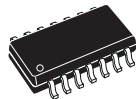
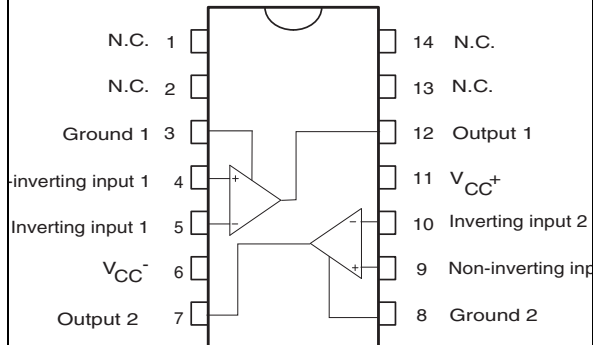


**DIP14**  
(plastic package)



**SO-14**  
(plastic micropackage)



**Pin connections**  
(top view)

### Features

- Two independent comparators
- Supply voltage: +5 V to  $\pm 15$  V
- Typically 80 ns response time at  $\pm 15$  V
- Minimum fan-out of two each side
- Maximum input current of 1  $\mu$ A over the operating temperature range
- Inputs and outputs can be isolated from system ground
- High common-mode slew rate

### Description

These products are precision high-speed dual comparators designed to operate over a wide range of supply voltages down to a single 5 V logic supply and ground. They feature low input currents and high gains.

The open collector of the output stage makes them compatible with transistor-transistor logic (TTL) as well as capable of driving lamps and relays at currents up to 25 mA.

Although designed primarily for applications requiring operation from digital logic supplies, these comparators are fully specified for power supplies up to  $\pm 15$  V.

They feature faster response times than the LM111 at the expense of higher current consumption. However, the high speed, wide operating voltage range and low package count make the LM119, LM219, and LM319 much more versatile.

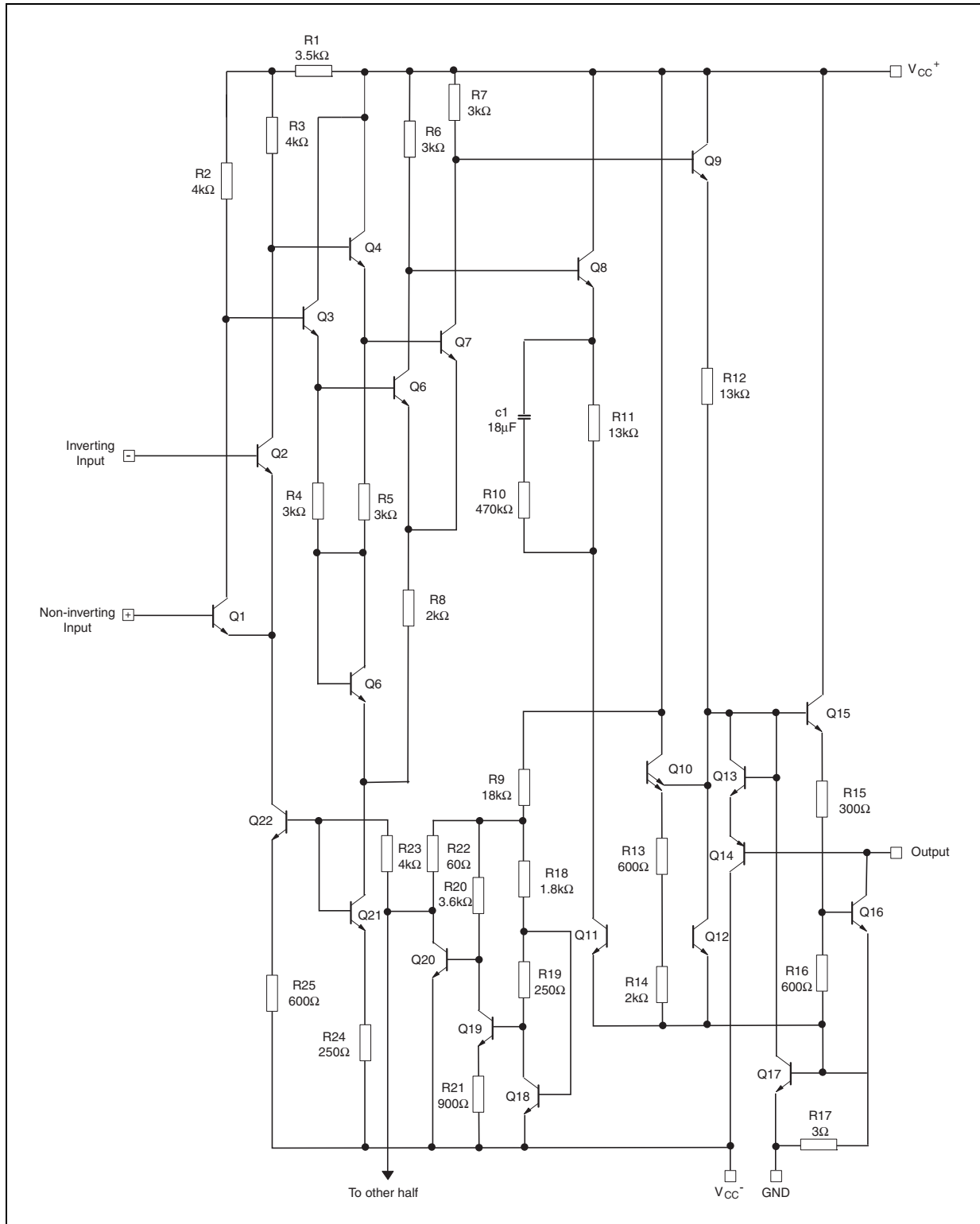
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# 1 Schematic diagram

