

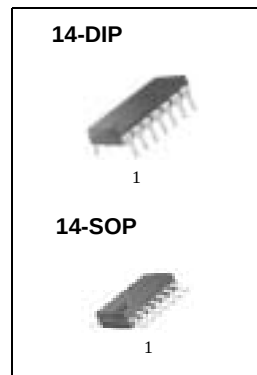
# LM2901, LM339/LM339A, LM3302 LM239/LM239A Quad Comparator

## Features

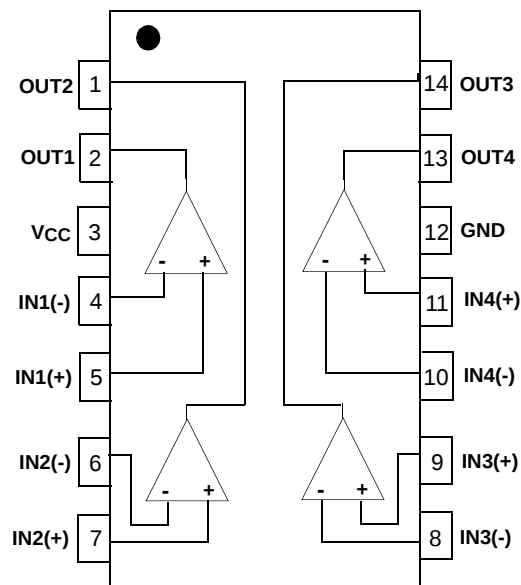
- Single or Dual Supply Operation
- Wide Range of Supply Voltage  
LM2901, LM339/LM339A, LM239/LM239A: 2 ~ 36V  
(or  $\pm 1 \sim \pm 18V$ )  
LM3302: 2 ~ 28V (or  $\pm 1 \sim \pm 14V$ )
- Low Supply Current Drain 800 $\mu A$  Typ.
- Open Collector Outputs for Wired and Connectors
- Low Input Bias Current 25nA Typ.
- Low Input Offset Current  $\pm 2.3nA$  Typ.
- Low Input Offset Voltage  $\pm 1.4mV$  Typ.
- Input Common Mode Voltage Range Includes Ground.
- Low Output Saturation Voltage
- Output Compatible With TTL, DTL and MOS Logic System

## Description

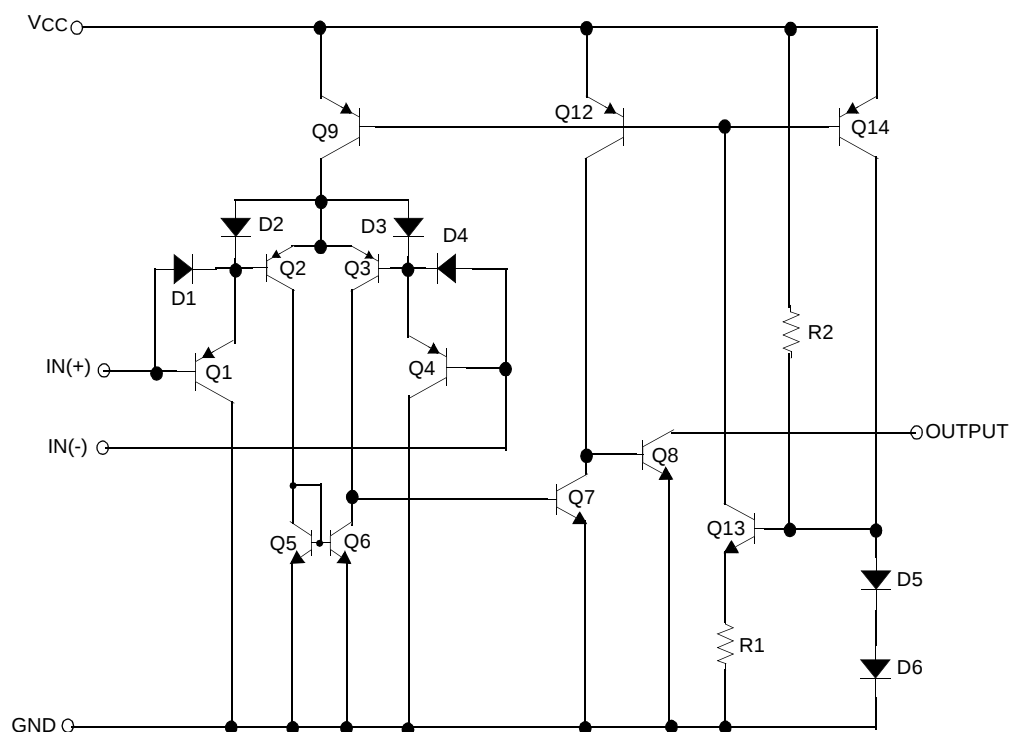
The LM2901, LM339/LM339A, LM239/LM239A, LM3302 consist of four independent voltage comparators designed to operate from single power supply over a wide voltage range.



