# LM101A-LM201A
# LM301A

## SINGLE OPERATIONAL AMPLIFIERS

| | LM101A LM201A | LM301A |
|---|---|---|
| ■ INPUT OFFSET VOLTAGE | 0.7mV | 2mV |
| ■ INPUT BIAS CURRENT | 25nA | 70nA |
| ■ INPUT OFFSET CURRENT | 1.5nA | 2nA |
| ■ SLEW RATE AS INVERSING AMPLIFIER | 10V/µs | 10V/µs |

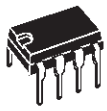
### DESCRIPTION

The LM101A is a general purpose operational amplifier which offers many features: supply voltages from ±5V to ±22V, low current drain, overload protection on the input and output, no latch-up when the common-mode range is exceeded, free from oscillations and compensation with a single 30pF capacitor. It has advantages over internally compensated amplifiers in that the compensation can be tailored to the particular application: slew rate of 10V/µs and bandwidth of 3.5MHz can be easily achieved.

### ORDER CODE

| Part Number | Temperature Range | Package | |
|---|---|---|---|
| | | N | D |
| LM101A | -55°C, +125°C | • | • |
| LM201A | -40°C, +105°C | • | • |
| LM301A | 0°C, +70°C | • | • |
| **Example :** LM201AN | | | |

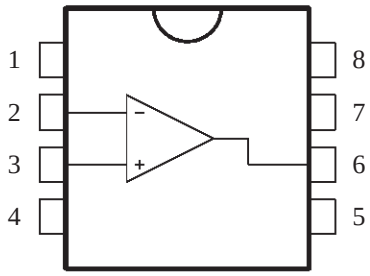
**N =** Dual in Line Package (DIP)
**D =** Small Outline Package (SO) - also available in Tape & Reel (DT)



**N**
**DIP8**
(Plastic Package)

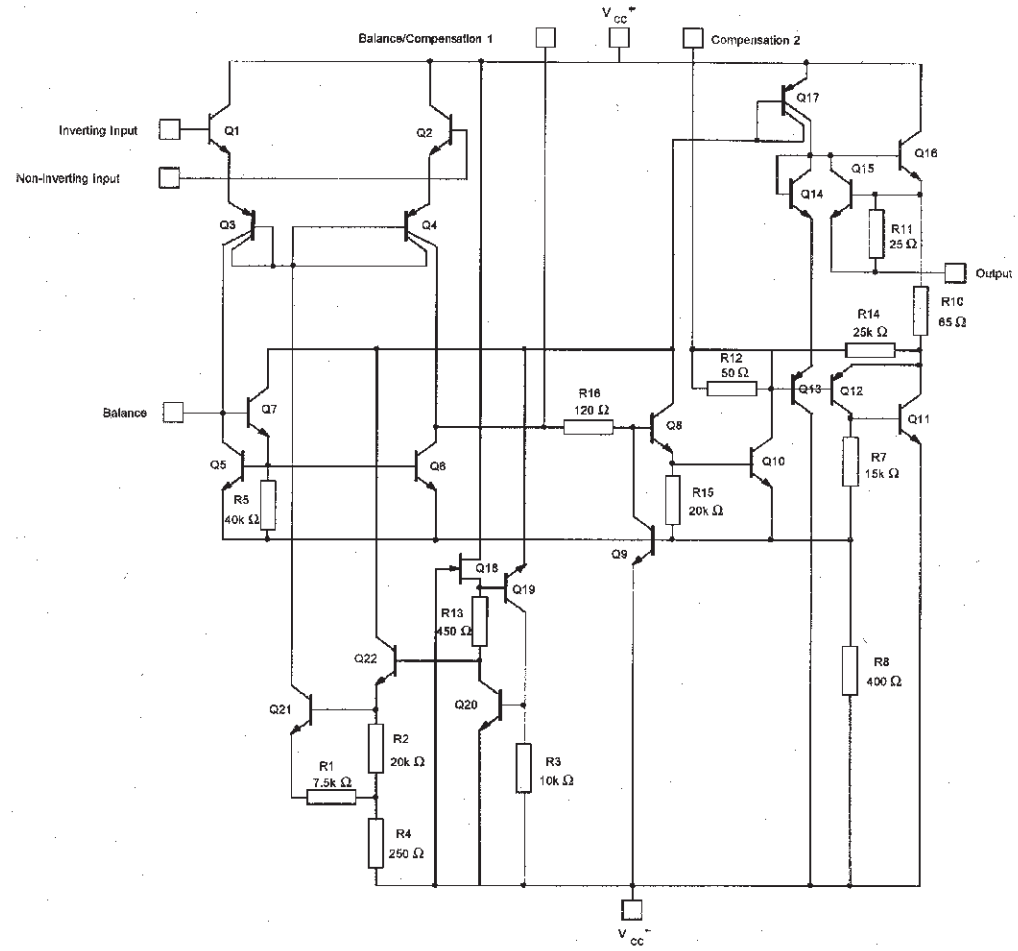
**D**
**SO8**
(Plastic Micropackage)

