FEATURES

- *Guaranteed* 200pA max. input offset current
- *Guaranteed* 2nA max. input bias current
- *Guaranteed* 600μA max. supply current
- *Guaranteed* 0.5mV max. offset voltage
- *Guaranteed* 5μV/°C max. drift
- Wide supply voltage range: ± 2V to ± 18V

APPLICATIONS

- Integrators
- Transducer amplifiers
- Analog memories
- Light meters

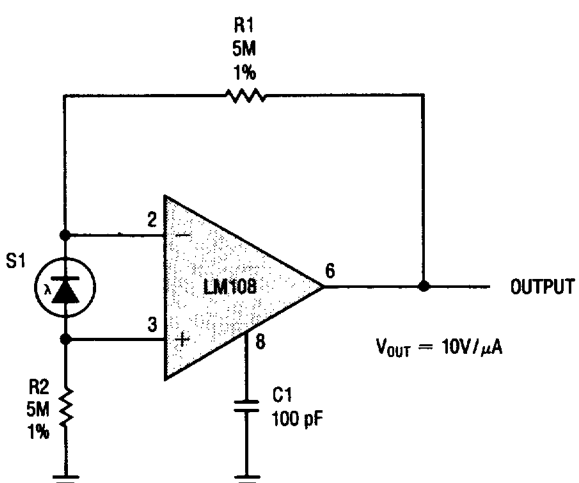
DESCRIPTION

The LM108 series of precision operational amplifiers are particularly well-suited for high source impedance applications requiring low offset and bias currents as well as low power dissipation. Unlike FET input amplifiers, the offset and bias currents of the LM108 do not change significantly with temperature variations. Advanced design, processing and testing techniques make Linear's LM108 a superior choice over previous devices.

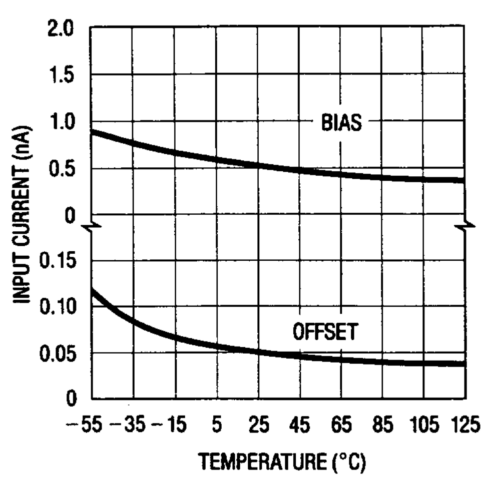
A photodiode sensor application is shown below. For applications requiring higher performance, see the LT1008, and LT1012.

2

Amplifier For Photodiode Sensor



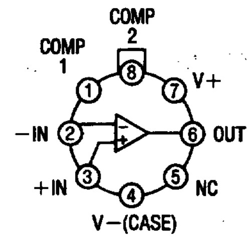
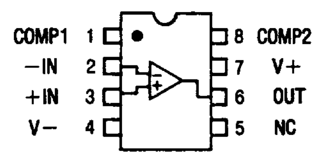
Input Currents



ABSOLUTE MAXIMUM RATINGS

Supply Voltage
  LM108A/LM108 .... ±20V
  LM308A/LM308 .... ±18V
Differential Input Current (Note 1)......... ±10mA
Input Voltage (Note 2).................... ±15V
Output Short Circuit Duration............ Indefinite
Operating Temperature Range
  LM108A/LM108 .... −55°C to 125°C
  LM308A/LM308 .... 0°C to 70°C
Storage Temperature Range
  All Devices.................. −65°C to 150°C
Lead Temperature (Soldering, 10 sec.)...... 300°C

PACKAGE/ORDER INFORMATION

Package	ORDER PART NO.
TOP VIEW  METAL CAN H PACKAGE	LM108AH LM108H LM308AH LM308H
TOP VIEW  PLASTIC DIP N8 PACKAGE	LM308AN8 LM308N8

