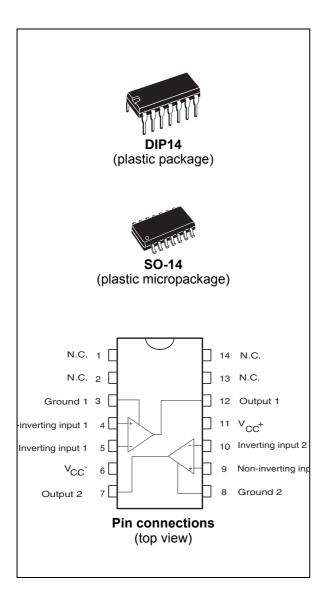


LM119, LM219, LM319

High-speed dual comparators

Datasheet - production data



Features

- Two independent comparators
- Supply voltage: +5 V to ±15 V
- Typically 80 ns response time at ±15 V
- · Minimum fan-out of two each side
- Maximum input current of 1 µA 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 ±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

R7 3kΩ R6 $4k\Omega$ 3kΩ Q9 $4k\Omega$ Q4 Q8 Q3 Q7 R12 Q6 c1 18μF R11 13kΩ Inverting Input Q2 R5 3kΩ R10 470kΩ $3k\Omega$ R8 2kΩ Non-inverting + Q1 Input Q6 Q15 Q13 R9 18kΩ 300Ω Q22 R23 R22 R13 600Ω - Output Q14 R18 1.8kΩ R20 $3.6k\Omega$ Q21 Q16 Q12 Q20 R16 R19 R14 R25 600Ω 250Ω 600Ω $2k\Omega$ Q19 R24 250Ω Q17 R21 900Ω Q18 R17 3Ω GND To other half v_{cc}-

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 _{CC} -	Negative supply voltage	-25	
V _{CC} ⁺	Positive supply voltage	18	V
V _{id}	Differential input voltage	±5	
V _i	Input voltage ⁽¹⁾	±15	
	Output short-circuit to ground	Infinite	
Tj	Maximum junction temperature	150	°C
T _{stg}	storage temperature range	-65 to +150	
R _{thja}	Thermal resistance junction to ambient ⁽²⁾⁽³⁾ DIP14 SO-14	80 105	°C/W
R _{thjc}	Thermal resistance junction to case ⁽²⁾⁽³⁾ DIP14 SO-14	33 31	C/VV
ESD	HBM: human body model ⁽⁴⁾ MM: machine model ⁽⁵⁾ CDM: charged device model ⁽⁶⁾	400 100 1500	V

- 1. For supply voltages lower than ±15 V the absolute maximum input voltage is equal to the supply voltage.
- 2. Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuits on all amplifiers.
- 3. Rth are typical values.
- 4. 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 Ω), done for all couples of pin
 combinations with other pins floating.
- 6. 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 ±15	V
T _{oper}	Operating free-air temperature range LM119 LM219 LM319	-55 to + 125 -45 to + 105 0 to + 70	°C

3 Electrical characteristics

Table 3. V_{CC} = ±15 V, T_{amb} = +25 °C (unless otherwise specified)

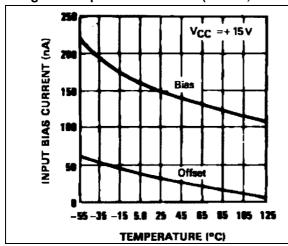
Symbol	Parameter		LM119, LM219			LM319		
Symbol			Тур.	Max.	Min	Тур.	Max.	Unit
V _{io}	Input offset voltage $(R_s \le 5 \text{ k}\Omega)^{(1)(2)}$ $T_{min} \le T_{amb} \le T_{max}$		0.7	4 7		2	8 10	mV
l _{io}	Input offset current $^{(1)}$ $T_{min} \le T_{amb} \le T_{max}$		30	75 100		80	200 300	nA
I _{ib}	Input bias current $^{(1)}$ $T_{min} \le T_{amb} \le T_{max}$		150	500 1000		250	1000 1200	TIA
A _{vd}	Large signal voltage gain	10	40		8	40		V/mV
l _{CC} ⁺	Positive supply current $V_{CC} = \pm 15 \text{ V}$ $V_{CC}^{+} = +5 \text{ V}, V_{CC}^{-} = 0 \text{ V}$		8 4.3	11.5		8 4.3	12.5	mA
I _{CC} -	Negative supply current		3	4.5		3	5	
V _{icm}	Input common mode voltage range V _{CC} = ±15 V V _{CC} ⁺ = +5 V, V _{CC} ⁻ = 0 V	±12	±13	3	±12	±13	3	
V _{OL}	Low level output voltage $\begin{split} &I_o = 25 \text{ mA} \\ &V_i \leq -5 \text{ mV} \\ &V_i \leq -10 \text{ mV} \\ &T_{min} \leq T_{amb} \leq T_{max} \\ &V_{CC}^+ \geq +4.5 \text{ V, } V_{CC}^- = 0 \text{ V, } I_{o(sink)} < 3.2 \text{ mA} \\ &V_i \leq -6 \text{ mV} \\ &V_i \leq -10 \text{ mV} \end{split}$		0.75	1.5		0.75	1.5	V
I _{OH}	$\begin{aligned} & \text{High level output current (V}_0 = +35 \text{ V}) \\ & V_i \geq 5 \text{ mV} \\ & V_i \geq 10 \text{ mV} \\ & T_{min} \leq T_{amb} \leq T_{max}, V_i \geq 5 \text{ mV} \end{aligned}$		0.2	2		0.2	10	μΑ
t _{res}	Response time ⁽³⁾		80			80		ns

