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# LM119-LM219-LM319

## High speed dual comparators

### Features

- Two independent comparators
- Supply voltage: +5V to  $\pm 15V$
- Typically 80ns response time at  $\pm 15V$
- Minimum fan-out of 2 each side
- Maximum input current of  $1\mu A$  over operating temperature range
- Inputs and outputs can be isolated from system ground
- High common-mode slew rate

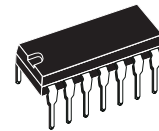
### Description

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

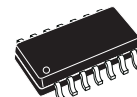
The open collector of the output stage makes it compatible with TTL as well as capable of driving lamps and relays at currents up to 25mA.

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

They feature faster response than LM111 at the expense of higher current consumption. However, the high speed, wide operating voltage range and low package count make the LM119/219/319 much more versatile.

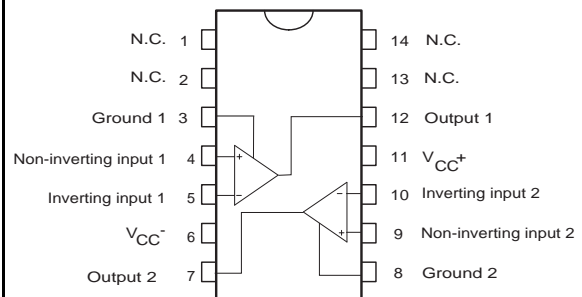


**DIP14**  
(Plastic package)



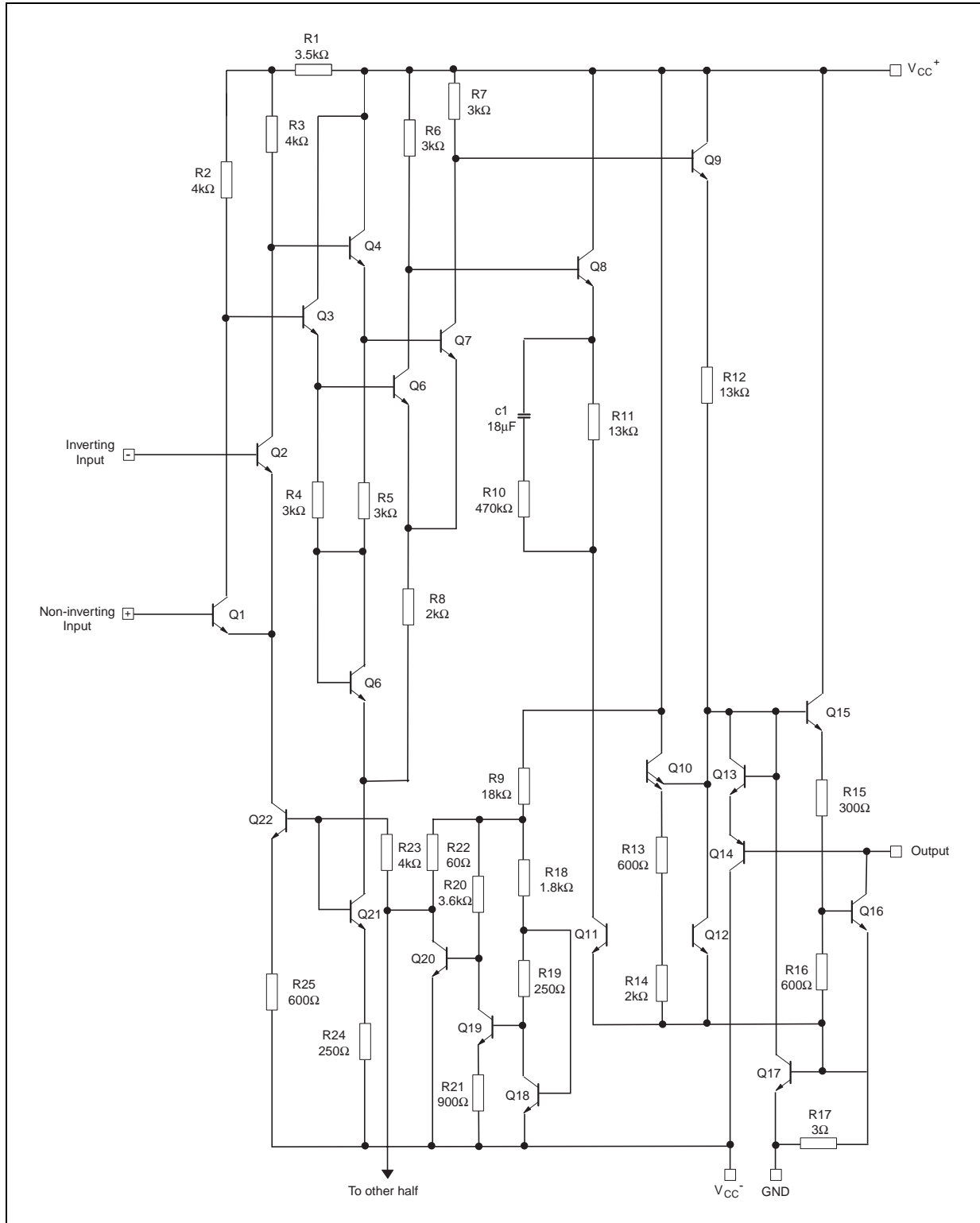
**SO-14**  
(Plastic micropackage)

