



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 |

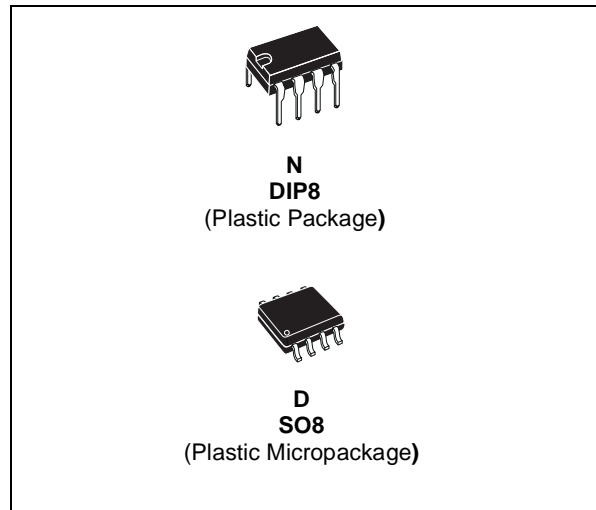
DESCRIPTION

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.

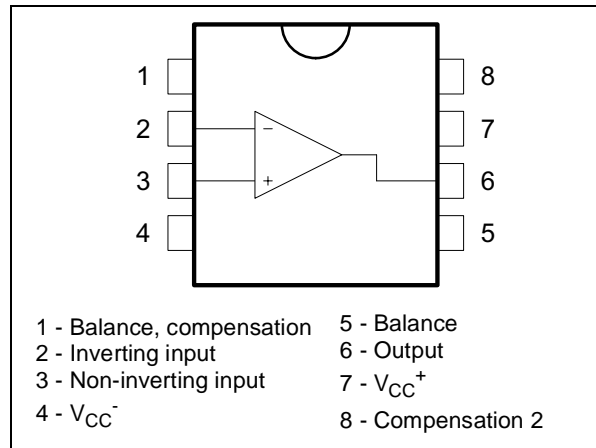
ORDER CODE

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

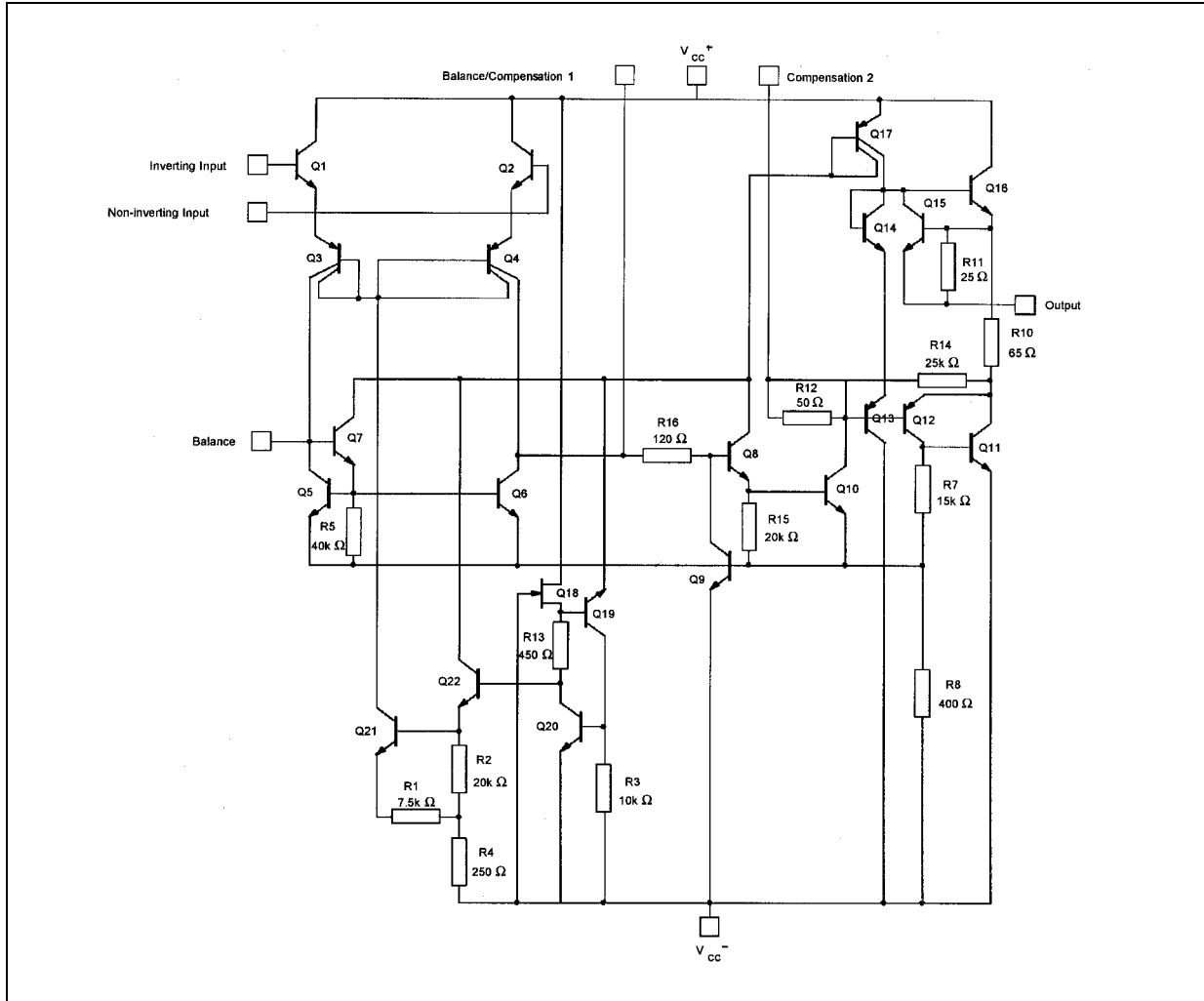
N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)