## Internal Block Diagram



## Schematic Diagram



## Absolute Maximum Ratings

| Parameter                                                              | Symbol               | Value                             | Unit |
|------------------------------------------------------------------------|----------------------|-----------------------------------|------|
| Supply Voltage                                                         | V <sub>CC</sub>      | ±18 or 36                         | V    |
| Supply Voltage only LM3302                                             | V <sub>CC</sub>      | ±14 or 28                         | V    |
| Differential Input Voltage                                             | V <sub>I(DIFF)</sub> | 36                                | V    |
| Differential Input Voltage Only LM3302                                 | V <sub>I(DIFF)</sub> | 28                                | V    |
| Input Voltage                                                          | V <sub>I</sub>       | -0.3 to +36                       | V    |
| Input Voltage Only LM3302                                              | V <sub>I</sub>       | -0.3 to +28                       | V    |
| Output Short Circuit to GND                                            | -                    | Continuous                        | -    |
| Power Dissipation                                                      | P <sub>D</sub>       | 570                               | mW   |
| Operating Temperature<br>LM339/LM339A<br>LM2901/LM3302<br>LM239/LM239A | T <sub>OPR</sub>     | 0 ~ +70<br>-40 ~ +85<br>-25 ~ +85 | °C   |
| Storage Temperature                                                    | T <sub>STG</sub>     | -65 ~ +150                        | °C   |

## Electrical Characteristics

(VCC = 5V, TA = 25°C, unless otherwise specified)