^{1.} These specifications apply for V_{CC} = ±15 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 ±15 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.

^{2.} At output switch point, $V_0 \approx 1.4$ V, no load, with V_{CC} from 5 V to ±15 V and over the full input common-mode range.

^{3.} 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)



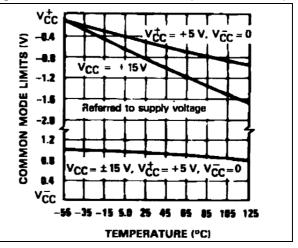


Figure 4. Output saturation voltage (LM119, LM219)

Tamb = +25°C

Tamb = +25°C

Tamb = -55°C

Figure 5. Supply current (LM119, LM219)

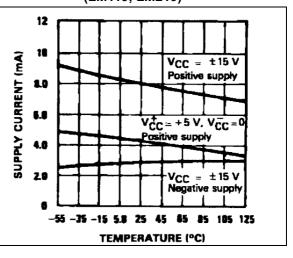
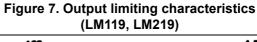
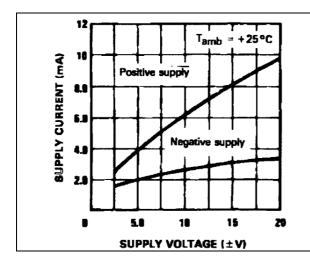


Figure 6. Supply current (LM119, LM219)

OUTPUT VOLTAGE (V)





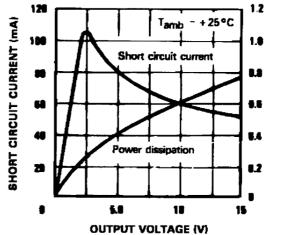


Figure 8. Input bias currents (LM319)

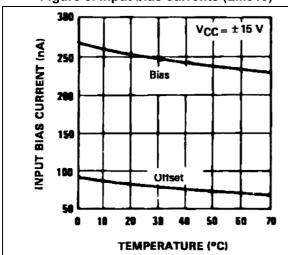


Figure 9. Common mode limits (LM319)

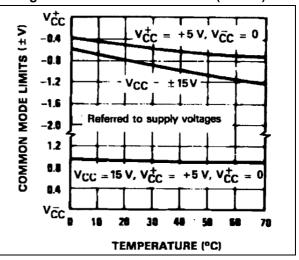


Figure 10. Output saturation voltage (LM319)

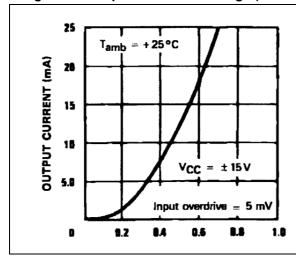


Figure 11. Supply current (LM319)

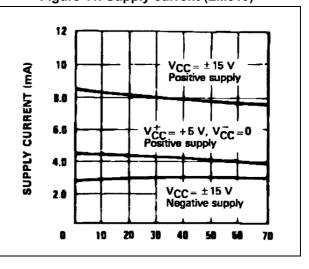


Figure 12. Transfer function

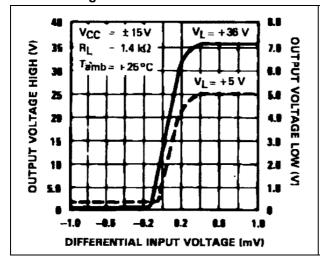


Figure 13. Input characteristics

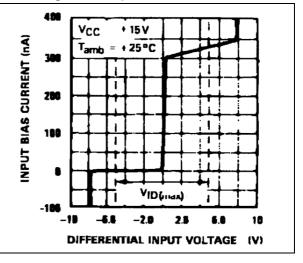




Figure 14. Response time on falling edge, $V_{CC} = \pm 15 \text{ V}$

6.0 VCC = ± 15 V 5.0 RL = 500 Ω 4.0 INPUT VOLTAGE (mV) OUTPUT VOLTAGE (V) VL= +5 V 20 mV 3.0 Tamb = +25°C 5_mV 24 1.5 -100 150 200 250 TIME (ns)