ELECTRICAL CHARACTERISTICS ±5V ≤ V_s ≤ ±20V and −55°C ≤ T_A ≤ 125°C, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		LM108A MIN	LM108A TYP	LM108A MAX	LM108 MIN	LM108 TYP	LM108 MAX	UNITS
V_{OS}	Input Offset Voltage	T_A = 25°C			0.3	0.5		0.7	2.0	mV
			●			1.0			3.0	mV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Temperature Coefficient of Input Offset Voltage		●		1.0	5.0		3.0	15	μV/°C
I_{OS}	Input Offset Current	T_A = 25°C			0.05	0.2		0.05	0.2	nA
			●			0.4			0.4	nA
$\frac{\Delta I_{OS}}{\Delta Temp}$	Average Temperature Coefficient of Input Offset Current		●		0.5	2.5		0.5	2.5	pA/°C
I_B	Input Bias Current	T_A = 25°C			0.5	2.0		0.5	2.0	nA
			●			3.0			3.0	nA
A_{VOL}	Large Signal Voltage Gain	T_A = 25°C, V_S ± 15V,		80	300		50	300		V/mV
		V_{OUT} = ± 10V, R_L ≥ 10kΩ	●	40			25			V/mV
CMRR	Common Mode Rejection Ratio		●	96	110		85	100		dB
PSRR	Power Supply Rejection Ratio		●	96	110		80	96		dB
	Input Voltage Range	V_S = ± 15V	●	±13.5			±13.5			V
V_{OUT}	Output Voltage Swing	V_S = ± 15V, R_L = 10kΩ	●	±13	±14		±13	±14		V
R_{IN}	Input Resistance	T_A = 25°C (Note 3)		30	70		30	70		MΩ
I_S	Supply Current	T_A = 25°C			0.3	0.6		0.3	0.6	mA
		T_A = 125°C			0.15	0.4		0.15	0.4	mA

ELECTRICAL CHARACTERISTICS ±5V ≤ V_s ≤ ±15V and 0°C ≤ T_A ≤ 70°C, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		LM308A MIN	LM308A TYP	LM308A MAX	LM308 MIN	LM308 TYP	LM308 MAX	UNITS
V_{OS}	Input Offset Voltage	T_A = 25°C			0.3	0.5		2.0	7.5	mV
			●			0.73			10	mV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Temperature Coefficient of Input Offset Voltage		●		2.0	5.0		6.0	30	μV/°C
I_{OS}	Input Offset Current	T_A = 25°C			0.2	1.0		0.2	1.0	nA
			●			1.5			1.5	nA
$\frac{\Delta I_{OS}}{\Delta Temp}$	Average Temperature Coefficient of Input Offset Current		●		2.0	10		2.0	10	pA/°C
I_B	Input Bias Current	T_A = 25°C			1.5	7.0		1.5	7.0	nA
			●			10			10	nA
A_{VOL}	Large Signal Voltage Gain	T_A = 25°C, V_S ± 15V,		80	300		25	300		V/mV
		V_{OUT} = ± 10V, R_L ≥ 10kΩ	●	60			15			V/mV
CMRR	Common Mode Rejection Ratio		●	96	110		80	100		dB
PSRR	Power Supply Rejection Ratio		●	96	110		80	96		dB
	Input Voltage Range	V_S = ± 15V	●	±14			±14			V
V_{OUT}	Output Voltage Swing	V_S = ± 15V R_L = 10kΩ	●	±13	±14		±13	±14		V
R_{IN}	Input Resistance	T_A = 25°C (Note 3)		10	40		10	40		MΩ
I_S	Supply Current	T_A = 25°C			0.3	0.8		0.3	0.8	mA

2

The ● denotes the specifications which apply over the full operating temperature range.

For MIL-STD components, please refer to LTC 883 data sheet for test listing and parameters.

Note 1: Differential input voltages greater than 1V will cause excessive current to flow through the input protection diodes unless current limiting resistance is used.

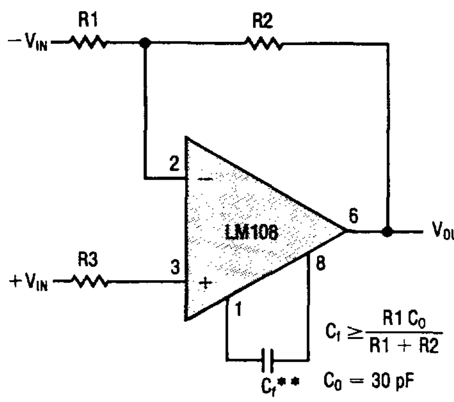
Note 2: For supply voltages less than ± 15V, the maximum input voltage is equal to the supply voltage.

Note 3: Guaranteed by design.

