

## DUAL VOLTAGE COMPARATOR

LM119/219/319

## DESCRIPTION

The LM119 series are precision high speed dual comparators fabricated on a single monolithic chip. They are designed to operate over a wide range of supply voltages down to a single 5V logic supply and ground. Further, they have higher gain and lower input currents than devices like the  $\mu$ A710. The uncommitted collector of the output stage makes the LM119 compatible with RTL, DTL and TTL as well as capable of driving lamps and relays at currents up to 25mA.

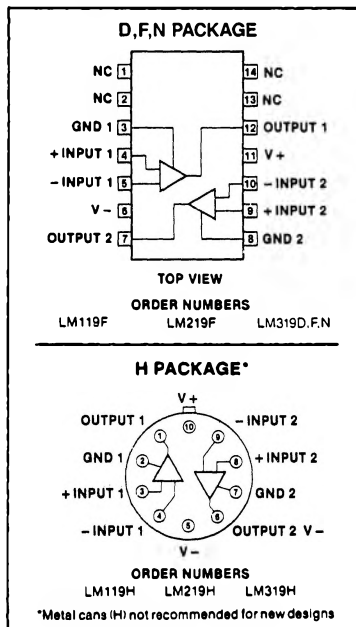
Although designed primarily for applications requiring operation from digital logic supplies, the LM119 series are fully specified for power supplies up to  $\pm 15V$ . It features faster response than the LM111 at the expense of higher power dissipation. However, the high speed, wide operating voltage range and low package count make the LM119 much more versatile than older devices like the  $\mu$ A711.

The LM119 is specified from  $-55^{\circ}C$  to  $+125^{\circ}C$ , the LM219 is specified from  $-25^{\circ}C$  to  $+85^{\circ}C$ , and the LM319 is specified from  $0^{\circ}C$  to  $+70^{\circ}C$ .

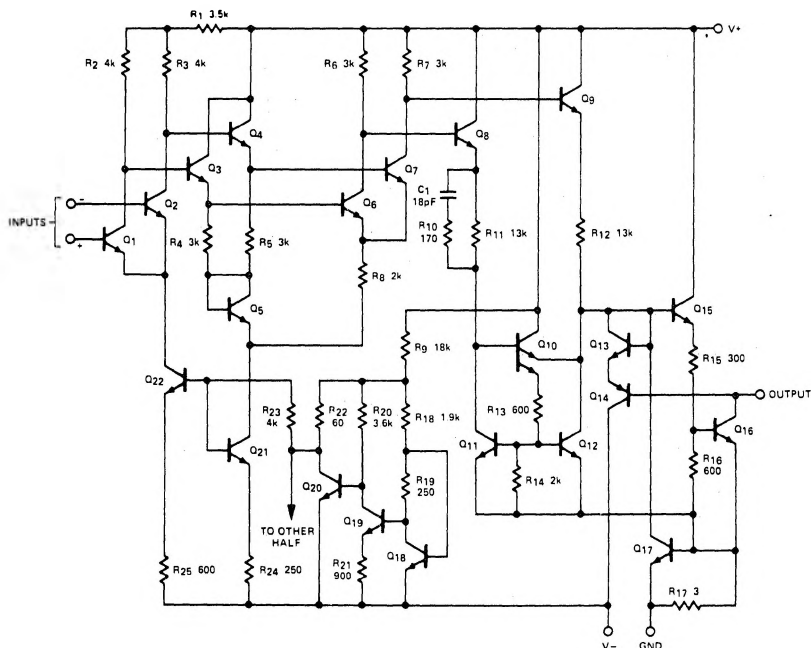
## FEATURES

- Two independent comparators
- Operates from a single 5V supply
- Typically 80ns response time at  $\pm 15V$
- Minimum fan-out of 3 (each side)
- Maximum input current of  $1\mu A$  over temperature
- Inputs and outputs can be isolated from system ground
- High common mode slew rate
- MIL-STD-883 A, B, C available

## PIN CONFIGURATIONS



## EQUIVALENT SCHEMATIC



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## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                           | RATING      | UNIT |
|-------------------------------------|-------------|------|
| Total supply voltage                | 36          | V    |
| Output to negative supply voltage   | 36          | V    |
| Ground to negative supply voltage   | 25          | V    |
| Ground to positive supply voltage   | 18          | V    |
| Differential input voltage          | ±5          | V    |
| Input voltage <sup>1</sup>          | ±15         | V    |
| Power dissipation <sup>2</sup>      | 500         | mW   |
| Output short circuit duration       | 10          | s    |
| Operating temperature range         |             |      |
| LM119                               | -55 to +125 | °C   |
| LM219                               | -25 to +85  | °C   |
| LM319                               | 0 to +70    | °C   |
| Storage temperature range           | -65 to +150 | °C   |
| Lead temperature (soldering, 10sec) | 300         | °C   |

