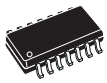
TS339

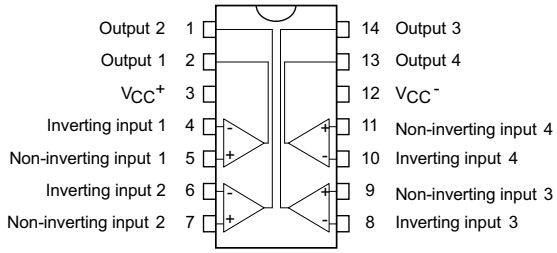
Micropower quad CMOS voltage comparator

Datasheet - production data



D
SO14
(plastic micropackage)

P
TSSOP14
(thin shrink small outline package)



Pin connections
top view

Features

- Extremely low supply current: 9 µA typ./comparator
- Wide single supply range 2.7 V to 16 V or dual supplies (±1.35 V to ±8 V)
- Extremely low input bias current: 1 pA typ.
- Extremely low input offset current: 1 pA typ.
- Input common-mode voltage range includes GND
- High input impedance: 10^{12} Ω typ.
- Fast response time: 1.5 µs typ. for 5 mV overdrive
- Pin-to-pin and functionally compatible with bipolar LM339 device

Description

The TS339 device is a micro-power, CMOS, quad voltage comparator with extremely low consumption of 9 µA typ./comparator (20 times less than the bipolar LM339). Similar performances are offered by the quad micro-power comparator TS3704 with a push-pull CMOS output. Thus response times remain similar to the LM339 device.

Table 1. Device summary

Order code	Temperature range	Package	Packaging	Marking
TS339CD/CDT	0 °C, 70 °C	SO14	Tube or tape and reel	S339C
TS339IDT	-40 °C, 125 °C			S339I
TS339IPT		TSSOP14	Tape and reel	

Contents

1 Absolute maximum ratings

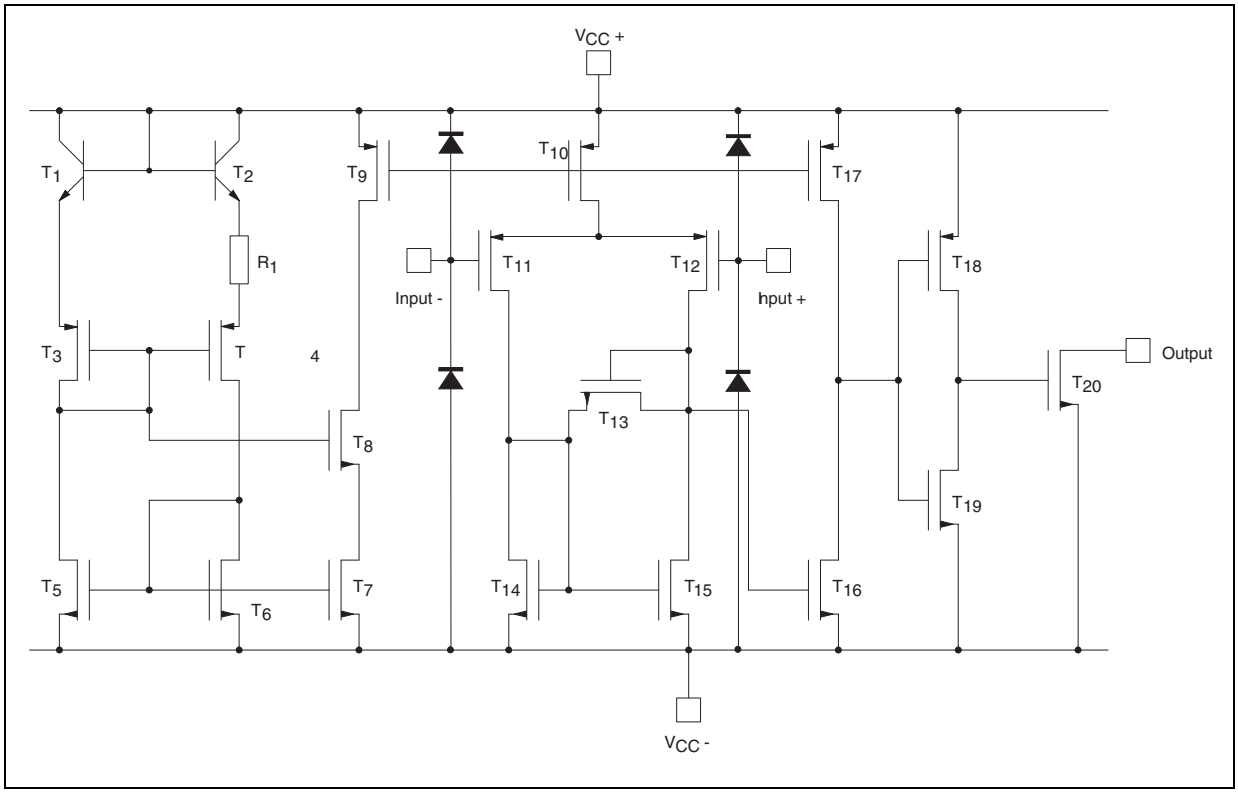
Table 2. Key parameters and their absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}^+	Supply voltage(1)	18	V
V_{id}	Differential input voltage(2)	±18	
V_i	Input voltage(3)	18	
V_o	Output voltage	18	
I_o	Output current	20	mA
I_F	Forward current in ESD protection diodes on inputs(4)	50	
p_d	Power dissipation(5) SO14 TSSOP14	 830 710	mW
T_{stg}	Storage temperature range	-65 to +150	°C
ESD	HBM: human body model(6)	50	V
	MM: machine model(7)	40	
	CDM: charged device model	800	

