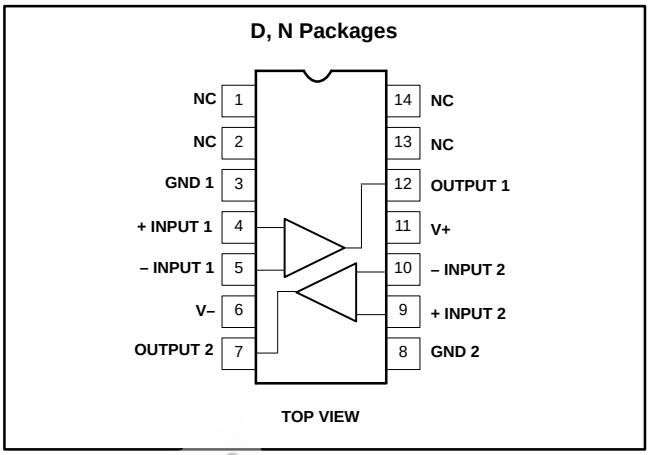
# Dual voltage comparator | LM219/319

## DESCRIPTION

The LM319 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 µA710. The uncommitted collector of the output stage makes the LM319 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 LM319 series are fully specified for power supplies up to ±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 LM319 much more versatile than older devices like the µA711.

