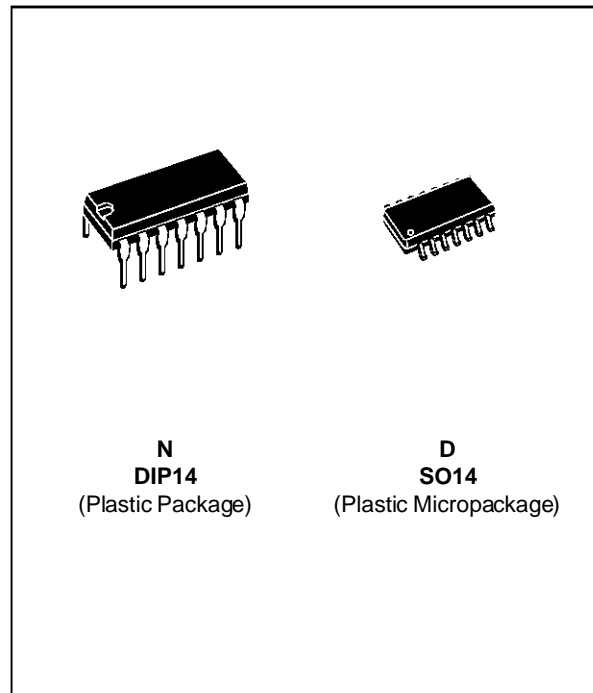


## LOW POWER QUAD VOLTAGE COMPARATORS

- WIDE SINGLE SUPPLY VOLTAGE RANGE OR DUAL SUPPLIES FOR ALL DEVICES : +2V TO +36V OR  $\pm 1V$  TO  $\pm 18V$
- VERY LOW SUPPLY CURRENT (1.1mA) INDEPENDENT OF SUPPLY VOLTAGE (1.4mW/comparator at +5V)
- LOW INPUT BIAS CURRENT : 25nA TYP
- LOW INPUT OFFSET CURRENT :  $\pm 5nA$  TYP
- INPUT COMMON-MODE VOLTAGE RANGE INCLUDES GROUND
- LOW OUTPUT SATURATION VOLTAGE : 250mV TYP. ( $I_o = 4mA$ )
- DIFFERENTIAL INPUT VOLTAGE RANGE EQUAL TO THE SUPPLY VOLTAGE
- TTL, DTL, ECL, MOS, CMOS COMPATIBLE OUTPUTS



### DESCRIPTION

This device consists of four independent precision voltage comparators. All these comparators were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible.

These comparators also have a unique characteristic in the fact that the input common-mode voltage range includes ground even though operated from a single power supply voltage.

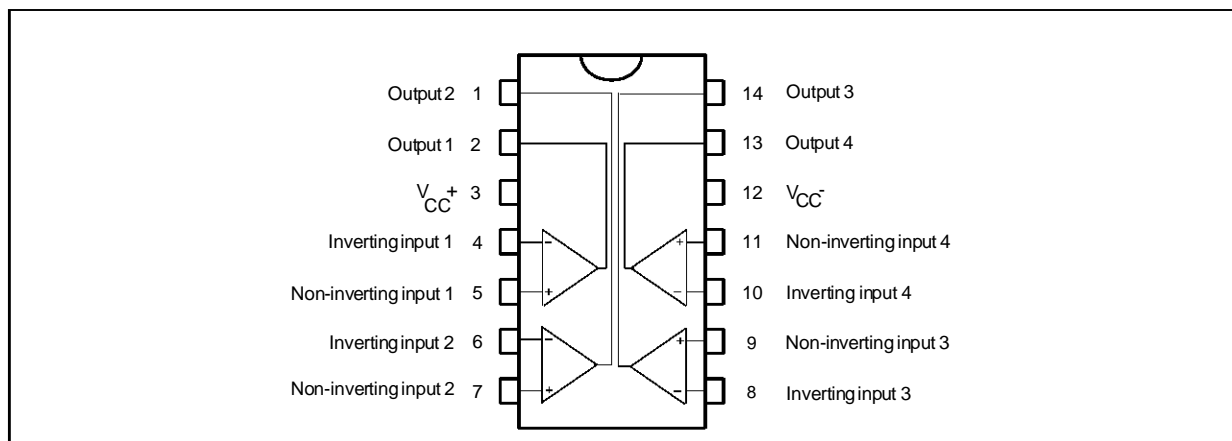
### ORDER CODES

| Part Number | Temperature Range | Package |   |
|-------------|-------------------|---------|---|
|             |                   | N       | D |
| LM2901      | -40, +125°C       | •       | • |