### Pin connections (Top view)



# 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
$V_{CC^+}$	Positive supply voltage	18	V
$V_{id}$	Differential input voltage	$\pm 5$	V
$V_i$	Input voltage <sup>(1)</sup>	$\pm 15$	V
	Output short-circuit to ground	Infinite	
$T_j$	Maximum junction temperature	150	°C
$T_{stg}$	storage temperature range	-65 to +150	°C
$R_{thja}$	Thermal resistance junction to ambient <sup>(2) (3)</sup>		°C/W
	DIP14 SO-14	80 105	
$R_{thjc}$	Thermal resistance junction to case <sup>(2) (3)</sup>		°C/W
	DIP14 SO-14	33 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  $\pm 15V$  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: 100pF discharged through a 1.5k $\Omega$  resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
- Machine model: a 200pF 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	-40 to + 105	
	LM319	0 to + 70	

### 3 Electrical characteristics

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

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

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

Figure 2. Input bias currents (LM119-219)

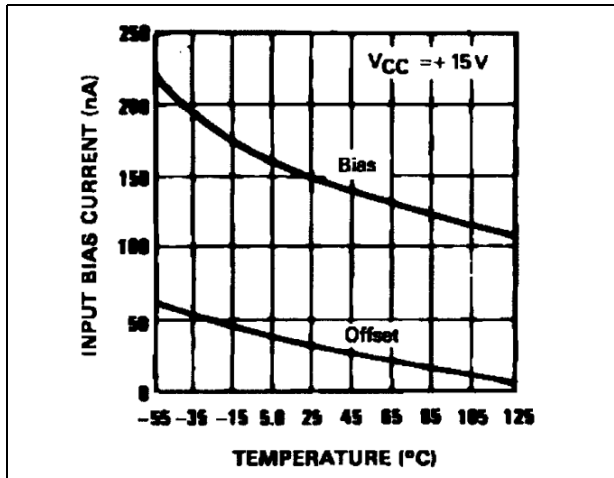


Figure 3. Common mode limits (LM119-219)

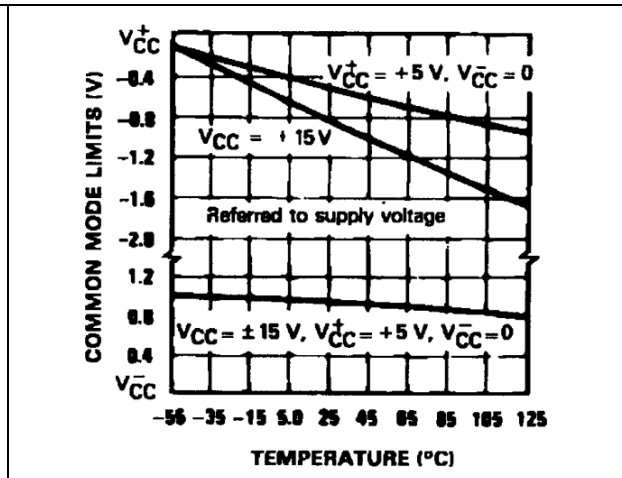


Figure 4. Output saturation voltage (LM119-219)