PIN CONNECTIONS (top view)



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 D Suffix | 500 300 | | | 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 | | | °C |

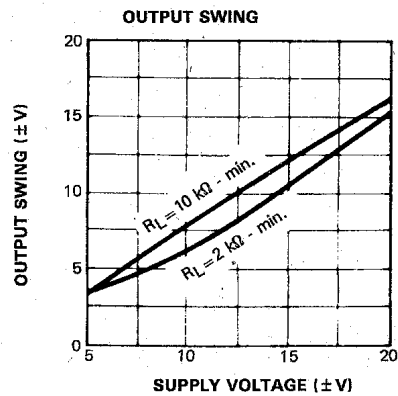
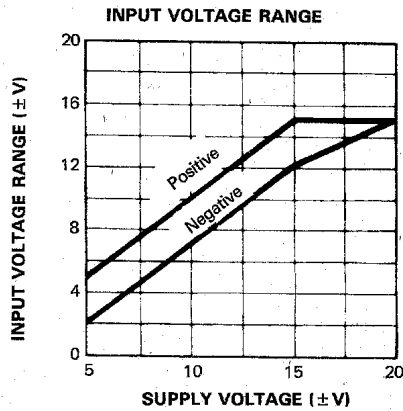
ELECTRICAL CHARACTERISTICS $\pm 5V \leq V_{CC} \leq \pm 20V$, $C_1 = 30pF$, $T_{amb} = 25^\circ C$ (unless otherwise specified)

