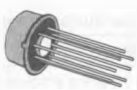
SGS-THOMSON MICROELECTRONICS

LM118-LM218 LM318

SINGLE OPERATIONAL AMPLIFIERS

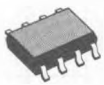
- INPUT OFFSET VOLTAGE :
  - 4 mV MAX. LM118 – LM218
  - 10 mV MAX. LM318
- INPUT BIAS CURRENT :
  - 250 nA MAX.
- INPUT OFFSET CURRENT :
  - 50 nA MAX.
- SLEW RATE OF 150 V/µs AS INVERTING AMPLIFIER



H
TO-99
(Metal Can)

GC
LCC20
(Tricecop (LCC))

N
DIP8
(Plastic Package)
J
CERDIP8
(Cerdip Package)



D
SO8
(Plastic Micropackage)

DESCRIPTION

The LM118, LM218 and LM318 are precision high speed operational amplifiers designed for applications requiring wide bandwidth and high slew rate. They feature internal frequency compensation and a factor of ten increase in speed over general purpose devices.

Although, no external frequency compensation components are needed for operation, feedforward compensation may be used to further increase the speed. For inverting applications, feedforward compensation will boost the slew rate to over 150 V/µs and almost double the bandwidth. However, for non-inverting or differential applications feedforward cannot be used.

The high speed and fast settling time of these op amps make them useful in A/D converters, oscillators, active filters, sample and hold circuits, or general purpose amplifiers.

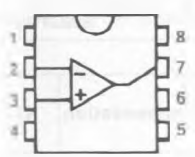
ORDER CODES

Part Number	Temperature Range	Package				
		H	N	J	GC	D
LM118	– 55 to + 125 °C	•		•	•	
LM218	– 40 to + 105 °C	•	•			▲
LM318	0 to + 70 °C	•	•			•

Note Hi-Rel Versions Available
Examples LM118J, LM218H

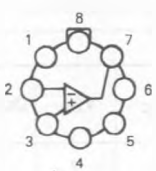
PIN CONNECTIONS

TO-99



1 - Balance/Compensation 1
2 - Inverting input
3 - Non-inverting input
4 - V_{CC}

DIP8/CERDIP8/ SO8



5 - Balance/Compensation 3
6 - Output
7 - V_{CC}

LCC 20

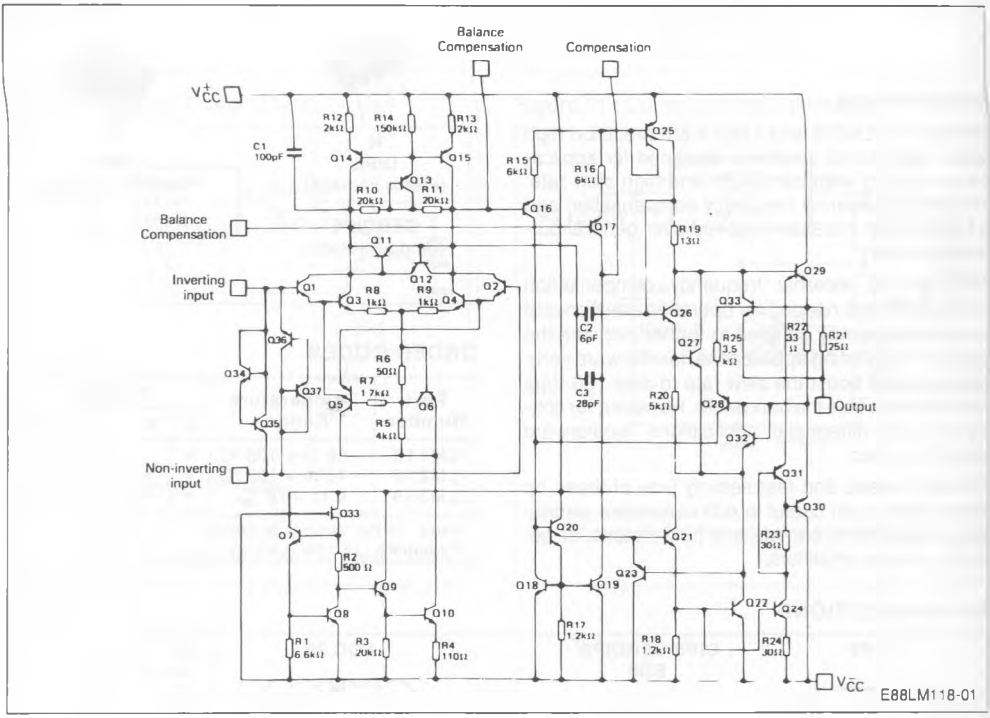
1 - NC
2 - Balance/Compensation 1
3 - NC
4 - NC
5 - Inverting input
6 - NC
7 - Non-inverting input
8 - NC
9 - NC
10 - V_{CC}
11 - NC
12 - Balance/Compensation 3
13 - NC
14 - NC
15 - Output
16 - NC
17 - V_{CC}
18 - NC
19 - NC
20 - Compensation 2