| Parameter                       | Symbol               | Conditions                                                                                                           | LM239A/LM339A           |      |                      | LM239/LM339 |      |                      | Unit |
|---------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------|------|----------------------|-------------|------|----------------------|------|
|                                 |                      |                                                                                                                      | Min.                    | Typ. | Max.                 | Min.        | Typ. | Max.                 |      |
| Input Offset Voltage            | V <sub>IO</sub>      | V <sub>O(P)</sub> = 1.4V, R <sub>S</sub> = 0Ω                                                                        | -                       | 1    | 2                    | -           | 1.4  | 5                    | mV   |
|                                 |                      | Note1                                                                                                                | -                       | -    | 4.0                  | -           | -    | 9.0                  |      |
| Input Offset Current            | I <sub>IO</sub>      | I <sub>IN(+)</sub> - I <sub>IN(-)</sub> , V <sub>CM</sub> = 0V                                                       | -                       | 2.3  | 50                   | -           | 2.3  | 50                   | nA   |
|                                 |                      | Note1                                                                                                                | -                       | -    | 150                  | -           | -    | 150                  |      |
| Input Bias Current              | I <sub>BIAS</sub>    | V <sub>CM</sub> = 0V                                                                                                 | -                       | 57   | 250                  | -           | 57   | 250                  | nA   |
|                                 |                      | Note1                                                                                                                | -                       | -    | 400                  | -           | -    | 400                  |      |
| Input Common Mode Voltage Range | V <sub>I(R)</sub>    | V <sub>CC</sub> = 30V                                                                                                | 0                       | -    | V <sub>CC</sub> -1.5 | 0           | -    | V <sub>CC</sub> -1.5 | V    |
|                                 |                      | Note1                                                                                                                | 0                       | -    | V <sub>CC</sub> -2   | 0           | -    | V <sub>CC</sub> -2   |      |
| Supply Current                  | I <sub>CC</sub>      | V <sub>CC</sub> = 5V, R <sub>L</sub> = ∞                                                                             | -                       | 1.1  | 2.0                  | -           | 1.1  | 2.0                  | mA   |
| Voltage Gain                    | G <sub>V</sub>       | V <sub>CC</sub> = 15V, R <sub>L</sub> ≥ 15kΩ (for large swing)                                                       | 50                      | 200  | -                    | 50          | 200  | -                    | V/mV |
| Large Signal Response Time      | T <sub>LRES</sub>    | V <sub>I</sub> = TTL Logic Swing<br>V <sub>REF</sub> = 1.4V, V <sub>RL</sub> = 5V,<br>R <sub>L</sub> = 5.1kΩ (Note2) | -                       | 300  | -                    | -           | 300  | -                    | ns   |
| Response Time                   | T <sub>RES</sub>     | V <sub>RL</sub> = 5V, R <sub>L</sub> = 5.1kΩ (Note2)                                                                 | -                       | 1.3  | -                    | -           | 1.3  | -                    | μs   |
| Output Sink Current             | I <sub>SINK</sub>    | V <sub>I(-)</sub> ≥ 1V, V <sub>I(+)</sub> = 0V,<br>V <sub>O(P)</sub> ≤ 1.5V                                          | 6                       | 18   | -                    | 6           | 18   | -                    | mA   |
| Output Saturation Voltage       | V <sub>SAT</sub>     | V <sub>I(-)</sub> ≥ 1V, V <sub>I(+)</sub> = 0V                                                                       | -                       | 140  | 400                  | -           | 140  | 400                  | mV   |
|                                 |                      | I <sub>SINK</sub> = 4mA Note1                                                                                        | -                       | -    | 700                  | -           | -    | 700                  |      |
| Output Leakage Current          | I <sub>O(LKG)</sub>  | V <sub>I(-)</sub> = 0V<br>V <sub>I(+)</sub> = 1V                                                                     | V <sub>O(P)</sub> = 5V  | -    | 0.1                  | -           | -    | 0.1                  | nA   |
|                                 |                      |                                                                                                                      | V <sub>O(P)</sub> = 30V | -    | -                    | -           | -    | 1.0                  | μA   |
| Differential Voltage            | V <sub>I(DIFF)</sub> | Note1                                                                                                                | -                       | -    | 36                   | -           | -    | 36                   | V    |

### Note:

- LM339/LM339A : 0 ≤ T<sub>A</sub> ≤ +70°C  
LM2901/LM3302 : -40 ≤ T<sub>A</sub> ≤ +85°C  
LM239/LM239A : -25 ≤ T<sub>A</sub> ≤ +85°C
- These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics** (Continued)

(VCC = 5V, TA = 25°C, unless otherwise specified)