## NOTES

- For supply voltages less than ±15V, the absolute maximum rating is equal to the supply voltage.
- The absolute maximum junction temperature is 150°C. Device dissipation must be derated as follows:  
K package —150°C/watt above 75°C  
F package —110°C/watt above 95°C

**DC ELECTRICAL CHARACTERISTICS**  $V_S = \pm 15V$ , for  $\left. \begin{array}{l} \text{LM119, } -55^\circ\text{C} \leq T_A \leq 125^\circ\text{C} \\ \text{LM219, } -25^\circ\text{C} \leq T_A \leq 85^\circ\text{C} \\ \text{LM319, } 0^\circ\text{C} \leq T_A \leq 70^\circ\text{C} \end{array} \right\}$  unless otherwise specified.

| PARAMETER                                           | TEST CONDITIONS                                                                                                     | LM119/219 |          |             | LM319 |      |              | UNIT     |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------|----------|-------------|-------|------|--------------|----------|
|                                                     |                                                                                                                     | Min       | Typ      | Max         | Min   | Typ  | Max          |          |
| V <sub>OS</sub> Input offset voltage <sup>1,2</sup> | R <sub>S</sub> ≤ 5KΩ, T <sub>A</sub> = 25°C<br>Over temp.                                                           |           | 0.7      | 4.0<br>7    |       | 2.0  | 8.0<br>10    | mV<br>mV |
| I <sub>OS</sub> Input offset current <sup>1,2</sup> | T <sub>A</sub> = 25°C<br>Over temp.                                                                                 |           | 30       | 75<br>100   |       | 80   | 200<br>300   | nA<br>nA |
| I <sub>B</sub> Input bias current <sup>1</sup>      | T <sub>A</sub> = 25°C<br>Over temp.                                                                                 |           | 150      | 500<br>1000 |       | 250  | 1000<br>1200 | nA<br>nA |
| A <sub>V</sub> Voltage gain                         | T <sub>A</sub> = 25°C                                                                                               | 10        | 40       |             | 8     | 40   |              | V/mV     |
| V <sub>OL</sub> Saturation voltage                  | V <sub>IN</sub> = 5mV, I <sub>OUT</sub> = 25mA, T <sub>A</sub> = 25°C                                               |           | 0.75     | 1.5         |       | 0.75 | 1.5          | V        |
|                                                     | V <sub>IN</sub> = 10mV, I <sub>OUT</sub> = 25mA, T <sub>A</sub> = 25°C<br>V <sub>+</sub> ≥ 4.5V, V <sub>-</sub> = 0 |           |          |             |       |      |              | V        |
|                                                     | V <sub>IN</sub> = 6mV, I <sub>OUT</sub> = 3.2mA<br>T <sub>A</sub> ≥ 0°C                                             |           | 0.23     | 0.4<br>0.6  |       |      |              | V        |
|                                                     | T <sub>A</sub> ≤ 0°C<br>V <sub>IN</sub> = 10mV, I <sub>OUT</sub> = 3.2mA                                            |           |          |             |       | 0.3  | 0.4          | V        |
| I <sub>OH</sub> Output leakage current              | V <sub>-</sub> = 0V, V <sub>IN</sub> = 5mV<br>V <sub>OUT</sub> = 35V, T <sub>A</sub> = 25°C<br>Over temp.           |           | 0.2<br>1 | 2<br>10     |       |      |              | μA<br>μA |
|                                                     | V <sub>-</sub> = 0V, V <sub>IN</sub> = 10mV<br>V <sub>OUT</sub> = 35V, T <sub>A</sub> = 25°C                        |           |          |             |       | 0.2  | 10           | μA       |
|                                                     |                                                                                                                     |           |          |             |       |      |              |          |
| V <sub>IN</sub> Input voltage range                 | V <sub>S</sub> = ±15V<br>V <sub>+</sub> = 5V, V <sub>-</sub> = 0V                                                   | 1         | ±13      | 3           | 1     | ±13  | 3            | V<br>V   |
| V <sub>ID</sub> Differential input voltage          |                                                                                                                     |           |          | ±5          |       |      | ±5           | V        |
| I <sub>+</sub> Positive supply current              | V <sub>+</sub> = 5V, V <sub>-</sub> = 0V, T <sub>A</sub> = 25°C                                                     |           | 4.3      |             |       | 4.3  |              | mA       |
| I <sub>+</sub> Positive supply current              | V <sub>S</sub> = ±15V, T <sub>A</sub> = 25°C                                                                        |           | 8.0      | 11.5        |       | 8.0  | 12.5         | mA       |
| I <sub>-</sub> Negative supply current              | V <sub>S</sub> = ±15V, T <sub>A</sub> = 25°C                                                                        |           | 3.0      | 4.5         |       | 3.0  | 5.0          | mA       |

