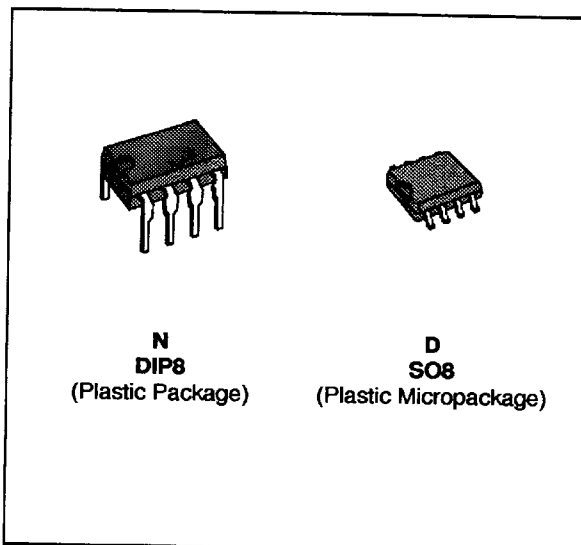


## PRECISION SINGLE OPERATIONAL AMPLIFIERS

- FREQUENCY COMPENSATION WITH A SINGLE 30pF CAPACITOR
- OPERATION FROM  $\pm 5V$  TO  $\pm 15V$
- LOW POWER CONSUMPTION : 50mW AT  $\pm 15V$
- CONTINUOUS SHORT-CIRCUIT PROTECTION
- OPERATION AS A COMPARATOR WITH DIFFERENTIAL INPUTS AS HIGH AS  $\pm 30V$
- NO LATCH-UP WHEN COMMON-MODE RANGE IS EXCEEDED
- SAME PIN CONFIGURATION AS THE LM101A



### ORDER CODES

| Part Number | Temperature Range | Package |   |
|-------------|-------------------|---------|---|
|             |                   | N       | D |
| UA748C      | 0°C, +70°C        | •       | • |
| UA748I      | -40°C, +105°C     | •       | • |
| UA748M      | -55°C, +125°C     | •       | • |

Example : UA748CN

748-01 TEL

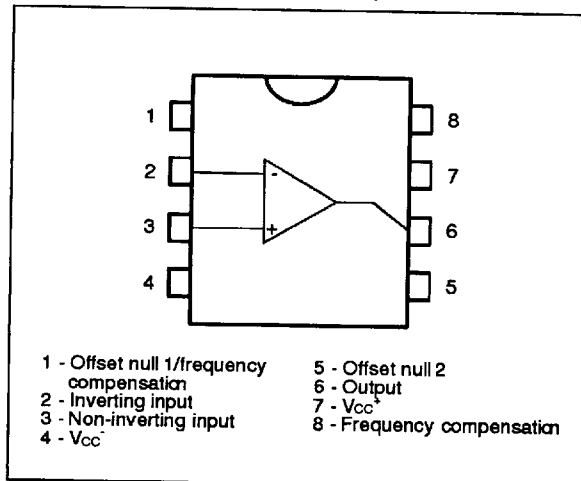
### DESCRIPTION

The UA748 is a general-purpose operational amplifier built on a single silicon chip. The resulting close match and tight thermal coupling gives low offsets and temperature drift as well as fast recovery from thermal transients.