**PIN CONNECTIONS** (top view)




1 - Balance, compensation
2 - Inverting input
3 - Non-inverting input
4 - $V_{CC}^-$
5 - Balance
6 - Output
7 - $V_{CC}^+$
8 - Compensation 2

## SCHEMATIC DIAGRAM




## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | LM101A | LM201A | LM301A | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | ±22 | | | V |
| $V_i$ | Input Voltage | ±15 | | | V |
| $V_{id}$ | Differential Input Voltage | ±30 | | | V |
| $P_{tot}$ | Power Dissipation N Suffix<br>D Suffix | 500<br>300 | | | mW |
| | Output Short-circuit Duration | Infinite | | | |
| $T_{oper}$ | Opearting Free-air Temperature Range | -55 to +125 | -40 to +105 | 0 to +70 | °C |
| $T_{stg}$ | Storage Temperature Range | -65 to +150 | | | °C |

## ELECTRICAL CHARACTERISTICS

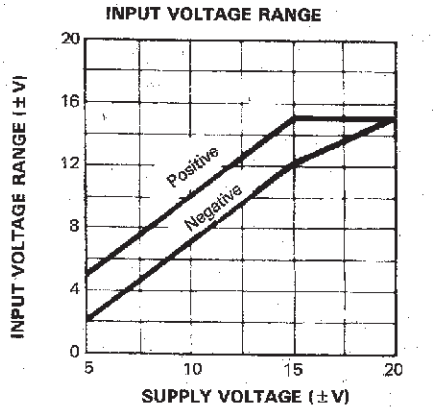
$\pm 5V \leq V_{CC} \leq \pm 20V$, C1 = 30pF, $T_{amb}$ = 25°C (unless otherwise specified)

