

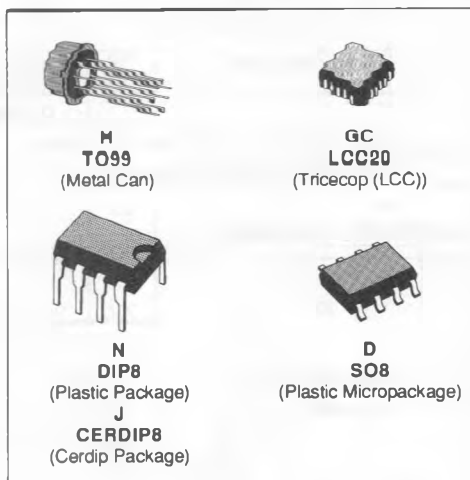
SINGLE OPERATIONAL AMPLIFIERS

LM101A
LM201A **LM301A**

■ INPUT OFFSET VOLTAGE	0.2 mV	2 mV
■ INPUT BIAS CURRENT	25 nA	70 nA
■ INPUT OFFSET CURRENT	1.5 nA	2 nA
■ SLEW RATE AS INVERTING AMPLIFIER	10 V/μs	10 V/μs

DESCRIPTION

The LM101A is a general-purpose operational amplifier. This amplifier offers many features : supply voltages from ± 5 V to ± 20 V, low current drain, overload protection on the input and output, no latch-up when the common-mode range is exceeded, freedom from oscillations and compensation with a single 30 pF capacitor. It has advantages over internally compensated amplifiers in that the compensation can be tailored to the particular application : slew rates of 10 V/μs and bandwidths of 3.5 MHz can be easily achieved. In addition, the circuit can be used as a comparator with differential inputs up to ± 30 V. The output can be clamped at any desired level to make it compatible with logic circuits.

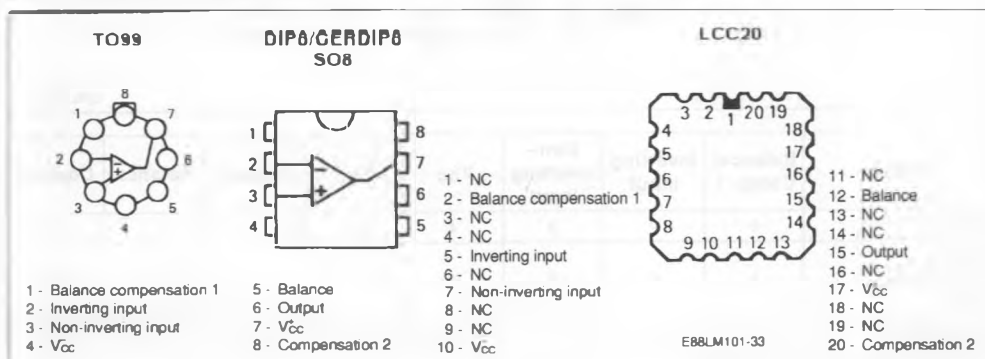


ORDER CODES

Part Number	Temperature Range	Package				
		H	N	J	GC	D
LM101A	- 55 to + 125 °C	•	•	•	•	•
LM201A	- 40 to + 105 °C	•	•	•	•	•
LM301A	0 to + 70 °C	•	•	•	•	•