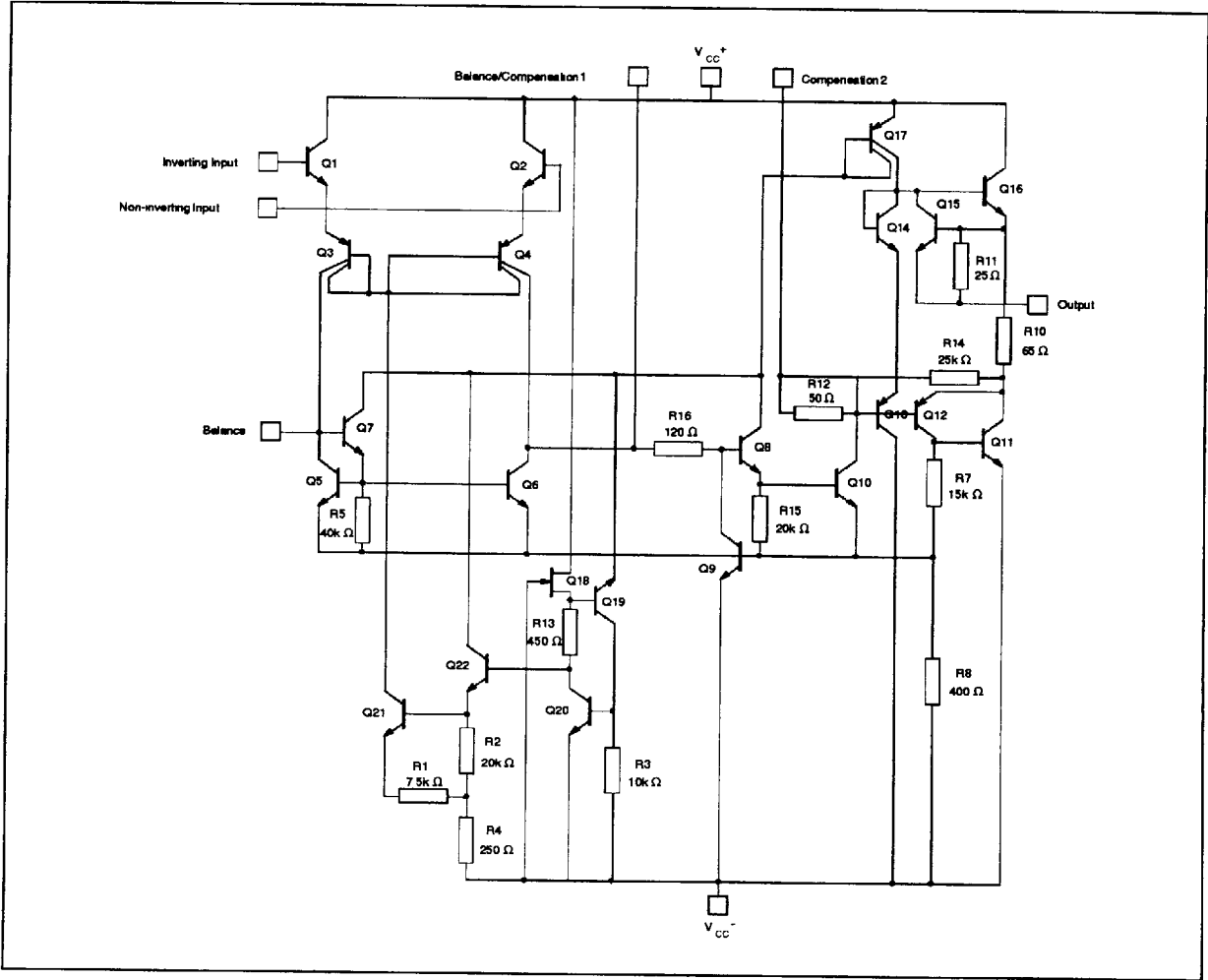
- Short-circuit protection
- Offset voltage null capability
- Large common-mode and differential voltage ranges
- Low power consumption
- No latch-up

The unity-gain compensation specified makes the circuit stable for all feedback configurations, even with capacitive loads. However, it is possible to optimize compensation for best high frequency performance at any gain. The low power dissipation permits high voltage operation and simplifies packaging in full-temperature range systems.

### PIN CONNECTIONS (top view)



SCHEMATIC DIAGRAM



748-03 EPS

ABSOLUTE MAXIMUM RATINGS

| Symbol            | Parameter                            | Value       |             |             | Unit |
|-------------------|--------------------------------------|-------------|-------------|-------------|------|
|                   |                                      | UA748M      | UA748I      | UA748C      |      |
| V <sub>CC</sub>   | Supply Voltage                       | ±22         | ±22         | ±22         | V    |
| V <sub>I</sub>    | Input Voltage                        | ±15         | ±15         | ±15         | V    |
| V <sub>id</sub>   | Differential Input Voltage           | ±30         | ±30         | ±30         | V    |
| P <sub>tot</sub>  | Power Dissipation                    | 500         | 500         | 500         | mW   |
|                   | Output Short-circuit Duration        | Infinite    |             |             |      |
| T <sub>oper</sub> | Operating Free Air Temperature Range | -55 to +125 | -40 to +105 | 0 to +70    | °C   |
| T <sub>stg</sub>  | Storage Temperature Range            | -65 to +150 | -65 to +150 | -65 to +150 | °C   |