**Example :** LM2901D

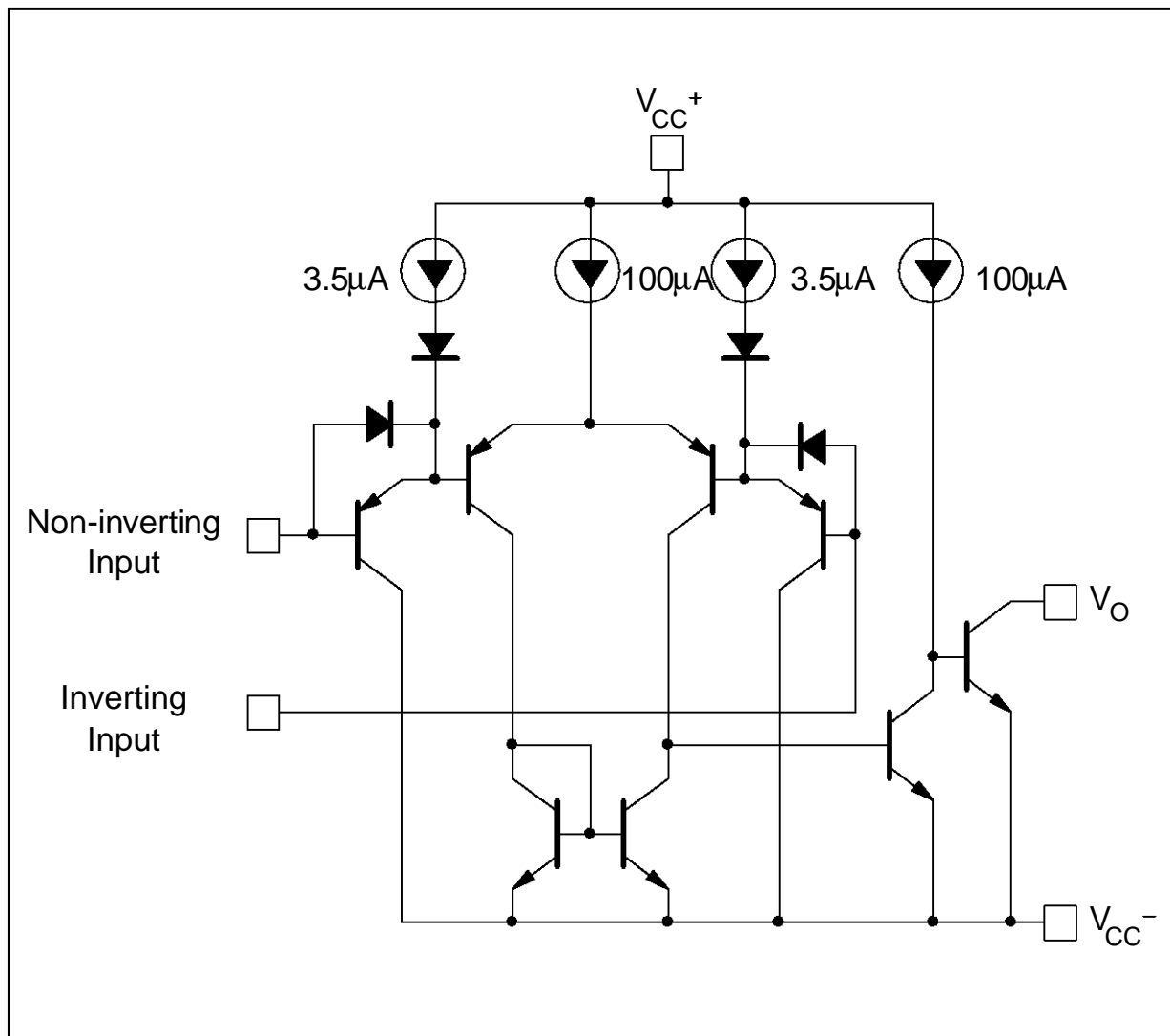
2901-01.TBL

### PIN CONNECTIONS (top view)



2901-01.EPS

SCHMATIC DIAGRAM (1/4 LM901)



2901-02.EPS

ABSOLUTE MAXIMUM RATINGS

| Symbol     | Parameter                                 | Value            | Unit        |
|------------|-------------------------------------------|------------------|-------------|
| $V_{CC}$   | Supply Voltage                            | $\pm 18$ to $36$ | V           |
| $V_{id}$   | Differential Input Voltage                | $\pm 36$         | V           |
| $V_I$      | Input Voltage                             | $-0.3$ to $+36$  | V           |
|            | Output Short-circuit to Ground - (note 1) | Infinite         |             |
| $P_{tot}$  | Power Dissipation                         | 570              | mW          |
| $T_{oper}$ | Operating Free-air Temperature Range      | $-40$ , $+125$   | $^{\circ}C$ |
| $T_{stg}$  | Storage Temperature Range                 | $-65$ , $+150$   | $^{\circ}C$ |

2909-02.TBL

Notes : 1. Short-circuit from the output to  $V_{CC}^+$  can cause excessive heating and eventual destruction. The maximum output current is approximately 20mA, independent of the magnitude of  $V_{CC}^+$ .

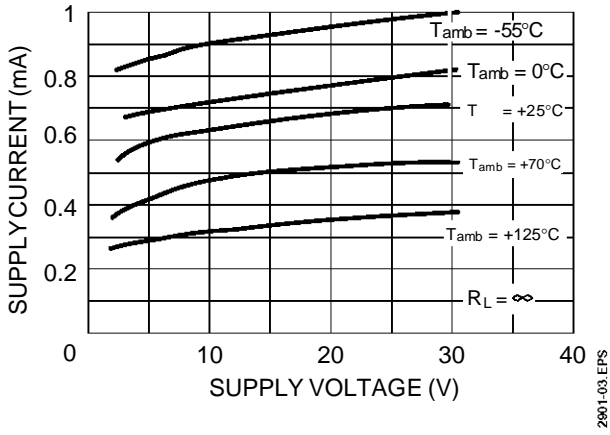
**ELECTRICAL CHARACTERISTICS**
 $V_{CC}^+ = +5V$ ,  $V_{CC}^- = GND$ ,  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