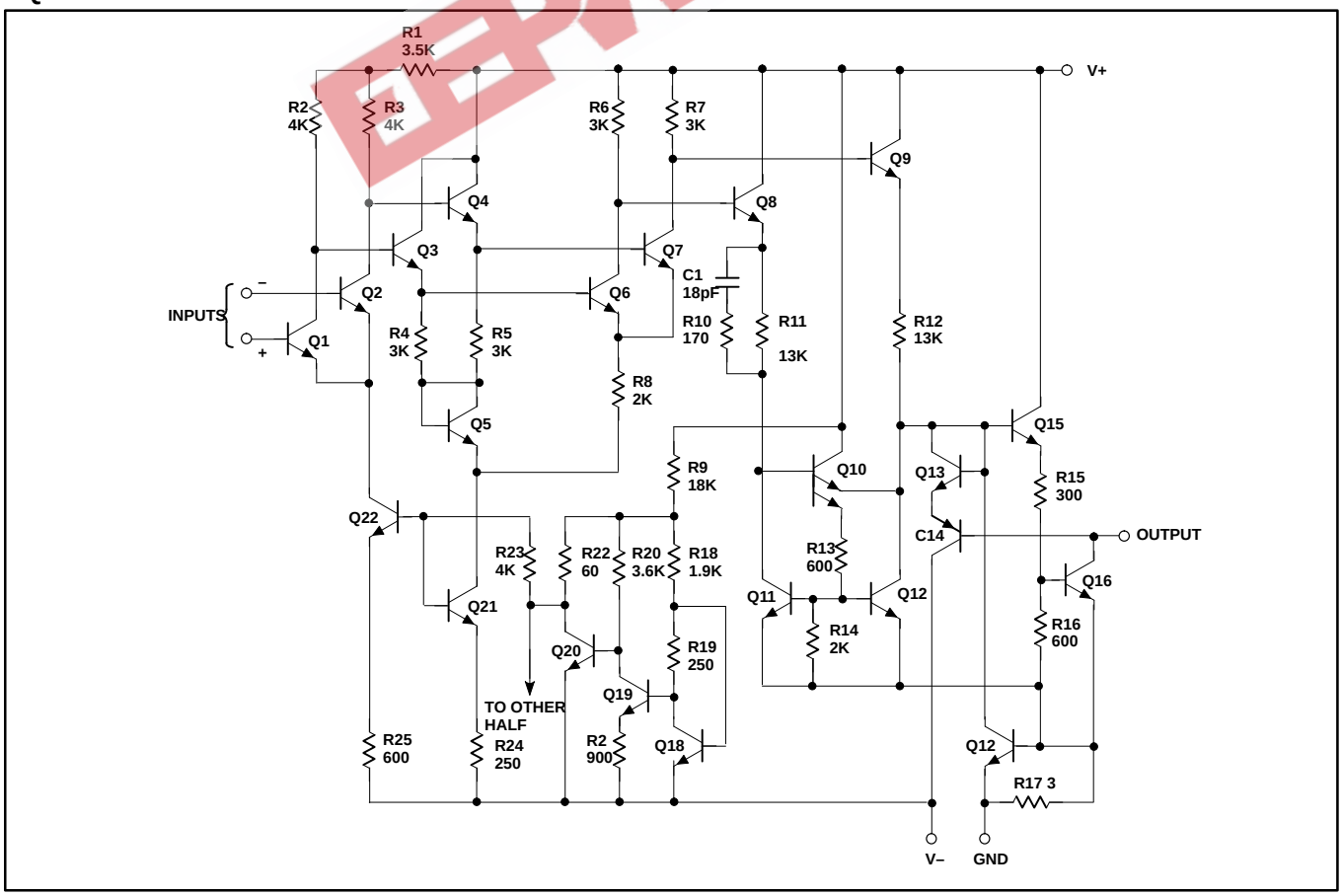
## PIN CONFIGURATION




## FEATURES

- Two independent comparators
- Operates from a single 5V supply
- Typically 80ns response time at ±15V
- Minimum fanout of 3 (each side)
- Maximum input current of 1µA over temperature
- Inputs and outputs can be isolated from system ground
- High common-mode slew rate

## EQUIVALENT SCHEMATIC



# Dual voltage comparator LM219/319

## ORDERING INFORMATION

| DESCRIPTION | TEMPERATURE RANGE | ORDER CODE | DWG # |
|---|---|---|---|
| 14-Pin Plastic Small Outline (SO) Package | -25 to +85°C | LM219D | 0175D |
| 14-Pin Plastic Small Outline (SO) Package | 0 to +70°C | LM319D | 0175D |
| 14-Pin Plastic Dual In-Line Package (DIP) | 0 to +70°C | LM319N | 0405B |

## ABSOLUTE MAXIMUM RATINGS

| SYMBOL | PARAMETER | RATING | UNIT |
|---|---|---|---|
| $V_S$ | 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 |
| $V_{IN}$ | Input voltage[1] | ±15 | V |
| | Maximum power dissipation, $T_A$=25°C (still-air)[2] | | |
| | N package | 1420 | mW |
| | D package | 1040 | mW |
| | Output short-circuit duration | 10 | s |
| $T_A$ | Operating temperature range LM219 | -25 to +85 | °C |
| | Operating temperature range LM319 | 0 to +70 | °C |
| $T_{STG}$ | Storage temperature range | -65 to +150 | °C |
| $T_{SOLD}$ | Lead soldering temperature (10sec max) | 300 | °C |

**NOTES:**
1. For supply voltages less than ±15V, the absolute maximum rating is equal to the supply voltage.
2. Derate above 25°C, at the following rates:
   N package at 11.4mW/°C
   D package at 8.3mW/°C

## DC ELECTRICAL CHARACTERISTICS

$V_S$=±15V, -25°C ≤ $T_A$ ≤ 85°C for LM219, 0°C ≤ $T_A$ ≤ 70°C for LM319, unless otherwise specified.

| SYMBOL | PARAMETER | TEST CONDITIONS | LM219 | | | LM319 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Typ | Max | |
| $V_{OS}$ | Input offset voltage[1, 2] | $R_S$≤5kΩ, $T_A$=25°C | | 0.7 | 4.0 | | 2.0 | 8.0 | mV |
| | | Over temp. | | | 7 | | | 10 | |
| $I_{OS}$ | Input offset current[1, 2] | $T_A$=25°C | | 30 | 75 | | 80 | 200 | nA |
| | | Over temp. | | | 100 | | | 300 | |
| $I_B$ | Input bias current[1] | $T_A$=25°C | | 150 | 500 | | 250 | 1000 | nA |
| | | Over temp. | | | 1000 | | | 1200 | nA |
| $A_V$ | Voltage gain | $T_A$=25°C | 8 | 40 | | 8 | 40 | | V/mV |
| $V_{OL}$ | Saturation voltage | $V_{IN}$≤-10mV, $I_{OUT}$=25mA, $T_A$=25°C, V+≥4.5V, V-=0 | | 0.75 | 1.5 | | 0.75 | 1.5 | V |
| | | $V_{IN}$≤-10mV, $I_{OUT}$=3.2mA | | 0.3 | 0.6 | | 0.3 | 0.4 | |
| $I_{OH}$ | Output leakage current | V-=0V, $V_{IN}$≥10mV | | | | | | | |
| | | $V_{OUT}$=35V, $T_A$=25°C | | 0.2 | 10 | | 0.2 | 10 | µA |
| $V_{IN}$ | Input voltage range | $V_S$=±15V | | ±13 | | | ±13 | | V |
| | | V+=5V, V-=0V | 1 | | 3 | 1 | | 3 | |
| $V_{ID}$ | Differential input voltage | | | | ±5 | | | ±5 | V |
| I+ | Positive supply current | V+=5V, V-=0V, $T_A$=25°C | | 4.3 | | | 4.3 | | mA |
| I+ | Positive supply current | $V_S$=±15V, $T_A$=25°C | | 8.0 | 12.5 | | 8.0 | 12.5 | mA |
| I- | Negative supply current | $V_S$=±15V, $T_A$=25°C | | 3.0 | 5.0 | | 3.0 | 5.0 | mA |