Note : Hi-Rel Versions Available
Examples : LM101AH, LM201AH

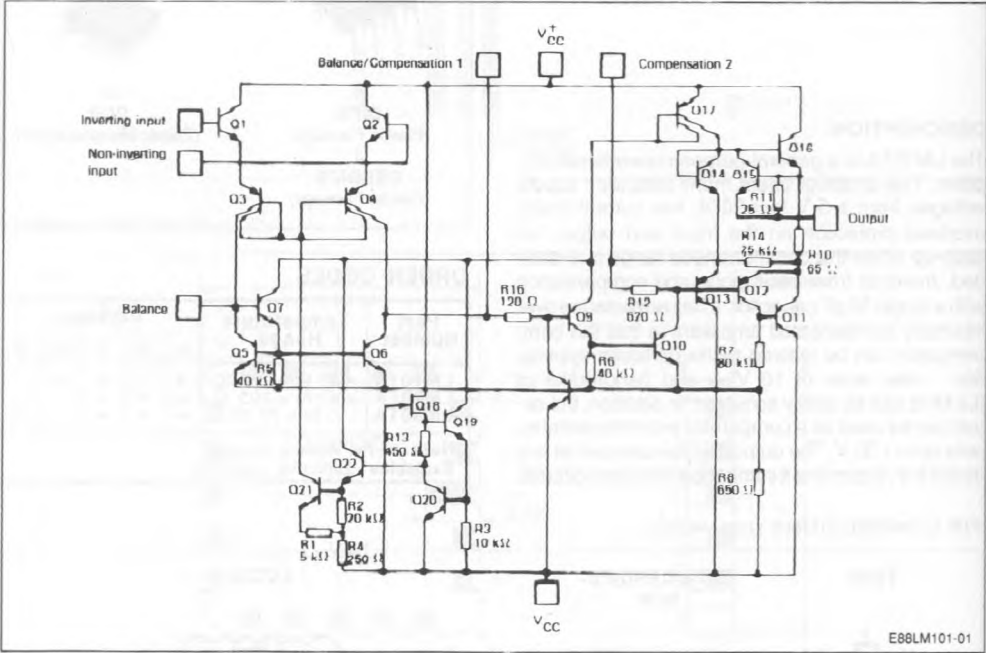
PIN CONNECTIONS (top views)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value			Unit
		LM101A	LM201A	LM301A	
V _{CC}	Supply Voltage	± 22	± 22	± 22	V
V _{ID}	Differential Input Voltage	± 30	± 30	± 30	V
V _I	Input Voltage	± 15	± 15	± 15	V
	Output Short-circuit Duration	Indefinite for T _{amb} = + 70 °C			Indefinite for T _{amb} = +55 °C
P _{tot}	Power Dissipation	N.J.H. Suffix GC Suffix D Suffix	500 665 300	500 300	mW
T _{oper}	Operating Free-air Temperature Range	- 55 to + 125	- 40 to + 105	0 to + 70	°C
T _{sig}	Storage Temperature Range	- 65 to + 150	- 65 to + 150	- 65 to + 150	°C

SCHEMATIC DIAGRAM



Case	Balance/ Comp. 1	Inverting Input	Non- inverting Input	V _{CC}	V _{EE}	Output	Balance	Comp. 2
TO99	1	2	3	4	7	6	5	8
DIP8 CERDIP8 SO8	1	2	3	4	7	6	5	8
LCC20*	2	5	7	10	17	15	12	20

* LCC20 : Other pins not connected

ELECTRICAL CHARACTERISTICS

LM301A : $0^{\circ}\text{C} < T_{\text{amb}} < +70^{\circ}\text{C}, \pm 5\text{V} \leq V_{\text{CC}} \leq \pm 20\text{V}, C_1 = 30\text{pF}$ LM201A : $-40^{\circ}\text{C} < T_{\text{amb}} < +105^{\circ}\text{C}, \pm 5\text{V} \leq V_{\text{CC}} \leq \pm 20\text{V}, C_1 = 30\text{pF}$ LM101A : $-55^{\circ}\text{C} < T_{\text{amb}} < +125^{\circ}\text{C}, \pm 5\text{V} \leq V_{\text{CC}} \leq \pm 20\text{V}, C_1 = 30\text{pF}$ * $\Rightarrow V_{\text{CC}} = \pm 15\text{V}$

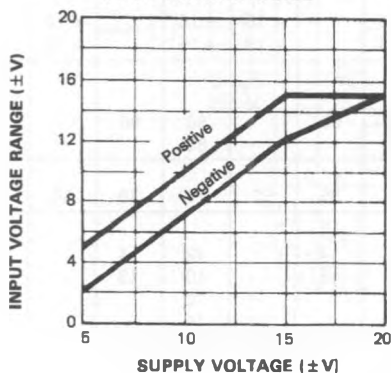
(unless otherwise specified)

Symbol	Parameter	LM101A/LM201A			LM301A			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage ($R_S \leq 10\text{ k}\Omega$) $T_{\text{amb}} = 25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$		0.2	1 3		2	5 6	mV
I_{IB}	Input Bias Current $T_{\text{amb}} = 25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$		25	75 100		70	100 200	nA
I_{IO}	Input Offset Current $T_{\text{amb}} = 25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$		1.5	10 20		2	20 40	nA
A_{VD}	Large Signal Voltage Gain * ($V_O = \pm 10\text{ V}, R_L = 2\text{ k}\Omega$) $T_{\text{amb}} = 25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	50 25	100		50 25	100		V/mV
SVR	Supply Voltage Rejection Ratio ($R_S \leq 10\text{ k}\Omega$) $T_{\text{amb}} = 25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	80 80	96		80 80	96		dB
I_{CC}	Supply Current no Load $T_{\text{amb}} = 25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$		1.8	3 3		1.8	3 3	mA
V_{I}	Input Voltage Range ($V_{\text{CC}} = \pm 20\text{ V}$) $T_{\text{amb}} = 25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	-15 -15		+15 +15	-15 -15		+15 +15	V
CMR	Common Mode Rejection Ratio ($R_S \leq 10\text{ k}\Omega$) $T_{\text{amb}} = 25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	80 80	96		80 90	96		dB
I_{OS}	Output Short-circuit Current * $T_{\text{amb}} = 25^{\circ}\text{C}$	10	30	50	10	30	50	mA
$\pm V_{\text{OPP}}$	Output Voltage Swing * $T_{\text{amb}} = 25^{\circ}\text{C}$ $T_{\text{min}} < T_{\text{amb}} < T_{\text{max}}$							V
	$R_L = 10\text{ k}\Omega$	12	14		12	14		
	$R_L = 2\text{ k}\Omega$	10	13		10	13		
	$R_L = 10\text{ k}\Omega$	12			12			
	$R_L = 2\text{ k}\Omega$	10			10			

