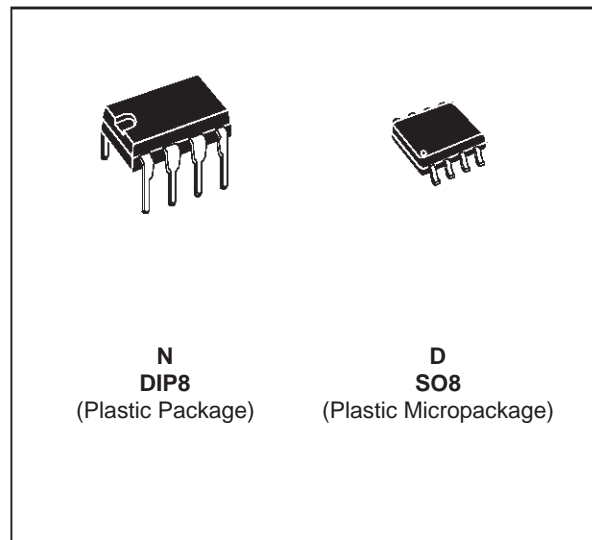


PROGRAMMABLE LOW POWER SINGLE OPERATIONAL AMPLIFIERS

- MICROPOWER OPERATION
- NO FREQUENCY COMPENSATION REQUIRED
- WIDE PROGRAMMING RANGE
- HIGH SLEW RATE
- SHORT-CIRCUIT PROTECTION
- PROGRAMMABLE SINGLE OP-AMP



ORDER CODES

| Part Number | Temperature Range | Package | |
|-------------|-------------------|---------|---|
| | | N | D |
| UA776C | 0°C, +70°C | • | • |
| UA776I | -40°C, +105°C | • | • |
| UA776M | -55°C, +125°C | • | • |

Example : UA776CN

DESCRIPTION

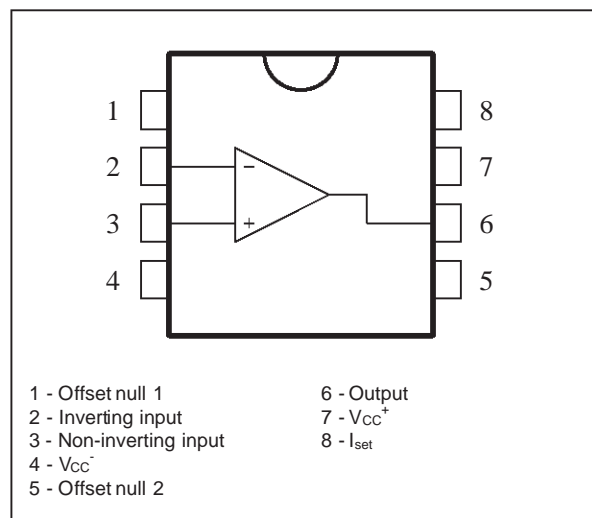
The UA776 programmable operational amplifier is characterized by low supply current and low equivalent input noise voltage over a wide range of operating supply voltages.

Coupled with programmable electrical characteristics, it is a versatile amplifier for use in high accuracy, low power consumption analog applications.