Figure 1. Circuit schematics (1/2 LM119)



## 2 Absolute maximum ratings and operating conditions

**Table 1. Absolute maximum ratings (AMR)**

| Symbol           | Parameter  | Value       | Unit |
|------------------|--|-------------|------|
| $V_o - V_{CC^-}$ | Output to negative supply voltage                        | 36          | V    |
| $V_{CC^-}$       | Negative supply voltage                                  | -25         |      |
| $V_{CC^+}$       | Positive supply voltage                                  | 18          |      |
| $V_{id}$         | Differential input voltage                               | $\pm 5$     |      |
| $V_i$            | Input voltage <sup>(1)</sup>                             | $\pm 15$    |      |
|                  | Output short-circuit to ground                           | Infinite    |      |
| $T_j$            | Maximum junction temperature                             | 150         | °C   |
| $T_{stg}$        | storage temperature range                                | -65 to +150 |      |
| $R_{thja}$       | Thermal resistance junction to ambient <sup>(2)(3)</sup> |             | °C/W |
|                  | DIP14<br>SO-14   | 80<br>105   |      |
| $R_{thjc}$       | Thermal resistance junction to case <sup>(2)(3)</sup>    |             |      |
|                  | DIP14<br>SO-14   | 33<br>31    |      |
| ESD              | HBM: human body model <sup>(4)</sup>                     | 400         | V    |
|                  | MM: machine model <sup>(5)</sup>                         | 100         |      |
|                  | CDM: charged device model <sup>(6)</sup>                 | 1500        |      |

- For supply voltages lower than  $\pm 15$  V the absolute maximum input voltage is equal to the supply voltage.
- Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuits on all amplifiers.
- $R_{th}$  are typical values.
- Human body model: 100 pF discharged through a 1.5 k $\Omega$  resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
- Machine model: a 200 pF cap is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5  $\Omega$ ), done for all couples of pin combinations with other pins floating.
- Charged device model: all pins and the package are charged together to the specified voltage and then discharged directly to the ground through only one pin. This is done for all pins.

**Table 2. Operating conditions**

| Symbol     | Parameter                            | Value         | Unit |
|------------|--------------------------------------|---------------|------|
| $V_{CC}$   | Supply voltage                       | 5 to $\pm 15$ | V    |
| $T_{oper}$ | Operating free-air temperature range |               | °C   |
|            | LM119                                | -55 to + 125  |      |
|            | LM219                                | -45 to + 105  |      |
|            | LM319                                | 0 to + 70     |      |

### 3 Electrical characteristics

Table 3.  $V_{CC} = \pm 15\text{ V}$ ,  $T_{amb} = +25\text{ }^\circ\text{C}$  (unless otherwise specified)

| Symbol     | Parameter  | LM119, LM219  |              |             | LM319         |             |              | Unit          |
|------------|--|---------------|--------------|-------------|---------------|-------------|--------------|---------------|
|            |  | Min.          | Typ.         | Max.        | Min           | Typ.        | Max.         |               |
| $V_{io}$   | Input offset voltage ( $R_s \leq 5\text{ k}\Omega$ ) <sup>(1)(2)</sup><br>$T_{min} \leq T_{amb} \leq T_{max}$  |               | 0.7          | 4<br>7      |               | 2           | 8<br>10      | mV            |
| $I_{io}$   | Input offset current <sup>(1)</sup><br>$T_{min} \leq T_{amb} \leq T_{max}$   |               | 30           | 75<br>100   |               | 80          | 200<br>300   | nA            |
| $I_{ib}$   | Input bias current <sup>(1)</sup><br>$T_{min} \leq T_{amb} \leq T_{max}$   |               | 150          | 500<br>1000 |               | 250         | 1000<br>1200 |               |
| $A_{vd}$   | Large signal voltage gain  | 10            | 40           |             | 8             | 40          |              | V/mV          |
| $I_{CC}^+$ | Positive supply current<br>$V_{CC} = \pm 15\text{ V}$<br>$V_{CC}^+ = +5\text{ V}$ , $V_{CC}^- = 0\text{ V}$  |               | 8<br>4.3     | 11.5        |               | 8<br>4.3    | 12.5         | mA            |
| $I_{CC}^-$ | Negative supply current  |               | 3            | 4.5         |               | 3           | 5            |               |
| $V_{icm}$  | Input common mode voltage range<br>$V_{CC} = \pm 15\text{ V}$<br>$V_{CC}^+ = +5\text{ V}$ , $V_{CC}^- = 0\text{ V}$  | $\pm 12$<br>1 | $\pm 13$     | 3           | $\pm 12$<br>1 | $\pm 13$    | 3            | V             |
| $V_{OL}$   | Low level output voltage<br>$I_o = 25\text{ mA}$<br>$V_i \leq -5\text{ mV}$<br>$V_i \leq -10\text{ mV}$<br>$T_{min} \leq T_{amb} \leq T_{max}$<br>$V_{CC}^+ \geq +4.5\text{ V}$ , $V_{CC}^- = 0\text{ V}$ , $I_{o(sink)} < 3.2\text{ mA}$<br>$V_i \leq -6\text{ mV}$<br>$V_i \leq -10\text{ mV}$ |               | 0.75<br>0.23 | 1.5<br>0.4  |               | 0.75<br>0.3 | 1.5<br>0.4   |               |
| $I_{OH}$   | High level output current ( $V_o = +35\text{ V}$ )<br>$V_i \geq 5\text{ mV}$<br>$V_i \geq 10\text{ mV}$<br>$T_{min} \leq T_{amb} \leq T_{max}$ , $V_i \geq 5\text{ mV}$  |               | 0.2<br>1     | 2<br>10     |               | 0.2         | 10           | $\mu\text{A}$ |
| $t_{res}$  | Response time <sup>(3)</sup>   |               | 80           |             |               | 80          |              | ns            |