ELECTRICAL CHARACTERISTICS (continued)

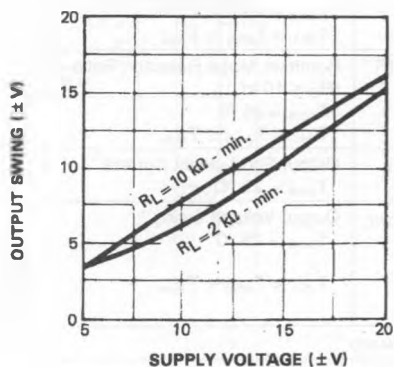
Symbol	Parameter	LM101A/LM201A			LM301A			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
S_{VO}	Slew Rate ($V_I = \pm 10$ V, $R_L = 2$ k Ω , $C_L < 100$ pF, $T_{amb} = 25$ °C, unity gain) * (note 1)	0.25	0.5		0.25	0.5		V/ μ s
t_r	Rise Time ($V_I = \pm 20$ mV, $R_L = 2$ k Ω , $C_L \leq 100$ pF, $T_{amb} = 25$ °C, unity gain) *		0.3			0.3		μ s
K_{OV}	Overshoot ($V_I = 20$ mV, $R_L = 2$ k Ω , $C_L \leq 100$ pF, $T_{amb} = 25$ °C, unity gain)		5			5		%
Z_i	Input Impedance, $T_{amb} = 25$ °C *	1.5	4		1.5	4		M Ω
R_O	Output Resistance, $T_{amb} = 25$ °C *		75			75		Ω
GBP	Gain Bandwidth Product * ($V_I = 10$ mV, $R_L = 2$ k Ω , $C_L \leq 100$ pF, $f = 100$ kHz, $T_{amb} = 25$ °C)	0.5	1	1.6	0.5	1	1.6	MHz
THD	Total Harmonic Distortion * ($f = 1$ kHz, $A_V = 20$ dB, $R_L = 2$ k Ω , $V_O = 2$ V _{PP} , $C_L \leq 100$ pF, $T_{amb} = 25$ °C)		0.015			0.015		%
V_n	Equivalent Input Noise Voltage ($f = 1$ kHz, $R_g = 100$ Ω) *		25			25		nV/ $\sqrt{Hz}$
DV _{IO}	Input Offset Voltage Drift $T_{min} \leq T_{amb} \leq T_{max}$		3	15		6	30	μ V/°C
DI _{IO}	Input Offset Current Drift 25 °C $\leq T_{amb} \leq T_{max}$ $T_{min} \leq T_{amb} \leq 25$ °C		10 20	100 200		10 20	100 200	pA/°C

INPUT VOLTAGE RANGE



E88LM101-02

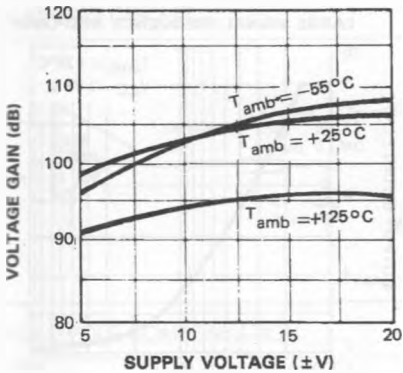
OUTPUT SWING



E88LM101-03

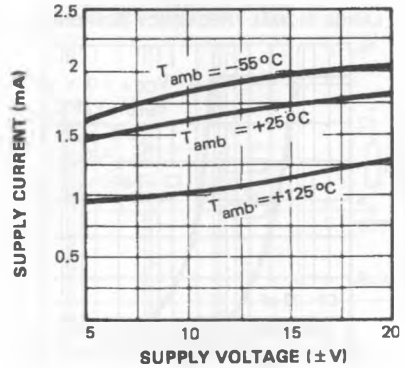
Note : 1. May be improved up to 10V/ μ s in inverting amplifier configuration (see basic diagram).