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	LM118	LM218	LM318	Unit
V_{CC}	Supply Voltage	± 20	± 20	± 20	V
V_i	Input Voltage (note 1)	± 15	± 15	± 15	V
I_{ID}	Differential Input Current (note 2)	± 10	± 10	± 10	mA
	Output Short-circuit Duration	Indefinite	Indefinite	Indefinite	
P_{tot}	Power Dissipation LM318D All other Versions	 500	 500	300 500	mW
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. For supply voltage less than ± 15 V, the absolute maximum input voltage is equal to the supply voltage.
2. The inputs are shunted with shunt diodes for overvoltage protection. Therefore, excessive current will flow if a differential input voltage in excess of 1 V is applied between the inputs unless some limiting resistance is used.

SCHEMATIC DIAGRAM



Case	Balance Compensation	Inverting Input	Non-inverting Input	V_{CC}^-	V_{CC}^+	Output	Compensation	N.C.
TO99/DIP8 CERDIP8/SO8	1, 5	2	3	4	7	6	8	
LCC20	2, 12	5	7	10	17	15	20	•

* LCC20 : Other pins are not connected.

ELECTRICAL CHARACTERISTICS

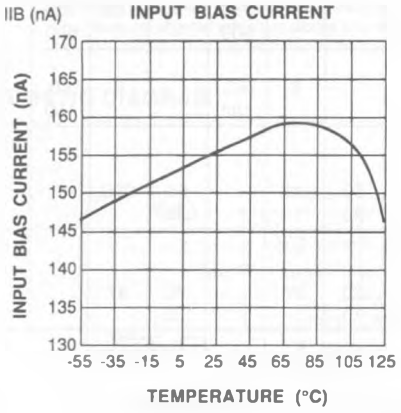
LM318 : $0 \leq T_{amb} \leq +70$ °C $\quad \pm 5\ V \leq V_{CC} \leq \pm 20\ V \quad C_1 = 30$ pF
LM218 : $-40 \leq T_{amb} \leq +105$ °C $\quad \pm 5\ V \leq V_{CC} \leq \pm 20\ V \quad C_1 = 30$ pF
LM118 : $-55 \leq T_{amb} \leq +125$ °C $\quad \pm 5\ V \leq V_{CC} \leq \pm 20\ V \quad C_1 = 30$ pF
* => $V_{CC} = \pm 15$ V
(unless otherwise specified)

Symbol	Parameter	LM118, LM218			LM318			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage $R_S \leq 10$ kΩ $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$		2	4 6		2	10 15	mV
I_{IB}	Input Bias Current $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$		160	250 500		160	250 500	nA
I_{IO}	Input Offset Current $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$		6	50 100		6	50 100	nA
A_{VD}	Large Signal Voltage Gain * ($V_O = \pm 10$ V, $R_L \geq 2$ kΩ) $T_{amb} = 25$ °C $T_{min} < T_{amb} \leq T_{max}$	50 25	200		50 25	200		V/mV
SVR	Supply Voltage Rejection Ratio ($R_S \leq 10$ kΩ) $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$	70 70	97		70 70	97		dB
I_{CC}	Supply Current, no Load $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$		5	8 15		5	10 15	mA
V_I	Input Voltage Range * $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$	− 11.5 − 11.5		11.5 11.5	− 11.5 − 11.5		11.5 11.5	V
CMR	Common Mode rejection Ratio * ($R_S \leq 10$ kΩ) $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$	80 80	105		80 80	105		dB
I_{OS}	Output Short-circuit Current * $T_{amb} = 25$ °C	10	30	60	10	30	60	mA
± V_{OPP}	Output Voltage Swing * $T_{amb} = 25$ °C $\quad R_L = 2$ kΩ $T_{min} \leq T_{amb} \leq T_{max}$	12 12	13		12 12	13		V
S_{VO}	Slew-rate ($V_I = \pm 10$ V, $R_L = 2$ kΩ, $C_L \leq 100$ pF, * $T_{amb} = 25$ °C, unity gain) (note 3)	50	70		50	70		V/µs
Z_I	Input Impedance, $T_{amb} = 25$ °C *	1	3		1	3		MΩ