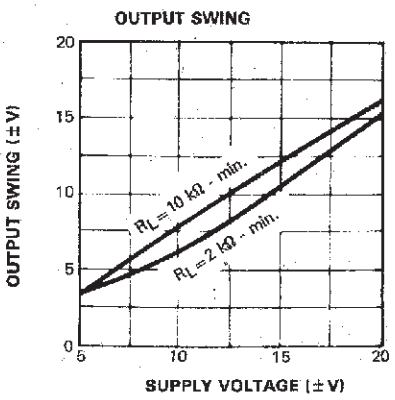
| Symbol | Parameter | LM101A - LM201A | | | LM301A | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| $V_{io}$ | Input Offset Voltage ($R_S \leq 10k\Omega$)<br>$T_{amb}$ = +25°C<br>$T_{min} \leq T_{amb} \leq T_{max}$ | | 0.7 | 2<br>3 | | 2 | 7.5<br>10 | mV |
| $DV_{io}$ | Input Offset Voltage Drift<br>$T_{min} \leq T_{amb} \leq T_{max}$ | | 3 | 15 | | 6 | 30 | µV/°C |
| $I_{ib}$ | Input Bias Current - note<br>$T_{amb}$ = +25°C<br>$T_{min} \leq T_{amb} \leq T_{max}$ | | 25 | 75<br>100 | | 70 | 250<br>300 | nA |
| $I_{io}$ | Input Offset Current<br>$T_{amb}$ = +25°C<br>$T_{min} \leq T_{amb} \leq T_{max}$ | | 1.5 | 10<br>20 | | 2 | 50<br>70 | nA |
| $DI_{Iio}$ | Input Offset Current Drift<br>$T_{min} \leq T_{amb} \leq 25°C$<br>$T_{min} \leq T_{amb} \leq T_{max}$ | | 10<br>20 | 100<br>200 | | 10<br>20 | 300<br>600 | pA/°C |
| $A_{vd}$ | Large Signal Voltage Gain *<br>$V_O \leq 10V$, $R_L$ = 2kΩ)<br>$T_{amb}$ = +25°C<br>$T_{min} \leq T_{amb} \leq T_{max}$ | 50<br>25 | 100 | | 25<br>15 | 100 | | V/mV |
| SVR | Supply Voltage Rejection Ratio ($R_S \leq 10k\Omega$)<br>$T_{amb}$ = +25°C<br>$T_{min} \leq T_{amb} \leq T_{max}$ | 80<br>80 | 96 | | 70<br>70 | 96 | | dB |
| $I_{CC}$ | Supply Current, no load<br>$T_{amb}$ = +25°C<br>$T_{min} \leq T_{amb} \leq T_{max}$ | | 1.8 | 3<br>3 | | 1.8 | 3<br>3 | mA |
| $V_{icm}$ | Input Common Mode Voltage Range<br>($V_{CC} = \pm 20V$)<br>$T_{amb}$ = +25°C<br>$T_{min} \leq T_{amb} \leq T_{max}$ | ±15<br>±15 | | | ±15<br>±15 | | | V |
| CMR | Common Mode Rejection Ratio ($R_S \leq 10k\Omega$)<br>$T_{amb}$ = +25°C<br>$T_{min} \leq T_{amb} \leq T_{max}$ | 80<br>80 | 96 | | 70<br>70 | 96 | | dB |
| $I_{OS}$ | Output Short-circuit Current *<br>$T_{amb}$ = +25°C | 10 | 30 | 50 | 10 | 30 | 50 | mA |
| $\pm V_{OPP}$ | Output Voltage Swing *<br>$T_{amb}$ = +25°C $R_L$ = 10kΩ<br>$R_L$ = 2kΩ<br>$T_{min} \leq T_{amb} \leq T_{max}$ $R_L$ = 10kΩ<br>$R_L$ = 2kΩ | 12<br>10<br>12<br>10 | 14<br>13 | | 12<br>10<br>12<br>10 | 14<br>13 | | V |
| SR | Slew Rate ($V_i = \pm 10V$, $R_L$ = 2kΩ,$C_L$ = 100pF, unity gain) - 1) | 0.25 | 0.5 | | 0.25 | 0.5 | | V/µs |

| Symbol | Parameter | LM101A - LM201A | | | LM301A | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| $t_r$ | Rise ($V_i$ = ±20mV, $R_L$ = 2kΩ,$C_L$ = 100pF, unity gain) | | 0.3 | | | 0.3 | | µs |
| $K_{OV}$ | Overshoot ($V_i$ = 20mV, $R_L$ = 2kΩ,$C_L$ = 100pF, unity gain) | | 5 | | | 5 | | % |
| $Z_i$ | Input Impedance * | 1.5 | 4 | | 1.5 | 4 | | MΩ |
| GBP | Gain Bandwidth Product * ($V_i$ = 10mV, $R_L$ = 2kΩ,$C_L$ = 100pF, f = 100KHz) | 0.5 | 1 | | 0.5 | 1 | | MHz |
| THD | Total Harmonic Distortion (f = 1kHz, $A_v$ = 20dB, $R_L$ = 2kΩ, $V_o$ = $2V_{pp}$, $C_L$ = 100pF) | | 0.015 | | | 0.015 | | % |
| $e_n$ | Equivalent Input Noise Voltage f = 1kHz, $R_S$ = 100Ω | | 25 | | | 25 | | $\frac{nV}{\sqrt{Hz}}$ |

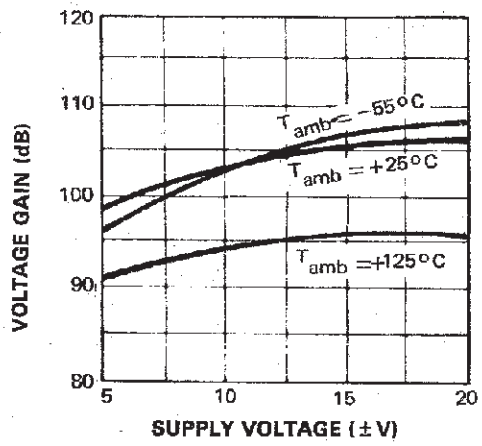
1. May be improved up to 10V/µs in inverting amplifier configuration

