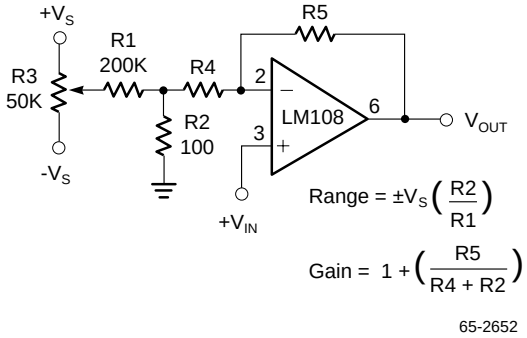


Figure 1. Offset Adjustment for Non-Inverting Amplifiers

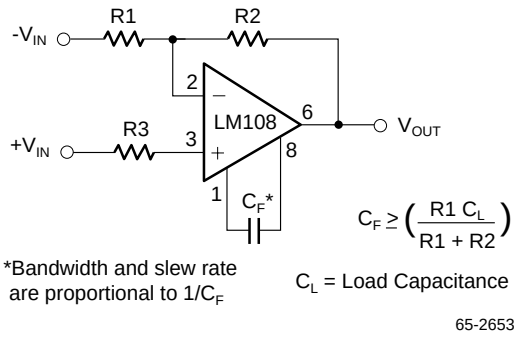


Figure 2. Standard Compensation Circuit

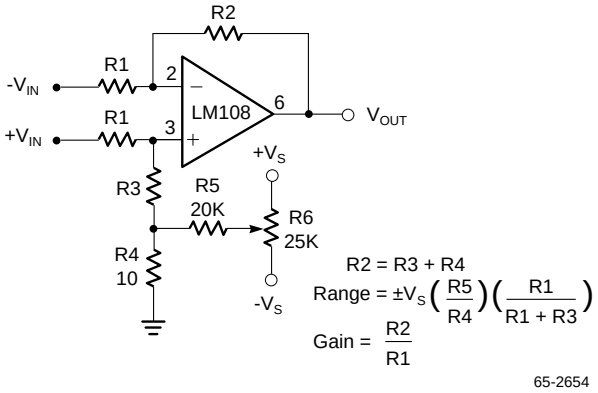


Figure 3. Offset Adjustment for Differential Amplifiers

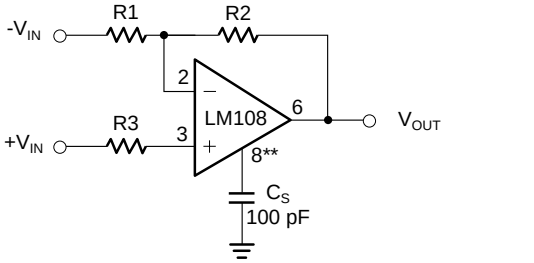


Figure 4. Alternate Frequency Compensation

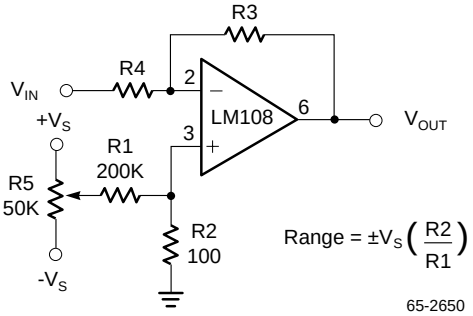


Figure 5. Offset Adjustment for Inverting Amplifiers

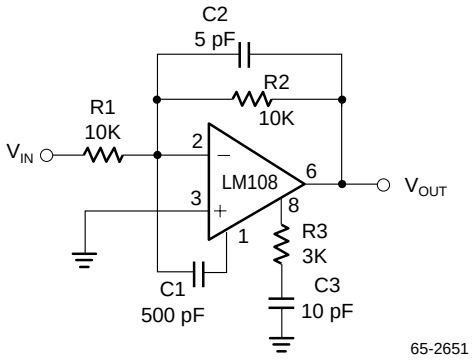
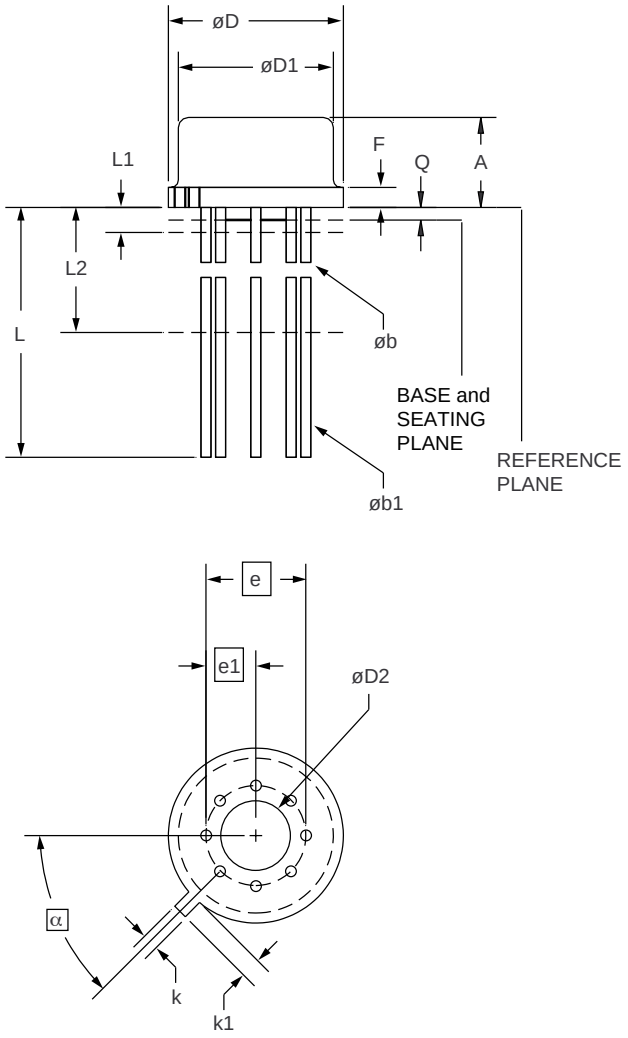


Figure 6. Feedforward Compensation

Mechanical Dimensions

8-Lead TO-99 Metal Can



Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	.165	.185	4.19	4.70	
øb	.016	.019	.41	.48	1, 5
øb1	.016	.021	.41	.53	1, 5
øD	.335	.375	8.51	9.52	
øD1	.305	.335	7.75	8.51	
øD2	.110	.160	2.79	4.06	
e	.200 BSC		5.08 BSC		
e1	.100 BSC		2.54 BSC		
F	—	.040	—	1.02	
k	.027	.034	.69	.86	
k1	.027	.045	.69	1.14	2
L	.500	.750	12.70	19.05	1
L1	—	.050	—	1.27	1
L2	.250	—	6.35	—	1
Q	.010	.045	.25	1.14	
α	45° BSC		45° BSC		

Notes:

1. (All leads) øb applies between L1 & L2. øb1 applies between L2 & .500 (12.70mm) from the reference plane. Diameter is uncontrolled in L1 & beyond .500 (12.70mm) from the reference plane.
2. Measured from the maximum diameter of the product.
3. Leads having a maximum diameter .019 (.48mm) measured in gauging plane, .054 (1.37mm) +.001 (.03mm) –.000 (.00mm) below the reference plane of the product shall be within .007 (.18mm) of their true position relative to a maximum width tab.
4. The product may be measured by direct methods or by gauge.
5. All leads – increase maximum limit by .003 (.08mm) when lead finish is applied.

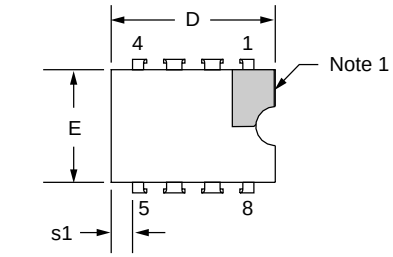
Mechanical Dimensions (continued)

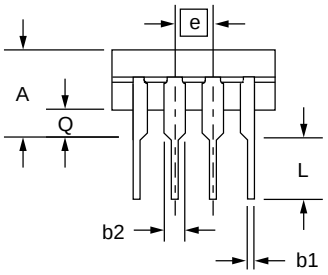
8-Lead Ceramic DIP

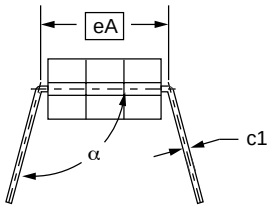
Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	—	.200	—	5.08	
b1	.014	.023	.36	.58	8
b2	.045	.065	1.14	1.65	2, 8
c1	.008	.015	.20	.38	8
D	—	.405	—	10.29	4
E	.220	.310	5.59	7.87	4
e	.100 BSC		2.54 BSC		5, 9
eA	.300 BSC		7.62 BSC		7
L	.125	.200	3.18	5.08	
Q	.015	.060	.38	1.52	3
s1	.005	—	.13	—	6
α	90°	105°	90°	105°	

Notes:

1. Index area: a notch or a pin one identification mark shall be located adjacent to pin one. The manufacturer's identification shall not be used as pin one identification mark.
2. The minimum limit for dimension "b2" may be .023 (.58mm) for leads number 1, 4, 5 and 8 only.
3. Dimension "Q" shall be measured from the seating plane to the base plane.
4. This dimension allows for off-center lid, meniscus and glass overrun.
5. The basic pin spacing is .100 (2.54mm) between centerlines. Each pin centerline shall be located within ±.010 (.25mm) of its exact longitudinal position relative to pins 1 and 8.
6. Applies to all four corners (leads number 1, 4, 5, and 8).
7. "eA" shall be measured at the center of the lead bends or at the centerline of the leads when "α" is 90°.
8. All leads – Increase maximum limit by .003 (.08mm) measured at the center of the flat, when lead finish applied.
9. Six spaces.







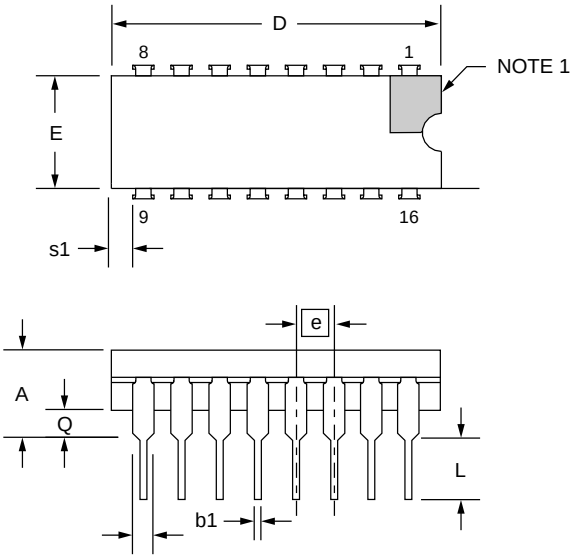
Mechanical Dimensions (continued)

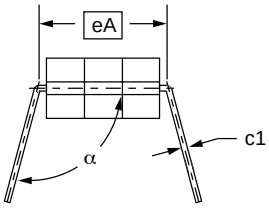
16-Lead Ceramic DIP

Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	—	.200	—	5.08	
b1	.014	.023	.36	.58	8
b2	.050	.065	1.27	1.65	2
c1	.008	.015	.20	.38	8
D	.745	.840	18.92	21.33	4
E	.220	.310	5.59	7.87	4
e	.100 BSC		2.54 BSC		5, 9
eA	.300 BSC		7.62 BSC		7
L	.115	.160	2.92	4.06	
Q	.015	.060	.38	1.52	3
s1	.005	—	.13	—	6
α	90°	105°	90°	105°	

Notes:

1. Index area: a notch or a pin one identification mark shall be located adjacent to pin one. The manufacturer's identification shall not be used as pin one identification mark.
2. The minimum limit for dimension "b2" may be .023 (.58mm) for leads number 1, 8, 9 and 16 only.
3. Dimension "Q" shall be measured from the seating plane to the base plane.
4. This dimension allows for off-center lid, meniscus and glass overrun.
5. The basic pin spacing is .100 (2.54mm) between centerlines. Each pin centerline shall be located within ±.010 (.25mm) of its exact longitudinal position relative to pins 1 and 16.
6. Applies to all four corners (leads number 1, 8, 9, and 16).
7. "eA" shall be measured at the center of the lead bends or at the centerline of the leads when "α" is 90°.
8. All leads – Increase maximum limit by .003 (.08mm) measured at the center of the flat, when lead finish applied.
9. Fourteen spaces.





Ordering Information

Part Number	Package	Operation Temperature Range
LM108D	8-Lead Ceramic DIP	-55°C to +125°C
LM108D/883B	8-Lead Ceramic DIP	-55°C to +125°C
LM108AD	8-Lead Ceramic DIP	-55°C to +125°C
LM108AD/883B	8-Lead Ceramic DIP	-55°C to +125°C
LM108T	8-Lead Metal Can TO-99	-55°C to +125°C
LM108T/883B	8-Lead Metal Can TO-99	-55°C to +125°C
LM108AT	8-Lead Metal Can TO-99	-55°C to +125°C
LM108AT/883B	8-Lead Metal Can TO-99	-55°C to +125°C
LH2108D	16-Lead Ceramic DIP	-55°C to +125°C
LH2108D/883B	16-Lead Ceramic DIP	-55°C to +125°C
LH2108AD	16-Lead Ceramic DIP	-55°C to +125°C
LH2108AD/883B	16-Lead Ceramic DIP	-55°C to +125°C

Note:

1. /883B suffix denotes Mil-Std-883, Level B processing