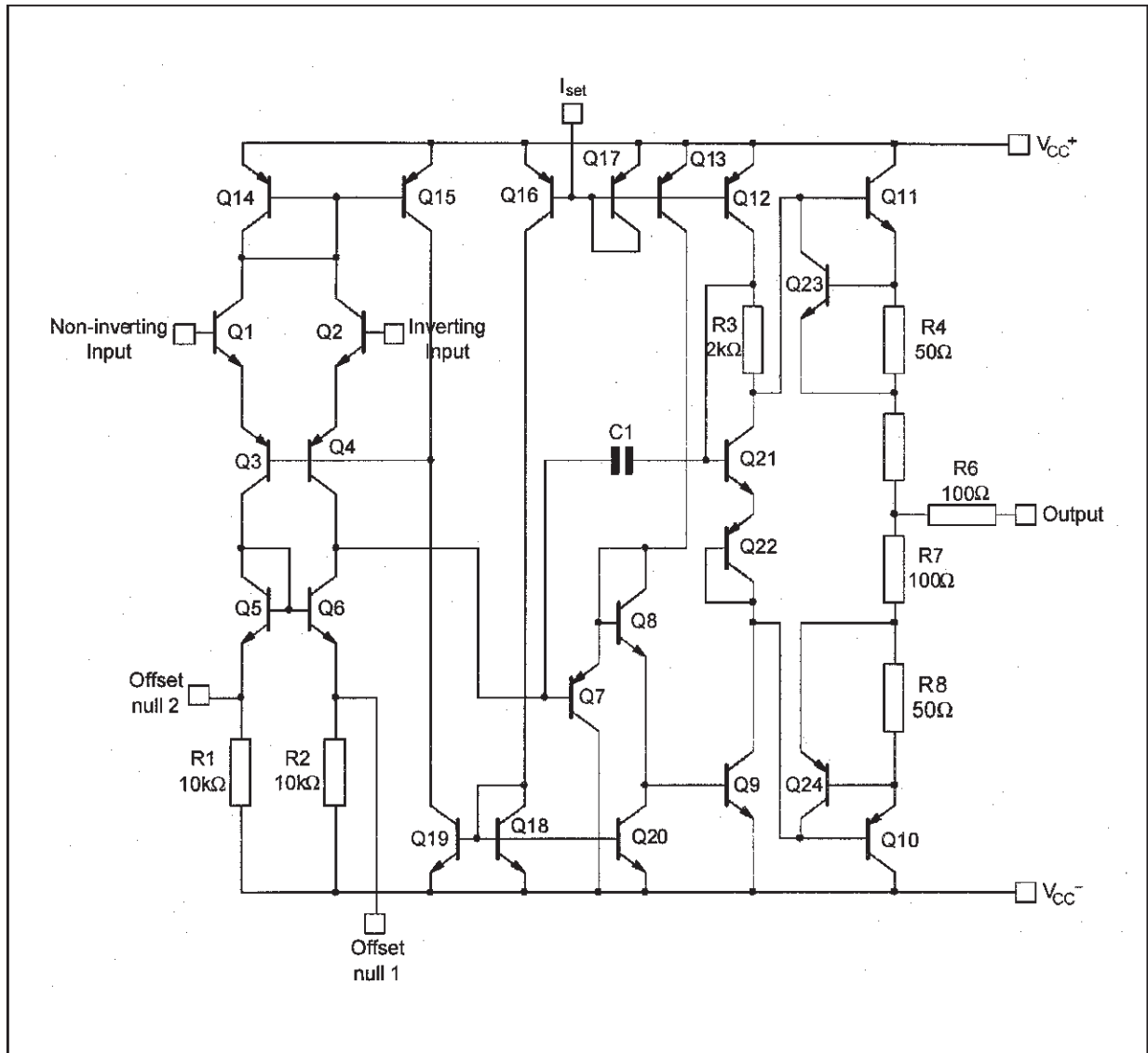
Input noise voltage and current, power consumption and input current can be optimized by a single resistor or current source that sets the chip quiescent current for nano-watt power consumption or for characteristics similar to the UA741.

Internal frequency compensation, absence of latch up, high slew rate and short-circuit protection assure ease of use in long time integrators, active filters, and sample and hold circuits.

PIN CONNECTIONS (top view)



SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | UA776M | UA776I | UA776C | Unit |
|------------|--------------------------------------|-------------|-------------|-------------|------|
| V_{cc} | Supply Voltage | ±18 | | | V |
| V_{id} | Differential Input Voltage | ±30 | | | V |
| V_i | Input Voltage - (note 1) | ±15 | | | V |
| P_{tot} | Power Dissipation | 500 | 310 | 310 | 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 | -65 to +150 | -65 to +150 | °C |