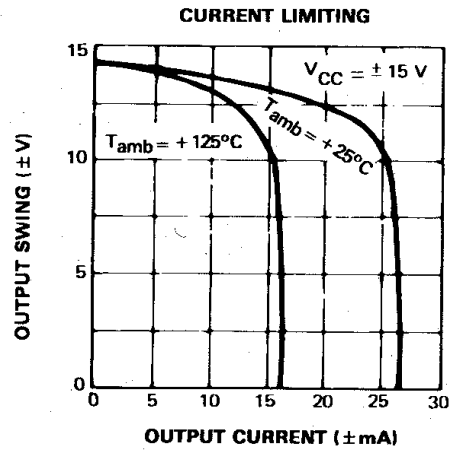
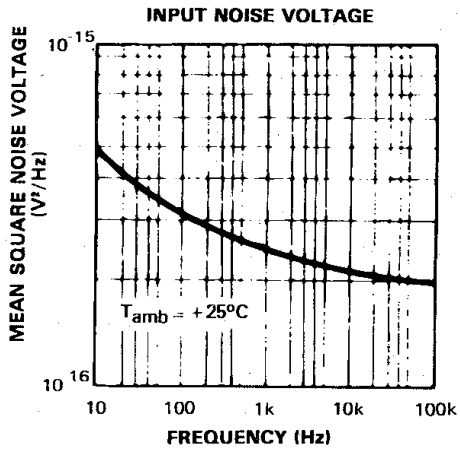
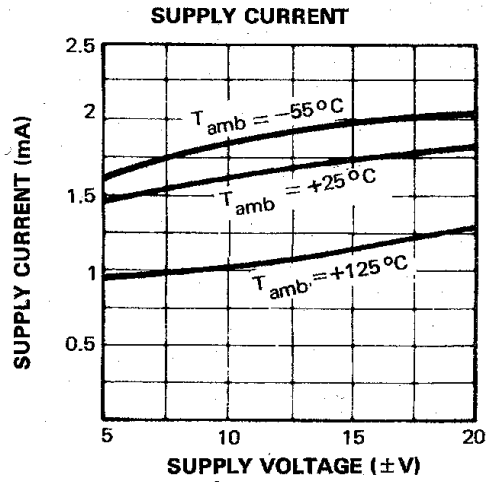
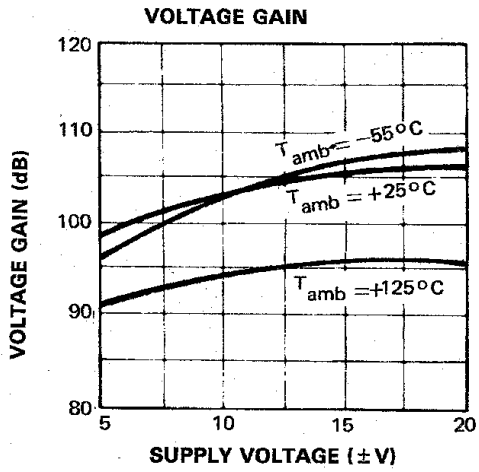
| Symbol | Parameter | LM101A - LM201A | | | LM301A | | | Unit |
|---------------|--|----------------------|--|------------|----------------------|---|------|------------------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| V_{io} | Input Offset Voltage ($R_S \leq 10k\Omega$) $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 0.7 | 2 3 | | 2 7.5 10 | | mV |
| DV_{io} | Input Offset Voltage Drift $T_{min} \leq T_{amb} \leq T_{max}$ | | 3 | 15 | | 6 30 | | $\mu V/^\circ C$ |
| I_{ib} | Input Bias Current - note $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 25 | 75 100 | | 70 250 300 | | nA |
| I_{io} | Input Offset Current $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 1.5 | 10 20 | | 2 50 70 | | nA |
| DI_{io} | Input Offset Current Drift $T_{min} \leq T_{amb} \leq 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 10 20 | 100 200 | | 10 20 300 600 | | $\mu A/^\circ C$ |
| A_{vd} | Large Signal Voltage Gain * $V_O \leq 10V$, $R_L = 2k\Omega$ $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 50 25 | 100 | | 25 15 | 100 | | V/mV |
| SVR | Supply Voltage Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 80 80 | 96 | | 70 70 | 96 | | dB |
| I_{CC} | Supply Current, no load $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 1.8 | 3 3 | | 1.8 3 3 | | mA |
| V_{icm} | Input Common Mode Voltage Range ($V_{CC} = \pm 20V$) $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | ± 15 ± 15 | | | ± 15 ± 15 | | | V |
| CMR | Common Mode Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 80 80 | 96 | | 70 70 | 96 | | dB |
| I_{OS} | Output Short-circuit Current * $T_{amb} = +25^\circ C$ | 10 | 30 | 50 | 10 | 30 | 50 | mA |
| $\pm V_{OPP}$ | Output Voltage Swing * $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | $R_L = 10k\Omega$ 12 $R_L = 2k\Omega$ 10 13 $R_L = 10k\Omega$ 12 $R_L = 2k\Omega$ 10 | | | $R_L = 10k\Omega$ 12 14 $R_L = 2k\Omega$ 10 13 | | V |
| SR | Slew Rate ($V_i = \pm 10V$, $R_L = 2k\Omega$, $C_L = 100pF$, 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 ($V_i = \pm 20\text{mV}$, $R_L = 2\text{k}\Omega$, $C_L = 100\text{pF}$, unity gain) | | 0.3 | | | 0.3 | | μs |
| K_{OV} | Overshoot ($V_i = 20\text{mV}$, $R_L = 2\text{k}\Omega$, $C_L = 100\text{pF}$, unity gain) | | 5 | | | 5 | | % |
| Z_i | Input Impedance * | 1.5 | 4 | | 1.5 | 4 | | $\text{M}\Omega$ |
| GBP | Gain Bandwidth Product * ($V_i = 10\text{mV}$, $R_L = 2\text{k}\Omega$, $C_L = 100\text{pF}$, $f = 100\text{KHz}$) | 0.5 | 1 | | 0.5 | 1 | | MHz |
| THD | Total Harmonic Distortion ($f = 1\text{kHz}$, $A_v = 20\text{dB}$, $R_L = 2\text{k}\Omega$, $V_o = 2V_{pp}$, $C_L = 100\text{pF}$) | | 0.015 | | | 0.015 | | % |
| e_n | Equivalent Input Noise Voltage $f = 1\text{kHz}$, $R_s = 100\Omega$ | | 25 | | | 25 | | $\frac{\text{nV}}{\sqrt{\text{Hz}}}$ |