- These specifications apply for  $V_{CC} = \pm 15\text{ V}$ , unless otherwise stated. The offset voltage, offset current and bias current specifications apply for any supply voltage from a single +5 V up to  $\pm 15\text{ V}$  supplies. The offset voltages and offset current given are the maximum values required to drive the output down to 1V or up to +14 V with a 1 mA load current. Thus, these parameters define an error band and take into account the worst case effects of voltage gain and input impedance.
- At output switch point,  $V_o \approx 1.4\text{ V}$ , no load, with  $V_{CC}$  from 5 V to  $\pm 15\text{ V}$  and over the full input common-mode range.
- The response time specified is for a 100 mV input step with 5 mV overdrive.

Figure 2. Input bias currents (LM119, LM219)

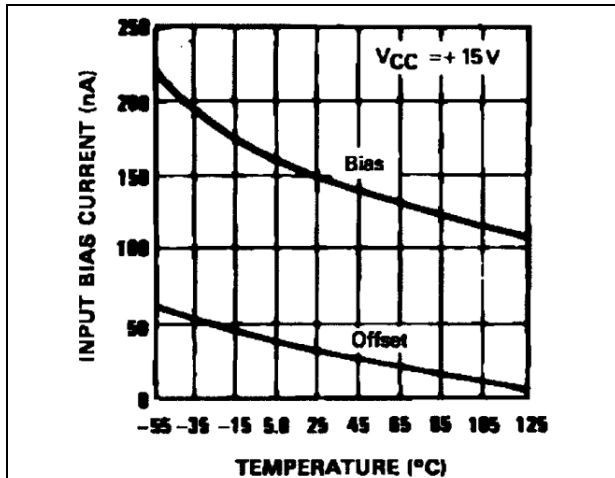


Figure 3. Common mode limits (LM119, LM219)

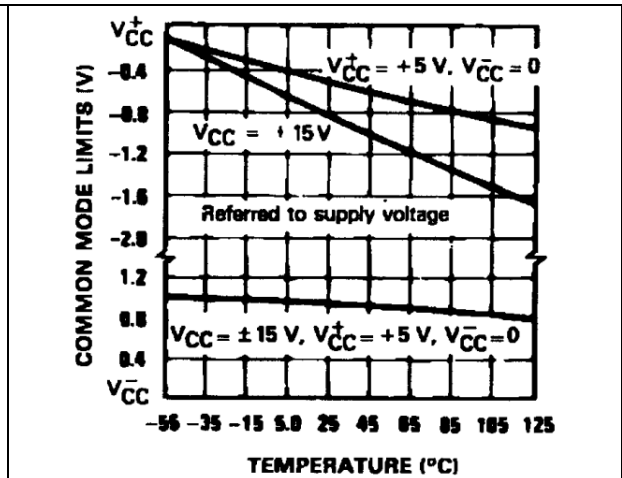


Figure 4. Output saturation voltage (LM119, LM219)

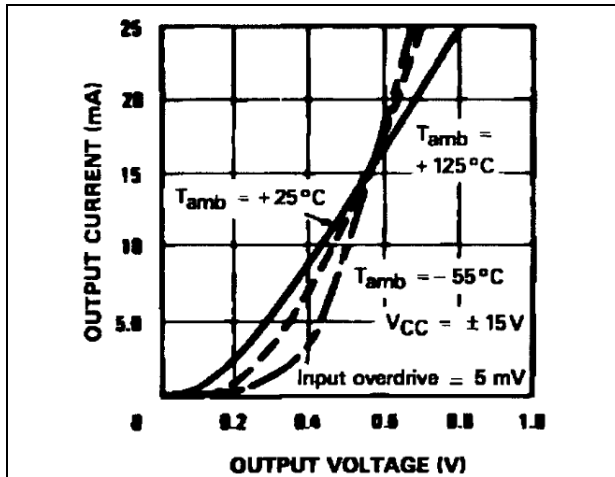


Figure 5. Supply current (LM119, LM219)