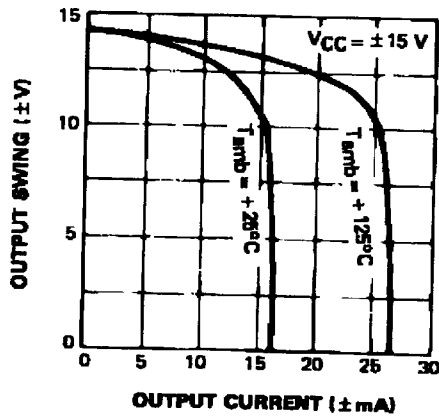
748-02 TEL

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

| Symbol        | Parameter                                                                                                                                                                                      | UA748-M-I            |          |            | UA748C               |          |            | Unit                   |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------|------------|----------------------|----------|------------|------------------------|
|               |                                                                                                                                                                                                | Min.                 | Typ.     | Max.       | Min.                 | Typ.     | Max.       |                        |
| $V_{io}$      | Input Offset Voltage ( $R_s \leq 10k\Omega$ )<br>$T_{amb} = 25^\circ C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                                                 |                      | 0.2      | 2<br>3     |                      | 2        | 7.5<br>10  | mV                     |
| $I_{ib}$      | Input Bias Current<br>$T_{amb} = 25^\circ C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                                                                            |                      | 1.5      | 10<br>20   |                      | 2        | 50<br>70   | nA                     |
| $I_{io}$      | Input Offset Current<br>$T_{amb} = 25^\circ C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                                                                          |                      | 25       | 75<br>10   |                      | 70       | 250<br>300 | nA                     |
| $A_{vd}$      | Large Signal Voltage Gain<br>( $V_{CC} = \pm 15V$ , $V_o = \pm 10V$ , $R_L = 2k\Omega$ )<br>$T_{amb} = 25^\circ C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                      | 50<br>25             | 100      |            | 25<br>15             | 10       |            | V/mV                   |
| SVR           | Supply Voltage Rejection Ratio ( $R_s \leq 10k\Omega$ )<br>$T_{amb} = 25^\circ C$<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>$T_{amb} = 25^\circ C$<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 ( $V_{CC} = \pm 20V$ )<br>$T_{amb} = 25^\circ C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                                        | $\pm 15$<br>$\pm 15$ |          |            | $\pm 15$<br>$\pm 15$ |          |            | V                      |
| CMR           | Common Mode Rejection Ratio ( $R_s \leq 10k\Omega$ )<br>$T_{amb} = 25^\circ C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                                          | 80<br>80             | 96       |            | 70<br>70             | 96       |            | dB                     |
| $I_{OS}$      | Output Short-circuit Current ( $V_{CC} = \pm 15V$ )                                                                                                                                            | 10                   | 30       | 50         | 10                   | 30       | 50         | mA                     |