## NOTES

- V<sub>OS</sub>, I<sub>OS</sub> and I<sub>B</sub> specifications apply for a supply voltage range of V<sub>S</sub> = ±15V down to a single 5V supply.
- The offset voltages and offset currents given are the maximum values required to drive the output to within 1 volt of either supply with a 1mA load. Thus these parameters define an error band and take into account the worst case effects of voltage gain and input impedance.

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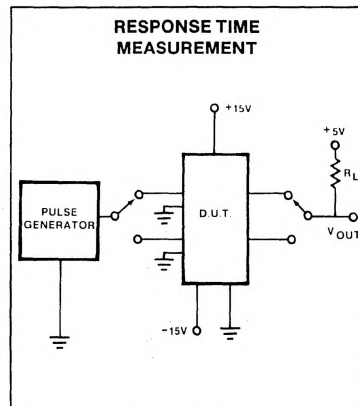
## AC ELECTRICAL CHARACTERISTICS

| PARAMETER      | TEST CONDITIONS                                                             | LIMITS |     |     | UNIT |
|----------------|-----------------------------------------------------------------------------|--------|-----|-----|------|
|                |                                                                             | Min    | Typ | Max |      |
| Response time* | $V_S = \pm 15V$ , $T_A = 25^\circ C$<br>$R_L = 500\Omega$ (see test figure) |        | 80  |     | ns   |

\*NOTE

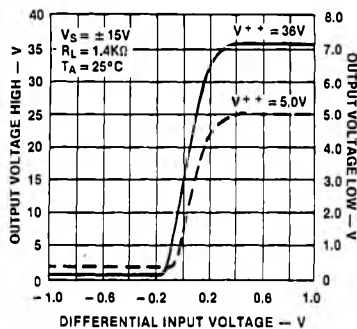
The response time specified is for a 100mV step with 5mV overdrive.

## TEST CIRCUIT

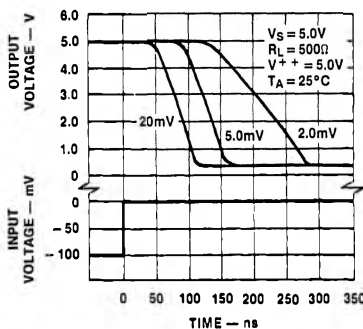


## TYPICAL PERFORMANCE CHARACTERISTICS

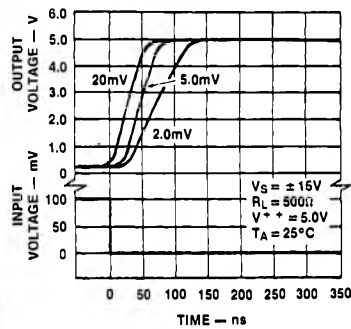
TRANSFER FUNCTION



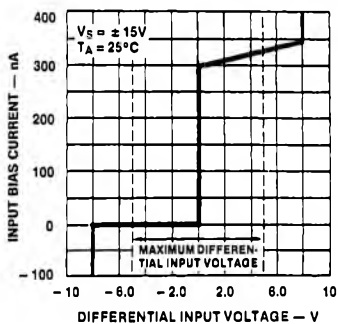
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



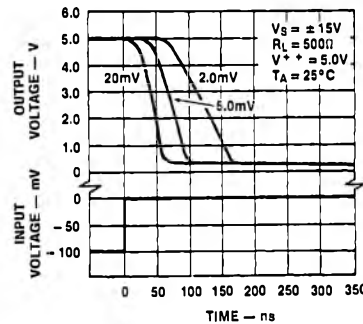
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