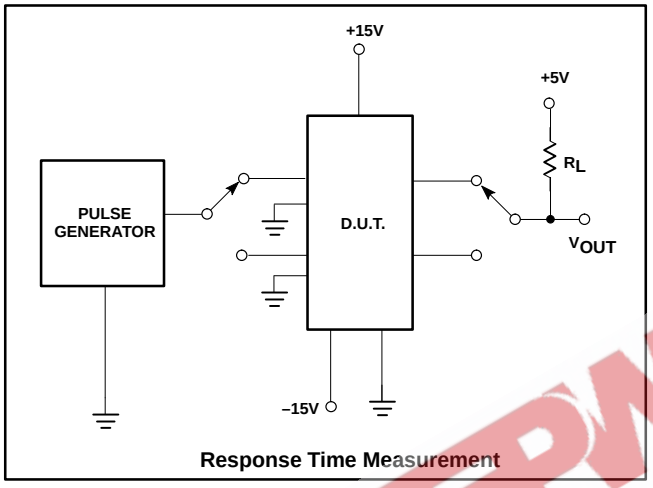
**NOTES:**
1. $V_{OS}$, $I_{OS}$ and $I_B$ specifications apply for a supply voltage range of $V_S$=±15V down to a single 5V supply.
2. The offset voltages and offset currents given are the maximum values required to drive the output to within 1V of either supply with a 1mA load. Thus these parameters define an error band and take into account the worst case effects of voltage gain and input impedance.

## AC ELECTRICAL CHARACTERISTICS

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $t_R$ | Response time[1] | $V_S$=±15V, $T_A$=25°C<br>$R_L$=500Ω (see test figure) | | 80 | | ns |

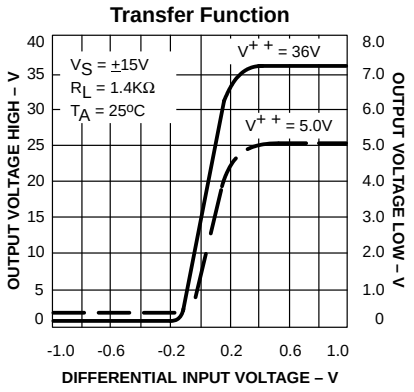
**NOTES:**
1. The response time specified is for a 100mV step with 5mV overdrive.

