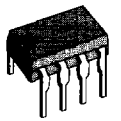
SGS-THOMSON MICROELECTRONICS

LM108/A - LM208/A LM308/A

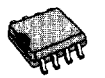
PRECISION SINGLE OPERATIONAL AMPLIFIERS

Outstanding characteristics of LM108A :

- INPUT OFFSET VOLTAGE : 0.5mV MAXIMUM
- INPUT BIAS CURRENT : 3nA MAXIMUM OVER FULL TEMPERATURE RANGE
- INPUT OFFSET CURRENT : 0.4nA MAXIMUM OVER FULL TEMPERATURE RANGE
- POWER SUPPLY CURRENT : 600µA MAXIMUM
- GUARANTEED DRIFT CHARACTERISTICS
- SLEW RATE OF 10V/µs AS INVERTING AMPLIFIER



N
DIP8
(Plastic Package)



D
SO8
(Plastic Micropackage)

J
CERDIP8
(Cerdip Package)

H
TO99
(Metal Can)

DESCRIPTION

The LM308,A is a precision operational amplifier having specifications a factor ten better than FET amplifiers over a -55°C to +125°C temperature range. Selected units are available with offset voltages less than 1mV and drifts less than 5mV/°C. This makes it possible to eliminate offset adjustments, in most cases.

The device operates with supply voltages from ±2V to ±22V and has sufficient supply rejection to use unregulated supplies. Although the circuit is interchangeable with and uses the same compensation as the LM101A, an alternate compensation scheme can be used to make it particularly insensitive to power supply noise and to make supply bypass capacitors unnecessary.

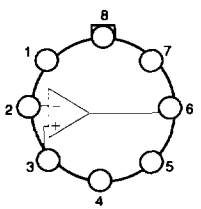
ORDER CODES

Part Number	Temperature Range	Package			
		H	N	J	D
LM108/A	-55, +125°C	•	•	•	•
LM208/A	-40, +105°C	•	•	•	•
LM308/A	0, +70°C	•	•	•	•
Examples : LM108H, LM108AH, LM308N					

108-01.TBL

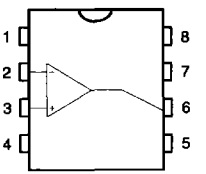
PIN CONNECTIONS (top views)

