

SINGLE OPERATIONAL AMPLIFIERS

The LM101A is a general-purpose operational amplifier. This amplifier offers many features: supply voltages from $\pm 5\text{ V}$ to $\pm 20\text{ V}$, 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 $10\text{ V}/\mu\text{s}$ 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 $\pm 30\text{ V}$. The output can be clamped at any desired level to make it compatible with logic circuits.

	LM101A LM201A	LM301A
• Input offset voltage	0.7 mV	2 mV
• Input bias current	30 nA	70 nA
• Input offset current	1.5 nA	3 nA
• Slew rate as inverting amplifier	10 V/ μs	10 V/ μs

ORDERING INFORMATION

Hi-Rel versions available - See chapter 14

PART NUMBER	TEMPERATURE RANGE	PACKAGE				
		H	DP	DG	GC	FP
LM101A	-55°C to $+125^\circ\text{C}$	•		•	•	
LM201A	-25°C to $+85^\circ\text{C}$	•	•	•		
LM301A	0°C to $+70^\circ\text{C}$	•	•	•		•

Examples: LM101AH, LM201ADP

SINGLE OPERATIONAL AMPLIFIERS

CASES

CB-11
(TO-99)



H SUFFIX
METAL CAN

CB-705



GC SUFFIX
TRICECOP (LCC)

CB-98



DP SUFFIX
PLASTIC PACKAGE
DG SUFFIX
CERDIP PACKAGE

CB-342

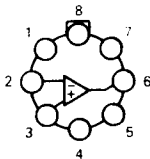


FP SUFFIX
PLASTIC
MICROPACKAGE

PIN ASSIGNMENTS

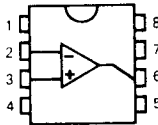
(Top views)

CB-11



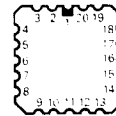
- Balance compensation 1
- Inverting input
- Non-inverting input
- V_{CC}^-

CB-98
CB-342



- Balance
- Output
- V_{CC}^+
- Compensation 2

CB-705

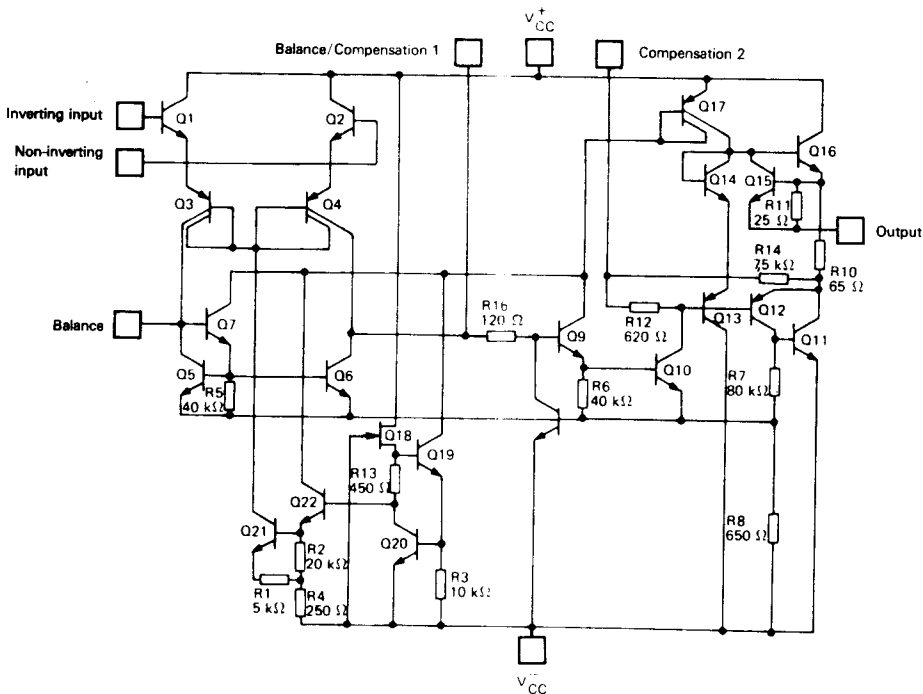


- NC
- Balance compensation 1
- NC
- NC
- Inverting input
- NC
- Non-inverting input
- NC
- NC
- V_{CC}^-
- NC
- Balance
- NC
- Output
- NC
- NC
- Output
- NC
- V_{CC}^+
- NC
- NC
- Compensation 2