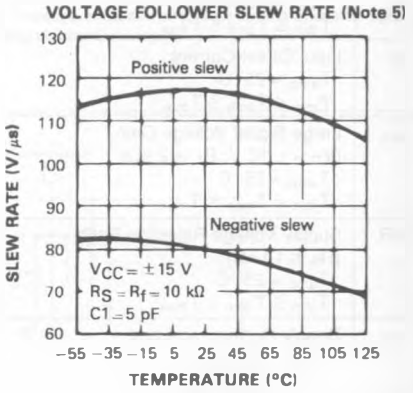
Note : 3. May be improved up to 150 V/µs in inverting amplifier configuration (see typical application).

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	LM118, LM218			LM318			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
GBP	Gain Bandwidth Product * (V_I = 10 mV, R_L = 2 kΩ, C_L ≤ 100 pF, f = 100 kHz, T_{amb} = 25 °C)		50			50		MHz
THD	Total Harmonic Distortion * (f = 1 kHz, A_V = 20 dB, R_L = 2 kΩ, V_O = 2 V_{PP}, C_L ≤ 100 pF, T_{amb} = 25 °C)		.008			.008		%
V_n	Equivalent Input Noise Voltage * (f = 1 kHz, Rg = 100 Ω)		17			17		$nV/\sqrt{Hz}$



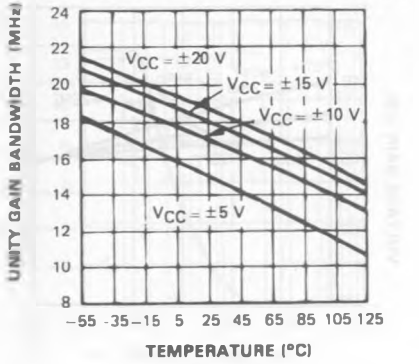
E88LM118-02



E88LM118-03

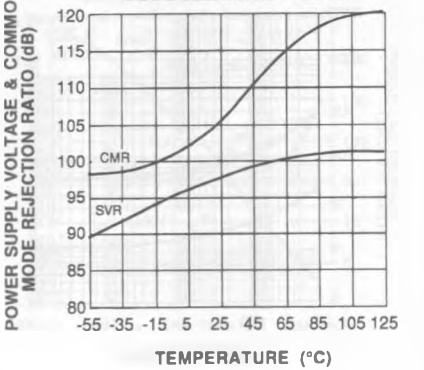
Note : 5. **LM118** : − 55 °C ≤ T_{amb} ≤ + 125 °C, ± 5 V ≤ V_{CC} ≤ ± 20 V
LM218 : − 40 °C ≤ T_{amb} ≤ + 105 °C, ± 5 V ≤ V_{CC} ≤ ± 20 V
LM318 : − 0 °C ≤ T_{amb} ≤ + 70 °C, ± 5 V ≤ V_{CC} ≤ ± 20 V

UNITY GAIN BANDWIDTH (GAIN : 1) (Note 5)