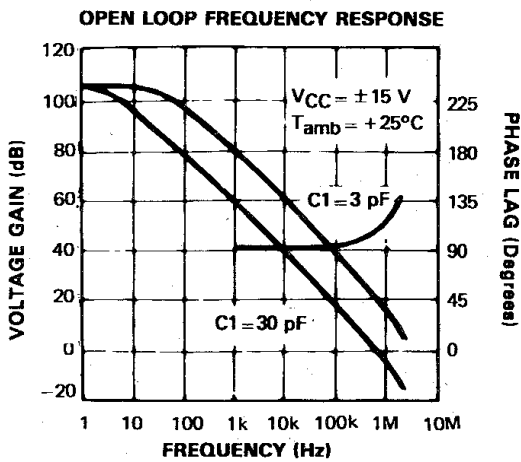
1. May be improved up to $10\text{V}/\mu\text{s}$ in inverting amplifier configuration

* ==> $V_{CC} = \pm 15\text{V}$, $T_{amb} = +25^\circ\text{C}$ (unless otherwise specified)

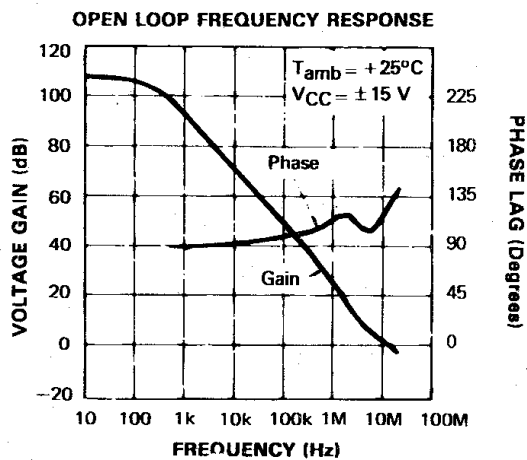




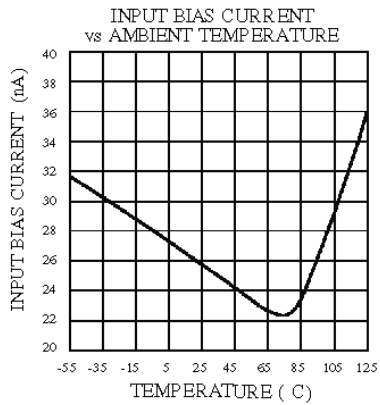
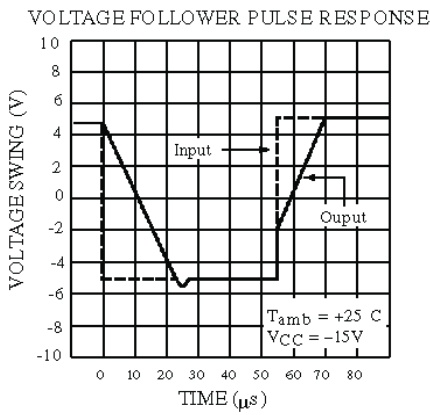
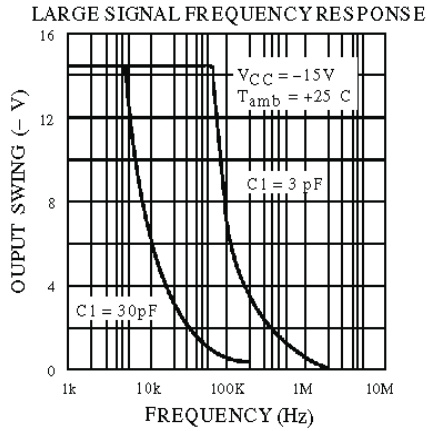
SINGLE POLE COMPENSATION



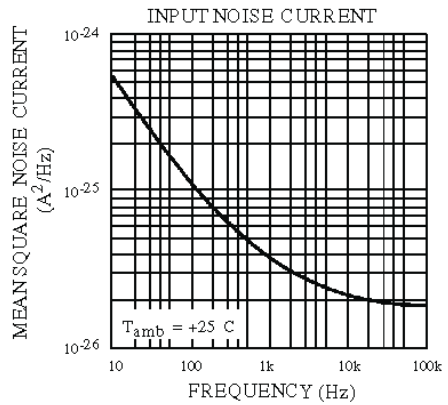
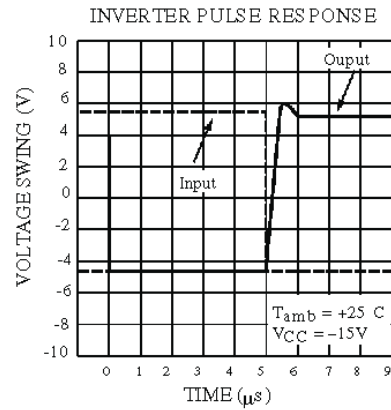
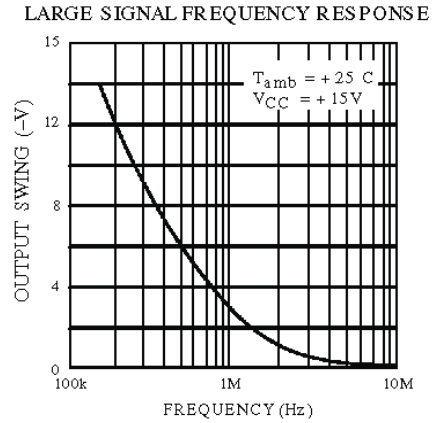
FEED FORWARD COMPENSATION