VOLTAGE GAIN



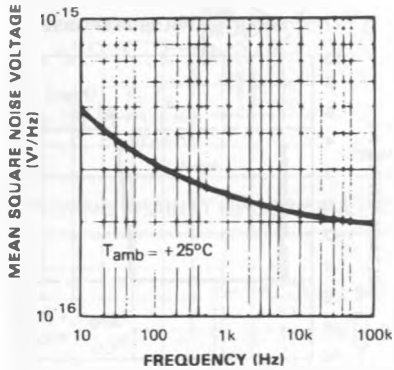
E88LM101-04

SUPPLY CURRENT



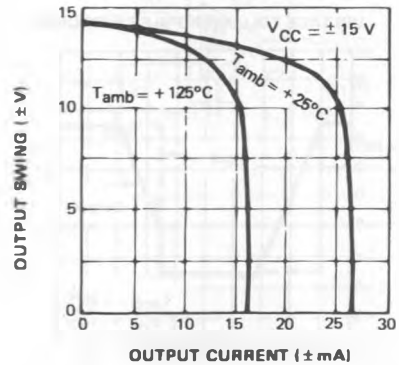
E88LM101-05

INPUT NOISE VOLTAGE



E88LM101-06

CURRENT LIMITING

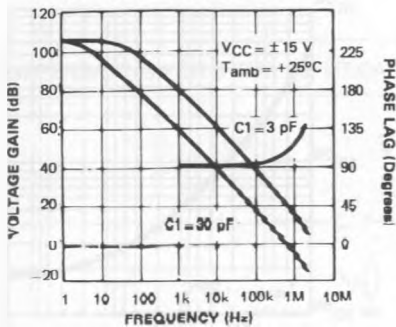


E88LM101-07

SINGLE POLE COMPENSATION

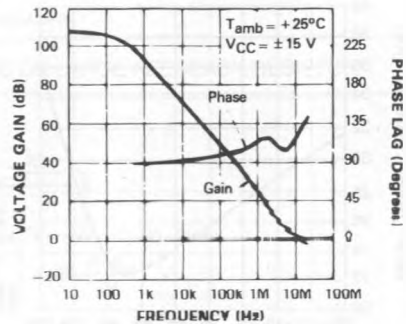
FEED FORWARD COMPENSATION

OPEN LOOP FREQUENCY RESPONSE



E88LM101-08

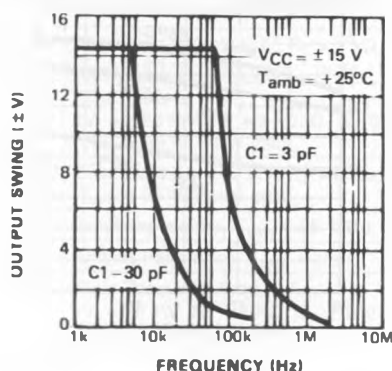
OPEN LOOP FREQUENCY RESPONSE



E88LM101-08

SINGLE POLE COMPENSATION

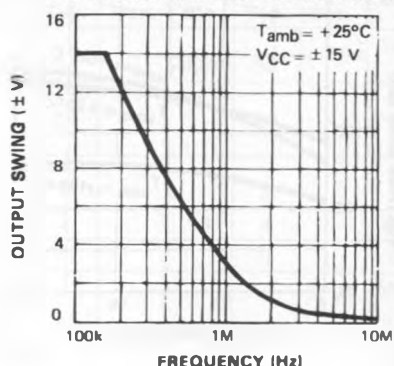
LARGE SIGNAL FREQUENCY RESPONSE



E88LM101-10

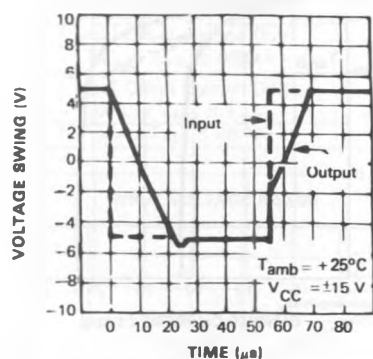
FEED FORWARD COMPENSATION