TO99



108-01.EPS

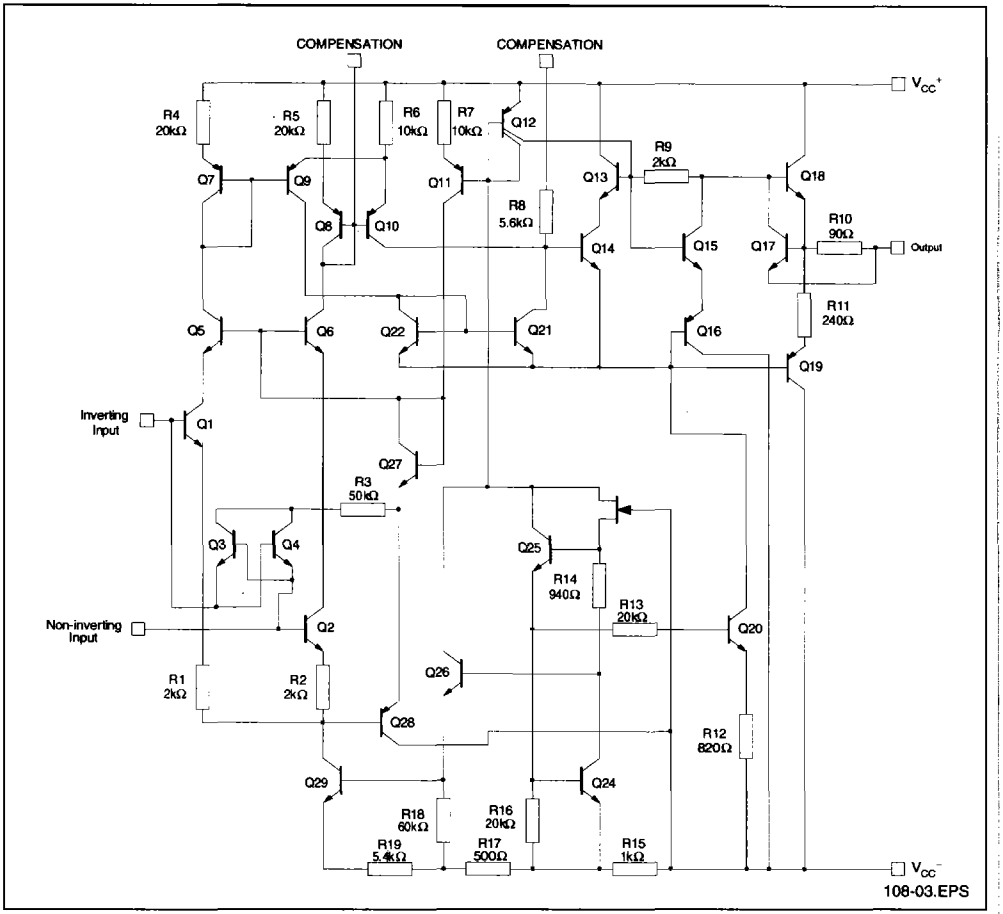
DIP8/CERDIP8
SO8



108-02.EPS

1 - Frequency compensation
2 - Inverting input
3 - Non-inverting input
4 - V_{CC}^-
5 - N.C.
6 - Output
7 - V_{CC}^+
8 - Frequency Compensation

SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	LM108,A	LM208,A	LM308,A	Unit
V_{CC}	Supply Voltage	±22	±22	±22	V
V_i	Input Voltage - (note 2)	±15	±15	±15	V
I_{id}	Differential Input Current - (note 1)	±10	±10	±10	
P_{tot}	Power Dissipation	500			mW
	Output Short-circuit Duration	Infinite			
T_{oper}	Operating Free-air Temperature Range	−55 to +125	−40 to +105	0 to +70	°C
T_{stg}	Storage Temperature Range	−65 to +150	−65 to +150	−65 to +150	°C

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

ELECTRICAL CHARACTERISTICS

$\pm 5V \leq V_{CC} \leq \pm 20V$, $C_1 = 30pF$, $T_{amb} = 25°C$ (unless otherwise specified)

Symbol	Parameter	LM108A - LM208A LM308A			Unit
		Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($R_S \leq 10k\Omega$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ LM108A - LM208A		0.3	0.5 0.75 1	mV
I_{ib}	Input Bias Current $T_{amb} = 25°C$ LM108A - LM208A LM308A $T_{min.} \leq T_{amb} \leq T_{max.}$ LM108A - LM208A LM308A		0.6	2 4 3 7	nA
I_{io}	Input Offset Current $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		0.05	0.2 0.4	nA
A_{vd}	Large Signal Voltage Gain ($V_{cc} = \pm 15V$, $V_O = \pm 10V$, $R_L = 10k\Omega$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	80 60	300		V/mV
SVR	Supply Voltage Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	96 96	110		dB
I_{CC}	Supply Current no Load $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		0.3	0.6 0.6	mA
V_{icm}	Input Common Mode Voltage Range ($V_{CC} = \pm 15V$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	±14 ±14			V
CMR	Common Mode Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	96 96	110		dB
I_{os}	Output Short-circuit Current ($V_{CC} = \pm 15V$)	3	10	20	mA
$\pm V_{opp}$	Output Voltage Swing ($V_{CC} = \pm 15V$, $R_L = 10k\Omega$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	13 13	14		V
SR	Slew Rate ($V_{CC} = \pm 15V$, $V_i = \pm 10V$, $R_L = 10k\Omega$, $C_L = 100pF$, $T_{amb} = 25°C$, unity gain)		0.15		V/µs
t_r	Rise Time ($V_{CC} = \pm 15V$, $V_i = \pm 20mV$, $R_L = 10k\Omega$, $C_L = 100pF$, unity gain)		0.7		µs
K_{ov}	Overshoot ($V_{CC} = \pm 15V$, $V_i = 20$ mV, $R_L = 10k\Omega$, $C_L = 100pF$, unity gain)		10		%
R_i	Input Resistance ($V_{CC} = \pm 15V$)	30	70		MΩ
GBP	Gain Bandwidth Product ($V_{CC} = \pm 15V$, $V_i = 10mV$, $R_L = 10k\Omega$, $C_L = 100pF$, f = 100kHz)	0.3	0.8		MHz
THD	Total Harmonic Distortion ($V_{CC} = \pm 15V$, f = 1kHz, $A_V = 20dB$, $R_L = 10k\Omega$, $V_O = 2V_{PP}$, $C_L = 100pF$)		0.12		%
e_n	Equivalent Input Noise Voltage ($V_{CC} = \pm 15V$, f = 1kHz, $R_s = 100\Omega$)		20		$\frac{nV}{\sqrt{Hz}}$
DV_{io}	Input Offset Voltage Drift $T_{min.} \leq T_{amb} \leq T_{max.}$		1	5	µV/°C
DI_{io}	Input Offset Current Drift $T_{min.} \leq T_{amb} \leq 25°C$		0.5	2.5	pA/°C