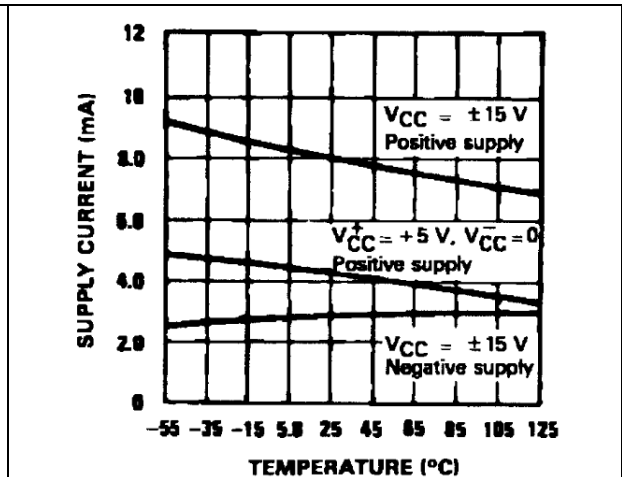


Figure 6. Supply current (LM119, LM219)

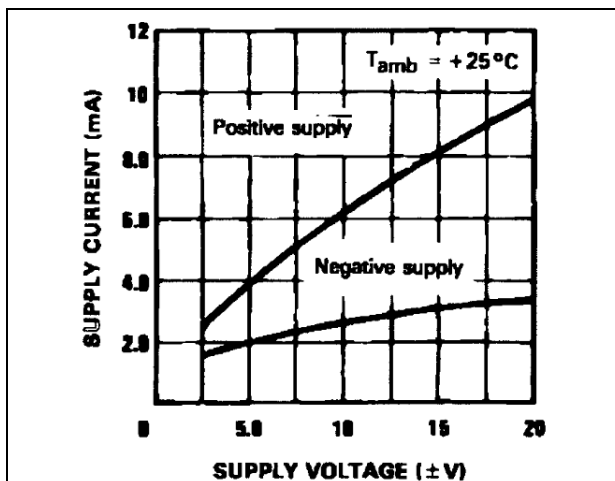


Figure 7. Output limiting characteristics (LM119, LM219)

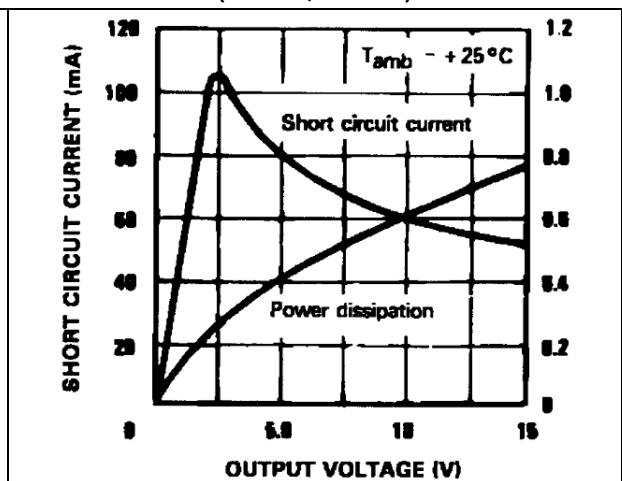


Figure 8. Input bias currents (LM319)

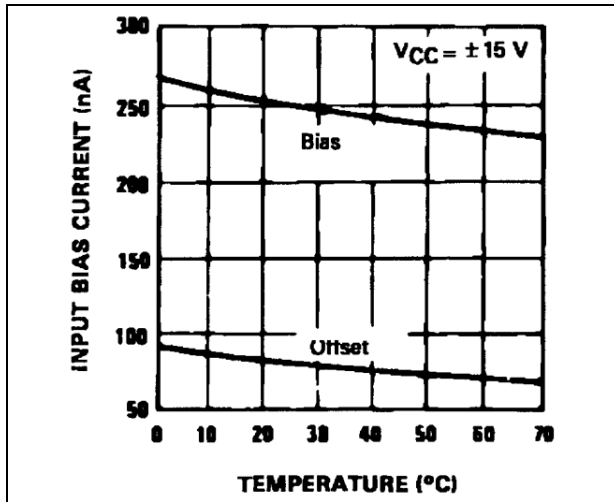


Figure 9. Common mode limits (LM319)