SINGLE POLE COMPENSATION

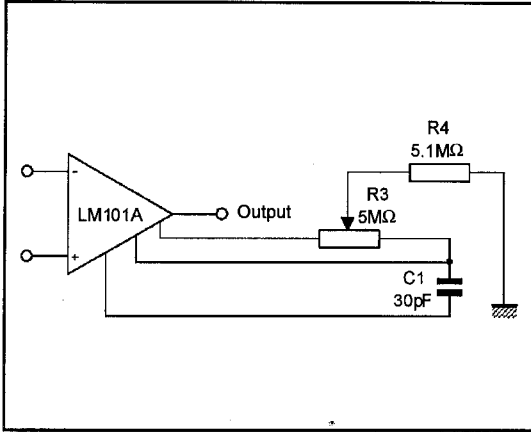


FEED FORWARD COMPENSATION

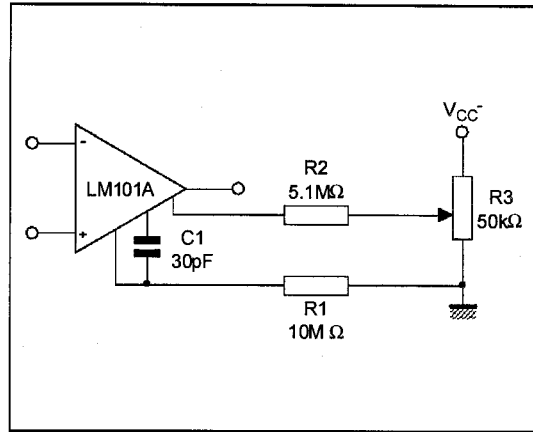


BASIC DIAGRAM

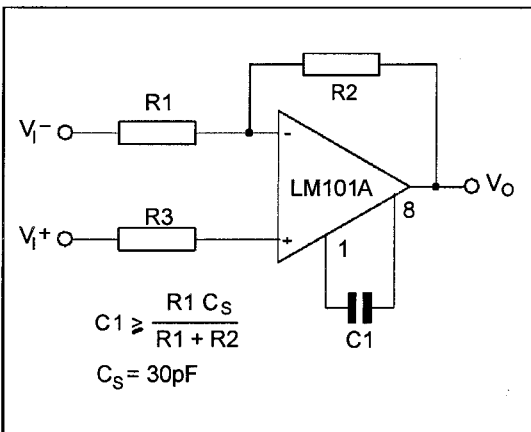
BALANCING CIRCUIT



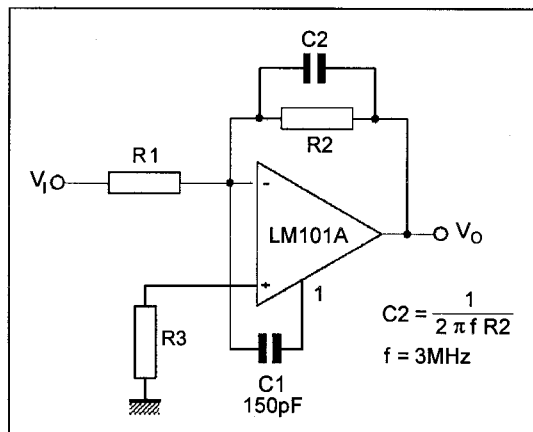
ALTERNATE BALANCING CIRCUIT



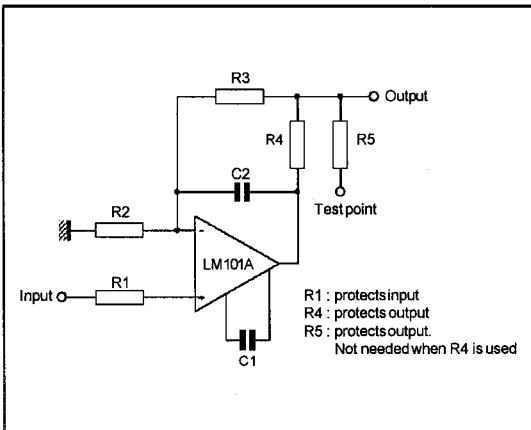
SINGLE POLE COMPENSATION



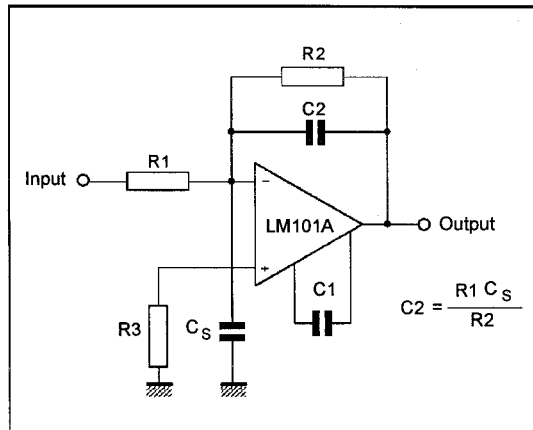
FEEDFORWARD COMPENSATION



PROTECTING AGAINST GROSS FAULT CONDITIONS