TYPICAL APPLICATIONS

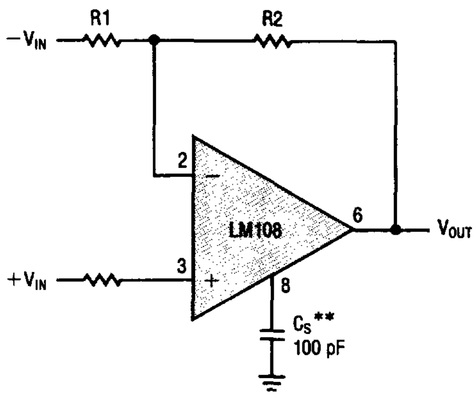
COMPENSATION CIRCUITS

Standard Compensation Circuit



** BANDWIDTH AND SLEW RATE ARE PROPORTIONAL TO 1/C_f

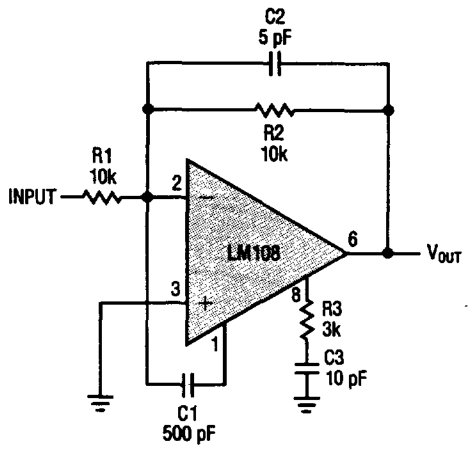
Alternate* Frequency Compensation



* IMPROVES REJECTION OF POWER SUPPLY NOISE BY A FACTOR OF TEN.

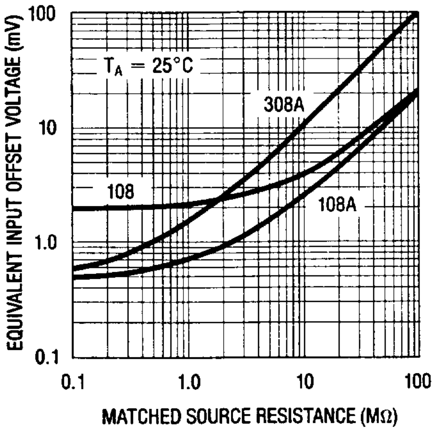
** BANDWIDTH AND SLEW RATE ARE PROPORTIONAL TO 1/C_S