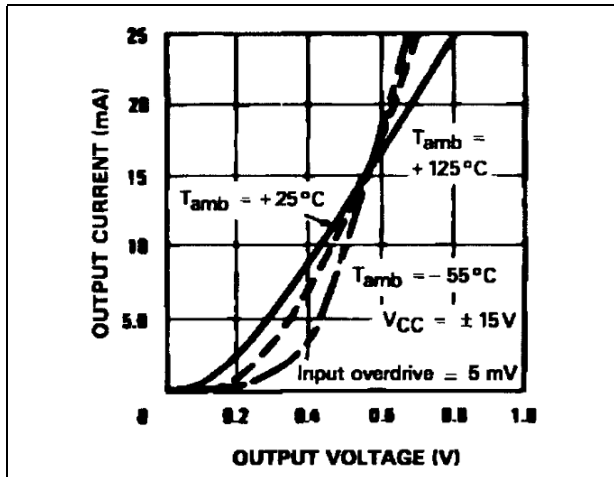


Figure 5. Supply current (LM119-219)

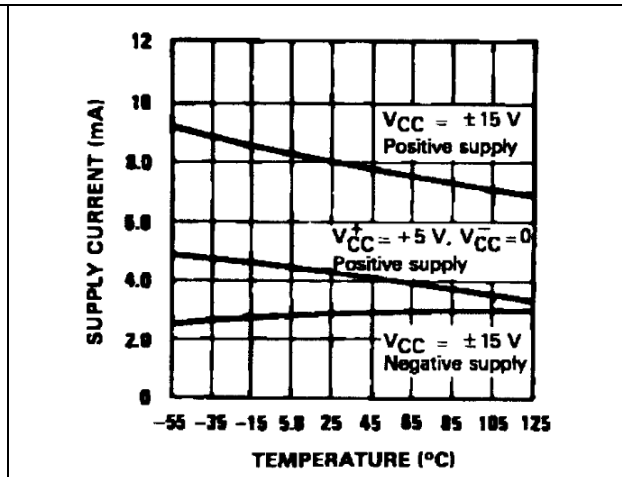


Figure 6. Supply current (LM119-219)

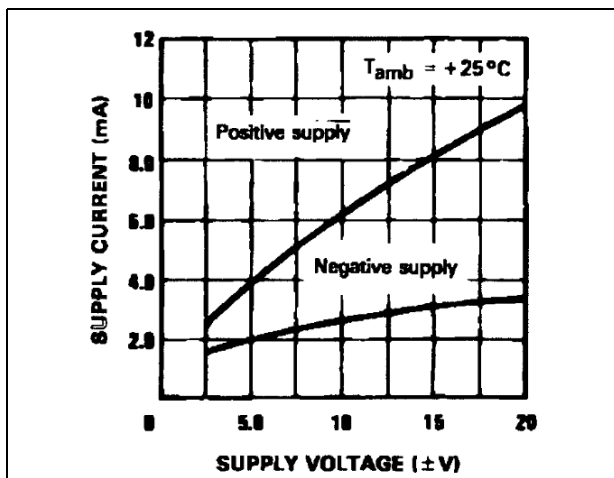


Figure 7. Output limiting characteristics (LM119-219)

