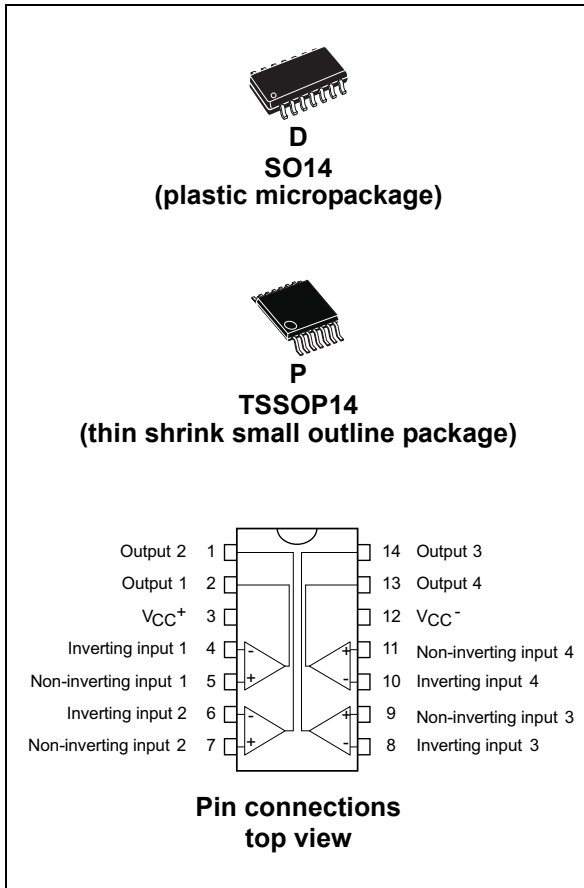


Micropower quad CMOS voltage comparator

Datasheet - production data



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 | | | TSSOP14 |
| TS339IPT | | | | |

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1 Absolute maximum ratings

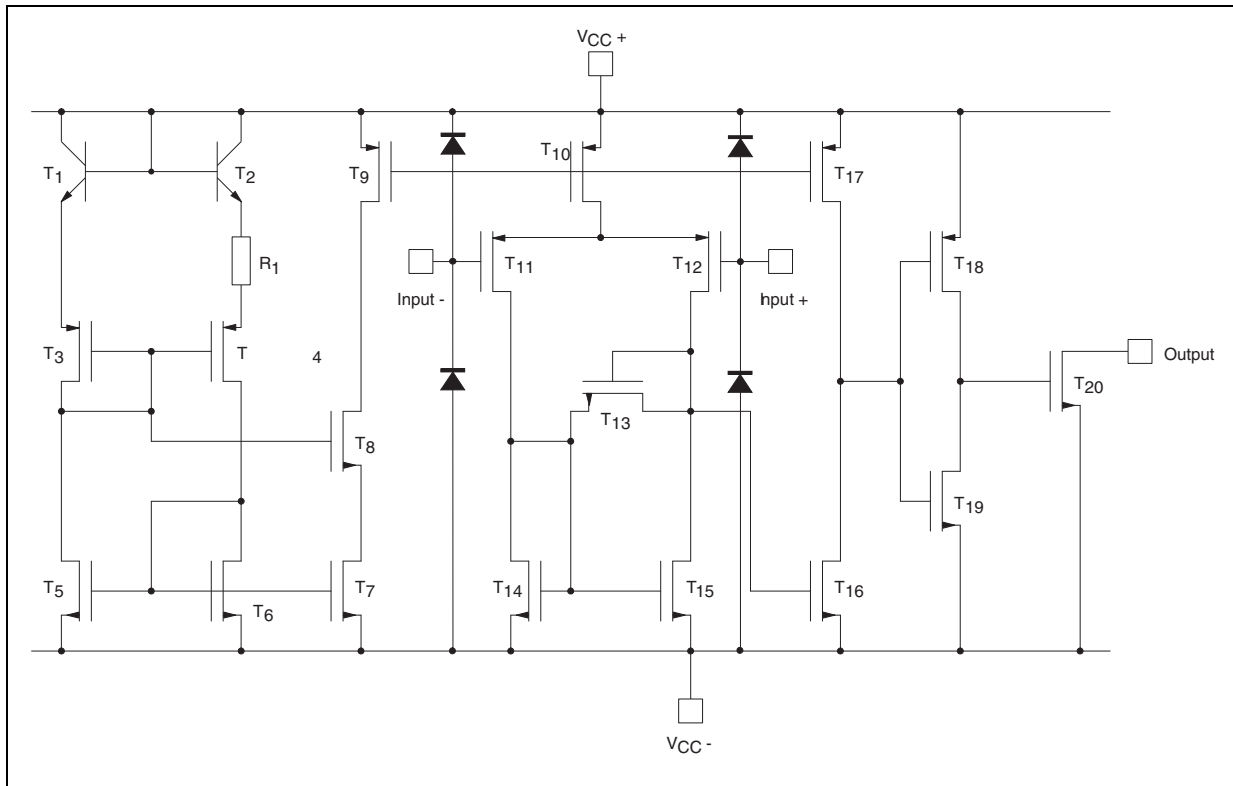
Table 2. Key parameters and their absolute maximum ratings

| 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⁾ | | mW |
| | SO14 TSSOP14 | 830 710 | |
| 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 | |