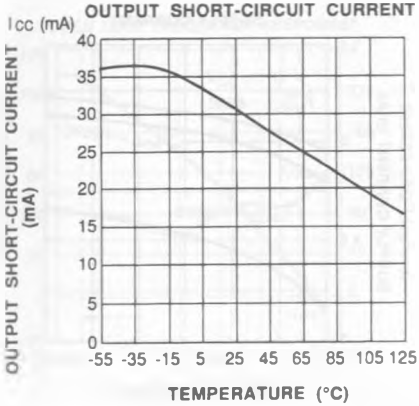
E88LM118-04

POWER SUPPLY VOLTAGE & COMMON MODE REJECTION RATIO



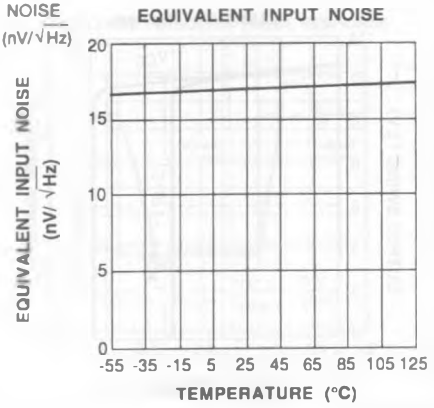
E88LM118-38

OUTPUT SHORT-CIRCUIT CURRENT



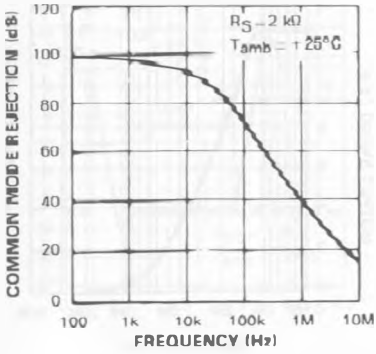
E88LM118-37

EQUIVALENT INPUT NOISE



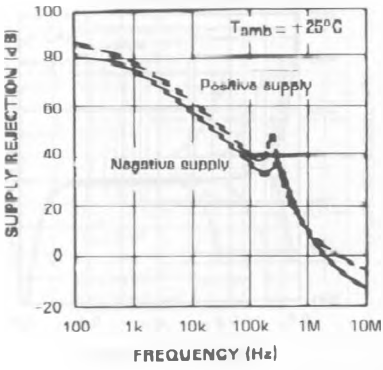
E88LM118-36

COMMON MODE REJECTION

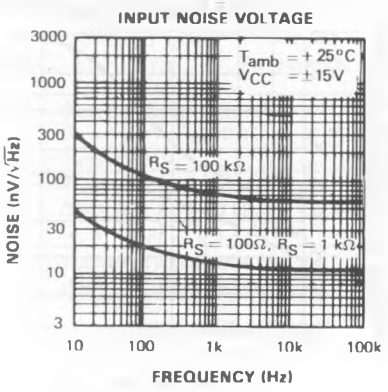


E88LM118-05

POWER SUPPLY REJECTION



E88LM118-06



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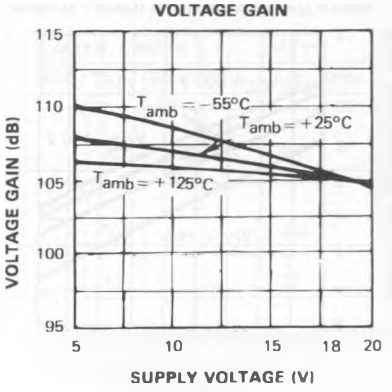
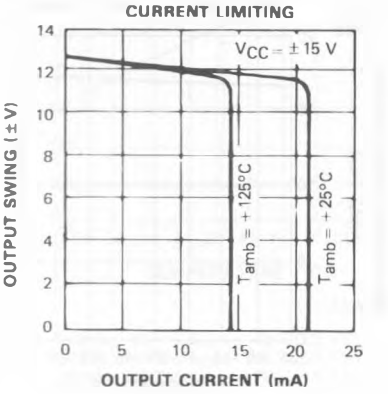


E88LM118-08



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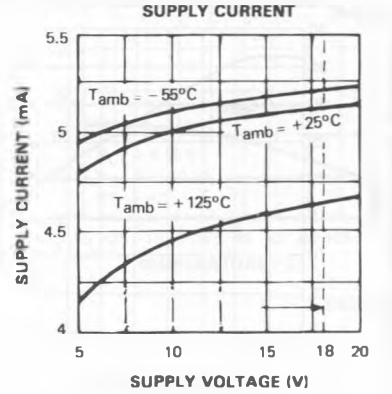
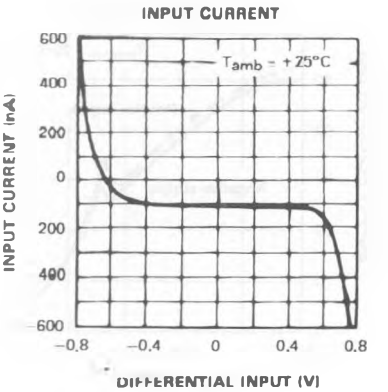
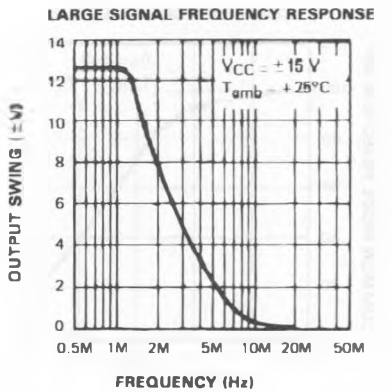