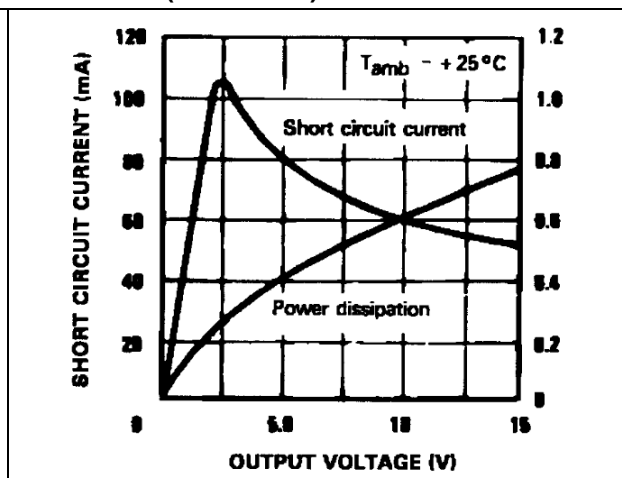


Figure 8. Input bias currents (LM319)

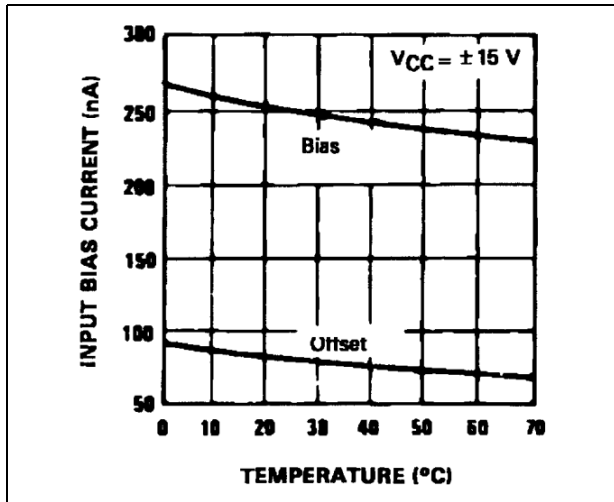


Figure 9. Common mode limits (LM319)

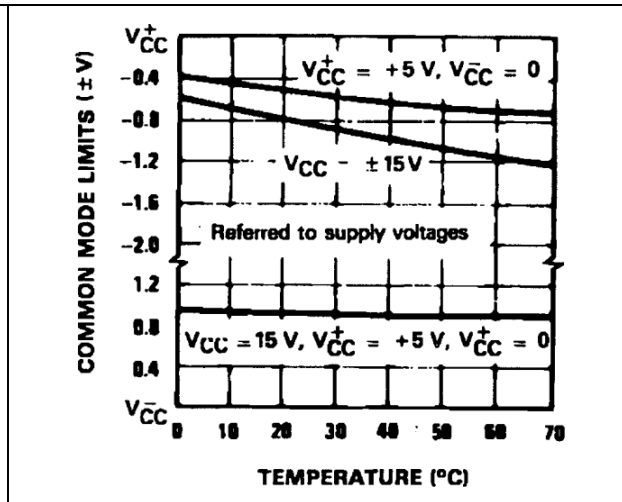


Figure 10. Output saturation voltage (LM319)

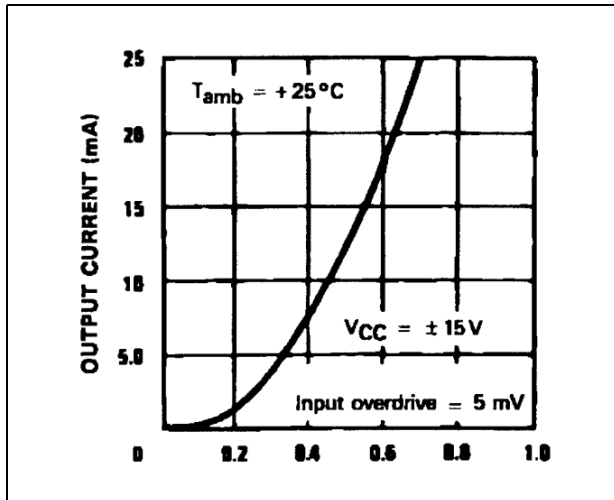


Figure 11. Supply current (LM319)