| Symbol     | Parameter                                                                                                                                    | Min.   | Typ.       | Max.                               | Unit          |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------|------------|------------------------------------|---------------|
| $V_{io}$   | Input Offset Voltage – (note 2)<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                         |        | 1          | 7<br>15                            | mV            |
| $I_{io}$   | Input Offset Current<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                                    |        | 5          | 50<br>150                          | nA            |
| $I_{ib}$   | Input Bias Current ( $I_{i+}$ or $I_{i-}$ ) - (note 3)<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                  |        | 25         | 250<br>400                         | nA            |
| $A_{vd}$   | Large Signal Voltage Gain<br>( $V_{CC} = 15V$ , $R_L = 15k\Omega$ , $V_O = 1$ to $11V$ )                                                     | 25     | 200        |                                    | V/mV          |
| $I_{CC}$   | Supply Current (all comparators)<br>$V_{CC} = +5V$ , no load<br>$V_{CC} = +30V$ , no load                                                    |        | 1.1<br>1.3 | 2<br>2.5                           | mA            |
| $V_{icm}$  | Input Common Mode Voltage Range - (note 4)<br>( $V_{CC} = 30V$ )<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$        | 0<br>0 |            | $V_{CC}^+ - 1.5$<br>$V_{CC}^+ - 2$ | V             |
| $V_{id}$   | Differential Input Voltage - (note 6)                                                                                                        |        |            | $V_{CC}^+$                         | V             |
| $V_{OL}$   | Low Level Output Voltage<br>( $V_{id} = -1V$ , $I_{sink} = 4mA$ )<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$       |        | 250        | 400<br>700                         | mV            |
| $I_{OH}$   | High Level Output Current ( $V_{id} = 1V$ )<br>( $V_{CC} = V_O = 30V$ )<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$ |        | 0.1        | 1                                  | nA<br>$\mu A$ |
| $I_{sink}$ | Output Sink Current<br>( $V_{id} = -1V$ , $V_O = 1.5V$ )                                                                                     | 6      | 16         |                                    | mA            |
| $t_{re}$   | Response Time – (note 5)<br>( $R_L = 5.1k\Omega$ connected to $V_{CC}^+$ )                                                                   |        | 1.3        |                                    | $\mu s$       |

- Notes :**
- At output switch point,  $V_O \approx 1.4V$ ,  $R_s = 0$  with  $V_{CC}^+$  from 5V to 30V, and over the full input common-mode range (0V to  $V_{CC}^+ - 1.5V$ ).
  - The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output, so no loading charge exists on the reference of input lines.
  - The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is  $V_{CC}^+ - 1.5V$ , but either or both inputs can go to +30V without damage.
  - The response time specified is for a 100mV input step with 5mV overdrive. For larger overdrive signals 300ns can be obtained.
  - Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than  $-0.3V$  (or 0.3V below the negative power supply, if used).