E88LM118-14

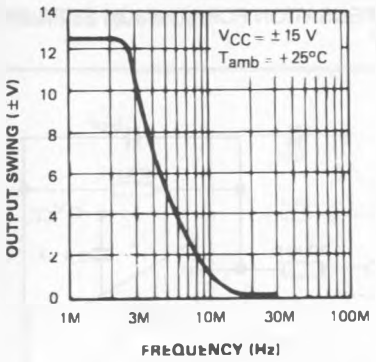


E88LM118-15



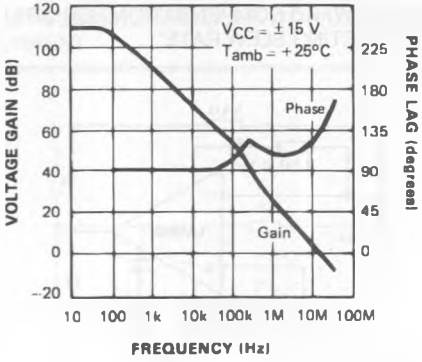
E88LM118-20

LARGE SIGNAL FREQUENCY RESPONSE*



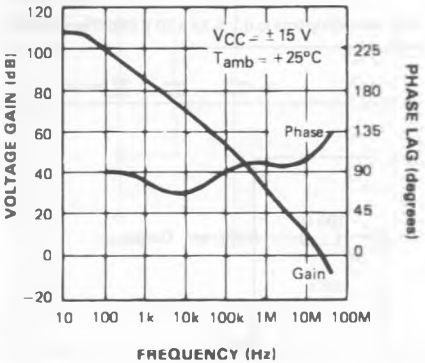
E88LM118-21

OPEN LOOP FREQUENCY RESPONSE



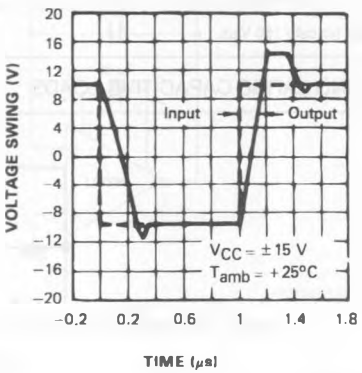
E88LM118-22

OPEN LOOP FREQUENCY RESPONSE*



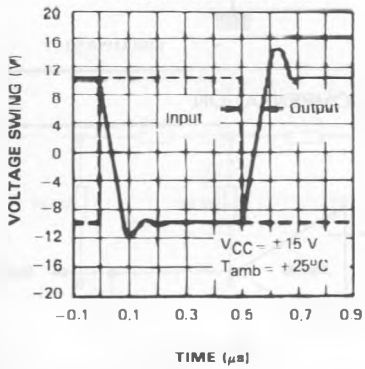
E88LM118-23

VOLTAGE FOLLOWER PULSE RESPONSE



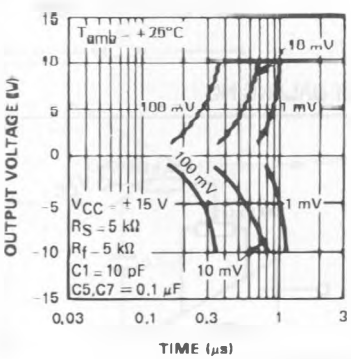
E88LM118-24