Note : 1. For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

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

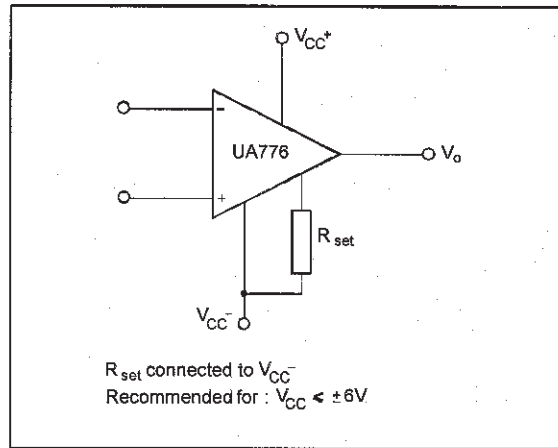
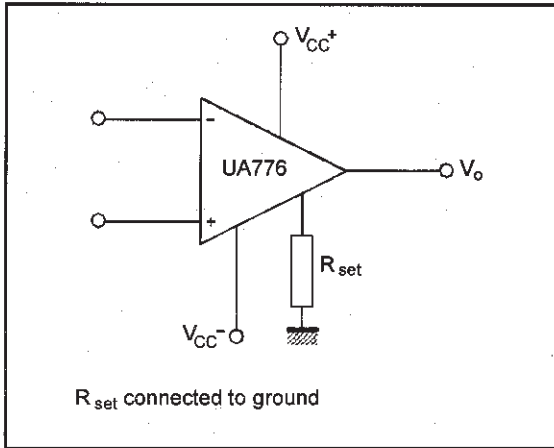
| Symbol | Parameter | $I_{set} = 1.5\mu A$ | | | $I_{set} = 15\mu A$ | | | Unit |
|---------------|---|----------------------|--------|-----------------|---------------------|----------|-----------------|------------------------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| V_{io} | Input Offset Voltage $T_{amb} = +25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 2 | 5 6 | | 2 | 5 6 | mV |
| I_{io} | Input Offset Current $T_{amb} = +25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 0.7 | 3 10 | | 2 | 15 40 | nA |
| I_{ib} | Input Bias Current $T_{amb} = +25^{\circ}C$ UA776M UA776I,C $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 2 2 | 7.5 10 20 | | 15 15 | 50 50 100 | nA |
| A_{vd} | Large Signal Voltage Gain ($V_O \pm 10V$) $T_{amb} = +25^{\circ}C$ $R_L = 5k\Omega$ $R_L = 75k\Omega$ $T_{min.} \leq T_{amb} \leq T_{max.}$ $R_L = 5k\Omega$ | 200 100 | 400 | | 100 75 | 400 | | V/mV |
| SVR | Supply Voltage Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = +25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | 77 77 | 92 | | 77 77 | 92 | | dB |
| I_{CC} | Supply Current, no load $T_{amb} = +25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 20 | 25 30 | | 160 | 180 200 | μA |
| V_{icm} | Input Common Mode Voltage Range | ± 10 | | | ± 10 | | | V |
| CMR | Common-mode Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = +25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | 70 70 | 90 | | 70 70 | 90 | | dB |
| I_{OS} | Output Short-circuit Current | 0.5 | 3 | 15 | 6 | 12 | 30 | mA |
| $\pm V_{OPP}$ | Output Voltage Swing $T_{amb} = +25^{\circ}C$ $R_L = 5k\Omega$ $R_L = 75k\Omega$ $T_{min.} \leq T_{amb} \leq T_{max.}$ $R_L = 75k\Omega$ | 12 10 | 14 | | 10 10 | 13 | | V |
| V_{ior} | Offset Voltage Adjustment Range | | 9 | | | 18 | | mV |
| SR | Slew Rate ($V_i = \pm 10V$, $C_L = 100pF$, unity gain) $R_L = 5k\Omega$ $R_L = 75k\Omega$ | 0.01 | 0.1 | | 0.2 | 0.8 | | V/ms |
| t_r | Rise Time ($V_i = \pm 20mV$, $C_L = 100pF$, unity gain) $R_L = 5k\Omega$ $R_L = 75k\Omega$ | | 1.6 | | | 0.35 | | ms |
| K_{OV} | Overshoot ($V_i = \pm 20mV$, $C_L = 100pF$, unity gain) $R_L = 5k\Omega$ $R_L = 75k\Omega$ | | 0 | | | 10 | | % |
| R_i | Input Resistance | | 50 | | | 5 | | $M\Omega$ |
| C_{id} | Differential Input Capacitance | | 2 | | | 2 | | pF |
| R_o | Output Resistance | | 5 | | | 1 | | $k\Omega$ |
| GBP | Gain Bandwidth Product ($C_L = 100pF$, $T_{amb} = 25^{\circ}C$) $f = 100kHz$ $f = 10kHz$ $R_L = 5k\Omega$ $R_L = 75k\Omega$ | 0.3 | 0.1 | | 0.4 | 0.7 | | MHz |
| THD | Total Harmonic Distortion ($f = 1kHz$, $A_v = 20dB$, $V_O = 2V_{PP}$, $C_L = 100pF$, $T_{amb} = 25^{\circ}C$) $R_L = 5k\Omega$ $R_L = 75k\Omega$ | | 0.8 | | | 0.025 | | % |
| e_n | Equivalent Input Noise Voltage ($f = 1kHz$, $R_s = 100\Omega$) | | 40 | | | 20 | | $\frac{nV}{\sqrt{Hz}}$ |