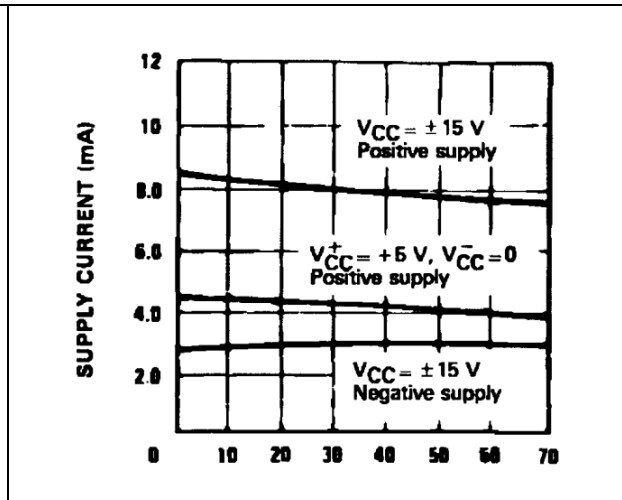


Figure 12. Transfer function

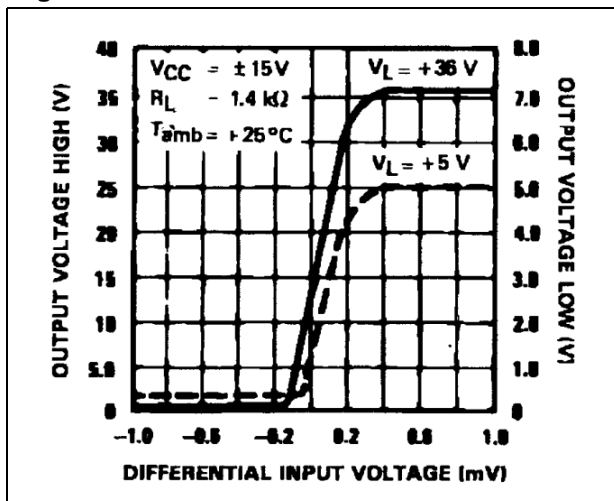


Figure 13. Input characteristics

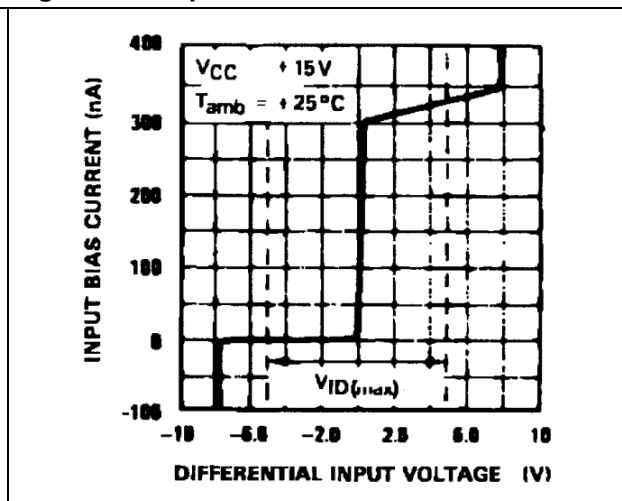


Figure 14. Response time for various input overdrives