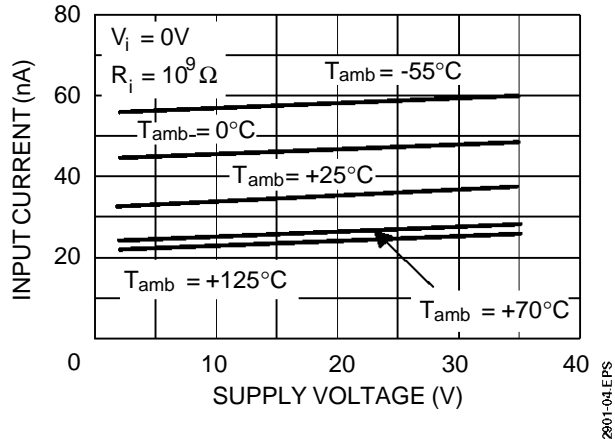
2901-03.TBL

SUPPLY CURRENT versus SUPPLY VOLTAGE



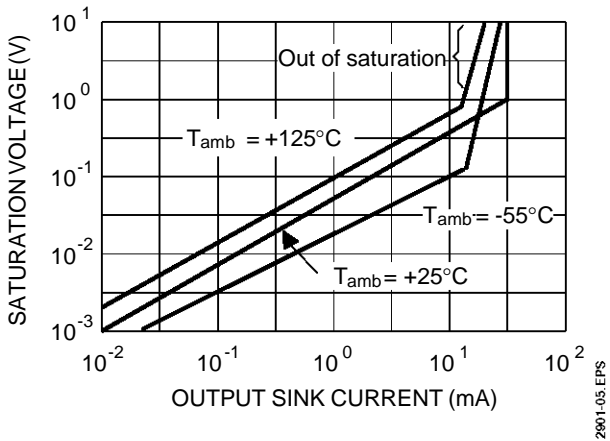
2901-03.EPS

INPUT CURRENT versus SUPPLY VOLTAGE



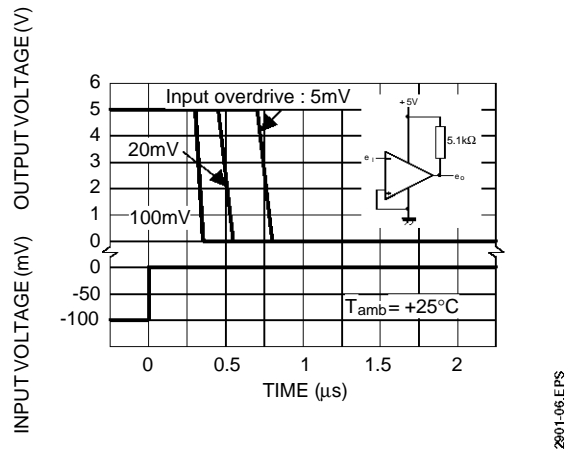
2901-04.EPS

OUTPUT SATURATION VOLTAGE versus OUTPUT CURRENT



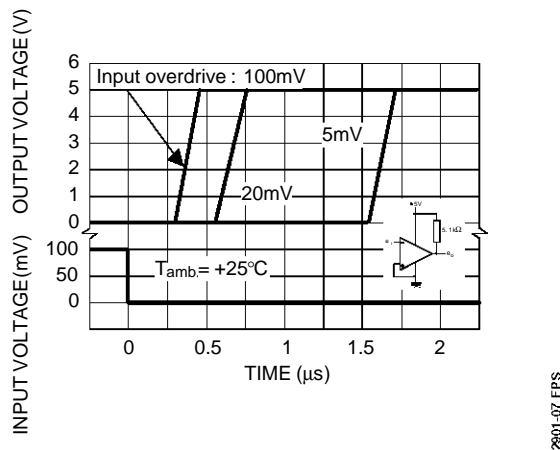
2901-05.EPS

RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - NEGATIVE TRANSITION



2901-06.EPS

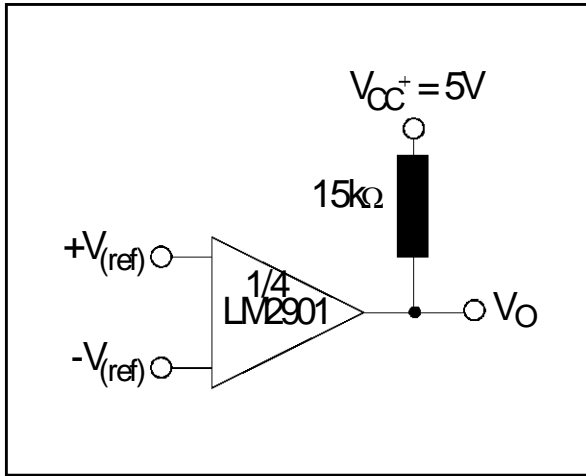
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - POSITIVE TRANSITION