| $\pm V_{OPP}$ | Output Voltage Swing ( $V_{CC} = \pm 15V$ )<br>$T_{amb} = 25^\circ C$<br>$T_{min} \leq T_{amb} \leq T_{max}$<br>$R_L = 10k\Omega$<br>$R_L = 2k\Omega$<br>$R_L = 10k\Omega$<br>$R_L = 2k\Omega$ | 12<br>10<br>12<br>10 | 14<br>13 |            | 12<br>10<br>12<br>10 | 14<br>13 |            | V                      |
| SR            | Slew Rate ( $V_{CC} = \pm 15V$ , $V_i = \pm 10V$ , $R_L = 2k\Omega$ ,<br>$C_L = 100pF$ , $T_{amb} = 25^\circ C$ , unity gain)                                                                  | 0.25                 | 0.5      |            | 0.25                 | 0.5      |            | V/ $\mu s$             |
| $t_r$         | Rise Time ( $V_{CC} = \pm 15V$ , $V_i = \pm 20mV$ , $R_L = 2k\Omega$ ,<br>$C_L = 100pF$ , $T_{amb} = 25^\circ C$ , unity gain)                                                                 |                      | 0.3      |            |                      | 0.3      |            | $\mu s$                |
| $K_{OV}$      | Overshoot ( $V_{CC} = \pm 15V$ , $V_i = 20mV$ , $R_L = 2k\Omega$ ,<br>$C_L = 100pF$ , $T_{amb} = 25^\circ C$ , unity gain)                                                                     |                      | 5        |            |                      | 5        |            | %                      |
| $Z_i$         | Input Impedance ( $V_{CC} = \pm 15V$ )                                                                                                                                                         | 1.5                  | 4        |            | 1.5                  | 4        |            | M $\Omega$             |
| $R_o$         | Output Resistance ( $V_{CC} = \pm 15V$ )                                                                                                                                                       |                      | 75       |            |                      | 75       |            | $\Omega$               |
| GBP           | Gain Bandwidth Product ( $V_{CC} = \pm 15V$ , $V_i = 10mV$ ,<br>$R_L = 2k\Omega$ , $C_L = 100pF$ , $f = 100kHz$ )                                                                              | 0.5                  | 1        |            | 0.5                  | 1        |            | MHz                    |
| THD           | Total Harmonic Distortion ( $V_{CC} = \pm 15V$ , $f = 1kHz$ ,<br>$A_V = 20dB$ , $R_L = 2k\Omega$ , $V_o = 2V_{PP}$ , $C_L = 100pF$ )                                                           |                      | 0.015    |            |                      | 0.015    |            | %                      |
| $e_n$         | Equivalent Input Noise Voltage<br>( $V_{CC} = \pm 15V$ , $f = 1kHz$ , $R_s = 100\Omega$ )                                                                                                      |                      | 25       |            |                      | 25       |            | $\frac{nV}{\sqrt{Hz}}$ |
| $DV_{io}$     | Input Offset Current Drift<br>$25^\circ C \leq T_{amb} \leq T_{max}$<br>$T_{min} \leq T_{amb} \leq 25^\circ C$                                                                                 |                      | 10<br>20 | 100<br>200 |                      | 10<br>20 | 300<br>600 | $pA/^\circ C$          |
| $DI_{io}$     | Input Offset Voltage Drift<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                                                                                              |                      | 3        | 15         |                      | 6        | 30         | $\mu V/^\circ C$       |