Feedforward Compensation

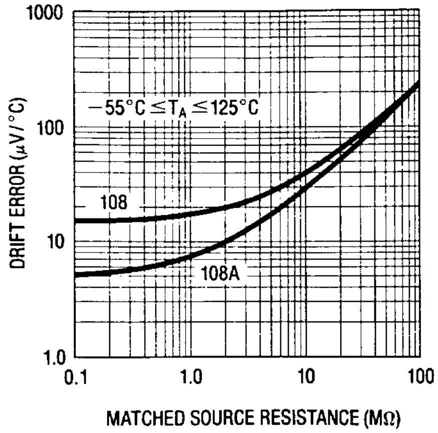


TYPICAL PERFORMANCE CHARACTERISTICS

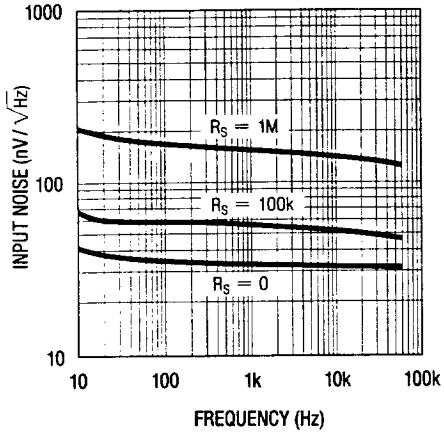
Guaranteed Offset Error



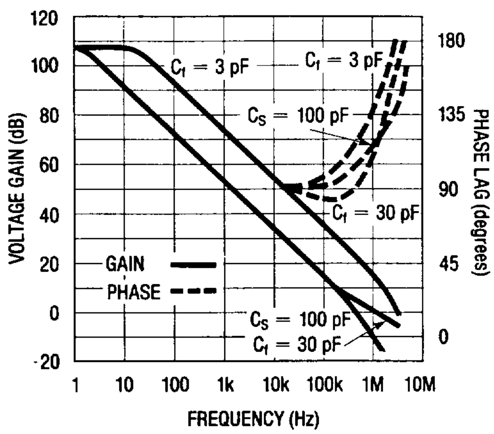
Guaranteed Drift Error



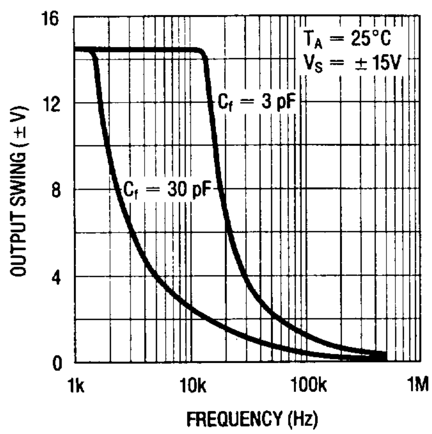
Input Noise Voltage



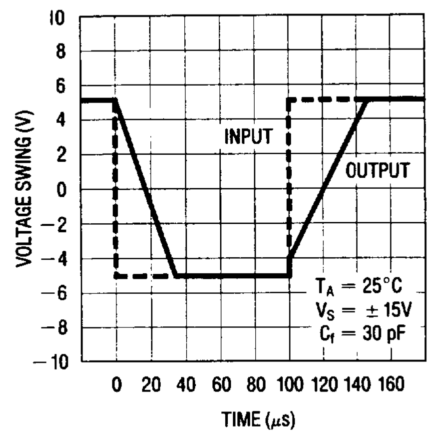
Open Loop Frequency Response



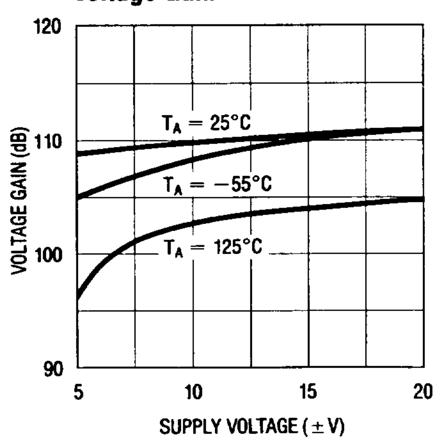
Large Signal Frequency Response



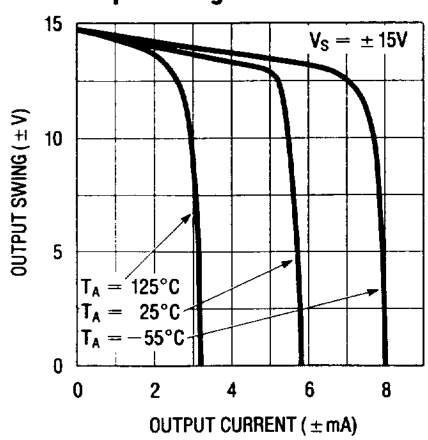
Voltage Follower Pulse Response