2901-07.EPS

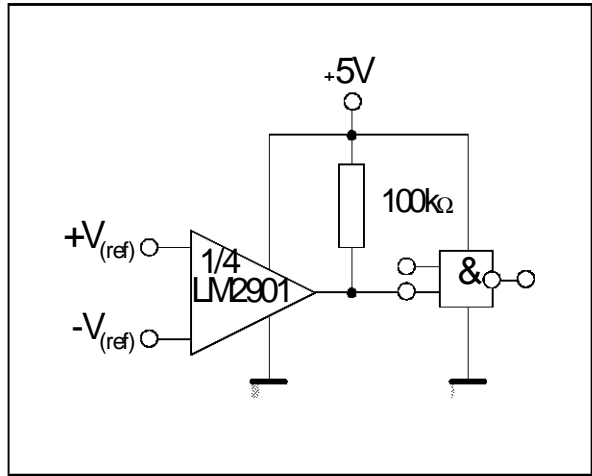
TYPICAL APPLICATIONS

BASIC COMPARATOR



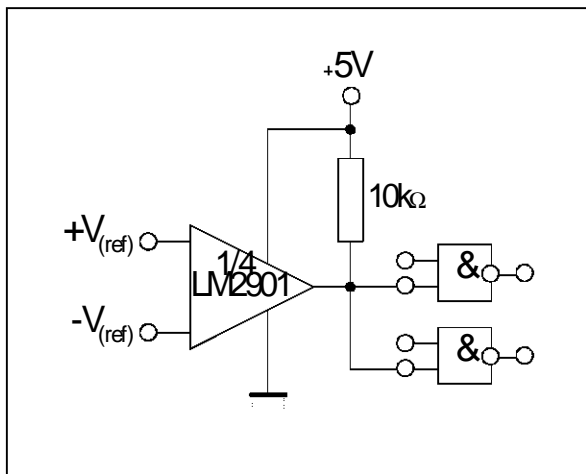
2901-08.EPS

DRIVING CMOS



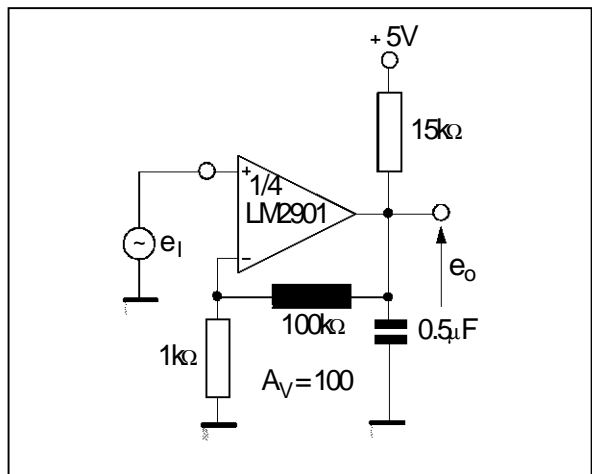
2901-06.EPS

DRIVING TTL



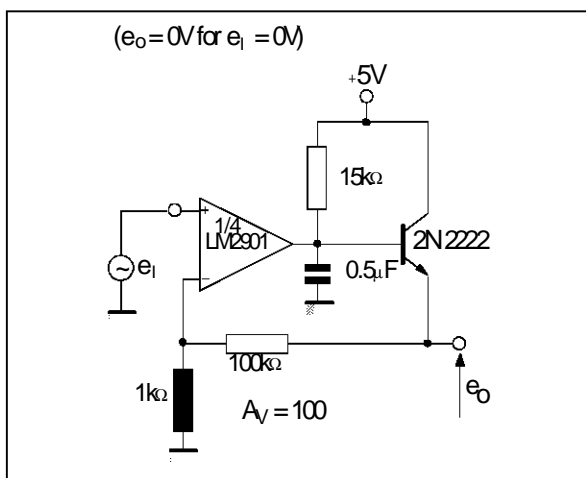
2901-10.EPS

LOW FREQUENCY OP AMP



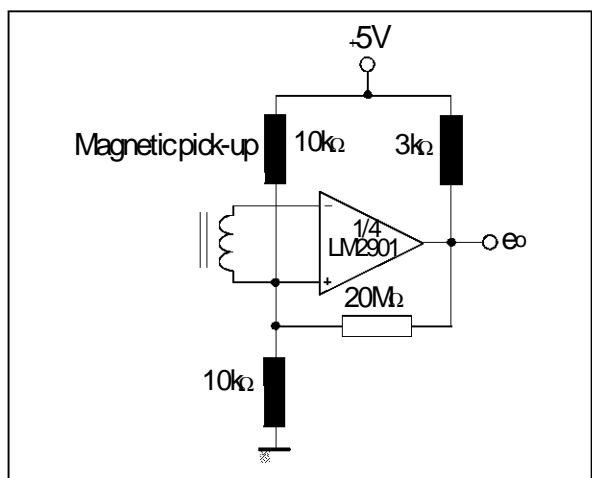
2901-11.EPS

LOW FREQUENCY OP AMP



2901-12.EPS

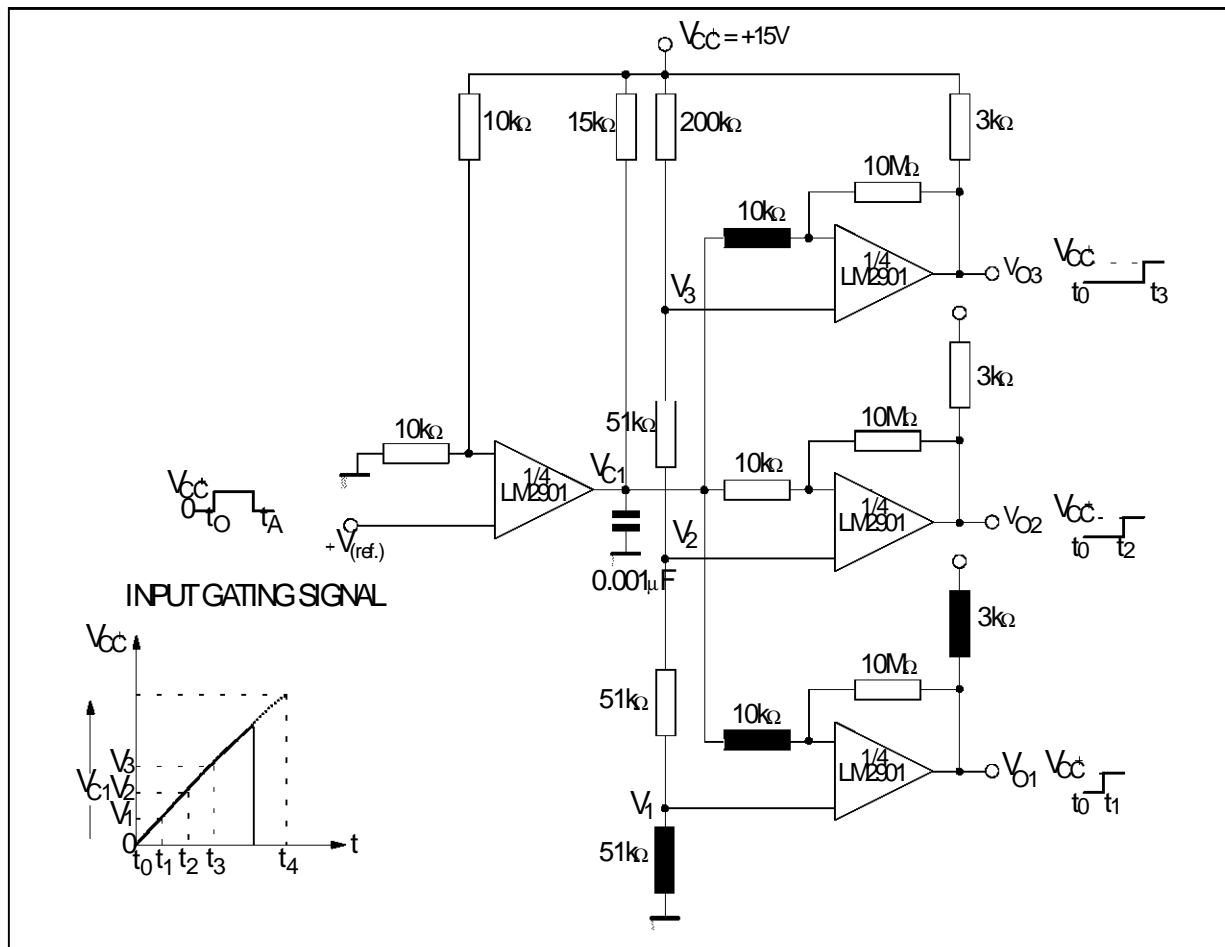