MAXIMUM RATINGS

Rating	Symbol	Value			Unit
		LM101A	LM201A	LM301A	
Supply voltage	V_{CC}	± 22	± 22	± 18	V
Differential input voltage	V_{ID}	± 30	± 30	± 30	V
Input voltage	V_I	± 15	± 15	± 15	V
Output short-circuit duration		indefinite for $T_{amb} = +70^\circ\text{C}$		Indefinite for $T_{amb} = +55^\circ\text{C}$	—
Power dissipation	P_{tot}	500 665	500	500 300	mW
Operating free air temperature range	T_{oper}	-55 to $+125$	-25 to $+85$	0 to $+70$	$^\circ\text{C}$
Storage temperature range	T_{stg}	-65 to $+150$	-65 to $+150$	-65 to $+150$	$^\circ\text{C}$

SCHEMATIC DIAGRAM



CASE	Balance/Comp. 1	Inverting Input	Non-inverting Input	V_{CC}^-	V_{CC}^+	Output	Balance	Comp. 2
CB-11	1	2	3	4	7	6	5	8
CB-98/CB-342	1	2	3	4	7	6	5	8
CB-705*	2	5	7	10	17	15	12	20

* CB-705 : Other pins not connected.

ELECTRICAL CHARACTERISTICS

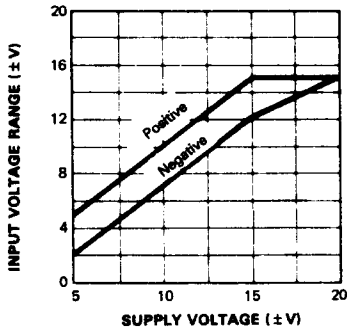
LM101A : $-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +125^{\circ}\text{C}$, $\pm 5 \text{ V} \leq V_{\text{CC}} \leq \pm 20 \text{ V}$, $C_1 = 30 \text{ pF}$ LM201A : $-25^{\circ}\text{C} \leq T_{\text{amb}} \leq +85^{\circ}\text{C}$, $\pm 5 \text{ V} \leq V_{\text{CC}} \leq \pm 20 \text{ V}$, $C_1 = 30 \text{ pF}$ LM301A : $0^{\circ}\text{C} \leq T_{\text{amb}} \leq +70^{\circ}\text{C}$, $\pm 5 \text{ V} \leq V_{\text{CC}} \leq \pm 15 \text{ V}$, $C_1 = 30 \text{ pF}$

(Unless otherwise specified)

