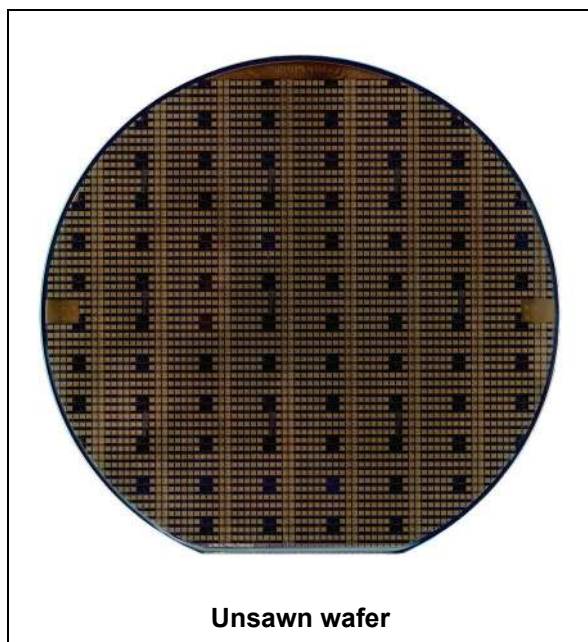

Micropower dual CMOS voltage comparator: unsawn wafer

Datasheet - production data

**Description**

The JTS393 is a micro power CMOS dual voltage comparator with extremely low consumption of 9 μA typical per comparator (20 times less than the dual bipolar LM393 device). Similar performance is offered by the dual micropower TS3702 (or JTS3702 in wafer version) with a push-pull CMOS output. Thus, response times remain similar to the LM393.

Features

- Extremely low supply current: typically 9 μA per 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 typical
- Extremely low input offset currents: 1 pA typical
- Input common-mode voltage range includes ground
- High input impedance: 10^{12} Ω typical
- Fast response time: 2.5 μs typical for 5 mV overdrive
- Functionally compatible with bipolar LM393

Related products

- See TS393 for plastic packaged version

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1 Schematic diagram and pad configuration

Figure 1. Schematic diagram (for one channel of JTS393)

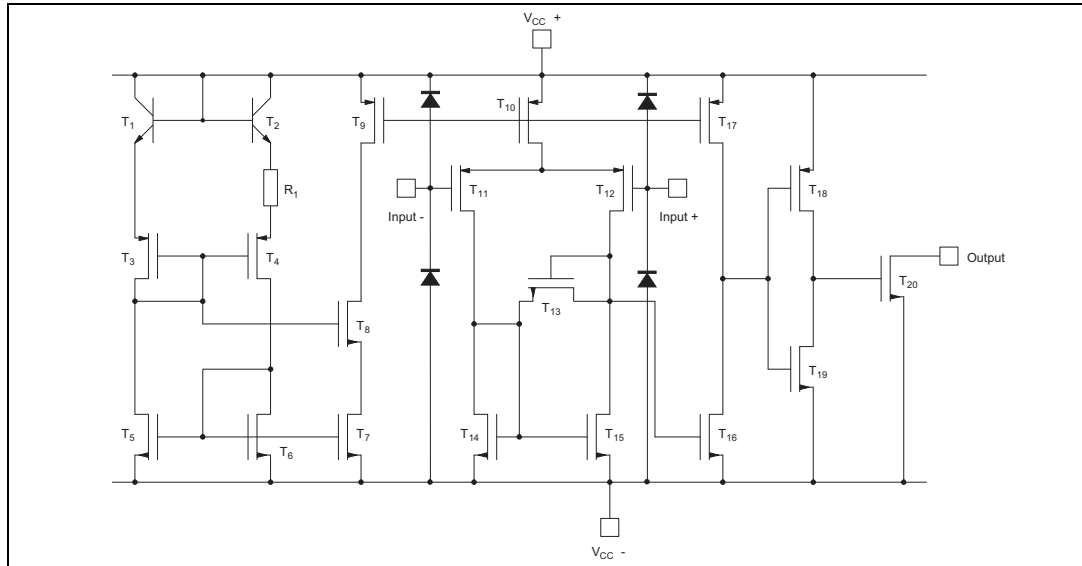


Figure 2. Pad configuration (top view)