TRANSDUCER AMPLIFIER



2901-13.EPS

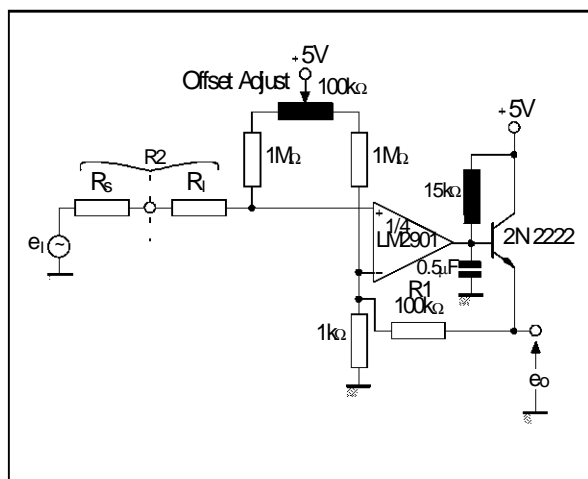
TYPICAL APPLICATIONS (continued)

TIME DELAY GENERATOR



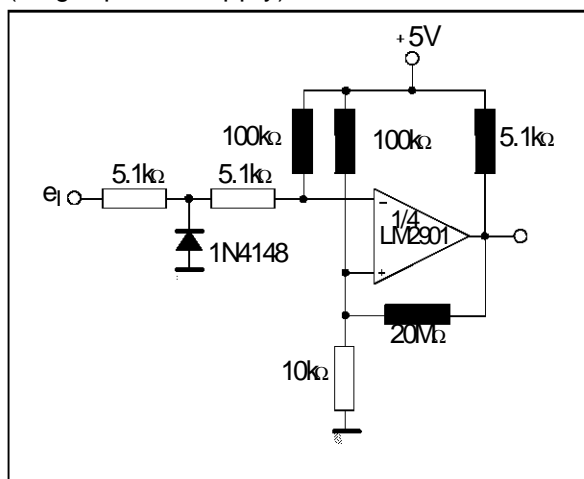
2901-14.EPS

LOW FREQUENCY OP AMP WITH OFFSET ADJUST



2901-15.EPS

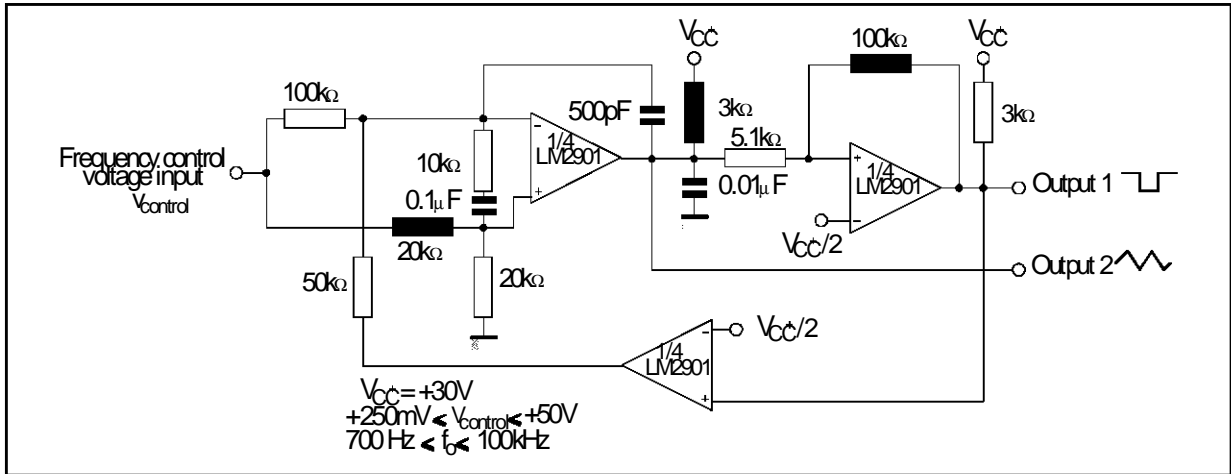
ZERO CROSSING DETECTOR (single power supply)



2901-16.EPS

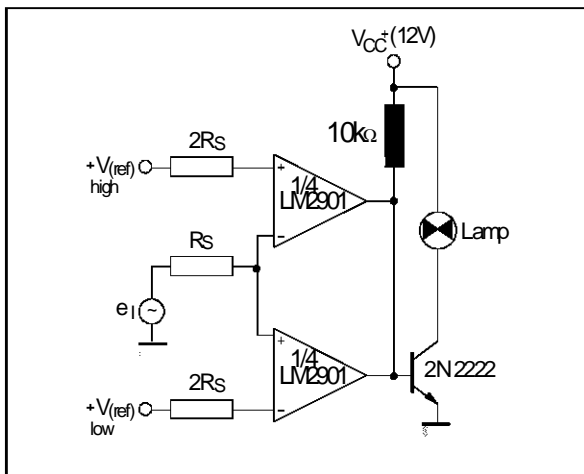
**TYPICAL APPLICATIONS** (continued)