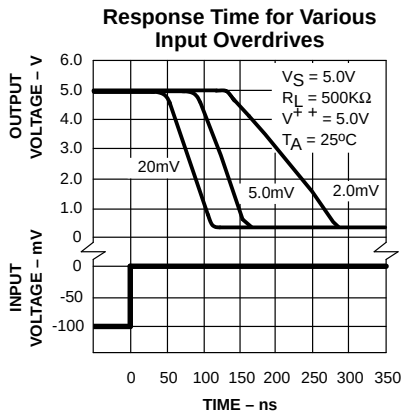
## TEST CIRCUIT

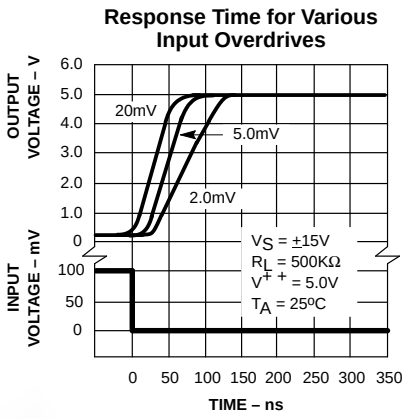


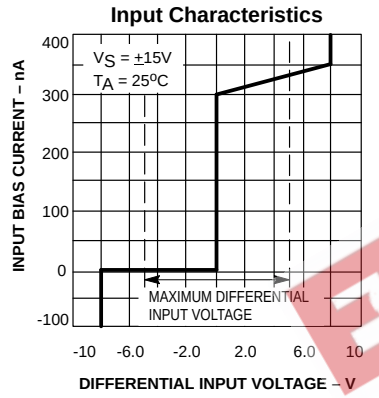

**Response Time Measurement**

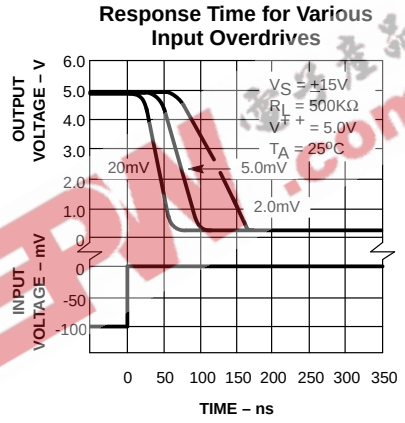
## TYPICAL PERFORMANCE CHARACTERISTICS

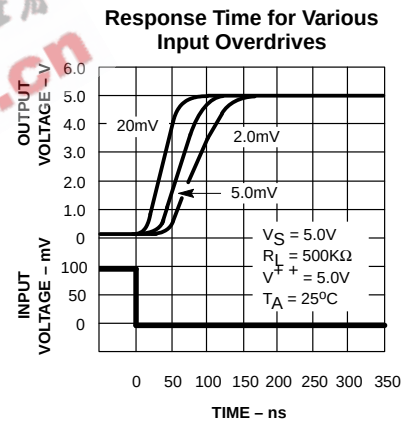


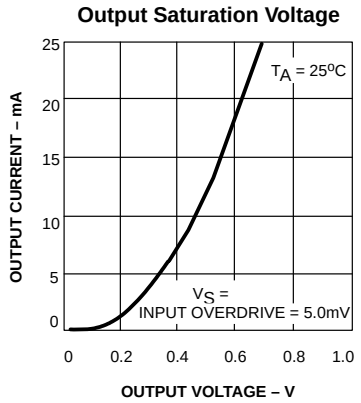



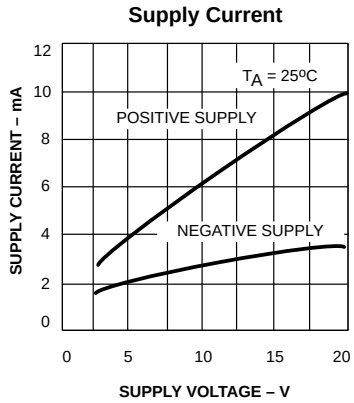



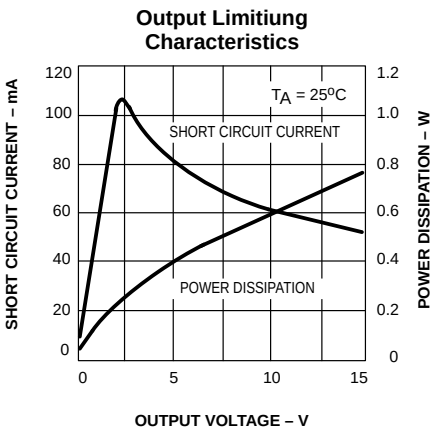