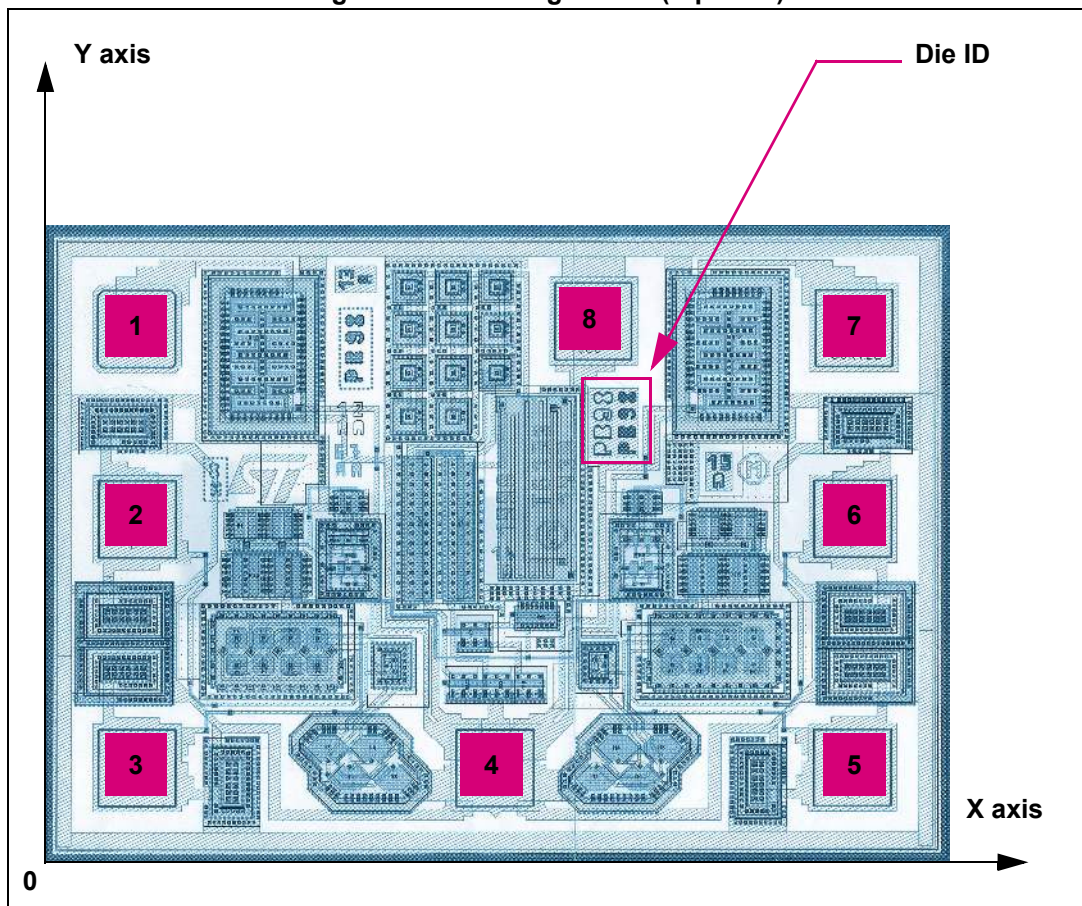


Table 1. Pad coordinates (pad placement origin is the lower left corner of the die)

| Pad number | Pad description | Center pad coordinates | |
|------------|-----------------------|------------------------|---------------------|
| | | X (μm) | Y (μm) |
| 1 | Output 1 | 165 | 870.3 |
| 2 | Inverting input 1 | 165 | 575.3 |
| 3 | Non-inverting input 1 | 165 | 140.3 |
| 4 | Vcc- | 695 | 140.3 |
| 5 | Non-inverting input 2 | 1225 | 140.3 |
| 6 | Inverting input 2 | 1225 | 575.3 |
| 7 | Output 2 | 1225 | 870.3 |
| 8 | Vcc+ | 835 | 870.3 |

Wafer dimension: 6 inches.

Die size without scribe line:

- X = 1326.0 μm
- Y = 926.0 μm

Scribe line: 60 μm

Bond pad opening 109 x 109 μm

2 Absolute maximum ratings and operating conditions

Table 2. Absolute maximum ratings (AMR)

| 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 input ⁽⁴⁾ | 50 | |
| T_J | Maximum junction temperature | 150 | °C |
| T_{stg} | Storage temperature range | -65 to +150 | |
| ESD | HBM: human body model ⁽⁵⁾ | 500 | V |
| | MM: machine model ⁽⁶⁾ | 200 | |

1. All voltage values, except 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 provides a stable output state. However, the maximum current through the ESD diodes (I_F) of the input stage must strictly be observed.
4. Guaranteed by design.
5. Human body model: 100 pF discharged through a 1.5 kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
6. 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.