- All voltage values, except the differential voltage, are with respect to network ground terminal.
- Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
- 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 (I_F) of the input stage must strictly be observed.
- Guaranteed by design.
- P_d is calculated with $T_{amb} = +25\text{ °C}$, $T_j = +150\text{ °C}$ and
 $R_{thja} = 150\text{ °C/W}$ for SO14 package
 $R_{thja} = 175\text{ °C/W}$ for TSSOP14 package.
- Human body model, 100pF discharged through a 1.5 kΩ resistor into pin of device.
- 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. $V_{CC}^+ = 3\text{ V}$, $V_{CC}^- = 0\text{ V}$, $T_{amb} = 25\text{ °C}$ (unless otherwise specified)

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

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

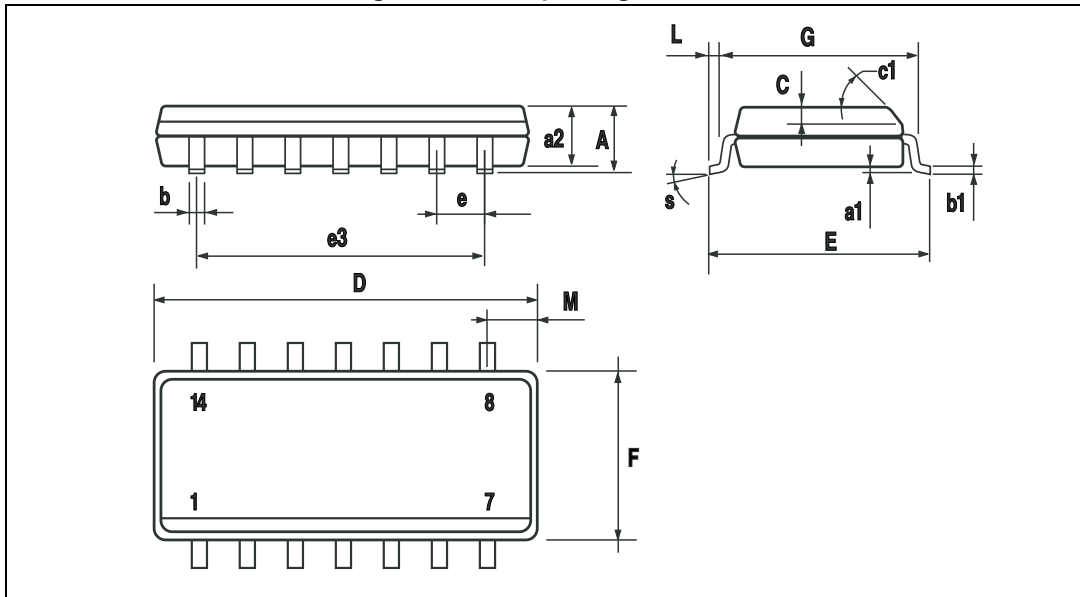


Table 5. SO14 package mechanical data

| 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

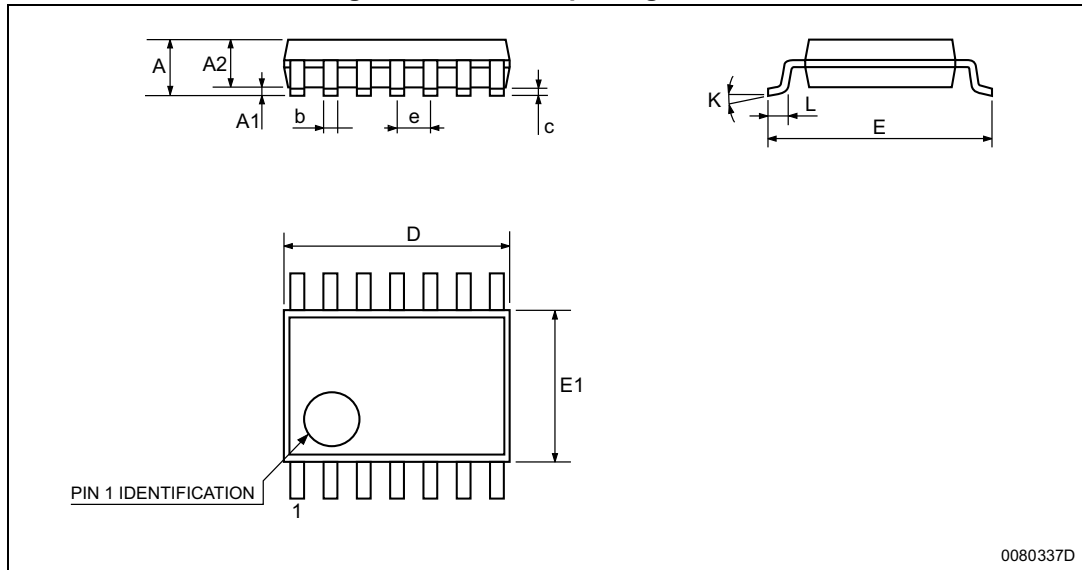


Table 6. TSSOP14 package mechanical data

| 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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