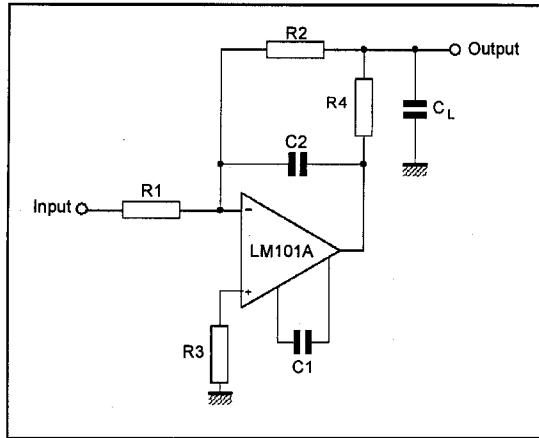


COMPENSATING FOR STRAY INPUT CAPACITANCES OR LARGE FEEDBACK RESISTOR



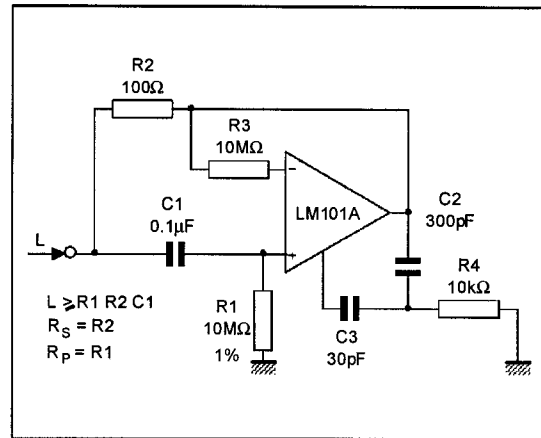
BASIC DIAGRAM (continued)

ISOLATING LARGE CAPACITIVE LOAD

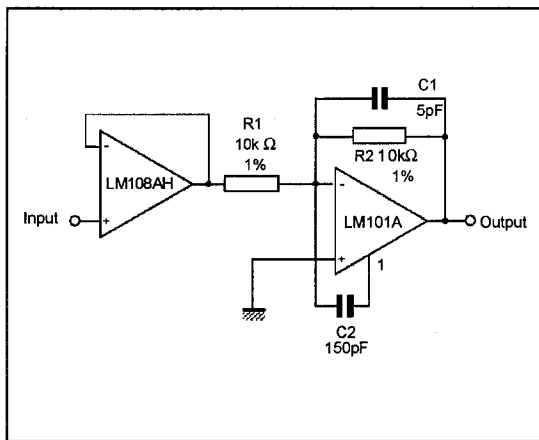


TYPICAL APPLICATIONS

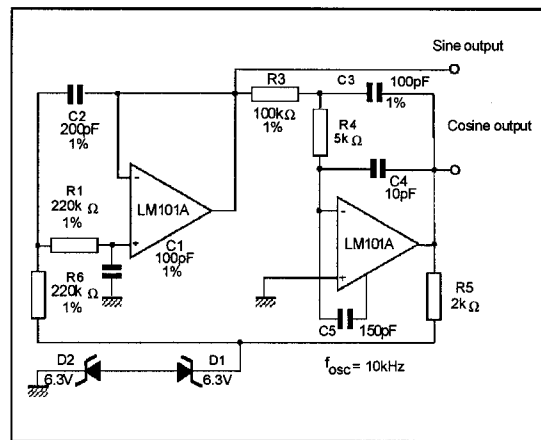
SIMULATED INDUCTOR



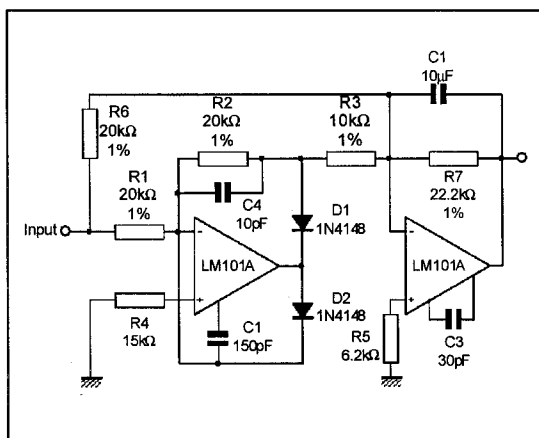
FAST AMPLIFIER WITH HIGH INPUT IMPEDANCE