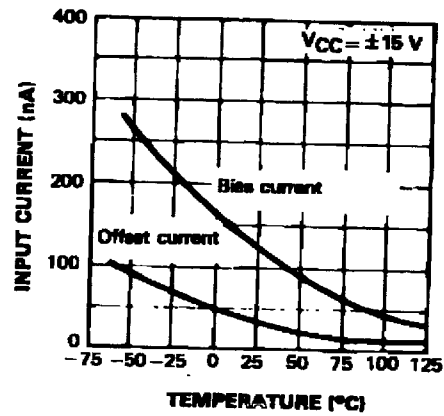
748-03 TEL

CURRENT LIMITING



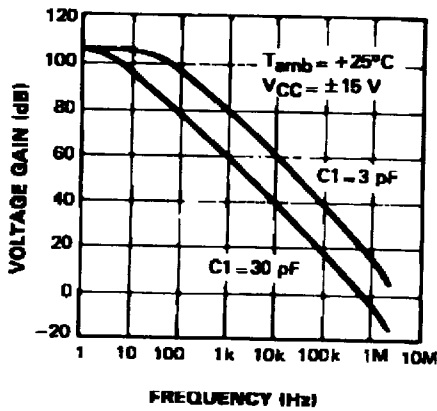
748-04 EPS

INPUT CURRENT



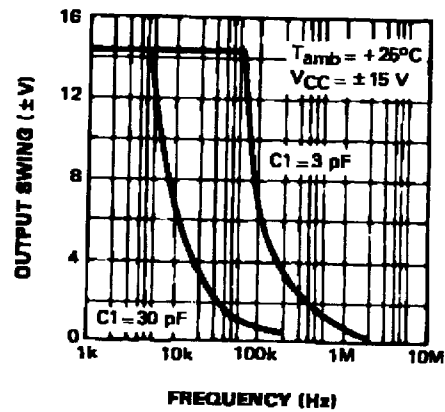
748-05 EPS

OPEN LOOP FREQUENCY RESPONSE



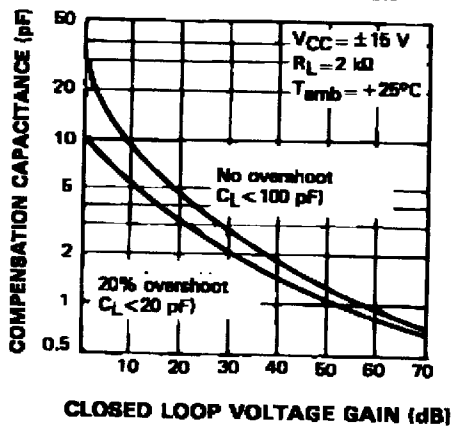
748-06 EPS

LARGE SIGNAL FREQUENCY RESPONSE



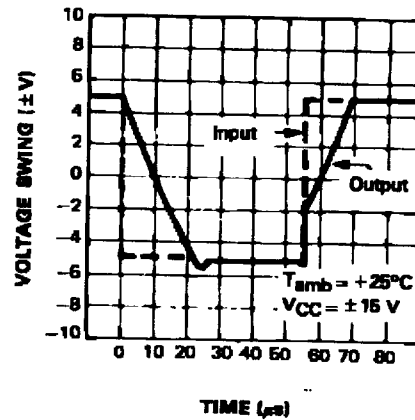
748-07 EPS

FREQUENCY COMPENSATION

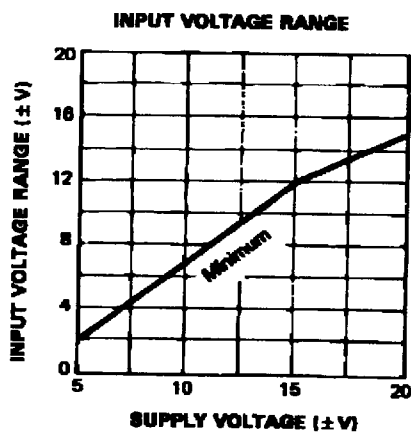