* ==> $V_{CC}$ = ±15V, $T_{amb}$ = +25°C (unless otherwise specified)

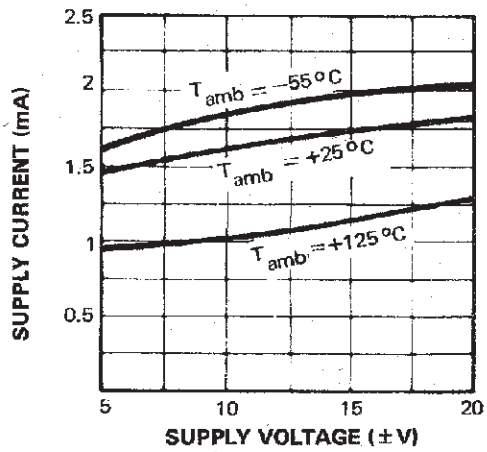


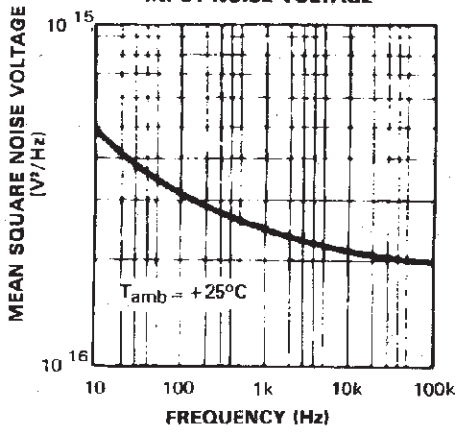
VOLTAGE GAIN



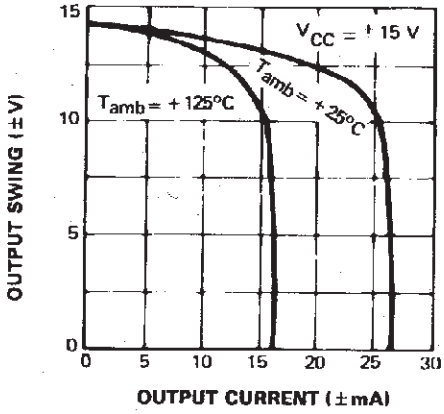

SUPPLY CURRENT




INPUT NOISE VOLTAGE

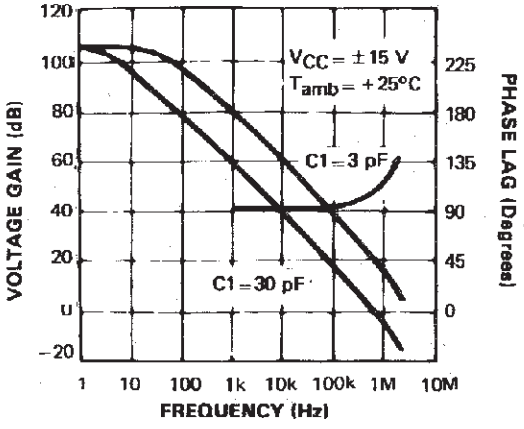



CURRENT LIMITING



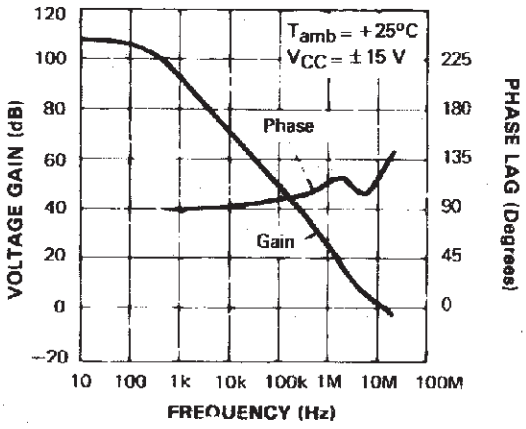

SINGLE POLE COMPENSATION

OPEN LOOP FREQUENCY RESPONSE




FEED FORWARD COMPENSATION

OPEN LOOP FREQUENCY RESPONSE

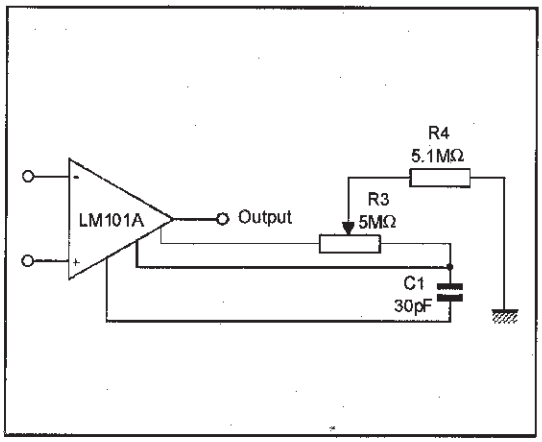


**SINGLE POLE COMPENSATION**

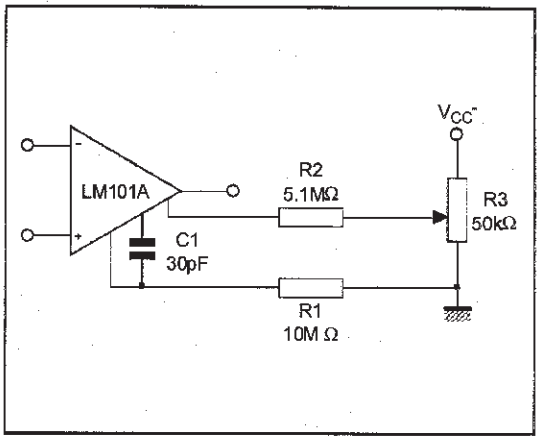