INVERTER PULSE RESPONSE*



E88LM118-25

INVERTER SETTLING TIME

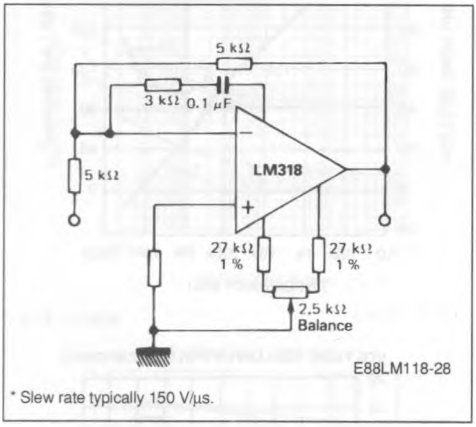


E88LM118-26

* With feedforward compensation

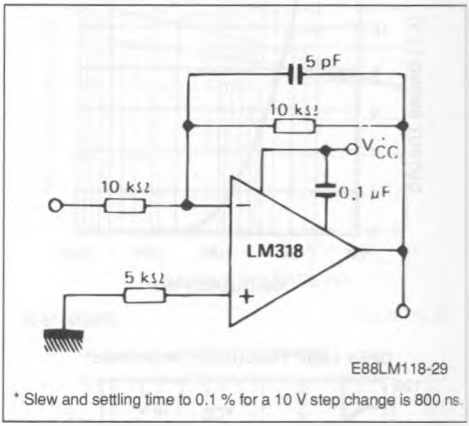
BASIC DIAGRAMS

FEEDFORWARD COMPENSATION FOR GREATER INVERTING SLEW RATE*



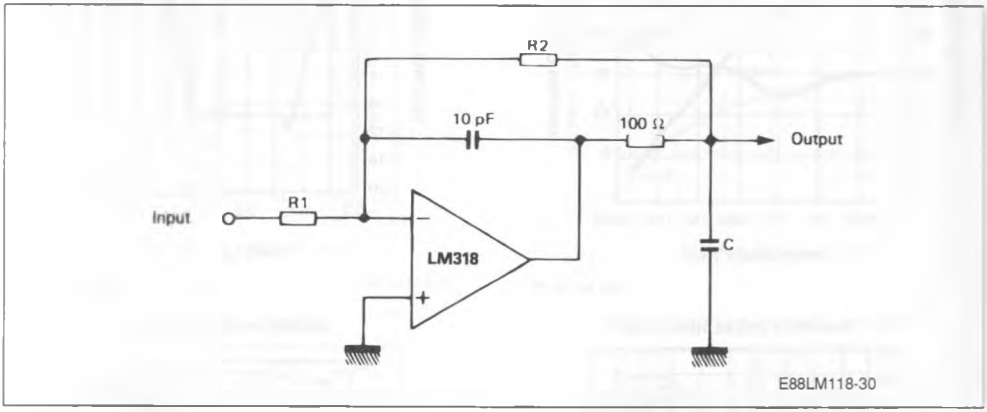
* Slew rate typically 150 V/µs.

COMPENSATION FOR MINIMUM SETTLING TIME*

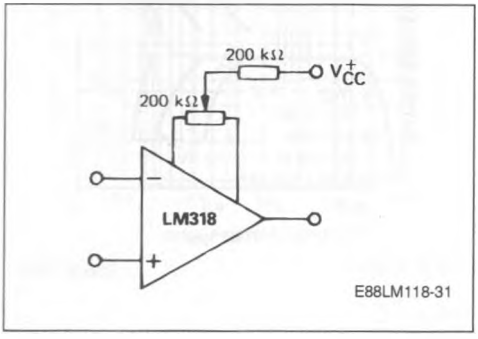


* Slew and settling time to 0.1 % for a 10 V step change is 800 ns.