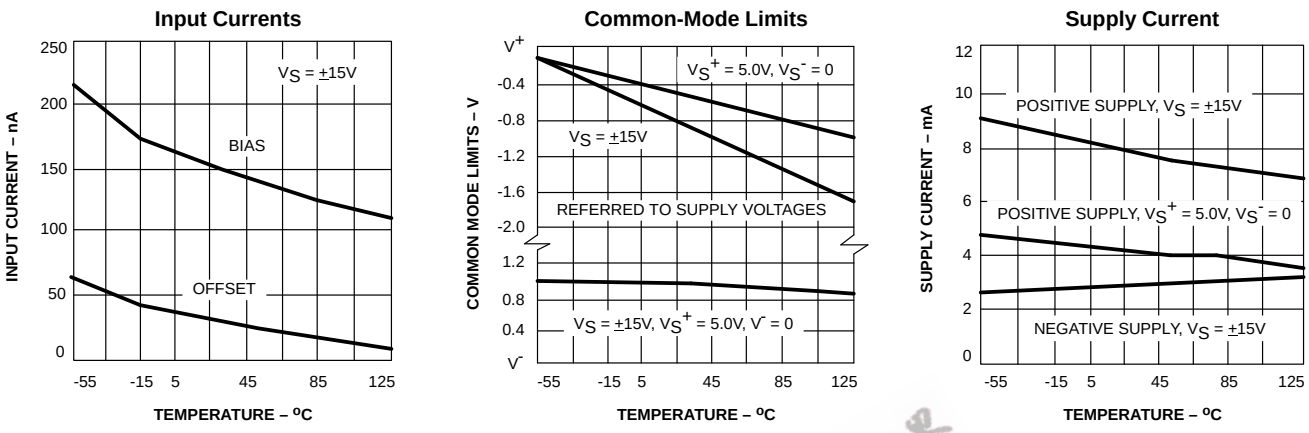



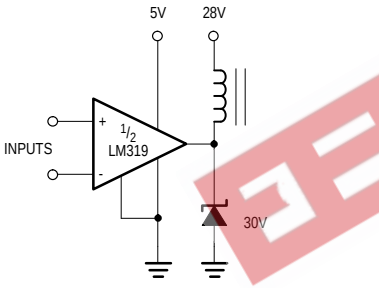



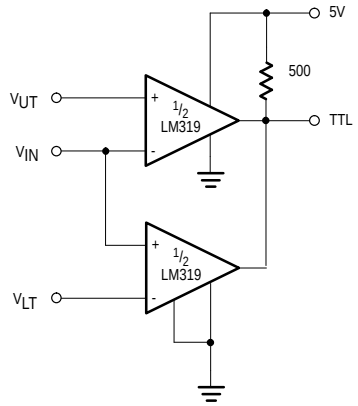
## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)




## TYPICAL APPLICATIONS

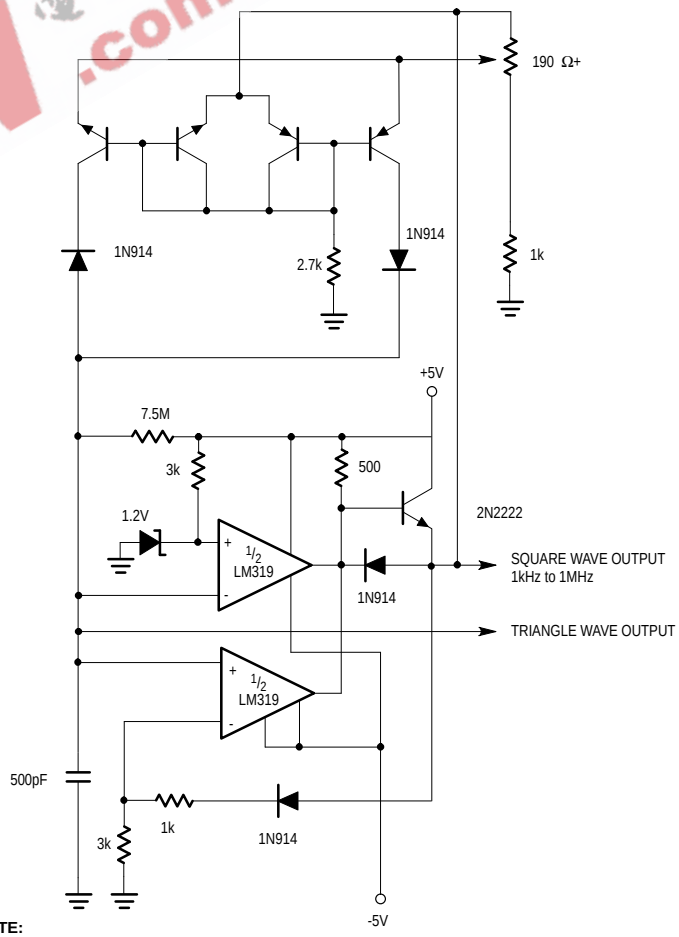



**Relay Driver**




**Window Detector**

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




**NOTE:**
Frequency adjust must be buffered for $R_L \leq 10\Omega$

**Wide Range Variable Oscillator**