**TWO-DECADE HIGH-FREQUENCY VCO**



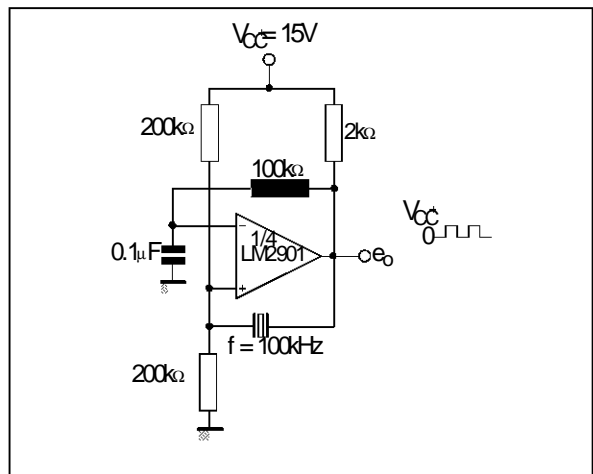
2901-17.EPS

**LIMIT COMPARATOR**



2901-18.EPS

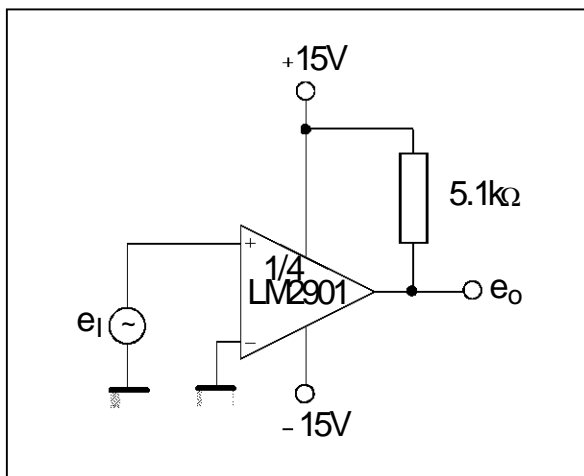
**CRYSTAL CONTROLLED OSCILLATOR**



2901-18.EPS

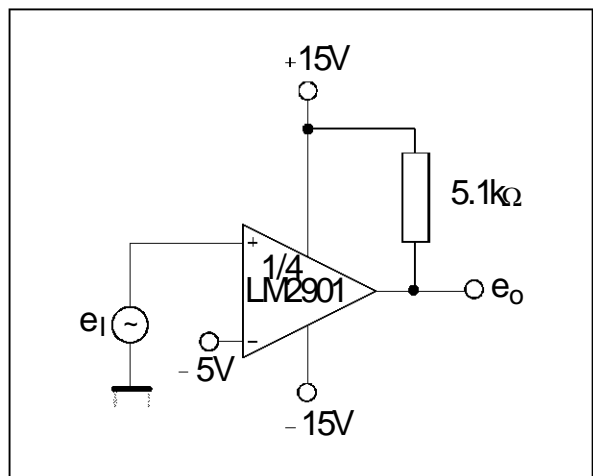
**SPLIT-SUPPLY APPLICATIONS**

**ZERO CROSSING DETECTOR**



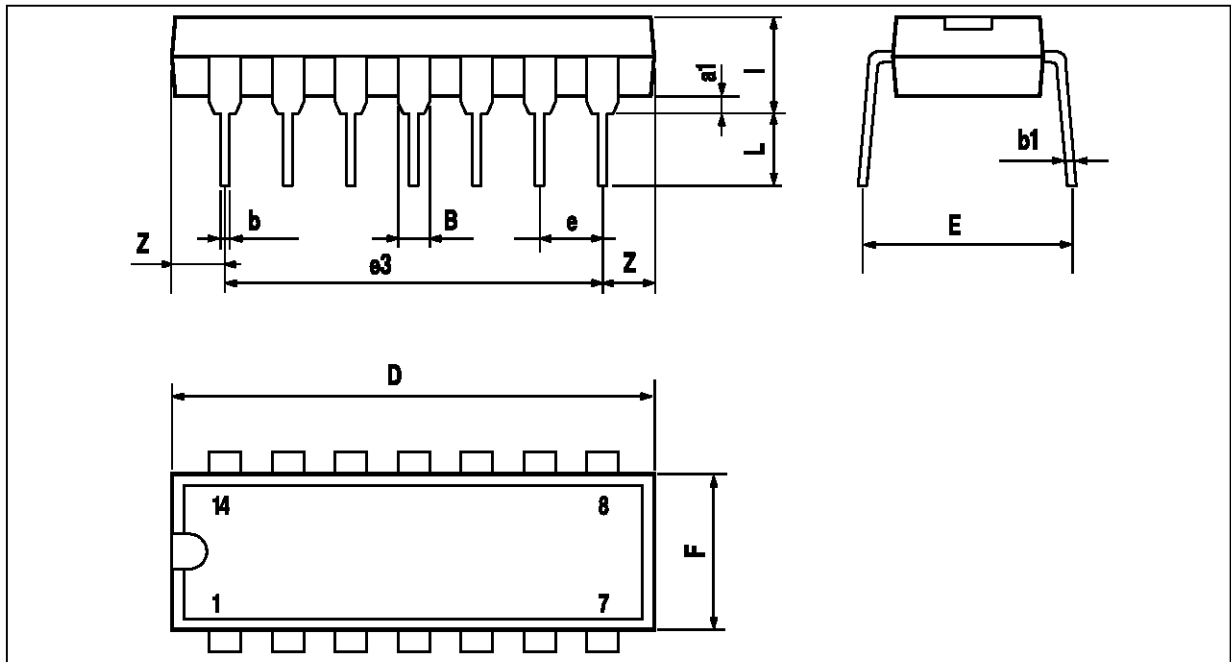
2901-20.EPS

**COMPARATOR WITH A NEGATIVE REFERENCE**



2901-21.EPS

**PACKAGE MECHANICAL DATA**  
14 PINS - PLASTIC DIP OR CERDIP



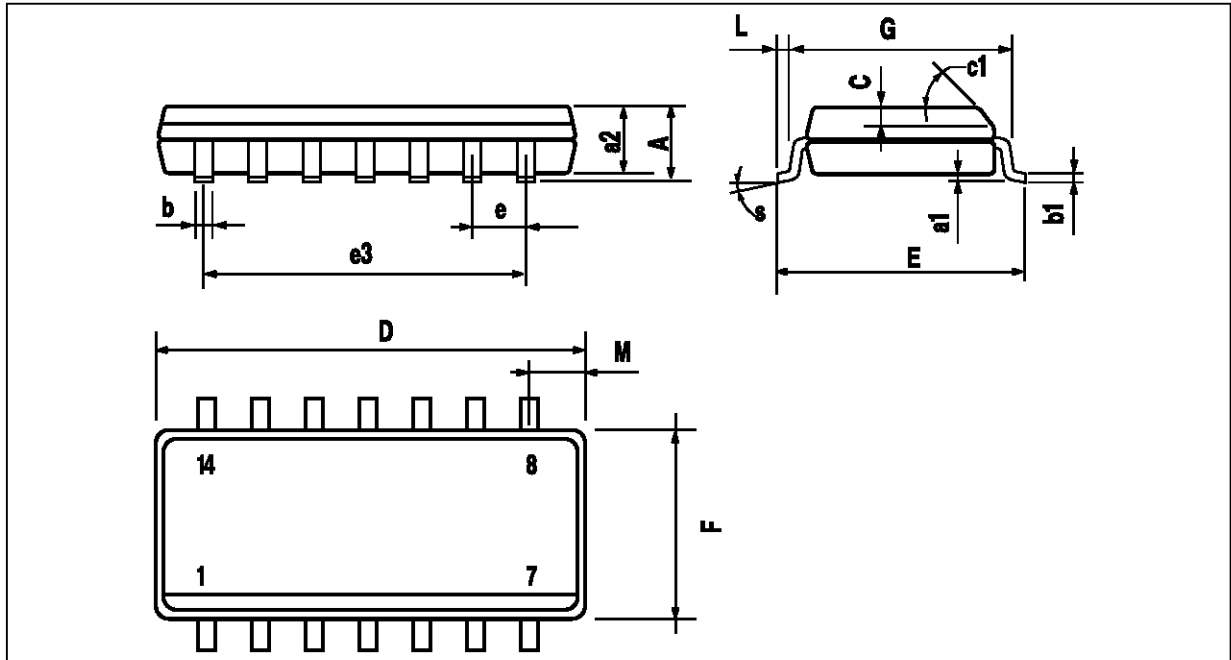
PM-DIP14LEPS

| Dimensions | Millimeters |       |      | Inches |       |       |
|------------|-------------|-------|------|--------|-------|-------|
|            | Min.        | Typ.  | Max. | Min.   | Typ.  | Max.  |
| a1         | 0.51        |       |      | 0.020  |       |       |
| B          | 1.39        |       | 1.65 | 0.055  |       | 0.065 |
| b          |             | 0.5   |      |        | 0.020 |       |
| b1         |             | 0.25  |      |        | 0.010 |       |
| D          |             |       | 20   |        |       | 0.787 |
| E          |             | 8.5   |      |        | 0.335 |       |
| e          |             | 2.54  |      |        | 0.100 |       |
| e3         |             | 15.24 |      |        | 0.600 |       |
| F          |             |       | 7.1  |        |       | 0.280 |
| i          |             |       | 5.1  |        |       | 0.201 |
| L          |             | 3.3   |      |        | 0.130 |       |