1. All voltage values, except the differential voltage, are with respect to network ground terminal.
2. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
3. Excursions of input voltages may exceed the power supply level. As long as the common mode voltage $[V_{icm}=(V_{in}^+ + V_{in}^-)/2]$ remains within the specified range, the comparator will provide a stable output state. However, the maximum current through the ESD diodes (IF) of the input stage must strictly be observed.
4. Guaranteed by design.
5. Pd is calculated with T_{amb} = +25 °C, T_j = +150 °C and
   R_{thja} = 150 °C/W for SO14 package
   R_{thja} = 175 °C/W for TSSOP14 package.
6. Human body model, 100pF discharged through a 1.5 kΩ resistor into pin of device.
7. Machine model ESD, a 200 pF cap is charged to the specified voltage, then discharged directly into the IC with no external series resistor (internal resistor < 5 Ω), into pin to pin of device.

2 Typical application schematics

Figure 1. Schematic diagram (for 1/4 TS339)



3 Electrical characteristics

Table 3. V_{CC}^+ = 3 V, V_{CC}^- = 0 V, T_{amb} = 25 °C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage(1) V_{ic} = 1.5 V $T_{min.} \le T_{amb} \le T_{max.}$			5 6.5	mV
I_{io}	Input offset current(2) V_{ic} = 1.5 V $T_{min.} \le T_{amb} \le T_{max.}$		1	300	pA
I_{ib}	Input bias current (2) V_{ic} = 1.5 V $T_{min.} \le T_{amb} \le T_{max.}$		1	600	
V_{icm}	Input common mode voltage range $T_{min.} \le T_{amb} \le T_{max}$	0 0		V_{CC}^+-1.2 V_{CC}^+ -1.5	V
CMR	Common-mode rejection ratio $V_{ic} = V_{icm\ min.}$		70		dB
SVR	Supply voltage rejection ratio V_{CC}^+ = 3 V to 5 V		70		
I_{OH}	High level output current V_{id} = +1 V, V_{OH} = 3 V $T_{min.} \le T_{amb} \le T_{max.}$		2	40 1000	nA
V_{OL}	Low level output voltage V_{id} = -1 V, I_{OL} = +6 mA $T_{min.} \le T_{amb} \le T_{max.}$		400	550 800	mV
I_{CC}	Supply current (each comparator) No load - outputs low $T_{min.} \le T_{amb} \le T_{max.}$		9	20 25	µA
t_{PLH}	Response time low to high V_{ic} = 0 V, f = 10 kHz, $T_{min.} \le T_{amb} \le T_{max}$ C_L = 50 pF, overdrive = 5 mV TTL input		1.5 0.7		µs
t_{PHL}	Response time high to low V_{ic} = 0 V, f = 10 kHz, R_L = 5.1 kΩ, C_L = 50 pF, overdrive = 5 mV TTL input		2.5 0.08		

1. The specified offset voltage is the maximum value required to drive the output up to 2.5 V or down to 0.3 V.
2. Maximum values including unavoidable inaccuracies of the industrial test.

Table 4. V_{CC}^+ = 5 V, V_{CC}^- = 0 V, T_{amb} = 25 °C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage(1) V_{ic} = 2.5 V, V_{cc}^+ = 5 V to 10 V $T_{min.} \le T_{amb} \le T_{max.}$		1.4	5 6.5	mV
I_{io}	Input offset current(2) V_{ic} = 2.5 V $T_{min.} \le T_{amb} \le T_{max.}$		1	 300	pA
I_{ib}	Input bias current(2) V_{ic} = 2.5 V $T_{min.} \le T_{amb} \le T_{max.}$		1	 600	pA
V_{icm}	Input common mode voltage range $T_{min.} \le T_{amb} \le T_{max}$	0 0		V_{CC}^+-1.2 V_{CC}^+ -1.5	V
CMR	Common-mode rejection ratio V_{ic} = 0 V		75		dB
SVR	Supply voltage rejection ratio V_{CC}^+ = +5 V to +10 V		85		dB
I_{OH}	High level output voltage V_{id} = 1 V, V_{OH} = +5 V $T_{min.} \le T_{amb} \le T_{max.}$		27	40 1000	nA
V_{OL}	Low level output voltage V_{id} = -1 V, I_{OL} = 6 mA $T_{min.} \le T_{amb} \le T_{max.}$		260	400 650	mV
I_{CC}	Supply current (each comparator) No load - outputs low $T_{min.} \le T_{amb} \le T_{max.}$		10	20 25	µA
t_{PLH}	Response time low to high V_{ic} = 0 V, f = 10 kHz, R_L = 5.1 kΩ, C_L = 15 pF, overdrive = 5 mV Overdrive = 10 mV Overdrive = 20 mV Overdrive = 40 mV TTL input		 1.5 1.2 1.1 0.9 0.8		µs
t_{PHL}	Response time high to low V_{ic} = 0 V, f = 10 kHz, R_L = 5.1 kΩ, C_L = 15 pF, overdrive = 5 mV Overdrive = 10 mV Overdrive = 20 mV Overdrive = 40 mV TTL input		 2.5 1.9 1.2 0.8 0.08		µs
t_f	Fall time f = 10 kHz, C_L = 50 pF, R_L = 5.1 kΩ, overdrive 50 mV		30		ns