**FEED FORWARD COMPENSATION**

## BASIC DIAGRAM

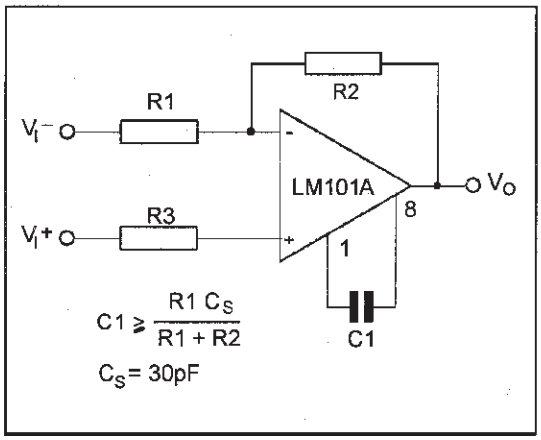
BALANCING CIRCUIT



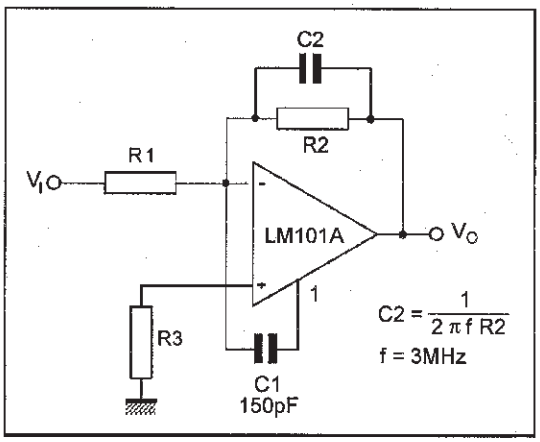

ALTERNATE BALANCING CIRCUIT



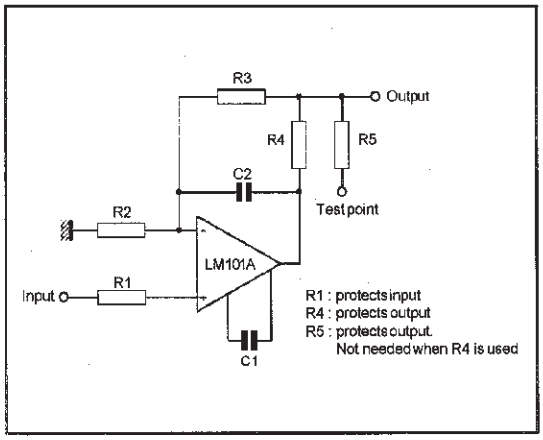

SINGLE POLE COMPENSATION



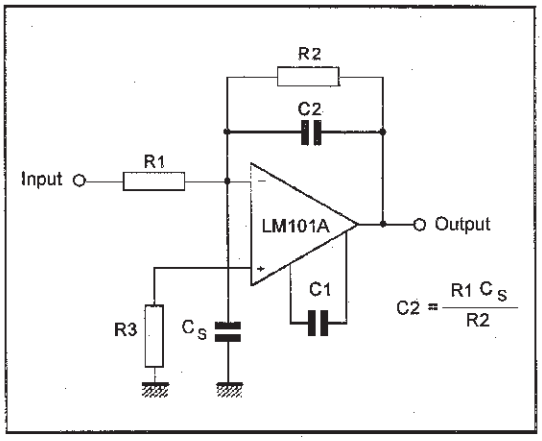

FEEDFORWARD COMPENSATION




PROTECTING AGAINST GROSS FAULT CONDITIONS

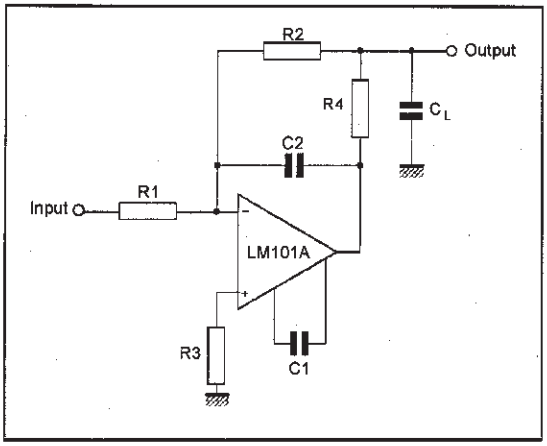



COMPENSATING FOR STRAY INPUT CAPA CITANCES OR LARGE FEEDBACK RESISTOR

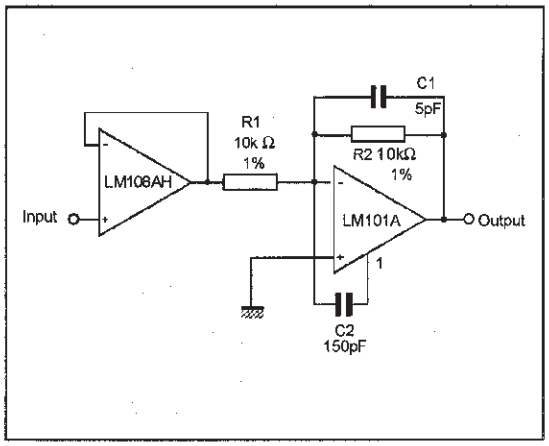


**BASIC DIAGRAM** (continued)

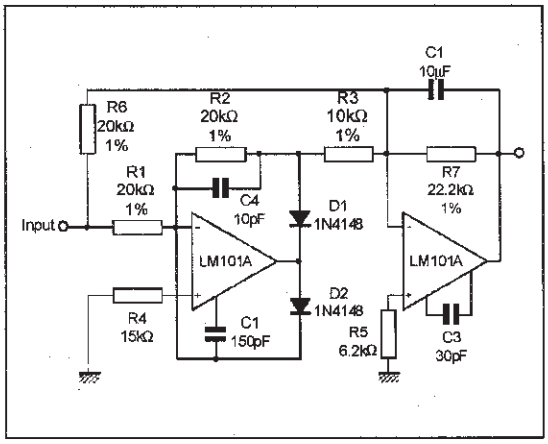
ISOLATING LARGE CAPACITIVE LOAD




FAST AMPLIFIER WITH HIGH INPUT IMPEDANCE