748-08 EPS

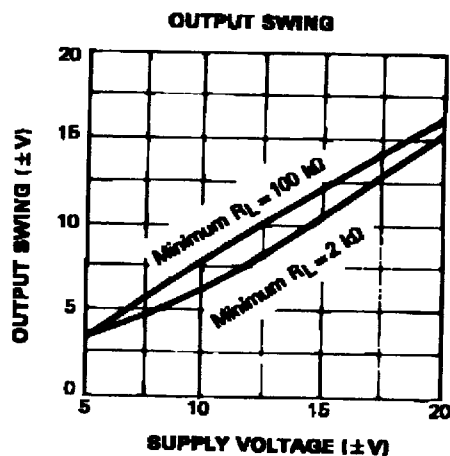
VOLTAGE FOLLOWER PULSE RESPONSE



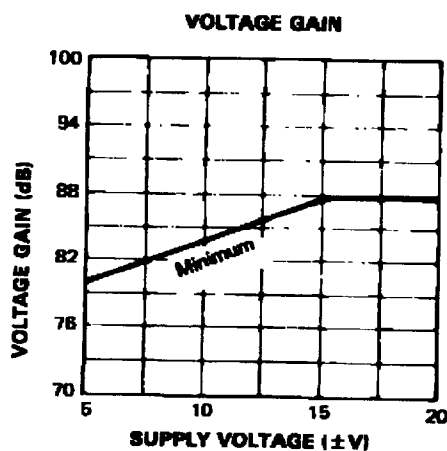
748-09 EPS



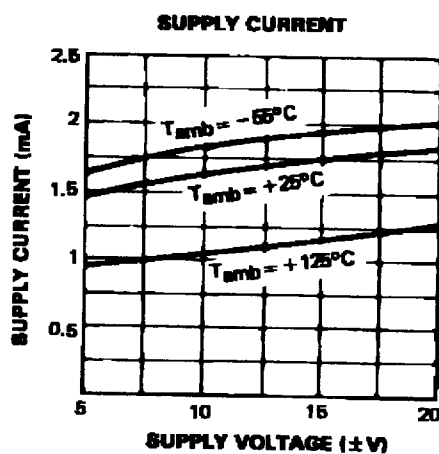
748-10 EPS



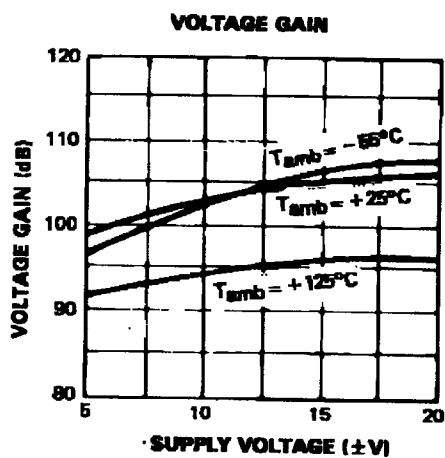
748-11 EPS



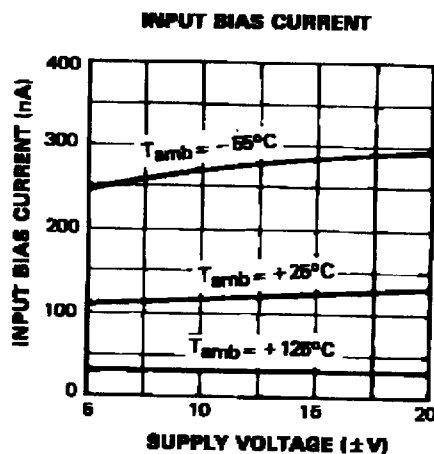
748-12 EPS



748-13 EPS



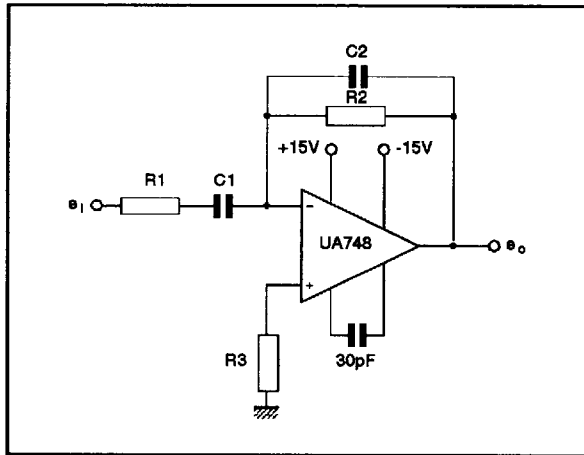
748-14 EPS



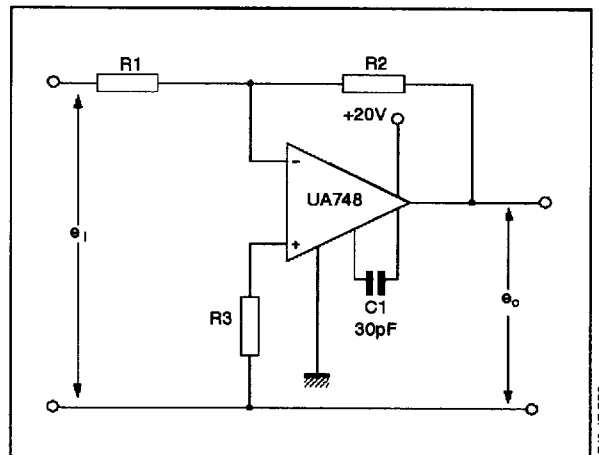