1. The specified offset voltage is the maximum value required to drive the output up to 4.5 V or down to 0.3 V.
2. Maximum values including unavoidable inaccuracies of the industrial test.

4 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.

4.1 SO14 package information

Figure 2. SO14 package outline

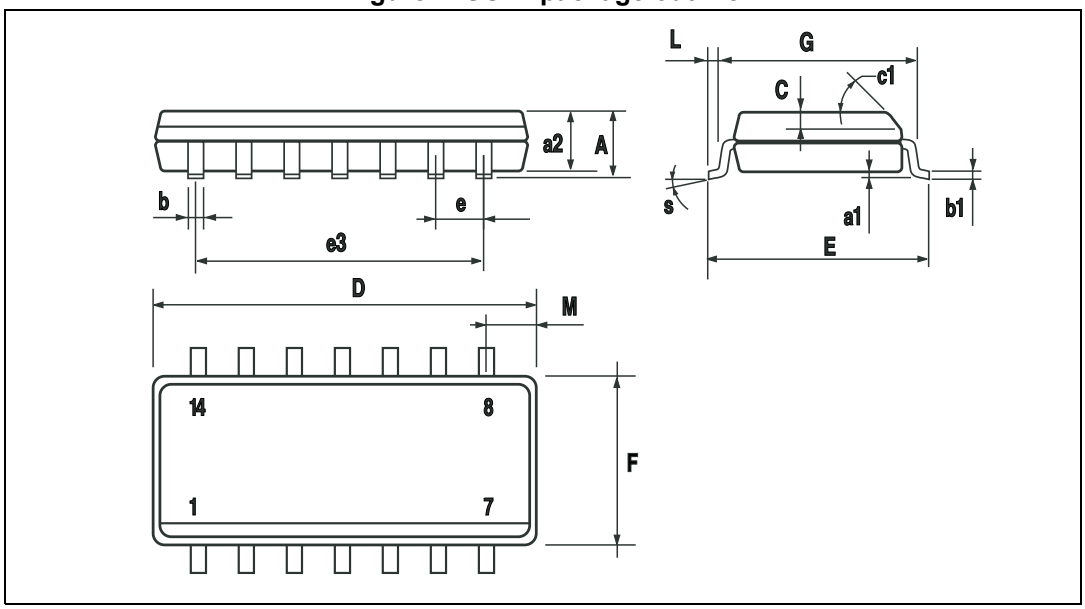


Table 5. SO14 package mechanical data

Symbol	Dimensions					
	mm			inch		
	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.)					

4.2 TSSOP14 package information

Figure 3. TSSOP14 package outline

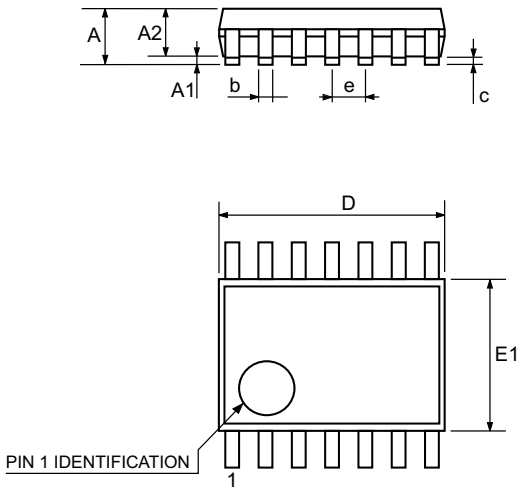


Table 6. TSSOP14 package mechanical data

Symbol	Dimensions					
	mm.			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0089
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030

5 Revision history

Table 7. Document revision history

Date	Revision	Changes
Jan. 2003	1	Initial release.
Aug. 2005	2	1 - PPAP references inserted in the datasheet see *Table 1: Order codes on page 1*. 2 - ESD protection inserted in *Table 2 Key parameters and their absolute maximum ratings on page 2*.
04-Sep-2012	3	Updated *Features*, *Table 1*, removed TS339IYD and TS339IYDT from *Table 1*. Updated ECOPACK text, reformatted *Section 4: Package information*. Minor corrections throughout document.
21-Feb-2014	4	Removed DIP package *Features*: updated fast response time *Device summary*: removed order codes TS339CN, TS339IN, and TS339ID; added temperature range for order codes TS339IDT and TS339IPT

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