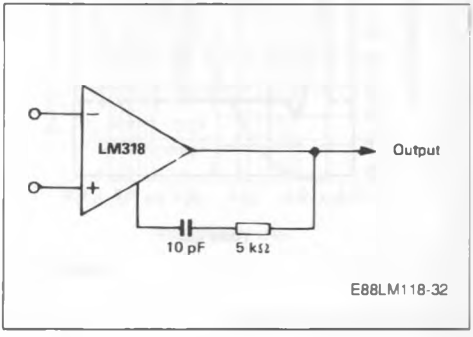
ISOLATING LARGE CAPACITIVE LOADS



OFFSET BALANCING

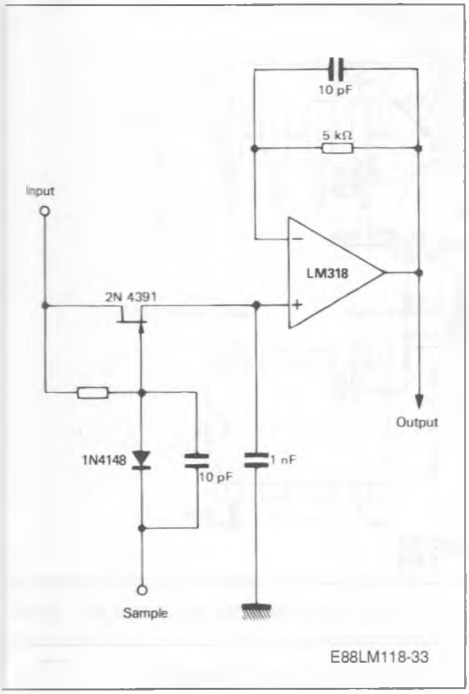


OVERCOMPENSATION



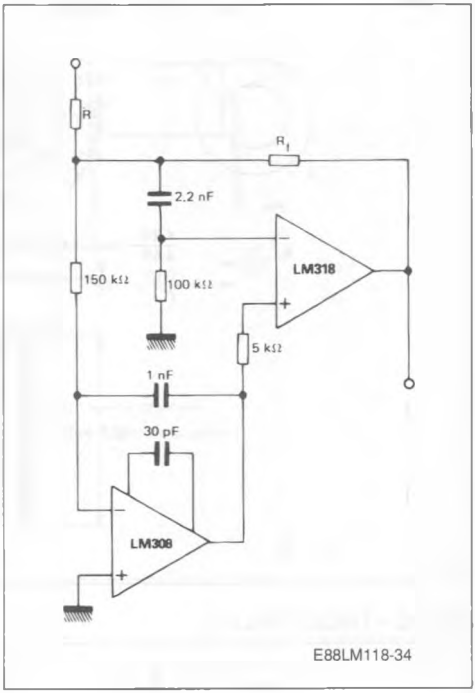
TYPICAL APPLICATION DIAGRAM

FAST SAMPLE AND HOLD



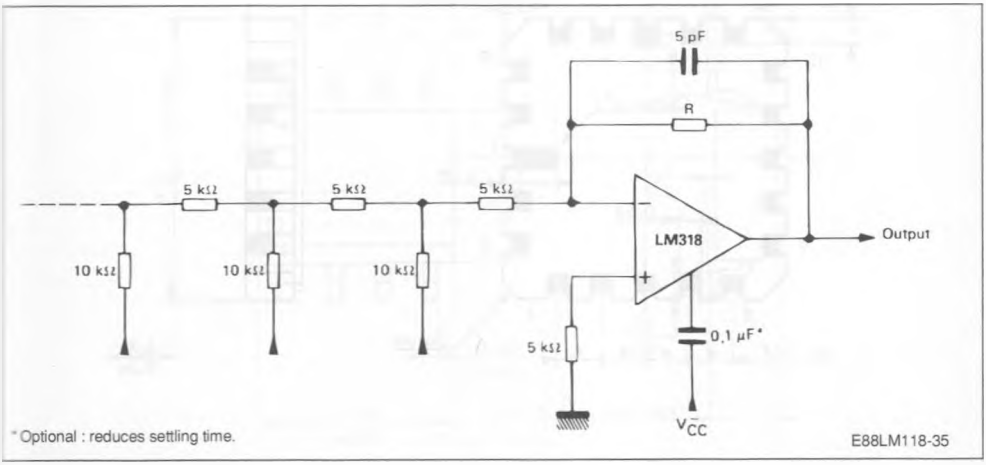
E88LM118-33

FAST SUMMING AMPLIFIER WITH LOW INPUT CURRENT



E88LM118-34

D/A CONVERTER USING LADDER NETWORK

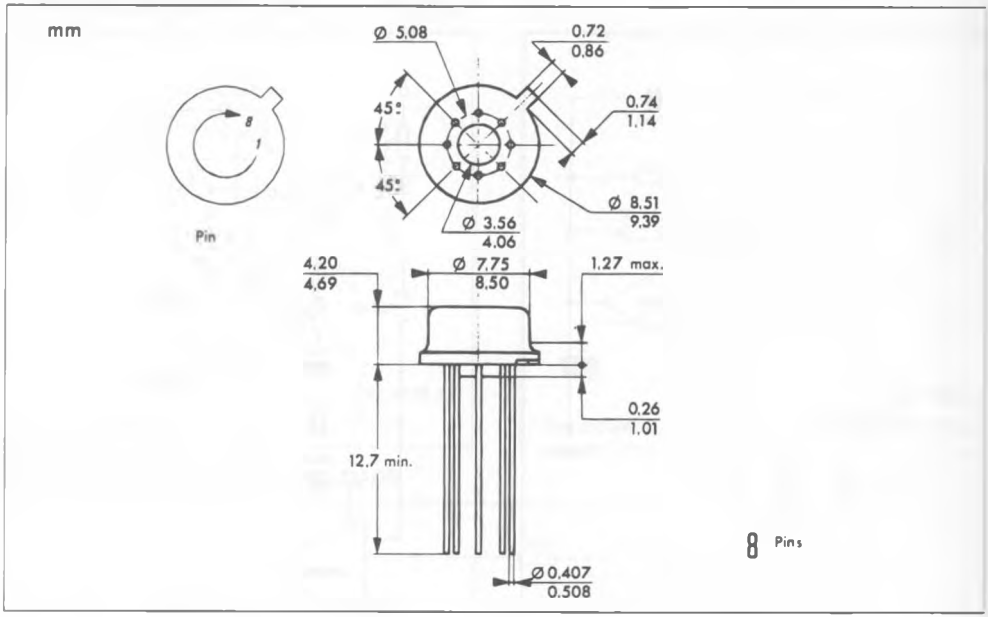


* Optional : reduces settling time.