ELECTRICAL CHARACTERISTICS $V_{CC} \pm 3V$, $T_{amb} = +25^{\circ}C$ (unless otherwise specified)

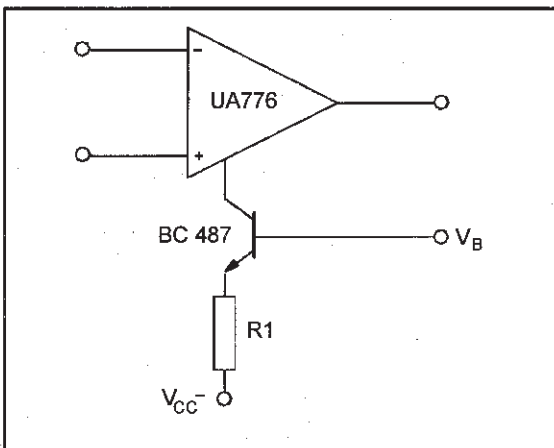
| Symbol | Parameter | $I_{set} = 1.5\mu A$ | | | $I_{set} = 15\mu A$ | | | Unit |
|---------------|--|----------------------|--------|---------------|----------------------|------------|-----------------|------------------------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| V_{io} | Input Offset Voltage $T_{amb} = +25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 2 | 5 6 | | 2 | 5 6 | mV |
| I_{io} | Input Offset Current $T_{amb} = +25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 0.7 | 3 10 | | 2 | 15 40 | nA |
| I_{ib} | Input Bias Current $T_{amb} = +25^{\circ}C$ UA776I,C $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 2 2 | 7 10 20 | | 15 15 | 50 50 100 | nA |
| A_{vd} | Large Signal Voltage Gain ($V_O \pm 10V$) $T_{amb} = +25^{\circ}C$ $R_L = 5k\Omega$ $R_L = 75k\Omega$ $T_{min.} \leq T_{amb} \leq T_{max.}$ $R_L = 75k\Omega$ $R_L = 5k\Omega$ | 50 25 | 200 | | 50 25 | 200 | | V/mV |
| SVR | Supply Voltage Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = +25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | 77 77 | 92 | | 77 77 | 92 | | dB |
| I_{cc} | Supply Current, no load $T_{amb} = +25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 13 | 20 25 | | 130 | 160 180 | μA |
| V_{icm} | Input Common Mode Voltage Range | ± 1 | | | ± 1 | | | V |
| CMR | Common-mode Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = +25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | 70 70 | 90 | | 70 70 | 90 | | dB |
| I_{os} | Output Short-circuit Current | 0.5 | 3 | 15 | 2 | 5 | 20 | mA |
| $\pm V_{OPP}$ | Output Voltage Swing $T_{amb} = +25^{\circ}C$ $R_L = 75k\Omega$ $R_L = 5k\Omega$ $T_{min.} \leq T_{amb} \leq T_{max.}$ $R_L = 75k\Omega$ $R_L = 5k\Omega$ | 2 2 | 2.4 | | 2 1.9 2 1.9 | 2.4 2.1 | | V |
| V_{ior} | Offset Voltage Adjustment Range | | 9 | | | 18 | | mV |
| SR | Slew Rate ($V_i = \pm 10V$, $C_L = 100pF$, unity gain) $R_L = 5k\Omega$ $R_L = 75k\Omega$ | | 0.03 | | | 0.35 | | V/ms |
| t_r | Rise Time ($V_i = \pm 20mV$, $C_L = 100pF$, unity gain) $R_L = 5k\Omega$ $R_L = 75k\Omega$ | | 3 | | | 0.6 | | μs |
| K_{OV} | Overshoot ($V_i = \pm 20mV$, $C_L = 100pF$, unity gain) $R_L = 5k\Omega$ $R_L = 75k\Omega$ | | 0 | | | 5 | | % |
| R_I | Input Resistance | | 50 | | | 5 | | M Ω |
| C_{id} | Differential Input Capacitance | | 2 | | | 2 | | pF |
| R_o | Output Resistance | | 5 | | | 1 | | k Ω |
| GBP | Gain Bandwidth Product ($C_L = 100pF$, $T_{amb} = 25^{\circ}C$) $f = 100kHz$ $f = 10kHz$ $R_L = 5k\Omega$ $R_L = 75k\Omega$ | | 0.075 | | | 0.5 | | MHz |
| THD | Total Harmonic Distortion ($f = 1kHz$, $A_v = 20dB$, $V_O = 2V_{PP}$, $C_L = 100pF$, $T_{amb} = 25^{\circ}C$) $R_L = 5k\Omega$ $R_L = 75k\Omega$ | | 1 | | | 0.03 | | % |
| en | Equivalent Input Noise Voltage ($f = 1kHz$, $R_s = 100\Omega$) | | 20 | | | 20 | | $\frac{nV}{\sqrt{Hz}}$ |