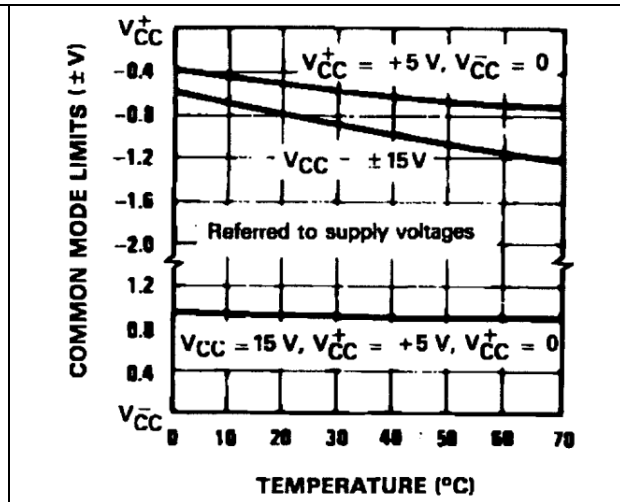


Figure 10. Output saturation voltage (LM319)

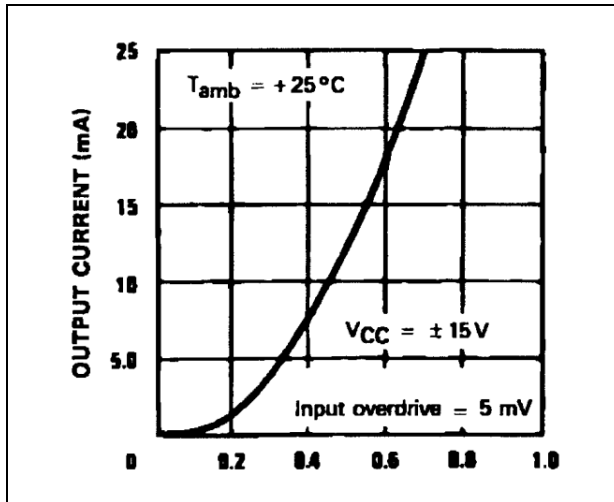


Figure 11. Supply current (LM319)