LARGE SIGNAL FREQUENCY RESPONSE



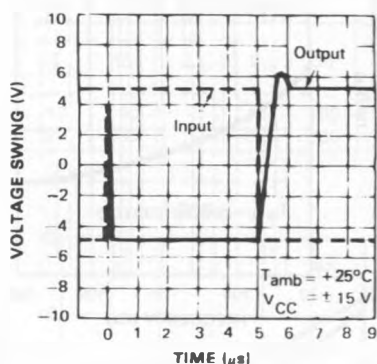
E88LM101-11

VOLTAGE FOLLOWER PULSE RESPONSE

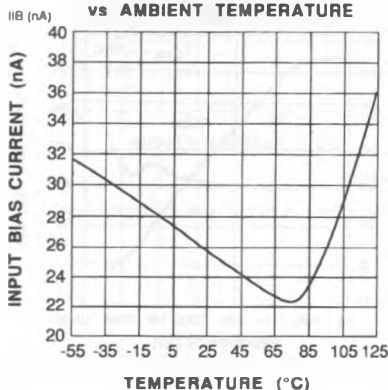


E88LM101-12

INVERTER PULSE RESPONSE

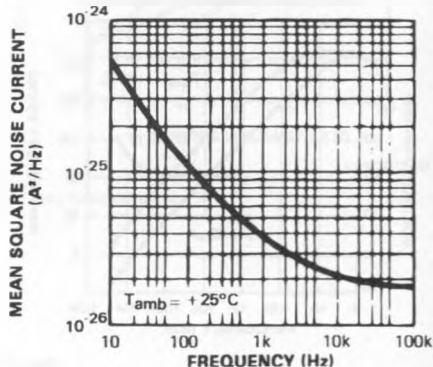


E88LM101-13

INPUT BIAS CURRENT
vs AMBIENT TEMPERATURE

E88LM101-14

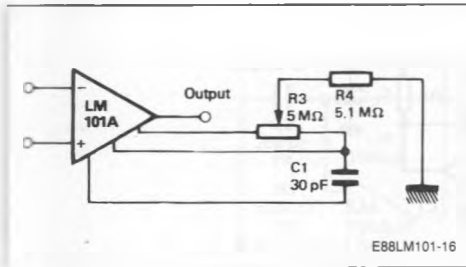
INPUT NOISE CURRENT



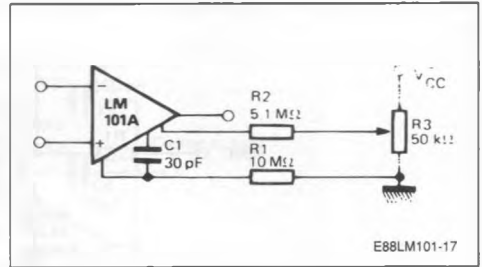
E88LM101-15

BASIC DIAGRAMS

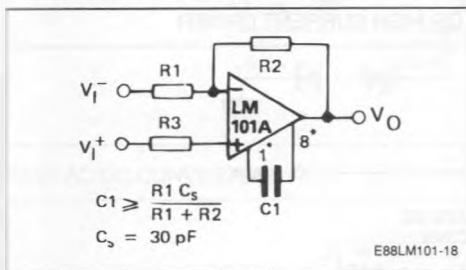
BALANCING CIRCUIT



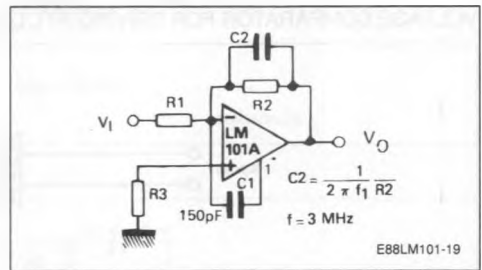
ALTERNATE BALANCING CIRCUIT



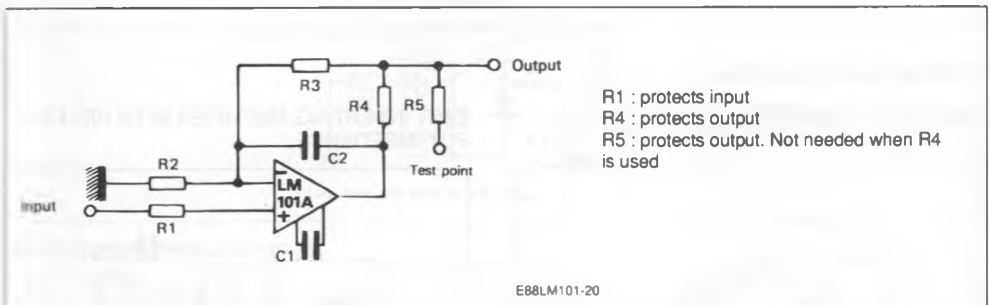
SINGLE POLE COMPENSATION



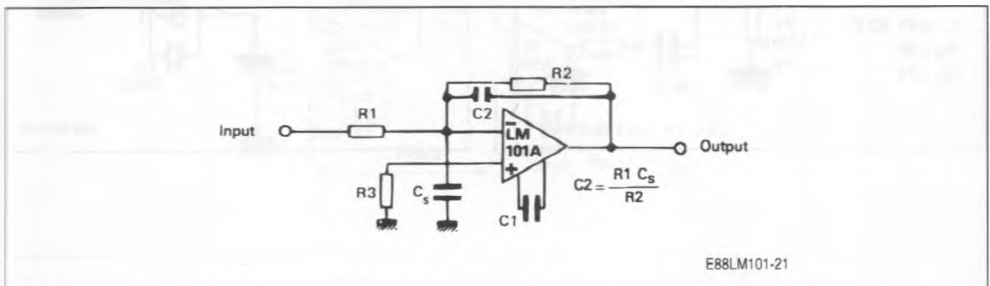