108-03.TBL

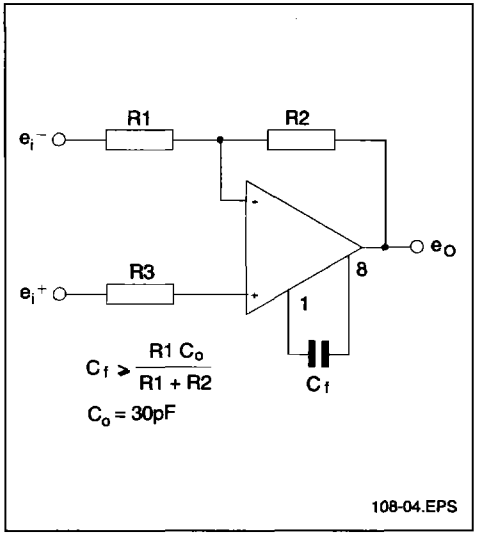
ELECTRICAL CHARACTERISTICS

$\pm 5V \leq V_{CC} \leq \pm 20V$, $C_1 = 30pF$, $T_{amb} = 25°C$ (unless otherwise specified)

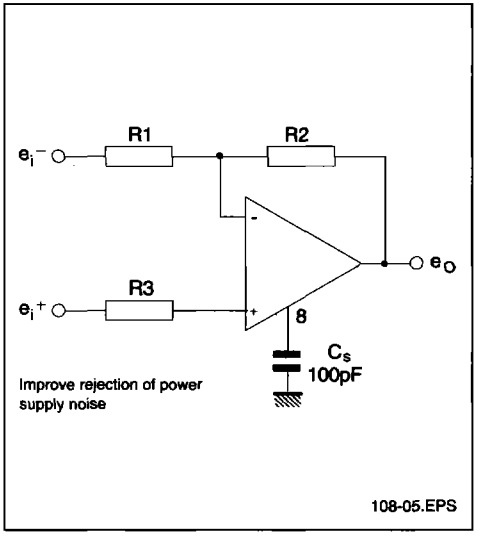
Symbol	Parameter	LM108 - LM208			LM308			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($R_S \leq 10k\Omega$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		0.7	2 3		2	7.5 10	mV
I_{ib}	Input Bias Current $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		0.6	2 3		0.6	7 10	nA
I_{io}	Input Offset Current $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		0.05	0.2 0.4		0.05	1 1.5	nA
A_{vd}	Large Signal Voltage Gain ($V_{CC} = \pm 15V$, $V_O = \pm 10V$, $R_L = 10k\Omega$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	50 25	300		25 15	300		V/mV
SVR	Supply Voltage Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	80 80	96		80 80	96		dB
I_{CC}	Supply Current no Load $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		0.3	0.6 0.6		0.3	0.8 0.8	mA
V_{icm}	Input Common Mode Voltage Range ($V_{CC} = \pm 15V$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	±13.5 ±13.5			±14 ±14			V
CMR	Common Mode Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	80 80	100		80 80	100		dB
I_{os}	Output Short-circuit Current ($V_{CC} = \pm 15V$)	3	10	20	3	10	20	mA
$\pm V_{opp}$	Output Voltage Swing ($V_{CC} = \pm 15V$, $R_L = 10k\Omega$) $T_{amb} = 25°C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	13 13	14		13 13	14		V
SR	Slew Rate ($V_{CC} = \pm 15V$, $V_i = \pm 10V$, $R_L = 10k\Omega$, $C_L = 100pF$, $T_{amb} = 25°C$, unity gain)		0.15			0.15		V/µs
t_r	Rise Time ($V_{CC} = \pm 15V$, $V_i = \pm 20mV$, $R_L = 10k\Omega$, $C_L = 100pF$, unity gain)		0.7			0.7		µs
K_{ov}	Overshoot ($V_{CC} = \pm 15V$, $V_i = 20$ mV, $R_L = 10k\Omega$, $C_L = 100pF$, unity gain)		10			10		%
R_i	Input Resistance ($V_{CC} = \pm 15V$)	30	70		30	70		MΩ
GBP	Gain Bandwidth Product ($V_{CC} = \pm 15V$, $V_i = 10mV$, $R_L = 10k\Omega$, $C_L = 100pF$, f = 100kHz)	0.3	0.8		0.3	0.8		MHz
THD	Total Harmonic Distortion ($V_{CC} = \pm 15V$, f = 1kHz, $A_V = 20dB$, $R_L = 10k\Omega$, $V_O = 2V_{PP}$, $C_L = 100pF$)		0.12			0.12		%
e_n	Equivalent Input Noise Voltage ($V_{CC} = \pm 15V$, f = 1kHz, $R_s = 100\Omega$)		20			20		$\frac{nV}{\sqrt{Hz}}$
DV_{io}	Input Offset Voltage Drift $T_{min.} \leq T_{amb} \leq T_{max.}$		3	15		6	30	µV/°C
DI_{io}	Input Offset Current Drift $T_{min.} \leq T_{amb} \leq 25°C$		0.5	2.5		2	10	pA/°C