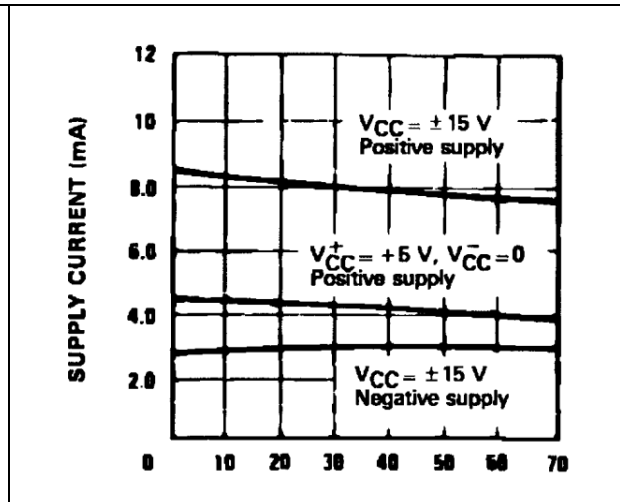


Figure 12. Transfer function

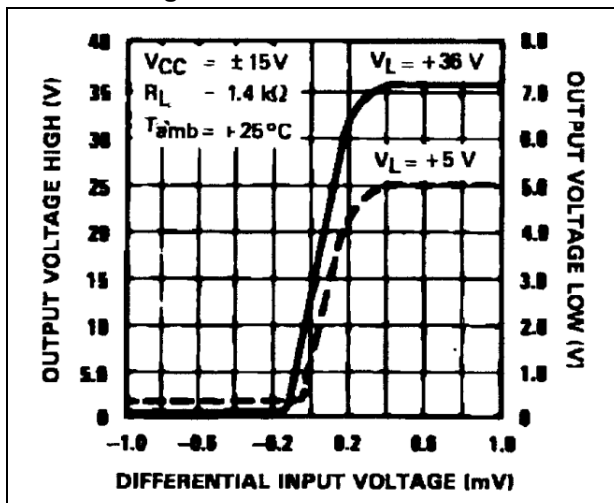


Figure 13. Input characteristics

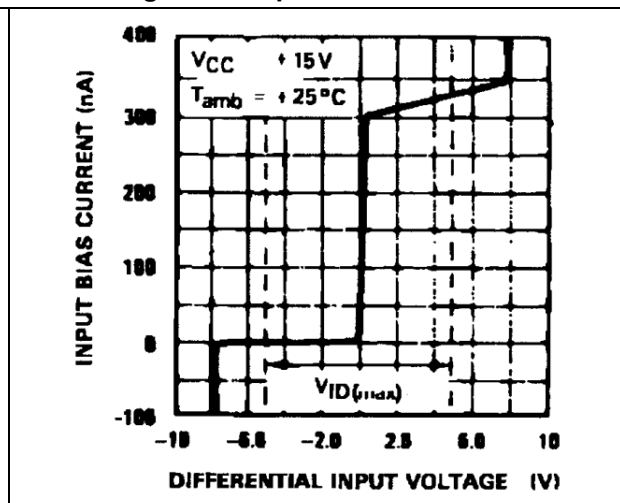


Figure 14. Response time on falling edge,  $V_{CC} = \pm 15\text{ V}$

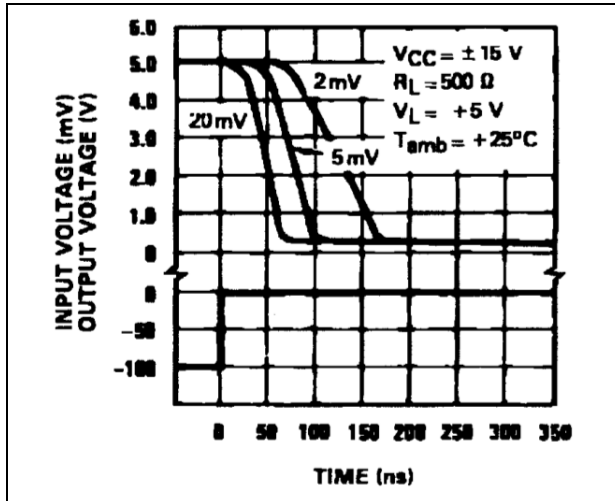


Figure 15. Response time on rising edge,  $V_{CC} = \pm 15\text{ V}$

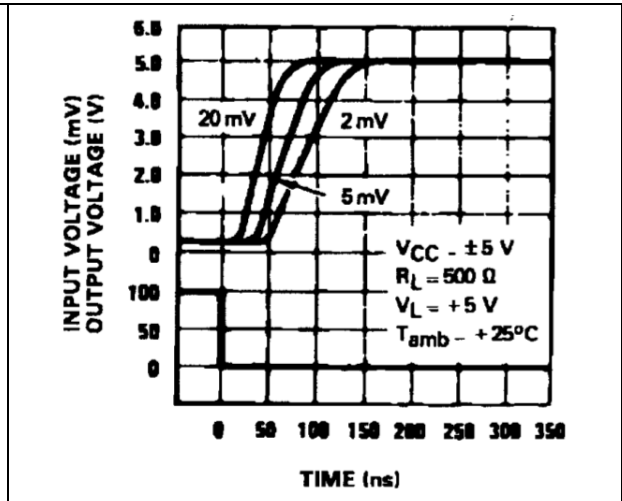


Figure 16. Response time on falling edge,  $V_{CC} = \pm 5\text{ V}$

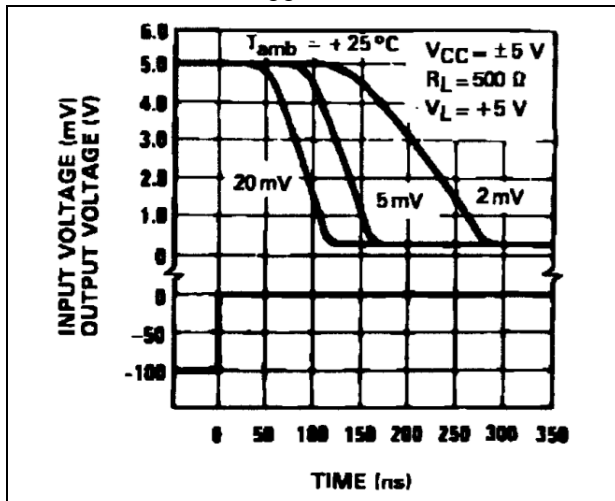
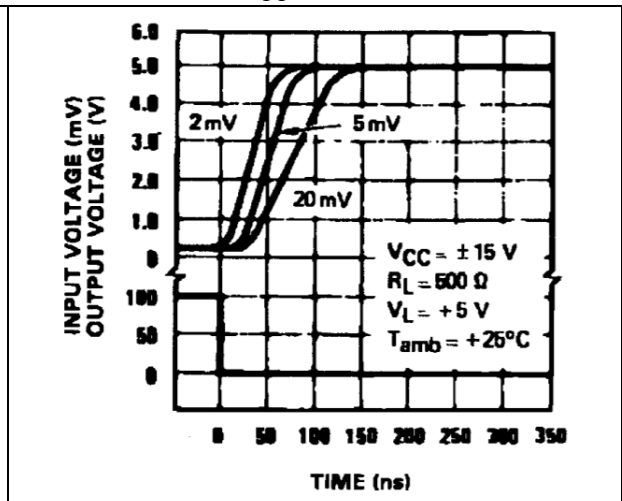