FEEDFORWARD COMPENSATION



PROTECTING AGAINST GROSS FAULT CONDITIONS

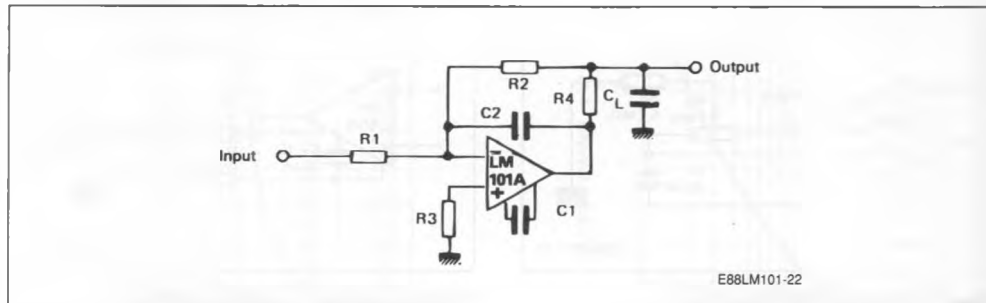


COMPENSATING FOR STRAY INPUT CAPACITANCES OR LARGE FEEDBACK RESISTOR

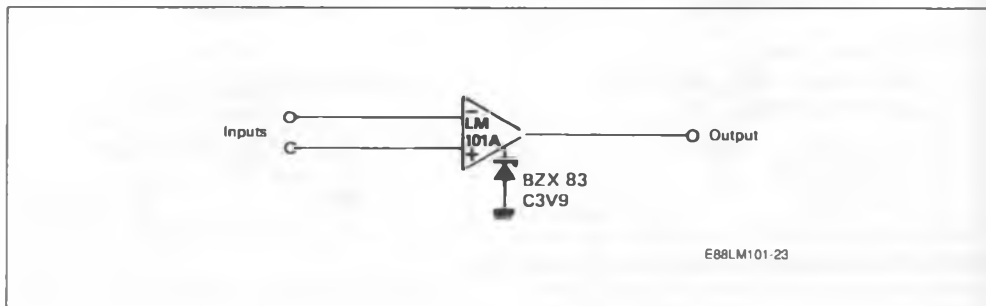


BASIC DIAGRAMS (continued)

ISOLATING LARGE CAPACITIVE LOADS

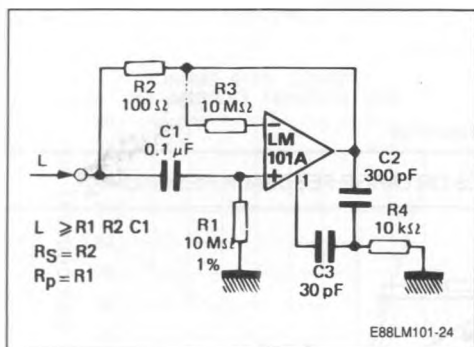


VOLTAGE COMPARATOR FOR DRIVING RTL LOGIC OR HIGH CURRENT DRIVER

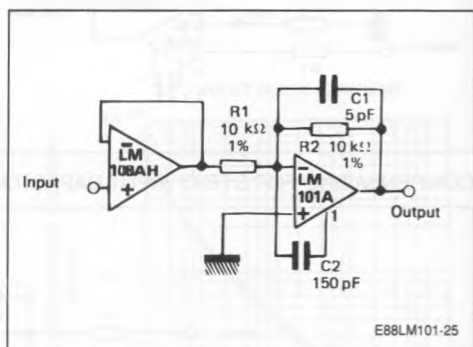


TYPICAL APPLICATIONS

SIMULATED INDUCTOR

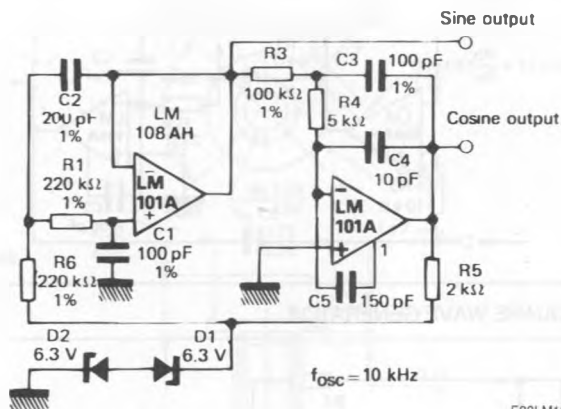


FAST INVERTING AMPLIFIER WITH HIGH INPUT IMPEDANCE



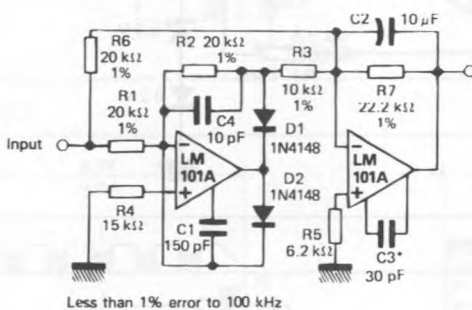
TYPICAL APPLICATIONS (continued)