Table 3. Operating conditions

| Symbol | Parameter | Value | Unit |
|------------|--|--|------|
| V_{CC}^+ | Supply voltage | 2.7 to 16 | V |
| V_{icm} | Common mode input voltage range $T_{min} \leq T_{amb} \leq T_{max}$ | 0 to $V_{CC}^+ - 1.2$ 0 to $V_{CC}^+ - 1.5$ | |
| T_{oper} | Operating free-air temperature range - JTS393C | 0 to +70 | °C |

3 Electrical characteristics

Table 4. Electrical characteristics at $V_{CC+} = 3\text{ V}$, $V_{CC-} = 0\text{ V}$, $T = 25\text{ °C}$ (unless otherwise specified)

| Symbol | Parameter | Conditions | 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 | |
| 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 | $V_{ic} = 0\text{ V}$, $f = 10\text{ kHz}$, $R_L = 5.1\text{ k}\Omega$, $C_L = 50\text{ pF}$, 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 5. Electrical characteristics at $V_{CC+} = 5\text{ V}$, $V_{CC-} = 0\text{ V}$, $T = 25\text{ °C}$ (unless otherwise specified)

| Symbol | Parameter | Conditions | 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 | |
| CMR | Common-mode rejection ratio | $V_{ic} = 0\text{ V}$ | | 71 | | dB |
| SVR | Supply voltage rejection ratio | $V_{CC}^+ = +5\text{ V to } +10\text{ V}$ | | 80 | | |
| I_{OH} | High level output current | $V_{id} = 1\text{ V}$, $V_{OH} = 5\text{ V}$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 2 | 40 1000 | nA |
| V_{OL} | Low level output voltage | $V_{id} = -1\text{ V}$, $I_{OL} = 6\text{ mA}$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 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 | $V_{ic} = 0\text{ V}$, $f = 1\text{ kHz}$, $R_L = 5.1\text{ k}\Omega$, $C_L = 50\text{ pF}$, Overdrive = 5 mV Overdrive = 10 mV Overdrive = 20 mV Overdrive = 40 mV TTL input | | 1.5 1.2 1.0 0.8 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 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 | | 25 | | 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 Packing description

Collective packing is used as STMicroelectronics qualified system for shipment of finished wafers.

The following parts of the collective packing are used in the clean room (see [Figure 3](#) for detailed view):

- Canister (composed of a base and a cover, maximum content is 25 wafers)
- Pink foam discs (lodged below and over the stack, minimum content is 2 discs)
- White interleaves (separators between wafers, maximum content is 26 or more for best fit).
- CMB bag (to protect canister under moderate vacuum)

Figure 3. Canister composition overview

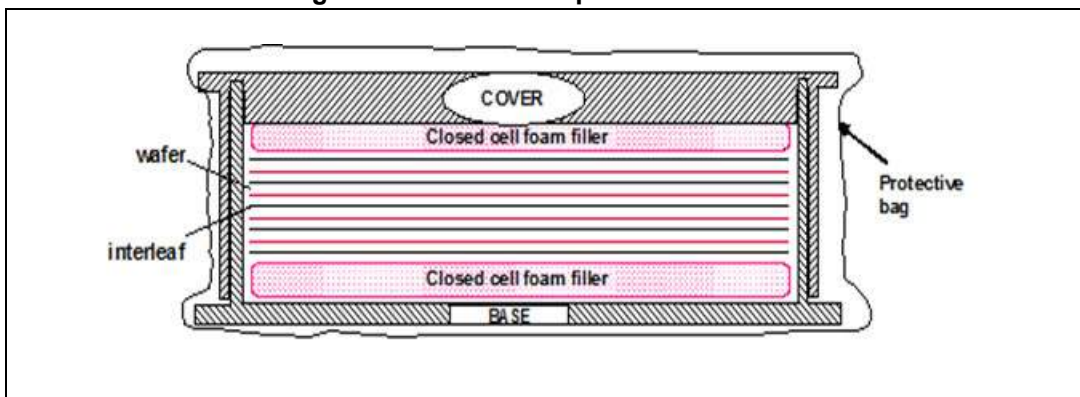


Figure 4. Packed canister picture



5 Ordering information

Table 6. Order codes

| Order code | Temperature range | Package | Packaging |
|--------------|-------------------|--------------|--------------------|
| JTS393C-1AA5 | 0 to +70 °C | Unsaun wafer | Collective packing |

6 Revision history

Table 7. Document revision history

| Date | Revision | Changes |
|-------------|----------|-----------------|
| 18-Dec-2013 | 1 | Initial release |

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