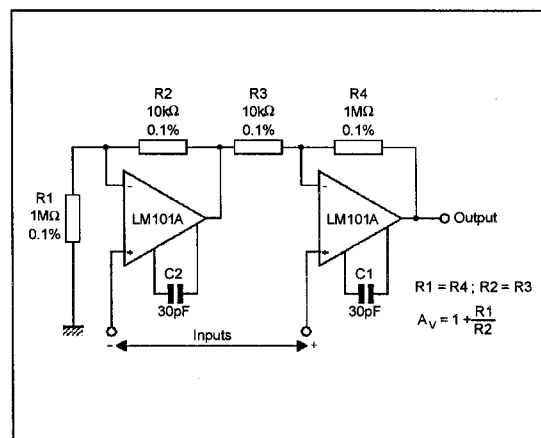
SINE WAVE OSCILLATOR



FAST AC/DC CONVERTER

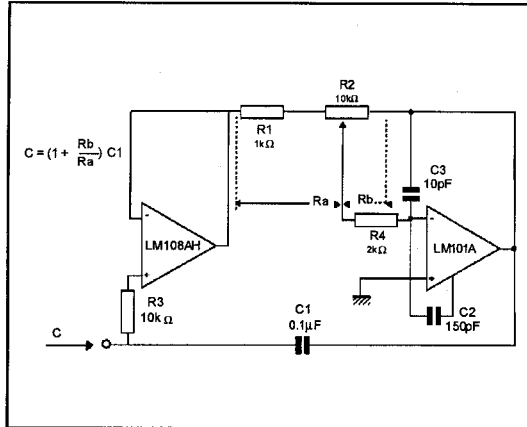


INSTRUMENTATION AMPLIFIER

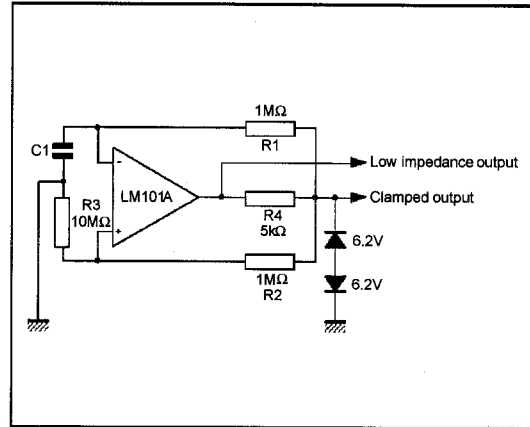


TYPICAL APPLICATIONS (continued)