SINE WAVE OSCILLATOR



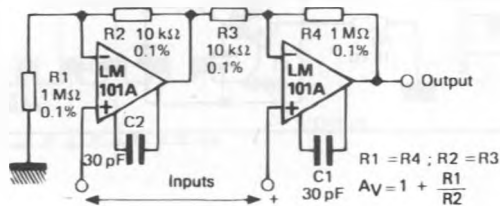
E88LM101-26

FAST AC/DC CONVERTER



E88LM101-27

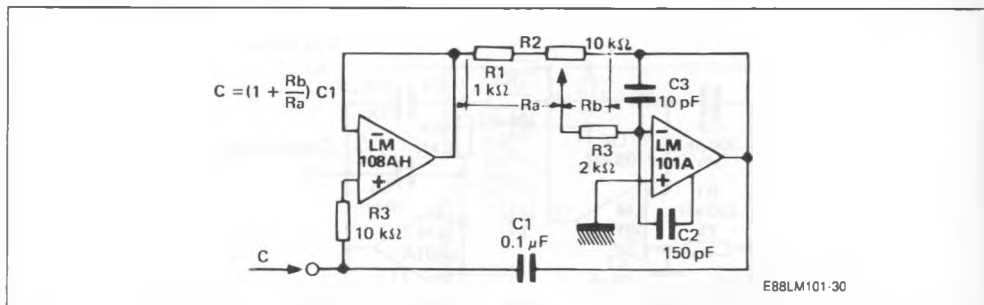
INSTRUMENTATION AMPLIFIER



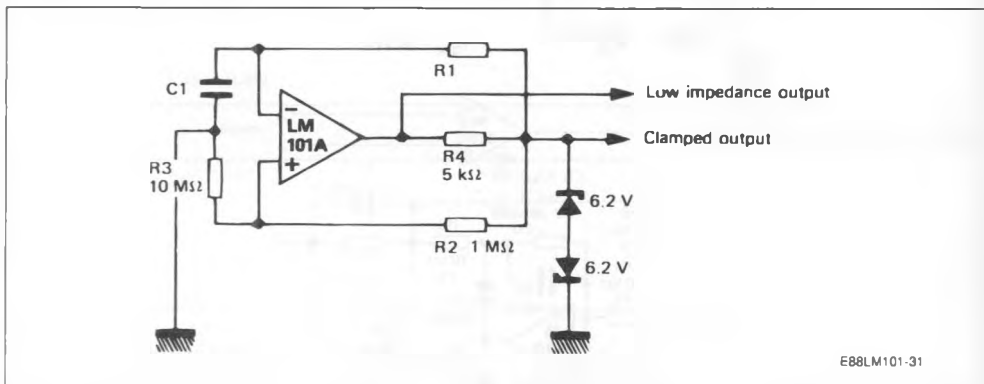
E88LM101-28

TYPICAL APPLICATIONS (continued)