| Parameter                       | Symbol               | Conditions                                                                                                           | LM2901 |      |                       | LM3302 |      |                       | Unit     |
|---------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------|--------|------|-----------------------|--------|------|-----------------------|----------|
|                                 |                      |                                                                                                                      | Min.   | Typ. | Max.                  | Min.   | Typ. | Max.                  |          |
| Input Offset Voltage            | V <sub>IO</sub>      | V <sub>O(P)</sub> = 1.4V, R <sub>S</sub> = 0Ω                                                                        | -      | 2    | 7                     | -      | 2    | 20                    | mV       |
|                                 |                      | Note1                                                                                                                | -      | 9    | 15                    | -      | -    | 40                    |          |
| Input Offset Current            | I <sub>IO</sub>      |                                                                                                                      | -      | 2.3  | 50                    | -      | 3    | 100                   | nA       |
|                                 |                      | Note1                                                                                                                | -      | 50   | 200                   | -      | -    | 300                   |          |
| Input Bias Current              | I <sub>BIAS</sub>    |                                                                                                                      | -      | 57   | 250                   | -      | 57   | 250                   | nA       |
|                                 |                      | Note1                                                                                                                | -      | 200  | 500                   | -      | -    | 1000                  |          |
| Input Common Mode Voltage Range | V <sub>I(R)</sub>    | LM2901, V <sub>CC</sub> = 30V<br>LM3302, V <sub>CC</sub> = 28V                                                       | 0      | -    | V <sub>CC</sub> - 1.5 | 0      | -    | V <sub>CC</sub> - 1.5 | V        |
|                                 |                      | Note1                                                                                                                | 0      | -    | V <sub>CC</sub> - 2   | 0      | -    | V <sub>CC</sub> - 2   |          |
| Supply Current                  | I <sub>CC</sub>      | R <sub>L</sub> = ∞, V <sub>CC</sub> = 5V                                                                             | -      | 1.1  | 2.0                   | -      | 1.1  | 2.0                   | mA       |
|                                 |                      | R <sub>L</sub> = ∞, V <sub>CC</sub> = 30V<br>(LM3302, V <sub>CC</sub> = 28V)                                         | -      | 1.6  | 2.5                   | -      | 1.6  | 2.5                   |          |
| Voltage Gain                    | G <sub>V</sub>       | V <sub>CC</sub> = 15V, R <sub>L</sub> ≥ 15kΩ<br>(for large swing)                                                    | 25     | 100  | -                     | 2      | 30   | -                     | V/<br>mV |
| Large Signal Response Time      | T <sub>LRES</sub>    | V <sub>I</sub> = TTL Logic Swing<br>V <sub>REF</sub> = 1.4V, V <sub>RL</sub> = 5V, R <sub>L</sub> = 5.1kΩ<br>(Note2) | -      | 300  | -                     | -      | 300  | -                     | ns       |
| Response Time                   | T <sub>RES</sub>     | V <sub>RL</sub> = 5V, R <sub>L</sub> = 5.1kΩ (Note2)                                                                 | -      | 1.3  | -                     | -      | 1.3  | -                     | μs       |
| Output Sink Current             | I <sub>SINK</sub>    | V <sub>I(-)</sub> ≥ 1V, V <sub>I(+)</sub> = 0V, V <sub>O(P)</sub> ≤ 1.5V                                             | 6      | 18   | -                     | 6      | 18   | -                     | mA       |
| Output Saturation Voltage       | V <sub>SAT</sub>     | V <sub>I(-)</sub> ≥ 1V, V <sub>I(+)</sub> = 0V                                                                       | -      | 140  | 400                   | -      | 140  | 400                   | mV       |
|                                 |                      | I <sub>SINK</sub> = 4mA<br>Note1                                                                                     | -      | -    | 700                   | -      | -    | 700                   |          |
| Output Leakage Current          | I <sub>O(LKG)</sub>  | V <sub>I(-)</sub> = 0V<br>V <sub>O(P)</sub> = 5V                                                                     | -      | 0.1  | -                     | -      | 0.1  | -                     | nA       |
|                                 |                      | V <sub>I(+)</sub> = 1V<br>V <sub>O(P)</sub> = 30V                                                                    | -      | -    | 1.0                   | -      | -    | 1.0                   | μA       |
| Differential Voltage            | V <sub>I(DIFF)</sub> | Note1                                                                                                                | -      | -    | 36                    | -      | -    | 28                    | V        |

**Note:**

- LM339/LM339A : 0 ≤ T<sub>A</sub> ≤ +70°C  
LM2901/LM3302 : -40 ≤ T<sub>A</sub> ≤ +85°C  
LM239/LM239A : -25 ≤ T<sub>A</sub> ≤ +85°C
- These parameters, although guaranteed, are not 100% tested in production.