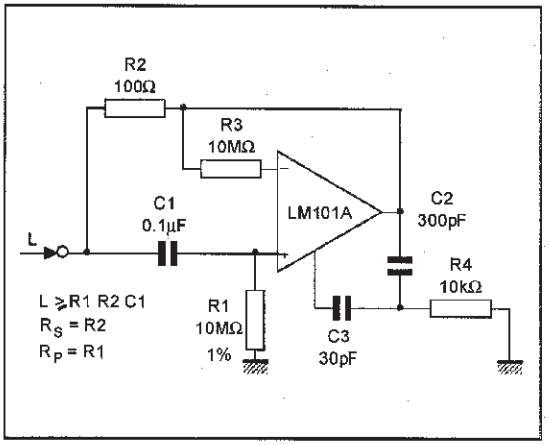



FAST AC/DC CONVERTER

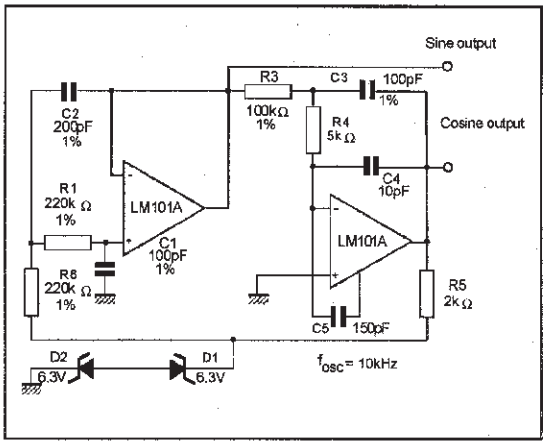



**TYPICAL APPLICATIONS**

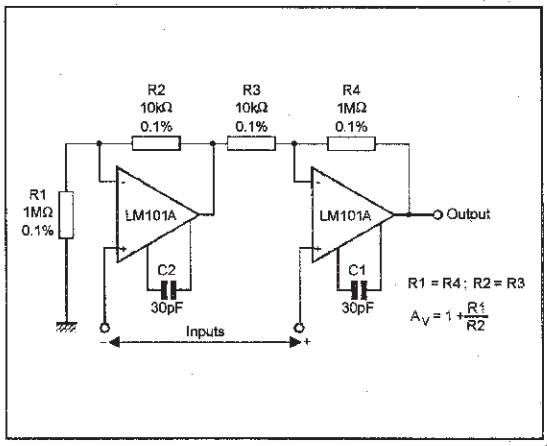
SIMULATED INDUCTOR




SINE WAVE OSCILLATOR

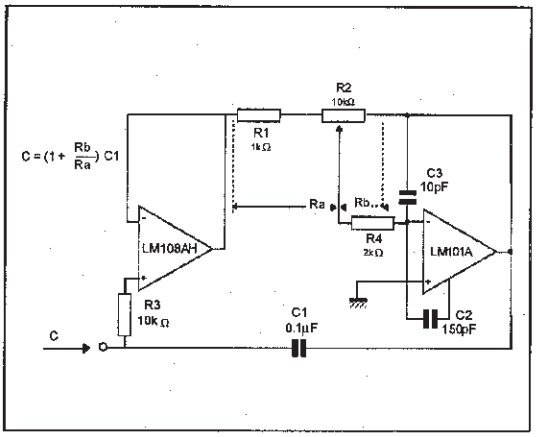



INSTRUMENTATION AMPLIFIER

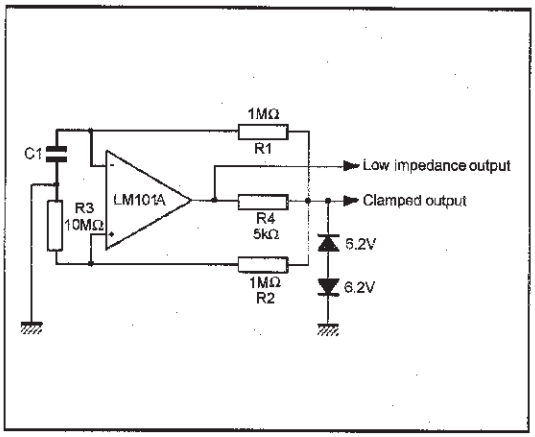


**TYPICAL APPLICATIONS** (continued)

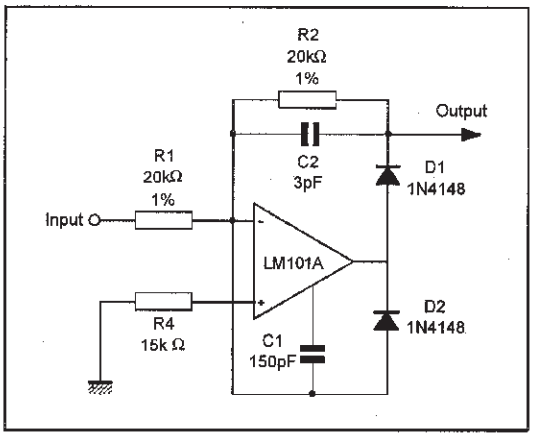
VARIABLE CAPACITANCE MULTIPLIER




LOW FREQUENCY SQUARE WAVE GENERATOR

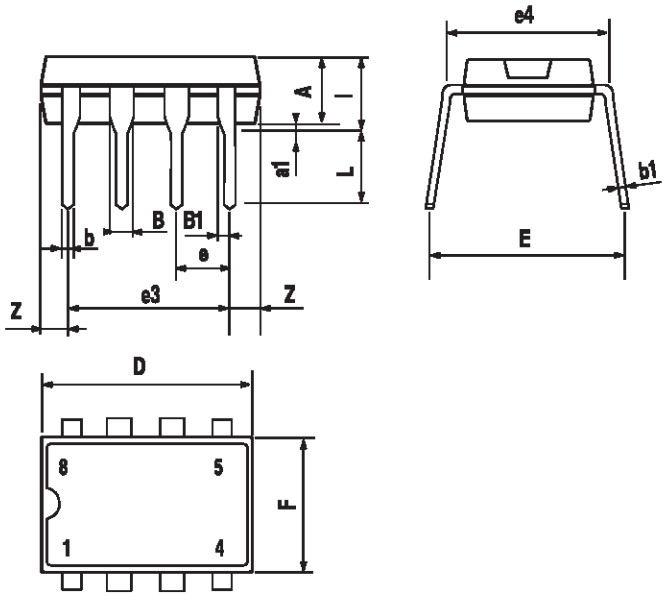



FAST HALF WAVE RECTIFIER



## PACKAGE MECHANICAL DATA

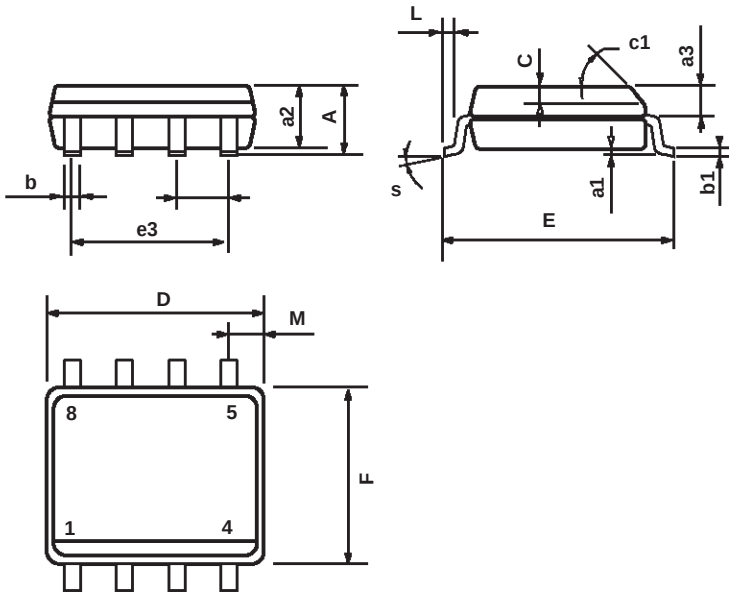