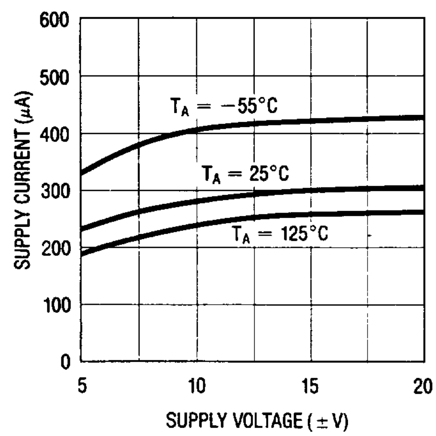
Voltage Gain



Output Swing

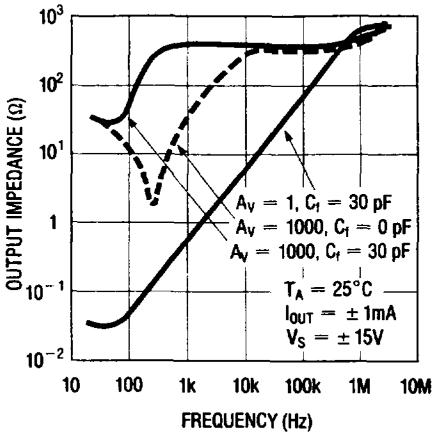


Supply Current

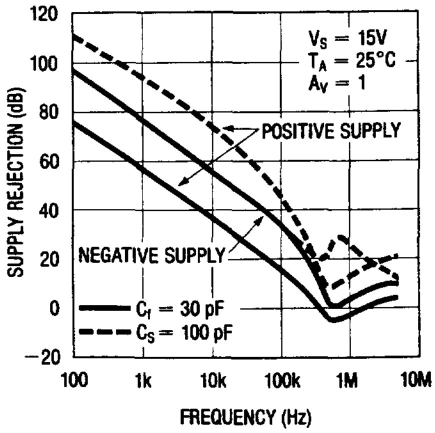


TYPICAL PERFORMANCE CHARACTERISTICS

Closed Loop Output Impedance



Power Supply Rejection



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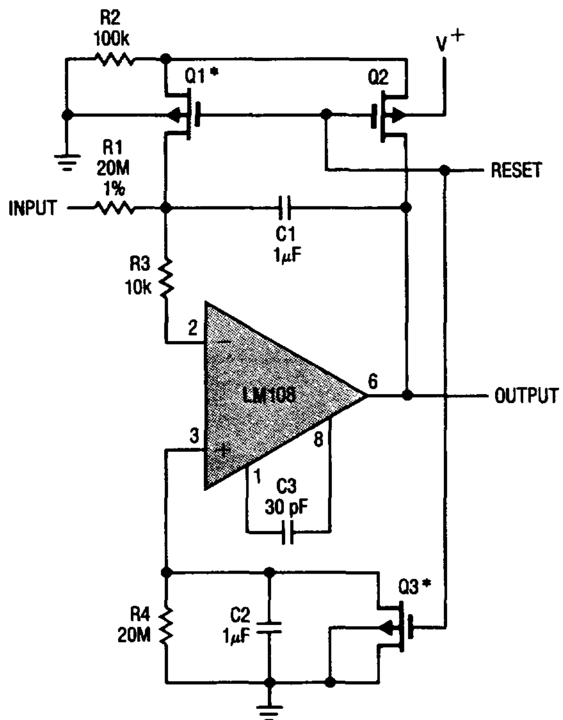
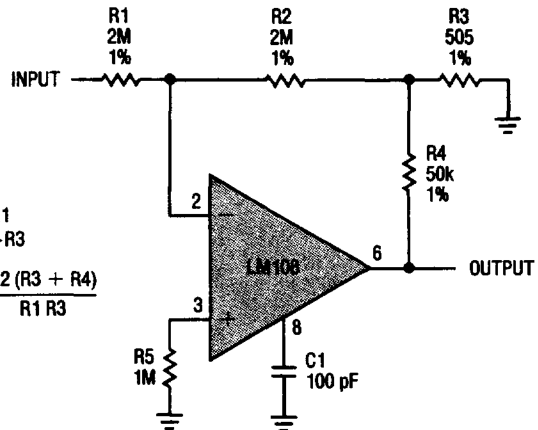
TYPICAL APPLICATIONS

Low Drift Integrator With Reset



* Q1 AND Q3 SHOULD NOT HAVE INTERNAL GATE-PROTECTION DIODES.