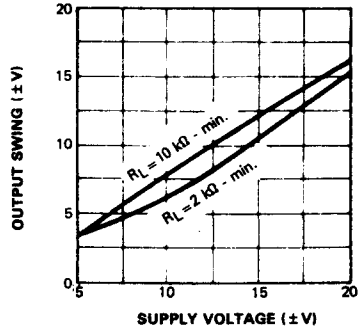
Characteristic	Symbol	LM101A/LM201A			LM301A			Unit
		Min	Typ	Max	Min	Typ	Max	
Input offset voltage ($R_S = 50 \text{ k}\Omega$) $T_{\text{max}} \leq T_{\text{amb}} \leq T_{\text{min}}$ $T_{\text{amb}} = +25^{\circ}\text{C}$	V_{IO}	—	—	3	—	—	10	mV
		—	0.7	2	—	2	7.5	
Input offset current $T_{\text{amb}} = +25^{\circ}\text{C}$	I_{IO}	—	—	20	—	—	70	nA
		—	1.5	10	—	3	50	
Input bias current $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$ $T_{\text{amb}} = +25^{\circ}\text{C}$	I_{IB}	—	—	100	—	—	300	nA
		—	30	75	—	70	250	
Large signal voltage gain ($V_{\text{CC}} = \pm 15 \text{ V}$, $R_L = 2 \text{ k}\Omega$, $V_O = \pm 10 \text{ V}$) $T_{\text{max}} \leq T_{\text{amb}} \leq T_{\text{min}}$ $T_{\text{amb}} = +25^{\circ}\text{C}$	A_{VD}	25	—	—	15	—	—	V/mV
		50	160	—	25	160	—	
Supply voltage rejection ratio ($R_S = 50 \text{ k}\Omega$)	SVR	80	96	—	70	96	—	dB
Supply current $V_{\text{CC}} = +20 \text{ V}$, $T_{\text{amb}} = T_{\text{max}}$ $V_{\text{CC}} = +20 \text{ V}$, $T_{\text{amb}} = +25^{\circ}\text{C}$ $V_{\text{CC}} = +15 \text{ V}$, $T_{\text{amb}} = +25^{\circ}\text{C}$	I_{CC}^+ , I_{CC}^-	—	1.2	2.5	—	—	—	mA
		—	1.8	3	—	—	—	
		—	—	—	—	1.8	3	
Temperature coefficient of input offset voltage	αV_{IO}	—	3	15	—	6	30	$\mu\text{V}/^{\circ}\text{C}$
Average temperature coefficient of input offset current $+25^{\circ}\text{C} \leq T_{\text{amb}} \leq T_{\text{max}}$ $T_{\text{min}} \leq T_{\text{amb}} \leq +125^{\circ}\text{C}$ $+25^{\circ}\text{C} \leq T_{\text{amb}} \leq +70^{\circ}\text{C}$ $0^{\circ}\text{C} \leq T_{\text{amb}} \leq +25^{\circ}\text{C}$	αI_{IO}	—	0.01	0.1	—	—	—	nA/ $^{\circ}\text{C}$
		—	0.02	0.2	—	—	—	
		—	—	—	—	0.03	0.3	
		—	—	—	—	0.02	0.6	
Input voltage range ($V_{\text{CC}} = V_{\text{CC}}(\text{max})$)	V_{I}	± 15	—	—	± 12	—	—	V
Common mode rejection ratio ($R_S \leq 50 \text{ k}\Omega$)	CMR	80	96	—	70	90	—	dB
Output voltage swing ($V_{\text{CC}} = \pm 15 \text{ V}$) $R_L = 2 \text{ k}\Omega$ $R_L = 10 \text{ k}\Omega$	V_{OPP}	± 10 ± 12	± 13 ± 14	— —	± 10 ± 12	± 13 ± 14	— —	V
Slew rate ($T_{\text{amb}} = +25^{\circ}\text{C}$) - Note 1	S_{VO}	—	0.5	—	—	0.5	—	V/ μs
Input impedance ($T_{\text{amb}} = +25^{\circ}\text{C}$)	Z_{I}	1.5	4	—	0.5	2	—	M Ω

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

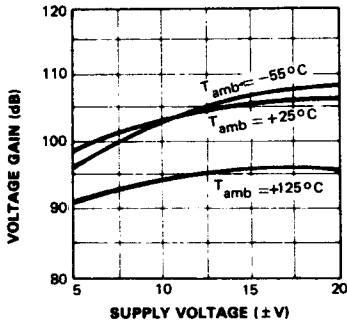
INPUT VOLTAGE RANGE (Note 2)



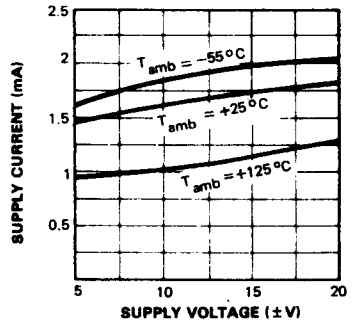
OUTPUT SWING (Note 2)



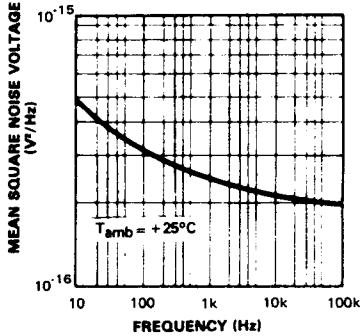
VOLTAGE GAIN (Note 2)