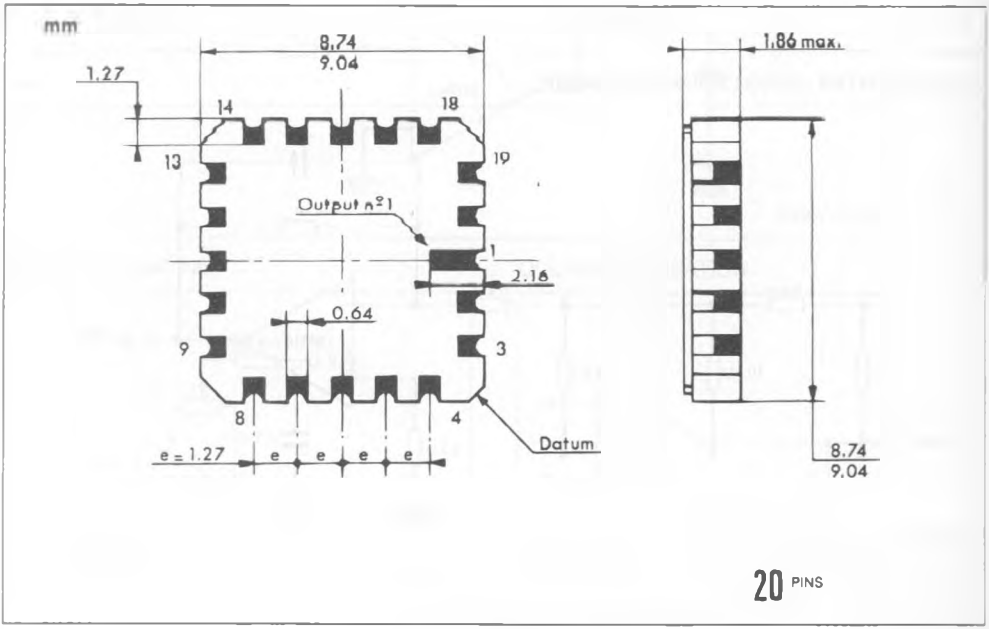
E88LM118-35

PACKAGE MECHANICAL DATA

8 PINS – TO-99 – METAL CAN

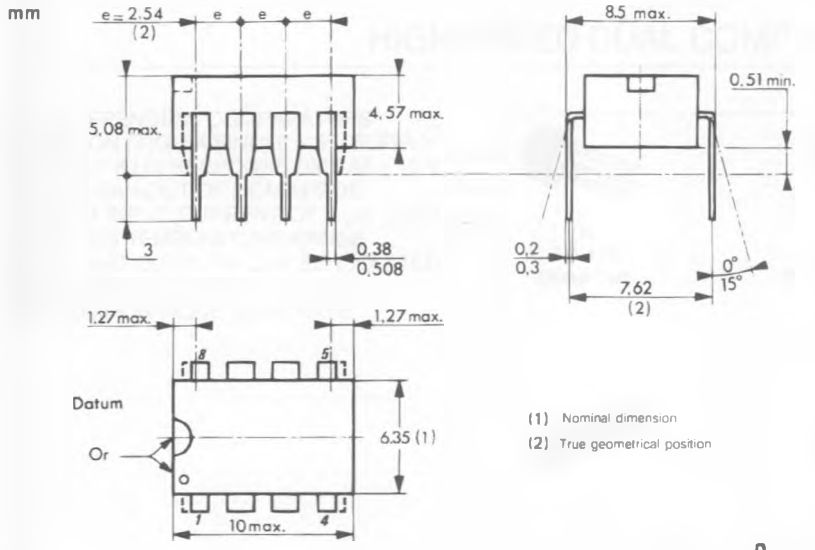


20 PINS – TRICECOP (LCC)



PACKAGE MECHANICAL DATA (continued)

PINS – PLASTIC DIP OR CERDIP



PINS – PLASTIC MICROPACKAGE (SO)