748-15 EPS

## TYPICAL APPLICATIONS

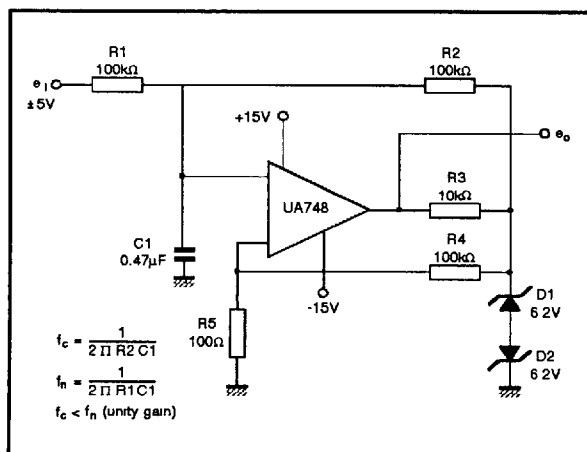
### PRACTICAL DIFFERENTIATOR



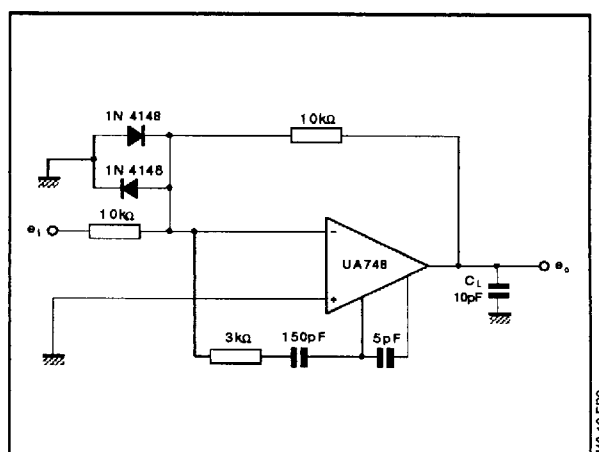
### SINGLE SUPPLY OPERATION



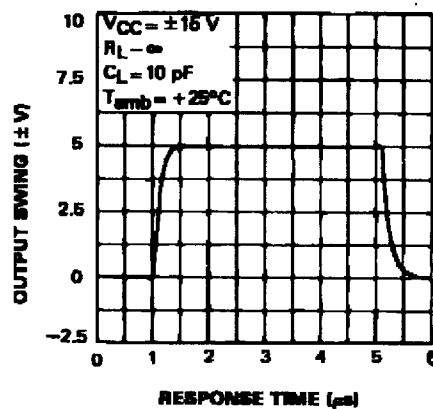
### PULSE WIDTH MODULATOR



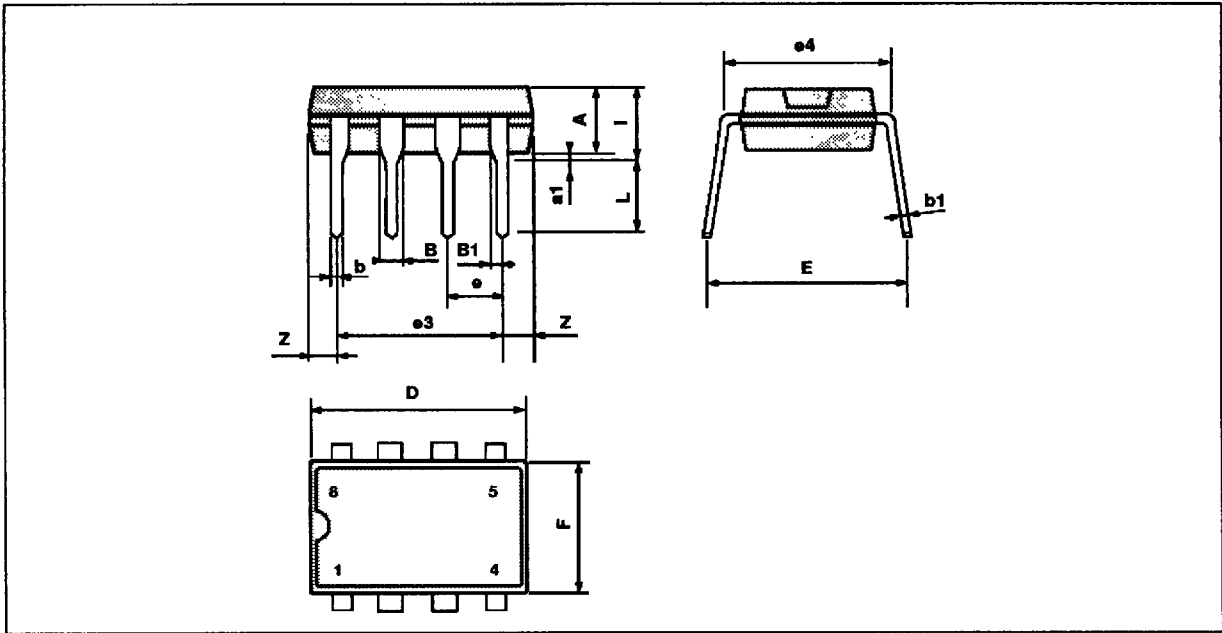
### FEED-FORWARD COMPENSATION



### LARGE SIGNAL FEED-FORWARD TRANSIENT RESPONSE



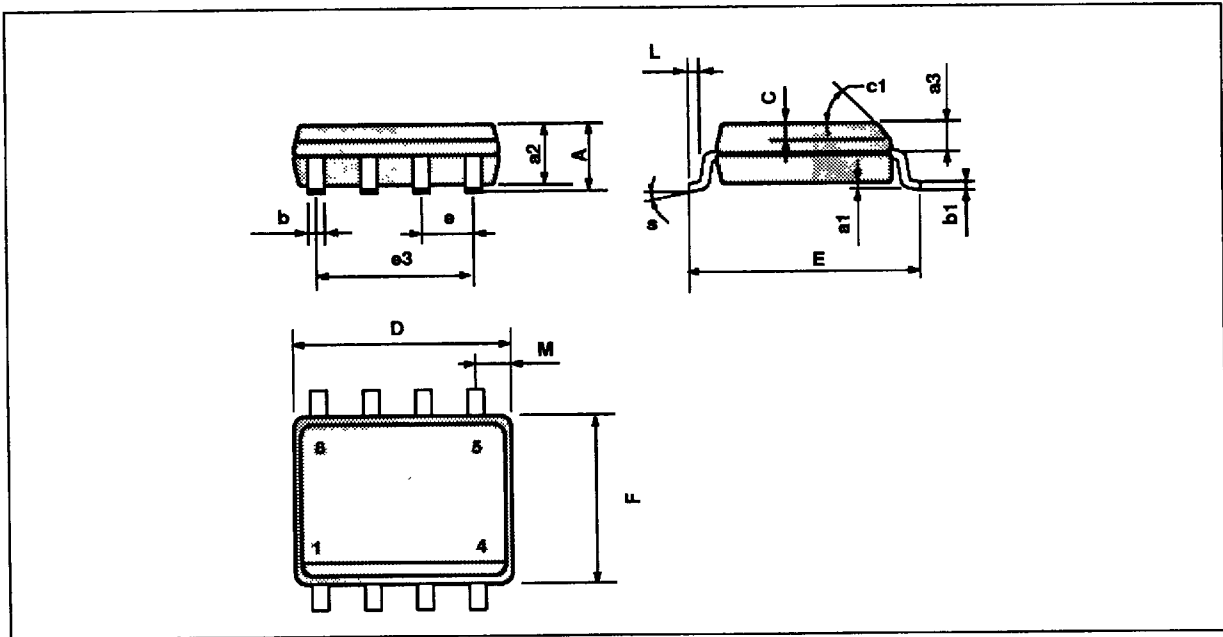
PACKAGE MECHANICAL DATA  
8 PINS - PLASTIC DIP OR Cerdip



| Dimensions | 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 |

DIP8 TBL

PACKAGE MECHANICAL DATA  
8 PINS - PLASTIC MICROPACKAGE (SO)



PM-S08 EPS

| Dimensions | 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.)   |      |      |        |       |       |

SO8 TBL

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