Inverting Amplifier With High Input Resistance

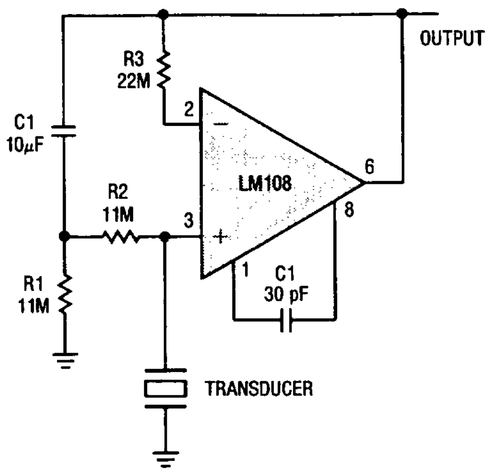


R2 > R1
R2 >> R3

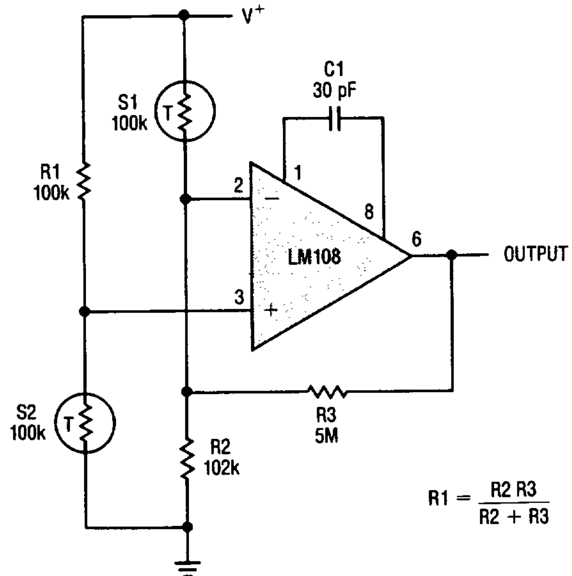
$$A_V = \frac{R2\,(R3 + R4)}{R1\,R3}$$

TYPICAL APPLICATIONS

Amplifier For Piezoelectric Transducers

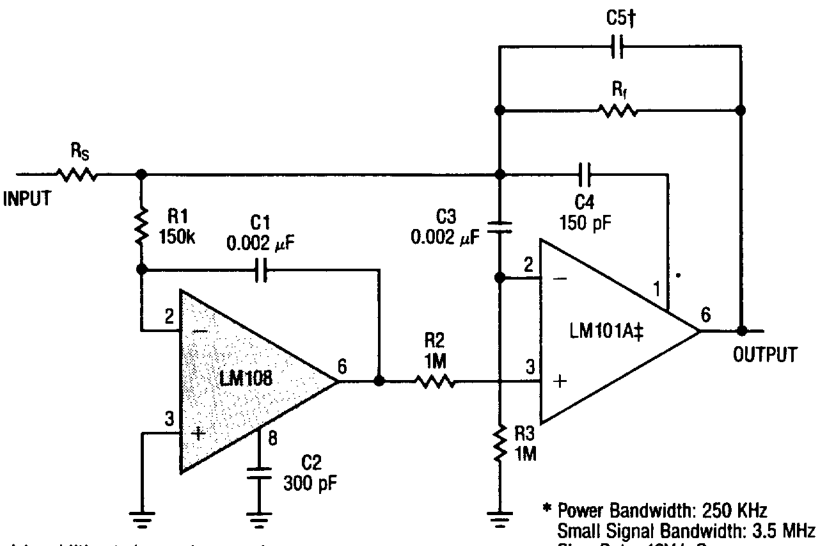


Amplifier For Bridge Transducers



$$R1 = \frac{R2\,R3}{R2 + R3}$$

Fast* Summing Amplifier

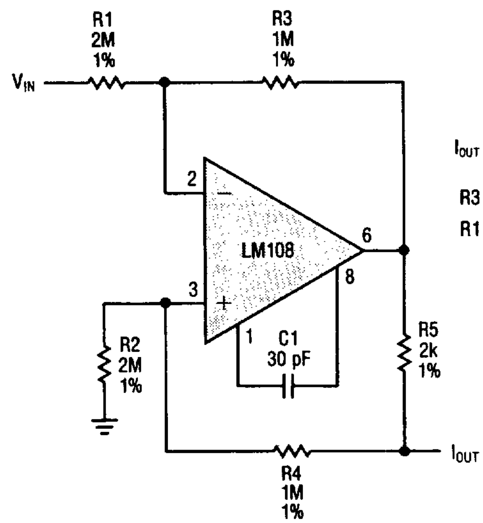


‡ In addition to increasing speed, the LM101A raises high and low frequency gain, increases output drive capability and eliminates thermal feedback.

* Power Bandwidth: 250 KHz
Small Signal Bandwidth: 3.5 MHz
Slew Rate: 10V/μS

$$\dagger C5 = \frac{6 \times 10^{-8}}{R_f}$$

Bilateral Current Source

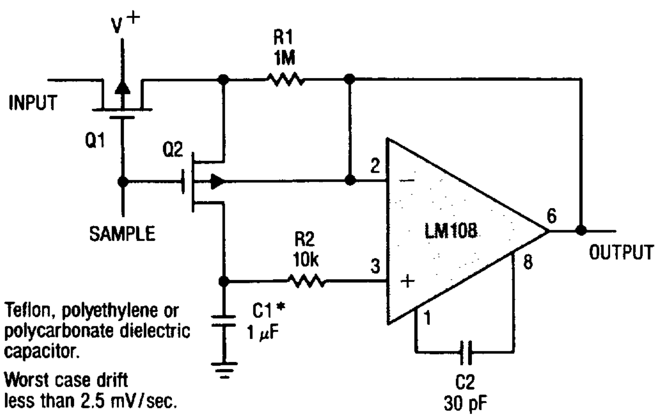


$$I_{OUT} = \frac{R3\,V_{IN}}{R1\,R5}$$

$R3 = R4 + R5$

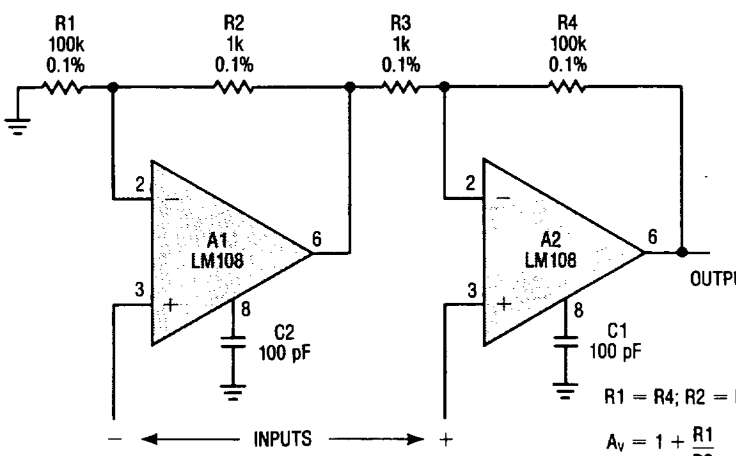
$R1 = R2$

Sample and Hold



* Teflon, polyethylene or polycarbonate dielectric capacitor.
Worst case drift less than 2.5 mV/sec.