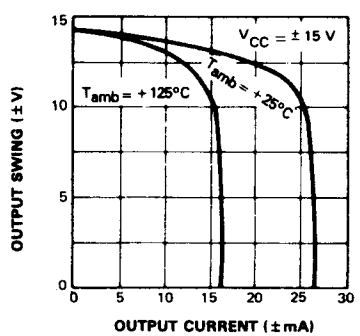
SUPPLY CURRENT (Note 2)



INPUT NOISE VOLTAGE



CURRENT LIMITING

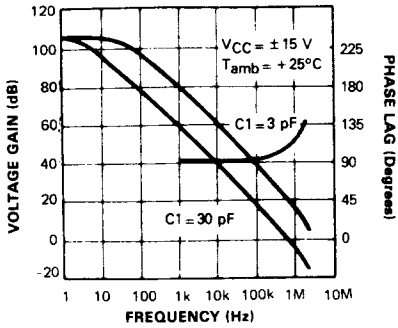


Note 2 : LM101A : -55°C ≤ Tamb ≤ +125°C, ±5 V ≤ VCC ≤ ±20 V
 LM201A : -25°C ≤ Tamb ≤ +85°C, ±5 V ≤ VCC ≤ ±20 V
 LM301A : 0°C ≤ Tamb ≤ +70°C, ±5 V ≤ VCC ≤ ±15 V

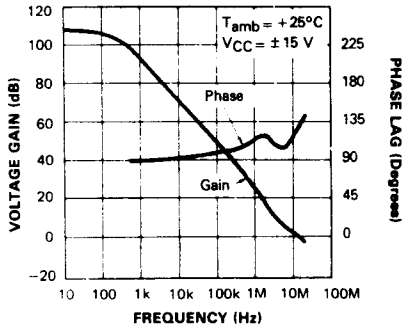
SINGLE POLE COMPENSATION

FEED FORWARD COMPENSATION

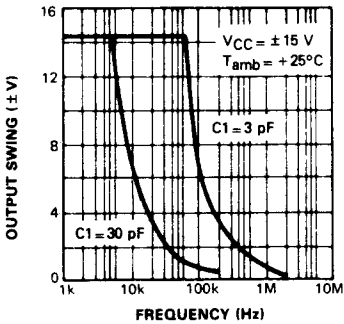
OPEN LOOP FREQUENCY RESPONSE



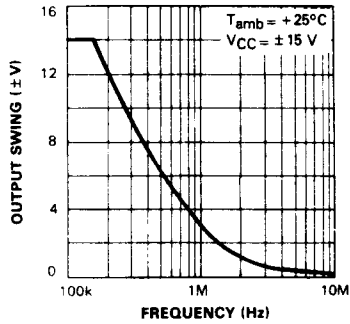
OPEN LOOP FREQUENCY RESPONSE



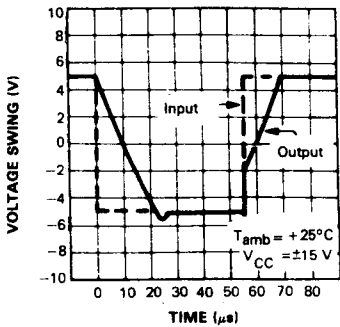
LARGE SIGNAL FREQUENCY RESPONSE



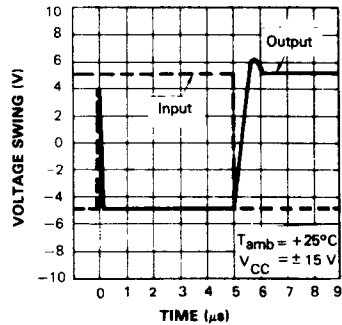
LARGE SIGNAL FREQUENCY RESPONSE



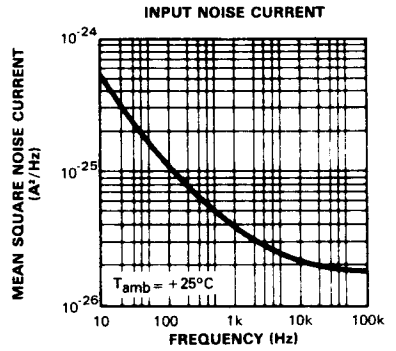
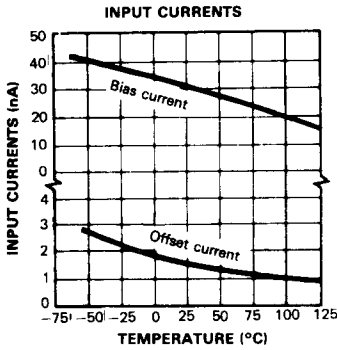
VOLTAGE FOLLOWER PULSE RESPONSE