BIASING CIRCUITS

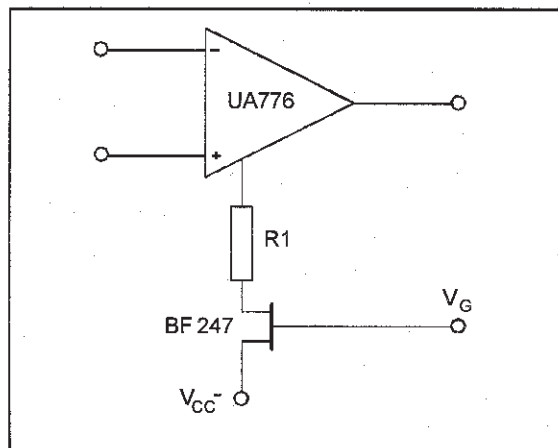
RESISTOR BIASING



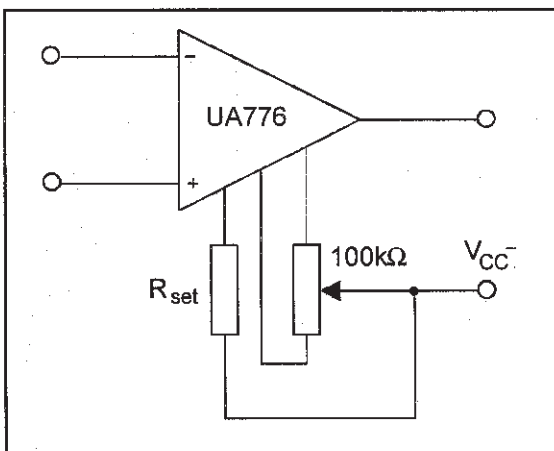
TRANSISTOR CURRENT SOURCE BIASING



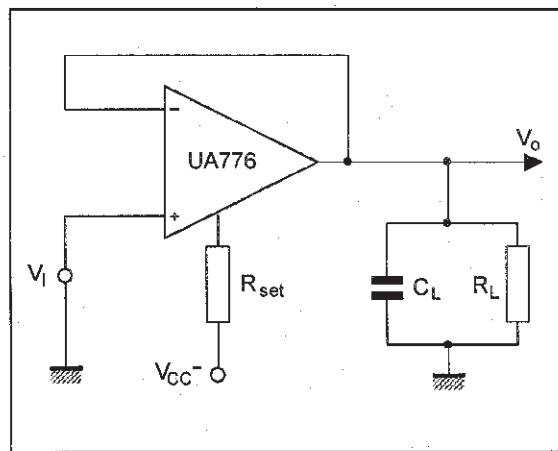
FET CURRENT SOURCE BIASING



OFFSET VOLTAGE NULL CIRCUIT