## Typical Performance Characteristics

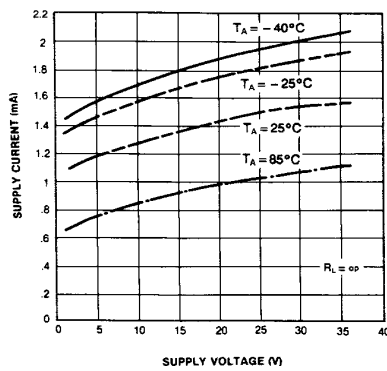


Figure 1. Supply Current vs Supply Voltage

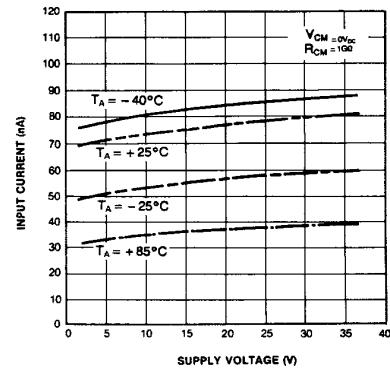


Figure 2. Input Current vs Supply Voltage

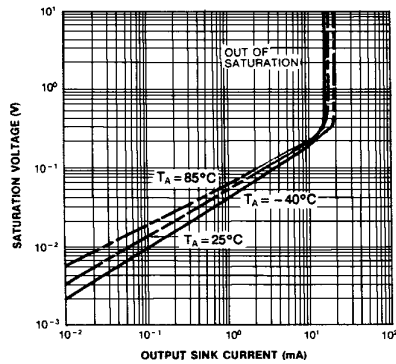


Figure 3. Output Saturation Voltage vs Sink Current

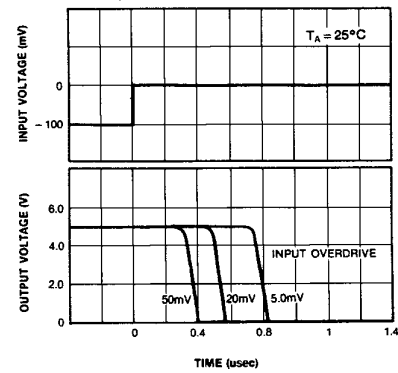


Figure 4. Response Time for Various Input Overdrive-Negative Transition

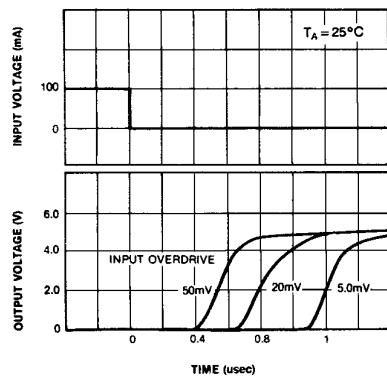


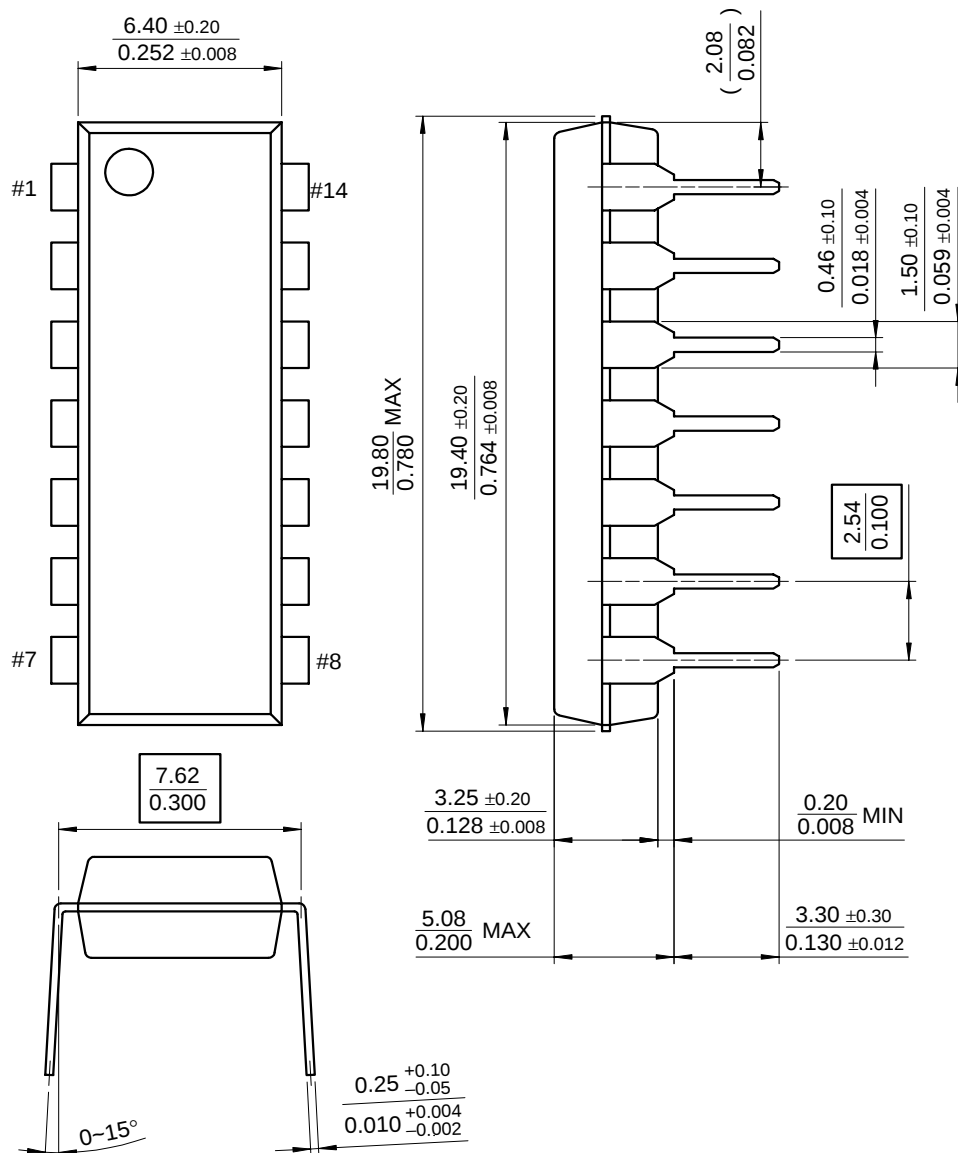
Figure 5. Response Time for Various Input Overdrive-Positive Transition

## Mechanical Dimensions

### Package

Dimensions in millimeters

### 14-DIP





## Ordering Information

| Product Number | Package | Operating Temperature |
|----------------|---------|-----------------------|
| LM339N         | 14-DIP  | 0 ~ +70°C             |
| LM339AN        |         |                       |
| LM339M         | 14-SOP  |                       |
| LM339AM        |         |                       |
| LM2901N        | 14-DIP  | -40 ~ +85°C           |
| LM2901M        | 14-SOP  |                       |
| LM3302N        | 14-DIP  |                       |
| LM3302M        | 14-SOP  |                       |
| LM239N         | 14-DIP  | -25 ~ +85°C           |
| LM239AN        |         |                       |
| LM239M         | 14-SOP  |                       |
| LM239AM        |         |                       |

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.