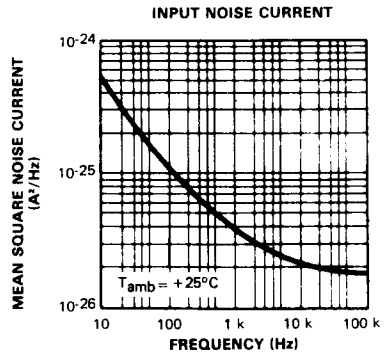
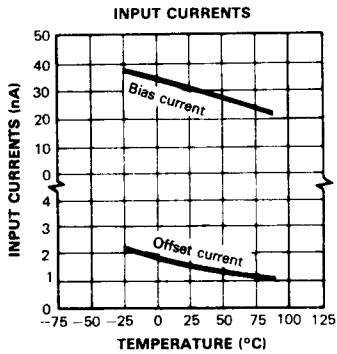
INVERTER PULSE RESPONSE



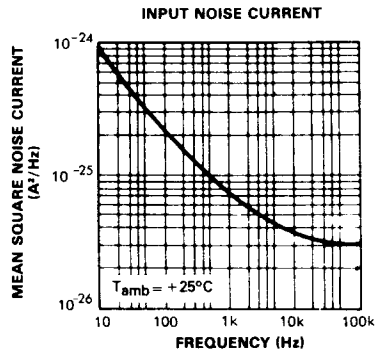
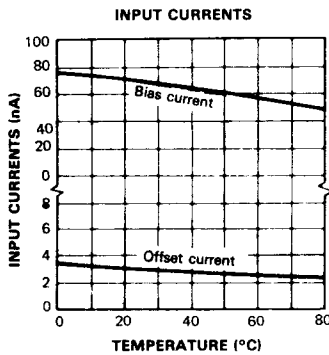
LM101A



LM201A

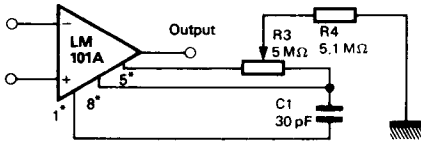


LM301A



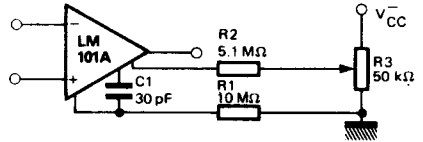
BASIC DIAGRAMS

BALANCING CIRCUIT

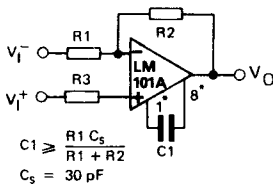


* CB-11 - CB-98 - CB-342 pin-configuration

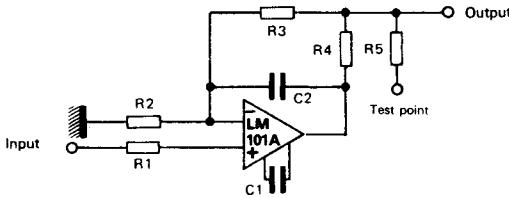
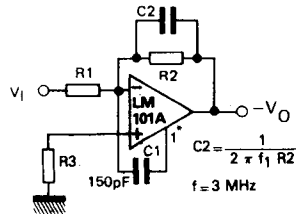
ALTERNATE BALANCING CIRCUIT