Figure 15. Response time on rising edge,

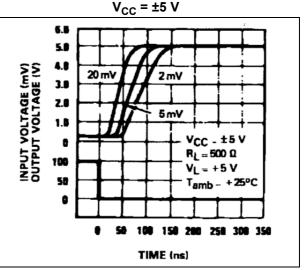
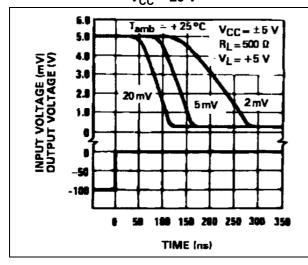
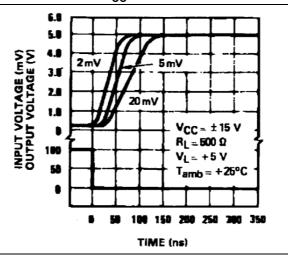


Figure 16. Response time on falling edge, $V_{CC} = \pm 5 V$



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



4 Typical application diagrams

Figure 18. Relay driver

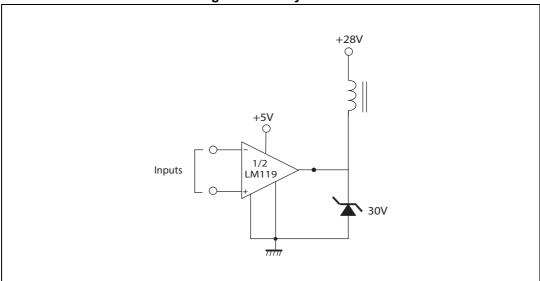
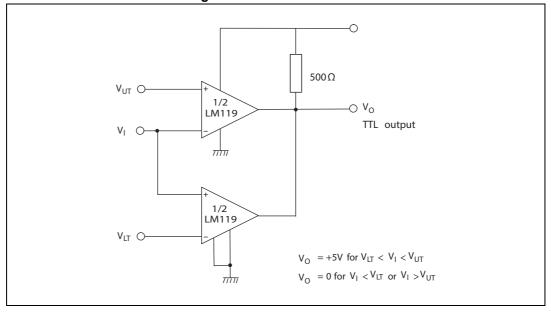


Figure 19. Window detector



5 Package information

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

5.1 DIP14 package information

Figure 20. DIP14 package mechanical drawing

Table 4. DIP14 package mechanical data

			Dime	nsions		
Ref.	Millimeters			Inches		
	Min.	Тур.	Max.	Min.	Тур.	Max.
a1	0.51			0.020		
В	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	
е		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

5.2 SO-14 package information

D M

Table 5. SO-14 package mechanical drawing

Table 6. SO-14 package mechanical data

			Dime	nsions			
Ref.	Millimeters			Inches			
	Min.	Тур.	Max.	Min.	Тур.	Max.	
Α			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	
С		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	
е		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	
М			0.68			0.026	
S	8° (max.)						

6 Ordering information

Figure 21. Order codes

Order code	Temperature range	Package	Packaging	Marking
LM119N		DIP14	Tube	LM119N
LM119D LM119DT	-55 °C to +125 °C	SO-14	Tube or Tape and reel	119
LM219N		DIP14	Tube	LM219N
LM219D LM219DT	-45 °C to +105 °C	SO-14	Tube or Tape and reel	219
LM319N		DIP14	Tube	LM319N
LM319D LM319DT	0 °C to +70 °C	SO-14	Tube or 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 <i>Table 1: Absolute maximum ratings</i> (<i>AMR</i>). Expanded orderable parts table, see <i>Table 21: Order codes</i> . Updated document format.			
26-Mar-2013	3	Minimum operating temperature changed from -40 °C to -45 °C. Updated titles of <i>Figure 14</i> , <i>Figure 15</i> , <i>Figure 16</i> , and <i>Figure 17</i> .			

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