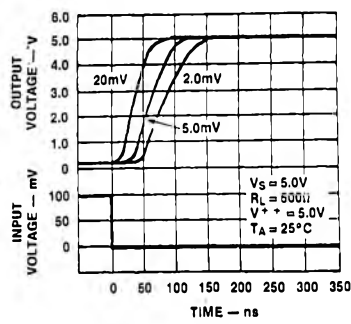
INPUT CHARACTERISTICS



RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES

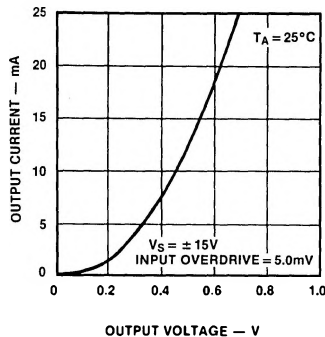


# DUAL VOLTAGE COMPARATOR

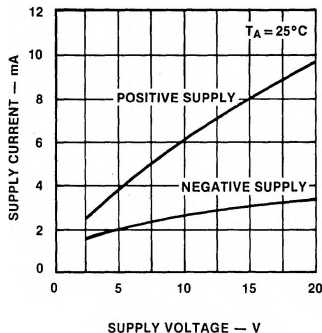
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## TYPICAL PERFORMANCE CHARACTERISTICS (Cont'd)

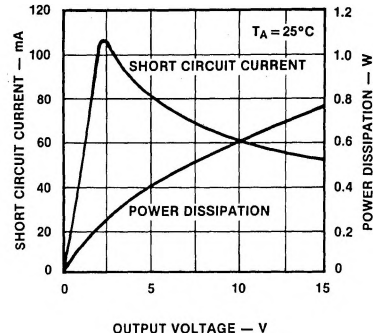
OUTPUT SATURATION VOLTAGE



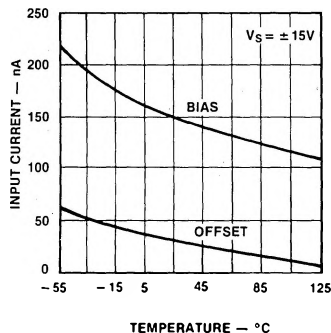
SUPPLY CURRENT



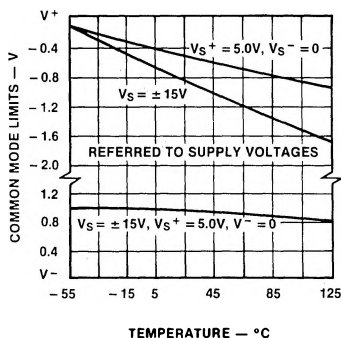
OUTPUT LIMITING CHARACTERISTICS



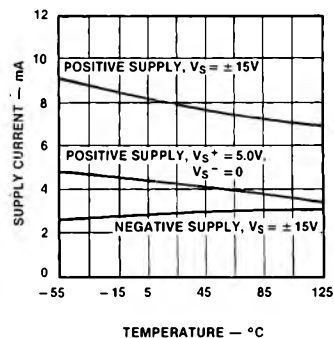
INPUT CURRENTS (LM119/219)



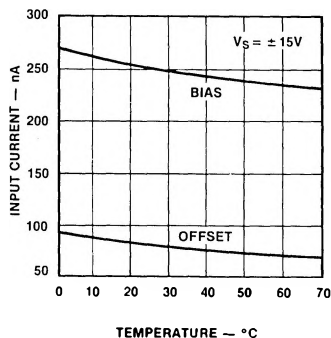
COMMON MODE LIMITS (LM119/219)



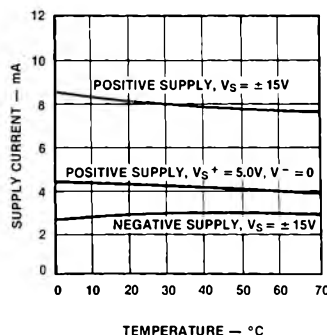
SUPPLY CURRENT (LM119/219)



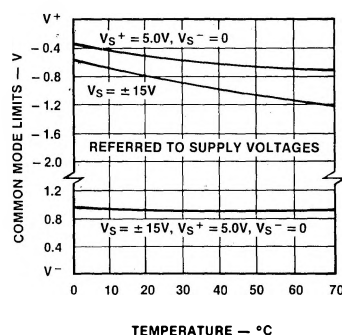
INPUT CURRENTS (LM319)



SUPPLY CURRENTS (LM319)



COMMON MODE LIMITS (LM319)

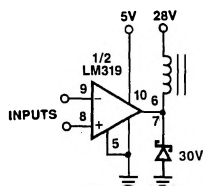


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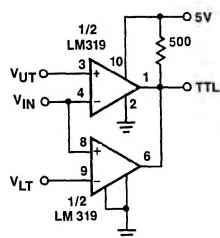
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## TYPICAL APPLICATIONS

## RELAY DRIVER



## WINDOW DETECTOR



$V_{OUT} = 5V$  for  $V_{LT} < V_{IN} < V_{UT}$   
 $V_{OUT} = 0$  for  $V_{IN} < V_{LT}$  or  $V_{IN} > V_{UT}$

## WIDE RANGE VARIABLE OSCILLATOR