BASIC DIAGRAMS

STANDARD COMPENSATION CIRCUIT

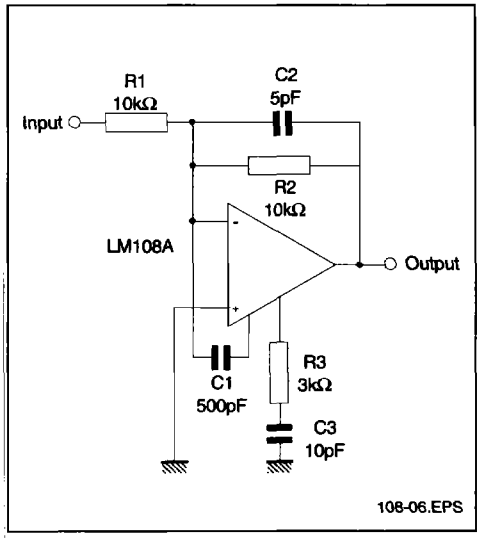


ALTERNATIVE FREQUENCY COMPENSATION

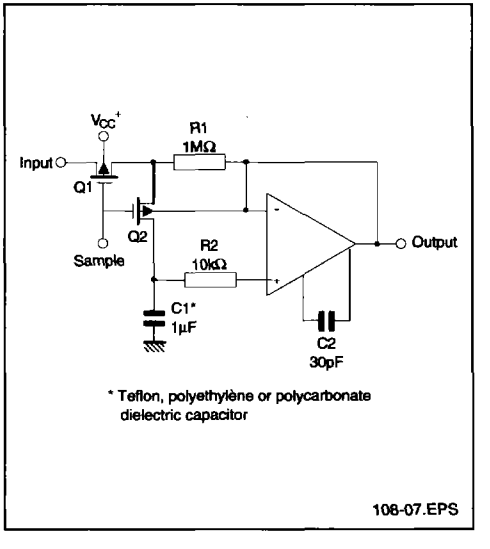


TYPICAL APPLICATIONS

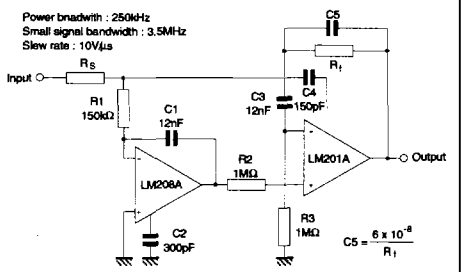
STANDARD FEEDFORWARD



SAMPLE AND HOLD



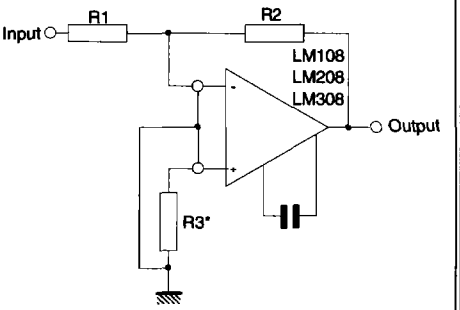
FAST SUMMING AMPLIFIER



In addition to increasing speed the LM201A raises high and low frequency gain and eliminates thermal feedback