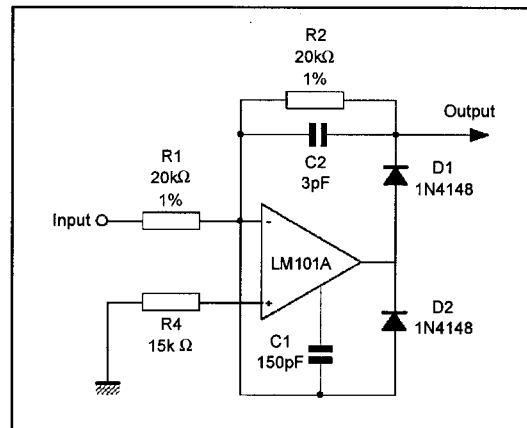
VARIABLE CAPACITANCE MULTIPLIER



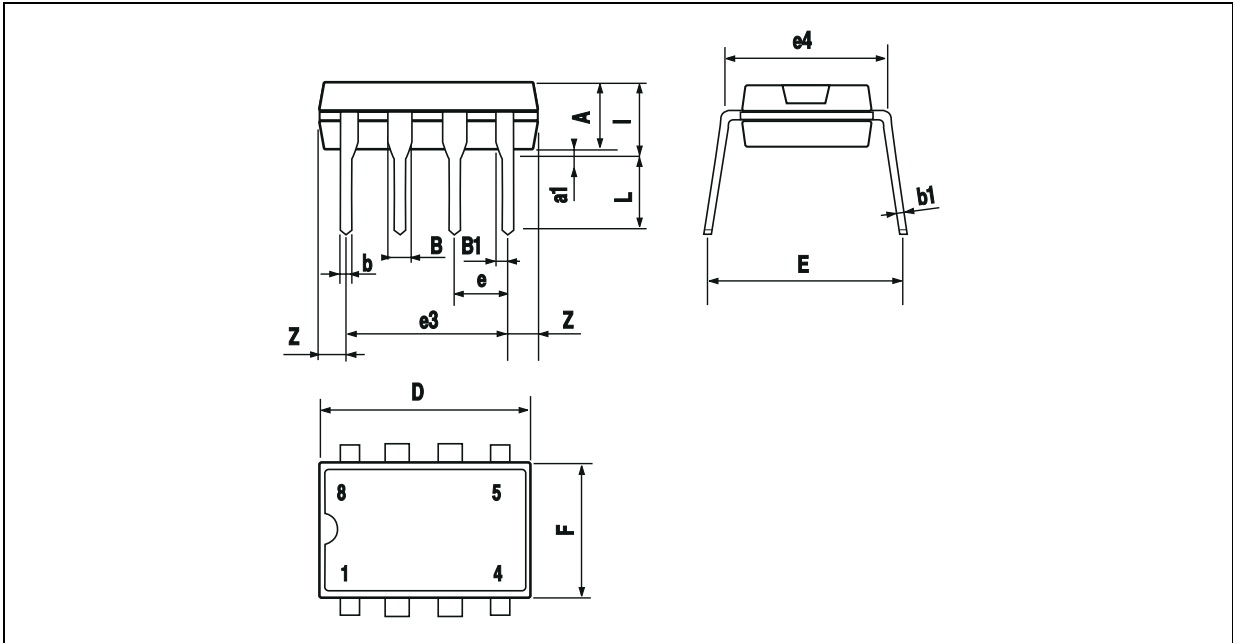
LOW FREQUENCY SQUARE WAVE GENERATOR



FAST HALF WAVE RECTIFIER

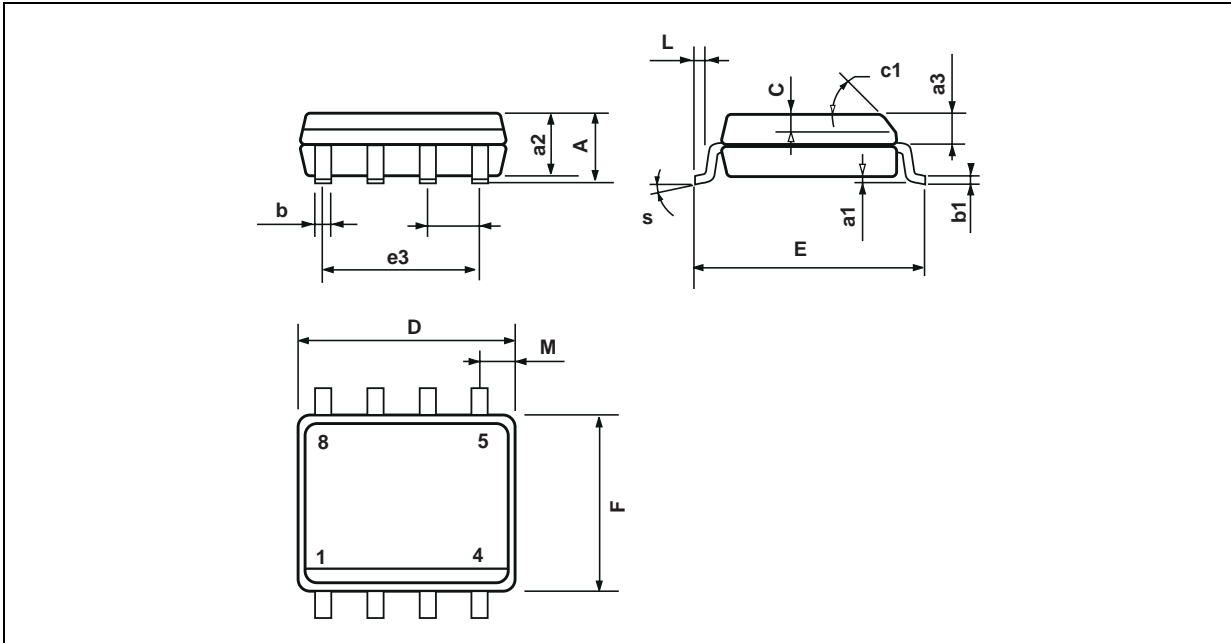


PACKAGE MECHANICAL DATA
8 PINS - PLASTIC DIP



| 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 | | | 0.260 |
| 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.) | | | | | |

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