Figure 17. Response time on rising edge,  $V_{CC} = \pm 15\text{ V}$





# 4 Typical application diagrams

Figure 18. Relay driver

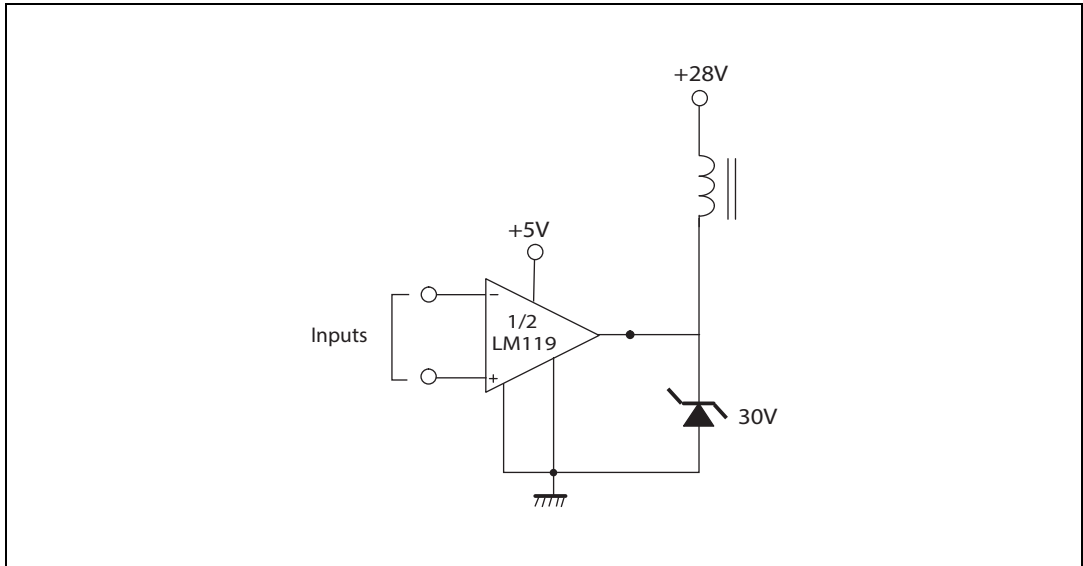
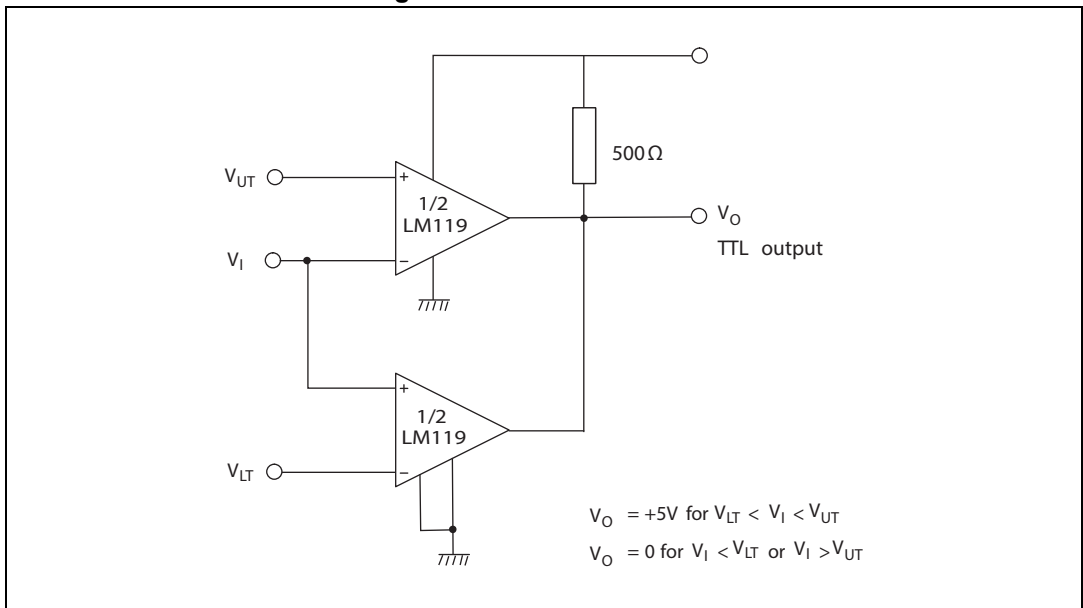


Figure 19. Window detector



## 5 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

### 5.1 DIP14 package information

Figure 20. DIP14 package mechanical drawing

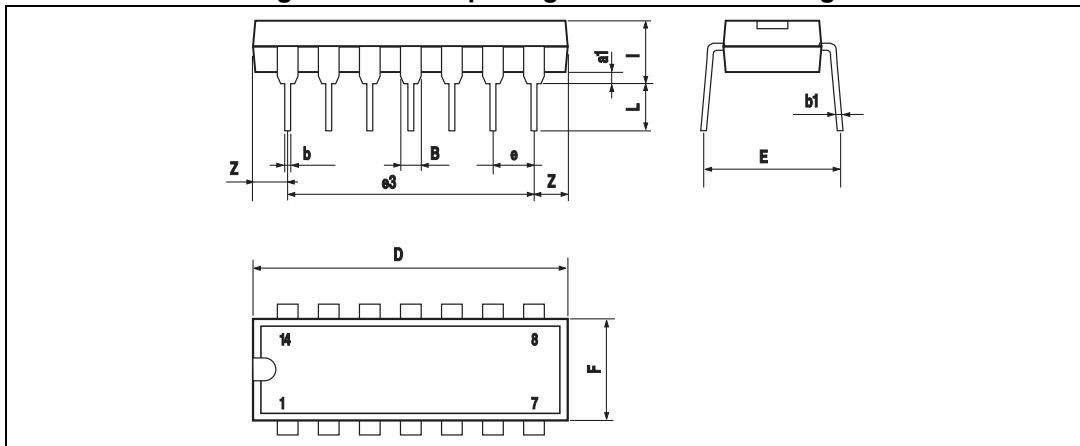


Table 4. DIP14 package mechanical data

| Ref. | 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 |
| L    |             |       | 5.1  |        |       | 0.201 |
| L    |             | 3.3   |      |        | 0.130 |       |
| Z    | 1.27        |       | 2.54 | 0.050  |       | 0.100 |