Differential Input Instrumentation Amplifier



$R1 = R4$; $R2 = R3$

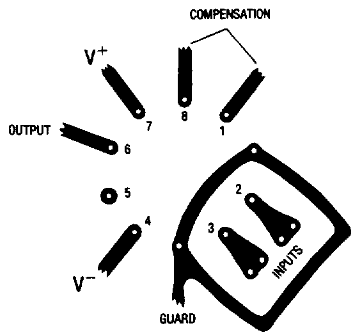
$$A_V = 1 + \frac{R1}{R2}$$

LINEAR TECHNOLOGY

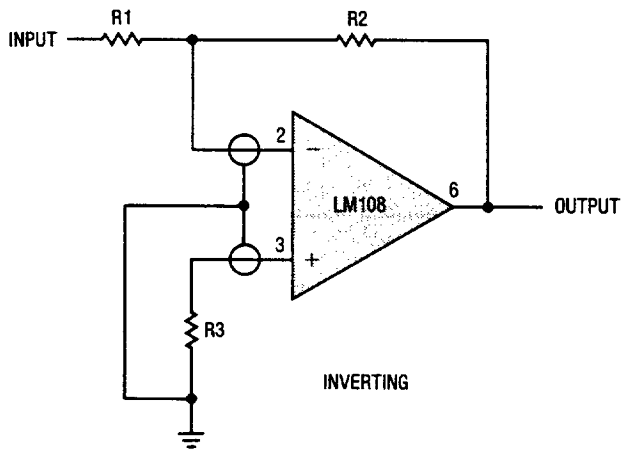
APPLICATIONS INFORMATION

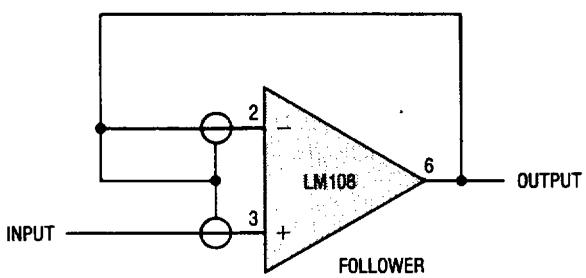
Input guarding

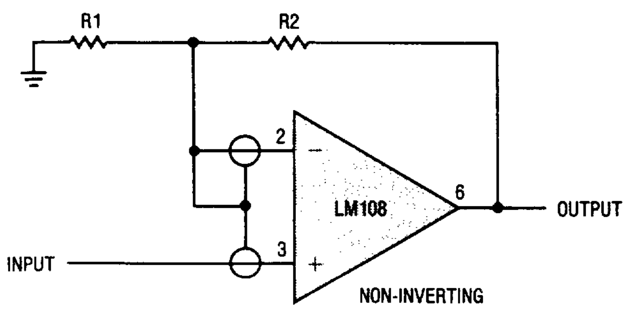
Input guarding is used to reduce surface leakage. Guarding both sides of the board is required. Bulk leakage reduction is less and depends on the guard ring width.



The guard ring is connected to a low impedance point at same potential as the sensitive input leads. Connections for various op amp configurations are shown below.

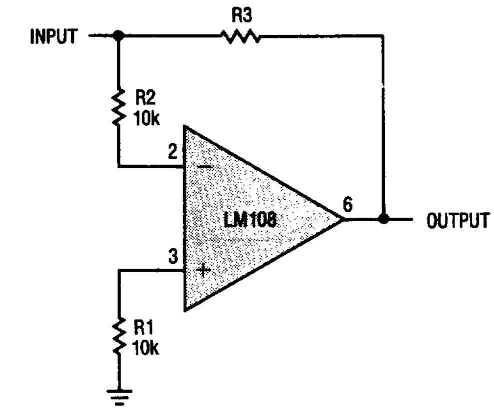




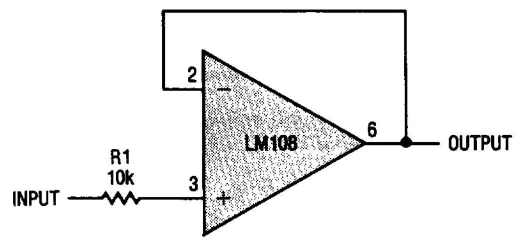


Input protection

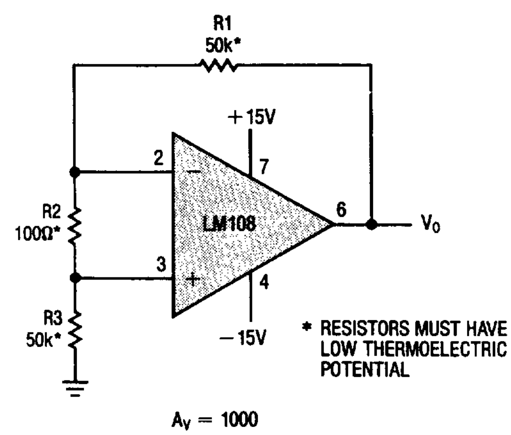
Current is limited by R2 even when input is connected to a voltage source outside the common mode range. If one supply reverses, current is controlled by R1. These resistors do not affect normal operation.



The input resistor controls the current when the input exceeds the supply voltages, when the power for the op amp is turned off, or when the output is shorted.