SINGLE POLE COMPENSATION

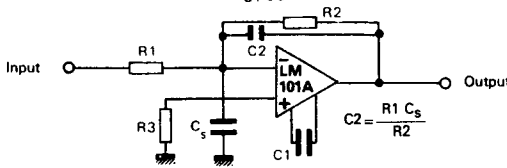


FEEDFORWARD COMPENSATION

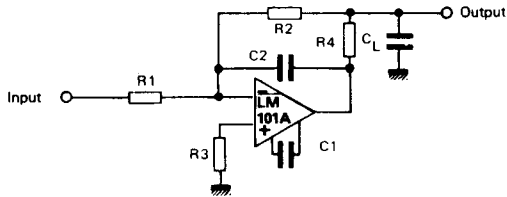


PROTECTING AGAINST GROSS FAULT CONDITIONS

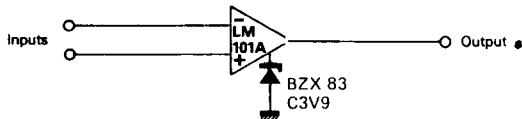
R1 : protects input
R4 : protects output
R5 : protects output. Not needed when R4 is used



COMPENSATING FOR STRAY INPUT CAPACITANCES OR LARGE FEEDBACK RESISTOR



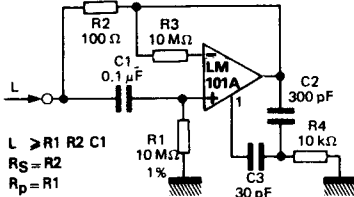
ISOLATING LARGE CAPACITIVE LOADS



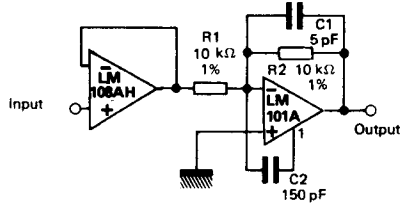
VOLTAGE COMPARATOR FOR DRIVING RTL LOGIC OR HIGH CURRENT DRIVER

TYPICAL APPLICATIONS

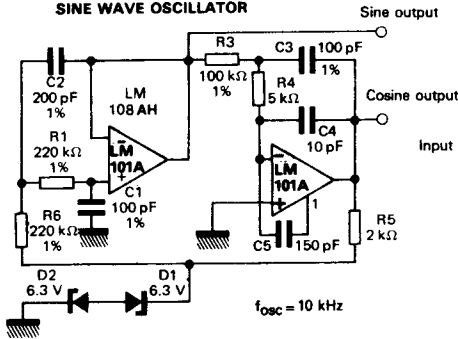
SIMULATED INDUCTOR



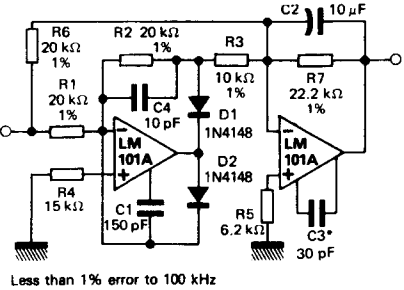
FAST INVERTING AMPLIFIER WITH HIGH INPUT IMPEDANCE