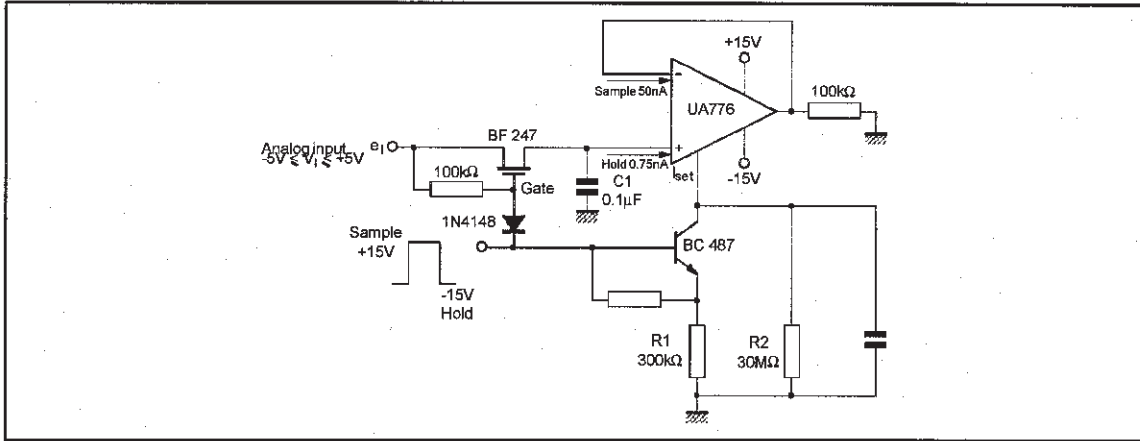


TRANSIENT RESPONSE TIME TEST CIRCUIT



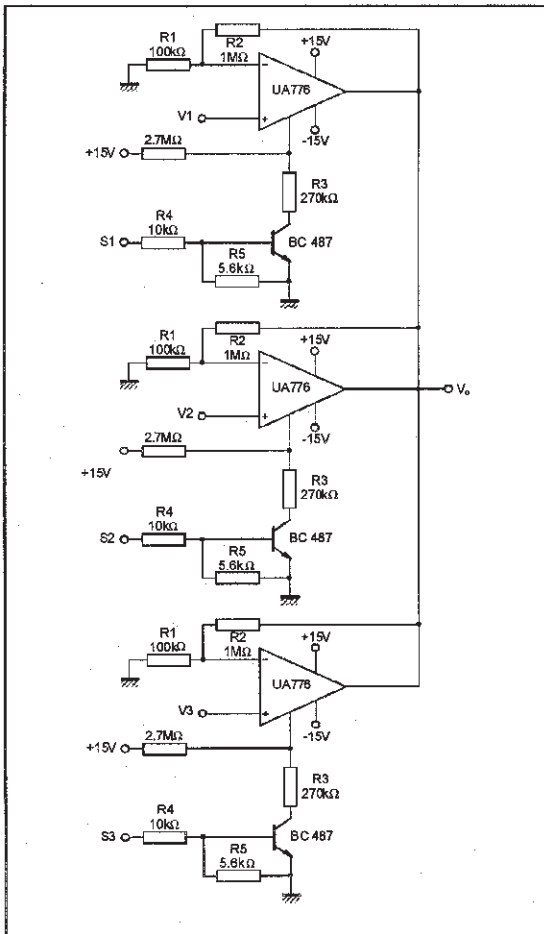
TYPICAL APPLICATIONS

HIGH ACCURACY SAMPLE AND HOLD



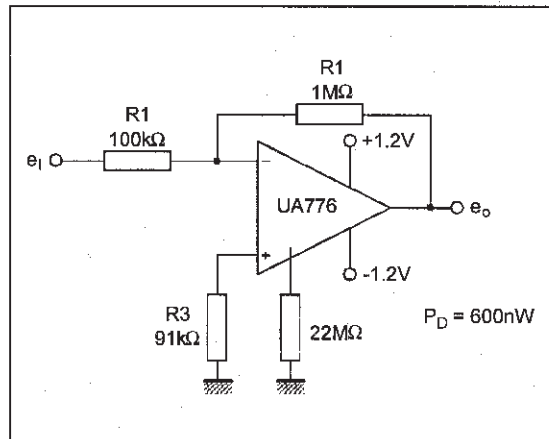
776-10.EPS