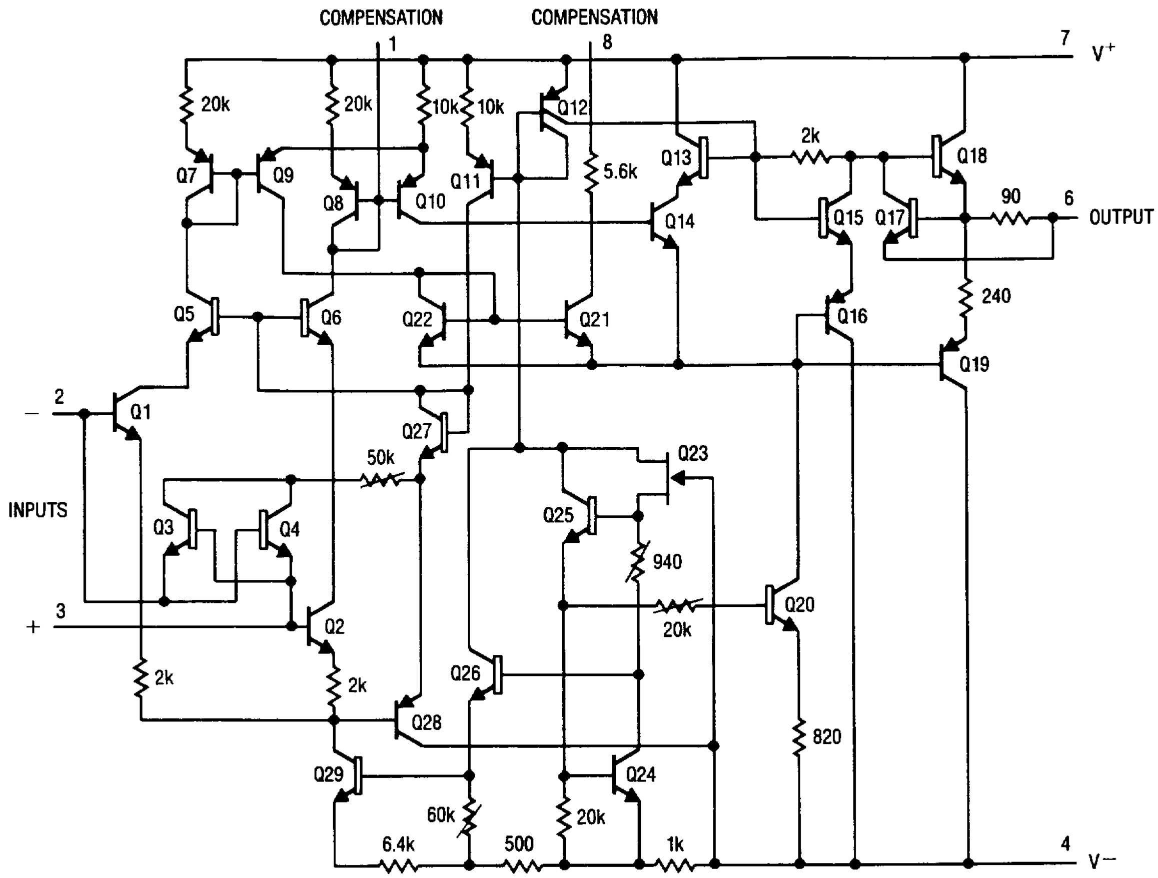
Offset Voltage Test Circuit†



$A_V = 1000$

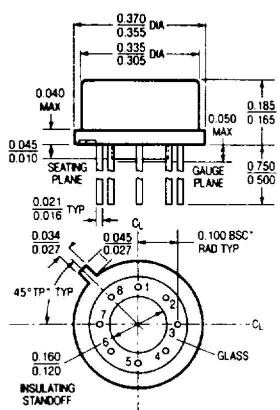
† THIS CIRCUIT IS ALSO USED AS THE BURN-IN CONFIGURATION WITH SUPPLY VOLTAGES EQUAL TO ±20V, R1=R3=10k, R2=200Ω, A_V=100.

SCHEMATIC DIAGRAM



PACKAGE DESCRIPTION

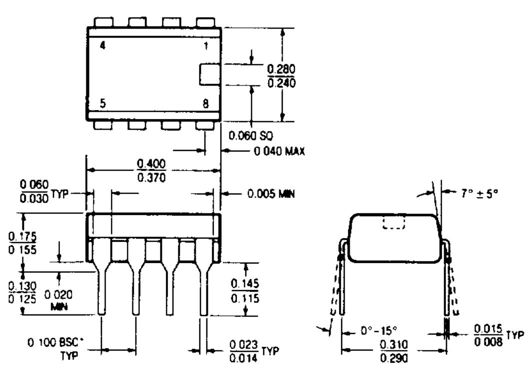
H Package
Metal Can



NOTE: DIMENSIONS IN INCHES

$T_j$max	Θ_{ja}	Θ_{jc}
150°C	150°C/W	45°C/W

N8 Package
8 Lead Plastic



NOTE: DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.
*LEADS WITHIN 0.007 OF TRUE POSITION (TP) AT GAUGE PLANE.

$T_j$max	Θ_{ja}
100°C	130°C/W

LINEAR TECHNOLOGY