| Z          | 1.27        |       | 2.54 | 0.050  |       | 0.100 |

DIP14.TBL



**PACKAGE MECHANICAL DATA**  
14 PINS - PLASTIC MICROPACKAGE (SO)



PM-S014EFS

| Dimensions | Millimeters |      |      | Inches |       |       |
|------------|-------------|------|------|--------|-------|-------|
|            | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A          |             |      | 1.75 |        |       | 0.069 |
| a1         | 0.1         |      | 0.2  | 0.004  |       | 0.008 |
| a2         |             |      | 1.6  |        |       | 0.063 |
| b          | 0.35        |      | 0.46 | 0.014  |       | 0.018 |
| b1         | 0.19        |      | 0.25 | 0.007  |       | 0.010 |
| C          |             | 0.5  |      |        | 0.020 |       |
| c1         | 45° (typ.)  |      |      |        |       |       |
| D          | 8.55        |      | 8.75 | 0.336  |       | 0.334 |
| E          | 5.8         |      | 6.2  | 0.228  |       | 0.244 |
| e          |             | 1.27 |      |        | 0.050 |       |
| e3         |             | 7.62 |      |        | 0.300 |       |
| F          | 3.8         |      | 4.0  | 0.150  |       | 0.157 |
| G          | 4.6         |      | 5.3  | 0.181  |       | 0.208 |
| L          | 0.5         |      | 1.27 | 0.020  |       | 0.050 |
| M          |             |      | 0.68 |        |       | 0.027 |
| S          | 8° (max.)   |      |      |        |       |       |

S014.TBL

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