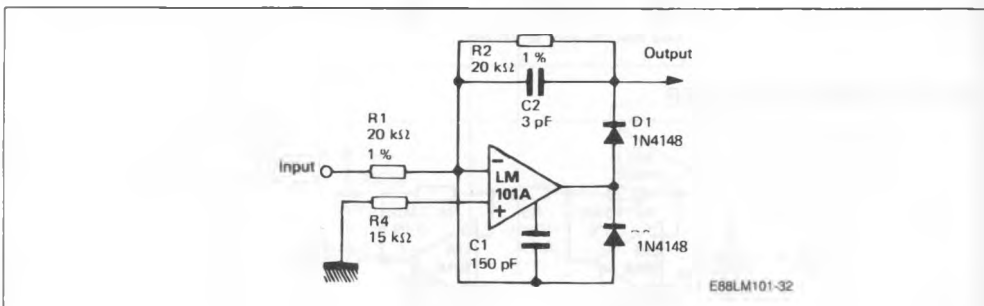
VARIABLE CAPACITANCE MULTIPLIER



LOW FREQUENCY SQUARE WAVE GENERATOR



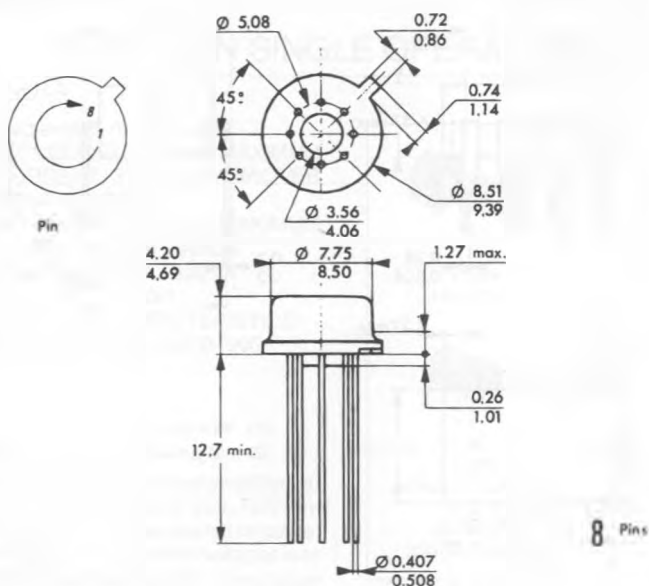
FAST HALF WAVE RECTIFIER



PACKAGE MECHANICAL DATA

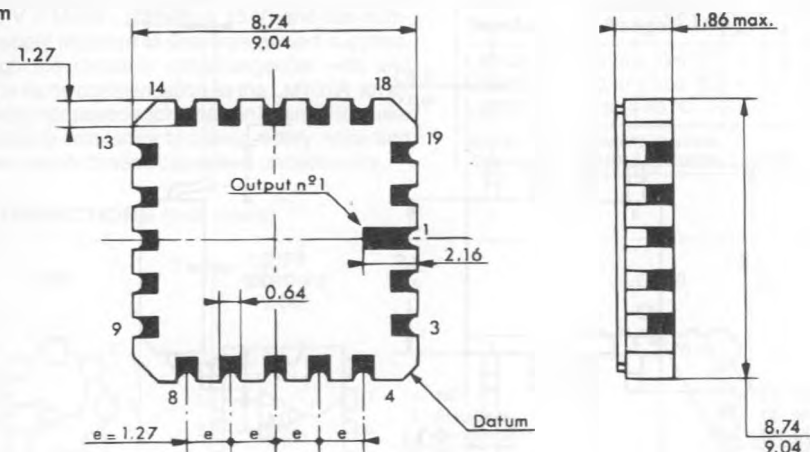
8 PINS – METAL CAN TO99

mm



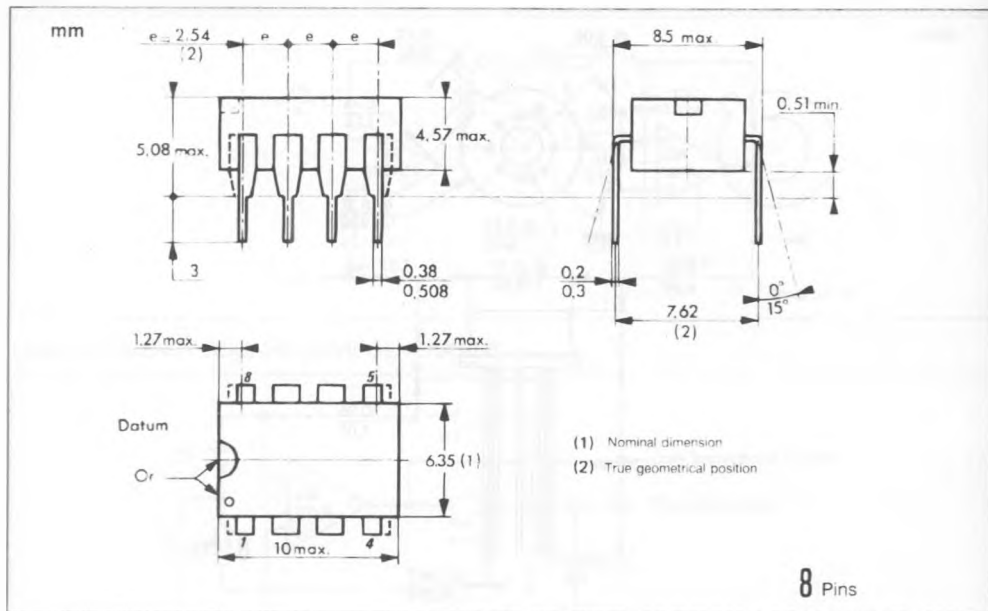
20 PINS – TRICECOP (LCC)

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PACKAGE MECHANICAL DATA (continued)

8 PINS – PLASTIC DIP OR CerdIP



8 PINS – PLASTIC MICROPACKAGE (SO)