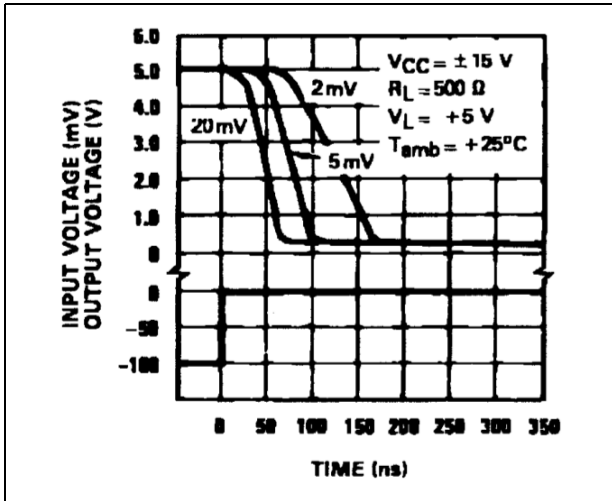


Figure 15. Response time for various input overdrives

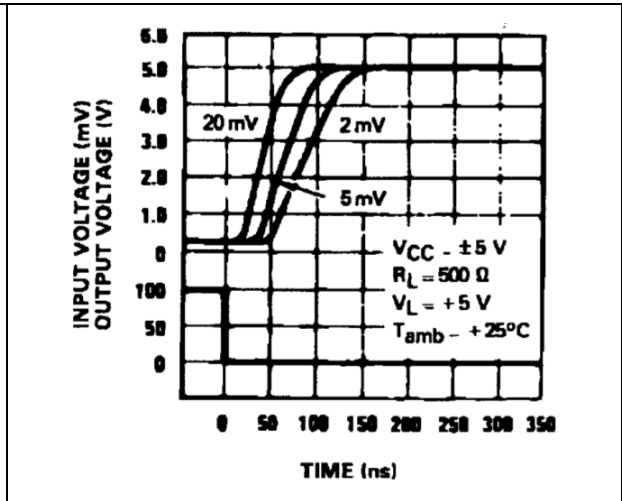


Figure 16. Response time for various input overdrives

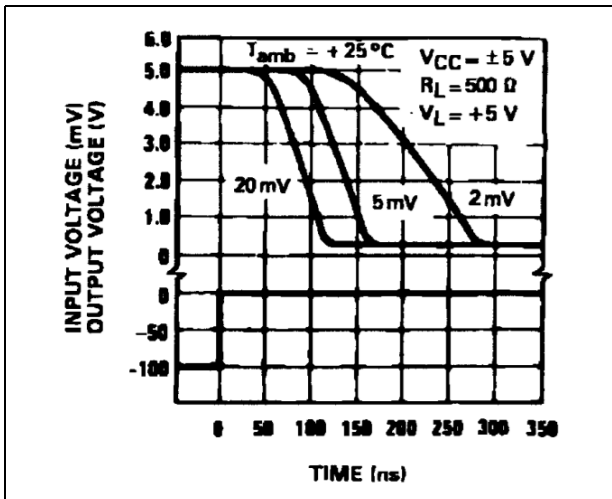
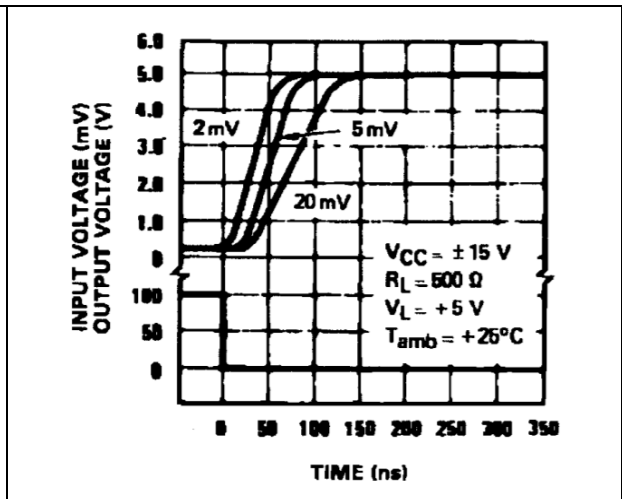