MULTIPLEXING AND SIGNAL CONDITIONING WITHOUT FETs



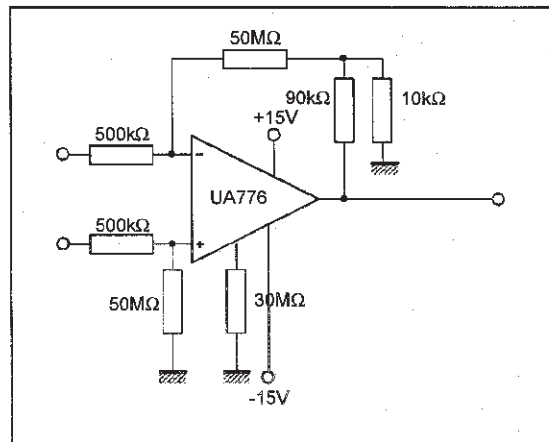
776-11.EPS

NANO-WATT AMPLIFIER



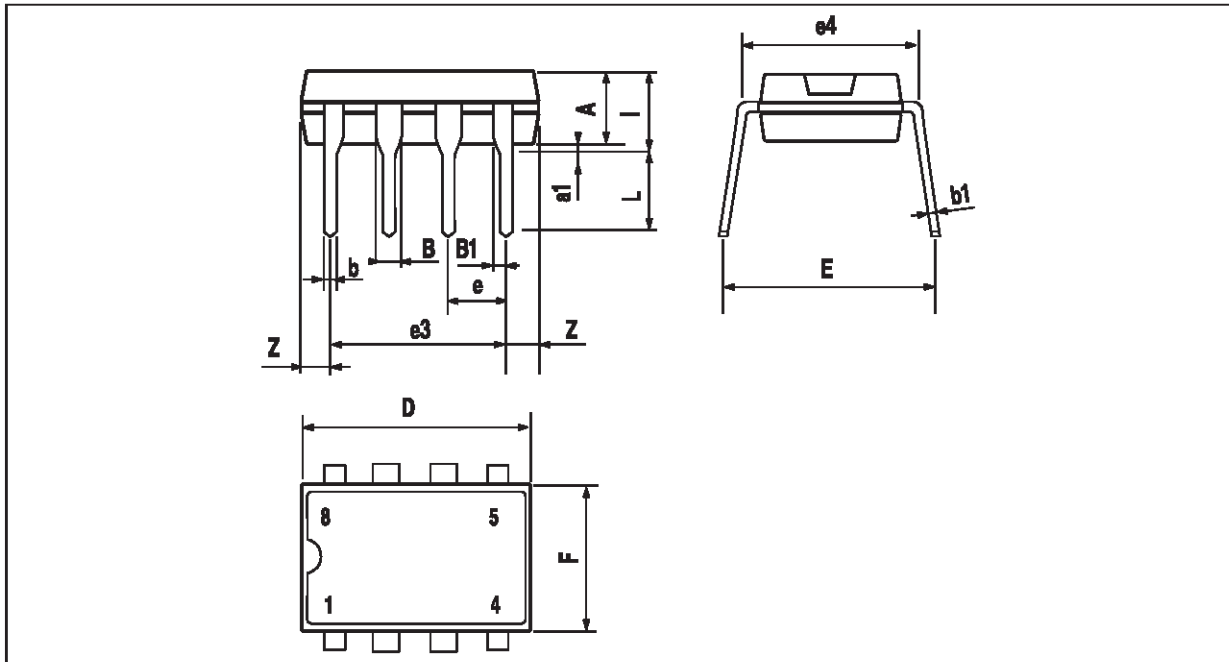
776-12.EPS

HIGH INPUT IMPEDANCE AMPLIFIER



776-13.EPS

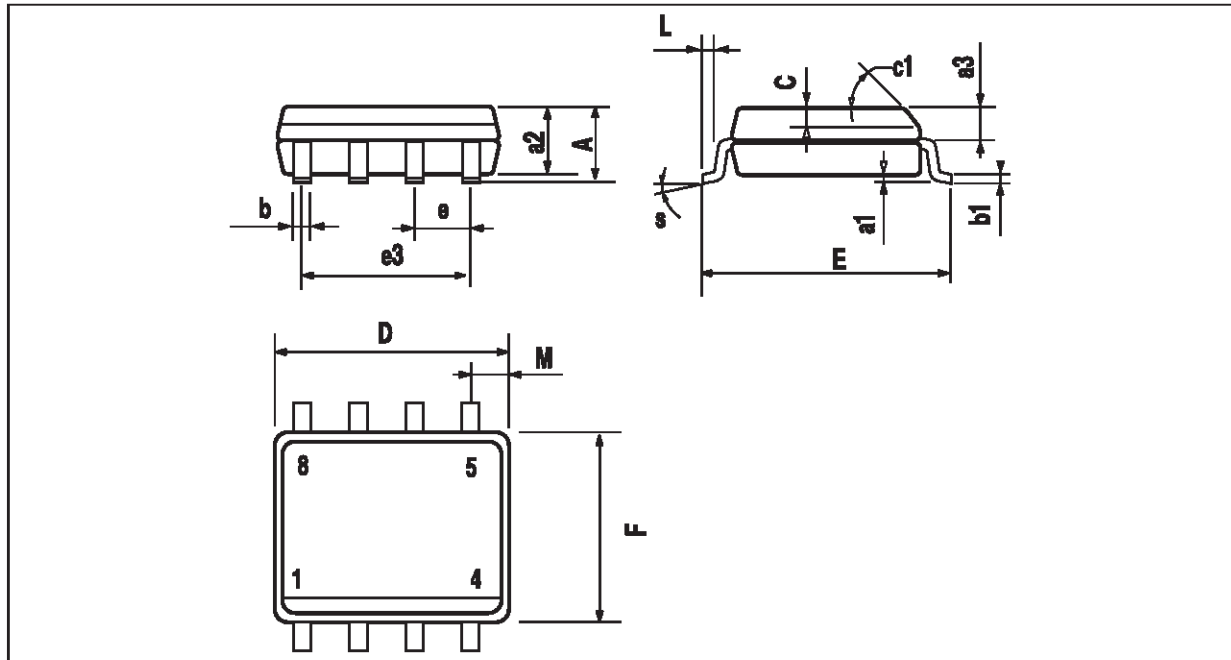
PACKAGE MECHANICAL DATA
8 PINS - PLASTIC DIP



| 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 |

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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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