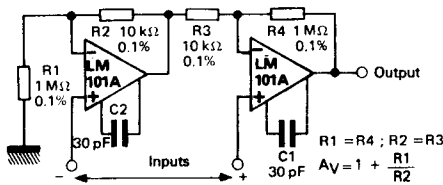
SINE WAVE OSCILLATOR



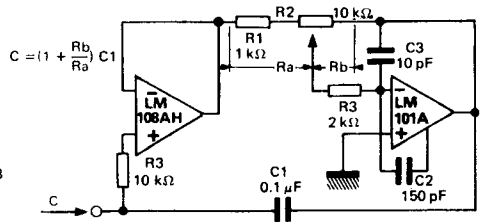
FAST AC/DC CONVERTER



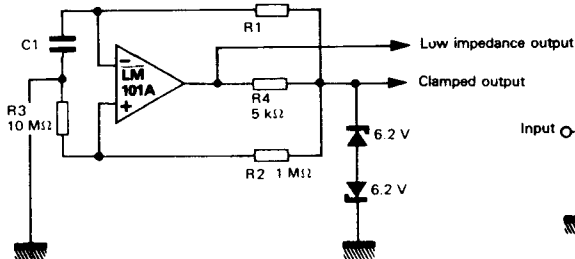
INSTRUMENTATION AMPLIFIER



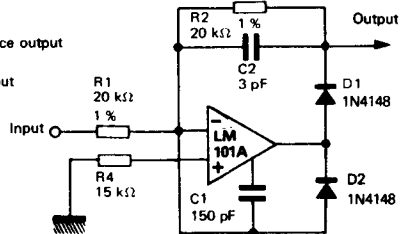
VARIABLE CAPACITANCE MULTIPLIER

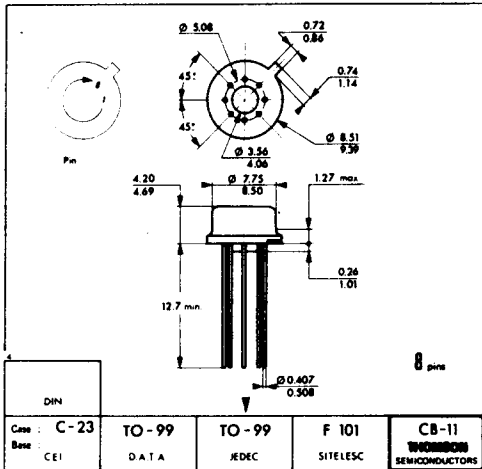


LOW FREQUENCY SQUARE WAVE GENERATOR



FAST HALF WAVE RECTIFIER

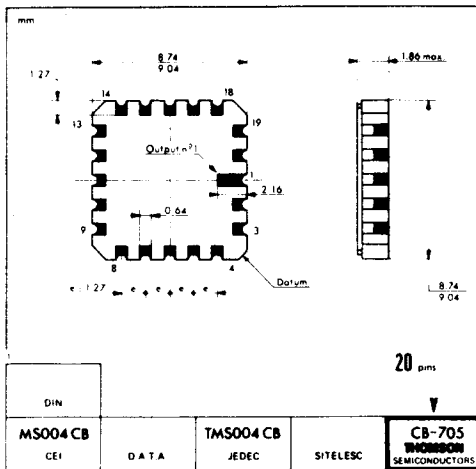




CB-11
(TO-99)



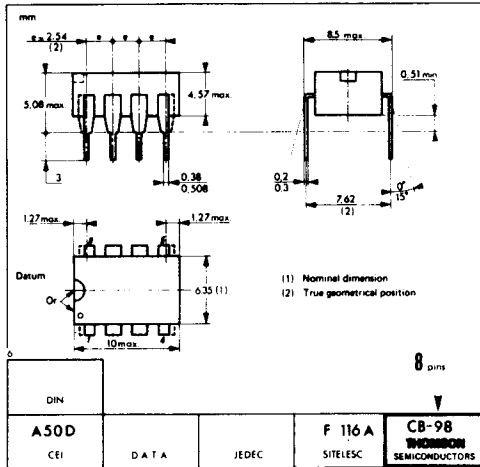
H SUFFIX
METAL CAN



CB-705



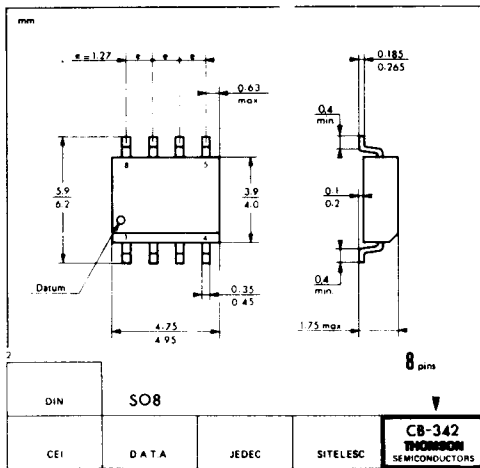
GC SUFFIX
TRICEOP (LCC)



CB-98



DP SUFFIX
PLASTIC PACKAGE
DG SUFFIX
CERDIP PACKAGE



CB-342



FP SUFFIX
PLASTIC
MICROPACKAGE

These specifications are subject to change without notice.
Please inquire with our sales offices about the availability of the different packages.