108-08.EPS

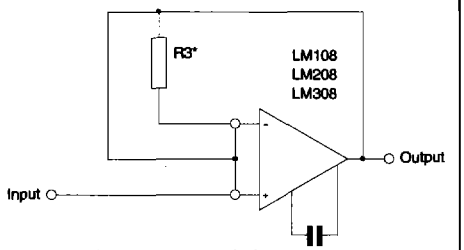
INVERTING AMPLIFIER



* Used to compensate for large source resistances

108-09.EPS

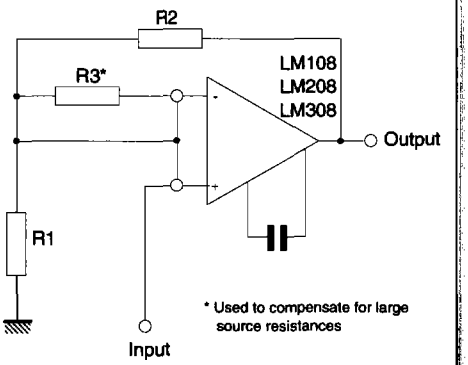
FOLLOWING AMPLIFIER



* Used to compensate for large source resistances

108-10.EPS

NON-INVERTING AMPLIFIER



* Used to compensate for large source resistances

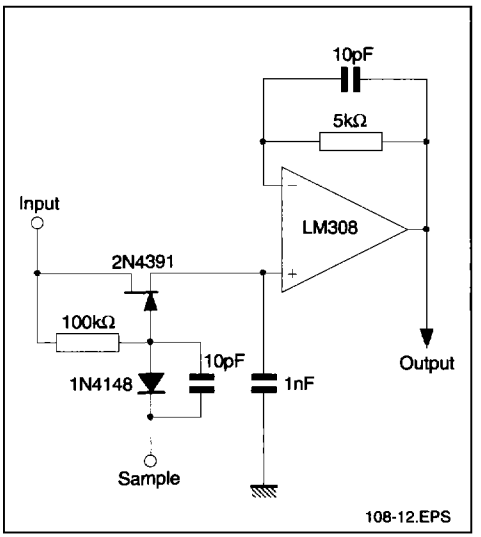
108-11.EPS

INPUT GUARDING

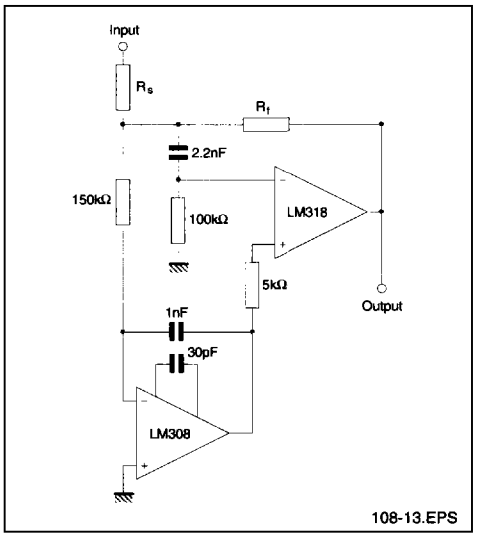
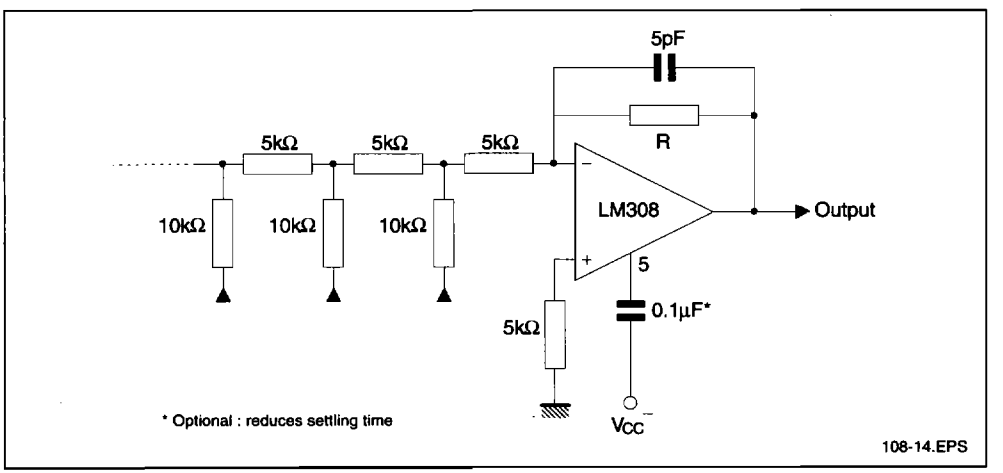
Leakage currents are on the verge of causing trouble at +125°C. The standard pin configuration of most IC op amps has the input pins adjacent to pins which are the supply potentials. Therefore, it is advisable to employ guarding to reduce the voltage difference between the inputs and adjacent metal runs. A ten-lead pin circle is used, and the leads of the IC are formed so that the holes adjacent to the inputs are vacant when it is inserted in the board. The guard, which is a conductive ring surrounding the inputs, is connected to a low impedance point that is at the same potential as the inputs.

TYPICAL APPLICATION DIAGRAMS

FAST SAMPLE AND HOLD



FAST SUMMING AMPLIFIER WITH LOW INPUT CURRENT



D/A CONVERTER USING LADDER NETWORK