## 5.2 SO-14 package information

Table 5. SO-14 package mechanical drawing

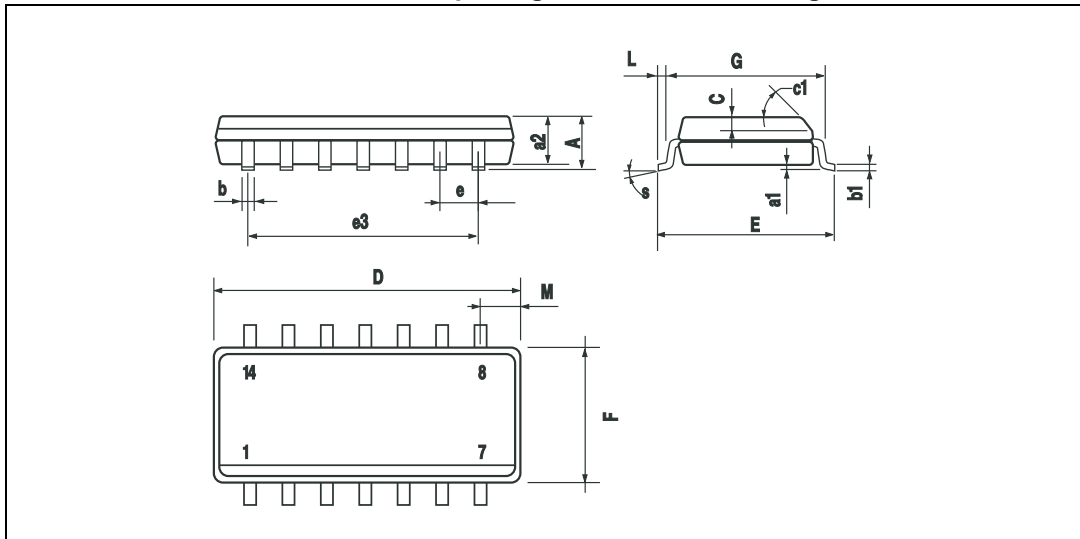


Table 6. SO-14 package mechanical data

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    |             |      | 1.75 |        |       | 0.068 |
| a1   | 0.1         |      | 0.2  | 0.003  |       | 0.007 |
| a2   |             |      | 1.65 |        |       | 0.064 |
| b    | 0.35        |      | 0.46 | 0.013  |       | 0.018 |
| b1   | 0.19        |      | 0.25 | 0.007  |       | 0.010 |
| C    |             | 0.5  |      |        | 0.019 |       |
| c1   | 45° (typ.)  |      |      |        |       |       |
| D    | 8.55        |      | 8.75 | 0.336  |       | 0.344 |
| E    | 5.8         |      | 6.2  | 0.228  |       | 0.244 |
| e    |             | 1.27 |      |        | 0.050 |       |
| e3   |             | 7.62 |      |        | 0.300 |       |
| F    | 3.8         |      | 4.0  | 0.149  |       | 0.157 |
| G    | 4.6         |      | 5.3  | 0.181  |       | 0.208 |
| L    | 0.5         |      | 1.27 | 0.019  |       | 0.050 |
| M    |             |      | 0.68 |        |       | 0.026 |
| S    | 8° (max.)   |      |      |        |       |       |

## 6 Ordering information

Figure 21. Order codes

| Order code        | Temperature range | Package | Packaging                | Marking |
|-------------------|-------------------|---------|--------------------------|---------|
| LM119N            | -55 °C to +125 °C | DIP14   | Tube                     | LM119N  |
| LM119D<br>LM119DT |                   | SO-14   | Tube or<br>Tape and reel | 119     |
| LM219N            | -45 °C to +105 °C | DIP14   | Tube                     | LM219N  |
| LM219D<br>LM219DT |                   | SO-14   | Tube or<br>Tape and reel | 219     |
| LM319N            | 0 °C to +70 °C    | DIP14   | Tube                     | LM319N  |
| LM319D<br>LM319DT |                   | SO-14   | Tube or<br>Tape and reel | 319     |

## 7 Revision history

Figure 22. Document revision history

| Date        | Revision | Changes  |
|-------------|----------|--|
| 5-Jul-2002  | 1        | Initial release.   |
| 28-Jan-2007 | 2        | Added ESD, $R_{thja}$ parameters in <a href="#">Table 1: Absolute maximum ratings (AMR)</a> .<br>Expanded orderable parts table, see <a href="#">Table 21: Order codes</a> .<br>Updated document format. |
| 26-Mar-2013 | 3        | Minimum operating temperature changed from -40 °C to -45 °C.<br>Updated titles of <a href="#">Figure 14</a> , <a href="#">Figure 15</a> , <a href="#">Figure 16</a> , and <a href="#">Figure 17</a> .    |

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