8 PINS - PLASTIC DIP




| Dim. | Millimeters | | | Inches | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | 3.32 | | | 0.131 | |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.15 | | 1.65 | 0.045 | | 0.065 |
| b | 0.356 | | 0.55 | 0.014 | | 0.022 |
| b1 | 0.204 | | 0.304 | 0.008 | | 0.012 |
| D | | | 10.92 | | | 0.430 |
| E | 7.95 | | 9.75 | 0.313 | | 0.384 |
| e | | 2.54 | | | 0.100 | |
| e3 | | 7.62 | | | 0.300 | |
| e4 | | 7.62 | | | 0.300 | |
| F | | | 6.6 | | | 0260 |
| i | | | 5.08 | | | 0.200 |
| L | 3.18 | | 3.81 | 0.125 | | 0.150 |
| Z | | | 1.52 | | | 0.060 |

## PACKAGE MECHANICAL DATA

8 PINS - PLASTIC MICROPACKAGE (SO)




| Dim. | Millimeters | | | Inches | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| a2 | | | 1.65 | | | 0.065 |
| a3 | 0.65 | | 0.85 | 0.026 | | 0.033 |
| b | 0.35 | | 0.48 | 0.014 | | 0.019 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | 0.25 | | 0.5 | 0.010 | | 0.020 |
| c1 | 45° (typ.) | | | | | |
| D | 4.8 | | 5.0 | 0.189 | | 0.197 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 3.81 | | | 0.150 | |
| F | 3.8 | | 4.0 | 0.150 | | 0.157 |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 |
| M | | | 0.6 | | | 0.024 |
| S | 8° (max.) | | | | | |