Figure 17. Response time for various input overdrives





## 4 Typical application diagrams

Figure 18. Relay driver

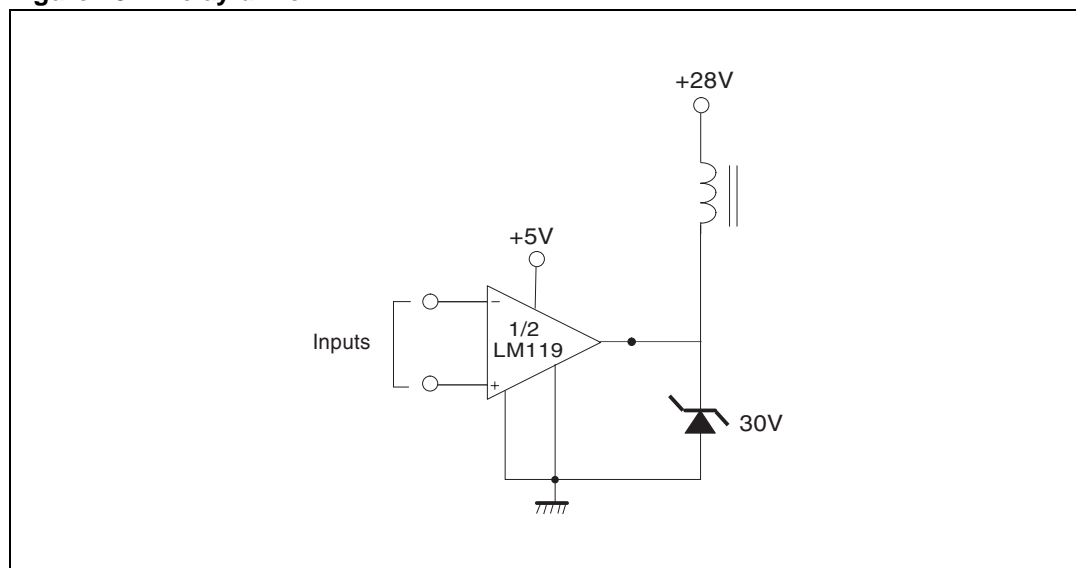
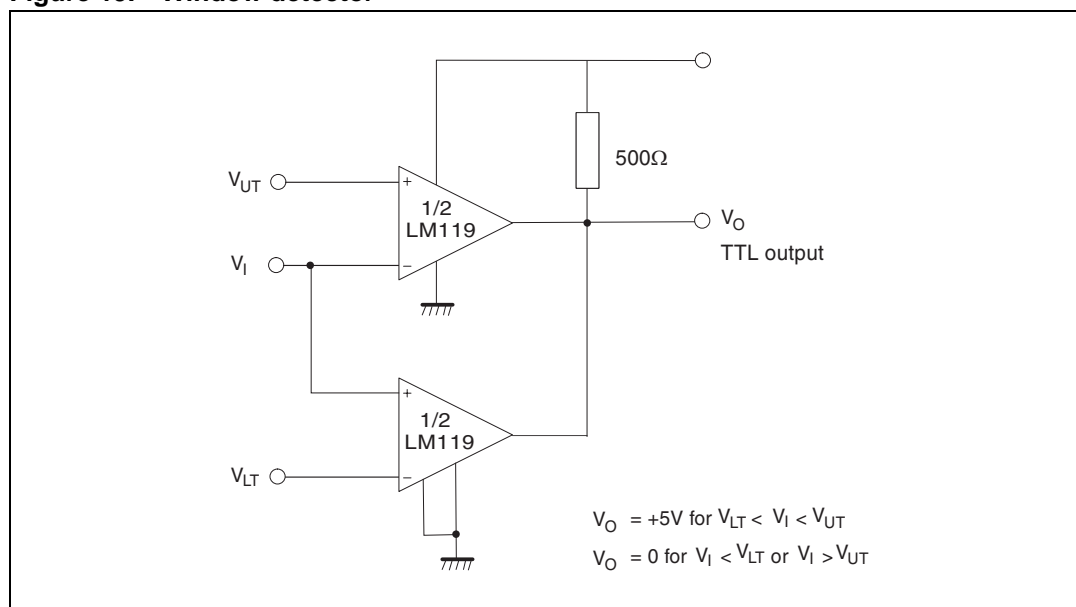


Figure 19. Window detector



## 5 Package information

In order to meet environmental requirements, ST offers these devices in ECOPACK<sup>®</sup> packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).

### 5.1 DIP14 package information

Figure 20. DIP14 package mechanical drawing

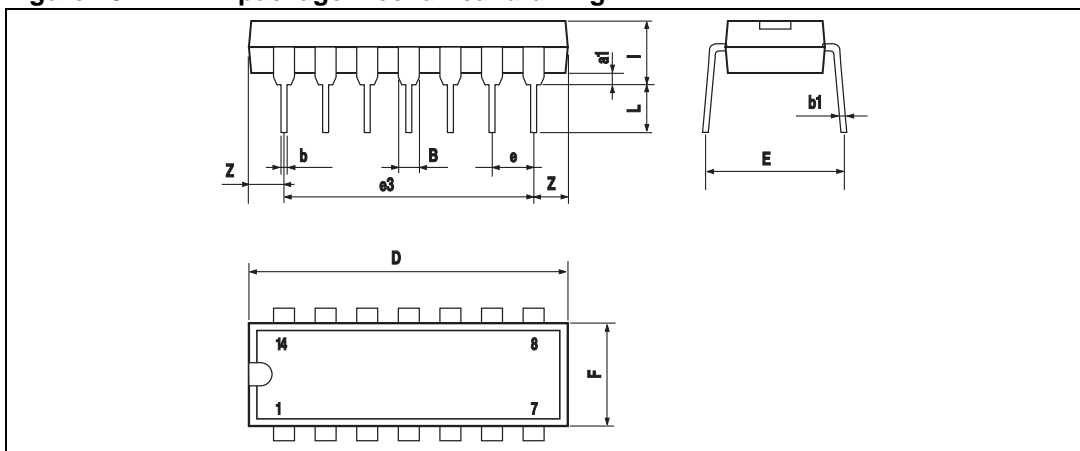


Table 4. DIP14 package mechanical data

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

Figure 21. SO-14 package mechanical drawing

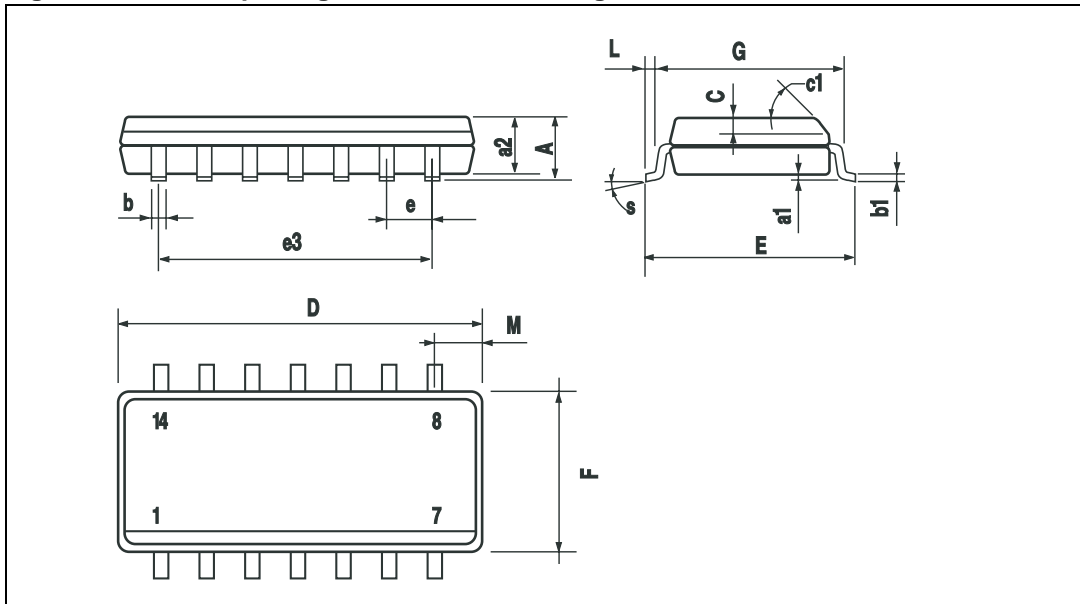


Table 5. SO-14 package mechanical data

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

**Table 6. Order codes**

Order code	Temperature range	Package	Packaging	Marking
LM119N	-55°C to +125°C	DIP14	Tube	LM119N
LM119D LM119DT		SO-14	Tube or Tape & reel	119
LM219N	-40°C to +105°C	DIP14	Tube	LM219N
LM219D LM219DT		SO-14	Tube or Tape & reel	219
LM319N	0°C to +70°C	DIP14	Tube	LM319N
LM319D LM319DT		SO-14	Tube or Tape & reel	319

## 7 Revision history

**Table 7. 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> . Expanded orderable parts table, see <a href="#">Table 6: Order codes</a> . Updated document format.

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